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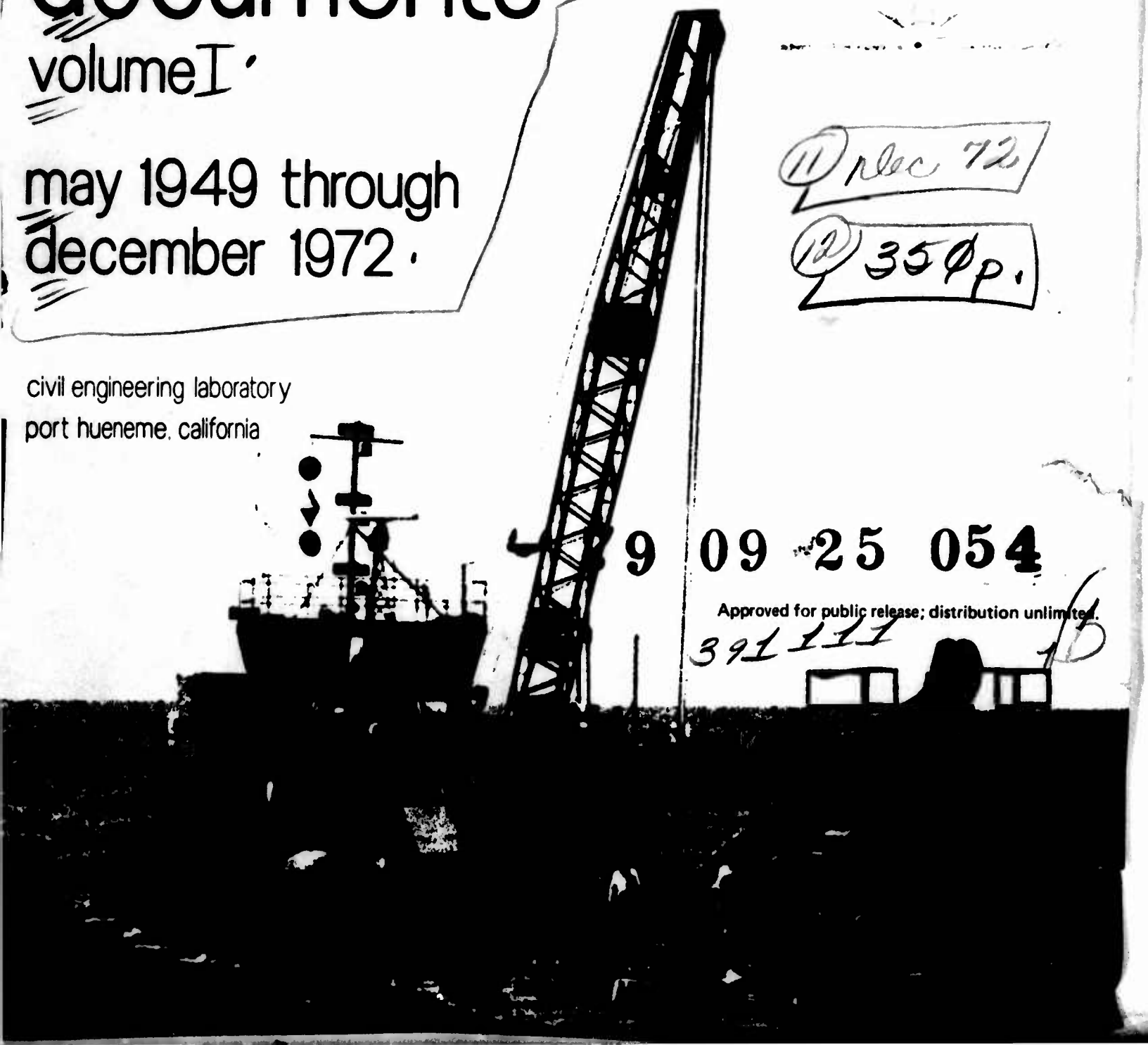
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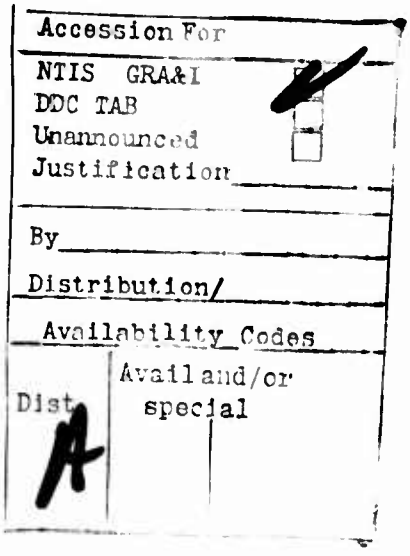
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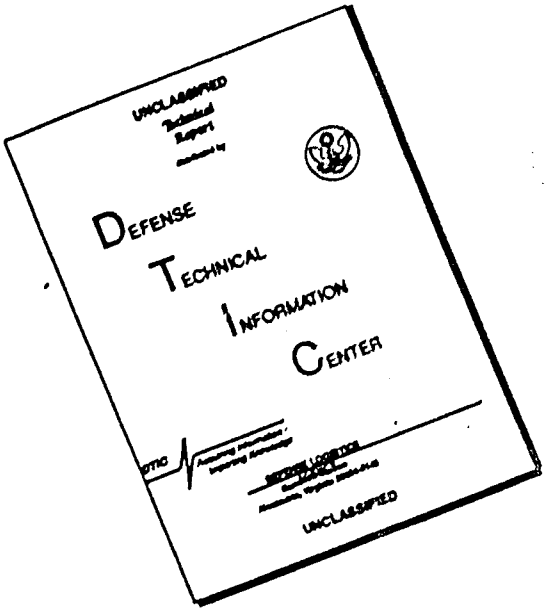
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TECHNICAL REPORTS

R-001
Beach Soil Stabilization, Aniline-Furfural Method, Sep 1950, R. H. Henley, H. J. Sieland, E. R. Holden, ATI 209350

Field tests using the Winterkorn Aniline-Furfural procedures for beach soil stabilization are described. The use of various accelerators is discussed, and recommendations are made for further investigation of the use of resins for the stabilization of beach sand.

The mechanical equipment used to stabilize the sand in a single continuous operation is described, and information obtained shows the need for extensive modification of the proportioning and mixing machinery prior to further full-scale field studies. Operational characteristics desirable for new design are outlined.

R-002
Temporary Protective Shelter. Construction and Performance Tests, Aug 1950, E. P. Donoghue, E. H. Moser, W. Viessman, ATI 209383, PB 154617

Tests were made at the proving ground, Port Hueneme, Calif., during the summer of 1949. The data, results and recommendations contained in the report deal with the mechanical test, the evaluation of the structure and equipment, and the results obtained by pressurization. Data on the biological and chemical aspects are reported separately as Camp Detrick Special Report No. 133, attached as Appendix A.

The structure as modified was generally suitable for the purpose, although shower and toilet facilities were limited. From a ventilation and air conditioning point of view, the air conditioners and collective protectors were found to be sufficient to meet the requirements based on a simulated occupancy of 50 persons at rest, and the building was effectively pressurized in accordance with the specifications.

R-003
Some Theoretical Considerations Concerning Radiation From Overhead Transmission Lines, June 1958, A. M. Intrator, ATI 209384, PB 154618

An experimental program planned by U.S. Naval Civil Engineering Research and Evaluation Laboratory to investigate methods of suppressing radiation from overhead power lines called for the use of some new techniques. To understand the problem more fully and to obtain information useful in planning the tests, a review of the theory of radiation from overhead lines was made and the theory used to compute values and construct curves of the radiation field pattern within 3000 meters of a 3-wire transmission line 2000 meters long with ground return through the earth. It is assumed that the line acts as a horizontal transmitting antenna and that both the transmitting and receiving antenna are relatively close to the ground. Only the surface wave need be considered under these conditions.

It is concluded that radiation from power lines is directional along the axis of the line and that the field strength decreases rapidly with distance from the line. Interference caused by the coupling of spurious energy to power lines will be slight at very high frequencies. Radiation will more likely be greater from transmission lines with grounded-neutral, wye-connected transformers at both ends than from other systems.

R-004
(not published)

R-005
(not published)

R-006
Experimental Arctic Operation Hard Top 1, 1953, Jan 1954, E. H. Moser, AD 55160, PB 157964

A small U.S. Naval construction detachment was airlifted in midwinter 1953 by the U.S. Air Force to the Greenland ice cap where during a 90-day period they built a camp, assembled construction equipment, and compacted a mile-long snow runway using the pulvimixer-roller processing technique. After two failures, a snow runway was developed that successfully supported a C-47 aircraft on wheels while landing, taxiing, and taking off.

Factual data was collected and analyzed on logistical problems of personnel, material, movement, communications and supply, camp construction, maintenance, and the human factors involved in arctic camp life, and, the development of a mechanical process for compacting a snow mat overlying soft deep snow that is capable of supporting wheeled cargo aircraft.

R-007
Experimental Arctic Operation HARD TOP II, 1954, Dec 1955, W. R. Reese, AD 121609

A U.S. Naval Construction detachment, slightly larger than that of the previous year, went by surface movement in midwinter 1954 to the Greenland ice cap location of HARD TOP I, where during a 99-day period they rehabilitated and enlarged the camp, constructed a runway system of main and auxiliary runways with other useful areas using several variations of the pulvimixer-roller technique. Successful C-47 operational tests were conducted.

Further evaluation was made of logistical problems, including personnel, materiel, staging, movement and support, camp construction, maintenance, and human factors and a mechanical process for construction of runways by compacting snow.

R-007 Supplement
Experimental Arctic Operation HARD TOP II, 1954, Supplement, Dec 1955, W. R. Reese, AD 125059

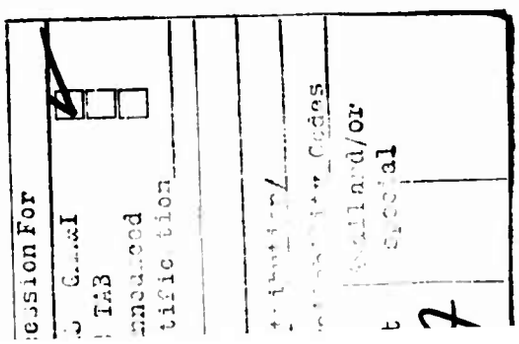
Heavy aircraft operational tests and equivalent load cart tests on the main runway during operation HARD TOP II, although limited in success, pointed the way toward a method of further development of surface hardness in snow compacted runways. The tests showed the hampering effects of packed overburden, surface levelness variation, runway grade, and increasing snow surface temperatures. Some runway surface loading data were developed. Modification of the compaction tester to provide more realistic loadings is recommended.

R-008
Evaporative Cooling of Internal Combustion Engines, Jan 1958, E. J. Beck, PB 134357, AD 163134

This paper deals with the desirability and feasibility of cooling internal combustion engines by allowing the coolant to boil, then separating and condensing the vapors in a closed cycle at atmospheric or slightly higher pressure.

The general conclusion reached is that cooling by boiling is in practically every respect a superior process, and will prevent the accelerated wear and sludging associated with cold ambient temperature or light loads. Some potential fuel savings are seen through reduction of auxiliary pumping and fan power.

It is further concluded that the system can not be applied without hesitation to any and all engines, but that the process whereby specific engines may be examined for vapor cooling is simple and direct. Some tentative design data for application are proposed.



R-009
Squaw Valley Winter Trials, 1957-1958. Compacted-Snow Parking Lot Study, Sep 1958, J. E. Dykins, R. C. Coffin, E. H. Moser, AD 205459, PB 137880

Using conventional Navy snow-compaction equipment, a small parking lot was built in mid-February 1958 on a 5-ft snow pack overlaying well-drained flat terrain in Squaw Valley. Between 8 to 23 March, private cars and interstate busses used the lot on six occasions for all-day parking, and the Navy regularly trafficked the lot with wheeled vehicles. Maintaining an adequate surface for traffic during heavy rains, long warm spells, high solar radiation, and new snowfalls was the most critical problem encountered.

It was found that a 1/2 in. surface cover of sawdust preserved the compacted-snow mat during rain storms, warm spells, and periods of high solar radiation. Furthermore, the sawdust contributed to better traction and safe-driving conditions. Recovery of the lot following snowfallarequired a varying effort, and setup time ranging from one hour to a full day, depending upon the depth of new falls and ambient temperatures.

R-010
Concrete Jacketing of Timber Piles Below the Water Line, Dec 1958, D. F. Griffin, J. M. Hayhoe, R. B. McIntosh,AD 221813L

The Laboratory was requested to investigate various pile jacketing methods to determine the most economical method. The most economical method was determined in terms of an evaluation and feasibility study on a laboratory scale rather than by an analysis of actual construction costs. Five specific jacketing methods were suggested for consideration. Tests of three of the suggested methods are reported herein. In addition, several modifications of these methods were investigated. As a result of experience gained during these tests it was concluded that under the criterion established, the remaining two methods would be prohibitively expensive and could be eliminated from further consideration.

R-011
Acid Injection Prevents Scale in Vapor Compression Distillation Units, Dec 1958, J. S. Williams, AD 203971, PB 151559

The Laboratory has developed a method of intermittent acid injection to prevent scale in vapor compression distillation units. In response to a Bureau request for an in-service type evaluation of the equipment on a Navy Stock Unit, a 1,000-hr test was performed on an 85-gph model. Results of this test substantiated the successful experiments on prototype units performed earlier. It was found that 1.5 lb of sulfuric acid per 1,000 gal of water produced would keep the unit free of scale. Based on the test, it is concluded that intermittent injection is the best method of scale prevention for units now in stock, and the Laboratory recommends that these units be modified to include the acid feeder. The Laboratory intends to continue descaling investigations in conjunction with other phases of the distillation program.

R-012
Electrolysis of Sea Water, of Sea Water Fortified With Salt, and Fresh (Tap) Water Fortified With Salt, Dec 1958, T. Roe, A. E. Hanna, N. Hochman, AD 201641, PB 140029

The Naval Civil Engineering Laboratory was requested by the Chief of Civil Engineers, U.S. Navy, to investigate the practicability of producing sodium hypochlorite decontaminating solutions by the electrolysis of sea water, thus eliminating the logistic and storage problems associated with the production of hypochlorite from chlorine andalkali, and the deterioration of stored hypochlorite. The Laboratory work included development of equipment and processes for the production of sodium hypochlorite by the electrolysis of sea water. This paper presents experimental data which shows the extent to which sodium hypochlorite can be produced for decontamination purposes by the electrolysis of sea water, sea water fortified with salt, and fresh (tap) water fortified with salt. The results of twenty-five test runs are listed. Using multiple pass operation, two parallel plate cells can produce a maximum of 2.03% (20,300 ppm) available chlorine from sea water saturated with salt, if the initial solution temperature is maintained throughout the operation by the use of heat exchangers between cells. Under the same conditions, a maximum of 1.55% (15,500 ppm) available chlorine can be produced from fresh (tap) water saturated with salt, and a maximum of 0.82% (8,200 ppm) can be produced from sea water.

R-013
Influence of Grade of Steel on Blast Resistance of Reinforced Concrete Beams, Jan 1959, W. A. Shaw, J. R. Allgood, AD 201109, PB 140058

In this paper a method is presented for determining the influence of the grade of reinforcing steel on the blast resistance of reinforced concrete beams. Based upon preselected criteria of failure, the peak dynamic load-carrying capacity is calculated for beams of a given configuration, but having different percentages and grades of reinforcing steel. These calculations are made for blast-type loads of different duration. From plots of the results, it is shown that the suitability of various grades of reinforcing steel will depend primarily upon the maximum permissible deflection, the characteristics of the loading, and the amount of tension steel used.

R-014
Strength Tests of Aircraft Mooring Eyes in Concrete Pavement, Dec 1958, J. E. Smith, J. E. Schroeder, AD 203482, PB 138700

Knowledge of the strength of aircraft mooring eyes installed in concrete runway aprons was needed. Three sizes of two types of eyes designed by BUDOCKS were tested to determine their holding capacities and their relative merits. Three directions of pull were used in the tests, all loads being applied at an angle of 30 degrees to the horizontal.

The two types of mooring eyes performed equally. Failures occurred in the steel bar in 95% of the tests. Holding capacities varied from about 12,000 lb to about 70,000 lb, depending on the mooring eye size and the direction of the pull.

It was concluded that failure will occur in the steel if the eye is placed in good quality concrete of sufficient thickness. It was recommended that choice of eye type be based on cost of fabrication and ease of placement.

R-015
LST Multiple Pile Driving Rig (Barge Mounted), Feb 1959, J. J. Hromadik, R. C. Towne, AD 250600, PB 140030

Due to the unavailability of an LST, it was decided to test the general feasibility of the multiple pile driving concept on a pontoon barge, prior to testing on an LST. Alterations to the design were submitted by the contractor for the purpose of mounting the driving assembly on the stern of a double-tier, 10x24 pontoon barge. Subsequently, the fabrication and mounting of the multiple pile driving rig was accomplished at, and by, the Laboratory.

The engineering evaluation consisted of mooring studies and the driving of pile bents. Results of these tests indicated that the mechanical and structural design was unsatisfactory and that satisfactory mooring of the barge for pile driving operations was virtually impossible within practical and economic limitations. In view of the test results, further testing on an LST is not warranted.

R-016
Plastic Splicing Systems for Plastic or Lead Covered Electrical Cable, Apr 1959, M. J. Sherry, G. M. Sandquist, AD 213206L

Several plastic splicing sytems for electrical cable were evaluated to determine their suitability for splicing lead, rubber, and plastic insulated cables. The materials were tested for mechanical strength, electrical insulating properties, resistance to aging, acid, alkali, ozone, heat, flame, and moisture, and for ease of application and performance in service. The plastic splicing systems failed in tests for flammability, and flexibility at low temperatures; however, it is considered that they will be suitable for many applications with considerable saving in time, although the cost of the materials is somewhat higher than the standard taping method. The Minnesota Mining and Manufacturing Company's "Scotchcast" system, using prepared molds, proved to be simplest and most effective to use. It is recommended that information on plastic splicing systems be included in future BUDOCKS manuals and instructions covering use of electrical cables, and that NAVDOCKS Specification 9YG by revised to allow use of plastic splicing materials where flammability and low temperature flexibility are not critical considerations.

R-017
Engineering Evaluation of Large Steel Pontoons and Bow/Stern Pontoons, Feb 1959, J. J. Traffalis, AD 205591, PB 140057

The U.S. Naval Civil Engineering Laboratory conducted engineering tests on some large (10-ft x 6-ft) steel pontoons to determine their suitability as replacements for the present NL (5-ft x 7-ft x 5-ft) steel pontoon. Six large pontoons and two bow/stern pontoons were procured by the Bureau of Yards and Docks and sent to the Laboratory for test and evaluation.

When compared with the standard NL (Navy Lighter) pontoon structure with equivalent deck area, the large pontoons (1) are structurally adequate, (2) have a 10% greater reserve buoyancy, (3) are approximately 40% heavier, and (4) can be assembled into a barge more rapidly if a 20 ton crane is available.

Difficulties encountered during the fabrication of the large pontoon and the assembly of the pontoons into a barge were due to: (1) variation in plate sizes, (2) deformation of pressed steel panels, and (3) jigs not being used during the fabrication of the pontoons. Heavy duty equipment not usually available at advance bases is required during the fabrication of the individual pontoons and in the assembly of the pontoons into barges.

R-018
Polar Base Transportation and Material Handling Equipment. Portable Loading Platform, Mar 1959, J. B. Camm, AD 205592, PB 140031

The Laboratory was instructed by the Chief of Civil Engineers to develop a portable loading platform, primarily for the on-and-off loading of R4D (C-47) aircraft in polar regions. In 1953, a heavy, cumbersome platform of steel and timber construction was used in the HARD TOP 1 operation. It was reported to be a very valuable unloading aid in the pioneer phase of this operation. The Air Force also used this same platform for Operation Mint Julep and on the Arctic Ice Island T-3. They were satisfied with the unit and its successful application.

This report covers the final development of a platform incorporating refinements to the Deep Freeze 1 model for production-shop fabrication and incorporating other modifications found necessary during initial performance tests conducted at the Laboratory.

Evaluation of the third and final model of the platform shows that the weight saving of 1,785 lb achieved by redesign of the HARD TOP unit does not affect the serviceability or structural adequacy of the platform. Where weight is critical, an additional reduction of 330 lb is possible with the use of an aluminum deck and ramp. The platform can be used with cargo sleds in polar regions as well as aircraft.

R-019
Development and Evaluation of Small Relative Humidity Sensing Elements, Apr 1959, J. C. King, K. B. Edwards, AD 215253L

While conducting tests at the Laboratory on moisture migration, vapor transmission, and infiltration measurements, the need arose for a small, accurate relative-humidity sensing element for use in small, confined spaces. Accordingly, two commercially available elements that utilize an electrolytic film as part of a low-voltage circuit were evaluated.

It is recommended that the device designed by the Laboratory be used when accurate measurements in small, confined spaces are required, and where calibration can be accomplished with the sensing device in place. For relative humidities less than 83% and where accuracy is not important, the electronics element is recommended.

R-020
Deck Coating Tests, Dec 1958, W. R. Nehlsen, AD 203972, PB 138265

A constant expense in Naval operations is the protection of steel surfaces to prevent corrosion of equipment used in harbor and ocean areas. A coating made with cement powder, boiled linseed oil, and lead naphthenate dryer was proposed as a superior protective coating for deck surfaces. Tests were made using this coating and a similar formula with pumice replacing the cement powder. Sample areas of these coatings were placed on harbor vessels at Port Hueneme adjacent to areas of the standard Navy zinc chromate and paint protective coating. The effectiveness of the coatings in providing adhesive, non-slip, wear resistant and corrosion resistant qualities was tested, and the standard Navy paint coating was judged to be superior. The pumice coating allowed rusting within a few weeks and the cement coating also was softer than the paint and was damaged more by abrasion.

R-021
Engineering Evaluation of Reinforced Plastic Pontoons, Jan 1959, J. J. Traffalis, AD 205594, PB 140278

It was concluded that (1) the plastic pontoons are physically interchangeable with the P-1 steel pontoon, but do not have the structural capabilities of the steel pontoon, and (2) the addition of the steel deck plate eliminates abrasive damage to the pontoon deck, but the method of securing the deck plate to the corner connection is unsatisfactory.

It is recommended that the plastic pontoons be improved and re-evaluated prior to acceptance as a substitute for the T6B and P-1 steel pontoons.

R-022
Development of 21-Ft Wide End-To-End Connected NL Pontoon Causeway, Mar 1959, R. C. Towne, AD 205595, PB 140032

The Laboratory developed a 3x15 NL pontoon causeway with a "hinge" type end connection, which can operate in 4-ft to 6-ft waves, be moored in a 40-mph wind, withstand a 3-knot current parallel to beach, and is suitable for operation in areas of extreme tidal ranges. Sixty-ton tanks can be moved over the causeway without difficulty, and vehicle speeds of 15 mph can be attained in moderate surf.

It was concluded that the subject causeway will meet the criteria formulated by BUDOCKS and, in addition, can be left moored on the beach in 8-ft surf conditions. The present marriage system for joining the causeway to an LST is unsatisfactory in surf conditions over 2 ft in height.

R-023
A Survey of Literature Pertaining to the Use of Admixtures for Portland Cement Concrete, Apr 1959, D. B. Taylor, AD 215256L

This report summarizes the findings of a literature survey in the field of admixtures for portland cement concrete, exclusive of air-entraining agents, and makes recommendations for future investigations. Very little reliable information has been published about proprietary admixtures; however, guides for the use of admixtures in general, and specifically admixtures of known chemical composition, are available in the literature. A great deal of research remains to be done to disclose the true role of admixtures for portland cement concrete.

R-024
Evaluation of Triplex Backfill Tampers, Apr 1959, O. P. Bak, AD 215257L

This report presents the test results and conclusions on the subject tamper comparison. The testing performed indicated that (1) the triplex compacts approximately twice as fast as the single unit, (2) operator fatigue is less with the triplex unit, (3) safety is increased with the triplex unit, (4) the triplex unit is as versatile as the single unit, except for operating in extremely small spaces, and (5) the lower seals of the tampers used on the triplex should have greater strength against transverse forces.

R-025
Nuclear Radiation Shielding Provided by Buried Shelters, Oct 1959, J. C. Ledoux, AD 230086, PB 145155

This report presents methods of calculating the attenuation of initial gamma, initial neutron, and residual gamma radiation incident upon buried shelters from fission-type weapons. Attenuation curves are presented which take into account variations in the moisture content and density of the soil cover. The effect of the various energy spectra for each type of radiation has been considered. Three types of shelter configurations have been investigated: the rectangular or slab, the hemisphere, and the arch.

Although a simplified model has been assumed, comparison with experimental values of attenuation factors for flexible arch-type structures indicates that the methods developed in this report will predict doses or attenuations within a factor or two.

R-026
Development of an Improved Transfer Line Barge, Apr 1959, J. E. Smith, AD 215255L

A concept was tested wherein a small crane is lifted by the LST hoisting equipment and placed on the barge after launching. A special sloped-wall, well-type base mounting is utilized to facilitate placement of the crane aboard the barge and allow a more rapid operational readying time than present methods. Flexibility in transferring loads is provided by means of a single rotatable boom. From the test results it was concluded that the concept for an improved transfer barge, using the small crane described in the report, is workable and practicable. However, further refinements in procedure and equipment are advisable and can best be achieved by in-service testing.

R-027
Harbor Screening Tests of Marine Borer Inhibitors, Part 1, Jul 1959, H. Hochman, T. Roe, Jr., AD 209527, PB 143053

This report lists the results of harbor tests of treated panels exposed and removed between September 1955 and August 1958. It also lists all treated panels which have been exposed for one year or more and which have shown no attack or very slight amounts of attack.

Although the impregnation of wood with some toxic materials afforded very little protection against any species of borers in harbor exposure tests, other materials were specific and protected the panels against one type of borer but not another.

These results, together with results obtained from current and future laboratory toxicity tests will be used in developing additional wood treatments. Panel testing will be continued to screen these treatments under harbor exposure conditions. Emphasis will be placed on the addition to creosote and creosote-coal tar solutions of materials which are toxic to limnoria.

R-028
Evaluation of the Drott Four-In-One Bucket, Apr 1959, O. P. Bak, AD 215254L

The Drott Four-In-One Bucket is recommended, with slight modifications, for integration into the S-1 and P-1 components. It is also recommended, with these modifications, for use at those advanced based and shore establishments which desire a multipurpose machine of this nature and capacity.

R-029
Evaluation of 1/2-In. Square-Drive Electric Impact Wrenches, Jul 1959, W. B. Mitchell, A. L. Scott, AD 220245L

Tests were conducted to determine conformance of four 1/2-in. square-drive electric impact wrenches with applicable military specifications and to determine whether or not cost differences were reflected in performance differences. The wrenches were tested simultaneously in a test rack which imposed conditions considered somewhat more severe than those encountered in erecting standard bolted steel tanks. Each wrench met the major requirements of specifications. Performance differences were not such as to indicate the existence of different quality grades that differences in cost and appearance suggested.

R-030
A Feasibility Study of the Application of Mass Spectrometry to Paint Vehicle Analysis, Sep 1959, R. D. Hitchcock, AD 209528, PB 161326

This report describes an investigation of the feasibility of developing mass spectrometric techniques for paint vehicle analysis. A pyrex glass heated-inlet system was designed and built for the introduction of paint vehicles into the mass spectrometer in a vapor state. It was found that a conventional ball-and-socket glass joint, operable by external magnets, could be used as a vacuum cutoff valve. It was also found that stable temperatures could be maintained in the inlet system without thermostatic control. Repeated analyses of linseed oil at 250°C, 300°C, 350°C and 400°C were made.

The cracking patterns of other drying oils and synthetic resins and mixtures of these two types of vehicles were measured and studied. It is concluded that a pyrex glass heated-inlet system can be used to introduce the vapors of paint vehicles into a mass spectrometer and that, in spite of random variations in molecular structure induced by elevated temperatures, a distinct cracking pattern can be associated with each vehicle.

It is recommended that a catalog of mass spectra of paint vehicle constituents be prepared and that statistical analysis of repeated trials be used to derive the variability of each pattern. It is also recommended that chromatographic techniques be studied for separating paint vehicle components so that they can be analyzed separately in a mass spectrometer.

R-031
Portable Topping Plant, Oct 1959, M. C. Lorenz, AD 406217

The need for a portable petroleum refinery or topping plant to supply fuel for equipment at advanced bases is discussed. The development of two prototype units for the production of gasoline, kerosene and diesel oil is outlined. The details of the testing, modifications, and retesting of the Mark II prototype at two different locations in Montana are discussed. Testing was accomplished under a variety of weather conditions, including sub-zero temperatures. Several different crude oils were used, yielding products in varying proportions. Portability of the unit was proved by dismantling and moving 400 miles by truck in the middle of winter. The plant can be erected and producing fuel within 48 hours. The feasibility of Seabee operation was determined by having Seabees participate. Operation of the plant was improved by modifications to simplify the components, increase durability and reliability, and improve products.

R-032
Development of a Brushless Regulated AC Generator of Radio-Interference-Free Design, Sep 1959, A. M. Brown, AD 209529, PB 161104

This report describes the development of a generator of radio-interference design which produces a conventional voltage-regulated output without requiring brushes, commutator, or slip rings. There are no sliding or arcing contacts to initiate radio interference. The unique feature developed is the manner in which regulated excitation is supplied to the rotating field.

Acceptance tests showed that the generator complied with Navy voltage regulation specifications. NCEL tests showed that it was radio-interference-free to MIL-I-16910 standards. Total running time to date logged on the generator is 1600 hours.

It is concluded that brushless generators with standard performance characteristics can be built with all sliding, current-carrying surfaces eliminated. Such machines have inherent in their design prospects for a degree of highly reliable operation unattainable in conventional generators.

R-033
Evaluation of Certain Nonspecification Preservatives for Lubricating Properties, Aug 1959, O. P. Bak, H. R. Joerding, AD 220065

This report presents the test results and conclusions on the lubricating effectiveness of certain promising preservative lubricants. Testing performed indicated that the Fiske Brothers No. F-250 lubricant satisfies the condition of good load-bearing, wear, and extreme pressure operating qualities. If this lubricant proves adequate for five-year preservation of gear cases, it will satisfy the objective for usage in the five-year preservation plan.

R-034
Comparison of the Dyna-Fog, SR and the Modified TIFA Fog Generators, Aug 1959, E. N. Hellberg, AD 225562L

The U.S. Naval Civil Engineering Laboratory was requested by the Bureau of Yards and Docks to evaluate the Todd Shipyards Corporation modified Model 40E TIFA and the Curtis Automotive Devices, Inc. Dyna-Fog, SR fog generators. Tests were conducted to determine their suitability, ruggedness, and dependability for use by decontamination crews in applying water-base disinfectant solutions in the form of fog to the interiors of buildings. Comparison of throughput rates was also made.

It was concluded that the Dyna-Fog machine is more adaptable for use by military decontaminating crews than the modified TIFA. It is recommended that an in-service check be run on a number of Dyna-Fog units to secure a statistical sample.

R-035
Elasto-Plastic Response of Reinforced Concrete Beams to Short-Duration Loads, Sep 1959, S. K. Takahashi, AD 226428, PB 143964

It has been found from previous NCEL experiments that the spring-mass theory can be used to determine the deflection of reinforced concrete beams subjected to long-duration pulse loads. The question arose as to whether this theory is applicable for loads with durations of less than six times the natural period of the beam. To investigate this question, four small-scale reinforced concrete beams were tested in the rapid load machine. The tests indicate that the spring-mass theory is quite adequate for predicting initial maximum deflection or the load-carrying capacity of a beam.

R-036
Compartment-Type Air Lock Studies, Jun 1960, E. N. Hellberg, AD 239741, PB 149230

Approximately sixty tests were made to determine air lock performances. Most tests were conducted at a building pressure of 0.4 in. of water, with lock air flows varying from 200 to 400 cfm. Other tests were made at varying building pressures, and one test was made on an unpressurized building when subject to a simulated 15-mph wind.

Both air locks performed satisfactorily when operated at over 300 cfm. It was determined from these tests, however, that it was difficult and inconvenient to regulate the air flow through the perforated doors of the original NCEL-developed lock. It is recommended that the final design of the NCEL lock be considered satisfactory for BUDOCKS requirement for interior use.

R-037
Fording Kits for Tractors, Sep 1959, A. L. Scott, AD 229211L

This report presents the findings of an investigation requested by the Bureau of Yards and Docks to develop a fording kit for the Allis Chalmers HN-21 tractor and of the possibility of consolidating the components of this kit with those of the kits developed by the Army for the caterpillar D-8 tractor and by the Marine Corps for the International Harvester TD-24 into a universal kit applicable to all three class 6 crawler tractors.

A universal kit proved to be impractical due to the number of items in each kit which could neither be adapted to the other two class 6 tractors nor be replaced by a universal item.

R-038
Development of an Improved CW Impregnating Plant, Sep 1959, J. E. Halton, AD 226206

Experimental chemical-processing equipment was designed and constructed by the laboratory to convert a 100-lb combination laundry to impregnation use. Through a series of tests, a new chemical-handling unit was developed and procedures were simplified. Tests disclosed that a turbine mixer utilized in a baffled mixing tank could be successfully used in the proper preparation of impregnation chemicals. A unit design incorporating this mixer is recommended for use with a combination washer-extractor for clothing impregnation.

R-039
Winterization of Polar Equipment. Intake Air Preheating for Two-Stroke-Cycle Diesel Engines, Oct 1959, E. J. Beck, AD 226900, PB 143904

This report deals with the results of the laboratory's first experiments with supplying heat to the intake air of a two-stroke-cycle diesel engine in order to determine the heat requirement necessary to achieve adequate combustion at low ambient temperatures. Cold chamber tests, in which

intake air was electrically heated to simulate engine waste heat input were conducted at temperatures varying from Port Hueneme normal ambients to -32°F in steps of approximately 32°F.

Air preheating was found to markedly improve the operation of a two-stroke-cycle diesel engine at low ambient temperatures. Sufficient design data were obtained to allow a rational approach to the final problem of designing an experimental unit utilizing its own waste heat, normally rejected.

R-040
Portable Beach Signal Tower, Oct 1959, S. K. Takahashi, AD 230602L

A patented scaffolding tower was chosen as a prototype. Modifications were made and the tower was satisfactorily proof-tested.

Two persons can erect the modified tower within 10 minutes and can disassemble it in about the same time. No tools or specialized training are required. The dismantled tower can be bundled into four convenient packages, each of 480 lb, and occupies about 34 cu ft of shipping space. The packaging could consist of paper or fiberboard wrappings which would add little to the shipping weight or cube.

The scaffold as modified meets the specified requirements and is recommended for in-service evaluation as a portable beach signal tower for Naval communications.

R-041
Characteristics of Coral Mortars, Jun 1960, W. R. Lorman, AD 239742, PB 149466

With the view of developing technical guides needed of producing coral mortar of better quality than heretofore available in field construction, certain physical properties of laboratory mortars fabricated with coralline materials were observed in a comprehensive program of tests. Nearly 2500 specimens were involved in the experimentation. To determine how and to what degree the physical characteristics of coral mortars are affected by physical factors, selected correlations were studied.

Of the 36 principal findings, those of paramount significance are: (1) coral mortar yield is independent of sand derivation and type of mixing water, (2) coral mortars produced with reef sand and brackish water demonstrate the least volume change, (3) the type of water employed in the mix has no practical effect upon the dynamic elastic modulus of the mortar, and (4) the nominal compressive strength of coral mortar is affected insignificantly by changing the derivation of natural-graded coral sand and increases with age irrespective of type of water used in the mix.

R-042
Test of Telephone Repeaters TA-287(XC-1)/G, Oct 1959, K. B. Edwards, AD 228158

Twenty-five Signal Corps telephone repeaters TA-287 (SC-1)/G, which are transistorized and encapsulated negative impedance amplifiers, were tested to determine their operating characteristics on WD-1/TT field wire and to determine the effects of solar radiation, high temperature, and high humidity on performance.

Although aided considerably by the repeaters, the strength of voice communications over five repeaters and 30 miles of wire was somewhat less than that obtainable on city telephone service, but clarity was good. Over 12 miles and two repeaters, or 18 miles and three repeaters, the strength was equal to, or better than, city service. The amplification of 700-cps signals, however, was seriously influenced by ambient air temperature changes. The performance of five of the twenty-five repeaters was poor because of amplification instability, decline, or failure.

Physical features of the repeaters and accessories were satisfactory, except for short-lived rubber insulation on the battery wires, and nonlocking buckles on the canvas containers. Solar radiation, high temperature, and high humidity did not affect the performance of repeaters attached to fixed-impedance artificial telephone lines.

R-043
Barge Resistance Tests, Oct 1959, A. L. Scott, AD 230601

The data were analyzed, and a set of curves was produced which shows: (1) speed vs. resistance (towline pull) at three different drafts with trim even fore and aft, and (2) speed vs. resistance at three conditions of trim with the same load.

From these curves the resistance of a 3x12 barge can be determined for various load and speed conditions, and the effect of fouling and trim as shown can be used with this data to assist in predicting barge resistance for any given conditions of load, trim, speed, and fouling.

In spite of the unfavorable test conditions at sea, the resulting curves conformed to the pattern of similar curves of tests made under ideal conditions, and it is deemed that the results can be relied upon for a fairly accurate estimate of the barge resistance at the speed and load conditions shown.

R-044
New and Modified Anchors for Moorings, Mar 1960, R. C. Towne, J. V. Stalcup, AD 250603, PB 149998

Existing fleet mooring anchors have, in many instances, behaved erratically under load due to rotational instability and insufficient holding power in varying types of bottoms. In November 1967, the Bureau of Yards and Docks directed NCEL to test present standard anchors to (1) determine their behavior and holding power in sand, mud and clay, (2) compile factual data for modifications of existing anchor types, and (3) develop design criteria for new, more efficient mooring anchors. Upon completion of tests on the current type anchors in May 1955, the laboratory developed and fabricated a "family" (200 lb, 3,000 lb, 6,000 lb, 9,000 lb, 12,000 lb) of new mooring anchors which is capable of holding powers ranging from 6,000 lb to 210,000 lb in a sand bottom, and can operate more efficiently in mud than present type stockless commercial anchors with stocks.

From the results of the investigation of the new mooring anchor, it was concluded that this anchor will satisfy the physical and operational requirements specified by BUDOCKS.

R-045
The Ionics Brackish Water Demineralizer, May 1960, J. S. Williams, J. W. Burdick, AD 250604

During a two-year period a number of evaluation tests were conducted on an Ionics Brackish Water Demineralizer. Difficulties arising from minor design inadequacies, chemical phenomena, and inexperience with this new development were overcome in turn. A final performance run was completed successfully. A product containing 175 ppm total solids was obtained from a feed water containing 3500 ppm total solids. When operated at an average rate of 121 gph, the energy requirements were 23 kWh per 1000 gallons of water produced. Operation at lower initial concentration and higher product concentration would decrease the cost of demineralized water proportionately. Comparison of data obtained from a unit under test by the City of Coalinga, Calif., provided close correlation with the NCEL results.

R-046
Development of the Rush Roll, a Mobile Structure Used as a Roadway or Floating Pontoon Bridge, Nov 1959, P. J. Rush, AD 230087, PB 145158

The Laboratory has developed a mobile, easily installed transition structure that acts as a trafficway capable of supporting the heavies military vehicles across unstable

terrains. The basic unit of the trafficway is the Rush Roll, a 6-ft-diam segmented cylinder of corrugated steel pontoons weighing 6,000 lb which can be towed by jeep. It can be delivered by LST to the seaward end of a pontoon causeway, or launched into the sea and towed to the beach by light amphibious craft. The roll unfolds to form a four-trussed structure 13-1/2 ft wide and 17-1/2 ft long that can be rapidly joined with other units to create a roadway or floating pontoon bridge of any length, or may be assembled into rafts powered by outboard motors.

R-046 Add.
Development of the Rush Roll, a Mobile Structure Used as a Roadway or Floating Pontoon Bridge, Addendum, Dec 1961, P. J. Rush.

R-047
Development and Test of Sled Train Hookup and Release Devices, Jan 1960, D. Taylor, AD 233336

The Bureau of Yards and Docks authorized work on devices which would facilitate hooking-up one sled to another, and coupling and releasing the tractor and train. Four devices were developed and tested: sled-to-tractor hitch, sled-to-sled hitch, sled train safety release, and drawpole elevating device. The sled-to-tractor hitch and sled-to-sled hitch could not be used with the tractor winch cable as originally intended, and were declared unsatisfactory. A torsilastic drawpole support, conceived as a modified OTACO drawpole spaces with Neidhart torsional springs at each end, was considered as a substitute for the drawpole elevating device.

The tractor hitch with safety release device was mounted on a D2LGP snow tractor and used effectively by one man to couple and release a sled equipped with a drawpole elevating device. These items are recommended for in-service test.

R-048
Toxicity of Chemicals to Marine Borers, Part 1, Jun 1960, H. P. Vind, N. Hochman, AD 239743, PB 161909

Methods for evaluating the toxicity of chemical agents to marine borers were developed, and a method was devised for processing the data on a digital computer. Toxicity data covering the testing of several hundred compounds and mixtures were processed. The purpose of this report is to organize, condense, and interpret results obtained at MCEL between July 1954 and January 1959 together with all available data on the toxicity of chemical agents to marine wood-boring organisms.

About a third of the many constituents of creosote tested by the Laboratory were toxic to marine borers. The aliphatic constituents were not toxic either to adult limnoria or teredo larvae. With the exception of the xylenols, the monocyclic constituents also were not toxic. The bicyclic compounds and all constituents of creosote that contain only two benzene nuclei (such as naphthalene, diphenyl, dibenzyl, diphenylene oxide, and acridine) were toxic to both species of test animals.

The results of the toxicity tests have been and are being employed as a guide in the selection of compounds for harbor testing. It is recommended that the toxicity testing program be continued and that the effectiveness of the toxic compounds as wood preservatives be tested in the harbor and that no further consideration be given the compounds which were not toxic. The compounds should be tested individually and as mixtures.

R-049
Precompression Required in Prestressed Concrete Piling, Dec 1959, J. R. Keeton, AD 250605

Breakage of prestressed concrete piles has occurred in some Naval districts and not in others. In the few instances in which driving failures have been experienced, the inadequacies were overcome by correction of faulty handling and/or driving techniques and procedures.

A survey of Naval activities, industrial designers, suppliers, and users of prestressed concrete piling revealed no experimental or research data from which the optimum amount of residual (after losses) concrete precompression can be determined. Residual precompression ranges of 700 to 850 psi for pretensioned piles and 600 to 1,200 psi for post-tensioned piles are adequate for load capacities and lengths currently in use.

R-050
Sealer-Hardeners for Portland Cement Concretes, Nov 1959, J. M. Mayhoe, D. F. Griffin, AD 250606

Nine proprietary products were tested for hardening, sealing, curing, and combination effects. As a result of this investigation, it was determined that certain sealer-hardeners impart varying degrees of abrasion resistance improvement to concrete, and certain products impart improvement in each of the three areas of hardening, sealing, and curing. The criterion for acceptance or rejection of a sealer-hardener is determined to be its ability to improve the abrasion resistance of a particular concrete to a degree sufficient to recommend its use from an economical standpoint.

R-051
Squaw Valley Winter Trials, 1958-1959. Compacted-Snow Parking Study on Meadow Land, Nov 1959, R. C. Coffin, AD 230088, PB 145156

Using conventional Navy snow-compaction equipment a 15-acre parking lot was built in mid-February 1959 by depth processing and compacting a 14-to-20-in. snow pack overlaying meadow land which was in part poorly drained. The most critical problems encountered during the trials were those of protecting the compacted-snow mat from destruction by intrusion of runoff water from surrounding areas, compacting a relatively thin cover of snow on poorly drained areas, and maintaining a level traffic bearing surface as the mat settled unevenly with the dissipation of the underlying snow strata.

The installation of a drainage system prevented the complete destruction of the compacted mat by runoff water. The application of a 1/4-in. layer of sawdust was found to be sufficient to preserve even thin layers of compacted snow, laying directly on the ground, from destruction by intense solar radiation and warm weather. Double-dragging and shallow depth-processing of the compacted mat resulted in level surfaces but necessitated re-sawdusting of large areas of exposed snow to protect the mat from destruction by radiation and high temperatures. Maintenance of the lot during snowfalls was effectively accomplished by compaction as the snow fell, so long as the individual layers of newly compacted snow did not exceed 6 in. in depth.

Improvement of specialized maintenance equipment is desirable. Rubber tired equipment should be used to reduce surface damage of compacted areas, and sawdust spreading equipment should be improved to provide faster coverage and more uniform spreading.

R-052
Engineering Study of Waves and Currents in the Harbor of Port Hueneme, California, Dec 1959, J. J. Leendertse, AD 230347, PB 145157

The report presents information as to the likely effect of the water wave environment of Port Hueneme Harbor, Calif., and on harbor operations in general, of alterations to the major wharves, or deepening the harbor, and of proposed changes in the open drainage way, which empties into the harbor.

R-053
Prototype 250-Pounds-Per-Hour Advanced Base Incinerator, Dec 1959, K. B. Edwards, E. C. Morales, AD 230128, PB 145159

A prototype 250-lb/hr advanced base incinerator was developed by the Laboratory to satisfy the need for garbage- and waste-burning incinerators that are rugged, portable, and easily erected. The incinerator was designed to be supplied by a manufacturer as a factory prefabricated kit, including bagged powdered refactory for monolithic casting in the field. To determine the adequacy of the design, a kit was purchased, erected, and tested.

It was concluded that the prototype is of satisfactory design, and it is recommended that it be given consideration for advanced base use.

R-054
Dredges for Amphibious Operation, Dec 1959, O. P. Bak, A. L. Scott, AD 250607, PB 154702

Landing operations are frequently hampered by offshore sand bars or coral reefs which block the movement of landing craft to the beach. This is a study of the feasibility of using a dredge, or other means, to cut access slots through the bars to the beach, and to cut slots in the beach as slips for the landing craft.

A set of curves has been plotted which shows the amount of material that has to be removed per foot of slot at various depths for different craft, and the time necessary for various size dredges to accomplish this.

Slots in the beach for landing slips were found to be impractical because the surf moves large volumes of material which rapidly refills the slots with sand.

R-055
Joint Strength of Composite Timber-Concrete Piles, Dec 1959, W. L. Cowell, AD 250608

An engineering investigation consisting of an examination of the literature, a survey of district public works offices, a patent search, and inquiries directed to commercial manufacturers, designers and users, was made to determine the relative strength of composite-pile joint systems and to advise BUDOCKS whether there is a need for laboratory investigation in this field.

The investigation revealed that, while there is a wide variety of composite-pile joint systems available, complete experimental data are not available on which to base selection of appropriate joint systems for specific applications.

In view of the economic advantage offered by composite concrete-timber piles it is recommended that laboratory tests be conducted to evaluate the various joint systems and provide quantitative design data.

R-056
Comparison of Methods of Strain Measurement in Portland Cement Concrete Cylindrical Specimens, Feb 1962, I. R. Keeton, AD 279463

Experimental short-time loading tests were made on portland cement concrete cylindrical specimens to reveal relative strain-sensing capabilities of mechanical and resistance strain gages. In addition, end-to-end strains were measured with resistance-type cantilever reeds.

Comparative tests indicated that strain measurements made with devices containing electrical resistance strain-sensing elements are more accurate because they tend to minimize the effects of experimental procedures. Accordingly, where feasible, future concrete strain measurements at NCEL should be made with devices utilizing resistance strain-sensing elements rather than with mechanical strain gages.

R-057
Evaluation of Condensate Return Line Corrosion Testers, Mar 1961, J. M. Mayhoe, N. L. Slover, AD 252586

Three proprietary testers were evaluated, the National District Heating Association corrosion tester, the Bureau of Mines condensate-corrosion tester, and the Crest Instrument Company corrosometer probe. An NCEL tester was also evaluated.

In two laboratory and two field test series, the variation in the test data was relatively insignificant among three testers - the Bumines tester, the corrosometer probe, and the NCEL tester. The NDHA tester showed a significant variation in the test data from the other testers.

R-058
Evaluation of Hydraulic Engine Starters, Dec 1959, A. L. Scott, AD 250609

Tests conducted for eight months by PHIBCB One to determine the effectiveness of a hydraulic starting system for marine diesel engines led to the conclusion that the hydraulic starting system tested is superior to the conventional electric starting systemfor engines exposed to a salt air environment at moderate ambient temperatures.

Seven months of in-service testing of two brands of hydraulic starters conducted by NCEL at Port Hueneme confirmed the above conclusion.

R-059
Comparative Evaluation of Industrial Sweepers, Mar 1960, J. J. Bayles, R. E. Jochums, AD 250610

A comparative evaluation of various industrial and warehouse sweepers was conducted by the Laboratory in order to determine the best machine for Naval requirements.

R-060
Strain Gage Technique for Dynamic Measurements of Ice, Feb 1960, D. B. Clark, AD 235057, PB 146971

Strain gages were applied to various samples of fresh water and sea water ice. These were compression-loaded dynamically to failure, while the strain was recorded with an oscillograph and bridge amplifier. Sufficient strain data was recorded to indicate the validity of the new technique. Under rapid compression loading to a point near failure of the ice, a strain-gaged ice sample can be cycled without permanent deformation or flow of the ice, and without slippage of the gage. Gages properly coated are shown to hold their high electric impedance against sea water ice for a period of time exceeding three weeks.

Resistance wire strain gages, with proper preparation and application, can be used advantageously to measure the dynamic strains in fresh water ice or sea ice, and thus determine their structural characteristics.

R-061
Evaluation of the "Moon" Oil Burning Conversion Unit for Army Tent Stoves, Nov 1959, C. R. Hoffman, AD 250611

As the result of recommendations made by the Army Infantry Board, Fort Benning, Georgia, this Laboratory was requested to determine if, from an engineering viewpoint, the "Moon" conversion unit is a suitable replacement for the burner, oil, stove, tent, M-1941, or if it possesses design features that should be incorporated in Army space heaters.

The tests have shown that the "Moon" conversion unit does not burn the fuels tested as efficiently, or as cleanly, as the standard burner, oil, stove, tent, M-1941, nor is it as trouble free in operation. It is not recommended as a replacement for the standard burner, oil, stove, tent, M-1941.

R-062
Contiguous Wrapping of Transmission Line Conductors With High-Mu Tape for Large Radio-Interference Attenuation, Mar 1960, D. B. Clark, R. D. Hitchcock, AD 235873, PB 147115

The problem assigned this Laboratory by BUDOCKS was to find means of reducing this interference to acceptable levels. This report describes the application of a high-permeability stiffing tape to a transmission line, resulting in high attenuation of radio frequency energy in the range of interference frequencies found normally on transmission lines. A theoretical treatment is presented of a long conductor coated with a high-permeability material. The results of this analysis show a great magnification of the skin effect losses at frequencies above the power transmission frequency, and are supported by experimental measurements made on three long conductors wrapped with a thin, high-permeability tape. A small helical air gap was formed in the wrapping of two of the transmission lines to reduce saturation effects which would normally occur on lines distributing power. The attenuation measured on these lines was about half that of the fully wrapped line, but gave much lower standing wave ratios (less than 1.28) and a low characteristic impedance phase shift. The attenuation of these lines was large compared to the attenuation of a bare line in the frequency range measured from 25kc to 50 Mc.

It is expected that high-permeability tape coatings with a gap will prove to be a useful and practical technique for reducing interference on power transmission lines.

R-063
Evaluation of 60-KW Winterized Diesel Engine Generator Sets--Caterpillar, Apr 1960, R. M. Leseberg, J. H. Sams, AD 250612

Two winterized 60-kW Caterpillar Tractor Company diesel-engine-driven generator sets with Louis Allis Company AC generators were procured and evaluated for suitability as standard advanced base equipment. Initial tests indicated that certain modifications were necessary, and the manufacturer completed these modifications. The units were accepted, tested, and evaluated at NCEL for compliance with military specification MIL-G-10327A(CE) according to methods of test of military specification MIL-G-10228A(CE).

The 60-kW prototype generator sets generally met applicable military specifications except that the speed regulation recovery time exceeded the 4 sec allowed. The engine governing system performed poorly, and other minor deficiencies were encountered. Fuel consumption is 0.708 lb/kWh, which is considered economical.

Certain suggested modifications will correct these deficiencies of this model caterpillar generator. The 60-kW caterpillar generator sets of this type should not be accepted for advanced base use until they incorporate these modifications and correct the engine governing system.

R-064
Evaluation of Gardner-Denver Airtrac Drill, Jul 1960, R. H. Henley, R. E. Jochums, AD 240934

After preliminary review, the "Air-Trac" pneumatic rock drill might be a desirable replacement for the standard wagon drill due to its improved production rates, its self-propulsion capability, and its ability to tow an air compressor. This report presents the results and conclusions of the evaluation of the "Air-Trac" drill.

The "Air-Trac" drill, or one of similar design, is recommended as a replacement for the standard wagon drill for use at advanced bases.

R-065
Evaluation of Joint-Sealing Compounds for Airfield Pavements, Jan 1960, R. J. Lowe, H. Tomita, AD 250613

This report presents the results of specification and field evaluation tests performed to determine the effectiveness of 22 different compounds used to seal joints in concrete airfield pavements. Of the sealers tested, only one passed all of the tests.

It was concluded that materials marketed to conform to federal specification SS-S-170 are not acceptable, that a new specification for polysulfide liquid polymers is required, and that acceptance testing include exposure tests to jet or simulated jet exhaust. Continued testing of new and improved compounds is planned.

R-066
Relative Column Strength of Long Piles, Feb 1960, J. J. Hromadik, AD 250614

Sufficient data are lacking on which to base accurate design criteria for long piles used to support waterfront structures. In order to determine the selection of the best type of commercially available pile, full-scale tests on the relative column strengths of six different types, 80 feet long, were conducted at NCEL.

Nine of the eighteen specimens scheduled for the test program were tested under conditions of piles at refusal, utilizing a field test tower capable of producing loads up to 400 tons, in which specimens with an unsupported length of 60 ft or more were loaded to buckling failure. Tests on four types were conducted to failure; tests on two types were terminated at the capacity of the loading system.

This report is an interim on the results of tests to date. Data are sufficient to determine ultimate load capacities with reasonable accuracy. Good agreement is obtained between test buckling loads and theoretical buckling loads calculated on the basis of tangent modulus principles.

R-067
A Packaged Fire Sprinkler System for Advanced Base Buildings, Feb 1960, R. J. Zablodil, C. R. Hoffman, R. S. Chapler, AD 234878

The fire sprinkler system was developed to protect the standard 20 ft x 48 ft advanced base building. It has a 370-gal storage tank, a rectangular, 12-headed sprinkler loop, and associated valves and fittings. The system is dry and starts automatically when supervisory pressure maintained in the loop is lost. Pressure loss opens the pilot-operated main nitrogen valve to pressurize the storage tank from two high pressure nitrogen cylinders.

Five tests, one each with 1, 3, 6, 9, and 12 heads open, were made at 70°F, using water as the extinguishant, and all five were satisfactory. Flow rates varied from 12 gpm with one head open to 70 gpm with all 12 heads open, and operating time varied from a minimum of 5 min to a maximum of 30 min. Three tests were made at -65°F on the nitrogen pressurization portion alone. Satisfactory performance was obtained with regulated pressure approximately twice that of the 70°F tests.

The nitrogen pressurization components should be improved for low temperature application, and a prototype sprinkler system should be fabricated and field tested in the Arctic.

R-068
Coral and Coral Concrete, Apr 1960, W. R. Lorman, AD 239744, PB 149232

1. Describes and defines coral reefs, beaches, and elevated formations. The principal sources of coral aggregate are classified as reef, beach, bank-run, and quarry coral.

2 Presents salient features relative to prospecting for suitable coral deposits, extracting coralline limestones, and processing and stockpiling the aggregate

3 Summarizes findings concerning such physical properties of coral aggregate as bulk density, specific gravity, and absorption

4 Furnishes typical coral concrete mix-proportion data together with anticipated strength values, and gives technical data concerning mixing time and use of concrete admixtures under tropical conditions

R-069
Superseded by R-121

R-070
Interference Suppression for Automotive Ignition Systems, Feb 1960, A M Brown, AD 236876, PB 147812

Prototype harnesses performed their function satisfactorily under in-service tests on Navy vehicles at Point Mugu, Calif., and at Davisville, R I Radio interference suppression was good, ignition system operation was good, and equipment maintenance was nominal No operating failures from moisture condensation were experienced However, difficulties were experienced in making the original installations, and inconveniences were encountered by mechanics in dismantling and reassembling the harness components while making engine repairs

It is recommended that further attention be given to improving the design of the harness in order to overcome deficiencies and make its use more acceptable to automotive maintenance personnel

R-071
Refuse Disposal at Bay Area Naval Stations, Dec 1959, W R Nehlsen, AD 250015

No Bay Area station is currently violating any smog prevention regulations by its refuse disposal methods A new regulation expected about 1 January 1960 will probably result in a violation by Oakland Naval Supply Center Results of the survey show that integration of the refuse disposal systems at two or more of the stations does not appear practical, with the exception of the possible use of a single incinerator by the Oakland Naval Supply Center, the Treasure Island Naval Station, and San Francisco Naval Shipyard Neither the refuse charring or compaction systems are considered applicable to the Bay Area problem at this time No radically new method of handling refuse has been discovered, and the current problem at several stations is selecting the most economical means to fit the local conditions

R-072
ABC Decontamination Equipment for Personnel in the Arctic, Mar 1960, W R Nehlsen, AD 236875, PB 146969

A 60-man/hr portable shower unit was designed by NCEL to fulfill a BUDOCKS requirement for decontamination of large numbers of personnel in Arctic climates A shower waste water treatment and recirculation system was included to minimize the effects of critical water shortages expected under Arctic conditions Tests performed by NRDL, Fort Detrick, and the Army Chemical Warfare Labs on the shower waste recirculation system showed that satisfactory results could be obtained on atomic and biological agents, but the allowable time interval before starting chemical agent decontamination proved to be so brief that no mass decontamination method could be considered effective

Because of the inherent dangers of the recirculating system, an individual washing kit was devised by NCEL as an alternative to the shower unit The individual washing kit is safer and more economical for atomic and biological decontamination, but neither system is suitable for chemical agent decontamination

R-073
Passive Resistance of Earth-Anchors in Sand, Part 2, Mar 1960, J B Smith, AD 235874, PB 147118

The overall test program is about 15% completed So far, a small 2-ft-high by 2-1/2-ft-wide earth-anchor has been tested in sand at various depths down to 7 ft Holding powers at the 7-ft depth were about 48,000 lb Sand tests at a 2-ft depth with an individually pulled 3-ft-high by 24-ft-wide earth-anchor resulted in holding powers of about 200,000 lb Three 3-ft-high by 6-ft 9-in -wide rectilinear-placed earth-anchors, pulled in parallel at a 2-ft depth, held about 265,000 lb

Firm conclusions and a final report will be made when the test program is complete

R-074
Paraffin as a Conduit Seal Against Blast Pressure, Feb 1960, H G Aggas, AD 234960, PB 147811

The Laboratory was requested to determine the blast resistance of paraffin as a sealing compound in Crouse-Hinds explosion-proof sealoffs These sealoffs, which had approximately one-half of their cross-sectional area filled with standard electrical wire, were sealed with paraffin and tested in the blast simulator Paraffin is an effective seal for resisting dynamic and static pressures to at least 150 psi at an average temperature of 68°F The sealoffs were subjected to dynamic pressures up to 170 psi with no damage to the wax seal

R-075
Warehouse and Preservation Methods and Economics For Storing Materiel, Jun 1960, R J Zablodil, J C King, AD 239745, PB 149233

NCEL is conducting a five-year storage test program to evaluate various storage environments and preservation levels for materiel under the Bureau of Yards and Docks technical cognizance Similar paired items of military equipment were stored in different storage environments - an open air slab, a shed, a standard warehouse, a 40% RH warehouse, and a 50% RH warehouse One of each pair had light domestic preservation treatment and the other full contact preservation treatment Deterioration was permitted to develop at its natural rate in each environment Periodic inspections were used to determine the storage protection afforded by each environment

Results of 2-1/2 years of storage show that protection is poor in open air, fair in the shed, good in the standard warehouse, and better in the RH warehouses.

The Navy standard 40-ft by 100-ft prefabricated metal building appears generally satisfactory for advanced base dehumidified warehousing, but it has too many joints to be easily sealed

R-076
Hold-Down Clamp For 3x15 Pontoon Causeway, Jun 1960, J. V. Stalcup, AD 239746, PB 149156

Ten hold-down clamps were tested that were designed by the Bureau of Yards and Docks, Amphibious Construction Battalions One and Two, and the U.S. Naval Civil Engineering Laboratory. All of the clamps held a greater load than 32,000 lb, but the pontoon angles to which the clamps attach failed at an applied load of approximately 32,000 lb because of bending and/or shear stresses. The clamp used with 2x30 causeway sections was also tested to provide a comparison of strength between the new holddown clamps and the pontoon angles.

Three clamps, BUDOCKS No. 2, PHIBCB TWO No. 1, and NCEL No. 3, were judged to be comparable on the basis of strength, weight, cost, and ease of installation.

R-077
Harbor Screening Tests of Marine Borer Inhibitors, Part 2, Mar 1960, H. Mochman, T. Roe, AD 235875, PB 147116

The Laboratory has been conducting exposure tests of materials for treating timbers in order to reduce the damage caused by marine borers to waterfront structures. This report lists the results of harbor tests of treated panels removed between August 1958 and August 1959 at Port Hueneme and Pearl Harbor. It also lists all treated panels which have been exposed for one year or more and which have shown no attack or very slight amounts of attack.

These results together with results obtained from current and future laboratory toxicity tests will be used in developing additional wood treatments under harbor exposure conditions. Emphasis will be placed on the addition to creosote and creosote-coal tar solutions of materials which are toxic to Limnoria.

R-078
Dynamic Tests of Aluminum Beams, Mar 1960, J. R. Allgood, S. K. Takahashi, AD 235869, PB 147117

Results are presented on static and dynamic tests of three built-up beams of 5456-H311 aluminum alloy. The beams, with a clear span length of 8 ft 1-3/8 in., had restrained ends and were subjected to uniformly distributed loading. One of the members was tested statically and sustained a load of 21.6 psi prior to the occurrence of web buckling. The other two members were subjected to blast loads with peak overpressures of 18.2 psi and 18.5 psi. Web buckling also occurred in these members.

The dynamic response of the members is discussed, and a design criterion is proposed based on a limit deflection of L/50. In accordance with the suggested criterion it is shown that the alloy and section used are not ideal for resisting blast loading.

R-079
Device for Replacing Tie Rods in Pontoon Assemblies, May 1960, J. V. Stalcup, R. C. Towne, AD 238689, PB 148554

During the development of the independent pontoon system by NCEL, a wedge clamp was proposed as a replacement for the heavy and relatively costly tie rods. The wedge clamp joins the bottom pontoon angles while standard P-5 or AP-1 plates connect the deck angles.

Launching and sea tests were conducted on three pontoon barges assembled with the wedge clamps.

Tests indicate that wedge clamps are satisfactory for joining pontoon strings, especially for pontoon structures wider than three strings, but do not provide resistance to the vertical shear between strings that occurs during side launching. In sea water, corrosion does not hinder the operation of the clamps.

When barge assembly methods permit their use, standard P-5 or AP-1 plates are better than clamps.

R-080
Shielding Factors for Underground Shelters of Various Geometric Shapes, Apr 1961, J. C. Ledoux, L. K. Donovan, AD 254344, PB 155647

This study investigates the additional nuclear shielding from an isotropic (plane) radioactive gamma source afforded by various shapes of underground curved-roof shelters compared to the basic slab shield. This additional shielding is defined in the form of a dimensionless geometry factor which is a function of the physical dimensions and shape of the shelter.

Curves are presented from which the geometry factors for the underground shelter shapes of spheres, horizontal cylinders, ellipsoids, and vertical cylinders or silos can be obtained with minimum calculations using only the physical dimensions of the shelter and the depth of material above the crown of the shelter.

The geometry factors thus obtained are independent of material and photon energy except in the case of the silo and can be used as dimensionless factors once the attenuation for a slab shield has been calculated for a particular set of radiological conditions and materials.

R-081
Laundry Water Recovery by Flotation Clarification, Jul 1960, J. E. Halton, J. V. Graham, AD 240935, PB 160951

Field activities of the Bureau of Yards and Docks include operating laundries for hospitals and military camps. In some areas fresh water for these laundries is limited, and the Prosperity Company of Syracuse, N.Y., was awarded a contract to develop an experimental plant for recovering laundry water by flotation process. The Boston Navy Shipyard tested the plant and the process, and found them feasible. The treatment plant was assigned to NCEL for simplification of controls, development of treatment methods for various laundry wastes, and development of design criteria for a recovery unit to be used for an in-service test.

These objectives have been attained, and treatment methods have been developed that are applicable to many types of laundry wastes. The unit recovers laundry water effectively and rapidly, and the only fresh water required for the laundry is a small quantity for a final rinse of clothing. Chemical expense is moderate, and the treated waste water is supplied for re-use heated and softened so that the net cost of the process is low. The process is now ready for in-service testing at a field laundry. Application data is included to facilitate selection of a site and economic analysis for Navy use of this process.

R-082
Study of Creep in Concrete, May 1960, J. R. Keeton, AD 237959, PB 148397

Cylindrical concrete specimens of several sizes were subjected to constant sustained compressive stresses of 2,000 psi and 3,000 psi. These stresses represented 38% and 57%, respectively, of their ultimate compressive strengths at time of loading. Specimens were placed in controlled environments of 20%, 50% and 100% RH at 73°F.

End-to-end concrete deformation was measured with electronic cantilever deflection reeds and deformation in the central portions was measured with mechanical strain gages. Corresponding shrinkage measurements were made on unloaded control specimens.

Test results are reported for 175 days of loading. In the range of sizes investigated, creep does not appear to be greatly influenced by specimen size, but creep is 5% to 10% greater in 20% RH than in 50% RH. Creep in 100% RH is about two-thirds of that in 50% RH.

R-083
Radiation Slide Rule for Atomic Fall-Out Problems, May 1960, J. C. Ledoux, AD 238690, PB 148660

A nuclear weapon explosion results in earth and bomb debris which has become contaminated with fission products, residual radiation or fallout. The problem of decontaminating an area depends largely on the radiation intensity and the rate of decay of the fission products.

Previous methods of determining dose to personnel during decontamination operations used tables or graphs to determine the total dose which would be received at a certain location over a specified period of time. Except for values used in the tables the desired value must be obtained by interpolation.

This report presents the theory, construction, and use of a circular slide rule which is designed to solve passive defense problems dealing with residual radiation. The rule is based on the T **(-1.5) law of radioactive decay. The slide rule can be used to solve an infinite number of individual problems without the necessity of interpolation in

tables or construction of graphic plots. A number of typical problems are worked with the slide rule to indicate its method of use.

R-084
Literature Survey of Concretes for Nuclear Radiation Shielding, Jun 1960, M. Merrill, W. L. Cowell, AD 239871, PB 161910

A literature survey was made to determine the extent of knowledge about shielding materials used as aggregates in concrete. Information is presented on (1) mix design incorporating various types of heavy aggregates, (2) available cost data relating to construction methods and aggregates, (3) problems associated with heavy concretes during construction, and (4) nuclear shielding properties for concretes.

The use of heavy aggregates for increasing the density of concretes has been well explored by previous investigations. At present there are no materials that can compete economically with barite and iron ores. Of the iron ores, magnetite is the most popular. Of the high cross-sectional materials for thermal neutron absorption, baron is generally the most economical.

R-085
Determination of Octadecylamine in Steam Condensate, May 1960, T. Roe, H. Hochman, AD 250616

Two commercial test kits, the Dearborn test kit and the Nagafilm Control, designed for the determination of octadecylamine in steam condensate, were evaluated for accuracy and reliability. Solutions of various octadecylamine content were prepared and analyzed and results tabulated.

Both kits will determine octadecylamine in solution. Both, however, give low readings when used to analyze for dioctadecylamine, which forms when octadecylamine decomposes under boiler conditions. In overall performance, the Dearborn kit is more accurate, less expensive, and easier to use. Some changes, however, should be made in expressing the concentration of filming amine in condensate, and the toxicity of dioctadecylamine should be established.

R-086
Blast Loading of 15-Foot R/C Beams, Jan 1961, J. R. Allgood, S. K. Takahashi, W. A. Shaw, AD 249657, PB 153964

This report presents the results of a series of tests designed to reveal the nature of the dynamic reponse of restrained R/C beams as compared with simple beams. A secondary aim was to verify the results of previous small-scale beam tests.

The test data gives an insight into the complex elastoplastic action of simple and restrained flexural members. It was found that considerable advantage is to be gained by using restrained members instead of simply supported ones and that the simulator is an exceptionally simple and reliable loading device.

R-087
Fire-Retardant Coatings, Oct 1960, R. L. Alumbaugh, AD 246250, PB 171182

Fifteen fire-retardant systems applied to wooden test panels and exposed to a marine atmosphere were tested after 4 to 18 months of weathering. The fire-retardant characteristics of the majority of coating systems decreased as a result of weathering. However, one of the systems showed no evidence of coating failure, and its fire-retardant characteristics improved with weathering.

Nine systems were tested for fire-retardant properties using three standard test methods. The National Bureau of Standards radiant panel method and the ASTM stick and wick method generally ranked the systems in the same order of effectiveness, while results of the ASTM fire test cabinet method showed some variation from this order. The NBS radiant panel method differentiated between coating systems better than either ASTM method.

Chemical impregnates generally deteriorate in a marine atmosphere. Only one of the impregnates merits further investigation.

R-088
Evaluation of the McKiernan-Terry DE20 Diesel Pile Hammer, Aug 1960, J. J. Hromadik, AD 250617

Tests to evaluate the driving capabilities of the DE20 hammer on various types and sizes of vertical piles and wood batter piles are described and discussed. The functional and operational characteristics of the hammer are described, test results and output analyses are presented, and comparisons are made from an operational and economical standpoint of the diesel pile hammer versus the conventional steam-powered pile hammer.

Interpretation of the results indicates that the DE20 unit is capable of driving vertical and batter piles at an output of 10,000-11,000 ft-lb per blow. A comparison of test results, operational characteristics and shipping data demonstrates the diesel unit's superiority over the conventional steam hammer in terms of time, transportation, support, and materials. Adoption of the McKiernan-Terry DE20 Diesel Pile Hammer as Navy standard stock equipment is recommended.

R-089
Effects of Jet-Engine Exhaust on Virginia Diabase Concrete Pavement, Nov 1960, H. Tomita, AD 246589, PB 153178

In coordination with a National Bureau of Standards' study on the refractory qualities of concrete, NCEL conducted a study to determine the resistance of Virginia diabase concrete to thermal shock from jet aircraft operations. In simulated field tests, concrete slabs and beams were subjected to the exhaust of a jet engine.

The slabs spalled during the afterburner power level of the first exposure cycle, with recorded surface temperatures of 900°-1000°F. Subsequent exposures resulted in no additional spalling during 3 cycles of exposure but suffered reduction in flexural and compressive strengths.

The Virginia diabase concrete did not possess the necessary refractory qualities and flexural strength requirements. Its use is not recommended for jet aircraft full-power test areas. It is recommended that simulated field tests be conducted on small concrete slabs and beams before a concrete is designated for areas which will be subjected to severe jet-engine exhaust conditions.

R-090
Dual-Rail Snow Tracks for Model 955 Traxcavator, Aug 1960, D. Taylor, J. J. Doman, A. L. Scott, AD 245622

As a continuation of its dual-rail track system development, NCEL adapted dual-rail modifications to a weight-handling tractor. A caterpillar model 955 Traxcavator was fitted with 40-in. dual-rail tracks for low ground pressure and given a series of shakedown and in-service tests.

The unit performed satisfactorily in all tests. No significant defects of design or construction were found. It was concluded that for snow tractors weighing up to 33,500 lb, the dual-rail snow track system is practical for units with nonoscillating tracks. A single wooden track-carrier block mounted between the track rails was found to be better than double blocks mounted under the rails.

R-091
Combination Cargo Sleds, Oct 1960, J. J. Doman, D. Taylor, AD 246000, PB 152942

A 20-ton bobsled, similar to those used at Operation Deep Freeze I (1955-56), was purchased, and three different

modifications were made before a satisfactory combination cargo sled was produced.

The sled was developed for Arctic use so that it can be readily converted from a bobsled for long-haul sled train operations to two fixed-runner sleds for short-haul operations.

The combination cargo sled was tested satisfactorily over a sand course at Port Hueneme. It is recommended that the sled be given a cold-weather in-service test.

R-092
Forces Induced by Breaking Water Waves on a Vertical Wall, Mar 1961, J. J. Leendertse, AD 252980, PB 155444

Analyses are presented of two-dimensional laboratory measurements of the forces induced by breaking waves on a vertical barrier placed on a plane with a one-to-ten slope. The deepwater wave heights ranged from 0.2 to 0.6 ft, and their periods ranged from 1.9 to 3.3 sec. The ratio between the depth of water in front of the barrier and the deepwater wave length was approximately 0.011.

Experimentally derived graphs are included from which, for waves with a steepness between 0.013 and 0.006, the average force and the interval between the initial impact of the wave and the maximum of the second rise can be calculated.

An experimentally derived expression is presented for the descending branch of the initial, high-intensity, short-duration force. This expression indicates that, at a time slightly after the initial impact, the force is approximately four times the value of the peak itself.

A method is presented for the design of a breakwater in which the basic dynamic equation is utilized together with the experimentally derived history of the excitation. An example of its application is included.

R-093
Reissued as N-392.

R-094
The Tundra Truck, Sep 1960, D. Taylor, AD 246251

NCEL originally conceived an idea for an amphibious vehicle (Tundra Truck) having an LVT engine and power train driving two 60-in.-wide endless rubber track belts on large spring-mounted buoyant rollers. The vehicle was built under various contracts and then tested at NCEL. It maneuvered easily in water, and had a speed of 3 knots, but failed on land because of the power it lost in rolling resistance between the bogie wheels and the rubber track belt. Furthermore, the vehicle could not be steered on land because its turn resisting moment was greater than the turning moment under all normal operating conditions.

R-095
Teflon as a Metal Preservative, Oct 1960, R. J. Zablodil, M. R. Joerding, AD 246252

A film of Teflon was applied to most corrodible surfaces of a jeep for long-term exposure in open storage in the marine environment at Port Hueneme. The effectiveness of Teflon as a preservative varied with the degree of exposure to the weather and outside air. The film on fully exposed surfaces began to break down after 3 months, semi-exposed areas failed within 6 months, and applications on brake drums failed within 10 months.

Teflon is recommended as a preservative for internal surfaces of cavities, such as transmissions and differentials. It is not recommended for surfaces exposed to marine air or for surfaces forming seals. Teflon on the master cylinder caused poor braking and on the wheel cylinder allowed brake fluid to leak. Piston blow-by suggests that Teflon reduces the surface adherence of oil. It is likely that vibration will loosen nut and bolt assemblies.

R-096
Cancelled.

R-097
Corrosion Survey of Steel Sheet Piling, Dec 1960, C. V. Brouillette, A. K. Manna, AD 249658, PB 171501

In a survey of the corrosion occurring on steel sheet piling at eight Naval harbors a parallel series of samples were cut from three piles at each harbor, and the corrosion losses were determined by laboratory analyses. A technical literature survey revealed additional data on the corrosion of steel sheet piling and the effectiveness of cathodic protection.

Investigation showed that the greatest rate of corrosion of steel sheet piling is in the splash zone and at about 2 ft below MLW. The vertical distribution of the intensity of corrosion is the same as that found in the literature.

No protective maintenance coatings had been applied from MLW to the top of the pile at any of the eight harbors investigated. Coating piles fully before driving them increases their life, especially from MLW into the mud zone. Cathodic protection has been in use at Puget Sound Naval Shipyard for the last six years and appears to have retarded corrosion of the piling below MLW.

R-098
Acceptance Test for Preservative Lubricants Based on Infrared Spectra, Dec 1960, J. B. Crilly, AD 247707

Infrared spectra of 33 lubricants have been prepared for use in military specifications as a reference for the inspection and identification of acceptable preservative oils. A simple scheme for classifying spectra is presented by which the spectrum of a lot sample or an unknown material can be matched with the spectrum of a qualified product.

The method is based on the findings that differences between spectra of unlike materials are sufficient to discriminate among them, that several lots of the same material produce spectra which are nearly identical, and that spectra from the same lot are identical within experimental error.

R-099
Steel Surface-Hardening Processes and Materials, May 1961, R. L. Alumbaugh, C. V. Brouillette, AD 257846

The Laboratory investigated (1) the surface-hardening properties of Nitro-loy and similar casehardening compounds and the effect of these on various types of steel, and (2) the heat-treating properties of the various steels.

R-100
Superseded by N-391.

R-101
Foamed Plastics and Other Selected Insulating Materials, D. F. Green, AD252981

This report summarizes a literature survey of foamed thermal insulating materials and recommends future laboratory investigations. It presents information about thermal insulation properties and applications of foamed materials including plastic, rubber, glass, and concrete. Pertinent data from commercial manufacturers' brochures and other available literature is also summarized.

Foamed materials have been used extensively for thermal insulation in both the high and low temperature fields, but the survey revealed that, while many proprietary foamed products exist, little information other than that provided by the manufacturers is available about their properties.

R-102
Reissued as N-394

R-103
Feasibility of Flotation Clarification for Water Treatment, Dec 1960, J. R. Malton, W. R. Nehlsen, J. V. Graham, AD 248070, PB 153610

As a result of NCEL developmental work on a flotation process for waste-water clarification, the feasibility of expanding application of this process to treat turbid water was studied. A 5-gpm experimental water-treatment flotation clarifier was constructed and used to treat naturally and artificially turbid waters. Experiments also were made to show the effects of water alkalinity variations on the process.

Because of high chemical requirements, this process is not considered suitable for further development.

R-104
Evaluation of Sanitor Type B Waste-Disposal System in Polar Camp Use, Oct 1960, W. R. Nehlsen, AD 246001

Polar camps on the littoral may have limited supplies of fresh water available, and a low-water-use waste-disposal system can be of considerable value in improving camp sanitation. A commercial system combining a low-water-use toilet with an aerated treatment appeared to be applicable to this situation, and two units were procured for testing. Results show that the capacity of the treatment tank is lower than expected, but that the system may be useful for some polar camp requirements.

R-105
Radiological Decontamination Methods and Equipment for Cold-Weather Regions, Sep 1961, D. Taylor, E. N. Hellberg, W. R. Nehlsen, L. K. Donovan, AD 264130

The information contained in this report is designed to be used along with NAVDOCKS TP-PL-13, radiological recovery of fixed military installations, in order to adapt TP-PL-13 to cold-weather conditions. This report is to act as the basis for a cold-weather supplement to TP-PL-13 which will be published by the Bureau of Yards and Docks.

The effects of cold weather upon the operation of the basic recovery plan are pointed out. The major problem areas most likely to be encountered in recovering a fixed military installation subjected to radiological contamination in cold climatic conditions are outlined, and methods and equipment to be used for radiological decontamination are indicated and illustrated for various cold-weather conditions.

R-106
Dual-Rail Snow Tracks for the Caterpillar D-4 Tractor, Oct 1960, A. L. Scott, D. Taylor, AD 246002

As a continuation of the LGP tractor development program, the dual-rail snow track system was adpated to a caterpillar D-4 tractor. The unit was fitted with 42-in. dual-rail tracks to decrease ground pressure and was given a series of shakedown and in-service tests.

The unit performed satisfactorily in all tests. No significant defects of design or construction were found. Heavy steel braces enabled the extended final drive shafts to support the oscillating tracks without excessive strain. It was concluded that the dual-rail snow track system is practicable for use on the caterpillar D-4 tractor.

R-107
Snow-Compaction Equipment, Snow Rollers, Jan 1961, J. B. Camm, AD 250215, PB 154332

While the Navy's cold-processing snow-compaction techniques were being developed, two types of rollers along with other special equipment were used to produce good-quality compacted snow.

An 8-ft diam, 8-ft wide, 10,240-lb steel roller was developed to compressively compact the snow field before grading and depth-processing and to compact the pulverized snow after processing. This roller was also used to maintain compacted snow areas by progressively compacting new snowfall and draft. It was effective at speeds up to 500 fpm and could cover 4.9 acres/hr under good conditions. Based on 1959 prices, its cost is about $5,500 per unit.

A 13-ton standard construction roller with 13 pneumatic wheels was used in the final stage of construction to strengthen the top 6 in. of the compacted snow. This roller, along with the snow-compacting roller, was also useful in compressively compacting new snowfall.

R-108
Snow-Compaction Equipment, Snow Mixers, Jan 1961, R. C. Coffin, E. H. Moser, AD 250216, PB 154333

Commercially available, towed-type construction mixers were modified as snow mixers for the Navy's cold-processing snow-compaction techniques. Two sizes of snow mixers, along with other special equipment, were necessary to produce good-quality compacted snow. One size, a model 24 snow mixer, had a 24-in.-diam rotor, a maximum rotor speed of 790 rpm, and a maximum peripheral speed of 4,960fpm. The other size, a model 42 snow mixer, had a 42-in.-diam rotor, a maximum rotor speed of 515 rpm, and a maximum peripheral speed of 5,665 fpm.

Both models satisfactorily mixed and blended snow for depth-processed, compacted-snow mats. They were also useful for processing new deep snowfall and heavy drift on compacted mats for maintaining the compacted surface. The model 24 mixer can construct a mat up to 16 in. thick; the model 42 mixer can construct a mat up to 28 in. thick.

R-108 Suppl.
Snow-Compaction Equipment, Snow Mixers, Supplement, Jan 1961, R. C. Coffin, E. H. Moser

This supplement identifies the commercial components used in the model 24 and model 42 snow mixers described in TR-108. These snow mixers were developed to pulverize and intermix the top 2 to 42 in. of snow in the construction of compacted-snow areas by the Navy cold-processing techniques.

R-109
Snow-Compaction Equipment, Snow Drags, Oct 1960, J. B. Camm, AD 246003, PB 171375

Numerous types and sizes of drags were tested and evaluated during the development of the Navy's snow-compaction techniques. As techniques were developed for constructing skiways, roads, and runways on shallow and deep snow fields, two types of drags, along with other special equipment, were found necessary to produce good-quality compacted snow.

A snow-leveling drag was needed in the preliminary stages of construction to level and compact windrows left by other equipment, to spread and level shallow drift and light snowfall, and to remove slight surface irregularities.

A snow-finishing drag was needed in the final stage of construction to obtain a hard, smooth finish on compacted snow. Such a finish was necessary for successful operation of aircraft, cars, trucks and other wheeled vehicles on the compacted surface.

R-110
Snow-Compaction Equipment, Snow Planes, Feb 1961, E. N. Moser, AD 250532, PB 154463

A commercially available two-type land plane was modified to a snow plane for the Navy's cold-processing snow-compaction techniques. Two sizes have been developed. One, for general-purpose use, had a 40-ft span and is called a model 40 snow plane. The other, for specific use on the long-wave sastrugi at the South Pole, has an 80-ft span and is called a model 80 snow plane. This report describes the development and evaluation of the model 40.

The snow plane is a satisfactory piece of equipment for planing natural and compacted snow, grading draft snow, and laterally moving snow to build up or level a snow field. A combination planer bowl and grader blade operated hydraulically, is provided for planing and grading. As a planer the model 40 can cover up to 3-1/4 acres an hour, and as a grader it can cover up to 3 acres an hour.

R-110 Suppl.
Snow-Compaction Equipment, Snow Planes, Supplement, Feb 1961, E. N. Moser, AD 250533

This supplement identifies the proprietary components used in the model 40 and model 80 snow planes and auxiliary equipment described in TR-110. These snow planes were developed to level and grade snow in the construction of compacted-snow areas by the Navy cold-processing techniques.

R-111
Snow-Compaction Equipment, Sprayers and Dusters, Jul 1962, E. N. Moser, S. E. Gifford, AD 282940

As a part of the Laboratory's program to develop methods and equipment for constructing load-bearing snow by the Navy's cold-processing techniques, experiments were made to determine the feasibility of using additives to increase and preserve the hardness of compacted snow.

Early in the Laboratory's snow-compaction investigations it was found that the horizontal distribution of hardness in depth-processed snow varied as much as 100% within a few square feet even with good quality control during processing. Experimental work showed that adding free water to the compacted mass reduced this variation, and a sprayer with an insulated tank was developed for adding free water at a controlled rate.

In 1960, the Navy built and maintained a 12,000 car compacted-snow parking lot and access road for the Olympic Winter Games at Squaw Valley, Calif. As the compacted snow would not support afternoon traffic on warm, sunny days because of decay in surface hardness, sawdust was used to insulate the snow. It was found that a 1/4-in. dusting applied with a front-delivery spreader not only prevented surface-hardness decay, but also provided better traction for vehicles. While sawdust is an excellent insulator for compacted snow, it was concluded that its shipping bulk per unit of coverage is prohibitive for general application in polar areas.

R-111 Suppl.
Snow-Compaction Equipment, Sprayers and Dusters, Supplement, Jul 1962, E. N. Moser, S. E. Gifford, AD 283033

This supplement identifies the proprietary components used in the water sprayers and sawdust spreaders described in TR-111. This equipment was used to investigate the feasibility of developing more uniform hardness in compacted snow by an application of water, and of using an insulator to protect the surface from deterioration under high air temperatures and solar radiation. These investigations were made as a part of a study toward the construction of load-bearing snow by the Navy cold-processing techniques.

R-112
Snow Compaction Equipment, Vibratory Finishers, Jun 1962, E. N. Moser, S. E. Gifford, AD 401249

Aircraft tests on compacted snow have shown that a harder wearing surface is required on snow compacted by depth processing. A special rolling technique improved the surface hardness, but a preliminary experiment on cold, dry polar snow indicated that vibration might produce a better surface. As a result, two types of construction vibrators were tested as surface finishers for compacted snow at winter test sites in the Sierras of California.

It was concluded from the Sierra tests that vibration improves surface hardness in compacted snow, but that investigations are needed on cold, dry snow to determine the magnitude and durability of this improvement on compacted snow in polar areas. It was also concluded that the apparent differences in the two types of vibratory finishers used on warm, wet snow were insufficient for selection of the more suitable type of finisher for further testing

R-112 Suppl.
Snow-Compaction Equipment, Vibratory Finishers, Supplement, Jun 1962, E. N. Moser, S. E. Gifford, AD 401250

This supplement identifies the proprietary components used in the shoe-type and rolling-type vibratory finishers and auxiliary equipment described in TR-112. These finishers were used to investigate the feasibility of surface-hardening compacted snow by vibration in the construction of load-bearing areas by the Navy cold-processing techniques.

R-113
Snow-Compaction - Design Criteria and Test Procedures, Apr 1964, E. N. Moser, AD 427120

Extensive experiments have been conducted in the Arctic, Antarctica, and the Sierras of California to develop techniques and equipment for the Navy's cold-processing snow-compaction procedures. These procedures are based on the mechanical acceleration of the natural metamorphic processes occurring in snow. Techniques and equipment are presently available for producing high-strength snow capable of supporting wheeled aircraft with tire inflation pressures up to 75 psi and gross weights up to 75,000 lb. Current investigations in Antarctica are directed toward increasing the load-bearing capacity of compacted-snow runways on deep, perennial snowfields up to 150,000 lb.

Existing criteria are given for the design of compacted-snow roads and runways on annual and perennial snowfields. The limitations of these criteria require that they be applied with judgment.

Instruments and procedures are available for testing the temperature, density, texture, and the hardness index of compacted snow. Of these the hardness index, which is time and temperature dependent, can be used in conjunction with a minimum hardness guide to determine the approximate dynamic load-bearing capacity of compacted snow. The nonhomogeneous characteristics of snow cause considerable variation in hardness, especially in a large area of compacted snow. As a result a snow road or snow runway must be traffic-tested with vehicles and aircraft before they are put into general use. Light to heavy vehicles and ski-equipped aircraft must be used for these tests.

Improved test equipment, instruments, and procedures are being developed to test the properties and trafficability of compacted snow. These instruments should provide more precise measurements of the snow properties and replace most, if not all, of the traffic tests now required for compacted snow.

R-114
Snow Compaction, Techniques, Jun 1962, E. H. Moser, AD 281946

Extensive experiments have been conducted in the Arctic and Antarctica and in the Sierras of California to develop techniques and equipment for the Navy's cold-processing snow-compaction procedures for producing load-bearing snow by mechanical acceleration of the natural metamorphic processes occurring in snow. Six techniques have been developed: precompaction preparations, compressive compaction, depth-processing, double depth-processing, surface-hardening, and layered compaction.

The most elementary of these techniques, precompaction preparations, is used primarily to prepare a snow field for compaction, but it can be used alone to construct an improved skiway on snow. The next four techniques separately have limited application, but collectively they are used in the layered-compaction technique which is used to build runways for heavy, wheeled aircraft on deep snow. All six techniques are used in the maintenance and repair of snow-compaction areas, with the choice of technique depending on the need. In addition to developing techniques and equipment for compacting snow to varying degrees of hardness, some investigations have been made on the protection of this snow from deterioration under intense solar radiation and prolonged periods of above-freezing temperatures.

R-115
Reissued as N-396.

R-116
Blast Load Tests on Post-Tensioned Concrete Beams, May 1961, H. T. Miyamoto, J. R. Allgood, AD 259138

Four types of post-tensioned prestressed concrete beams with straight unbonded bars were tested under static and blast loading to study their behavior.

The tests showed that the response of prestressed beams can be predicted by a one-degree-of-freedom system, provided the correct damping and resistance functions are known. The logarithmic decrement of the beams was about 0.05 to 0.28, which permitted negative deflections to develop under short-duration loading. A recommended dynamic design procedure is given.

R-117
Effect of Temperature on the Boring Activity of Limnoria, Mar 1961, H. P. Vind, H. Hochman, AD 252065, PB 155063

The Laboratory has been seeking to better understand the reasons for differences in the service life of marine timbers in various localities and to resolve the factors that determine how long a preservative will function. As part of this investigation, experiments were performed to determine the effect of temperature on the boring activities of cold, temperate, and warm-water species of limnoria.

It was concluded that timbers exposed to marine environment in cold-water harbors (limnoria lignorum territory) are subject to limnoria attack in midsummer only. Timbers exposed in temperate-water harbors (limnoria quadripunctata territory) are subject to limnoria attack throughout the summer, and those exposed in warm-water harbors (limnoria tripunctata territory) are subject to extensive limnoria attack throughout the year.

R-118
Evaluation of Steam Cleaners, Dec 1960, J. J. Doman, D. Taylor, AD 250217

Two vapor heating corporation steam-cleaning units, vapor model 80 (gasoline engine-driven) and vapor model 200 (electric-driven), were tested for one year at the USN CBC, Port Hueneme, Calif. The two cleaners had fewer automatic devices and cost much less than the Navy Stock Unit CF4940-264-3951. They did not conform to the existing steam-cleaner specification MIL-C-40368.

The model 80 is not recommended for Navy use. It is suitable only for small steam-cleaning operations where electric power is not available.

The model 200 performed satisfactorily. It was simple to operate, had low maintenance and service requirements, and performed all the cleaning operations formerly accomplished by two Navy standard stock machines. It is recommended that a specification be prepared to cover this unit and that it be accepted for use at Naval installations.

R-119
Evaluation of an Insulating Oil Test Kit, Feb 1961, A. E. Hanna, AD 251308

Samples of fresh insulating oil were contaminated with known amounts of oleic acid or benzaldehyde and tested with the Allis-Chalmers kit for acidity and polar compound content. The acidity was indicated by a spot test which showed the increase in acidity by a change in color. The polar compound content was indicated by the degree of irregularity of a test spot. Samples of oils taken from transformers in storage were also tested.

The kit was easy to use and functioned as claimed by the manufacturer in detecting the presence of acidic and polar compounds in insulating oils.

R-120
Behavior of Instrumented Prestressed Concrete Pavement at NAS Lemoore, California, Mar 1961, J. A. Bishop, AD 253430, PB 156026

Longitudinal and transverse post-tensioning loads and the distribution of these forces along the lengths of tendons were defined by calibrated links or couplers installed in the tendons. Strains induced in the concrete by stressing and existing for several months after stressing were measured by Carlson strain meters embedded in the concrete adjacent to instrumented couplers. A load test resulted in the definition of a deflection pattern and the measurement of pressures under load. There was apparently a substantial amount of friction between longitudinal tendons and their ducts as indicated by the difference in tendon force between ends and center. Couplers installed in transverse tendons, which were encased in ducts and stressed from one end only, did not indicate a large friction loss from one end of the tendon to the other. Tendon forces decrease, and compressive strains in the concrete increase, with time under the influence of slab shrinkage and increased pavement temperatures. A load test shows that the 6-in. thickness of prestressed concrete pavement is the equivalent of at least 11 in. of conventional concrete pavement.

R-120 Suppl.
Behavior of Instrumented Prestressed Concrete Pavement at NAS Lemoore, California, May 1963, J. A. Bishop, AD 404228

The observations reported in TR-120 are supplemented by further observations of the behavior with age and use of an instrumented prestressed concrete taxiway at NAS Lemoore. Data will continue to be taken annually.

R-121
Design Charts for R/C Beams Subjected to Blast Loads, Oct 1960, J. R. Allgood, G. R. Swihart, AD 429331, PB 160552

An ultimate load theory is combined with an idealized dynamic theory to form a computational program for the development of a set of design charts for reinforced concrete beams. The behavior of beams under blast loading is reviewed to aid in the explanation of the computational program and the charts. A procedure for the treatment of

shear and bond is presented. The design curves are given and exemplified, and their limitations are discussed.

R-122
Polar Camp Water Systems, Dec 1960, W. R. Nehlsen, AD 249483, PB 154081

Polar climate and terrain make normal water supply systems difficult or impossible to construct at polar camps. As a result, Navy forward bases have used expensive systems which have often proven unsatisfactory. This report uses 25-to-500-man camps as a basis for improvement studies on polar water supply, and it classifies water supply problems according to available water sources.

Better water with less work and cost would improve the habitability of polar camps. Drinking water can best be made palatable by adsorptive filtering. Manpower effort and costs can be reduced by conserving fresh water, using salt water where available, using waste heat, and efficiently mechanizing snow handling. Technical studies required include developing or testing taste and odor filters, sea water access lines, snow-handling equipment, integrated distillation and power equipment, and adaptation of facilities to polar camp buildings.

R-123
Methods of Shotcrete Construction for Personnel Shelters, Mar 1961, R. M. Webb, AD 253431, PB 155445

To evaluate methods for the economical construction of shotcrete personnel shelters, shotcrete arches were cast over various forms: a quonset arch, a flexible plywood shell, a pneumatic airform, and a compacted earth mound. Salvageable quonsets were found to be the most economical. Wet-mix shotcrete containing coarse aggregate was placed which permitted use of conventional concrete mixes.

R-124
Evaluation of Jered Beach Salvage Crane, Dec 1960, J. J. Bayles, R. E. Jochums, AD 249728

Preliminary tests of the Jered Beach Salvage Crane by the U.S. Naval Amphibious Construction Battalion Two near Little Creek, Va., indicated that modifications would be needed to relieve the towing tractor of the additional weight of the crane before tests could resume. The deficiencies determined by ACB-2 and those suspected by the Laboratory prior to actual testing are discussed, and the evaluations and results of tests are reported.

Preliminary studies, supported by field tests, indicated that the crane presented too much rolling resistance to be towed by the Caterpillar D-8 Tractor, and is designed so that provision of sufficient flotation is not feasible. Further testing and modification have been held in abeyance until test work on the Army Transportation Corps Landing Craft Retriever, Mark II, is completed. At that time re-evaluation of the need for the Jered Crane can be made.

R-125
Reissued as N-39R.

R-126
Soil Stabilization by Vibration, Mar 1961, C. R. White, AD 253432, PB 171844

This task, partly contracted to the California Institute of Technology and others and partly done by NCEL, started with a theoretical and experimental determination of the factors that control vibratory compaction of sand. A 6-1/2-ton vibratory compactor was then designed and built to evaluate the theoretical and experimental findings. The machine effectively compacted sand to depths not previously achieved by conventional compaction equipment. It compacted sand subgrade beneath a flexible pavement while operating on the pavement surface, and it compacted highway base material in fills 20 and 40 in. deep. It also had brief trials on Navy airfield construction.

Further studies to reveal vibratory methods for compacting cohesive soils have included theoretical and experimental determination of parameters, and the design and construction of a research compactor for field studies. The new machine was necessary, because the characteristics of the sand compactor were not suitable for compacting cohesive soils. However, field testing and evaluation of the range and degree of effectiveness of the new machine for compacting cohesive soils remain to be authorized and accomplished.

R-127
Mobile Piers and Breakwaters - An Exploratory Study of Existing Concepts, Apr 1961, J. T. O'Brien, D. I. Kuchenreuther, R. E. Jones, AD 256843.

Twenty-seven concepts for mobile wave attenuators and piers in six categories are reviewed toward exploring their capability to form a single mobile unit - termed a multipurpose harbor unit - which could be used with others like it to form either a breakwater or a pier. It is concluded that the caisson type is not feasible as a pier, but is feasible as a breakwater. The floating platform is feasible as a pier and to a lesser extent as a breakwater. The legged platform is feasible as a pier and also as a breakwater if a proper wave attenuator is attached. Hinged baffles, water current inducers (including both pneumatic and hydraulic breakwaters) and chemical additives are not feasible as wave attenuators whereas fixed baffles are feasible.

R-128
Submarine Hulks as Protective Shelters, Feb 1961, R. F. Swalley, AD 251309, PB 154787

Various schemes are considered for emplacing a submarine hulk as an underground shelter. The most practical method is to dredge a slip into a beach area, float in the submarine, and cover it with sand.

Modifications to the submarine would be necessary before it could function as a shelter. It would be necessary to install a new electrical system, a new entrance, a modified ventilation system, and a renewed air-conditioning unit. The overpressure capacity would be at least 130 psi, with commensurate radiation protection provided by a cover of 8 ft of sand. It is estimated that a submarine hulk could be adequately modified and emplaced for about $60,000. A breakdown of costs is given.

R-129
Oscilloscope Engine Performance Analyzer, Jan 1961, A. L. Scott, AD 250534

The oscilloscope engine performance analyzer uses a cathode-ray tube to depict events in the ignition cycle of a spark-fired engine. By analyzing variations in the pattern on the screen an operator can diagnose engine performance faults. The Allen unit is portable and can be used by mobile field forces as well as by permanent installations.

The unit was tested for conformance to applicable military specifications and found to be satisfactory. The instruction manual, however, was not explicit enough to enable an inexperienced operator to use the unit effectively.

R-130
Water Vapor Transmission of Plain Concrete, May 1961, D. F. Griffin, R. L. Henry, AD 257789

The effects of water-cement ratio, relative humidity, aggregate size, concrete splice position, and certain admixtures, such as oleic acid and sodium chloride, on the permeability of plain concrete were investigated.

Water vapor transmission values were found to be significantly higher for higher water-cement ratios, smaller aggregate, and the absence of sodium chloride. Concrete slice position, oleic acid, and relative humidity were found to have no significant effect when compared with experimental variability. The study demonstrates that water vapor transmission is not directly proportional to water vapor pressure differentials between the ends of the flow path.

R-131
Moisture Migration Rates Through Building Materials, May 1961, R. J. Zabludil, AD 256717

Tests were made to determine moisture migration rates (1) through concrete floors as affected by different types of soil beds, and (2) through various wall materials, such as concrete block, common brick, mortar, gypsum, and wood. Wall materials were tested singly and compositely.

R-132
Fire Extinguishers Containing Inhibited Lithium Chloride Solution for Polar Use, Mar 1961, C. V. Brouillette, AD 253630

In this investigation, five different commercial extinguishers, fabricated of drawn brass or silicon bronze and lined with a lead alloy, were tested with the lithium chloride solution using either sodium dichromate-oxalic acid or sodium dichromate alone as an inhibitor. It was determined that 0.5% sodium dichromate satisfactorily inhibits corrosion by the water solution of lithium chloride when contained in an extinguisher of drawn brass.

R-133
Column Strength of Long Piles, May 1961, J. J. Hromadik, AD 258262

Full-scale axial load tests were conducted on six different types of commercially available piles to determine their resistance against failure by buckling. Seventeen 80-ft specimens, each with an unsupported length of 60 ft or more, were tested under conditions of piles at refusal. A field test tower with a loading system induced axial compressive loads to 440 tons. Application of tangent modulus principles for use in the generalized Euler equation for predicting buckling loads is demonstrated by way of examples. It is concluded that the theory has practical application, and its usage is recommended.

R-133 Suppl.
Computer Program and Design Values, May 1966, J. J. Hromadik, G. D. McDougal, AD 633266

A 1620 IBM computer program was written in Fortran to determine the ultimate load for concentrically loaded, concrete long piles. The piles were of three basic cross sections: circular, octagonal, and square. The theoretical evaluation of the ultimate load was made by using the tangent modulus in the generalized Euler formula. Presented in this supplement are the computer program and the computer results in the form of tables giving the ultimate load for various column slenderness ratios.

R-134
Engineering and Economic Study on Tent Decks and Frames, Apr 1961, J. J. Traffalis, AD 253631

Three materials, magnesium, plastics, and aluminum, were investigated for use in frame fabrication. Four materials, plastics, concrete, stabilized soils, and corrosion-resistant metals, were studied for deck use. Procedures stemming from the U.S. Marine Corps requirements resulted in the design and fabrication of an aluminum tent frame and in the procurement and test of two types of aluminum decks.

R-135
Evaluation of a 40-Foot by 100-Foot Elliptical Arch Utility Building, Jun 1961, R. M. Webb, AD 258516

A 40-ft by 100-ft elliptical arch building manufactured by the Wonder Building Corporation was erected and subjected to the loading specified in the uniform military requirements criteria for prefabricated advanced base buildings. Tests proved the building arches to be structurally sound under design conditions corresponding to a 20-psf snow load and a 70-mph wind velocity. However, the end walls do not provide a factor of safety compatible with that of the arches since the double sliding doors failed under one-third of the required load capacity. With the exception of weathertightness, structural stability of the end walls, and failure of the doors, the building meets the minimum military requirements. The shipping weight, cubage, and erection time compare favorably to those of buildings of similar dimensions.

R-136
Prototype Inflatable Causeway, Jun 1961, J. J. Hromadik, AD 259335

Utilization of an inflatable-type causeway that could be multi-tiered on an LST, or in the well deck of an LSD, is considered to offer a marked logistics advantage over the present type of causeways. A prototype section of such a causeway was designed and fabricated under contract and evaluated by the Laboratory. Evaluation results indicate that the inflatable system is feasible, but that the prototype unit is too complex for military operations. Retention of the flotation system is advocated, with a recommended redesign of the superstructure.

R-137
Dose Attenuation Factors for Concrete Slab Shields Covered with Fallout as a Function of Time After Fission, Jun 1961, A. B. Chilton, L. K. Donovan, AD 258246

The dose attenuation of fallout radiation by various thicknesses of concrete shelter roofs as a function of time after a nuclear detonation was investigated. A spectrum of energies is used for the fallout source rather than a single average energy as has been done in previous studies. Presented herein are dose attenuation factors for various thicknesses of shelter roofs as a function of time after fission. The Office of Civil and Defense Mobilization recommends a 2-week shelter-stay time in the event of a nuclear attack. Therefore, an average dose attenuation factor for any 14-day stay time as a function of time of arrival of the fallout or shelter entry time for various roof thicknesses is also presented.

R-138
An Investigation of Desiccant Dusting, Apr 1961, J. C. King, AD 253903

Desiccant dust emitted by dehumidification machines in warehouses has been reported in a number of Naval and Marine installations. NCEL conducted an investigation to determine the extent of the problem and to find ways to eliminate or minimize it. Dehumidification machines were observed in operation at three, bases. Tests were conducted using samples of desiccants from various manufacturers. These observations indicate that the machines and desiccants which were the worst offenders have been removed from use. Dusting is no longer a significant problem with new and sturdier desiccants and improved dehumidification machines.

R-139
Propulsion Unit Mountings for 3x15-Pontoon Causeway Sections, Apr 1961, J. E. Smith, AD 256380

An investigation was conducted to determine the possibility of developing a special type of mounting that would

permit propulsion units to be placed on 3x15 pontoon causeway sections. The mounting would provide a means for moving the units clear of the end-to-end connection so that the sections may be used as barges as well as causeways, thus eliminating the need for tender craft and the additional expense and utilization of critical shipping space attendant with their use.

Two different prototype mountings were fabricated and tested. Neither design was successful because the causeway sections could not be connected without the aid of tender craft. It was concluded from this and other unfavorable operational factors that development of a special propulsion unit mounting for the intended purpose is not feasible.

R-140
Investigation of Wide-Gage Portal Crane Track Alignment and Running Gear, Feb 1962, J. J. Bayles, R. E. Jochums, AD 279364, PB 181180

The Laboratory constructed a 1.20 scale model and the base and trackage required for testing various crane structures and track curves, and the Bureau of Yards and Docks forwarded coordinates for a test curve for checking with the model. The results of this model test confirmed the expected results and supported the theory for criteria used in designing portal crane track curves.

Model studies were then made of problem situations at the Boston and Mare Island Naval Shipyards. Recommended realignments were developed and model-tested, and the information was made available to the shipyards for their use in planning rehabilitation of their trackage.

The results of these studies demonstrated that the scale model can be used to design curves for the efficient operation of portal cranes. No proven mathematical solution has been developed that will give precise design criteria. Some laboratory and laboratory-sponsored attempts are presented.

R-141
Evaluation of David Round Winch, Model "Special 99 SR", Sep 1961, J. J. Bayles, AD 267461

The winch used in transfer barge operations is unsafe. MCEL tested several 5-ton commercial winches and each proved unsatisfactory. One of those tested was modified by the manufacturer, and was then retested. This winch, the David Round and Son "Special 99 SR," was unsatisfactory as a 5-ton winch, but the Laboratory recommended it as a one-ton winch suitable for one-man operation for very short periods of time, or a one-half-ton winch suitable for extended one-man use during amphibious operations.

R-142
Potential of Thermoelectric Devices in BUDOCKS Applications, Apr 1961, D. Taylor, J. J. Doman, AD 254896

The Naval Civil Engineering Laboratory made a survey of available information on recent developments in thermoelectric devices and techniques. It was determined that the efficiency of existing thermoelectric materials was too low to merit recommendation of their use for equipment equivalent to existing Bureau of Yards and Docks catalog items. However, commercial thermoelectric generators are available which could satisfy small power requirements in remote locations where conventional power sources are not available and where efficiency or initial cost is not a prime consideration.

R-143
Cancelled.

R-144
Shelter Habitability Studies. The Effect of Oxygen Depletion and Fire Gases on Occupants of Shelters, Jul 1961, J. S. Muraoka, AD 259835

A literature study on the effects of various gases on shelter occupancy was conducted. Various physiological effects from simple headache to unconsciousness and death are experienced by personnel in closed occupied rooms by breathing air containing excess carbon dioxide and carbon monoxide, or inadequate oxygen. During fire catastrophes, casualties result from flames, heat, and falling objects, but a greater number of casualties are caused by fire gases, especially carbon monoxide, which infiltrate open shelters.

Shelters exposed to the hazard of mass fire should have all their openings closed to prevent the entrance of fire gases, and should employ chemical oxygen generators and carbon dioxide absorbents for air revitalization. These chemicals will produce better breathing conditions inside closed shelters. However, since they also produce heat during chemical reaction, their use must be limited.

R-145
Cathodic Protection Studies, Jul 1961, A. E. Hanna, AD 261389

A seven-section floating drydock was placed under cathodic protection in order to study the interaction between several hulls in a single system and to provide a protracted study of the effectiveness of cathodic protection. The feasibility of using a single power source for many hulls and the practicability of employing automatic control were investigated. The durability of the component materials in the system was observed.

It was concluded that galvanic and impressed current systems are equally effective in reducing corrosion. The choice between them, or between different anode materials, is largely a question of the specific application. A combination of cathodic protection and floating inhibitor in a ballast tank provides essentially 100% protection; only two underwater coating systems were considered as having performed satisfactorily. A single rectifier supplied sufficient power for the seven-section drydock, plus an AFDL and three YR-class drydocks. Automatic control systems were successful in maintaining hull polarities within an acceptable range.

R-146
Shelter Habitability Studies. Odors and Requirements for Ventilation, May 1961, J. S. Muraoka, AD 256381

This is a report on the effects body and tobacco smoke odors have on man. Ventilation requirements for the removal of these odors from enclosed structures are presented.

The number of persons (smokers and non-smokers) occupying a shelter and the fresh air supply are two important factors affecting the quality of the air. The outdoor air temperature, the humidity, and the number of occupants influence the amount of fresh air supply needed to maintain a comfortable atmosphere in the shelter.

Methods found to be effective in reducing the concentration of body odors and tobacco smoke in closed rooms are: fresh outdoor air supplied through a simple ventilation system, recirculation of indoor air through charcoal filters or through a spray-type dehumidifier, use of deodorants, and/or an increase in the temperature and humidity of a room.

R-147
Harbor Screening Tests of Marine Borer Inhibitors, Part 3, May 1961. M. Hochman, T. Roe, AD 257068

The Laboratory is exposing wood panels impregnated with various materials to determine their resistance to attack by marine borers. This report lists the results of harbor tests of treated panels removed from exposure between

1 August 1959 and 15 August 1960. It also lists all treated panels which have been exposed for one year or more and which have shown no attack or very slight amounts of attack. Treatments which have been exposed for less than one year are not reported unless they have failed and have been removed from test.

These results together with results obtained from current and future laboratory toxicity tests will be used in developing additional wood treatments. Panel testing will be continued to screen these treatments under harbor exposure conditions. Emphasis will be placed on the addition to creosote and creosote-coal tar solutions of materials which are toxic to limnoria.

R-148
Blast Loading of 8-Foot Aluminum Beams, Jun 1961, S. K. Takahashi, D. F. Green, AD 259336

Sixteen built-up beams fabricated from 5456-H311 and 5456-H321 aluminum alloy were tested under uniformly distributed static and blast loads. The beams had a clear span length of 8 ft 1-5/16 in. and an end fixity of 85%. Three beams were loaded statically to failure. The remaining beams were subjected to blast loads of smaller magnitude to determine the dynamic response.

Buckling occurred after yielding in the lower flange and web adjacent to the support at static and dynamic loads of 130 and 63 lb/in., respectively. Based on a yield load with a factor of safety of 1.65, design static and dynamic working loads of 64 and 29 lb/in., respectively, are recommended for the specific beams tested.

A chart is included which may be used to predict the maximum deflection of a structural member in the plastic range under a long-duration load once the static properties are known.

R-149
100-Ton Advanced Base Floating Crane, Jun 1961, J. J. Hromadik, R. C. Towne, AD 259078

An advanced base crane of 100-long-ton capacity was designed by the Derrick and Hoist Company, New York City. In the original design the derrick was mounted on a double tier pontoon barge. Assembly and evaluation of the prototype barge crane at NCEL led to the design and evaluation of the more feasible single-tier pontoon hull.

This report describes the derrick items and their erection, the assembly of both the double- and single-tier barges, and the subsequent evaluation of each, including operation.

The 100-long-ton crane, single-tier pontoon hull satisfactorily met the design and operating criteria. It is recommended for advanced base use.

R-150
Protection of Exposed Parts of Shelters Against Thermal Radiation From Megaton Weapons, Jul 1961, F. W. Brown, A. Y. Eliason, AD 260957

In a theoretical study of the thermal radiation effects of underground shelters that are designed to withstand 100 psi, it has been found that for surface bursts of one megaton or greater the 100-psi contour is within the fireball. A 10-megaton weapon has been taken as an example, and calculations have been made for the thermal flux received by a structure at a distance corresponding to the 100-psi overpressure. The total heat flux is of the order of 60,000 cal per cm square. Possible measures for the protection of entrance coverings and ventilation valves are examined. Conventional heat-shielding materials seem to be impractical for these immense thermal radiation levels. The degree of protection necessary makes all but the most sophisticated materials impractical.

Simple carbon and graphite shields are discussed, and more complicated shielding systems are proposed for future experimental studies.

R-151
Lithium Hydroxide Canisters for Personnel Shelters, Jun 1961, R. J. Zablodil, J. M. Stephenson, R. S. Chapler, AD 258753

Because present hand-operated blowers at low crank speeds would not deliver enough air for a personnel shelter through the standard lithium hydroxide canister, a canister-blower device with two canisters paralleled was developed by NCEL. The device will deliver 15 cfm of air with 3% carbon dioxide at a crank speed of 29 rpm.

The unit reduced the carbon dioxide in a 500-cu-ft sealed room from about 3% to 1/2% during the first hour's run. In subsequent runs the reduction from 3% became succeedingly less. During the eighth and final run the concentration was reduced to just 2%.

Operational instructions are appended, with a chart showing when and how to use the equipment.

R-152
Salt Water Pump Protection With Neoprene Coatings, Jul 1961, D. Taylor, J. J. Doman, AD 260396

A series of abrasion tests was performed on 21 different commercial air-cured brush-on synthetic coatings to determine their suitability for use in dry-dock pumps which transfer abrasive mixtures. GACO N-29 cold bond neoprene, a sheet-stock bonding agent, was found to be superior to all coatings tested for resistance to abrasion. This coating, applied about 0.54 in. thick to the internal surfaces of a ballast compartment pump on the AFDL-6, remained soft and resilient after 26-1/2 months in service, and there was no apparent wear. It is recommended as an abrasion-resistant maintenance coating. It is also recommended that the procedure for the protection of salt water pumps with neoprene coatings, Appendix B, be adopted as a maintenance procedure for AFDL pumps, and that consideration be given to using a similar procedure for Naval shipyard drydock drainage pumps.

R-153
Adhesion of Joint Sealers to Contaminated Cement Mortar Blocks, Jun 1961, N. Tomita, AD 259337

After selecting a bond-test procedure, a number of joint sealers were tested for adhesion to surfaces of mortar blocks contaminated with other joint sealers, hydraulic oil, jet fuel, or concrete curing compounds. The investigation showed in general that joint faces must be free from old joint sealers for adequate adhesion of the reseal material, that all oil and fuel deposits should be removed when hot-poured resealers are used, and that curing compounds should be removed before resealing with all cold-applied sealers and some hot-poured sealers.

A recommendation is made that joints be free of contaminants before resealing, or that the reseal material be ascertained by tests to be compatible with the contaminants. A suggested procedure is given for such test.

R-154
Perimeter Panel Heating for Polar Buildings, Jul 1961, J. M. Stephenson, AD 259988

In polar buildings the problem of keeping the body comfortable is aggravated by cold walls and air stratification which results in excessive body radiation losses and overheated air. To determine whether panel heating could outperform the more conventional methods, an experiment was set up to test four radiant panels and compare their performance with finned-tube baseboard heaters. The design criteria for the prefabricated T-5 building was used in designing a 4-ft by 8-ft by 2-1/2 ft test box in which one 4x8 wall served as a removable test panel. Three of the test panels and the baseboard heater used hot water, and one panel used hot air. The test box was placed in the NCEL cold chamber, and the panels and baseboard heaters were each tested with an ambient temperature of -65°F. Conditions

most conducive to comfort were obtained with an aluminum-faced ceiling panel. Cost estimates indicate that a suitable panel system of heating for the T-5 building is slightly more expensive and somewhat heavier than the baseboard system, but it is concluded that the benefits from panel heating are worth the additional expense. It is recommended that a panel system be installed in polar buildings to evaluate its performance under actual conditions.

R-155
Technical Data From Deep Freeze I, II, and III Reports (1955 to 1958), Apr 1961, R. C. Coffin, AD 256459

This report is a compilation of technical data obtained principally from the fourteen volumes of reports prepared by Mobile Construction Battalion (Special) for Operations Deep Freeze I, II, III. Supplemental information was obtained from correspondence and situation reports originated by Deep Freeze forces, and reports of military and professional civilian observers, which are listed in the references and bibliography.

The information is grouped into fifteen general technical subject areas, which are subdivided into specific problem areas. Within the problem areas the data are presented by individual U.S. Antarctic Stations whenever different environmental, topographical, or operational conditions contributed diverse solutions for the same or similar problems.

The objective of the compilation is to provide a ready reference for persons concerned with the design, construction, maintenance, and operation of equipment and facilities in the antarctic. It is recognized that the information is historical and pertains to specific or limited sections of the south polar area. However, the sources utilized in compiling this report are the only documentations of large-scale construction and continuing Naval shore-based operations in Antarctica.

R-156
Statistical Analysis of Six Ventilation Air Filters, Jul 1961, E. N. Hellberg, AD 259900

Six different commercial air filters were selected for tests to determine statistically and within reasonable confidence limits the expected variation in arrestance and resistance values.

R-157
Paint Sprayers, Aug 1961, A. L. Scott, AD 266973

Tests were conducted to determine conformance to Navy specifications and to compare the performance of the following portable paint sprayers: a hydraulic-atomizing GRACO hydra-spray outfit, an air-atomizing diaphragm pump-operated GRACO redi-spray outfit, an air-atomizing piston-pump-operated GRACO powerflo outfit, and an air-atomizing pressure-pot Navy standard outfit. All units met the major requirements of specifications.

R-158
Development of 15,000-Pound STATO Anchor, Nov 1961, R. C. Towne, J. V. Stalcup, AD 267390

A 15,000-lb anchor was fabricated using the criteria developed for the STATO "family" of anchors. The successful evolution of this new member of the STATO anchors may permit additional economies to be realized in the design of permanent moorings. This report describes the development of the anchor, discusses tests and results, suggests proof-loading techniques, and offers a statistical approach to predicting holding powers based on limited testing. The new STATO anchor has a holding capacity of 320,000 lb in a sand bottom.

R-159
Evaluation of a 60-Foot by 100-Foot Frameless Arch Utility Building, Sep 1961, R. M. Webb, AD 263942

A 60-ft by 100-ft arch building prefabricated of 18-gage galvanized steel by the Wonder Building Corporation was erected and subjected to the loading specified in the uniform military requirements criteria for prefabricated advanced base buildings. The results of the tests show that the building arches are structurally unsound under design conditions corresponding to a 20-psf snow load. The double sliding end-wall doors failed under one-third of the design wind loading. The weight, cubage, and erection time are satisfactory. The watertightness is unsatisfactory, but may be easily corrected. Because of failure of the arches and end-wall doors, the building is considered to be unsatisfactory.

R-160
Temperature Effect on Vapor-Compression Distillation, Sep 1961, J. W. Burdick, J. S. Williams, AD 263925

Comparison of data from tests made at normal room temperatures with data from tests conducted in the cold chamber at NCEL provided reasonable proof that cold feedwater alone was not responsible for marked reduction in vapor-compression distillation unit output. These tests showed that low ambient temperatures coupled with air movement increased heat losses and, thereby, reduced the fuel economy of such units to a marked degree.

R-161
The Salinity and Density of Natural and Flooded Sea Ice at Thule, Greenland, 1958, Sep 1961, A. I. Funai, AD 263577

As part of the Laboratory's ice engineering research program, the salinity and density of ice formed by successively flooding and freezing 3-in. layers of sea water onto the top of a natural sea-ice sheet were determined and compared with similar determinations from the undisturbed natural sea ice. The flooded-ice salinity data averaged 10.9 ppt, or over twice the average for natural sea ice but only a third the salinity of the sea water used for the floodings. The flooded-ice density data averaged 0.867 gm/cu cm, or about 7% lower than the average density of natural sea ice. The air content of the flooded ice, estimated from the density data, was between 8 and 10% by volume, or from 1.5 to 3 times greater than the estimated brine content of the ice at -20°C. The variability of the salinity and density data from the flooded ice was also found to be about 3 times greater than the variability of the natural-ice data. An analysis of the salinity data from both types of ice indicated that from 70 to 90% of the total variance could be attributed to variations of salinity with strata or layer depth.

From these findings it is concluded that sea-water salts can escape from flooded-ice layers, presumably in the form of a residual concentrated brine which drains through vertical channels that form in the underlying ice. Most of the salts escape during the 48-hr period after each flooding; however, additional floodings enable still more of the salts in the lower layers to escape. It is apparent that as brine drains out of the ice, air infuses into the voids left by the brine, thereby lowering the density of the ice.

R-162
Deterioration of 600-Volt Cable Sheaths by Flotation-Type Corrosion Inhibitors, Oct 1961, A. E. Hanna, AD 265782

Cable manufacturers and distributors were asked to recommend a sheath material for cathodic protection cables in floating drydock ballast tanks. Materials suggested were polyethylene, polyvinyl chloride, neoprene, and a butadiene-acrylonitrile copolymer. Quantities of cables sheathed with these materials were ordered and tested with stock cables obtained from Naval supply sources.

A butadiene-acrylonitrile copolymer was found to be superior to all others after 300 hr of immersion in typical flotation-type corrosion inhibitors. The next most resistant was the polyvinyl-chloride sheath, followed closely by a heavy stock neoprene and a homogeneous polyethylene serving as both jacket and insulation

R-163
Unfueled Power Supply for Isolated Bases on Sea Ice, Oct 1961, C. W. Terry, AD 263905

Three sources of power which do not require fuel were investigated to determine whether their use might be practical: (1) the temperature differential between the water under sea ice and the air above the ice; (2) wind-driven generators, and (3) solar energy cells. A review of theory and the results of a laboratory test showed that a device depending on temperature differential is not a practical answer because of ice formation on the evaporator. A literature search showed that windmills have been used satisfactorily under somewhat similar circumstances. It appears that they would give adequate power for at least part of the bases under consideration. The literature search also showed that solar energy cells should operate satisfactorily during the seasons having long hours of sunlight. A further study of these two possibilities is recommended.

R-164
Ship-to-Shore Bulk Fuel Delivery System (Buoyant), Nov 1961, J. J. Traffalis, AD 265985

To meet the need for the ship-to-shore delivery of large quantities of fuel in the early phases of amphibious assaults, a lightweight-hose fueling system was developed for use in conjunction with the shore portion of the Marine Corps amphibious assault bulk fuel handling system. The system, which can be installed from a warping tug or YFU, consists essentially of a tension-relieved 4-in. rubber hose payed out and recovered by a diesel-powered hose reel, plus all equipment necessary for installation and maintenance. This report describes the design and development of the system by NCEL and presents the results of operational tests by PHIBCB ONE. The system was found to meet the criteria, and is recommended for inclusion in the functional component system.

R-165
A Fenestral Sprinkler System to Prevent Fires Caused by Thermal Radiation, Sep 1961, J. C. King, AD 263467

A fenestral sprinkler system has been designed for the interior of buildings to extinguish fires which can result from the entrance through windows of thermal radiation from a nuclear bomb. The system is wet and has its own water supply which activates automatically when the external water-main supply is inadequate. An additive solution is fed into the system regardless of water source and enhances the extinguishing properties of plain water. The piping system is similar to that of ordinary fire protection systems, portions of which could be used with minor modifications. A normally closed solenoid valve in the branch-room lines is operated by a flame detector and permits the use of open heads. The system is self-deactivating but remains armed after all solenoid valves close following extinguishment. Only rooms subject to thermal radiation need protection. The fenestral sprinkler system is recommended for test.

R-166
Evaluation of Interference Suppression of Fluorescent Lamps, Oct 1961, D. B. Clark, AD 265780

The evaluation of the interference characteristics of commercial fluorescent fixtures advertised as "interference-free," including both hot-cathode and cold-cathode lamps, demonstrates that those fixtures which are completely enclosed electrically are free of interference. A hot-cathode instant-fire fixture, with conducting-glass door panel interchangeable with an aluminum honeycomb door panel covering a one-piece metal fixture, proved to be greater than 6 db below the specification limits shown in BUSHIPS MIL-I-16910(A). The cold-cathode lamps tested failed to meet specification limits.

R-166 Suppl.
Evaluation of Interference Suppression of Fluorescent Lamps, Supplement, Oct 1961, D. B. Clark

This supplement provides proprietary information about the fluorescent light fixtures evaluated in TR-166 to determine their adequacy to suppress inherent electromagnetic interferences to levels below those required by military specifications.

R-167
Summary of In-Service Test Reports. Front-End Loaders, Oct 1961, J. J. Bayles, AD 263926

This report summarizes quarterly progress reports for the in-service testing of five front-end loaders. The Bureau of Yards and Docks assigned these loaders to various field activities for in-service testing following comparative evaluation tests of some of the loaders at NCEL. The field activities submitted quarterly progress reports to BUDOCKS, with copies to NCEL. The Laboratory concurs in the recommendations of the field activities that the Hough model HMD, the Pettibone-Mulliken model 175, and the Michigan model 125A are equally effective and satisfactory in front-end loader operations, and for forklift operations where necessary.

Because only one of each model was tested, the result cannot be considered conclusive.

R-168
Summary of In-Service Test Reports. Maintenance Trucks, Oct 1961, J. J. Bayles, AD 263887

The Bureau of Yards and Docks assigned 1-ton maintenance/service utility trucks to the Naval Construction Forces for in-service testing. This testing was accomplished by Mobile Construction Battalions at overseas bases. Quarterly reports of the testing were evaluated by NCEL.

The Laboratory concurs in the recommendations of the field forces that certain single-purpose equipment can be replaced by the maintenance/ service utility-type vehicle. Modifications are included in the recommendations.

R-169
Effect of Temperature Rise on Compressive Strength of Hardened Cement Paste, Nov 1961, H. Tomita, D. E. Well, AD 268262

In connection with the effect of turbojet engine exhaust on concrete pavements, NCEL conducted two studies, one on the effect of temperature rise on cement paste, and one on the effect of thermal shock on concrete aggregates. The cement paste study is reported herein. A summary of the aggregate study is given in an appendix.

On the basis of this study, it appears that rate of heating cement paste is not a contributing factor to spalling of concrete pavement surfaces subjected to thermal shock. On the basis of both the cement paste and aggregate studies, it appears preferable to have the cement paste and aggregates as dry as possible before the concrete is subjected to high thermal-shock conditions.

R-170
Effect of Aggregate Size on Thermal Shock Resistance, Nov 1961, N. Tomita, D. B. Taylor, AD 268155

In connection with the effect of turbojet engine exhaust on concrete pavements, NCEL conducted two studies, one on the effect of thermal shock on concrete aggregates and one on the effect of temperature rise on cement paste. The aggregate study is reported herein. A summary of the cement-paste study is given in an appendix.

In this aggregate study, five sizes of five different aggregates in oven-dried and saturated-surface-dried conditions were subjected to eleven degrees of furnace temperatures between 1,000 and 2,000°F. Three samples were tested for each combination, making a total of 1,650 tests in all. Breakdown of the aggregates was established by comparing the before-heating and after-heating sieve analyses.

It was found that heating caused breakdown of the aggregates. By statistical analysis, it was determined that the larger aggregates had more breakdown than the smaller ones, and that the higher temperatures caused more breakdown than the lower temperatures. It was also determined that the saturated-surface-dried aggregates experienced more breakdown than the oven-dried aggregates.

It appears from this investigation that smaller aggregates are preferable to larger aggregates for heat-resistant concrete. On the basis of both the aggregate and cement-paste studies, it appears preferable to have the aggregates and the cement paste as dry as possible before the concrete is subjected to high thermal shock conditions.

R-171
Engineering Tests of Landing Craft Retriever, Mark II, Sep 1961, A. A. Denny, AD 849597

At the conclusion of operational tests by Assault Craft Unit One at Coronado, Calif., the Army-developed landing craft retriever, Mark II, was transferred to the Laboratory for engineering tests. The results of these tests indicate that the basic design of the LCR II is adequate for its function as a landing craft retriever. However, to be satisfactory for use by the operating forces, the engine cooling system, hydraulic system filters, hoist cable guides, and engine throttle controls will require modification.

R-172
Radiological Decontamination Sweeper, Oct 1961, W. R. Nehlsen, AD 266072

Three types of pavement sweepers were investigated to determine their adaptability for high-rate radiological decontamination. A runway sweeper utilizing an air nozzle pickup was found to be not adaptable. Ordinary street sweepers can perform limited services as decontamination sweepers, but are not suitable for complete development as high-rate units. A sweeper developed for Air Force decontamination needs, the ARDC 100DS, is adaptable to the task requirements.

R-173
Improvements for Advanced-Base Vapor-Compression Distillation Units, Jan 1961, J. S. Williams, AD 271678

The need for dependable sea-water conversion equipment has been long standing. An underlying cause of trouble is lack of experience on the part of those responsible for the operation of the equipment. The solution to the problem seems to be simplification both of operating procedures and the mechanical design of seawater conversion units. Efforts by the Laboratory to achieve simplicity have resulted in the development of devices and techniques which have improved the dependability of the equipment. A feedwater controller for use on diesel-powered stills and a blowdown controller for universal use have greatly reduced the chances for operator error. They permit automatic operation, with assured production of distillate at a constant rate. The substitution of smaller engines improved the economic performance of stills. This was possible because of the laboratory-developed method of scale free operation.

R-174
Design Criteria for Camels or Floating Fenders, Jan 1961, J. J. Leendertse, AD 279205

In a study to establish criteria for the design of a camel system suitable for the berthing of ships up to 20,000 tons displacement, analyses were made of existing camel and fender systems and determinations were made of the forces and movements induced by ships while berthing. A literature study of approach velocities indicates that 1 fps normal to the wharf face generally is the maximum velocity that has been used for design. For the design of camels in this report, an approach velocity of 0.7 fps is the suggested value. By using this value in the analyses of the energy capacities, a total capacity of 75 ft-tons is considered sufficient for camels used at the quarter points of a ship with 20,000 tons displacement.

Two designs, using concepts based on hydraulic and torsional principles, and meeting the determined requirements, were obtained.

R-175
The Effects of Long-Time Loads on Pre-Stressed Concrete Hollow-Box Beams, Nov 1961, R. A. Breckenridge, AD 267468

Prestressed concrete beams suffer from certain time-dependent changes. They lose part of their initial prestress, their deflection increases, and the concrete shrinks and creeps. To obtain information on prestressed concrete hollow-box beams, eight such beams were loaded for 4-1/2 yr and changes in deflections, concrete strains, and prestressing forces were recorded. The beams were 42 ft long, 33 in. deep, and 18 in. wide. They were simply supported on a 40-ft span and uniformly loaded with concrete weights. Four different loading conditions were used on the eight beams. The loaded beams had an additional time-dependent deflection during the 28 days following loading approximately equal to the immediate elastic deflection at the time of loading. The beams with no live load continued to deflect upward. Measurements showed that the time-dependent strains in the concrete were greater than the immediate strains due to normal working stresses. The prestressing force data indicates that the unloaded beams experience a greater reduction of prestress than the loaded beams, that the first-year prestressing losses can be as high as 13%, and that in 4-1/2 yr they can be as high as 22%.

R-176
Evaluation of a 20-Foot by 48-Foot Aluminum Building of Sandwich-Panel Construction, Mar 1962, R. M. Webb, AD 279456

A prototype 20-ft by 48-ft aluminum building manufactured by the Harvey Aluminum Corporation was erected, tested, and evaluated to determine its suitability for use by the Navy. The building was subjected to the loading specified in the uniform military requirements criteria for 20-ft by 48-ft prefabricated advanced-base buildings. Tests proved the prototype to be structurally unsound. The structure failed under a test snow loading of 16 psf by rupture of welds within the structural joints, and the prototype was not entirely satisfactory with respect to weathertightness and to deflection and delamination of the panels. The total weight of the packaged building, 13,645 lb, is greater than that of steel buildings of similar design. The cubage of the packaged building, 1,406 cu ft, is exceptionally high. It is concluded that the building does not meet the minimum requirements of BUDOCKS criteria.

R-177
Minor Tests and Evaluations, FY 1961, Jan 1962, H. J. Sieland, AD 272035

This report covers several unrelated subjects of a minor test and evaluation nature. The major work on two of the subjects, "Effects of Jet-Engine Exhaust on Virginia Diabase Concrete Pavement" and "Development of the Rush Roll, a Mobile Structure Used as a Roadway or Floating Pontoon Bridge," has been published in formal documents; however, additional work subsequent to the submittal of the formal publications is reported herein. The results of investigations on six other subjects, not covered in formal printed documents, are also included in this report.

R-178
Evaluation of the Interference-Suppressing Power Conductor, Dec 1961, D. B. Clark, J. L. Brooks, AD 268730

The field evaluation of a 4-mile installation of 13.2 kV, 3-phase, special interference-attenuating power line was completed successfully in January 1961. The power distribution wires were of a new type developed recently at NCEL. Interference attenuation is obtained by wrapping conventional power line conductors with a high-permeability tape.

NCEL engineers and scientists made the tests described in this report at the U.S. Army Electronic Proving Ground, Fort Huachuca, Az., with logistic support from the proving ground staff. Survey measurements were made of the broad-spectrum electromagnetic interference (30 cps to 1,000 Mcps) induced at one end of the line with large-impulse noise generators. The special line, with large magnitudes of interference at its beginning, is shown to attenuate effectively over the broad frequency spectrum to bring the noise level of the line down to the level of the natural ambient in about half of its length.

Impedance measurements of the power line as a transmission line showed it to be independent of line terminations, and that considerable attenuation was present

The effect of the high-permeability tape thickness on attenuation is considered theoretically and experimentally, and it shows that attenuation is proportional to the tape thickness until the thickness is of the order of one "skin depth." The potential applications and limitations of the new interference-suppressing line are presented.

R-179
Air-Transportable Laundry, Jan 1962, J. W. Chapin, W. R. Nehlsen, AD 279146

The Bureau of Yards and Docks is developing a small hospital component, the G6B, but no existing laundry specification is available to meet the capacity and weight requirements. With the basic criteria established by the Bureau, NCEL procured a prototype 16-lb/hr unit, based on commercial items, to test its suitability as a standard component. The laundry, consisting of four 500-lb skid-mounted units, performed satisfactorily. Procurement specifications based on this unit are suggested.

R-180
Ship-to-Shore Bulk Fuel Delivery System (Bottom Laid), Jan 1962, J. J. Traffalis, AD 279462

To meet the need for the ship-to-shore delivery of relatively large quantities of fuel in the early phases of amphibious assaults, a 4-in. bottom-laid pipeline fueling system was developed for use in conjunction with the shore portion of the Marine Corps amphibious assault bulk fuel handling system. The system has a 5,000-ft installed length. The developed system has been adopted as a standard and is a part of the PIA functional component (assembly 5397). Operational use to date has been in conjunction with the Marine Corps amphibious assault bulk fuel handling system. This report describes the design and development of the system by NCEL and presents the results of operational tests by PHIBCB ONE and PHIBCB TWO

R-181
Asbestos-Fiber-Filled Aluminum-Asphalt Roof Coatings, Nov 1961, C. V. Brouillette, AD 267466

Three roof coatings, Uniflex, Aluminum Griptite, and Alumanation, were evaluated with respect to chemical composition and resistance to both accelerated weathering and outdoor exposure in marine atmospheres.

The three proprietary roof coatings gave slightly better protection to galvanized steel than did specification enamel, TT-E-189; however, the enamel gave better protection to the wire-brushed mild-steel panels. The Alumanation gave better protection to both galvanized- and ungalvanized-steel test panels than did Uniflex or Aluminum Griptite. It also has a slightly higher nonvolatile solids content and can be applied in a thicker film per coat.

R-182
The Effects of Marine Organisms on Engineering Materials for Deep-Ocean Use, Mar 1962, J. S. Muraoka, AD 287952, PB 181181

A literature survey was made of the effects of marine organisms on various types of engineering materials, particularly in deep-ocean environments. Numerous materials, such as manila ropes, cotton fishing nets, petroleum hydrocarbons, rubber products, steel, submarine cables (telegraph and telephone), concrete, and cork (floats), have been attacked and destroyed by various marine organisms in various depths, from shallow protected waters to ocean depths exceeding 7,200 ft. Marine organisms which have been observed to be responsible for the destruction of these materials include species of wood- and rock-burrowing animals, purple sea urchins, sharks, fish and microorganisms.

A proposed field and laboratory study to accumulate further biological and engineering data about the relative behaviors of various materials to marine biological deterioration is presented.

R-183
Static and Dynamic Behavior of Portal-Frame Knee Connections, May 1962, W. A. Shaw, AD 276657

Twenty-three steel portal-frame knee connections were subjected to uniformly distributed static and dynamic loads along one leg of the connections. Three types of connections (square, curved, and tapered haunch knees) were tested in each of two loading configurations. The load was applied so that the inner flange of the connection was either in tension or compression. The connections were designed to join wide-flange steel sections about 16 in. in depth at an angle of 90 deg; each leg of the members was approximately 9 ft long.

The detailed results of the tests are evaluated, and comparisons are made of the various connections in regard to energy-absorbing capacity, stiffness, ductility, rotational capacity, and development of the fully plastic yield moment in the wide-flange beam. Measurements of pressure, deflection, reaction, strain, and acceleration are tabulated, and the static and dynamic analyses of various connections and loading conditions are presented in appendixes.

R-184
Harbor Screening Tests of Marine Borer Inhibitors, Part 4, Feb 1962, H. Hochman, T. Roe, AD 279465, PB 181182

The Laboratory is exposing wood panels impregnated with various materials to determine their resistance to attack by marine borers. This report lists the results of harbor tests of treated panels removed from exposure between 15 Aug 1960 and 15 Aug 1961. It also lists all treated panels

which have been exposed for one year or more and which have shown no attack or very slight amounts of attack. Treatments which have been exposed for less than one year are not reported unless they have failed and have been removed from test.

Certain organic, metal-organic, and inorganic compounds, when combined with creosote or creosote-coal tar solutions, show promise in improving the preservative ability of these materials, especially toward limnoria.

Those treatments or woods which have not been attacked by one or more species of borers during their entire period of exposure or as of 15 August 1961 are summarized.

R-185
Point Barrow Trials, FY 1959. Investigations of Thicknened Sea Ice, Apr 1962, J. E. Dykins, A. I. Funai, AD 275502

During the winter of 1958-59, trials were conducted at Point Barrow, Alaska, to investigate techniques for increasing the thickness of sea ice. Several test pads, the largest a 300-ft-diam circle, were constructed on a natural ice sheet by various experimental methods. Each technique was studied from the standpoint of the construction problems involved and certain characteristics of the ice produced. The temperatures, salinities, densities, and strengths of the various types of constructed sea ice were compared with those of natural sea ice.

Basically, three methods of surface-thickening natural sea ice were investigated: confined flooding, free flooding, and spraying and sprinkling.

The investigations indicated that free flooding was the most promising of the techniques studied. It was not only the simplest from a construction standpoint, but it also appeared to eliminate most of the objectionable features present in the other techniques.

R-186
Point Barrow Trials, FY 1959. Special Equipment for Thickening Sea Ice, Apr 1962, J. E. Dykins, AD 280501

The following report covers the test and evaluation of three major pieces of construction equipment used in the 1958-59 trials. This equipment included an experimental pump wanigan for lifting, transporting, and spreading the sea water used to thicken the sea ice; a power-driven, hand-operated ice drill used to open sea water intake wells and to inspect the constructed ice; and a heavy-duty utility service sled used as a portable source of electric power and auxiliary heat during construction of the ice test pads.

It is recommended that no further development be made on the pump wanigan, but instead, suitable equipment be developed for test and evaluation of the free-flooding technique for thickening sea ice. It is also recommended that a portable, power-driven, hand-held drill be developed for safe drilling of holes up to 12 in. in diameter and to depths of at least 16 ft. Finally, it is recommended that the heavy-duty service sled be considered for adoption as a piece of polar construction equipment.

R-186 Suppl.
Point Barrow Trials, FY 1959. Special Equipment for Thickening Sea Ice, Supplement, Apr 1962, J. E. Dykins

This supplement identifies the commercial items used in the special equipment evaluated in the FY 1959 Point Barrow trials. The experimental pump wanigan and the portable ice drill were used in the ice construction techniques investigated during the trials. The heavy-duty utility sled was used to support the operation of this equipment.

R-187
Analysis of Critical Motions of a Floating Platform, Aug 1962, J. J. Leendertse, AD 286091

Theoretical calculations and experimental measurements were made to determine the response to heave in the significant frequency range of 3 to 4 sec of the CUSS 1, an ocean-bottom drilling barge to be used in experimental trials prior to Project Mohole. Roll was measured also.

Approximately 20 min of pertinent barge motion measurements were made during two cruises while the barge drifted in the Santa Barbara (California) channel. No measurements of water-level variation (sea state) were made.

It was found that in seas in the channel, estimated as from 2 to 3 ft in height and with significant periods of 3 to 5 sec as generated by winds of about 20 knots, the roll of the barge did not exceed three degrees and that its average heave at periods of from 3 to 4 sec was about 1/4 in. The spectral density of the heave at a period of 3.4 sec was about 1/8 sq in./rad/sec.

R-188
An Evaluation of Organotin Compounds as Preservatives for Marine Timbers, Mar 1962, H. P. Vind, H. Hochman, AD 276003, PB 181311

Investigations at NCEL and other laboratories indicate that some organotin compounds have considerable promise as preservatives for marine timbers. However, there are a great number of organotin compounds, and they do not all possess the properties required of such a preservative. Laboratory screening tests and literature surveys were therefore undertaken to determine the biological, physical, and chemical properties of various organotin compounds. Toxicity to marine borers, solubility in sea water, volatility, odor, and chemical stability were investigated.

It was concluded from these studies that the most promising organotin compounds are sufficiently toxic to marine borers to be effective deterrents and are sufficiently nonvolatile and insoluble in sea water to resist leaching. However, they may not be sufficiently stable chemically to last over a long period of years. It was further concluded that substantially greater quantities of an organotin compound would be required to protect marine timbers from limnoria than from teredo and martesia.

All compounds containing the same organotin radical are leached from wood at about the same rate and, per unit weight of tin, all are about equally toxic. Therefore, choice of anionic radical appears to be relatively unimportant.

R-189
Sea Ice Engineering, Summary Report, Project Ice Way, Sep 1962, W. D. Kingery, D. W. Klick, J. E. Dykins, AD 287604

Project Ice Way was a joint field activity of the Terrestrial Sciences Laboratory, Air Force Cambridge Research Laboratories and the Naval Civil Engineering Laboratory. The project consisted of construction, operational evaluation, and scientific study of a sea-ice airfield on North Star Bay near Thule Air Base, Greenland, during January, February, March, April, and May 1961. This summary report of the engineering and scientific program includes a technical discussion of the site selection and engineering aspects of construction activities, together with technical evaluation of operational experience. A variety of scientific and engineering studies of sea-ice strength, mechanical properties, salinity, deformation, and deterioration characteristics were investigated along with the operational tests.

Successful operational tests of aircraft of different sizes up to and including a B-52 jet bomber indicated that sea-ice platforms can carry heavier loads than has previously been recognized. The major limitation, long-time bearing strength, has been investigated in more detail than previously and can provide a basis for fixing suitable operational requirements for heavy aircraft on sea ice.

Parallel investigations of properties by different techniques on the same ice has provided a basis for correlating different types of measurements and deriving necessary operational criteria from them.

R-190
Infrared Measurement of Sulfonate Additives, Apr 1962, J. B. Crilly, R. J. McGowan, AD 280134, PB 181312

Infrared spectra of 18 oil samples, to which varying concentrations of sulfonate were added, were made and plotted on graphs. It was shown that there was a correlation between concentration and absorption of the sulfonate inhibitors. The method is based on the fact that sulfonates absorb at wave lengths between 9 and 10 microns when exposed to infrared radiation. This absorption was found to be directly proportional to the concentration of the sulfonates and so may be used to measure content of sulfonates in oils.

R-191
Design for a Cast-in-Place Concrete Shelter, Dec 1962, J. R. Allgood, R. M. Webb, R. F. Swalley, AD 292930

The objective of this task was to develop an economical, arch-shaped shelter, utilizing pneumatically-placed mortar, as an alternate to existing standard types. Criteria and plans for a 100-man shotcrete shelter are presented which will provide protection against an overpressure of 100 psi and concomitant effects from nuclear weapons. Shotcrete is recommended because of the economic advantages gained from using a single lightweight form as opposed to the heavy double form required for conventionally placed concrete. An effort has been made to provide a balanced and versatile design which may be adapted to the specific needs of various commands.

Methods for the design of the basic structural components of the shelter are given, including a method for estimating the relative displacement between the floor and the foundation when the structure is subjected to blast loading. Simple yet adequate design procedures are given which are suitable for use in the design office.

R-192
Static and Dynamic Loading of Pretensioned Concrete Beams, Jun 1962, S. K. Takahashi, AD 278118

Nine simply supported pretensioned beams were tested in the blast simulator either statically or dynamically. In the dynamic tests the beams were subjected to long- and short-duration loading. As expected, the load capacity of the beams subjected to short-duration loads was greater than that of those subjected to long-duration loads. The deflection-time traces showed that no tensile stresses occurred in the top fiber for any of the loads applied and that a permanent deformation can be considered negligible for loads less than 85% of the ultimate load.

A method of predicting the static ultimate deflection is presented and applied to one of the beams. The experimental data is compared with the theory. All of the statically tested beams failed in bond near the supports. In the dynamic tests, two beams failed by concrete compression at mid-span, and the rest failed in bond. A solution for dynamic response, which includes damping, is shown and applied to one of the tests.

R-193
Hydrophobic Cement, Jun 1962, W. L. Cowell, AD 276740

Protection of cement from hydration during storage has long been a problem because of the resultant loss in strength when incorporated in concrete. This loss in strength may be greatly reduced by intergrinding oleic acid with the cement clinker to render the cement resistant to absorption of moisture. Oleic-acid-treated cements stored for over two years with only a canvas covering showed no signs of sack-hardening or deterioration. The optimum concentration of acid for maximum protection ranges between 0.2 and 0.5% by weight of cement. A concentration of 0.2% or slightly above seems to be the most practical.

Foreign research on hydrophobic cements was explored. Foreign investigators reported an apparent greater success with oleic acid than was experienced by NCEL. Extensive tests at NCEL simply could not verify foreign claims of low air entrainment and nominal strengths for mortar and concrete incorporating only oleic acid.

R-194
Protective Coatings for Steel Piling, Results of 30-Month Tests, Jun 1962, R. L. Alumbaugh, AD 278356

Eight coating systems selected from a previous study were evaluated by the Laboratory as protective coating systems for steel piles. The systems were applied to both sheet and "H" piles. The coated piles were driven in the surf of the outer harbor at Port Hueneme and exposed for periods of 12 to 30 months.

At the conclusion of the 30-month exposure period, all eight systems showed some coating deterioration resulting either from the driving operation or the exposure condition. The most severe damage was attributed to the action of the sea-water-sand slurry which caused moderate to heavy abrasion damage, just above the mudline, to all the systems.

Based on overall protection to the three exposure zones (splash, tidal, and embedded) together with cost considerations, a vinyl mastic coating system provided the most economical protection to the steel piling during the 30-month exposure period.

R-195
Attenuation of Gamma Radiation in a Two-Legged 11-Inch Rectangular Duct, May 1962, D. W. Green, AD 275600

Results are presented of experiments carried out with an 11x11-in. duct in concrete with one right-angle bend, using cobalt 60 as a gamma-ray source. Experiments cover the effects of moving the source and detector off the centerline position, of replacing the inside concrete corner lip with one of lead, and of removing various scattering areas in the corner. Measured values of attenuation factors for the corner and second leg are compared with calculated values, using the Ledoux-Chilton analysis. The comparisons suggest that the analysis provides an adequate treatment of the single-scatter effect in the duct. Multiple-scatter effects, however, which are not taken into account by the analysis, apparently are responsible for approximately half of the radiation reaching the detector. An empirical expression is obtained which adequately represents most of the experimental results of duct measurements available at the present time.

R-196
Multipurpose Mobilization Building, Jun 1962, J. J. Hromadik, R. A. Bliss, AD 282933

This report describes the building, molds, and metal side forms for the prefabrication of the panels, and the erection techniques employed. It also offers suggestions and cautions for future construction of similar prefabricated panel buildings.

R-197
Coating Studies at Kwajalein, Kaneohe, and Port Hueneme, Jul 1962, C. V. Brouillette, R. L. Alumbaugh, AD 288797

Twenty-nine protective coating systems were applied to sand-blasted steel test panels and placed on exposure in the Marine atmospheres of Kwajalein, Marshall Islands, Kaneohe, Hawaii, and Port Hueneme, California.

A mica-filled asphalt emulsion applied over a wash primer and a zinc chromate primer gave excellent protection to both scribed and unscribed panels for 5 years. Four additional coating systems gave, for the same period to time, protection which was superior to that given by the selected standard test coating, Saran.

R-197 Suppl.
Coating Studies at Kwajalein, Kaneohe, and Port Hueneme, Supplement, Jul 1962, C. V. Brouillette, R. L. Alumbaugh

R-197 Add.
Coating Studies at Kwajalein, Kaneohe, and Port Hueneme, Addendum, Aug 1962, C. V. Brouillette, R. L. Alumbaugh, AD 634201

Data on twenty-nine coating systems were not reported in TR-197 since nine systems were anti-fouling coatings not suited for atmospheric exposure, six systems were reported in TN-309, three systems became damaged prior to exposure, one system was a pre-gel grease, one system was not applied to atmospheric exposure test panels, and nine systems were exposed at Port Hueneme only.

R-198
Analysis of Creosote by Infrared Spectroscopy, Aug 1962, R. W. Drisko, AD 284223

As a part of the Laboratory's task to develop materials and techniques for treating timbers to retard or prevent marine borer attack, infrared spectroscopy was used to obtain analytical data from a number of creosotes that would have been very difficult to obtain by chemical means. A method was devised to distinguish by infrared spectroscopy pure coke-oven creosote from low-temperature or vertical-retort creosote. Infrared spectroscopy can also be used to detect adulteration of coke-oven creosote with petroleum containing saturated hydrocarbons or aromatic hydrocarbons with saturated hydrocarbon chains.

Spectral differences were detected in creosote extracted from a pair of similarly creosoted panels, one of which was exposed in a harbor and the other of which remained on a shelf in the laboratory. Spectral differences were also noted in creosote extracted from different cross-sectional depths of marine piling. Creosote from the outermost portion of the piling contained a greater amount of saturated hydrocarbons and a greater amount of oxidation products than did creosote from further into the interior of the piling.

Olefins were shown to be present in the saturated hydrocarbon chromatography fraction of a number of creosotes. This is believed to be the first report on the presence of olefins in creosote.

R-199
Deadman Anchorages in Sand, Jul 1962, J. E. Smith, AD 282934

An extensive test program was conducted to obtain information for improving or expanding design criteria for deadman anchorages in sand as used for the lateral support of engineering structures. Horizontal loads were applied to reinforced concrete deadman, ranging in size from 5 to 72 sq ft of face area, placed singly and in rectilinear groups of three at several depths. The 72-sq-ft deadman was also tested behind triangular and trapezoidal berms of different sizes.

Satisfactory correlation of results was obtained from the tests. Deadman holding capacities and reaction patterns under applied loads were determined and an empirical equation by which both the capacities and reaction patterns can be calculated was developed. In addition, failure-wedge development and extent were defined and information was obtained concerning the effect of coupling elevation and repeated loads on holding capacity.

R-200
Evaluation of the Improved Meco Still, Jul 1962, C. M. Saturnino, AD 282950

The unit was tested at operating conditions specified by Meco for a period of 1320 hours. It proved easy to operate, requiring only the minimum of attention. The distillate production averaged 418 gpm, just over the rated production of 417 gpm. The economy ratio averaged 296 pounds of distillate per pounds of fuel, slightly less than the rated economy ratio of 300. The salinity of the distillate was below the specified 5 ppm, most of the time it was around 1 ppm. At the end of the test the unit was opened for inspection. No evidence of scale was found in the water side of the evaporator.

It was concluded from the analysis of the test data that the unit satisfied the requirements specified in the contract. Unqualified acceptance of the unit must be withheld until extensive field testing has been completed.

R-201
Characteristics of AC Crane Controls, Jun 1962, A. M. Brown, AD 807717L

DC motors have provided satisfactory torque and speed control for cranes, but require an AC to DC conversion of the normally AC power supply. To eliminate this expensive conversion, AC crane controls were developed by the industry. At the request of BUDOCKS, an evaluation of four different types of AC crane controls installed on four bridge cranes at the Naval Repair Facility in San Diego was undertaken by NCEL. It is concluded that AC crane controls have characteristics which will satisfy most crane application requirements both as to hook speed and precision-positioning of loads. However, the crane and control system should be carefully selected to suit the load application. Systems not suited to the work application will prove unsatisfactory.

R-202
600-GPM Ship-to-Shore Bulk Fuel Delivery Systems, Jun 1962, J. J. Traffalis, AD 290135

To meet the anticipated increased fuel requirements for amphibious assault operations, a 6-in. buoyant and 6-in. bottom-laid ship-to-shore fueling system were developed and tested. The systems have a 5,000-ft installed length. This report describes the systems and all necessary materials and equipment to install and maintain the 5,000-ft length. It also describes their development and test, and installation and operational techniques utilized and recommended by NCEL. The systems satisfactorily meet the design criteria and are feasible for installation and operation by amphibious construction battalions.

R-202 Suppl.
600-GPM Ship-to-Shore Bulk Fuel Delivery Systems, Sep 1966, J. J. Traffalis, AD 801078L

To meet the anticipated increased fuel requirements for amphibious assault operations, two ship-to-shore fueling systems were developed and tested: a 6-in buoyant system and a 6-in. bottom-laid system. The systems have a 5,000-ft installed length. The buoyant system, which can be installed from a warping tug, LCU, or LCM-8, consists primarily of a tension-relieved, collapsible, rubber hose mounted on a diesel-powered hose reel. The bottom-laid system, designed for installation by a warping tug, consists essentially of 30-ft sections of buttress-threaded casing coupled together by a pneumatically powered pipe tong. The system requires a prepared beach site for assembly and launching.

This report describes the development and testing of improved components and techniques for the buoyant and

bottom-laid systems. The components and techniques satisfactorily meet the design criteria and are feasible for operation by the amphibious construction battalions.

R-203
Evaluation of Small Diesel-Engine-Driven Generator Sets, 5-kW Hobart, Jun 1962, R. H. Leseberg, AD 283301

The sets were found to be compact, lightweight, and basically well designed. The units were economical in operation and required a minimum amount of routine maintenance and specialized operator skill during operation. With minor modifications during the evaluation test program, the generator sets completed a 1000-hr full-rated-load run without major breakdown and satisfied the objectives of the task. With all of the modifications incorporated, the 5-kW generator sets are recommended as suitable replacements for equivalent gasoline-engine-driven generator sets and should be satisfactory for an advanced base in-service evaluation.

R-204
Deep-Ocean Studies. Service Vehicle, Aug 1962, D. Taylor, AD 284222

Under the Naval Civil Engineering Laboratory's task to develop systems and techniques for construction in deep-ocean areas, a survey was conducted to determine present capability for deep-ocean work. A summary of previous underwater experience and a brief description of eighteen different underwater-vehicle concepts and prototypes are given. Criteria are provided as a basis for the design of two suitable vehicles for the construction and maintenance of deep-ocean structures.

R-205
Removal of Asphalt From Drums, Jun 1962, C. A. Scharpf, J. H. Sams, J. S. Williams, AD 282935

NCEL efforts have produced two methods of removing asphalt from drums which promise to be superior to present methods in general use at overseas installations. In one method, the inside of the drum is coated with a release agent, such as a silicone film, to prevent adherence of the asphalt. When ready for use, the metal drum is cut and stripped away and the contents allowed to fall into the melting kettle. Clean separation is readily obtained at a drum surface temperature below 92°F, but the removal becomes increasingly difficult above that temperature. Coating the drums with reflective paints and storing the drums in the shade until required are effective means of maintaining low surface temperatures.

In the other method, the full drum, with head removed, is immersed briefly in hot water and then inverted. The weight of the asphalt causes it to slide out of the container. Although this method does not require use of an interior film on the drum, a slightly larger quantity of product remains behind when the cylindrical slug of asphalt falls out.

R-206
Armored Wheelhouse for Propulsion Unit Operators, Jun 1962, J. E. Smith, AD 277828

Operators of propulsion units on pontoon barges are unprotected from shell fragments and small-arms fire, so the Naval Civil Engineering Laboratory designed, fabricated, and tested an armored wheelhouse for use with the 02D, 06DH, and 90200 propulsion units. After NCEL tests, the prototype was tested operationally be PHIBCB ONE. On the basis of the test programs, the Laboratory concluded that the armored wheelhouse meets design objectives. Also presented is an alternate wheelhouse designed for use on warping tugs.

R-207
Ice Runway Investigations on the Ellesmere Ice Shelf, Jul 1962, D. E. Well, N. L. Slover, AD 284309

In order to obtain specific knowledge of the engineering characteristics of ice as found on natural fresh water ice islands, NCEL participated with Air Force Cambridge Research Laboratories in joint studies on the Ellesmere Ice Shelf in the fall of 1959 and the summer of 1960. Three major forms (according to topography) of fresh water ice were found in this area: moat, rise, and shelf ice.

Flooded ice plots were constructed on the ice shelf during the fall season of 1959. The following summer, observations were made on the constructed ice and the adjacent natural ice. Measurements were made to determine the problems and effort involved in the construction of aircraft runways on each major ice form, and small test plots were used to investigate controlled melting by increasing the effective solar energy absorption in the ice sheet.

R-207 Suppl.
Ice Runway Investigations on the Ellesmere Ice Shelf, Supplement, Jul 1962, D. E. Well, N. L. Slover, AD 286369

This supplement identifies the commercial items used in the special equipment evaluated in the ice runway investigations on the Ellesmere Ice Shelf. The flooding equipment was used in the ice construction techniques evaluated during the investigations. The hot air heater was used to support the operation of this equipment.

R-208
Removal of Sand From Drydocks, Aug 1962, J. J. Doman, C. A. Dittus, AD 284310

Sand left by sandblasting operations on graving dock floors is sucked into dewatering pumps, causing damage to valuable machinery. This survey was made to determine the most effective and economical method for removing sand prior to dewatering. Low-profile equipment can remove spent sand from unobstructed dock floors. In areas with unrestricted ceiling a scoop loader can remove the accumulated sand for placement into containers. A low-profile tractor is adequate for movement of sand in open spaces of the dock. But when a vessel is mounted on blocks, the working area and height near the blocks prevent the use of large-size and high-profile equipment.

R-209
Analysis of a Pulsed-Light Deep-Ocean Search System, Nov 1962, R. D. Hitchcock, AD 291697

In the study of methods for locating deep-ocean structures a major problem is the identification of objects at distances beyond 10 meters or so. Because underwater sonar detection devices do not provide definition comparable to that of optical detectors, there is a need for an extended-range undersea television system. Extension of underwater visibility would result from the use of pulsed light synchronized with a gated video camera because veiling luminance caused by back-scattering light would be reduced. Analysis of a hypothetical system using a pulsed searchlight and an internally gated television camera shows that the maximum range of such a system is 100 meters for a perfectly reflecting retrodirective target. For bottom-located objects, such as sunken vessels and mines or natural underwater objects, the maximum range is about 70 meters. A laser could theoretically extend the range to 270 meters for a perfect target.

The most satisfactory available light source is a capacitor-discharge air arc for which no shuttering device is needed. The video tube should be an intensifier orthicon capable of providing a resolution of about 250 lines for an input of 10^{-9} lumen per cm squared. The problems of seawater luminescence are found to be trivial.

R-210
Technical Data From Deep Freeze IV and 60 Reports (1958 to 1960), Dec 1962, R. C. Coffin, AD 292000

This report is a compilation of technical data obtained principally from reports prepared by the Commander, Antarctic Support Activities (Wintering-Over Group), for operations Deep Freeze IV and 60. Supplemental information was obtained from correspondence and situation reports originated by Deep Freeze Forces, and reports by military and civilian observers, which are listed in the references and bibliography. Data compiled from reports of previous Deep Freeze operations are contained in NCEL Technical Report R-155, "Technical Data From Deep Freeze I, II, and III Reports (1955 to 1958)," of 24 April 1961.

The information is grouped into thirteen general technical subject areas, which are subdivided into specific problem areas. Within the problem areas the data are presented by individual U.S. Antarctic Stations whenever different environmental, topographical, or operational conditions contributed diverse solutions for the same or similar problems.

The objective of the compilation is to provide a ready reference for persons concerned with the design, construction, maintenance, and operation of equipment and facilities in the Antarctic. It is recognized that the information is historical and pertains to specific or limited sections of the south polar area. The sources utilized in compiling this report are among the first documentations of large-scale construction and continuing Naval shore-based operations in Antarctica.

R-211
Protection Against Intense Thermal Radiation (a Device for Automatically Closing Venetian Blinds), Jul 1962, J. C. King, AD 288441

A device has been developed which permits venetian blinds to drop and close automatically. In the event of a nuclear war, it can prevent injury from thermal radiation and from shattering glass. It can also prevent radiation from a nuclear explosion or other source, such as large fires, from igniting combustible objects such as curtains, papers, and upholstery. Automatic operation is effected electrically by a signal from a detector which is triggered by the flash of a nuclear explosion, or the operation can be triggered by a central manually operated switch. The device fits inside the blind's top enclosure and is simple, inexpensive, and easy to install.

Tests were made on two 74-in. window blinds. The blinds dropped and closed in less than 1-1/2 seconds from a fully raised position with slats at maximum reverse angle. Two of the devices were installed in window blinds at the Laboratory during October 1961. These devices have been operated daily since that time without failure or need for maintenance, and they do not hamper the manual adjustment of the blinds.

R-212
Long-Time Creep of Prestressed Concrete I-Beams, Oct 1962, S. L. Bugg, AD 287983

This report covers the fabricating, prestressing, grouting and long-time loading of 22 post-tensioned prestressed concrete I-beams. These 42-ft members were subjected to loads varying in magnitude from dead load only to dead load plus 1.5 design live loads for periods of 74 to 80 months. The report contains data on the properties of the beam materials, shrinkage prior to prestressing, tendon elongations, and long-time creep and deflection of the beams due to loads of various magnitudes.

R-213
Application of X-Ray Diffraction to Oceanic Soil Analysis, Oct 1962, J. B. Crilly, R. J. Smith, AD 288536

The core borings in Deep Ocean Subtask of the General Structures in Deep Ocean Program is designed to gain familiarity with means of obtaining and treating undisturbed samples from the floor of the deep sea relative to their supporting abilities. One of the major problems connected with oceanic soil work pertains to distinguishing the various soil types that all have much visual similarity. To determine the suitability of X-ray diffraction methods for investigating its compositional characteristics, a representative sample of ocean floor soil procured from a 1,200-ft water depth on the continental shelf off the Port Hueneme Harbor entrance was subjected to analysis. The sample was broken into plus-200-mesh, minus-200-mesh, and clay fractions by means of a sieving and centrifuging process. Diffraction patterns obtained for the clastic fraction verified results of microscopic compositional estimates. X-ray analysis of the clay fraction indicated the presence of kaolinitic, illitic, and montmorillonitic types. The effects on the patterns of varying instrument settings and scanning rates are described. It is recommended that diffraction patterns be obtained in conjunction with normal test measurements to assist in discriminating between fine-grained soil constituents.

R-214
The Two Current-Probe Method of Measuring Conducted Radio Frequency Interference, Sep 1962, J. L. Brooks, AD 288533L

A new approach to the problem of measuring conducted interference is described. A brief discussion is presented on the limitations and uncertainties of the presently accepted method using line-impedance-stabilization networks (LISN). These limitations stem from the fact that no information is obtained concerning the impedance values of the circuit being measured during a noise measurement. The new method described provides a means of overcoming the limitations of the present method completely by the use of commercially available current-probes in an impedance- and noise-measurement system.

A method of determining the impedance values of the circuit has been worked out which requires the use of two current-probes. Either the noise-source impedance or the load impedance or both may be determined by this method. Two separate measurements and calculations are required, however, one to determine the magnitude of the impedance and the other to determine the phase angle.

An evaluation of the device is presented, as well as numerous examples of noise measurements showing the correlation between measured and predicted results.

R-215
Impact-Reduction Method for Side-Launching Pontoon Structures, Oct 1962, J. E. Smith, AD 288281

When pontoon structures are side-launched from LST's, the high impacts cause damage to the structures, resulting in excessive maintenance and replacement costs. An investigation was conducted at NCEL to determine if impacts and resultant damage could be reduced with a cushioning material.

An expendable fibreboard cushion was designed, and procedures for assembling and attaching it were developed. Impacts and apparent damage to the pontoon structure were reduced to acceptable levels in tests. Operational testing by the field forces is recommended for full evaluation.

R-216
Blast Loading of Small Buried Arches, Apr 1963, J. R. Allgood, C. R. White, R. F. Swalley, H. L. Gill, AD 403113

The objective of the work represented by this report was to gain information which will serve as a guide in

developing design methods for underground structures. In pursuit of this goal, preliminary tests have been conducted on small buried arches to determine the influence of the dominant parameters. Information has been obtained on the response to long-, medium-, and short-duration blast loads including the deflection, thrust, and moment patterns. One static test also was performed. Curves showing the form of arching under static and blast loading are given. In addition, buckling and the variation of interface pressure are discussed briefly. A model analysis of the system and subsequent comparison of the deflections from the small-structure tests and the Operation Plumbbob Structure 3.3 tests indicate that modeling of deflections is possible.

R-217
The Effect of Salt in Concrete on Compressive Strength, Water Vapor Transmission, and Corrosion of Reinforcing Steel, Nov 1962, D. F. Griffin, R. L. Henry, AD 294576

The information reported herein represents basic data about the effects of salt in concrete on compressive strength, water vapor transmission (WVT), and corrosion of the reinforcing steel. Variables included in the study are (1) water-cement ratio, (2) diameter of specimen, (3) thickness of specimen, (4) percent concentration of salts - either sodium chloride or sea-water salts, and (5) environment of specimen - 20, 50, or 75% relative humidity at 73.4°F.

The investigation, partially carried out utilizing the NCEL-developed wet cup, has been in progress for approximately 1-1/2 years. An additional study of experimental walls subjected to sea-water spray was begun about one year ago and will continue for several years.

Sea-water salts at one time were thought to be detrimental to reinforced concrete, but this study shows that, if controlled, some salt is beneficial. A gain in strength, lower values of WVT, and no significant corrosion of mild steel are realized when a salinity of 25 grams of salt per kilogram of solution is established in the mixing water.

R-218
Point Barrow Trials, FY 1960. Free Flooded and Ice-Aggregate-Fill, Nov 1962, J. E. Dykins, N. S. Stehle, K. O. Gray, AD 291698

During the winter of 1959-60, trials were conducted at Point Barrow, Alaska, to further develop techniques for increasing the bearing strength of ice sheets by increasing their thickness and to observe the behavior of the ice types during the rising temperatures of an arctic spring. Several test pads were constructed for this purpose, by free flooding, and ice-aggregate-fill methods. The construction problems encountered and certain characteristics of the constructed ice were studied for each construction technique. For comparison, one confined flooded test plot was constructed concurrently with the free-flooded plot and one was constructed concurrently with the ice-aggregate plots. Temperature, salinity, density and strength of the various types of constructed sea ice and natural sea ice were compared.

The investigations showed that free flooding was the simplest construction technique. Both types of aggregate used in the dry-fill method (fractured young sea ice and chipped natural sea ice) proved difficult to handle, and much of the equipment was too large for small plots.

R-219
Settling and Filtering Equipment for Roof-Washdown Radiological Countermeasures, Feb 1963, E. N. Hellberg, AD 297559

Tests were made to determine if radioactive fallout particles can be removed from roof-washdown water by settling and filtering, thus permitting continuous use of the water by recirculation. A settling tank, a filtering tank, a circulating pump, a flocculent injector, and other allied mechanical equipment were used in the test. The fallout simulant was sand of various particle sizes tagged with a radioactive tracer. Since a roof section was not used in the tests, the simulant was fed directly into a sloping, open channel which returned the wash water from the filtering tank to the settling tank.

It was concluded that settling and filtering tanks connected in series permit satisfactory separation of the simulant from the wash water. It was further concluded that a recirculating-water roof-washdown system using settling and filtering tanks is feasible.

R-220
Epoxy Asphaltic Concrete, Nov 1962, R. J. Lowe, AD 291584

To investigate the influence of epoxy asphaltic concrete on the load deflection characteristics of a flexible pavement, a pavement section consisting of 20 in. of base, 3 in. of asphaltic concrete, and two 3/4-in.-thick layers of epoxy asphaltic concrete was placed in the Laboratory's mechanical subgrade. Each part of the pavement section was load-tested prior to the placement of the next part. The influence of one section on the other is presented. Durability properties as obtained from accelerated weathering tests are presented.

R-221
Warehouse and Preservation Methods and Economics for Storing Material, Dec 1962, R. J. Zablodil, J. C. King, AD 296387

Results are presented in two parts: (1) efficacy of storage environments, and (2) economy of storage systems. Part 1 shows that protection is poor in open-air storage, fair in a shed, good in the standard warehouse, and excellent in controlled-humidity warehouses. Five components - internal-combustion engines, gear boxes, fuel-injector sets, hydraulic brake systems, and cooling systems - had a high incidence of rust regardless of storage environment and with little regard to preservation level. Compared to domestic treatment, contact preservation decreased the incidence of rust about 58% for open-air storage, 44% for the shed, and 30% for the standard warehouse; no rust due to storage environment occurred in the controlled-humidity warehouses for either preservation level.

Part 2 shows that, under environmental conditions similar to those of the test, storage in the 50% RH warehouse using domestic treatment is usually cheaper, but that the standard warehouse with this treatment is cheaper for automotive and nonmetallic equipment. It is cheaper to protect equipment stored for stateside use with domestic treatment, but contact preservation is cheaper for overseas use.

The Navy's standard 40-ft by 100-ft prefabricated metal building appears generally satisfactory for advanced base dehumidified warehousing, but it has too many joints to be easily sealed and quickly erected.

R-222
1,000-Hour Test of 30-kW Brushless Generator Set, Nov 1962, R. H. Leseberg, AD 290698

The Laboratory evaluated a 30-kW diesel-engine-driven generator set that had been modified under a contract with the Leach Corporation, Inet-Palmer Special Products Division of Los Angeles, Calif., to incorporate a brushless generator design and a static-type voltage regulator.

The 30-kW modified brushless generator set was found to have excellent power-generating characteristics for 60-cps operation at the 120-208 voltage connection. It completed more than 1000 hours of operation at various power factor loads, and the average voltage-droop characteristics indicate that two similar units could be expected to operate satisfactorily in parallel. It is recommended the brushless generator set design be in-service tested.

R-223
Investigation of Nonspecification Preservatives, Nov 1962, J. M. Stephenson, E. Morales, AD 291136

NCEL conducted an exposure test of a number of nonspecification lubricant-preservatives and other rust inhibitors to evaluate their effectiveness in preventing corrosion. Thirty-seven preservatives were applied to various critical components of five tractors, three jeeps and 25 pumps. This equipment was periodically inspected every 4 months for a period of 5 years. Among the 37 preservatives were 15 specification preservatives, included for comparison purposes. The nonspecification preservatives which failed before the 5-year limit were either reapplied or replaced with other candidates. Out of 76 components, 53 were completely protected by the nonspecification preservatives for the 5-year period. In a few cases results were inconclusive, but the tests indicate that those which were satisfactory could be safely substituted for specification preservatives according to their recommended usage.

R-224
Greenheart Alkaloids, Mar 1963, P. J. Hearst, AD 409557

It is commonly believed that the resistance of the tropical wood greenheart (ocotea rodiaei) to marine borer attack is due to the presence of the toxic alkaloid "bebeerine," and that this alkaloid is the same as chondrodendrine (1), whose structure is known. The latter alkaloid could not be obtained from greenheart. Radiasine dimethiodide, which was isolated, apparently is the first pure alkaloid obtained from greenheart. By gradient elution chromatography and subsequent fractional crystallization, eight alkaloid hydrochlorides were isolated from the ether-soluble alkaloids of greenheart bark. All the alkaloids are quite toxic to teredo but less toxic to limnoria, and when impregnated into pine panels, they prevent teredo attack and greatly reduce limnoria attack. The alkaloids may therefore be the chief factor in the resistance of greenheart to the former species of marine borer, but may be a less important factor in its resistance to the latter species.

R-225
Corrosion-Resistant Nonmetallic Materials for Pipe and Pipe Jackets or Linings - A Literature Survey, Jan 1963, T. Roe, R. L. Alumbaugh, AD 298922

This report summarizes nonmetallic materials which are available as pipe or for lining and/or jackets for metallic or nonmetallic pipe. Certain mechanical, thermal and chemical properties for each material are listed together with data on sizes available and cost per foot of 3-in.-ID material. A few thermoplastic materials which are not presently used in pipe fabrication are included because they may be used for this purpose in the future. Commercial standards and federal and military specifications for the various materials are itemized, and current regulations and standards pertaining to the use of plastic pipe for transporting potable water are noted.

R-226
Blast Loading of Concrete Beams Reinforced With High-Strength Deformed Bars, Apr 1963, W. A. Keenan, AD 408447

Economical blast-resistant concrete structures can be constructed by reinforcing concrete members with high-strength deformed bars if such members can meet the requirements of (1) adequate strength and ductility under blast loading, and (2) limited deflections and formation of cracks under static service loads. A theoretical study and a series of beam tests were made to determine if concrete members reinforced with high-strength deformed bars can meet the above requirements.

It is concluded that the two major factors which may restrict the use of high-strength steel in blast-resistant design are (1) the inability of such a steel to elongate a required minimum amount, and (2) excessive deflections and/or cracks of beams reinforced with high-strength steels under static service loads.

The tests demonstrate that more resistance can be gained with a lesser amount of high-strength steel than lower grades of steel and that chromium alloy steel of the type used in this investigation has a sufficient amount of ductility for use in simply supported beams. Both the theoretical study and the experimental tests indicate that excessive deflections may be controlled by prestressing the tensile steel.

R-227
NCEL Crane Moment Indicator, Mar 1963, J. J. Bayles, I. M. Derr, R. E. Jochums, AD 403665

Upon completion of testing the Teledyne crane moment indicator, which proved to be unsatisfactory, the Laboratory was directed to redesign the system, build a model, and test it on a locomotive crane.

The redesigned system is essentially an analogue computer which measures the crane overturning moment for any vertical boom angle with any load at any horizontal angle of train and warns the crane operator when an unsafe moment is reached. Devices which measure the vertical and horizontal train angles of the boom and the weight of the load are circuited so that the output signals register the percent of maximum allowable moment on an indicator dial. Visual and audible signals warn when the crane approaches an unsafe operating condition, when the power to the system is inadequate for proper operation, and when certain electronic components become defective. New and improved electronic or mechanical components were incorporated in the design whenever their use could reasonably be expected to eliminate potential sources of error.

Testing showed that the design is sound. The prototype model is responsive, reliable, accurate for readings where load conditions cause concern, and virtually fail-safe. The model is readily adaptable to the various types of materials-handling mobile cranes.

R-228
A Semiempirical Formula for Differential Dose Albedo for Gamma Rays on Concrete, Nov 1962, A. B. Chilton, C. M. Huddleston, AD 294104

A semiempirical formula is developed which yields values for the differential dose albedo of gamma rays on concrete. Gamma rays of incident energies 0.2, 0.5, 1.0, 2.0, 3.0, 4.0, and 10.0 mev are considered. Results of the formula are compared with values derived from Monte Carlo calculations for the backscattering of gamma rays from a semi-infinite slab of concrete. Results show that a two-parameter formula gives satisfactory agreement with the Monte Carlo calculations. The principal assumption involved in the theoretical analysis is that the actual reflection process can be approximated by two terms, one involving a single Compton scattering event, and the other involving isotropic scattering.

R-229
Corrosion Studies on BW-CW Decontaminants, Apr 1963, C. V. Brouillette, AD 407487

The object of the task was to determine the corrosiveness of various BW-CW decontaminants toward the common metals of construction, such as steel, copper, aluminum, magnesium, and zinc, with emphasis placed on the metals and alloys used in the manufacture of high-speed aircraft. The corrosiveness of these decontaminants to 33 metals and alloys and seven metallic couples was determined by two types of tests: one by partial immersion, and one by atmospheric exposure. In general the corrosive attack of the

decontaminants on the metals was more severe in the immersion test than in the atmospheric-exposure test. The data indicate that DS-2 and beta-propiolactone are, in general, the least corrosive of the decontaminants evaluated.

R-230
Metabolism of Creosote by Certain Marine Microorganisms, Dec 1962, R. W. Drisko, T. R. Oneill, H. Hochman, AD 291905

Laboratory experiments showed that microorganisms present on creosoted piling in Port Hueneme Harbor were found to have the ability to metabolize creosote, causing loss of creosote and producing chemical changes similar to those which occur naturally in creosote exposed in a submerged harbor environment. This metabolism appears to be restricted to the aromatic hydrocarbon components. Two of these, naphthalene and phenanthrene, were shown to be metabolized to a significant extent by certain marine microorganisms.

R-231
Effects on Structural and Harbor Installations of Ground Shock Induced by Underwater Explosions, Jun 1963, I. W. Heller, SECRET, AD 346603

R-232
Booster Stations for 4-Inch Ship-to-Shore Fuel Delivery Systems, Feb 1963, J. J. Traffalis, R. A. Bliss, AD 400105

To extend the effective delivery range of the 4-in. buoyant and bottom-laid fuel delivery systems beyond the current 5,000-ft capability, NCEL developed a diesel-driven booster station and tested a gas-turbine-driven booster station. This report describes the design, development, and comparative evaluation of the two units.

R-233
Evaluation of the Maxim Double-Effect, Eight-Stage Flash Sea-Water Evaporator, Jan 1963, J. S. Williams, AD 296797

A sea water conversion unit of unique design was evaluated by NCEL to determine its suitability for use at advanced bases where potable water is available only by desalting saline water. The equipment was conceived and manufactured by the Maxim Silencer Company, now a division of The American Machine and Foundry Company, under a contract with the Bureau of Yards and Docks. It was a combination of a double-effect vapor-compression evaporator and eight flash stages. Motive steam was furnished by a package steam generator. The unit was designed to produce 12,000 gal of distilled water per day and to have a water-to-fuel ratio of 85 lb of water to 1 lb of diesel fuel.

Continued mechanical difficulties prevented bringing the evaluation to a successful conclusion. Water production was below rated capacity much of the time, and the fuel economy averaged less than 80 to 1. The contract was terminated by mutual agreement.

R-234
Evaluation of 40- by 100-Foot Arch-Rib Utility Building, May 1963, R. M. Webb, AD 409847

A 40- by 100-ft arch-rib building, prefabricated of 12-gage-steel ribs and 26-gage galvanized sheeting by Trim-Steel, Incorporated, was erected and subjected to the loading specified in the uniform military requirements criteria for prefabricated advanced base buildings. It is concluded that the building meets the minimum requirements of the criteria for advanced base buildings.

R-235
A Study of the Effectiveness of Fuel-Oil Additives in Use in the Eleventh Naval District, Nov 1962, J. S. Williams, AD 296796

A survey was conducted at a number of heat-plant installations at bases in the Eleventh Naval District to determine the need for the use of additives to prevent sludge in No. 6 fuel-oil storage tanks. The fact that no sludging problems could be found at bases not using an additive indicated that a need did not exist. Several of the facilities reported that additives decreased the formation of soot by improving the combustion. A test was made to check the validity of these claims. An additional test without additive showed that changes in operating schedules would also reduce soot accumulation. It was concluded that no requirement exists for additives for sludge prevention. It was further concluded that combustion catalysts are beneficial for boilers operating under intermittent and cycling conditions, but that no substantial benefit results from the use of catalysts when boilers are operated continuously.

R-236
Harbor Screening Tests of Marine Borer Inhibitors, Part 5, Feb 1963, H. Hochman, T. Roe, AD 401215

The Laboratory is exposing wood panels impregnated with various materials to determine their resistance to attack by marine borers. This report lists the results of harbor tests of treated panels removed from exposure for one year or more and which have shown no attack or very slight attack. Treatments which have been exposed for less than one year are not reported unless they have failed and have been removed from test. Those treatments or woods which have not been attacked by one or more species during their entire period of exposure or as of 15 August 1962 are summarized.

R-237
Potential of Ground Effect Machines, May 1963, J. H. McHugh, R. E. Jochums, AD 410029

This study considers the use of ground effect machines in three areas within the field of responsibility of the Bureau of Yards and Docks. These areas are amphibious support, polar operations, and construction equipment. Each of these problem areas share a common major requirement, namely, the ability to move across mixed or unstable terrain with practical speed and load capacities.

It is concluded that ground effect machines have only limited application in the problem areas. The increase in mobility and operating speed can only be accomplished with large vehicles having very high rates of fuel consumption. On the basis of predicted performance, GEMS appear to be limited to carrying high-priority cargo. The noise and debris resulting from the air blast of the plenum chamber and peripheral jet are serious handicaps.

R-238
Point Barrow Trials, FY 1962. Ablation and Crystal Studies of Sea Ice, Apr 1963, N. S. Stehle, AD 402839

During the spring of 1962, NCEL conducted trials at Point Barrow, Alaska, on the deterioration, ablation and some physical characteristics of natural and constructed sea ice. Although deterioration occurred throughout the ice sheet, ablation occurred only at the surface. Observations on temperature, salinity, density and crystal orientation of these two ice types showed that the average ice temperature for the total ice thickness was about the same for an undisturbed natural ice area as for a constructed ice area. It was found that the high salinity of constructed ice did not greatly affect the salinity of the underlying natural ice and that with time the salinity and density of the constructed ice approached that of natural ice. Also it was

observed that the preferred c-axis orientation of sea ice is towards the horizontal, although snow and wind influence a random orientation and crystal size.

It was concluded from these trials that prevention and reduction of ablation during thaw should improve the characteristics of sea ice, but further knowledge is needed to determine the influence and effect of the size and c-axis orientation of the ice crystals. Improved field sampling and testing techniques are needed to obtain more accurate knowledge of the properties of ice.

R-239
Effects on Structural and Harbor Installations of Air Blast Induced by Underwater Nuclear Explosions, Jun 1963, D. B. Ryder, SECRET, AD 346602

R-240
Attenuated Total Reflectance Spectroscopy of Paint Vehicles, Apr 1963, R. J. McGovan, AD 404468

Certain problems are encountered in using infrared transmission spectroscopy for the quantitative evaluation of paint vehicles; therefore, an investigation of attenuated total reflectance spectroscopy was conducted. In thin-film analysis, it is very difficult, if not impossible, to know the sample thickness, knowledge of which is essential in quantitative infrared transmission spectroscopy. The attenuated total reflectance technique eliminates this problem. Therefore, it was concluded that this method is superior to transmission measurements for quantitative evalution of paint vehicles.

R-241
Pioneer Polar Structures. Accessories for the Jamesway Shelter, May 1963, G. E. Sherwood, AD 409581

Accessories were developed for improving the Jamesway in order to provide a suitable lightweight, quick-erecting shelter for use as quarters, messing, galley, utilities, administration, and other such applications in pioneer polar camps. These accessories included a heavy-duty floor and foundation system, a wall-extension kit, special entry kits, an improved electrical distribution system, and special utility accessories. Prototypes of the accessories were fabricated and evaluated by the Laboratory. Evaluation indicated that they met the requirements of pioneer polar operations and increased the general usefulness of the Jamesway shelter.

It was concluded that the heavy-duty floor and foundation system, the wall-extension kit, the special entries, and the improved electrical distribution system should be accepted as standard accessories for the Jamesway shelter. The special utility accessories should be considered for use with the Jamesway for special applications. Drawings and specifications for the accessories described in the report are presented in Technical Note N-482.

R-242
Low-Frequency Shielding Effectiveness of Conductive Glass, May 1963, H. A. Lasitter, AD 410564

The shielding effectiveness of conductive glass at low and intermediate frequencies (100 kc to 1,000 Mc) was investigated. A mathematical model was used to describe the absorption and reflection. This model is based on a film applied to conductivity. Experimental data agreed well with theoretical calculations. Coated glass exhibits a permeability similar to that of free space, so that low-impedance attenuation is limited to the conductivity of the film. The analysis is primarily concerned with high-impedance, near-field incident waves. Transmission in the visible spectrum was also determined for several 4- by 4-in. conductive glass samples which vary in surface resistance from 9 to 125 ohms/square. Larger samples (8 by 3 ft) of conductive glass were also investigated.

R-242 Suppl.
Low-Frequency Shielding Effectiveness of Conductive Glass (Supplement), May 1963, H. A. Lasitter

This supplement lists types of glass related to manufacturers.

R-243
A Comparison of the TEG-F, Chromatographic, and Spectrophotometric Methods of Creosote Analysis, Jun 1963, R. W. Drisko, AD 411144

A number of blends of four petroleum oils in creosote and creosote-coal tar solution were analyzed by the TEG-F, chromatographic, and spectrophotometric methods of creosote analysis. The chromatographic and spectrophotometric methods were considerably more accurate and have wider application than the TEG-F method.

R-244
Water Vapor Transmission of Concrete and of Aggregates, Jun 1963, R. L. Henry, G. K. Kurtz, AD 412407

An investigation was made of the effects of water-cement ratio, type of reinforcing steel, aggregate size relative humidity, concrete splice position, and two admixtures - sodium chloride and oleic acid - on the water vapor transmission of concrete. A collateral investigation was made of the water vapor transmission of aggregates, and a study was made of the growth of sodium chloride whisker crystals on concrete.

R-245
Distilling Sea Water With Diesel Generator Waste Heat, May 1963, J. S. Williams, W. R. Nehlsen, AD 406634

NCEL investigated the amount of heat available from a 60-kW generator and then procured and tested a waste-heat still to operate in conjunction with the generator. Test results have shown that approximately 200 gph of distilled water can be produced by the waste-heat still and that the combination of units is feasible. Standard design for use with standard generator units are recommended. Design criteria and outline specifications are presented.

R-246
Protection of Mooring Buoys, Part 1, Initiation of Field Testing, Jun 1963, R. W. Drisko, R. L. Alumbaugh, AD 411426

This is the first of a series of reports on protection of mooring buoys. Thirteen different protective coating systems were applied to fifteen buoys at the U.S. Naval Station, San Diego. A cathodic protection system was installed on three of the buoys, and three others served as controls. The application of each coating system is described, and a cost analysis for complete overhaul and replacement of each of the test buoys is presented. The test buoys are currently serving the fleet in San Diego Bay and will be periodically inspected and evaluated for protection afforded by coatings and cathodic protection installations.

R-246 Suppl.
Protection of Mooring Buoys, Part 1, Initiation of Field Testing (Supplement), Jun 1963, R. W. Drisko, R. L. Alumbaugh, AD 412869L

Technical Report R-246 is the first of a series of reports on the protection of mooring buoys, and it presents the results of tests of thirteen different protective coating systems. This supplement lists the proprietary sources of materials.

R-247
Umbrella Pile-Anchors, May 1963, J. E. Smith, AD 408404

Two umbrella pile-anchor designs were developed for use in moorings and dolphins. One design weighs about 1,400 lb and requires a casing for placement, the other weighs about 2,200 lb and is driven directly into the ground in a locked position, then opened. Tests indicated that both designs are operational in homogeneous soils free of boulders and other large obstructions. Both have bearing capacities and resistance-to-uplift capacities in excess of 300 kips in sand bottoms. Each design offers advantages for use in specific situations depending on such factors as fabrication costs, soil characteristics and depth of water at the driving site, and equipment available for placement.

R-248
Polar Construction Equipment - Engine-Priming Systems, May 1963, S. E. Gifford, AD 807716L

In cold areas, internal-combustion engines become difficult to start, with difficulty increasing as the ambient temperature lowers. Starting can be facilitated by priming. One method is to inject into the cylinders or air-intake systems a combustant which is highly volatile at low temperatures and easily ignited over a wide fuel-air ratio. Seven types of pressurized ether priming systems were tested and evaluated for engine starting capability, reliability, ease of operation, ease of maintenance and repair, safety, and operational cost.

R-249
Air Force Arctic Building, Jun 1963, J. P. Cosenza, AD 411389

A prefabricated, panelized, 16- by 28-ft structure was designed and built for the U.S. Air Force by NCEL. The building, made of steel-faced honeycomb-core panels with plywood edges, was designed for use in the Dew system in the Arctic. The prototype was tested at the Climatic Laboratory at Eglin Air Force Base, Florida, under a variety of controlled climatic conditions, including wind, rain, and snow. Tests included erection, heat loss, structural, and weathertightness, and packaging studies. The building has a low coefficient of heat transmission and can withstand a 125-mph wind load, a 100-psf snow load, and racking.

Three years after fabrication, the crated prototype was removed from storage and inspected. This inspection revealed such extensive deterioration of the steel faces and edges on the panels, that the prototype could not be assembled or repaired. It was concluded that this building must be redesigned, using corrosion-resistant material in order to achieve a 25-year life.

R-250
Polar Equipment - Safety Cab for Tractors, Jun 1963, J. E. Dykins, AD 410924

The cab was evaluated for safety features, disassembly and reassembly, weathertightness, structural adequacy, operator visibility, and operator comfort. The cab performance was evaluated as highly satisfactory for all of the tests.

R-251
Sea Tests on Swing-Moored Aircraft Carrier, Sep 1963, J. T. O'Brien, B. J. Muga, AD 417203

Sea tests involving motions and forces were conducted on the CVU-91, a deactivated Casablanca-class aircraft carrier. The ship, which has a displacement of about 9,600 long tons, was swing-moored by a 2-1/2-in. die-lock chain in about 372 ft of water in the Pacific off Southern California. Water-level variations, ship rotations and accelerations, mooring force, and wind velocity and direction were measured in sea states of 5 and 6. Two records, of 34 minutes each, were analyzed, using time-series techniques to relate the motions and forces to the water-level variations. Apparent amplitude response operators were obtained for all the ship motions and the mooring force. The averages of the highest one-third of the wave-induced amplitudes in sea state 6 were 0.85 ft in surge, 3.20 ft in sway, and 7.07 ft in heave, 4.60 deg of roll, 2.63 deg of pitch, and 0.31 deg of yaw, and 17.5 kips in the mooring chain. Some of the highest-recorded wave-induced amplitudes were 3.6 deg of pitch, 12.0 deg of roll, and 84.6 kips in the mooring chain. This latter force, added to the initial chain tension of 38.3 kips resulted in a total of 122.9 kips. The most dominant motion, of 15-minute period and 45-deg amplitude, was fishtailing.

It was concluded that the mooring chain was loaded lightly and affected only fishtailing; test- and model-derived response operators for pitch and roll agree well over a limited range; and heave and pitch can be deduced by separation of measurements of acceleration made at bow and stern.

R-252
Design Concept for an Elevated South Pole Station, Jun 1963, J. L. Anderson, J. E. Schroeder, AD 410460

An above-grade composite design was selected as the most promising for the South Pole station. Following this selection, a conceptual design was developed. The principal components included an elevated structure and underlying tunnel for the camp core, with the major outlying facilities connected to this core by fully lined under-snow tunnels. The success of the elevated structure was confirmed by wind-tunnel model studies which showed that little drift would occur under an elevated building in a climate similar to that of the South Pole.

R-253
Effects on Structural and Harbor Installations of Water Shock Induced by Underwater Nuclear Explosions, Jun 1963, R. F. Swalley, CONFIDENTIAL, AD 346387

R-254
Effects on Structural and Harbor Installations of Water Waves Induced by Underwater Nuclear Explosions, Jun 1963, B. J. Muga, SECRET, AD 346601

R-255
Heat-Transfer Studies of Dropwise Condensation and Thin-Film Evaporation, Jun 1963, C. Saturnino, AD 410566

Experiments were conducted to investigate heat-transfer rates from water-film evaporation and dropwise condensation. Dropwise condensation was induced by coating the polytetrafluoro-ethylene polymer, and film evaporation was obtained by allowing water to fall in a thin film around the surface of the tube. The effect of tube length and feed flow on the overall heat-transfer coefficient was also investigated. The overall heat-transfer coefficients obtained from the dropwise condensation experiments were considerably greater than those obtained from the film-type condensation experiments conducted to obtain comparison data. Overall heat-transfer coefficients as high as 4,000 Btu/sq ft/F/hr were obtained from the dropwise condensation experiments as compared to values of about 700 Btu/sq ft/F/hr that were obtained from the film-type condensation. The results of thin-film evaporation on the internal surface of the tube were inconclusive.

R-256
Survival of Sewage Bacteria in Zero-Centigrade Sea Water, Jun 1963, J. E. Halton, W. R. Nehlsen, AD 410026

The survival of escherichia coli, a common indicator organism among sewage bacteria, was studied in sea water at 0°C. It was found that from the time of innoculation about 70% of the organisms survived for 8 days, 34% for 15 days, and 1% for 35 days.

R-257
Loadings on Drydock Gates From Nuclear Explosions, May 1964, R. F. Swalley, SECRET, AD 350670

R-258
Protection of Mooring Buoys, Part 2, First Rating Inspection, Oct 1963, R. W. Drisko, AD 421616

This is the second of a series of reports on the protection of mooring buoys. Fifteen test buoys serving the fleet in north San Diego Bay were given their initial inspection and rating for amount of coating deterioration, corrosion of steel, and fouling. Only two of the thirteen different coating systems under test showed serious deterioration. Because of the good condition of the coatings, it was difficult to assess the amount of protection provided the three cathodically protected buoys. However, from the slight coating deterioration and the potential imparted, it appeared that the underwater portion of the buoys and a portion of the ground tackle benefited from cathodic protection. Buoys with antifouling coatings had only light fouling; those without antifouling coatings had medium amounts of fouling.

The most important factor in the deterioration of coatings and corrosion of steel was localized abrasion by overriding ships and mooring lines. Damaged areas on several buoys were cleaned by power wire brushing and patched with a polyamide catalyzed epoxy material. It was concluded that protection of damaged areas on the underwater portions of buoys with epoxy materials or cathodic protection might significantly increase the service life of buoys.

R-259
Corrosion of Buried Pipes, Dec 1963, H. R. Joerding, AD 425720

The objective of this task was to determine the relative merit and economy of various types of external protective coverings for underground metal, cold pipes in the highly corrosive soil at the Naval Ordnance Test Station, China Lake, California.

A highly corrosive area of the station was selected as a test site. A network of a number of test pipes with different commercial protective coverings was connected to an existing cold water line and tested for 49 months. Included in the test as control were bare pipes of galvanized steel, black steel, and copper. Visual inspections through test holes were made periodically to determine the progress of corrosion. At the end of the test, all pipes were removed and brought to NCEL for close examination.

Final results showed no corrosion on galvanized steel pipe that was factory-wrapped with resin-impregnated glass cloth. This covering is very difficult to damage and imposes no special handling or installation requirements. Black steel pipe that was wrapped with black polyvinylchloride plastic tape was in excellent condition. Extreme care was necessary during installation to prevent cuts or nicks in the tape. The black steel pipes protected by bituminous coating, cured gilsonite, and uncured gilsonite had deteriorated badly.

R-260
Polar Construction Equipment. Hot-Water Cab-Heating System, Sep 1963, S. E. Gifford, AD 416801

An investigation was made to select a cab-heating system suitable for maximum operator comfort in air temperatures to -40°F and winds up to 15 knots. Previously, design criteria had been based on air temperatures to -65°F, but a detailed study of conditions at a typical coastal polar station showed that this extreme was not essential and that a -40°F temperature and 15-knot wind would be an adequate criterion 99% of the time.

Tests showed that, in temperatures to -40°F with winds to 15 knots, a hot-water heating system would comfortably heat weathertight cabs on equipment which used liquid-cooled engines, provided the engine coolant was at or near its normal operating temperature range. During two summer seasons at McMurdo Station, hot-water heating systems on a variety of construction equipment provided satisfactory cab heating for 80% of the operators in temperatures to -32°F and winds to 25 knots, but the slow warm-up of the cabs in air temperatures below -10°F was objectionable. This deficiency may be overcome by controlling engine environments and by providing auxiliary circulating pumps for low-temperature coolants. In-service testing is recommended.

R-261
Evaluation of Broom Filaments for Powered Sweepers, May 1964, J. J. Bayles, AD 647352

Tests were conducted to determine the most efficient and economical broom filament and brush construction for industrial and street sweepers. The tests included accelerated wear tests of various kinds of filament materials, sweeping efficiency tests of pickup brush and side-broom filament materials, and efficiency tests of three different types of pickup broom fill. The evaluation is augmented by a survey of the experience of several municipalities. There are many filament materials and many possible diameter sizes and shapes for these filaments. Some of these materials and sizes are excellent for certain sweeping conditions. Some are for specialized work. Others do a fair job over a wide range of conditions. There seems to be no universal filament best for all conditions. A selection guide has been prepared for the filaments evaluated. In general, the dense fill type of pickup broom obtains the best results.

R-262
Exponential Curve Fitting With Applications, Sep 1963, G. E. Mayo, W. L. Wilcoxson, AD 421443

This report presents a method of exponential curve fitting to experimental data. It considers the cases where the function tends asymptotically to either a constant slope or maximum value as the abscissa becomes large. Three models and their general form have been developed for the application of this method. Derivations, solutions (by an iterated least-squares method), and applications of the models are presented, and computer program listings, flow charts, and sample problems are included.

R-263
Test of German Sand-Type Filter, Nov 1963, J. M. Stephenson, AD 426552

The shelter equipment developed by the Artos Machinery Company of Germany specifies a sand filter which NCEL evaluated with respect to ventilation characteristics and effectiveness in protecting a shelter from the hot blast of a nuclear explosion.

The heat-absorbing characteristics of the sand were studied under conditions similar to a nuclear blast, by subjecting the filter to blasts of hot pressurized air. Heat-absorption characteristics were also studied, in 24-hour tests simulating night and day, when ventilating air of varying temperatures was passed through the filter. The

sand proved to be an excellent heat absorber, maintaining the outlet temperature at an acceptable level.

Since a sand filter is not a positive closure device, it has a typical response for a given impulse, and the response depends on its physical characteristics. Consequently, if a filter is to be classified as safe for a certain overpressure and time duration, the filter as a unit should be pretested or the sand must be very carefully graded and matched against control samples.

R-264
Computer Calculation of Dose Rates in Two-Legged Ducts Using the Albedo Concept, Oct 1963, J. M. Chapman, AD 422911

This report gives the results of calculations of gamma-ray dose rates in two-legged rectangular concrete ducts. The calculations were performed on an IBM 1620. They are based on the differential dose albedo and include multiple scattering effects. The results of the calculations are compared with experimental data for ducts whose widths vary from 11 in. to 6 ft, using Co-60, Cs-137, Au-198, and Na-24 gamma-ray sources. The calculated dose rates agree to within ±30% for all ducts and all sources, except for small ducts with CS-137 sources, ducts with very short first legs (L1/W less than or equal to 1.33), and for Au-198 sources.

R-265
Temporary Polar Structures - Maintenance Shelter, Nov 1963, J. B. Camm, AD 424547

The need for improved facilities for equipment maintenance and repair in temporary polar camps resulted in the development and evaluation of a packaged maintenance shelter for these camps. The shelter, a 28- by 56- by 12-ft building with a heavy duty floor, was designed by ERDL. NCEL equipped it with a steel beam foundation, a heating and ventilating system, an electrical system, and shop equipment and tools for the general maintenance and repair of all types of transportation and construction equipment generally associated with polar operations.

Prototype shelters were tested and evaluated at Squaw Valley, Calif., Point Barrow, Alaska, and McMurdo Sound, Antarctica. It was concluded from these tests that the shelter and its outfitting is well suited for the maintenance and repair of equipment at temporary polar camps and that it should be included as a facility for such camps.

R-266
Evaluation of Murray and Tregurtha Model 9D-200 Propulsion Unit, Sep 1963, A. L. Scott, AD 419049

Tests were made to determine the relative merits of the Murray and Tregurtha outboard propulsion units, models 9D-200 and 06DH, for shallow-water operations. The 9D-200 was designed to replace the heavier and more expensive 06DH for use on warping tugs in amphibious operations. Its principal features are automatic hydraulic tail-section elevation and a smaller propeller, which enable it to work more efficiently than the 06DH in shallow water. Tests at NCEL indicated that the 9D-200 is more reliable and resistant to damage in shallow water than the 06DH but that in deep water the 06DH develops more thrust.

R-267
A 25-Man Pioneer Polar Camp, Oct 1963, G. E. Sherwood, AD 421929

A 25-man pioneer polar camp was developed to provide comfortable living conditions during periods of occupancy up to one year in the Arctic and Antarctic. The camp design includes structures, air conditioning, water supply sanitation, and other such facilities integrated to form a unified functional component. The basic camp was designed for 25-man occupancy and expansion in 25-man increments to a 100-man capacity. Each man is provided with an individual cubicle. Double bunks or shift use of single bunks may be used, with two men sharing a cubicle, to increase the camp capacity for short periods.

The basic building is the Jamesway shelter, variously outfitted for use as quarters, messing, galley, utilities, administration, communications, medical, head, laundry, and storage facilities. A portable maintenance shelter was developed for maintenance of camp equipment. Specifications and reduced scale drawings for the camp have been published in NCEL Technical Note N-500, "Specifications for a 25-Man Pioneer Polar Camp."

R-268
Sea Test of a Spread-Moored Landing Craft, Jun 1964, J. T. O'Brien, B. J. Muga, AD 442601

Sea tests of motion and mooring force were conducted on an LST (landing ship tank) of about 4400 long tons displacement. The LST was spread-moored by six 2-1/16 in. and one 1-1/4 in. (Port Breast) stud-link chains in about 45 ft of water in the open Gulf of Mexico about 65 air miles south of New Orleans, Louisiana. Water-level variations at a single location, ship rotations and accelerations, mooring force, and wind were measured in sea states of 2 and 5. Three recordings of 38, 62, and 67 minutes duration were analyzed, using time-series techniques to provide apparent amplitude-response operators for all of the ship's motions and the mooring force. Those for longitudinal motion compare well with those obtained by use of theory. The most probable maximum-motion amplitudes in sea state 4 are found to be 1.7, 1.1, and 1.8 ft, respectively, in surge, sway, and heave, and 3.43 and 0.61 deg, respectively, in pitch and yaw. Roll was measured only in sea state 2, with a corresponding maximum of 2.2 deg. In sea state 4, the maximum wave-induced tensions measured were 85.1 kips in the port-bow chain (consistently the dominant chain) and 9.9 kips in the stern chain. The initial tensions in these chains were 30.8 and 7.5 kips, respectively.

R-269
Ignition Interference Autoalarm System, Dec 1963, J. L. Brooks, AD 425361

At electromagnetically sensitive Navy land installations it is often necessary to detect, quickly and easily, an electromagnetically offensive vehicle as it enters the sensitive area. This report describes a device called the ignition interference autoalarm system which has been designed to fill this need. The system, intended for installation at the entrances of sensitive areas, is designed to detect electromagnetic interference above a predetermined level within a given radius, and to automatically give an optional visible or audible signal.

The results of an extensive evaluation of the system both in the laboratory and in the field show that it is a very practical device. It can detect a noisy vehicle, and, under controlled conditions, can rapidly measure vehicle interference to the requirements of MIL-L-16910A.

R-270
Reissued as N-557.

R-271
Epoxy Sealers and Bonding Agents for Concrete, Mar 1964, R. L. Alumbaugh, AD 434197

The Laboratory investigated epoxy resins as a general class of materials for sealer coatings and bonding agents (adhesives, caulking compounds, and crack fillers) for use in the construction and maintenance of concrete and concrete-masonry structures.

Sealer coatings: twenty-four epoxy and standard sealer coatings were applied to three representative types of

concrete specimens and the coated specimens were periodically rated for coating deterioration and immersed to determine waterproofing characteristics.

Bonding agents: ten epoxy bonding agents were tested for use as adhesives, caulking compounds, and crack fillers and an eleventh as a caulking compound or crack filler. The effectiveness of the bonding agents was determined by gluing cut concrete flexural, shear, and tensile specimens together and loading the specimens until failure occurred. Results of these tests show that the strength of epoxy bonding agents is normally superior to the concrete to which they are bonded, and thus this class of materials should prove extremely useful as adhesives, caulking compounds, or crack fillers for concrete.

R-272
The Panoramic Spectrum Analyzer as an RFI Meter, Dec 1963, S. J. Wooten, AD 425758

The panoramic spectrum analyzer provides a higher signal-to-noise relationship than is normally available in other EMI-measuring devices. The wide sweep range provides better identification and acquisition of the EMI, and the narrow amplifier bandwidth results in a higher gain. This report describes the normal operating procedures for the equipment, sensitivity, bandwith, and input impedance of the system. Also covered are field-intensity measurements, operational characteristics, and how nearly the units meet the specifications and recommendations.

R-273
Evaluation of the AN/URM-152 RFI Meter, Nov 1963, S. J. Wooten, AD 424206

This report covers measurements and observations of the unit's input impedance, sensitivity, bandwidth, effective frequency range, attenuation control, tuning control, metering functions, power requirement, operational characteristics, and an assessment of how nearly the meter meets the requirements set by the contract specifications.

The fundamental design of the AN/URM-152 over the 0.15-1000 Mc range makes it a desirable instrument for field use, but further development would be needed for it to meet operational and reliability requirements.

R-274
Model Studies of Large Vented Openings - Phase 1, Mar 1964, D. S. Teague, AD 434222

To determine the optimum configuration of pits for protecting generators from blast loading, tests were conducted using the NCEL 12-in. shock tube. The effects of overpressure and dynamic pressure were considered separately. Various parapets and covers (including gratings and special structures) were installed around or over the pit. No parapets or covers were found that appreciably reduce the overpressure in the pit, but all reduce the dynamic pressure to some extent. The parapets make the least reduction, and the gratings the most. Special structures, such as louvres, reduce dynamic pressure by various amounts according to their design, but simplicity and effectiveness make the use of gratings appear more promising.

R-275
Evaluation of an Improved RFI Suppressing Power Conductor, Jan 1964, D. B. Clark, J. L. Brooks, AD 427189

An improved power conductor for suppressing radio frequency interference (RFI) was developed, consisting of no. 2 AWG stranded copper wrapped with two layers of 7-mil silicon iron (SIFE) magnetic tape and a 50-mil extruded polyvinyl chloride jacket. To evaluate its capability for attenuating RFI and its resistance to deterioration, the lossy conductor was installed on a 3-mile, 3-conductor, 4-kV power line on San Nicolas Island, off the coast of Southern California.

Attenuation exceeded that reported for the Fort Huachuca lossy line, at frequencies below 1 Mc, and was equal or greater at higher frequencies. The stranded conductor's effect on attenuation is discussed, and curves are included for comparing the attenuation of solid and stranded conductors wrapped with lossy tape. Ambient noise levels are shown.

R-276
Polar Construction Equipment - Utility Service Sled, Nov 1963, S. E. Gifford, AD 423710

Use in NCEL field operations in Alaska and Antarctica showed the utility service sled to be an essential piece of support equipment for building construction, ice and snow runway construction, engine starting, and field repair of equipment in air temperatures down to -44°F. It was concluded that it should be adopted as a standard item for polar construction operations.

R-277
Static and Dynamic Plate-Bearing Tests on Dry Sand Without Overburden, Jan 1964, C. R. White, AD 428332

The NCEL Atomic Blast Simulator is intended for testing beams, beam-column connections, and other relatively narrow structural elements. This report describes the successful adaptation of the simulator for providing dynamic loads on a bearing plate on sand and presents some tentative results as a preliminary part of Task YF008.08.03.402, "Fundamental Behavior of Soils Under Time-Dependent Loads." The dynamic bearing capacity of a 12-in.-diam bearing plate on dry sand without overburden was 90% higher than the static bearing capacity. Also, the dynamic bearing modulus was considerably higher than the static, e.g., 226 psi per in. dynamic versus 137.7 psi per in. static at 0.5-in. plate settlement.

R-278
Static Loading of Small Buried Arches, Jan 1964, J. R. Allgood, H. L. Gill, AD 429332

Static and dynamic tests have been performed to study the behavior of small buried arches. The objective of the work was to gain information which will serve as a guide in developing design methods for underground structures. This report describes the static tests, the prime purposes of which were (1) to obtain information on the behavior of a statically loaded soil-arch system, and (2) to provide data for comparison with that from a similar system subjected to blast loading.

The test configuration consisted of two conterminous semicircular arches each 30 in. in diameter buried in dry sand with 6 in. of cover over the crown. The arches were identical except for differing footing widths. The entire system was contained by the NCEL Atomic Blast Simulator Pit, which is 9 ft by 10 ft in plan and 12 ft deep. Static loads up to 25 psi were applied to the surface of the sand as various measurements were being made.

R-279
River Barge Concepts for Fuel Transport, Apr 1964, R. C. Towne, AD 349869L

The purpose of this task is to determine the most practical and economical equipment and methods for transporting fuel by water downstream on the Mekong River from Nong Khai, Thailand, to Savannakhet, Laos. Pontoon barges were studied and tested and unit hull barges were studied as vehicles for moving fuel on the river when the current is from 5 to 8 knots and the water depth ranges from 6 to

11 ft. A unit hull barge of 40,000-gal capacity can be designed to meet the conditions of 5- to 8-knot current speed in 6- to 11-ft water.

The 15,000-gal cargo capacity is low compared to the estimated 12,000 gal of fuel needed to propel the barge. The net fuel transported per ton of barge is only 136 gal.

The unit hull barge better fulfills the speed requirements of the task objectives. It requires less horsepower and a correspondingly smaller fuel consumption to transfer greater quantities of fuel in a shorter time. Its 40,000-gal capacity may provide a transport system nine times greater than the pontoon barge system. Individual modules can be utilized in constructing the unit hull. This would be a distinct advantage in minimizing assembly time and in decreasing the cost of transporting the barges.

R-280
Permeability of Coral Concrete, Jun 1964, W. R. Lorman, AD 601949

The water permeability of hardened coral concrete was investigated to learn the effects of mix design factors. The independent variables were aggregate type and source, water-cement ratio, cement content, and pozzolanic admixture. The coral aggregate consisted of crushed coralline limestone from the reefs at Eniwetok and the lagoon at Kwajalein. San Gabriel River aggregate from the wash near Irwindale, California, was used in the reference mixtures. Each aggregate was blended to conform to a gradation based on Weymouth's theory of particle interference, the maximum size was 0.75 in. The net water-cement ratios were 0.40 and 0.70 by weight. The cement factors were 4.5 and 9.0 bags/cu yd of concrete. Calcined opaline shale from the vicinity of Davenport, California, was used as the admixture which replaced 25% of the cement by volume. All mixtures contained Type 1 portland cement and fresh mixing water.

The use of calcined opaline shale, as a partial replacement of portland cement, served to make the coral concrete test specimens stronger, more watertight, and more damp-proof than was otherwise possible, all other factors being equal.

R-281
Failure Modes of Impact-Loaded Footings on Dense Sand, Jan 1964, L. W. Heller, AD 428283

This report reviews the current (1 Jul 1963) literature, summarizes the various static and dynamic failure modes observed by several investigators, presents an analytical technique which explains the observed failure modes, suggests that the failure mode is dependent upon the footing acceleration during the impact loading, and defines the limiting footing accelerations associated with the two major failure modes.

R-282
Dose Measurements for Neutron Streaming in Ducts, Mar 1964, D. R. Doty, AD 436183

The purpose of this report is to describe an operating facility and present some preliminary findings concerning the streaming of neutrons in ducts of protective shelters. The experimental results are compared to a simplified theoretical treatment using the albedo approach. Dose measurements were obtained in a 3x3-ft concrete duct for thermal, 2.5-mev, and 14.7-mev neutrons using a 12-in. spherical energy-independent dosimeter. In the second leg, for all energies, the dose was found to have a higher drop-off than the theory predicted. Reasons for the discrepancy are examined and a comparison of effective albedos is made for various energies.

R-283
Lateral Thrust on Piles, Jun 1964, L. W. Heller, AD 601894

The objective of this task is to obtain the in-place properties of deep soil deposits with relation to pile foundations subjected to lateral thrust which will result in the verification of the Palmer-Thompson theory for piles subjected to lateral load.

Lateral-load tests have been conducted on 16-in.-wide piles in a sand fill and a natural clay deposit. Incremental, repetitive and sustained free-head and fixed-head loadings were applied to a single pile instrumented with soil-pressure and pile-deflection gages. Laboratory soil tests were conducted on samples from the pile test sites.

The experimental results indicate that the pile-soil system does not respond elastically to a lateral load. Since the Palmer-Thompson theory is premised on elastic pile-soil behavior, verification of this theory has not been achieved.

R-284-1
Structures in Deep Ocean, Engineering Manual for Underwater Construction, Chapter 1, Introduction, Mar 1964, W. J. Tudor, AD 600306

The objective of this manual is to provide information on environments, systems, and techniques relative to construction in deep ocean areas. Developments in Naval warfare have placed emphasis on the deep ocean areas as an operating environment. Consequently, in support of these operations, there is a need for knowledge concerning methods of construction in the deep ocean. Information has been provided by scientists, engineers, and offshore operators, especially those engaged in petroleum production.

R-284-2
Structures in Deep Ocean, Engineering Manual for Underwater Construction, Chapter 2, Deep-Ocean Environment, Mar 1964, W. J. Tudor, AD 600307

Technological development indicates that much of the Naval warfare of the future will occur at deep ocean depths. The objective of this report is to provide information on environments and to describe systems and techniques developed for construction in deep ocean areas. This chapter contains environmental knowledge pertaining to waves and current action, salinity and temperature variations, bottom topography, marine organisms, chemical and physical properties of sea water, etc. In order to treat all of this data, it was convenient to first locate and distinguish the oceans and then describe the ocean bottom and ocean contents before finally describing the dynamic factors acting on the oceans.

R-284-3
Structures in Deep Ocean, Engineering Manual for Underwater Construction, Chapter 3, Reconnaissance and Positioning, Mar 1964, T. T. Lee, AD 600305

In determining surface position from landfall, the two chief methods are the optical (sextant-angle fix) and the electromagnetic methods. Electromagnetic methods involve radar and other techniques such as the tellurometer, raydist, and geodimeter. In determining position from a point out of sight of land, celestial navigation is the general measurement. Electromagnetic techniques, such as Shoran and Loran, are effective for long-range accuracy (distances between 50 and 1400 miles). Lorac is considered to be one of the most accurate long-range (500 miles or greater) positioning systems. Various acoustical systems can be used in determining position when out of sight of land, but the system which will enable ships to obtain accurate position regardless of range and distance from land is the newly established satellite navigation system, "Transit" (under development), which will eventually reduce position error to as little as 150 ft. In determining relative position, bottom to surface, various acoustic systems such as sonar

pingers have been used. Wire sounding, underwater landmarker, and buoy systems including the new nuclear-powered sonar beacon system (for use at depths to 15,000 ft) are other methods for establishing relative bottom to surface position.

Maintaining a position relative to an underwater construction site represents a major problem to the constructor. Factors involved include that of a suitable mooring system. Conventional anchor cable systems are commonly used for depths less than 6,000 ft. For greater depths, the U.S. Navy Bureau of Yards and Docks has devised a special deep-sea mooring system. Surface-propulsion mooring systems have been used successfully in deepwater by providing working vessels or floating platforms with directionally controlled power units. Sonar buoy systems are often provided to help maintain position. Tugboats have been used to maintain the position of a ship or platform during short-term operations. The surface position of a deep-ocean structure can be relocated by a satellite system or by conventional means with an accuracy of 150 ft to 3 miles, then, electronic devices such as Raydist, sonar searchers, and television sets can be used to relocate the exact position of a structure.

R-284-7
Structures in Deep Ocean, Engineering Manual for Underwater Construction, Chapter 7, Buoys and Anchorage Systems, Oct 1965, J. E. Smith, AD 413928

Technological developments affecting Naval warfare requirements and the demands of scientific programs have directed emphasis on structures in deep ocean areas. The overall objective of this manual is to provide information on environments, systems, and techniques relative to construction in such areas. This chapter contains data on buoys and deep-water anchorage systems for the restraint of structures on the surface, on the bottom, and at intermediate levels. New concepts are considered, as well as extended uses of conventional shallow-water anchorages. Types and uses and the fabrication, installation, protection, and maintenance of promising systems are discussed from the standpoint of deep ocean applications.

R-285
Young's Modulus of Elasticity and Poisson's Ratio of Plain Concrete, Apr 1964, W. L. Cowell, AD 434917

Dynamic and static determinations of Young's modulus and Poisson's ratio were made on concrete cylinders to establish a relationship between the two methods when applied to concrete test specimens. Three curing conditions, three sizes of cylinders, and two strengths of concrete were used; the cylinders were tested at 2, 4, 7, 12, and 24 weeks from the casting date. Dynamic values were calculated from the fundamental transverse, longitudinal, and torsional frequencies of the specimens. Static values were obtained by the NCEL compressometer-extensometer, surface-mounted strain gages, and an NCEL-developed hoop transducer.

There is no constant relationship between the values for Young's modulus of elasticity and Poisson's ratio for concrete as determined by static and dynamic methods. The relationship changes with the age and curing environment of the concrete. It is recommended that a static method be used in the determination of Young's modulus of elasticity and Poisson's ratio of concrete.

R-286
Modified T-5 Barracks - Controlled Climatic Heating Studies, May 1964, C. R. Hoffman, AD 600619

This report presents the results of controlled climatic heating studies conducted on the modified T-5 barracks developed for polar use. The studies encompassed three areas of investigation: (1) heat-loss and heat-transfer analyses of the structural shell using electric heat sources and forced convection, and a thermodynamic evaluation of two different ceiling materials, (2) evaluation of the radiant hot-air floor plenum heating system designed by the Army Engineer Research and Development Laboratories, (3) evaluation of the overhead duct hot-air heating, ventilation, and humidification system for use in the NCEL-developed temporary polar camp.

R-287
Test of Aluminum Connections, Jun 1964, S. K. Takahashi, AD 603421

The major objective of the task was to evaluate the compatibility of high-strength aluminum connections with parent members in aluminum deckhouses. Additional objectives were to verify experimentally the design techniques for detail connections used by the Bureau of Ships and to determine the structural response of these connections so that a realistic design of aluminum frames can be executed rapidly by ship designers. The deckhouse was designed to withstand a load of 10 lb/sq in. which is the equivalent of 974 lb per linear inch on the lateral surface of the columns.

Six different types of aluminum members, each with different types of connections, were subjected to uniformly distributed static and dynamic loadings. The configurations of the members were T-shaped, L-shaped, three beam-columns of different depths, and transverse beam-column.

The tests demonstrated the significance of buckling failures of aluminum members subjected to static and dynamic loads. The 8- and 10-in. beam-columns failed by buckling of the compression flange. Buckling occurred at the re-entrant corners of the T-shaped and L-shaped connections. Lateral buckling of the compression flange of the column between the transverse beams occurred. This member was re-designed to correct this lateral buckling and subsequently performed satisfactorily. The mode of failure of the various connections under dynamic loads was essentially the same as the mode of failure during the static tests.

R-288
A Temporary Polar Camp, Mar 1964, G. E. Sherwood, AD 434217

A temporary polar camp was developed to provide comfortable living conditions for periods up to 5 yr in the Arctic and Antarctic. The camp design included structures, air conditioning, water supply, sanitation, and other facilities integrated to form a unified functional component. The basic camp was designed for 50-man occupancy and expansion in 50-man increments to a 200-man capacity. Each man is provided with an individual room. Double bunks may be used, with two men sharing a room, to increase the camp capacity for short periods.

The building unit is the modified T-5, variously outfitted for use as quarters, messing, galley, utilities, administration, communications, recreation, medical, head, laundry, and storage facilities. A duplex concept is used by which two building units are joined end to end by a service core which houses an air-conditioning system, head, and laundry, to form a basic building. A T-5M maintenance shelter is provided for maintenance of camp equipment.

Specifications and reduced scale drawings for the camp have been published in NCEL Technical Note N-540, "Specifications for a Temporary Polar Camp."

R-289
Gamma-Ray Streaming Through Ducts, Feb 1964, C. M. Huddleston, W. L. Wilcoxson, AD 430603

A survey is presented of the current status of experimental and theoretical investigations of the problem of gamma-ray streaming through air ducts in concrete. Data are tabulated and plotted for a variety of experiments. Comparisons are made between theory and experiment, inconsistencies are pointed out, and areas needing further investigation are indicated.

R-290
EMI-Shielding Effectiveness of Copper-Sprayed Enclosures, May 1964, H. A. Lassiter, AD 600041

To determine the cost and shielding effectiveness of copper-spraying large surfaces, a plywood structure and a paper barrel were copper-sprayed. To determine the EMI-shielding effectiveness of copper spray, the seams of three screen rooms were sprayed and tested. Two were portable, demountable, screen rooms, located inside NCEL buildings for several years. One had a single-wall screen, and the other had a double-wall screen. The average increase in shielding effectiveness of the single-wall room was 15 db at 400 Mc, that of the double-wall room was 10 db at both 400 Mc and 200 Mc. The third was a portable screen room exposed to the weather for ten years. The maximum increase for this room was 62.8 db at 200 Mc.

Material and labor costs indicate that it is more expensive to copper-spray a plywood room than to buy a prefabricated one. However, it is more economical to copper-spray the seams of existing screen rooms than to replace them.

R-291
Protection of Mooring Buoys, Part 3, Second Rating Inspection, Apr 1964, R. W. Drisko, AD 448211

This is the third of a series of reports on the protection of mooring buoys. Fifteen test buoys serving the fleet in north San Diego Bay were given their second rating for amount of coating deterioration, corrosion of steel, and fouling. The coating systems of eight of the buoys were in good condition, six showed varying degrees of moderate deterioration, and one was so badly deteriorated that it had to be removed from service. Two sets of 11 test panels coated with the different coating systems used on the buoys were given their initial rating inspection after 6 months exposure. One set was in San Diego Bay and the other in Port Hueneme Harbor.

One of the three cathodic protection systems on test buoys was rendered inoperative when the remote ground cable connection was broken loose by a ship. The two cathodic protection systems that remained operate detected rusting in the submerged zone even though the buoys had a potential of -710 mV rather than the desired -850.

R-292
Shock Absorber System for Connecting 8x15 Causeway to LST, Apr 1964, R. C. Towne, G. D. McDougall, AD 440016

Suitable gear and techniques are needed for connecting an LST to a 8x15 pontoon causeway in the surf. Three methods of connection were developed and tested. Test results indicate that spring-mounted bumpers integral with the causeway are a satisfactory method for joining and maintaining a connection with an LST in a 6-ft surf. It was concluded from observations of the shock absorber barge during tests that the system is feasible. It is recommended for in-service testing.

R-293
Evaluation of 15-kW and 60-kW Diesel-Electric Brushless Generators, Apr 1964, R. H. Isaacberg, AD 447119

The laboratory evaluated two 15-kW and four 60-kW diesel-driven brushless generator sets to determine their operational characteristics, their conformance with procurement and military specifications and contract requirements, and their general suitability for use by the Bureau of Yards and Docks. All six units met the procurement and MIL-I-16910A specifications in part and failed the specifications in part. All six units are desirable and have good operational characteristics. All can be made to comply with the procurement specification and MIL-I-16910A through redesign and rework of the units.

R-294
Computer Assessment of Nuclear Damage, May 1964, D. H. Ryder, SECRET

R-295
Electronic Methods to Determining Young's Modulus and Poisson's Ratio of Portland Cement Concrete, Apr 1964, J. H. McCarthy, AD 441898

The purpose of this task was to develop improved methods for determining Young's modulus and Poisson's ratio of portland cement concrete. This report describes the development effort and presents the results of comparative tests of various electronic and mechanical strain-measuring devices used on cylindrical concrete specimens.

Experiments were made with three separate methods of measuring longitudinal strain. Electrical resistance strain gages were mounted directly on the surface of the concrete, and a technique was developed for their attachment to damp concrete. A hoop transducer device utilizing electrical resistance strain gages was designed, and compressometers were used for mechanical measurements. Lateral strain measurements were made with surface-mounted electrical resistance strain gages and with mechanical compressometers, and an experimental cantilever transducer device was designed and tested.

R-296
Initial Field Testing of Airfield Marking Paints, Mar 1964, R. W. Drisko, A. E. Hanna, AD 434891

Six white airfield marking paints were selected on the basis of laboratory tests and previous field experience for field evaluation study at NAS, Point Mugu, California. This report describes their application to test stripes on an asphaltic runway and presents the results of three initial inspections made within about 2 months after application. Because one of the six paints bled badly upon application in the field, it was eliminated from test. The five remaining paints varied widely in their initial rate of deterioration. The temperatures of stripes in the best condition were higher and those of stripes in the worst condition were lower than the temperatures of the other test stripes. It was concluded that mere conformance of a marking paint to Federal Specification TT-P-85B does not insure good service in the field.

R-296 Suppl
Initial Field Testing of Airfield Marking Paints, May 1965, R. W. Drisko, AD 614784

Technical Report R-296 described the application of test stripes to an operational asphalt runway and reported their condition at the time of three inspections made within 64 days. This supplement presents further data on their condition at four additional periods of time up to a total of 568 days.

R-297
Repair of Bomb-Damaged Runway, Jun 1964, T. Yoshihara, AD 451814

NCEL conducted a study to determine the capability of construction battalion forces to make hasty repairs to a bomb-damaged runway under wartime conditions using presently authorized equipment, and to evaluate the effects of high-explosive bombs dropped on an airfield runway. A field exercise, conducted at an abandoned airfield during the period of 18-22 November 1963, consisted of damaging a runway with live bombs dropped by A4C aircraft, followed by emergency repair operations. Tests of the restored runway proved the adequacy of the repair procedure.

R-298
Snow Compaction in Antarctica - Roads on Snow-Covered Sea Ice, Mar 1964, E. H. Moser, AD 434118

During the austral summer of Deep Freeze 61 the Laboratory provided technical guidance to a Navy snow-compaction team testing the practicability of compacted roads on snow-covered sea ice over McMurdo Sound. An experimental 22-ft-wide road was constructed between McMurdo Station and Williams Field in October and November 1960. This road included 3 miles of snow road, 1.4 miles of ice road, a snow-wedge transition ramp between the ice road and the snow road, and a snow, ice, and gravel transition ramp between the ice road and the shore at McMurdo Station.

The road was used day and night for a 10-day period during late November and early December by all types of wheeled vehicles including 30-ton tractor-and-trailer rigs. It was concluded that a network of snow roads between McMurdo Station and its outlying facilities will improve the ground communications and transportation threefold between these points. However, continued development is required to improve the construction and maintenance techniques for such roads.

R-299
Polar Construction Equipment - LGP D4 Series C Snow Tractor, Apr 1964, D. Taylor, AD 436196

Two caterpillar D4 Series C tractors were purchased and modified during FY63 for use as snow tractors in Antarctica. To minimize the need for spare parts, modifications were similar to those of the D4 tractor with 42-in. dual-fail tracks. The two tractors were evaluated, and both performed satisfactorily during 50-hr break-in periods. Consideration should be given to reducing the weight of future tractors, but at the same time retaining the reliability of the dual-rail track system.

R-300
Underwater-Curing Epoxy Coatings, May 1964, R. W. Drisko, J. W. Cobb, R. L. Alumbaugh, AD 439344

Four different proprietary underwater-curing epoxy materials were studied for their adhesion to sandblasted steel and to a variety of protective coatings. The four epoxies were all similar in formulation; major differences were types and amount of added fillers. Pairs of steel test panels were bonded with these epoxies. One panel of each pair was sandblasted steel, the other was either sandblasted steel or coated steel. Duplicate bonded pairs were submerged in a tank of flowing sea water, one for a week and the other for 6 months. At the end of these times, the pairs of panels were pulled apart in a testing machine to determine the magnitude of their shear strength. All four underwater-curing epoxies adhered strongly to bare and coated steel panels, and there was no loss in bonding strength after 6 months in sea water.

R-301
Harbor Screening Tests of Marine Borer Inhibitors - 6, May 1964, T. Roe, H. Mochman, AD 600915

The Laboratory is exposing wood panels impregnated with various materials to determine their resistance to attack by marine borers. This report lists the results of harbor tests of treated panels removed from exposure between 15 Aug 1962 and 15 Aug 1963. It also lists all treated panels which have been exposed for 1 yr or more and which have shown no attack or insufficient attack to warrant removal.

Certain organic, metal-organic, and inorganic compounds, when combined with creosote or creosote-coal tar solutions, show promise in improving the preservative ability of these materials. Aluminum oxinate and malachite green oxalate are not effective additives. Certain treatments containing a combination of one material specifically toxic to limnoria and another material specifically toxic to teredine borers are also showing promise as preservative systems. Other systems of this type have experienced limnoria and martesia attack.

Those treatments or woods which have not been attacked by one or more species during their entire period of exposure or as of 15 August 1963 are summarized.

R-302
Cancelled

R-303
Friction Coefficients Between Tires and Pavement Surfaces, Jun 1964, H. Tomita, AD 602930

A review of the problem of aircraft skidding on Naval airfields during landings and a thorough literature search on the work conducted on friction coefficient were made. The literature search revealed that much work has been conducted on basic theoretical studies of friction coefficient, on development of friction measuring devices, and on investigations to determine the factors which affect the friction coefficient between tires and pavement surfaces.

Various field-testing devices have been developed by others, used, and compared in an effort to locate low-friction pavements and to standardize the method of measurement. One device still in the development stage showed promise of measuring friction coefficient under simulated conditions of landing aircraft.

The review of the problem and of the work conducted on fricton coefficient is summarized. A recommendation is given to the effect that no effort be made at this time to develop a friction measuring device.

R-304
Low-Frequency Current-Probe System for Measuring Conducted Radio-Frequency Interference, Jun 1964, J. L. Brooks, AD 601895

A new approach to the problem of measuring conducted radio-frequency interference is described. An instrument has been developed which has the capability of measuring the impedance levels and noise currents of a power line or cord which is to be tested for conducted interference. This report describes the instrument in detail.

An evalaution of the hardware developed is presented, as well as numerous examples of RFI measurements showing the correlation between measured and predicted results. The design accuracy of the system is ±10% for the frequency range from 20 kc to 2 Mc and the impedance range from 10 to 10,000 ohms at 0 to 360 degrees.

R-305
Premixed Hot Asphalt Paving Mixture, Apr 1964, J. A. Bishop, AD 601497

A premixed, prepackaged combination of fine aggregate and emulsified asphalt was developed for patching runways and other pavement surfaces. Coarse aggregate is added in the field while the mixture is heated to remove water from the emulsion.

The mixture was tested in the laboratory and in field tests at NAS, Alameda, California, and NAAS, Fallon, Nevada. The material, prepared according to specifications, was obtained commercially. The tests showed that when the coarse aggregate was added during the field heating-and-mixing cycle as recommended, the patching material was high-quality and could be handled like conventional asphaltic concrete.

R-306
The Effect of Salt in Concrete on Compressive Strength, Water Vapor Transmission, and Corrosion of Reinforcing Steel, Jul 1964, D. F. Griffin, P. L. Henry, AD 603376

The purpose of this investigation was to determine the effects of sodium chloride and sea-water salts separately in concrete. The investigation covered the effects of salt on the compressive strength and water vapor transmission (WVT) of concrete, as well as the corrosive effects of salt on mild reinforcing steel. Variables included water-cement ratio, salinity of mixing water, and diameter and thickness of the specimens. The test environments included 20, 50, and 75% RH at 73.4°F.

The data presented herein supports the general conclusion stated in a previous report, namely, that at a mixing-water salinity of approximately 25 grams of salt per kilogram of solution, compressive strength is increased, WVT is minimized, and corrosion of mild steel is not significant.

R-306 Suppl.
Corrosion of Mild Steel in Concrete, Aug 1965, D. F. Griffin, AD 618375

In a research effort to determine the fundamental cause of deterioration of certain concrete buildings in a marine environment, it was shown that sea salts can accumulate in a building wall exposed to airborne sea spray in quantities sufficient not only to deteriorate the concrete but also to cause the reinforcing steel to rust and thereby expand with enough force to crack the concrete.

In small reinforced concrete walls sprayed with sea water once each morning, the same destructive phenomena occurred at the laboratory within a period of 2 yrs that occurred in about the same length of time to concrete buildings on the Pacific Ocean atolls. The concrete cracked severely along the lines of the reinforcing steel.

This report supplements and extends technical report R-306, "The Effect of Salt in Concrete on Compressive Strength, Water Vapor Transmission, and Corrosion of Reinforcing Steel."

R-307
Investigations of Biocatalysts for Drain Cleaning, May 1964, W. R. Nehlsen, J. E. Halton, AD 441560

The feasibility of using biocatalytic compounds in the maintenance of sink and floor drains was investigated. Laboratory tests showed a wide variation in effectiveness of these compounds on simulated drain cleaning problems. The compound that proved most effective in the laboratory was then tested in-service, with good results, in a number of drains in a mess hall. This compound is recommended for use in troublesome drains.

R-308
Temporary Polar Structures - Modified T-5 Barracks, May 1964, G. E. Sherwood, AD 600528

The need for a comfortable building for quartering personnel in temporary polar camps led to the development of the modified T-5 barracks. This building of modular panel design is 28 ft wide, has a 9 ft ceiling, and is expandable in length on a 4-ft module. It was designed by ERDL and equipped with a steel-beam foundation by NCEL. The roof panels are supported on steel trusses made up of three sections bolted together.

A prototype 28- by 56-ft building was evaluated by NCEL. Heating studies were conducted in a controlled climatic laboratory. The prototype was then outfitted as a 10-bedroom quarters and shipped to Hallett Station, Antarctica, for in-service test. It was concluded from laboratory evaluation that the building is suitable for housing personnel in temporary polar camps.

R-309
Polar Structures - the NCEL Family of Wanigans, Jun 1964, J. E. Dykins, G. E. Sherwood, C. R. Hoffman, AD 601896

Prototypes of both sled wanigans and both portable camp Wanigans were tested and evaluated at polar field sites. These tests demonstrated that the sled Wanigans are well suited for housing the facilities required on sled train operations in polar regions, and that the portable camp Wanigans are well suited for housing those facilities required at transient field camps and isolated construction sites.

R-310
Lateral-Plate and Rigid-Pile Tests in Beach Sand, Aug 1964, H. L. Gill, AD 446370

Seven lateral-plate bearing tests were performed in moist beach sand at six different depths from 1 to 9 ft. In addition, 25 rigid-pile tests were performed in the same soil with pile widths ranging from 1 to 16 in. and embedment depths from 12 to 66 in. In conjunction with these experiments, determinations were made of the in-situ vane shearing strength, density, moisture content, and standard penetration of the soil. The objective of these studies is to develop procedures for the determination of soil moduli, including variations with depth, magnitude of deflection, and width of loaded area.

Among other information, the test results have shown that the coefficient of horizontal subgrade reaction, K_H, of the soil used decreases exponentially with increasing deflection and increases exponentially as depth increases. It was found that for different widths of loaded area, B, at some depth in this soil, $K_{H(B)}$ is a constant for a constant value of deflection, Y, divided by B. This indicates that $K_{H(B)}$ should be expressed as a function of depth and Y/B.

R-311
Polar Construction Equipment - Universal Engine-Starting Kit, May 1964, S. E. Gifford, AD 600440

This report covers the development and testing of an engine-mounted kit to facilitate starting and operating liquid-cooled engines in low temperatures. The kit was designed to preheat the engine, oil, and battery and to provide ignition assistance during cranking. The components included a gasoline-burning coolant heater, an electric coolant heater, an ether priming system, a battery heating system, and a crankcase shroud.

Laboratory tests and field trials show that the kit as a whole was adequate for low-temperature engine starting when using sub-zero oil for the engine lubricant. However, with a change to 20-weight oil in the mid-1950s it was found that the kit heaters did not provide sufficient heat for engine starting in temperatures below 0°F. The ether priming system and the battery heating system were found to be useful starting and operating aids for liquid-cooled engines on polar transportation and construction equipment under all conditions.

R-312
A Study of Effective Fender Systems for Navy Piers and Wharves, Mar 1965, T. T. Lee, AD 613940

Search of literature, consultation with authorities, field inspection and research, lead to the conclusions that, for berthing ships of up to 20,000 tons displacement, the most effective and economical fender systems for Navy docks are: (1) for sheltered harbors, a modified retractable system; (2) for unsheltered harbors, standard greenheart timber pile with rubber bearing block at deck level; and (3) for dock corners generally, the Raykin (rubber-in-shear) system.

Drawings and specifications for the three recommended fendering systems are included. Also included are: (1) comments by authorities in the field of marine fendering, (2) case histories, (3) load transmission and energy-absorption data, and (4) cost of construction and maintenance.

R-313
Polar Construction Equipment, Hot-Air Engine Preheating Slave System, Jun 1964, S. E. Gifford, E. H. Moser, AD 441980

Use of 20-weight engine oil in polar transportation and construction equipment necessitated preheating of the entire engine for easy starts in temperatures below 10°F. This requirement resulted in the development of a hot-air engine preheating slave system.

The preheating system was tested in controlled temperatures at various field sites in the United States, the Arctic, and the Antarctic. These tests demonstrated that the system provides an easy starting environment in air temperatures to -65 for internal combustion engines lubricated with 20-weight oil.

R-314
Water Vapor Transmission and Electrical Resistivity of Concrete, Jun 1964, R. L. Henry, AD 601769

This is the final report of a study of water vapor transmission (WVT) of plain concrete and of San Gabriel rock, corrosion of steel grids, and electrical resistivity of concrete.

The WVT studies involved San Gabriel rock and plain concrete with water-cement ratio, type of reinforcing steel grid, aggregate size, relative humidity, two admixtures (sodium chloride and oleic acid), and position of slice as variables in one or more of three phases of investigation. WVT rates decreased with an increase in age of concrete, in strength of concrete, in maximum aggregate size, and with the presence of 1.5% sodium chloride.

In order to determine the electrical resistivity of concrete, using the two-point method, sixteen concrete prisms were cast with carbon grids. Electrical resistivity increased with age and decreased with increased salinity of mixing water.

R-315
An Inflatable Causeway, Aug 1964, J. J. Hromadik, J. J. Traffalis, R. A. Bliss, AD 445030

An inflatable causeway that can be side-carried on an LST in multiple tiers may offer a marked logistic advantage over the present causeways. Such a causeway was developed by NCEL and tested.

Each causeway section consists of 24 steel modules assembled into two 12-unit strings with angles, and supported on inflatable pontoon cells restrained in cavities. The assembled superstructure resembles an inverted muffin tin. The cells are inflated by an air source external to the system; a limited auxiliary air supply is housed internally for emergency use.

Engineering tests and operational evaluation of the NCEL design indicate that the concept is technically sound and operationally feasible. The inflatable causeway is recommended for fleet use.

R-316
Protection of Mooring Buoys, Part IV, Results of Third Rating Inspection, June 1964, R. W. Drisko, AD 443376

This is the fourth of a series of reports on the protection of mooring buoys. Fifteen test buoys were given their third rating of coating deterioration, corrosion of steel, and fouling. The coating systems of eight of the buoys were in good condition, six showed varying degrees of moderate deterioration, and one was so badly deteriorated that the buoy was removed from service. Two sets of 13 test panels coated with the different coating systems used on the buoys were given their second rating after 1 yr of exposure. One set was in San Diego Bay and the other set in Port Hueneme Harbor. In spite of a few minor differences, the condition of the coating systems on the test panels in Port Hueneme showed a general correlation with those on the test panels and buoys in San Diego. Most of the Mark 1 buoys in the test program had suffered abrasion damage to their rivet heads in the submerged zone, and these rivet heads were undergoing serious galvanic corrosion.

The cathodically protected buoys had less corrosion in the submerged zone than the corresponding control buoys. Their potential, however, was considerably less than that designed for the systems, so new control heads were installed to produce a higher potential.

R-317
Pioneer Polar Structures - Portable Maintenance Shelter, Jun 1964, G. E. Sherwood, AD 601948

The need for adequate shelter for maintenance and other equipment in pioneer camps resulted in the development of a packaged maintenance shelter. The shelter, a canvas-covered, aluminum-frame structure, was developed by NCEL. It is skid-mounted for easy portability around a work area. The 20- by 24-ft shelter is adequate for the repair and maintenance of equipment as large as a size 2 snow tractor and a size 4 standard tractor. A standard NCEL portable Wanigan was outfitted with shop equipment and tools as a companion piece for the shelter.

A prototype shelter was evaluated on the Ross Ice Shelf in Antarctica. It was concluded from the test that the shelter and its outfitting is well suited for the maintenance and repair of equipment at pioneer polar camps and that it should be included as a facility for such camps.

Specifications and reduced scale drawings for the shelter have been published in Technical Note N-602, "Pioneer Polar Structures - Specifications and Outfitting for the Portable Maintenance Shelter."

R-318
Evaluation of Asbestos Asphalt Paving Mixes, Jun 1964, J. A. Bishop, AD 602931

An experiment was conducted to determine the effect on strength properties of adding asbestos fibers to asphalt paving mixtures. Beams, cylinders, and tensile briquets were molded with various percentages of asbestos (up to 2%) in combination with other fillers and a constant percentage of asphalt. Specimens were tested at the age of 0 months and at 6 and 18 months (accelerated). Marshall specimens were made of the same mixes and tested as soon as molded.

On the basis of a statistical analysis of the test results, strength properties did not improve enough to warrant further study.

R-319
Cancelled

R-320
Ignition of Thick Wood Specimens by High-Temperature Thermal Radiation, Nov 1965, F. W. Brown, III, AD 475535

An investigation was undertaken to determine the probability of ignition of thick woods by thermal radiation. A carbon-arc source was used to simulate the thermal radiation from a nuclear weapon.

Measurements were made to determine the irradiance and time necessary to produce glow and flaming ignition in Ponderosa pine, Douglas fir, and maple. The results of this study are presented in the form of graphs of irradiance as a function of time for several moisture contents for each type of wood. In all cases on the graphs, the locations of the

areas of char, persistent glowing ignition, and persistent flaming ignition are shown. The values of Q, total thermal energy necessary to produce sustained burning (with or without flame), can be easily computed from these data. They range from a minimum value of about 19 cal/cm sq for very dry pine to several thousand calories/cm sq for wood with a very high moisture content. It was concluded that for sound solid woods of a normal moisture content, it is almost impossible to start continued ignition with nuclear weapons of a size less than about 100 Mt at a distance where blast damage would not be severe. An appendix describes the high-intensity thermal-radiation facility used to conduct the investigation.

R-321
Cancelled

R-322
Thermoelectric-Generator Systems for Emergency Shelters, July 1964, D. Taylor, AD 443985

A study was conducted to determine the feasibility of using small flame-activated thermoelectric-generator systems to provide power for lighting small emergency shelters. Such systems were found feasible, and costs for a family-size and a 100-man shelter are given. Comparative merits and costs of other suitable systems are also given.

R-323
Reflectivity of Airfield Marking Paints, Jun 1964, R. W. Drisko, AD 446327

As part of an investigation to determine the appropriate formulation for an airfield marking paint, a laboratory study was made of the reflectivity of such paints. Diffuse reflectance spectra and percent reflectance in the visible and near infrared (0.4 to 2.5 microns) were recorded for 16 proprietary marking paints and a number of experimental paint formulations. Suitable combinations of pigments and infrared absorbers produced formulations with a desired high visible reflectance and low infrared reflectance.

R-324
Development of a Container for a Master Repeater Unit, Dec 1964, R. E. Jochums, SECRET

R-325
Gamma-Ray Dose Rates and Energy Spectra in a 3-Foot-Square Duct, Oct 1966, J. M. Chapman, AD450421

Dosimeter measurements and gamma-ray spectra were taken in a 3-ft-sq concrete duct, using cobalt-60 and cesium-137 sources. The dosimeter measurements are compared with computer-calculated dose rates, with very good agreement. The spectra show prominent peaks for single scatter and a large amount of lower-energy gamma rays. The spectra are used to determine the dose-rate contributions of individual scattering areas. These dose-rate contributions are compared to calculated values with fair results. The percentage of the dose-rate contribution from one scattering area due to gamma rays that have been previously scattered in the first leg was determined experimentally to be about 40%.

R-326
Air-Filter Shielding for Emergency Shelters, Aug 1964, N. Oldson, C. A. Dittus, W. R. Nehlsen, AD605502

Experiments were conducted to show which particle sizes of fallout falling from altitudes of 10,000 ft or more would be drawn into a typically protected shelter air intake. Results indicated that practically no particles over 60 microns in diameter would be captured. Some particles in the 30-60-micron-diameter size range were captured, and almost all particles below 30 microns in diameter were captured. Calculations made on two fallout-size distributions and three radioactivity levels indicate no significant hazard from material collected on the shelter air filters. Side-opening blast-closure devices, such as the AMF and OCD units, require additional protection to keep fallout from being captured by the high velocities at the inlet.

Shelters close to atomic blasts are likely to be subject to dangerous amounts of all sizes of particles coming from lower altitudes. The shelters must have all intakes closed during the danger period.

R-327
Cancelled

R-328
Forces Induced by Ocean Waves on Piles, Oct 1964, P. Holmes, AD451090

Probabilistic techniques employing spectral operations are used to analyze measurements of forces induced by hurricane-generated water waves on a vertical, circular pile, 3.71 ft in diameter. This pile forms a leg of an oil-drilling platform located 30 miles offshore from Leeville, Louisiana, in water 100 ft deep in the open Gulf of Mexico. Four 15-min records of measurements recorded on 10 Sep 1961 at three continuously immersed elevations are analyzed. It is found that the coefficient of drag can be assumed to be constant equal to 1.20 over the entire length of that portion of the pile which is continuously submerged. The coefficient of mass is found to vary significantly over this length of the pile, from a mean value of 2.42 at 15.9 ft below mean water level (MWL), 1.50 at 42.2 ft below MWL, to 0.92 at 75.6 ft below MWL. It is concluded that the technique used is proper, and a procedure is suggested for its use in design.

R-329
Deep-Ocean Biodeterioration of Materials - Part I. Four Months at 5,640 Feet, Nov 1964, J. S. Muraoka, AD608939

This is Part I of a series of reports on the biodeterioration of materials in the deep ocean. It covers the data obtained by sampling mud, sea water, and rocks, and data obtained by exposing 1,324 specimens of 492 materials for 4 months on the Pacific Ocean floor at a depth of 5,640 ft. The materials were attached to a submersible test unit (STU). The STU was retrieved in Feb 1964, and returned to the Laboratory for tests and analyses.

There were no marine fouling organisms attached to the metal test specimens. Some of the plastic materials were covered with a bacterial slime growth. Cotton rope, manila hemp rope, and burlap wrappings were deteriorated by microbial activity. Pine test panels and manila hemp rope were attacked by marine boring organisms (Xylophaga Washingtona Bartsch). Various species of fouling organisms were found on rock samples collected from the ocean floor in the vicinity of the STU test site.

R-330
Run-Up Impulsively Generated Water Waves, Dec 1964, J. M. Jordaan, AD454728

Theoretical and experimental studies were conducted to determine the run-up on a plane beach of water waves produced by systems of impulsive generation. The facility used for the studies consists of a wave basin which simulates the run-up of actual ocean waves on beaches.

Wave trains were generated by bobbing the plunger up and down pneumatically in a single stroke or in arbitrary sequences chosen to produce wave trains simulating those produced by underwater or surface explosions. The paraboloidal shape of the plunger was chosen because it resembles the crater produced by an underwater explosion.

The wave trains were recorded at several distances from the center of plunger, and the corresponding run-up on test beach units of 1/15 slope was recorded.

Theoretical results were derived and compared with the observed results. The extent of agreement between theory and experiment is discussed, and preliminary conclusions are that an adequate theory exists to predict wave generation due to underwater high-explosive blasts.

R-331
NCEL Dynamic Testing Machine, Oct 1964, W. L. Cowell, AD608173

This report describes the dynamic testing machine at NCEL and gives the results of dynamic tests conducted on a chrome-alloy steel. These results are compared with results obtained by other high-speed testing machines.

At a strain rate of 2 in./in./sec, the chrome-alloy steel shows an increase in the upper yield stress of approximately 25% compared to the average static value. A general increase in tensile strength (between 6 and 7% greater than static values) is evident with an increase in head velocity. No change in ductility could be detected.

R-332
Static and Blast Loading of Small Buried Cylinders, Nov 1964, J. R. Allgood, H. L. Gill, AD452683

This research was performed to obtain information on the behavior of shallow-buried cylinders subjected to static and blast loads in support of the task objective of gaining knowledge to provide guidelines for developing design methods for underground protective structures. It was especially desired to obtain data on the time and space variations of deflection, thrust, and moment under the two types of loading for purposes of making a comparison.

The results show that the net arching across a flexible shallow-buried cylinder is small and that the maximum moment occurs at the bottom of the cylinder. Differences in response to static and blast loading are relatively small except for the crown, which deflects about twice as much under blast loading as under corresponding static loading. An analogy with the simple spring-mass system is drawn to explain this behavior. Information obtained on the influence of placing a low-strength isolating material in the soil over a cylinder indicates that such an expedient is of questionable benefit.

The complete significance of the test results can be appreciated only when correlated with other available test data and theory. Such a correlation is accomplished in a companion report.

R-333-I
Study of Creep in Concrete - Phase I (I-Beam), Jan 1965, J. R. Keeton, AD610550

A practical method is determined whereby reasonably accurate estimates of creep and shrinkage of full-sized concrete structures can be obtained. Tests have been conducted on concrete cylinders placed in storage environments with controlled temperature and relative humidity. Non-loaded specimens and specimens subjected to constant sustained compressive loads, causing stresses up to about 60% of the ultimate compressive strength of the concrete, were used in the tests.

The most generally accepted findings about concrete volume changes were applied to the test data obtained and equations were developed that very closely fit observed data. Extrapolation of data from test cylinders to full-sized I-beams was accomplished by plotting the data versus the ratio of the exposed surface area to volume.

R-333-II
Study of Creep in Concrete - Phase II (Hollow-Box Beam), Feb 1965, J. R. Keeton, AD611138

Cylindrical concrete specimens 3 in. in diameter by 9 in. long and 6 in. in diameter by 18 in. long were tested in controlled storage environments of 20% RH, 50% RH, 75% RH, and 100% RH, with the temperature at 73F in all cases. Creep specimens were subjected to constant sustained compressive loads causing stresses up to about 50% of the ultimate compressive strength of the concrete. Non-loaded companion specimens were included to determine shrinkage.

Total creep data from the cylinders were extrapolated to estimate the total creep of beams by plotting these data versus the ratio of the exposed surface area to volume. Errors in the estimates were determined from previous data obtained in hollow-box beam tests.

R-333-III
Study of Creep in Concrete - Phases 3, 4, and 5, May 1965, J. R. Keeton, AD615521

Tests to determine prestressing losses were made on small rectangular concrete beams loaded in compression by axial prestressing steel stressed to about one-half of the recommended working stress. Relationships were disclosed which indicate the feasibility and practicability of predicting prestressing losses in full-sized beams by testing small prestressed concrete beams of sufficient size variation to provide surface-area-to-volume (SA/V) values for extrapolation curves. Concrete cylindrical specimens were subjected to long-time compressive loading at 1 day of age including 16 hr of steam curing. Creep and shrinkage of steam-cured concrete ranged from 25 to 46% less than that of the same concrete normally cured, the amount depending upon specimen size, applied stress, and storage humidity.

Tests were made which indicate that for a given concrete specimen, time-dependent strains are equal whether they are measured end-to-end or in the central portion of the specimen. The effects of age upon shrinkage were determined. Shrinkage measurements were made on the inside of cylindrical concrete specimens with embedded Carlson strain meters, and on the outside with a mechanical strain gage. Results indicate that shrinkage is equal whether measured internally or on the outside of the specimens.

The effects upon shrinkage of the size and shape of specimen were determined, using cylinders, prisms, tee-sections, and I-sections. Shrinkage is affected by both size and shape. It was determined that loaded and non-loaded concrete cylinders lose about the same weight of water when subjected to the same conditions.

R-334
A Hydraulic-Pneumatic Floating Fender, Feb 1965, T. T. Lee, AD458460

In-service tests of two 50-ft-long floating fenders (each a bulkhead fronted by two water-filled and two air-filled bags) indicate that they meet the requirements of reducing damage to piers, ship-hulls and pier fenders, particularly in protected harbors with only moderate swell and wind. They are higher in first cost ($77 per lineal ft of wharf in 1963) than comparable fenders. Over a 14-month period at Port Hueneme, California, correlated measurements of bag pressure and ship-berthing velocity were made for about 30 Naval and merchant ships, from these, loading forces and energy were calculated.

The report is intended to provide technical information and data to engineers and designers who are concerned with an effective increase in the energy-absorption capacity of existing fender systems. The test camels are particularly applicable to the deteriorated pier-fender system where low load transmission and high energy absorption are essential.

R-335
Improved Assemblage for Consolidation Testing of Soils, Nov 1964, J. P. Nielsen, R. J. Smith, AD451507

An improved assemblage of equipment for consolidation testing such soils as clays and sea-floor sediments is described. The equipment yields results of research quality and overcomes the disadvantages of cumbersomeness, frequency of inspection and maintenance, constant monitoring, and uncertainty which characterize conventional consolidation testing equipment. The assemblage consists of a small, portable load frame, a soil-compression sensor, a continuous chart recorder, and accessory electronic components. It provides a continuous, permanent record of sample compression.

R-336
Static and Dynamic Behavior of Pinned-Base Portal Frames, Feb 1965, S. K. Takahashi, R. H. Chiu, AD612776

The purpose of the tests reported herein was to provide more precise information on the effects of static and dynamic loads on steel structures and their members and to provide comparisons between results predicated by theory and results derived by experiment.

Results from nineteen dynamic tests and one complete static test are presented in this report. The tests were performed on four steel portal frames, 8-ft high and 12-ft long, fabricated from 12WF27 rolled sections. The frames were constant in cross section and hinged at their bases.

After several dynamic loads were placed on one column of one frame, the opposite column was loaded to determine the effect of repeated and reversed loading. The applied loads and the resulting deflections, strains, and accelerations were measured. The reduced data are presented in graphical and tabular forms.

Good correlation was obtained between theoretical and experimental values for both the static and dynamic tests. The dynamic response factor and the dynamic shear factors were 1.9 and 1.4, respectively.

R-337
Static and Dynamic Behavior of Fixed-Base Portal Frames, Jun 1964, S. K. Takahashi, R. H. Chiu, AD617718

The objective of this report is to provide information on the static and dynamic design of steel portal frames. To provide comparisons between theoretical and experimental results, four steel portal frames, 8-ft high and 12-ft long, fabricated from 10B17 rolled sections, were tested under uniformly distributed static and dynamic loads. The loads were applied to one column of each frame to simulate a horizontal, traveling blast wave. The cross section of the loaded column was different from the cross section of the girder and the unloaded column. The frames were partially restrained at their bases.

This report comprises results from twenty-three dynamic tests and one complete static test. The applied loads and the resulting deflections, strains, and accelerations were measured, and the reduced data are presented in graphical and tabular forms.

R-338
Static and Dynamic Plate-Bearing Tests on Dry Sand With Overburden, Sep 1964, C. R. White, AD607894

Six static and 53 dynamic soil-bearing tests were made under simulated overburden pressures of zero to 15 psi to determine the load-displacement characteristics of buried footings. The static bearing modulus increased as overburden pressure increased up to an overburden pressure of approximately 6 psi. The dynamic bearing modulus increased exponentially with overburden pressure to an overburden pressure of 15 psi. Up to 3 psi overburden pressure dynamic modulus was larger than static, but the difference was less at 3 psi overburden than at zero. The relationship between static and dynamic moduli was not firmly established for overburden pressures greater than 3 psi. These tests were made on a 15-in.-diameter bearing plate in dry sand using the NCEL atomic blast simulator.

R-339
Ice Construction - Mobile Pump Wanigan for Confined Flooding, Oct 1964, G. E. Sherwood, E. H. Moser, AD450939

An experimental pump Wanigan was evaluated at Point Barrow, Alaska, between 1958 and 1960, and selected components for the unit were evaluated at other field sites between 1960 and 1964. The mobile pump Wanigan is well-suited for thickening sea ice by confined flooding and is recommended as standard equipment for this type of ice construction. Specifications, reduced scale drawings, and commercial items were published in Technical Note N-608. Erection instructions are given in Technical Note N-587.

R-340
Protective Coverings for Ice and Snow - Aqueous Foam Studies, Oct 1964, N. S. Stehle, AD449711

Summer deterioration of their surfaces hampers the year-round use of natural ice islands and smooth sea-ice areas in the Arctic Ocean and permanent snow and ice areas in the Antarctic. Sawdust has been used by the Navy for protecting compacted-snow areas, but its scarcity and shipping bulk preclude its use in polar regions. In developing a suitable protective covering for ice and snow surfaces in polar regions, laboratory and field studies were conducted on protein-base aqueous foams stabilized with sodium carboxymethyl cellulose, by contract with Onondaga Associates, Inc., of Syracuse, N.Y., and by NCEL.

These foams are not adequate for continued protection of ice and snow surfaces against summer deterioration. They are difficult to generate, will not cure under normal polar conditions, have a short field life, are damaged by traffic, and offer only a slight weight savings over sawdust at a considerable increase in cost. Investigations should continue toward developing a covering for operational areas of ice and snow which protects against deterioration from solar radiation and near-thawing temperatures.

R-341
Improved Method of Determining Metal Corrosion Rate by Weight Loss, Nov 1964, E. S. Matsui, AD609228

A deficiency was found in the procedure for the salt-spray test given in Mil-C-23050 (ships), which is used to determine the weight loss suffered by metal structures, such as ballast tanks, from rusting. The procedure did not take into account the nonhomogeneity of material among the panels being tested. A modified method was developed, and the results obtained with this method were compared with those obtained using the original method. The modified method not only corrected the deficiency, but it also improved the precision of the test method significantly.

R-342
Mobile Construction Battalion Equipment and Operations, Mar 1965, D. Taylor, W. W. Watson, AD458065

NCEL made a study of the present and anticipated utilization of equipment for advanced base construction by the Naval Construction forces. Information was gathered from Mobile Construction Battalion reports and from battalion officers stationed at Port Hueneme. Task personnel observed some of the active equipment operating at Adak, Alaska, and other equipment in storage at the COMCBPAC pool at Port Hueneme, California. In general, the equipment is adequate and used to its full capability when deployed, but some problems and deficiencies were noted: (1) some poorly designed or faultily constructed equipment has entered the system by misconstruction of the commonly accepted intent of

a specification, (2) equipment selected for deployment is sometimes unsuitable for the field environment, (3) some equipment is used beyond its capability when the proper equipment is not available at the construction site, (4) the majority of the equipment is old, (5) trainee operators sometimes mishandle equipment during MCB deployments (which are training operations), and (6) equipment is not always properly maintained due to "tight" construction schedules and the dearth of rated mechanics. Many of the problems are recurring and some have been solved. The findings are placed in relation to the advanced base functional components P2, P4A, P4B, P4M, and P25.

R-343
Improved Transportability for the P25 Functional Component, Feb 1965, W. W. Watson, A. L. Scott, AD456888

The current P25 advanced base functional component cannot be moved rapidly overland on unimproved country roads, nor can it be airlifted via C-124 without extensive, time-consuming disassembly of a number of large pieces of heavy equipment. The P25 was studied to determine the changes necessary to improve its transportability.

Current developments show that the overland movement capability of the P25 can be markedly improved by changing the transportation equipment specifications to provide increased tire size, power-assisted steering, all-wheel drive, compression-ignition engines, increased horsepower, and automatic transmissions.

It should be noted that Army engineers consider the C-124 aircraft obsolete and that their future plans are based on use of the C-133 aircraft.

R-344
The Behavior of Shallow-Buried Cylinders, Jan 1965, J. R. Allgood, AD610656

The available information pertinent to the behavior of shallow-buried cylinders is synthesized and extended to gain a better understanding of its use for improving the design of underground shelters. The theoretical and experimental data are examined to define the areas in which further research is needed.

A failure plane analysis yields (1) the minimum depth of cover required for all of the surface load to be carried by arching, (2) the maximum percentage of surface load which can be carried by arching for any lesser depth, and (3) the relative deformation between the structure and the free field required to develop the maximum possible arching. For a shallow-buried cylinder in a uniform granular soil field, the net arching is shown to be essentially zero. Because the net arching across the structure is zero, the effective load on the structure tending to induce failure is the surface pressure. Consideration is given to the possibilities of elastic and inelastic buckling in the roof caving and local transitional buckling modes. Evidence is cited which indicates that for depths of cover sufficient to provide radiation protection, and for relatively thin-walled cylinders, failure will normally be in the inelastic transitional mode where a local buckle develops at or near the bottom of the cylinder.

R-345
Deep Ocean Civil Engineering, Back-Up Report, Undersea Technology Panel, Project Seabed, Sep 1964, O. B. Crumpler, J. J. Nromadik, et al., AD457974

This report was prepared prior to the Monterey session as the documentation of the state-of-the-art and projected technology in the field of deep ocean civil engineering in support of the undersea technology panel of Project Seabed, sponsored by the Special Projects Office.

R-346
Ice Grading Equipment - Development of an Experimental Rotating-Drum Cutter, Nov 1964, S. E. Gifford, AD451413

Tests of an experimental rotating-drum ice cutter are described. The tests were performed to determine the feasibility of grading polar ice surfaces through removing excess ice by fracture, using impact cutters mounted on a rotating-drum. Experiments were conducted to learn the best shape, size, and number of cutters required, horsepower needed for various depths of cut and travel speeds, the relative merits of overcutting and undercutting, and the most suitable cutting-drum rotating speed. The ice cutter's performance, which was tested in a cold chamber in Alaska and in Greenland, revealed that removal of ice by fracture was feasible. The criteria obtained from these tests have been used to develop an ice dozer for pioneering in rough ice areas. This unit is currently being tested and evaluated at various field sites.

R-347
Evaluation of Four Blast Closure Valves, Jan 1965, R. S. Chapler, AD455762

Four makes of blast closure valves were tested by NCEL to determine their airflow resistance, closure times, blast response and leakage, and their weather-ability. Two of the blast-actuated valves tested were the Swedish Wegematic, 14-in.-diam valve, and the Bureau of Ships 11- by 15-in. rectangular valve. Also tested were three flash-actuated valves, the Mosler Safe Company 48-in.-diam valve, and the Bureau of Yards and Docks 36- and 48-in. valves.

R-348
Polar Construction Equipment - Portable Floodlighting Unit, Nov 1964, N. E. Pierce, G. E. Sherwood, AD452160

A sled-mounted floodlighting unit was developed to provide illumination and a portable light-duty power source for work areas away from main camps and construction sites in polar regions. It consists of a standard Army Quartermaster 400-lb-capacity manhaul sled, a lightweight 3-kW gasoline-engine-driven generator, and four light standards with three 150-W lamps each. Evaluation of the unit in the Arctic has proved it to be well-suited for polar use. The sled-mounted unit is easily towed by one man, it provides the required illumination of 1 ft-candle at 100 ft within an included angle of 90 deg, it is lightweight and compact for shipment by air, it is trouble-free, and the cost is reasonable. The unit is detailed in Y and D drawing no. 993763 and is recommended as a standard item of construction equipment for polar operations.

R-349
An Empirical Formula for Calculating Gamma-Ray Dose Attenuation in Concrete Ducts, Nov 1964, W. C. Ingold, C. M. Huddleston, AD609049

A survey is presented of the current status of the calculation of gamma-ray dose-rate attenuation in air ducts through concrete. A simple empirical formula is exhibited which shows satisfactory agreement with the results of more complicated computational techniques and with experimental results. This simple formula represents a large saving in computation time - 2 sec per case compared to 400 sec by IBM-1620 computer. Its validity is established for a wide range of duct geometries and for gamma-ray energies up to 3 mev.

R-350
Gamma-Ray Shielding Effects of Metal Doors in Ducts, Jan 1965, P. R. Bryson, J. S. Grant, AD454729

Results are presented of an experiment carried out on the shielding effects of a steel door in a two-legged 11 x 11-in. concrete duct using cobalt 60 as a gamma-ray source.

Two door positions and two door thicknesses were used. A relatively strong inscatter effect was measured when the door was placed at the corner where direct radiation was received. When a 3/8-in. steel door was placed in the second leg 22 in. from the corner, the radiation was reduced 50 to 60%. It can be expected that the farther down the second leg the door is placed, the less radiation it will transmit, that the thicker the door, the greater its shielding effectiveness will be. A method of scaling the results to large ducts is presented based on the experimental measurements.

R-351
Diminishing Protection Found in Flotation-Type Ballast-Tank Preservatives, Dec 1964, C. V. Brouillette, AD454368

Samples of used rust-retarding, flotation-type, ballast-tank preservatives were taken from 30 floating drydocks to analyze their corrosion-resisting properties. After a few months' service inside the ballast tank of a floating drydock, these oils were found to fail the Mil-Spec requirements for rust retardation. It was found that because of improper use of these oils, only about 20% of the drydocks were receiving as much as 80% reduction in corrosion.

R-352
Remote Indicator System for E21 Series Automatic G-Agent Alarm, Mar 1965, I. M. Derr

A remote indicating system was developed for incorporation into the Navy's E21 series automatic G-agent alarm installations so that a number of remote E21 gas-attack alarm units could be monitored at a central control. An alarm sounds at the receiving station when gas is sensed, and a red light indicates the location of the E21 unit that sensed the gas. As a precaution, a warning indicates the presence of a signal on the assigned radio frequency that may cause either intentional or unintentional jamming of the frequency.

The remote indicator system consists chiefly of (1) a transistorized frequency-modulated transmitter mounted in the E21 gas alarm, (2) a transmitting antenna mounted on the gas alarm case, (3) a tone generator producing a modulating tone in the frequency range of 800 to 3,600 cps, (4) a programmer to allow time sharing of the frequency by several transmitters, (5) a receiving antenna, (6) a receiving station consisting of one FM radio receiver, 15 Motorola single-tone decoders, one signal-presence indicator, and associated power supplies.

The system was successfully field-tested at a variety of transmitter-to-receiver distances. The maximum distances tested were 4.7 miles over obstructed terrain and 9.8 miles over unobstructed. The transmitter actuated the central alarm in all cases.

R-353
Issued as R-333-II

R-354
Fast Neutron Streaming Through Two-Legged Concrete Ducts, Feb 1965, Y. T. Song, AD457746

As a part of the Laboratory's fundamental shielding studies for personnel shelters, fast neutron dose rates are calculated in the second leg of an air duct through concrete for neutron energies of 14 mev and 2.5 mev. The calculational technique is based on the Albedo concept. Dose rates are also calculated by a Monte Carlo technique, and the results obtained by the two theoretical methods are compared with each other and with experimental measurements.

Comparison shows very good agreement among these three independent determinations.

R-355
Protection of Mooring Buoys - Part V, Fourth Rating Inspection, Jan 1965, R. W. Drisko, AD611410

This is the fifth of a series of reports on the protection of mooring buoys. Fourteen test buoys were given their fourth rating for extent of coating deterioration, corrosion of steel, and fouling. A fifteenth buoy had been removed from test at the time of the fourth inspection because of its advanced deterioration. The coating systems on eight of the buoys were in good condition and the six other coating systems showed varying degrees of moderate deterioration. Two sets of thirteen test panels coated with the different coating systems used on the buoys were given their third rating inspection after 18 months of exposure. One set was exposed in San Diego Bay and the other in Port Hueneme Harbor. The condition of the coating systems on Port Hueneme test panels showed a general correlation with those on San Diego test panels and buoys. In addition to environmental deterioration on buoys and test panels, the buoys were abraded by mooring Naval vessels. The galvanic corrosion of rivet heads observed on most of the Mark I buoys during the last inspection had not worsened to any significant extent. On those buoys with an antifouling coat, very little antifouling protection remained after 20 months, but on the test panels two antifouling coatings were still retarding fouling after 18 months.

R-356
Sea-Ice Construction--Skid-Mounted Pumping Units, Jan 1965, E. H. Moser, G. E. Sherwood, AD456856

Two skid-mounted pumps were developed for thickening natural sea ice in polar areas where air cargo space is critical and support equipment is limited. One is a high-pressure, low-volume unit principally for confined flooding. The other is a low-pressure, high-volume unit principally for free flooding. Within limits, the units can be used for both types of flooding.

Both units consist of a diesel-driven centrifugal pump mounted on a towable skid-base and enclosed in an insulated aluminum-paneled shelter fitted with access ports and an automatic shutter-type ventilation system. They are winterized for easy operation in air temperatures to -40F, and they are equipped with entry ports for preheating with a portable hot-air slave heater in temperatures below 10F. Both units are air transportable in a ski-equipped C-47 aircraft, and they can be towed on snow and ice with equipment as small as an M-29C cargo carrier. No flooding gear is provided with the pumping units, this must be selected for the specific job requirements.

R-357
Developments in Protective Shelter Systems, Apr 1965, P. J. Rush, AD614979

This report covers available information in protective and environmental aspects as they apply to design, construction, and operation of shelter systems for the survival of personnel and equipment.

More than 400 references were studied to compile the report. Certain of the information was obtained from observations of nuclear detonations and their effects upon various components of shelter systems, other data included are the results of laboratory experiments, and some conclusions were derived from analytical considerations.

R-358
Deterioration of Rubber and Plastic Insulation by Deep Ocean Microorganisms, Mar 1965, J. S. Muraoka, AD461148

This laboratory research study determined the relative deteriorating effects of deep-ocean microorganisms on five electrical insulating materials. The plastic and rubber materials were exposed for 21 months in (1) sea water containing microorganisms from deep-ocean sediments or (2)

deep-ocean sediment. Control specimens were exposed in sterile sea water. Relative values for deterioration of the insulating materials were determined on the basis of insulation resistance and voltage breakdown tests. Other parameters of the deep-ocean environment, such as high hydrostatic pressures, low temperatures, and low dissolved oxygen were not a part of this study but will be considered in a future study.

Of the five materials, neoprene rubber was highly resistant to water absorption in the absence of microbes but was very susceptible to microbial deterioration. Polyethylene was highly resistant to microbes, but after 14 months it was very susceptible to water absorption. Silicone rubber, GR-S rubber, and polyvinyl chloride were fairly resistant to both microbes and water.

R-359
Building Materials for Attenuating Electromagnetic Interference, Mar 1965, H. A. Lasitter, AD612149

The electromagnetic shielding properties of coke-cement materials have been investigated experimentally and theoretically. Calculated and measured values are in close agreement. Eight types of material available commercially and used as construction material were evaluated as electromagnetic shields.

R-360
Cancelled

R-361
Field Strength Measurements in a Quasi-Absolute Half-Space, Mar 1965, D. B. Clark, H. A. Lasitter, R. D. Hitchcock, AD460764

Controlled field tests with Navy-type interference receivers were conducted to determine the accuracy of calibration techniques and of certain types of electromagnetic field measurements. An effectively infinite, highly conducting ground plane was provided by the Great Salt Lake mud flat used as a test area. A monopole source, carefully monitored by means of a current probe in its base, provided means to calculate accurately the generated CW electromagnetic fields.

Measurements made with both manufacturers' meters of the vertically polarized electrical field using rod antennas mounted on a ground plane placed coincident with the surface of the mud flat, in almost all cases fell within a ±1.5-db measurement and calibration error of each other and the calculated field. In many cases there was remarkable superposition of readings.

Measurements made with rod antennas mounted 1 m above ground were generally 5 to 6 db higher than the calculated field and measurements made with antennas flush with the ground.

Accuracy of calculations of the generated field were dependent upon the accuracy of the calibration of the signal source using the substitution method. Monitoring interference receivers were used with a current probe to measure the monopole base current. Source measurement and calibration procedures are described.

R-362
Migration of Fallout and Fallout Simulants into Soils, Feb 1965, A. E. Hanna, AD611411

A series of tests was performed to determine whether radioactive fallout would migrate vertically downward through soils. A thin layer of fused or leachable fallout simulant (Monterey sand coated with barium 140-lanthanum 140) or of natural fallout (fission products in soil) was spread on trays containing frozen soil mixtures. The trays were alternately thawed and allowed to refreeze, with radiation-level measurements made periodically. After a number of thaw-freeze cycles the frozen soils were vacuumed to remove surface activity. Core samples of the soils were taken and layers of the cores were counted to determine actual migration.

It was concluded that migration did occur by leaching and particle movement, and that particle migration occurred only in soils having a wide range of particle sizes. A single vacuuming removed most of the detectable activity.

R-363
Evaluation of Paint Systems for Use in Radioisotope Laboratories, Feb 1965, J. B. Crilly, S. H. Bassett, AD457917

Two paints, one based on epoxy resin and the other a strippable coating, were tested on concrete and on wood and compared to bare stainless steel for ease of cleaning of radioactive contaminants. It was found that the epoxy paint, Plasite 7122, provides a surface that can be easily decontaminated. This paint is in routine use at the Atomic Energy Commission's Los Alamos Scientific Laboratory, where it is employed to coat surfaces that are routinely exposed to radioactive contamination, and has been found to provide a readily cleanable surface.

The strippable coating, Fuller's Stripcoat, intended to be removed and replaced when contaminated, was effective for aqueous contaminant solutions but was ineffective for oily contaminants, which dissolved and penetrated the coating.

R-364
Thin-Film Evaporation in Vapor-Compression Stills, Apr 1965, E. J. Beck, AD613572

A study is made to explore promising mechanisms of heat transfer which may be used to develop more efficient seawater distillation units. As a basis of investigation an extensive research survey of low-temperature-difference boiling heat transfer is briefly summarized, with the conclusion that with the present understanding of ebullition there is little prospect of achieving the desired heat transfer with active boiling. The metal-to-fluid superheat necessary to form a steam bubble with known types and sizes of nucleation sites prevents ebullition except with minimum temperature differences of 8 to 10F between the temperature of the metal wall and the saturation temperature of the fluid.

The concept of evaporation from a very thin film without boiling is considered in detail, and two small experiments are reported. It is shown, both theoretically and experimentally, that very high evaporation rates can be obtained with the very thin film technique, methods of maintaining a thin film continuously in a practical vapor-compression still are considered. A single-tube experiment, in which methods of introducing feed water and checking probable scaling problems will be studied, is described as the next phase of this task.

R-365
Plastic Mooring Buoys - Part 1, Fabrication of Experimental Models, Mar 1965, R. W. Drisko, T. Roe, AD612055

Two experimental plastic mooring buoys were designed by BUDOCKS and fabricated by a private contractor. Each has a cylindrical steel framework to which a tension rod is welded, passing vertically through the axis. A swivel and eye are welded to the top for use of a free-swinging mooring, and an eye is welded to the bottom for joining to a riser chain. The steel framework is filled with closed-cell polyurethane foam. On one buoy this foamed core is covered with an exterior shell composed of ten layers of fiberglass cloth impregnated with polyester resin, on the other, the exterior shell is a sprayed-on coating of chopped fiberglass strands in polyester resin. This report is Part 1. Part 2 will cover the in-service evaluation of these experimental buoys.

R-366
Infrared Spectroscopy of Paint Vehicles, Feb 1965, J. B. Crilly, AD457586

Infrared spectroscopy has been investigated for its application to the specification testing of paint vehicles. Infrared absorbence by paint vehicles was measured using attenuated total reflectance of light by the vehicle and by transmission of solutions of vehicle. Reproducible results were not attained by either approach. Much more study is required to devise a method by which separate laboratories with different equipment could make measurements of adequate precision for inclusion in paint specifications.

R-367
Gravity Ventilation of Underground Shelters, Mar 1965, J. C. King, AD613550

Tests were conducted to determine the suitability of using gravity ventilation as an emergency method of providing air for survival in an underground shelter. The tests consisted of inducing through a simulated test shelter an airflow caused by (a) inside-outside temperature differentials, and (b) stack heaters in the exhaust duct. An additional test was made which involved a device to direct wind into the intake duct. It was found that wind blowing over the inlet and exhaust ducts created a negative pressure in the shelter that could not be satisfactorily overcome by the gravity methods used, thus, minimum ventilation rates could be obtained only when there was no wind blowing.

In the tests conducted to utilize the wind, an NCEL-designed air inducer which mounts on the inlet duct provided satisfactory ventilation during normal weather conditions when there was a wind of 6 to 8 mph.

R-368
Recovery of Laundry Waste Water for Shore Stations, Mar 1965, W. R. Nehlsen, AD612266

A laundry waste-water-recovery unit was in-service tested at the Midway Naval Station Exchange Laundry. Treatment results were comparable to those obtained at NCEL, although costs were higher than previously estimated. An analysis of test results indicates that the unit is not suitable for inclusion in the functional component system. However, the process itself may be used at permanent stations to supplement water supplies by 5 to 20%.

R-369
Design, Placement, and Retrieval of Submersible Test Units at Deep-Ocean Test Sites, May 1965, R. E. Jones, AD615769

Four submersible test units (STU's) were emplaced, exposing specimens of various materials to the sea floor sediment and to the surrounding water for various time periods and at various depths. Emplacement of the four and the retrieval of one (after 4 mo) are reported in detail, and the rigging and instrumentation systems are described. The heaviest STU emplaced so far weighed almost 7,500 lb and supported about 2,400 specimens of 600 different materials. Emplacements were made at depths of 2,400, 5,600, and 6,700 ft. Operations and system performance are discussed and conclusions and recommendations are presented.

R-370
A Graphical PERT Analog, Apr 1965, D. F. Sampsell, AD614701

This publication in intended as a guide for planners and schedulers of projects not governed by current directives concerning the use of pert or the critical path method.

The graphical PERT analog is an integrated noncomputer method of planning and scheduling the component activities of a project in terms of both time and cost. Essentially, GPA is a graphical approach to the PERT concept of project analysis. As is generally true of PERT methods, GPA can assist management to utilize available productive resources effectively, however, compared to other noncomputer methods presently used, GPA techniques are more straightforward and require minimal arithmetic calculations. Instructions are given for setting up a flow diagram schedule, and examples and exercises for practical applications of GPA methods are provided.

R-371
Plastic Hinge Formation in Reinforced Concrete Beams, Jun 1965, W. J. Nordell, AD617246

Fifteen static and dynamic tests were conducted to measure the actual magnitude of the curvature of a plastic hinge and to correlate the angle of deformation with resistance for beams subjected to dynamic loads. The primary variables were the amount of compression reinforcement, the distance between the concentrated loads, and the rate of loading. The dynamic step loads ranged in magnitude from about 1.10 to 1.25 times the static yield load. The computed values of moment, curvature, and deflection at the onset of plastic hinging were less than the experimental values for both static and dynamic loadings. The 30% increase in beam resistance under dynamic loads agreed with the increase in yield strength of the coupon specimens subjected to rapid straining. Plastic hinging was similar in the static and dynamic beams loaded at mid-span. Crushing occurred at approximately the same deflection under both types of load. For the beams with a pure moment region, a dynamic load equal to approximately 1.1 times the static load caused crushing at mid-span before the plastic hinge had developed as completely as it did for static loading, thus, for dynamic loads, the deflections were lower at the onset of crushing than they were for static loads.

R-372
Motion of Subsurface Soil Inclusions Subjected to Surface Blast Loading, Apr 1965, L. W. Heller, AD614902

An experimental investigation was conducted to provide an insight into the fundamental motion characteristics of inclusions buried in a soil field and subjected to a blast loading applied to the surface of the soil. The purpose of the work was to provide knowledge of those factors influencing the failure of an underground protective complex composed of structures, utility lines, communication lines, appurtenances, etc.

Dissimilar inclusions, representing elemental portions of a buried complex, were placed at different depths within a dry sand material compacted into a reinforced-concrete container. A sequence of 15 blast loadings at overpressure levels of 5 to 25 psi were applied to the surface of the sand, and the acceleration and displacement of the inclusions and the displacement of the soil were measured.

The experimental results indicate that the inclusions do not move with the surrounding soil but displace into the soil in the direction of the propagating soil stress wave. Stiffer inclusions attained the greatest acceleration, velocity, and displacement, inclusion-soil differential displacements of up to one-third the maximum inclusion displacement were recorded.

R-373
Architectural Acoustics, Simplified Measuring Techniques, May 1965, M. L. Look, AD616887

A preliminary study of the state of the art in architectural acoustics revealed a definite need for an improvement of methods for in situ acoustical measurements. A study was therefore made to develop and demonstrate measuring techniques and equipment that are simple, portable, and reasonably accurate.

Techniques for measuring three fundamental acoustical parameters are presented, and extensive background material is provided to familiarize the reader with the principles

and terminology of architectural acoustics. Methods, utilizing a memory oscilloscope, were developed for measuring the transmission loss of walls and partitions and for measuring the reverberation time of large rooms. A standard method for obtaining sound-absorption coefficients and measuring a wall material's specific impedance is presented, showing the expedience of the Smith chart for making impedance calculations.

Experimental measurements were made to evaluate and demonstrate the methods, and the results are in the form of tables, graphs, and oscilloscope traces. All three methods fulfill the task objectives. Elaborate setups are not required, and transmission losses can be determined at a fraction of the cost of measurements by present standard techniques.

R-374
Lateral-Plate Tests With Plate Diameter Varied, Apr 1965, H. L. Gill, T. J. Garcia, AD613991

To further the understanding of the mechanics of soil resistance to horizontal loading, a series of lateral-plate bearing tests was performed in the pit of the NCEL atomic-blast simulator. These tests were a continuation of an earlier test program which considered one plate diameter in one type of soil; during this series of test, three plate diameters were used, and the results were compared with data from previous tests. In addition, one test was performed with a different type of soil in an attempt to generalize the applicability of the test results. To simulate a variation in the depth of burial of the plate, overburden pressures were applied to the soil surface by a pneumatic bag.

R-375
Shallow-Buried Model Arches Subjected to a Traveling-Wave Load, Oct 1965, J. R. Allgood, R. H. Seabold, AD622552

Operation Snowball Project 3.4 consisted of tests performed on twelve model arches to determine their behavior under a traveling-wave blast loading. The prime objective was to define the body motions for a comparison with a previously developed theory.

On recovery of the structures after test it was found that the four 30-in. span arches were in relatively good condition. However, most of the eight 12-in. span arches were badly damaged. The damage was inflicted by ejecta of large, densely-compacted, hard lumps of clay. Fortunately, the ejecta did not obscure the results from the large arches on which all of the electronic instrumentation was located. All electronic instrumentation operated and records were obtained for all transducers.

Actual body motions were larger than those determined from the theory. Test results indicate that the foundation modulus varies and that arching shear should be expressed as a function of deflection.

Considerable data was obtained on shell response. Thrust distribution around the arch was fairly uniform, even though moments on the lee side were 30% greater than those at the same distance from the spring line on the blastward side.

Among other information, it was found that (1) the floor displaced about the same as the free field at the corresponding elevation, and (2) large forces developed in the footing tie bars.

R-376
Review of Report on the Effective Fender Systems in European Countries By Risselada and Van Lookeren Campagne, Oct 1965, T. T. Lee, AD622553

With the purpose of providing improved fenders for U.S. Navy use in berthing ships up to 20,000 tons, a Navy-contracted report by Risselada and Van Lookeren Campagne of the Netherlands on effective fender systems in European countries is digested and reviewed. Additional material has been added by the reviewer to provide a more useful treatment of the subject of European fendering systems. This report is intended as a supplement to NCEL Technical Report R-312, A Study of Effective Fender Systems for Navy Piers and Wharves, issued Mar 1965.

Significant European systems are described, with emphasis on systems attached to docks. The principles of operation, case history, and cost data for each system are given, comments, conclusions, and recommendations by both contractor and reviewer are reported and compared, and fender design criteria developed by contractor and reviewer are presented. Energy-absorption capacities, load-deflection characteristics, cost data (initial and annual), and the estimated longevity of contractor-recommended systems have been tabulated and illustrated schematically by the reviewer for the purpose of facilitating selection of a fender system suitable for a particular marine environment and berthing structure.

R-377
An Absolute Measurement of Thermal Neutron Albedo for Several Materials, May 1965, D. R. Doty, AD616011

Albedo is a concept which has proved useful in the calculation of the penetration of nuclear weapons radiation through a shelter entranceway. The application of the Albedo approach to describe the behavior of neutrons impinging upon various materials is the subject of this report.

Values of thermal neutron Albedo for lead, iron, paraffin, aluminum, carbon, and high-density concrete were measured, using the nuclear reactor of the University of California at Los Angeles. The results are in reasonable agreement with theoretical calculations. Verification of the angular dependence of neutron scattering was attempted, but with only partial success.

R-378
Numerical Analysis for Two-Layered Pavement Systems, Jul 1965, W. L. Wilcoxson, J. P. Nielsen, AD618066

Techniques are presented for numerically evaluating the Burmister integral expression for the settlement coefficient at ground level, in a layered-pavement system. Also, an economical and efficient means of evaluating ν_{12} is demonstrated, along with means for estimating the error associated with each evaluation. The influence curves presented will find immediate application in the design of airfield pavements and in the evaluation of existing runways. Included in a series of appendixes are the technical details for evaluating the settlement coefficient and data for constructing additional curves.

R-379
Monte Carlo Calculation of Neutron Streaming Through Two-Legged-Duct Entranceways, Jun 1965, L. B. Gardner, A. J. Mettler, AD616521

Several techniques for calculating dose rates in the study of shelter entranceways are reported herein. Calculations have been verified by experiments. These calculations also determine neutron energy spectra, a parameter that is difficult to measure and which is very useful in gaining insight into the design of protective structures. Both the neutron flux spectra and dose rates are calculated for various positions along the centerline of a two-legged duct. Calculations were performed utilizing the Adonis computer code which solves the Neumann approximation to the transport equation by Monte Carlo techniques. These Monte Carlo calculations were compared to second-leg calculations utilizing a semiempirical Albedo formula, and were also compared to experimental measurements made with a tissue equivalent dosimeter. Included is a discussion of Unigeom, a generalized computer program for Adonis geometry, designed to be run on the IBM 7094.

R-380
Harbor Screening Tests of Marine Borer Inhibitors - VII, May 1965, T. Roe, H. Hochman, AD615775

The Laboratory is exposing wood panels impregnated with various materials to determine their resistance to attack by marine borers. This report lists the results of harbor tests of treated panels removed from exposure between 15 Aug 1963 and 15 Aug 1964. It also lists all treated panels which have been exposed for 1 yr or more and which have shown no attack or insufficient attack to warrant removal.

When impregnated into wood test panels, creosote and 70-30 creosote-coal tar solution are about equally effective against Martesia and Teredine attack, but neither is effective against Limnoria. The addition of certain organic or metal-organic compounds to creosote or creosote-coal tar solution produces a preservative which is superior to creosote or creosote-coal tar solution alone. Treatments containing a combination of one material specifically toxic to Limnoria and another material specifically toxic to Teredine borers are also showing promise as preservative systems.

R-381
Floating Drydocks Used as Launch Platforms and Tracking Stations for Space Vehicles, Jun 1965, N. P. Oldson, AD464931L

The purpose of this report is to summarize and evaluate studies made under contract to develop concepts for using floating drydocks as launch platforms and tracking stations for space missions.

Contract NBY-32263 with the Martin Company specified (1) that a conceptual design study be made, that design and planning criteria be established, and that a structural analysis be made on the use of floating drydocks for Saturn V and Titan III-C launch systems at offshore Pacific missile range sites, and (2) that a conceptual design study be made for a floating tracking and communication station.

The Laboratory's evaluation of the contractor's effort is that the study was comprehensive and thorough and that the analysis and conclusions can be accepted with considerable confidence.

R-382
Issued as N-751

R-383
Pioneer Polar Structures - Jamesway Building Divider, May 1965, G. E. Sherwood, AD615520

A building divider was developed for the Jamesway polar shelter to separate two facilities located in the same building. The divider is constructed of tongue-and-groove panels of wood framing and plywood. It can be placed across the building width under any arch rib. The panels are insulated for soundproofing. A door included with the divider can be placed in any of three positions. The divider was in-service tested at the NCEL experimental camp near McMurdo, Antarctica. It was concluded that it satisfies the requirements for separating spaces in a Jamesway and should be used as a standard accessory for the Jamesway.

R-384
Pioneer Polar Structures - Jamesway Picture Window, May 1965, G. E. Sherwood, AD616984

A picture window was developed for use in the side of a Jamesway polar shelter. It is placed in a dormer of plywood and wood framing that fits between two Jamesway arch ribs. Windows can be placed side by side in any quantity to provide the desired width. Double plate glass is used in the standard window, but a hermetically sealed, triple-glass unit can be used as an alternate. Two prototype picture windows were in-service tested at the NCEL experimental camp near McMurdo, Antarctica. One window was used in the office, the other was used in the mess hall. It was concluded that the picture window satisfies the requirements for a window in the side of a Jamesway and should be used as a standard accessory for the Jamesway.

R-385
Protection of Mooring Buoys - Part IV. Results of Fifth Rating Inspection, Jun 1965, R. W. Drisko, AD616886

This is the sixth of a series of reports on the protection of mooring buoys. Fourteen test buoys were given their fifth rating for extent of coating deterioration, corrosion of steel, and fouling. A fifteenth buoy had been removed from testing at the time of the fourth inspection because of advanced deterioration. The coating systems on four of the buoys were in good condition, and those on the ten others showed varying degrees of moderate deterioration. Two sets of thirteen test panels each, coated with the different coating systems used on the buoys, were given their fourth rating inspection after 2 yr of service. One set was exposed in San Diego Bay and the other in Port Hueneme Harbor. The condition of the coating systems on the Port Hueneme panels showed a general correlation with the test panels and buoys in San Diego. On those buoys with antifouling paints, no detectable antifouling protection remained after 25 months but on the test panels at both locations two antifouling paints were still retarding fouling after 2 yr.

Three of the test buoys were cathodically protected with zinc anodes. The level of protection was great enough to mitigate rusting on the underwater portions of these buoys.

R-386
Horizontal Load Tests With a Segmental Pile, Jul 1965, H. L. Gill, T. R. Kretschmer, AD617916

Two series of tests were performed using a new testing apparatus called a segmental pile, which consists of 12-in.-diam steel tubing installed in a soil deposit in three separate longitudinal segments with all soil excavated from its interior. In the tests, the middle segment is forced horizontally while the corresponding loads and displacements are recorded. The first series of tests was performed in an artificially placed deposit of moist beach sand to (1) proof-check the new equipment, and (2) obtain data for comparison with the results of an earlier series of lateral-plate tests in the same soil. A second test series was performed in an undisturbed hydraulic fill of medium sand with a large variation of soil strength with depth. A purpose of the second series in addition to broadening the range of soil types studied was to attempt to correlate the lateral load-deflection relationship with an easily determined soil property.

R-387
Dynamically Loaded Strip Footing Buried in Dry Sand, Aug 1965, C. R. White, AD619815

This report describes the dynamic loading of a 12-in.-wide by 18-in.-deep by 6-ft-long concrete footing representing the strip footing of a subsurface shelter. Boundary conditions simulated those of a torsionally restrained footing of a flexible arch structure test-loaded at several different depths of burial. Static overburden pressure was applied only on one side to simulate the footing of an exterior wall. Dynamic loads from 5 to 40 kips/sq ft were applied to the footing while the adjacent soil was under simulated overburden pressures of 0 to 15 psi.

A logarithmic relationship between bearing modulus and overburden is demonstrated for downward displacements of the footing ranging from 0.25 to 1.5 in. The dynamic secant modulus increased exponentially with static overburden pressure.

R-188
Cancelled

R-189
Byrd Station Snow Tunnels - Maintenance Equipment and Techniques, Jun 1965, G. A. Sherwood, S. K. Gifford, AD465768

To prevent excessive snow-tunnel closure, equipment and techniques were developed to score and trim the snow-tunnel walls at Byrd Station, Antarctica. The equipment includes a chain saw and guide for scoring the snow to a controlled depth, hand tools for chipping the scored snow from the walls, a gasoline-fired snow melter for melting the waste snow, and a pump and hoses for transferring the water to the station sewer line. This equipment was tested at Byrd Station in Jan 1965 and found to be suitable for clearing walls with up to 7 in. of closure. Less frequent clearing would be possible if side-cutting equipment were used to remove the snow.

R-190
Bonding of Underwater-Curing Epoxies, Jun 1965, R. W. Drisko, AD466462

The bonding strength was measured for a number of underwater-curing epoxies applied to steel panels with several different methods of surface preparation. Sand-blasting resulted in the best bonding. The bonding strength was also measured for a number of underwater-curing epoxies applied to plastic, wood, and concrete specimens. The bonding strengths varied considerably from substrate to substrate and from epoxy to epoxy.

R-191
Polar Weather Limitations on Construction - Preliminary Arctic Survey, Jun 1965, N. S. Stehle, AD617265

To provide generalized weather patterns for logistics and construction in the Arctic, five stations - Barrow, Resolute, Thule, Kuroka, and Alert - were analyzed for temperature, wind, windchill, and sunlight-darkness.

Although this was a small representation of northern-hemisphere stations, as well as only a portion of the factors affecting logistics and construction, some generalizations could be made as to trends in the weather with latitude and with type of location. Further studies should be conducted, investigating other stations and more factors, in order to develop valid generalized weather patterns.

R-192
Polar Transportation Equipment - Lightweight, 1/4-ton Unit Cargo Sled, Jun 1965, N. K. Pierce, G. E. Sherwood, AD616522

A lightweight cargo sled made up of 1/4-ton-capacity units was developed to be pulled by light-duty tracked and wheeled vehicles. The units can be used singly or in multiples of up to six. The sled-unit couplers are suitable for connecting units on uneven terrain and for backing coupled sleds. The sled is of aluminum construction with a 5-ft by 5-ft 8-1/4-in. plywood deck.

A 2-unit sled was functionally tested in the Sierra Nevada and operationally tested at McMurdo, Antarctica. It was found suitable for trail use and for construction, maintenance, and operational functions at polar installations and facilities.

R-193
Deep-Ocean Biodeterioration of Materials - Part II. Six Months at 2,140 Feet, Aug 1965, J. S. Murioka, AD619014

This is Part II of a series of reports on the biological deterioration of materials in the deep ocean. It covers the data obtained after exposing 2,185 specimens of 601 different materials for 6 mo (197 days) on the Pacific Ocean floor at a depth of 2,140 ft (Test Site II). The materials were attached to a submersible test unit (STU). The STU was retrieved in Dec 1964 and returned to the laboratory for test and analysis.

There were marine fouling organisms attached to the plastic ropes, aluminum buoys, polyethylene-jacketed wire rope, nickel-plated shackles, and on some metal test specimens. Most of the plastic and all of the rope materials were covered with bacterial slime growth. Wood panels, plastics, and manila rope were attacked by marine borers. Cotton and manila rope specimens and jute-fiber burlap wrappings were severely deteriorated by bacterial action. Metal, glass, natural and butyl rubber, and some plastics with a smooth and extra hard surface were not affected.

The biological effects on materials recovered from Test Site II are briefly compared with materials recovered from Test Site I.

R-194
Dynamic Tests of Concrete Reinforcing Steels, Sep 1965, W. L. Cowell, AD622554

Dynamic tests were conducted on four grades of concrete reinforcing steel, (a) A15 intermediate grade, (b) A15 hard grade, (c) A432 (60,000-psi minimum yield strength), and (d) A611 (75,000-psi minimum yield strength). The effects of strain rate (up to 1.7 in./in./sec) and machine testing speed (up to 40 in./sec) on the upper yield stress and tensile strength of each steel were obtained. Results are compared with other dynamic tests conducted on concrete reinforcing steels.

R-195
Dynamic Shear Strength of Reinforced Concrete Beams - Part I, Dec 1965, W. A. Keenan, AD627661

A series of reinforced concrete beams were tested to study shear and diagonal tension in beams under dynamic load. The tests constitute the first phase of a study designed (1) to determine criteria for the minimum amount of web reinforcement required for developing the ultimate flexural resistance of beams and (2) to evaluate the difference between these criteria for static and dynamic loading.

Nine beams were tested, three were loaded statically and six dynamically. Each beam was simply supported at its ends, all loads both static and dynamic were uniformly distributed along the span. Major variables were stirrup spacing, peak load, load-duration, and rate of loading.

It was found that (1) the shear resistance at diagonal tension cracking and at first yielding of the stirrups increased under dynamic load, and (2) the formulas presented in a definitive report by a joint committee of the American Concrete Institute (ACI) and the American Society of Civil Engineers (ASCE) adequately predicted the static shear resistance but grossly underestimated the dynamic shear resistance. Evidence is cited which attributes the increase in shear resistance under dynamic load to an increase in the tensile strength of the concrete and yield strength of the stirrups. An effective amount of web reinforcement ($(Rb_w)_e$), 69% less than the amount required by the ACI-ASCE formula, resulted in flexure failures under static and dynamic load.

Equations are presented which permit prediction of the dynamic shear resistance corresponding to diagonal tension cracking and first yielding of the stirrups. A dynamic response chart is developed for estimating the maximum shear at the supports of a simply supported beam under a uniform dynamic load.

R-196
Ice Engineering - Growth Rate of Sea Ice in a Closed System, Jun 1965, N. S. Stehle, AD617194

A laboratory investigation was conducted of the growth rate and salinity characteristics of fresh water and sea ice under a variety of experimental conditions in order to

better understand the factors affecting growth rate, salinity, and brine drainage. The sea ice was produced in water of increasing salinity (a closed system), which produces ice that increases in salinity and generally has lower strength, poorer surface qualities, and a greater heterogeneity than natural ice.

From these experiments, it was concluded that further tests and analyses should be conducted to determine the process of natural brine drainage and to find additional methods to accelerate it. Growth rate data of sea ice in a closed system, which was little affected by the increase in water salinity until three-quarters of the ice was frozen, fit general growth-rate equations. Mathematical analyses of growth-rate equations and data from flooded and natural sea ice should be continued to develop a family of curves for the field determination of sea ice growth rates.

R-397
Protective Coatings for Steel Piling, Correlation of Results of Parallel Test Exposures at Port Hueneme and Guam, Aug 1965, C. V. Brouillette, R. L. Alumbaugh, AD470969

At the conclusion of a 30-mo exposure at Port Hueneme and a 48-mo exposure period at Guam, all seven systems showed some coating failure resulting either from the driving operation or the exposure conditions. Moderate to heavy damage to all systems was caused just above the mudline by the abrasive action of backwash in the surf at Port Hueneme. Coating failure, resulting in pitting, was observed in all coatings just below the mudline at Guam.

On a combined performance basis a vinyl mastic, a phenolic mastic, and the Navy saran coating are considered essentially equal. On a total applied cost basis the vinyl mastic and the saran are preferred, with the saran being slightly more economical.

R-398
Snow Drift on Natural, Depressed, and Elevated Surfaces Near McMurdo, Antarctica, Oct 1965, N. S. Stehle, G. W. Sherwood, AD622572

Drifting snow in polar areas results in problems of logistics and maintenance. To obtain knowledge of snow drift and accumulation on the Ross Ice Shelf near McMurdo Station, Antarctica, measurements of drift were made on natural, depressed, and elevated surfaces, and in camp and storage areas on these surfaces.

From these measurements, it was concluded that depressed surfaces quickly become filled with snow to the natural-surface level, and should be avoided in locations of annual accumulation. Elevated surfaces accumulate minimal drift when used for roads, runways, or storage areas, and should be investigated for use as future camp locations.

R-399
Compacted-Snow Runways in Antarctica - Deep Freeze 61-64 Trials, Feb 1966, R. C. Coffin, AD629675

In Deep Freeze 61, NCEL provided technical guidance to a Navy snow-compaction team investigating the practicability of building roads on snow-covered sea ice over McMurdo Sound and runways on the deep snow cover of the Ross Ice Shelf adjacent to McMurdo Station. These investigations and trials continued through Deep Freeze 64. This work was directed toward the development of a layered, compacted-snow runway on deep snow which would support aircraft weighing up to 150,000 lb with tires on the main wheels inflated to 135 psi, it was only partially successful. During the trials, there were intermittent areas of compacted snow capable of supporting aircraft weighing up to 100,000 lb with main tires inflated to 90 psi, but low-strength areas prevented takeoffs and landings with aircraft weighing over 25,000 lb with main tires inflated to 60 psi.

New processing and elevating equipment introduced in the Deep Freeze 64 trials showed considerable promise of producing dense, uniform, high-strength, elevated areas of compacted snow. It was concluded that the trials should continue in Deep Freeze 65 to explore the capabilities of this equipment.

R-400
Airfield Marking Paints, I. Effect on Cracking of Slurry Seal, Oct 1965, R. W. Drisko, AD622555

A study is being conducted to determine the basic causes of early failure of airfield marking paints and the deterioration of underlying slurry seal and asphaltic pavement associated with these paints. In the present report, data and statistical analyses are presented on the initial cracking of slurry seal along the edges of stripes of 20 experimental paint formulations. Such cracking, which in some cases occurred as early as 2 weeks after application, was generally followed by edge lifting and then by loss of adhesion of slurry seal to the underlying asphaltic pavement. Stripes of paints containing chlorinated rubber cracked extremely rapidly, especially such stripes with a double thickness. Alkyd painted stripes generally had less cracking than oleoresinous painted stripes. Poorer performance of alkyd paints was associated with a solvent of high boiling range, and poorer performance of oleoresinous paints with solvents of low aromaticity. The addition of a slight amount of carbon black to the test paints raised the temperatures of stripes to only a very slight extent. This addition improved the performance of some test paints but lowered it for others. Stripes with greater flexibility generally had less edge cracking. There were numerous interactions between the above paint variables.

Further causes of marking paint failure and the related damage to pavements and slurry seals are being investigated and will be reported later.

R-401
Polar Transportation Equipment--One-Ton Power Wagon With High-Flotation Tires, Aug 1965, W. H. Beard, G. E. Sherwood, AD468536

Two modified model S6W300 1-ton power wagons equipped with low-pressure 17.00 x 16 high-flotation tires were used on all types of roads and trails on adjoining areas of snow, ice, and frozen ground at McMurdo, Antarctica, during the summer seasons of FY-64 and FY-65. One was used as a camp service vehicle to haul supplies and personnel between McMurdo Station on Ross Island and the NCEL camp on the Ross Ice Shelf, a distance of about 6 miles. The other was used to support snow-compaction studies on the Ross Ice Shelf and at Williams Field.

Both power wagons performed well with a minimum of repair and maintenance, and no special skills were required for their operation and upkeep. They could be driven over all types of roads and trails, including 1-day-old equipment-packed trails on deep snow and icy roads with grades up to 20%.

During Deep Freeze 65 the S6W300 power wagon equipped with 17.00 x 16 tires was adopted by the U.S. Naval Support Forces, Antarctica, as an interim standard light-duty vehicle for McMurdo Station. It is recommended for inclusion in the equipment allowance for polar coastal stations.

R-402
Ice Construction - Survey of Equipment for Flooding, Jan 1966, C. R. Hoffman, J. E. Dykins, AD628548

Two surface-flooding techniques for improving natural ice areas have been developed by the U.S. Naval Civil Engineering Laboratory (NCEL). Confined flooding, in which the flood is retained by natural boundaries and dikes, is used principally for filling and leveling thick natural ice areas. Free flooding, in which the outward flow of water is retained by freezing of the flood boundary, is generally used for accelerated thickening of relatively thin natural ice.

This survey shows that adequate surface pumping units and flood distribution systems have been developed for confined flooding, and subsurface pumping units are being developed for free flooding. Mobile power-handling equipment is available for moving, lifting, and placing the pumps and other heavy gear required for ice construction, but the available man-handling gear for this work is less than adequate. Drills and augers are available for boring shallow holes in ice but not for deep holes. Electrical equipment and materials are available for cold-weather operation of single pump installations but systems for operating several pumps from a single power source have not been fully developed. Hot-air heaters, air compressors, chain saws, and other miscellaneous gear required for all types of ice flooding are available from commercial sources.

It was concluded that continued development of the subsurface pumps and the necessary supporting equipment is needed to advance the techniques for leveling and strengthening natural ice areas.

R-403
Cancelled

R-404
Photoelastic Determination of Strain Distribution in Cement Paste, Mortars, and Concrete, Nov 1965, J. R. Keeton, AD622780

The photoelastic method of stress analysis by means of transparent plastic coatings was employed to study the effects of aggregate inclusions in prisms of hardened portland cement paste, Ottawa 20-30 sand mortar, Ottawa graded sand mortar, river sand mortar, and river gravel concrete. With hardened cement paste as the reference, nonuniformity of maximum shear strain distribution was found to increase with the maximum size and with the range of gradation of the aggregate particles included in the cement paste. Comparative tests revealed that strain distribution is quite different between loaded and nonloaded hardened cement paste.

In a preliminary test to determine the effects of constant sustained stresses upon creep in the photoelastic coating itself, the inherent creep characteristics of the plastic coating material used in the study were found to be negligible.

R-405
An Experimental Current-Probe System for Measuring Conducted Radio-Frequency Interference From 20 kc to 80 Mc, Oct 1965, J. L. Brooks, AD622556

New and improved techniques and circuits based on newly developed instrumentation have been devised for adequately performing conducted radio-frequency-interference (RFI) acceptance and compatibility tests on electrical equipment. Tests made to military specifications which have been used in the past as guides for this type of testing have been found to be inadequate for determining the compatibility of tested equipment with electromagnetically sensitive equipment connected to the same power circuit or interconnected in a common system.

The new development, based on the current probe technique and involving measurements of noise-source impedances, load impedances, and noise currents, now enables one to specify completely in terms of the fundamental units of power the conducted RFI characteristics of the device under test. An impedance and phase meter was designed which covers the frequency range of 20 kc to 80 Mc and an impedance range of 10 to 10,000 ohms at 0 to 360 deg.

Functional utilization of the new techniques will require that applicable performance requirements be incorporated into appropriate military specifications. More explicit acceptability limits may now be specified. Recommended revisions are defined in this report. An evaluation of the hardware developed is presented as well as examples of RFI measurements. Complete circuit diagrams are provided.

R-406
Dynamic Compression Tests on Thin-Section Reinforced Concrete, Dec 1965, D. S. Fuss, AD626770

In support of the task objective of formulating design criteria for thin-shell concrete structures to withstand dynamic loading, experiments were performed to obtain information about the behavior of thin-section reinforced-concrete members subjected to dynamic compression. Information was obtained on the dynamic material strength and on the characteristics of the failure process.

The test members were planar concrete panels reinforced with a single layer of square-meshed welded-wire fabric. Several combinations of panel thickness, reinforcing-wire diameter, and mesh size were investigated, as well as two concrete strengths (4,000 and 7,000 psi) and a single rate of compressive-stress application (100,000 psi/sec).

The results of the experiments show that the dynamic material strength of thin, compressively loaded members can be estimated as the sum of the dynamic concrete-failure load and the dynamic steel-yield load as long as estimates of dynamic concrete-failure load are based upon concrete cylinder strength and estimates of dynamic steel-yield stress do not exceed the maximum stress prescribed for static design by the ACI code (ACI 318-63). During the failure process, high-strength concrete was found to expel more particles, traveling at higher velocities, than normal-strength concrete, and some types of reinforcing mesh were found to initiate expulsion of large pieces of concrete. These two failure characteristics, among others, are illustrated in the report by the use of extracts from high-speed photography of the tests.

R-407
Waste-Heat Seawater Conversion Unit at Marcus Island, Sep 1965, J. S. Williams, AD622557

An in-service test of a developmental multistage flash evaporator utilizing rejected heat from a diesel generator is described. Some background information is given, as well as test results covering a 20-month period. It is concluded that the system furnishes a very satisfactory means of providing potable water from a seawater source. The importance of proper installation is also pointed out.

R-408
Potable-Water-Shortage Survey, Oct 1965, W. R. Nealsen, AD474052

Present and predicted potable-water shortages at Naval shore stations were surveyed to obtain information relating station water requirements to the growing national and worldwide concern over water availability. For this survey, a lack of conventional fresh-water sources and unreasonable costs for water procurement and production constitute a shortage. Current water problems were found to exist primarily at overseas facilities on small islands or in unfavorable coastal locations. Polar areas have a continuing water problem with high water-production costs, resulting in a number of subsidiary problems in polar-base operations. Within the continental United States, there are a number of large stations located in regions where overall water deficiencies are expected to occur by 1980 or 2000. The major problem areas are Southern California and the Texas Southern Gulf Coast. A survey of water quality was also made, and corrosion, scale, and high concentrations of deleterious minerals were the most significant problems not responding to conventional treatment. It is recommended that a further study be initiated to develop improved methods for solving the water-quality problems.

R-409
Polar Transportation Equipment, Six-by-Six Truck-Tractor and 20-Ton Semitrailer With High-Flotation Tires, Oct 1965, W. H. Beard, G. E. Sherwood, AD472105

A 6x6 truck-tractor and 20-ton semitrailer with 19.75 10x20, low-pressure, high-flotation tires was used to haul cargo on all types of roads on adjoining areas of snow, ice, and frozen ground at McMurdo, Antarctica, during the summer season of Deep Freeze 65. The truck-tractor was also used as a prime mover for dolly-mounted trailers and for compacted-snow-runway maintenance equipment such as snow planes, compaction rollers, and drags. A hydraulic crane mounted on the truck-tractor was used for loading trailers, assembling equipment, and camp maintenance.

The truck-tractor performed quite well in all capacities, requiring only minimum maintenance and no repairs in over 300 hr of operation. No special skills were required for its operation and upkeep. It was driven on equipment-packed roads over deep snow and snow-covered ice and on icy roads with grades up to 20%. On deep snow a bearing strength of 15 to 20 psi in each 4-in. layer of the top 12 in. was necessary.

During Deep Freeze 65, the 6x6 truck-tractor and 20-ton semitrailer with 19.75x20 tires was adopted by the U.S. Naval Support Forces, Antarctica, as an interim standard cargo carrier for McMurdo Station. It is recommended for inclusion in the equipment allowance for polar coastal stations.

R-410
Thin-Film Evaporation in a Single Tube, Nov 1965, E. J. Beck, AD476216

In a study of thin-film evaporation without boiling for the improvement of heat-transfer rates especially in sea-water conversion units, experimental determinations were made of wall temperatures and evaporation coefficients for relatively thin films flowing down inside a vertical tube. Various methods of introducing the coolant with and without steam are discussed, as are methods of applying the results to vapor-compression stills. A series of runs with the same equipment were also made in which water was evaporated by nucleate boiling, as would occur in most conventional vapor-compression stills. The advantages and disadvatnages of the various methods are discussed.

The experiments indicate that an evaporator with standard vertical tubes, in which the evaporation is from a very thin film without boiling and the liquid is carried in a concurrent flow of wet steam, would have better than a 2.5 advantage in fuel consumption over a conventional vapor-compression still with boiling.

R-411
Pneumatic Conveying System for Removal of Sand from Drydocks, Nov 1965, S. Phelps, J. Quirk, AD473382

The removal of sandblasting material from drydocks is a problem which has been met by a variety of removal concepts at various Naval shipyards.

This report describes the specifications, operating characteristics, and test results of a pneumatic-conveying system which transports the sand to a dump truck on the drydock deck, and which can be operated by the available dock air supply.

The system was successful in performing its function and offers several advantages over previous methods, but does not answer the total sand-removal problem.

R-412
Monte Carlo Calculations of Gamma-Ray Streaming Through Coplanar and Noncoplanar Ducts, Jan 1966, L. B. Gardner and A. J. Mettler, AD627890

Past experimentation with the streaming of gamma radiation through models of ducted entranceways by using high intensity AU-198, CS-137, and CO-60 gamma-ray sources has proved to be time consuming. As a means of reducing expenses, a Monte Carlo computer program for studying gamma-ray streaming was utilized.

The Monte Carlo technique, using the Adonis computer code developed by the United Nuclear Corporation, was used to calculate gamma-ray dose rates and energy spectra within two-legged and three-legged rectangular air ducts through concrete. These calculations were performed to intercompare a coplanar and a noncoplanar configuration for CO-60 gamma-ray streaming through a three-legged duct.

The results of the Monte Carlo calculations are compared with previously obtained experimental findings. The agreement between the Monte Carlo method and previous experiments supports the validity of using the Monte Carlo method to simulate the behavior of gamma rays in ducts.

R-413
Improved Heat Transfer in Multistage Flash Evaporation, Dec 1965, E. J. Beck, AD625267

A study was made to explore the promising methods for improvement of multistage flash evaporators for the production of potable water from contaminated sources. The nature of the cycle is such that it is clearly limited by the heat-transfer processes. Of the available methods for improving heat transfer simply and reliably, it was concluded that the use of a convoluted heat-transfer wall which produces thin films on both surfaces showed the greatest promise. High heat-transfer rates had previously been reported for such a surface, but measurements had not been reported which allowed detailed assessment of the total picture. This report gives the details of a surface with small convolutions and the results of laboratory experiments to isolate the film coefficients on the two sides of the heat-transfer surface. A second experiment allowed direct measurement of an identical surface on the low-temperature side only, using a "cat whisker" thermocouple search technique.

R-414
Eccentrically Loaded Long Piles, Feb 1966, J. J. Hromadik and P. A. Dantz, AD628996

This study is primarily aimed at improving the understanding of the behavior of eccentrically loaded long piles (or columns) of reinforced concrete. A general inelastic analysis was developed and applied to circular, square, and octagonal cross sections, for both solid members and ones having a hollow circular core. For convenience, the analysis was programmed for the IBM 1620 computer using Fortran.

Twenty-four general cases are presented in the form of graphs. These graphs were used to evaluate ultimate loads and to study the effect of variables on ultimate loads. Also presented are the results of short-term load tests to failure of 39 specimens representing five basic cross sections. Other major test variables were slenderness and load eccentricity. Good agreement was obtained between theory and test, hence, it may be judged that the basic assumptions are reasonable. Since the theory appears to be confirmed by the test results, it is recommended for use by structural designers.

R-415
Ice Engineering - Tensile and Bending Properties of Sea Ice Grown in a Confined System, Jan 1966, J. E. Dykins, AD626585

The salinity, density, and petrographic structure of sea ice grown in a confined system can be closely identified with the characteristics of sea ice formed in a natural environment. This observation was made for ice 44 cm thick. The tensile strength was found to be more dependent on the orientation of the grain and subgrain structure than it was on temperature. The ice had a mean horizontal tensile strength of 67 psi at both -10C and -20C and of 78 psi at -27C. The mean vertical tensile strength was 152 psi at -10C, 163 psi at -20C, and 208 psi at -27C. The grain size or density of the ice did not have any appreciable effect on

the tensile strength. The bending creep from single-point loading of simple ice beams was similar to the high-temperature creep behavior of other solid materials; i.e., the creep generally progressed through three stages, primary, secondary, and tertiary or the creep-rupture phase.

R-416
Electromagnetic Shielding Effectiveness Measurements Using Low Conductivity Closed Surfaces, Dec 1965, H. A. Lasitter, AD624708

In an investigation to predict the shielding effectiveness of low-conductivity materials used in electromagnetic-interference-shielded structures, the symmetrical configuration of a spherical shell was adapted to approximate the closed walls of a normally cubical or rectangular shielded enclosure. A hemisphere was used for the experiments and a half cube with the same surface area and conductivity (0.1 mho/m) was used for comparison of an equivalent rectangular structure.

In measurements over a frequency range of 20 to 900 mc (or mhz), the half cube showed a greater shielding effectiveness than the hemisphere over a major portion of the frequency range. The primary advantage of the hemisphere is the ability to predict the absorption over a wide band of frequencies. The conductivity of the materials used in this investigation was found to exhibit an empirical relationship with frequency range.

R-417
Snow Transport Equipment - Model 40 Towed Snowplow Carrier, Dec 1965, R. W. Hansen, AD627983

A 40-ft-long ski-mounted snowplow carrier, designed for towing, was developed to eliminate pitching and rolling of the snowplow on deep snow and to permit uniform removal of snow from borrow pits, compacted-snow areas, and ice. The carrier includes two grader blades which funnel the snow into the feeder box of a rotary snowplow. These blades are hydraulically controlled for leveling or plowing.

Two prototype snowplow carriers, towed by size 2 tractors, were used near McMurdo, Antarctica, during Deep Freeze 64 and 65 for transporting fill snow to elevate a 150- by 6,000-ft experimental compacted-snow runway and a 3-mile-long road. They were also used for clearing drift snow from the experimental compacted-snow runway and the operational sea-ice runway. In these operations, snow was cast up to 100 ft at rates up to 2,000 cu yd/hr.

It was concluded that the Model 40 snowplow carrier is suitable for elevating roads and runways on deep snow and for clearing drift snow from compacted snow and ice. It should be included in the equipment allowance for polar installations on snow.

Specifications and drawings for the snowplow carrier are available in NCEL Technical Note N-757.

R-418
Cancelled

R-419
Asymptotic Growth Curves With Applications, Dec 1965, W. L. Wilcoxson, AD626318

A recurring problem at NCEL concerns the fitting of experimental data to an empirical or semiempirical formula of nonlinear form. Such problems, which involve asymptotic growth curves, are not amenable to solution by the usual linear least squares curve fitting techniques. Since nonlinear curve fitting problems have arisen in connection with various NCEL tasks, it appeared desirable to devise and adapt general mathematical methods for treating a class of nonlinear problems. This report describes methods for performing nonlinear curve fits, together with a method for choosing the best of several possible empirical formulas. Fortran computer programs are provided, and applications to NCEL tasks are discussed.

R-420
Studies of Snow Movement in a Wind Duct, Nov 1965, N. S. Stehle, AD623845

Drifting snow in polar areas with permanent snowfields presents problems in logistics and maintenance. To better understand the physics and mechanics of snow movement, studies are being conducted at NCEL in a 23-1/2-ft-long wind duct at wind speeds from 5 to 20 mph with temperatures from -35F to +20F. At these speeds, movement of in-place snow on the floor of the tunnel depends on the amount of snow added to the airstream. The amount of in-place snow moved is dependent on wind velocity, air temperature, exposure to solar radiation, and the physical properties of snow. Wind-duct tests using snow should be continued to determine the effect of prolonged wind, solar radiation, snow temperature, and varied surface patterns on drifting.

R-421
Migration of Bubbles in Ice Under a Temperature Gradient, Dec 1965, N. S. Stehle, AD627984

With the purpose of obtaining insight into the mechanisms of brine migration in polar ice, a laboratory investigation of the migration velocity of air bubbles and vapor figures in fresh-water ice was made (1) to test the theory of the migration of fluid inclusions under a temperature gradient, (2) to verify Nakaya's investigations of the migration of vapor figures under a temperature gradient, and (3) to study the physical characteristics of bubbles in ice under a temperature gradient.

The migration velocities of vapor figures measured in this investigation agreed with those of Nakaya, but his theoretical formula for the migration velocities of vapor figures had to be modified to take into account the effect of internal air pressure and figure shape. The observed velocities of vapor figures and air bubbles supported the theoretical calculations. It was determined that bubble shape, which changed during migration, and the air pressure in the bubble, which varied among bubbles, together with temperature markedly affected the velocity. In addition to changing shape during migration, the bubbles gradually filled with frost. The effect of frost on the velocity and the reason for its formation could not be completely explained. Similar experiments should be conducted with sea ice to determine the velocity of migration of brine pockets and the mechanisms limiting velocity.

R-422
High-Pressure Performance of Voltaic Cells, Jan 1966, R. D. Hitchcock, AD627931

Measurements were taken on the open-circuit voltage of a magnesium-copper electrolytic couple immersed in seawater under pressures up to 18,000 psi. The cell voltage was not affected by pressure from a vacuum of 3 cm of mercury to a pressure of 18,000 psi.

Measurements were also taken on the voltage of a lead-acid cell immersed in oil under pressures from atmospheric to 20,000 psi. Results indicate that cell performance is unaffected by pressure in this range.

Two theories are discussed which attempt to explain the fact that the observed open-circuit voltage of the magnesium-copper cell is more than a volt below the voltage calculated from half-reaction potentials. One theory assumes that adsorbed hydrogen atoms alter the work function of the electrode, the other theory proposes that, when magnesium dissolves in water, equilibrium is too far on the side of complete reaction in one direction to allow measurement of the free energy of formation of the aqueous magnesium ion.

R-423
Potentiostatic Corrosion Studies of Iron, Type 304 and Type 321 Stainless Steel, Dec 1965, H. A. Porte, AD624269

Important in the control and prevention of corrosion, electrochemical characteristics of iron and two types of stainless steel in various electrolyte systems were investigated as part of a long-range study of the mechanisms of the electrochemical and physical transformations that occur at electrode-electrolyte interfaces.

The anodic potentiostatic polarization of iron was investigated in deaerated in sulfuric acid, deaerated and aerated borate buffer solution (pH 8.4), and in deaerated and aerated seawater. The effects of potential rate change and chloride ion concentration on polarization characteristics were studied in the borate buffer and sulfuric acid solutions. Polarization curves were determined for Type 321 stainless steel in deaerated in sulfuric acid and in deaerated borate buffer, the effect of chloride ion concentration was studied in both solutions. Polarization experiments were performed on Type 304 stainless steel in deaerated in sulfuric acid, the effect of cathodic pretreatment was studied.

Electrochemical polarization curves have proved to be useful in predicting the behavior of a particular metal or alloy in different environments, and in predicting which of a group of alloys would be the most corrosion resistant in a particular environment.

R-424
Laboratory Simulation of Waves Generated by Underwater Nuclear Explosions, Jun 1966, J. M. Jordan, AD636408

The kinematics of surface gravity waves produced in water 2.5 ft deep in a basin 90 ft square by a sudden, localized disturbance was studied through measurements of height and period. The waves were generated by the quick withdrawal or immersion, or combinations of these actions, of a 14-ft-diam half-paraboloid plunger located near the mid-point of one wall of the basin. Smaller plungers of diverse shapes were also used. Measurements were made both in the constant-depth portion of the basin and over a beach with a uniform slope of 1/13.6, which was directly opposite the plunger. At the shoreline about 80 ft from the plunger, waves produced by a sudden withdrawal, for example, were 3 in. high, with a maximum period of 3 sec.

The waves compare adequately with those predicted by the theory of Kranzer and Keller, although they were 40% smaller and 20% shorter. By extrapolation, it was found that waves were produced which adequately simulated those from the actual underwater detonation of a high-energy explosive (5 tons TNT) and a nuclear device (20-knot equivalent). It is concluded that with proper scaling the plunger can be used to simulate waves from such causes.

R-425
Issued as N-794.

R-426
Screening of Chemical Toxicity to Marine Borers - Final Report, Feb 1966, H. Hochman, H. P. Vind, AD629707

TR-048 and this report are complementary. The former describes the methods employed in testing the toxicity of chemicals toward adult limnoria tripunctata and the larvae of teredo diegensis and presents some toxicity data. This report presents all toxicity data gathered as a part of the toxicity screening program and analyzes this data with respect to chemical structure and toxicity mechanisms. These correlations are of necessity sometimes vague because of the lack of sufficient data on toxicity mechanisms as well as the multiple mechanisms by which some chemical compounds can act.

The most striking and significant finding was the discovery that chemical compounds that were toxic to one borer genus frequently or even generally were little toxic or nontoxic to another genus. When a chemical compound exhibited toxicity to both genera of test animals employed in this test, the toxic mechanism was generally different in each case. An improved marine wood preservative, therefore, must contain a combination of agents that act by different toxic mechanisms rather than a single chemical compound or group of compounds that act by a single toxic mechanism or predominately by one mechanism.

The results of the toxicity screening tests have been employed by the Laboratory as a guide in the selection of the compounds for its harbor screening test program. The results of this latter program are being used as a basis for harbor testing at full-sized piles. The results of the pile tests will be used as a basis for formulating suitable treating solutions.

R-427
Issued as N-806.

R-428
Deep-Ocean Biodeterioration of Materials, Pt. 3, Three Years at 5,300 Feet, Feb 1966, J. S. Muraoka, AD631078

This is Part 3 of a series of reports on the biological deterioration of materials in the deep ocean. It covers the data obtained after exposing 1,318 test specimens of 316 different materials for 35 mo on the Pacific Ocean floor at a depth of 5,300 ft (Test Site 1). The materials were attached to a submersible test unit (STU). The STU was retrieved in Feb 1965 and returned to the Laboratory for tests and analyses.

Hydroid growths were found on all the test specimens placed on the STU. A few species of tube worms were found attached to metals, plastics, and coated test specimens. Most of the plastics and all the rope materials were covered with bacterial slime growth. Cotton and manila rope specimens were severely deteriorated by bacterial action. Wood panels, plastics, and manila ropes were attacked by marine borers. Metals, natural and butyl rubber, and certain plastic materials were not affected.

R-429
Engineering Properties of Shotcrete, May 1966, W. R. Lorman, AD634074

The important technical information gleaned from a literature survey covering the past 55 yr of laboratory and field experiences with mortars and concretes applied pneumatically (i.e., shotcrete) is presented. In addition to general facts concerning this method of construction, various physical properties of hardened shotcrete, which have been investigated by numerous researchers, are discussed. Insofar as strength and elasticity are concerned, hardened shotcrete generally is quite similar to hardened mortar or concrete made in the conventional manner and fully compacted. An experimental program is recommended for (1) developing supplementary data with regard to density, elasticity, and strength (bond, compressive, and flexural) of hardened shotcretes (premixed wet) made with 3/4-in. as well as 3/8-in. maximum-size aggregate, and (2) ascertaining whether or not comparatively small prismatic test specimens truly represent the engineering properties of hardened shotcrete in large wall panels.

R-430
Hydraulic-Pneumatic Floating Fender, Additional In-Service Tests, First Series, Mar 1966, T. T. Lee, AD630637

Tests of two experimental hydraulic-pneumatic floating fenders, first in a well-protected harbor (Port Hueneme) and then in a relatively exposed harbor (San Diego), are described. Each fender consists of a 50-ft-long bulkhead fronted by two air-filled and two water-filled rubber bags. Also included is information to aid engineers in increasing the energy-absorption capacity of existing dock fender systems.

After 19 mo of in-service tests of the floating fender it was concluded that (1) the energy-absorption capacity of the fender is adequate for a well-protected harbor such as that at Port Hueneme, (2) a fender system serving ships under navigation conditions and in a marine environment similar to those at Port Hueneme, requires a minimum energy-absorption capacity of 16 and a maximum of 50 in.-tons/1,000 tons of ship displacement; and (3) resistance to ship motion, including the hydrodynamic mass effect, is an important parameter which requires further investigation. It is recommended that (1) full-scale tests of berthing impact be continued, particularly at exposed harbors, to determine energy requirements for other fender designs and (2) model tests of berthing impact be initiated, particularly of the resistance to motion, for use in evaluating hydrodynamic mass. Although measurements were not made at San Diego, it is concluded that the fenders provided satisfactory service but were not loaded to capacity.

R-431
Protection of Mooring Buoys, Part 7, Results of Sixth Rating Inspection, Dec 1965, R. W. Drisko, AD624799

This is the seventh of a series of reports on the protection of mooring buoys. Fourteen test buoys were given their sixth rating for extent of coating deterioration, corrosion of steel, and fouling. A fifteenth buoy had been removed from testing at the time of the fourth inspection because of advanced deterioration. The coating systems on four of the buoys were in good condition, those on nine others showed varying degrees of moderate deterioration, and one was in poor condition. Two sets of 13 test panels each, coated with the different coating systems used on the buoys, were given their fifth rating inspection after 2-1/2 yr of service. One set was exposed in San Diego Bay and the other in Port Hueneme Harbor. The condition of the coating systems on the Port Hueneme panels showed a general correlation with the test panels and buoys in San Diego. On buoys coated with antifouling paints, no detectable antifouling protection remained after 25 mo, but on the test panels at both locations, two antifouling paints were still reducing fouling after 2-1/2 yr.

Three of the test buoys were cathodically protected with zinc anodes. The level of protection was high enough to mitigate rusting in the underwater portions of these buoys.

R-432
Submarine Illumination and Television in Harbor Water, Feb 1966, R. D. Hitchcock, AD628991

A submersible closed-circuit television system has been used to conduct a quantitative study of submarine illumination and vision in harbor water. The television camera is attached to a spread-U structure which holds a target jig and a pair of incandescent-light assemblies. The light assemblies are equipped with remotely controllable polarizers and employ 1,000-W quartz-iodide lamps. Observations of various types of targets were made during daylight hours and at night. The effects of color filtering, polarization filtering, and off-axis illumination on detection range and resolution for the Vidicon TV camera were determined. Theoretical calculations were confirmed. In harbor water with an attenuation length around 5 ft, color or polarization filtering provides no improvement in contrast or resolution. The seeing range for a Vidicon camera, in this type of water, is generally less than 10 ft. The best resolution obtainable was 1/4 in. at 8.7 ft.

A history and analysis of the performance of the underwater television system is included. Results are given of an experimental study of methods of constructing underwater lamp assemblies using tungsten-iodide bulbs.

R-433
Mechanics of Raising and Lowering Heavy Loads in the Deep Ocean, Cable and Payload Dynamics, Apr 1966, P. Holmes, AD631267

Based on a theoretical analysis of the cable and payload dynamics during lowering or raising heavy loads in the deep ocean given in Project TRIDENT Technical Report No. 1370863, further calculations of the maximum dynamic stresses expected in the lowering cable are presented covering a wide range of cable and payload parameters. The theoretical analysis is adapted to a proposed design procedure, and two typical design examples are given, the results of which are discussed in terms of the safety of the lowering or raising operations.

In order to make the design procedure applicable with a greater degree of confidence, it is considered necessary to make measurements of cable tensions and load and ship motions during a full-scale operation to fill in deficiencies of data and provide a basis for verification of theory and calculations. In particular, data are needed on the coefficients of drag and mass, which at this stage must of necessity be estimates.

R-434
Deadman Anchorages in Various Soil Mediums, Apr 1966, J. E. Smith, and J. V. Stalcup, AD631848

A test program was conducted to investigate deadman anchorage holding capacities under applied horizontal loads. Deadmen fabricated of concrete and ranging in face area from 5 to 72 sq ft were tested in depths of embedment from ground level to 7 ft. The deadmen were pulled both singly and in groups of three, in sand and in two soils with cohesive characteristics. The test program also included tests on a model scale.

The applied load versus horizontal displacement relationship exhibited a basic recognizable form for all conditions of tests. By graphic analysis, a series of reaction-pattern curves was developed relating deadman holding power in each cohesive soil to three factors, deadman face area, depth of embedment, and whether the deadmen were embedded singly or in a group. The results of the sand tests which were described in a previous report were converted from the previous analysis to a compatible form and presented with the cohesive soil test results. These curves provide an empirical means for determining deadman holding capacities at different amounts of displacement within the range of conditions tested.

The investigation disclosed that multiple anchors develop a higher holding capacity per net area than a single deadman with the same total face area. The increase in holding capacity ranging from 5 to 20% depends upon such factors as depth of embedment, the type of soil, and the spacing between deadmen. Under most test conditions, up to a 30% increase in holding capacities was attained in cohesive soils as compared to sand, but 2 to 3 times the horizontal displacement was required to achieve the maximum holding capacity.

R-435
Current-Voltage Characteristics of Thin-Film Diodes, Mar 1966, R. D. Hitchcock, AD630587

The current-voltage (I-V) characteristics of thin-film diodes were measured at 4.2K, 77K, and room temperature. Superconductive tunneling was achieved with a diode consisting of aluminum, aluminum oxide, and lead (AL/AL2O3/PB). In the nonsuperconducting state the AL/AL2O3/PB type of thin-film diode exhibited zener breakdown between 1.5 and 3.5 V. However, the AL/AL2O3/PB diodes did not have reproducible I-V characteristics, and the nonsuperconducting AL/AL2O3/PB diode could not be operated with AC voltage long enough to serve as a practical electronic device.

A thin-film diode consisting of aluminum, aluminum oxide, manganese, and lead exhibited power-law I-V characteristics at ambient temperatures, under 60-cycle excita-

tion, and could be operated with a reproducible I-V characteristic for several hours. Bistable switching was achieved with a thin-film diode consisting of aluminum, aluminum oxide, lead, and aluminum, in this diode the short-circuit state was produced by a high-voltage pulse and the open-circuit state by a low-voltage pulse.

A theoretical analysis of the observed I-V characteristics is presented.

R-436
Polar Transportation - Analysis of Tracked Personnel and Cargo Carriers for McMurdo, Antarctica, Apr 1966, N. E. Pierce, D. Taylor, AD481173

The Antarctic surface transportation system has been a source of many problems for the Antarctic support activities (ASA). Little information of value has been reported during the 10 yr of Operation Deep Freeze to assist in resolving these problems. An analysis of the transportation system at the McMurdo complex was made in relation to the existing ASA tracked and wheeled vehicles, cargo-handling equipment, and recently evaluated transport vehicles that appear suitable for operation in the McMurdo environment.

This report considers only tracked carriers, but excludes prime movers such as caterpillar tractors. The principal factors considered are the roads and the operational data for and uses of tracked carriers in the McMurdo area. It is found that the M29C Weasel is obsolete and uneconomical to maintain, but that there are several tracked carriers available that could satisfactorily replace it. It is concluded that the military M116 Husky, Thiokol 600 series Trackmasters, and Robin-Nodwell RN110D tracked carrier appear to be the most suitable, and it is recommended that they be tested at McMurdo along with the RNT110 Nodwell tracked trailer which is a possible replacement for the 10- and 20-ton cargo sleds presently used.

R-437
Sea Ice Strength Studies on McMurdo Sound During the Austral Summer 1964-65, Mar 1966, R. A. Paige, C. W. Lee, AD630201

During the austral summer of 1964-65, a study of some of the physical properties of sea ice was made near McMurdo Station, Antarctica, where the sea ice is used extensively for aircraft operations, travel, freight hauling, and docking facilities.

Tests of specimens showed that both shear and ring-tensile strengths increased almost linearly as specimen temperature decreased, the strength decreased as the ice sheet became warmer and more nearly isothermal. Average shear strength decreased from 140 psi in late Oct to a low of 90 psi in late Jan and then increased to 115 psi by 10 Feb just before breakup, average ring-tensile strength similarly decreased from 190 psi in mid-Dec to a low of 145 psi in early Feb, and then increased to 170 psi by 10 Feb. Internal deterioration and decrease in strength, thickness, salinity of brine, and temperature gradient are all related to rising temperatures and increased solar radiation during the summer.

Development of a reliable method of predicting the bearing capacity of sea ice depends upon more detailed knowledge of the effects of loads, the history of the ice, danger zones and safety factors, and other features to insure safe operation on the ice.

R-438
Technical Data Compiled from Operational Reports on Deep Freeze 61 Through 65, Apr 1966, J. P. Cosenza, AD480943

This report is a compilation of technical data obtained only from reports prepared by the Commander, Antarctic Support Activities, and the Commander, U.S. Naval Support Force, Antarctica, for Operations Deep Freeze 61 through 65. The reports are listed in the bibliography. Data from previous Deep Freeze operations are compiled in NCEL Technical Reports R-155 and R-210.

The object of the compilation is to provide a ready reference for persons concerned with the design, construction, maintenance, and operation of equipment and facilities in the Antarctic. It is recognized that the information is historical and pertains to specific or limited sections of the south polar area. However, the sources utilized in compiling this report are among the first documentations of large-scale construction and continuing Naval shore-based operations in Antarctica.

R-439
Mechanism of Rodenticidal Activity of Gliricidia Sepium, Apr 1966, H. Rochman, AD631002

A study was made of the mechanism by which gliricidia sepium(yaite) exerts its rodenticidal properties. Extraction of the leaves of this plant, followed by physical and chemical fractionation, revealed the presence of coumarin as a constituent of the phenolic fraction. Consideration of the conditions under which these leaves are used as rodenticides, the known bacterial conversion of coumarin into the hemorrhagic agent dicoumerol, and pathological evidence in rats fed on incubated leaves point to coumarin as the basis for the rodenticidal properties of this plant.

R-440
Hydrodynamic Analysis of a Spread-Moored Platform in the Open Sea, Aug 1966, B. J. Muga, AD638726

A moored construction-type platform excited by irregular random surface gravity waves was studied in the laboratory, in the field, and theoretically. The platform was spread moored by four 2-1/2-in. die-lock chains in about 165 ft of water in the open Pacific Ocean. Water level variations at three locations, ship rotations and accelerations, mooring forces, and wind velocities were measured in sea states 2 and 3, and a simulated sea state 4 in the laboratory. Three recordings each of the prototype and model tests were analyzed using time series techniques to provide apparent amplitude response operators for all ship motions and mooring forces. The motions of the barge when excited by regular uniform surface gravity waves were predicted using the linear theory of ship motion. The fundamental analytical tool used in the computations is the well-known slender body theory. Agreement between theory, model, and prototype results is considered to be excellent for the surge, sway, roll, heave, and pitch motions. Agreement for the yaw motion is poor. It is concluded that the most probable value of the annual maximum force induced on any of the moorings is 120 kips. The present mooring configuration possesses sufficient reserve strength to preclude failure of the moorings due to wave-induced motions.

R-441
Polar Camp Improvements, Water System Using a Hot-Water Snow Melter, Mar 1966, C. R. Hoffman, G. E. Sherwood, AD631322

Unsatisfactory operation of an electric snow melter in the Deep Freeze 64 NCEL camp led to the development of a hot-water snow-melting system using excess capacity in the camp water heater as the heat source. In tests of the semiautomatic hot-water melter, water was produced at a rate of 100 gph. This compared to 60 gph with the electric immersion heater snow melter which had been designed to operate on excess generator capacity available during periods of nonpeak electrical load.

The hot-water snow melter was used throughout the Deep Freeze 65 summer season to produce about 250 gpd. It was a fast and efficient melter, and had the advantage of employing standard parts which were easily assembled and operated. It was concluded that the hot-water melter should be considered for use in camps obtaining water by melting surface snow.

R-442
Dose-Attenuation Variation With Incident Gamma-Ray Energy in Two-Legged Concrete and Steel Ducts, Apr 1966, J. M. Chapman, AD630697

Gamma-ray dose-attenuation factors were measured in concrete and steel ducts. For concrete, 3-ft-sq and 11-in.-sq ducts were used with AU198 (0.412 MEV), CS137 (0.662 MEV), and CO60 (1.25 MEV) gamma-ray sources. For steel, an 11-in.-sq duct was used with CS137 and CO60 sources. Attenuation factors for given geometries were compared as a function of incident gamma-ray energy. The relative effectiveness of steel and concrete ducts of a given geometry was determined.

It was found that the attenuation factor decreases monotonically with increasing energy in concrete ducts. However, in the 11-in. steel duct the attenuation factor for the high-energy source (CO60) was greater than for the low-energy source (CS137). In comparing the 11-in. concrete and 11-in. steel ducts, it was found that dose rates in the concrete duct were higher by a factor of about 2. Measured attenuation factors were compared with values obtained using a computer code based on the albedo concept. It was found that calculated attenuation factors agree to within ±30% of the measured attenuation factors.

R-443
Blasting Agents for Navy Construction Forces, May 1966, A. L. Scott, AD481425L

Navy construction forces presently use dynamite for blasting in construction operations. Dynamite is subject to strict regulations regarding transportation and storage, and the required facilities are not often available in field operations.

Several blasting agents are now available which have the blasting capability of dynamite but are composed of two ingredients, by themselves nonexplosive, each of which can be transported and stored without restrictions and then mixed at the blast site. Aerex S-1, Aerex S-2, and AN-FO (ammonium nitrate plus fuel oil) are such agents. AN-FO is best suited to the needs of Navy construction forces. Because none of these agents is satisfactory for use under wet conditions, dynamite would be required to supplement them for wet work and as a primer for the two-component agents.

Aerex L-1, a two-component, liquid blasting agent and Dow MS-80, a waterproof slurry containing aluminum particles, were also investigated but are not recommended for use by Navy construction forces at this time.

R-444
Lossy Conductors for Attenuation of Power Line Interference, May 1966, D. B. Clark, AD633850

The installation of overhead and underground lossy power conductors at the Hawaiian Tracking Station, South Point, Hawaii, has been tested, and the results show that the conducted and radiated interference from the power line are greatly reduced. Measurements of attenuated interference covered the frequency range from 14 kHz to 1,000 mHz. A comparison to previously installed lossy lines shows that the Hawaii line, composed of the latest developments in lossy conductors, is the most effective in attenuating interference.

R-445
Potential Applications of Radioisotopes in the Navy, May 1966, L. B. Gardner, A. E. Hanna, H. E. Stanton, AD633785

NCEL has conducted a study of the potential applications of isotopic devices and techniques within the Naval Shore Establishment. Radiation characteristics, general applications of isotopic devices, and specific problem areas are discussed. Recommendations are included for the use of surface density and moisture gages in the inspection of compacted earth, and for additional work in the determination of the thickness of in-place steel sheet piling and the thickness and density of concrete.

R-446
Multipurpose Type I (MP-1) Fuel for Antarctic Use, May 1966, W. W. Watson, AD484877

The specifications for a multipurpose fuel, MP-1 (MIL-F-23188) have been developed by the BUWEAP. This fuel, proposed for use in Antarctica in aircraft turbines, diesel engines, and space heaters, has received prior approval for use in C-130 and C-135 aircraft. The current study was undertaken to determine its suitability for use in diesel engines, space heaters, emergency camp stoves, and lanterns.

These tests have indicated that MP-1 is a satisfactory substitute for DF-A (diesel fuel, arctic) in medium and high speed diesel engines, and in pot-type space heaters. MO-1 is not recommended as a regular fuel for pressurized, commercial camp stoves and lanterns which normally burn white gasoline, although under urgent conditions, it may be used in these units for short periods of time.

R-447
Dynamic Properties of Plain Portland Cement Concrete, Jun 1966, W. L. Cowell, AD635055

Two concrete mixes (a medium- and a high-strength mix), each cured under two different conditions (73F, 100% relative humidity for 26 days followed by 2 days in a 20% RH environment or 73F, 100% RH for 28 days followed by 21 days in a 20% RH environment) were tested to determine the effect of differences in moisture content and rate of loading on their compressive and tensile strengths.

The compressive tests showed the values for mechanical properties increased as the rate of loading increased. At the maximum rate of loading (approximately 2,000,000 psi/sec), the increases in compressive strength over the values for static loading for the moist, 28-day concrete were 45% for the medium-strength and 39% for the high-strength concrete. The increases for the drier, 49-day, medium- and high-strength concretes were 35 and 24%.

In the splitting tensile-strength tests, at a stress rate of 300,000 psi/sec the increases in tensile strength over the static values for the 28-day concrete were 70% for the medium-strength and 67% for the high-strength mix. For the 49-day concretes, the increases were 53% for the medium-strength and 40% for the high-strength mix.

Recommended percentage increases in compressive strength are given for concretes subjected to high strain rates.

R-448
The Transportation Problem with Variable Demands, Jun 1966, H. Gonshor, AD635881

The solution for the standard transportation problem assumes a constant supply at each source and a constant demand at each destination. In many practical applications it is desirable to know how the solution is affected if the demands at the destinations are varied.

There are relatively simple, intuitively plausible, algorithms which produce solution to the modified problem. Unfortunately there exist counter-examples which show that these simple algorithms do not necessarily produce an optimum solution to the modified problem.

The algorithm developed in this report produces an optimum solution to the modified problem with an amount of computation which increased roughly logarithmically with problem size.

R-449
Polar Construction Equipment, LGP D4 Series D Snow Tractor, Jun 1966, D. Taylor, AD486475

A caterpillar D4 series D(D4D) tractor was purchased and modified during FY65 to produce a low ground pressure (LGP) snow tractor with less weight and size than previous LGP D4C's, but with the same general antarctic construction capability. The basic D4D with accessories was about 700 lb heavier than the basic D4C, but the modified D4D was 1,440 lb lighter than the similarly modified D4C. This reduction in weight was made possible by an increase in the allowable ground bearing pressure and by the use of aluminum track shoes in place of steel. The LGP D4D gave satisfactory service, except for minor problems, during 210 hr of operation in various antarctic tasks during the winter of 1965-66 (antarctic summer). The aluminum tracks showed no noticeable wear. It is recommended that the cab of the D4D snow tractor be rearranged for operator convenience and better seating comfort, that the fender extension and gusset plates under the battery box be modified to clear the track at maximum oscillation of the track system, and that consideration be given to a single-rail wide-track D4 snow tractor for the next modification.

R-450
Protective Coverings for Ice and Snow, Jun 1966, N. S. Stehle, AD635963

Summer deterioration of snow and ice surfaces due to high solar radiation and near-melting temperatures hampers the year-round use of natural ice islands and smooth sea-ice areas in the Arctic Ocean, and permanent snow and ice areas in the Antarctic. Sawdust has been used successfully in the California Sierras for protecting compacted-snow areas during periods of alternating above- and below-freezing temperatures and high solar radiation, but its scarcity and shipping bulk preclude its use in polar areas. Urethane foam has proven even more successful than sawdust as a protective covering in laboratory tests during alternating above- and below-freezing temperatures and simulated solar radiation. Use of snow or chipped ice on ice surfaces in the Antarctic has generally provided sufficient protection to prevent deterioration and ablation, but warmer environments may preclude use of these natural materials.

The use of snow and chipped ice as protective coverings should be exploited and further studies should be made to gain quantitative knowledge on the protective properties of these natural materials and to determine the practical application of urethane foam in polar areas.

R-451
Foamglas Insulation for Buried Hot Pipes, Jun 1966, J. M. Stephenson, AD486854L

To determine if Foamglas is reliable for insulating and protecting buried hot pipes in direct contact with the soil, BUDOCKS requested NCEL to evaluate this waterproof insulating material (Federal Specification HH-I-551). A preliminary investigation disclosed that Foamglas was being used successfully by a number of organizations to protect pipes in dry soils. A more extensive investigation, which included examination of Foamglas-insulated pipes in situ and examination of samples of soils and Foamglas, disclosed: (1) the vapor barrier on the Foamglas was frequently broken, allowing moisture to penetrate the Foamglas insulation, (2) Foamglas absorbs more water (as much as 7.9% by volume) than had been reported, and (3) failure of vapor barrier and insulating material to prevent water intrusion permitted pipe corrosion, heat loss, and sometimes disintegration of the Foamglas. On the basis of these investigations it was concluded that Foamglas is not suitable for insulating pipes below the water table or in wet soils.

R-452
Tunnel Ventilation and Heat-Load Survey, Byrd Station, Antarctica, 1965, Jul 1966, C. R. Hoffman, AD636296

A ventilation and heat-load survey was conducted in the undersnow tunnels at Byrd Station, Antarctica, in late December 1965. This work was performed to obtain current information on tunnel cooling requirements and to obtain data for tunnel cooling system design.

The survey showed that average tunnel temperatures are 5F to 6F lower than during a similar survey conducted in 1963, but are still as much as 18F higher than the desired temperature of 0F.

Doors originally installed at tunnel entrances have deformed and become inoperative, allowing the free circulation of warm surface air throughout the undersnow camp.

It was concluded that tunnel temperatures in the undersnow camp can be reduced by installation of airtight bulkheads and suitable selfclosing doors to prevent the inflow of warm, surface air and reduce cross-circulation between tunnels. All tunnels except L-7, which contains the communications galley and generator buildings, can be adequately cooled by drawing cold air from tunnel walls. A cooling system based on the NAVFAC's air-plenum concept appears to be the most suitable means of cooling tunnel L-7.

R-453
Test of Zinc Inorganic Silicate Coatings on Work Areas of a Floating Drydock, Jun 1966, C. V. Brouillette, AD480753

Fourteen zinc inorganic silicate protective coatings (both postcured and selfcured) and one zinc-rich epoxy protective coating were applied to 42 deck sections and other work areas of the USS ARD-12 for a 2-yr, in-service field test.

After 13-mo exposure, which included five dockings, the postcured coatings, as a class, were significantly superior to the selfcured coatings. The zinc-rich epoxy coating also showed superior performance.

R-454
Construction and Evaluation of a Prototype Electromagnetically Shielded Room, Jun 1966, R. A. Lasitter, AD636179

An electromagnetically shielded room composed of 20-gage sheet-metal wall material with continuously soldered seams was constructed and evaluated at NCEL. The 20x20x8-ft room is a prototype model designed as a basis for determining specifications for the construction of large shielded room installations. Electromagnetic shielding evaluation of the room was performed in accordance with MIL STD-285, along with additional measurements at 1.0, 2.5, and 9.0 gc/sec. The lowest value of shielding effectiveness was 65 db at 14 kc/sec.

Construction techniques for such design features as sheet-metal joints, soldered seams, power-line filtering, ventilation ducts, and cable raceways are discussed. Techniques for providing penetrations into the room for gas, water, and sewage were investigated. Measurements of the effect of small, controlled openings into the room were determined. The acoustic shielding properties of the room are also given in this report.

R-455
Installation of Barrier Systems on Marine-Borer-Damaged Bearing and Fender Piles, Jun 1966, T. Roe, AD486525

All of the bearing and fender piles of Target Repair Facility Pier, San Diego, Calif., were inspected by a diver for mechanical and biological damage. On the basis of the inspection report data, bearing piles were chosen for barrier application, and four different systems were installed. Cupro-nickel, flexible polyvinyl chloride, coal-tar-pitch-impregnated fiber, and rigid thermoformed polyvinyl chloride. Eighteen fender piles were protected by wrapping with flexible polyvinyl chloride and installation of steel shoes as rubbing strips.

R-455 Suppl.
Installation of a Grout-Filled Sleeve Barrier System on Bearing Piles and In-Service Performance of Five Barrier Systems (Supplement to Technical Report R-455, Installation of Barrier Systems on Marine-Borer-Damaged Bearing and Fender Piles), May 1967, T. Roe, AD813929L

As part of an investigation of methods to extend the service life of waterfront structures, grout-filled nylon sleeve barriers (Prepakt Fabriform) were installed on 10 bearing piles of the Target Repair Facility Pier, San Diego, Calif.

The grout-filled sleeve barriers on the pier were inspected after 2 mo service, and the other five barrier systems after 7 to 17 mo service. Some piles protected by the latter systems had sustained mechanical damage because of the lack of a fender and camel system. Otherwise, all were performing satisfactorily except for the coal-tar-pitch-impregnated split fiber sleeve barriers (Sonoco Duro-pipe) which had been attacked by limnoria.

R-456
Deep-Ocean Biodeterioration of Materials, Pt. 4, One Year at 6,800 Feet, Jun 1966, J. S. Muraoka, AD636412

As Part IV of a series of reports on the biological deterioration of materials in the deep ocean, this report covers the data obtained after exposing metallic and non-metallic specimens for 13 mo on the floor of the Pacific Ocean at a depth of 6,800 ft (Test Site I). The specimens were attached to a submersible test unit that was retrieved in Feb 1965. Preliminary examination of the specimens was made aboard ship, and the final examination, tests, and analyses were performed at NCEL.

On recovery, most of the plastic materials and all of the rope specimens were covered with bacterial slime. Cotton and manila rope specimens were severely deteriorated by marine microorganisms. Wooden test panels, plastics, and manila ropes were attacked by molluscan borers. Glass, metals, natural and butyl rubber, and certain plastic materials were not adversely affected.

The results of breaking-strength tests on ropes, weight loss measurements of wood panels, moisture absorption tests on plastics, and insulation resistance and voltage breakdown tests on electrical insulating materials are presented.

R-457
Polar Camp Improvements, Requirements and Concepts for Covered Storage Facilities, Jun 1966, G. E. Sherwood, J. P. Cosenza, AD636417

A study of storage facilities in polar camps showed a need for improved facilities for camps on areas of drifting snow. Equipment and materials stored in the open become drifted over and require costly manpower for digout. Damage during storage and digout are also costly. Digout can cost $400 to $600 per piece of equipment following winter storage or prolonged storms.

The use of a lightweight, easily erected, low-cost storage shelter should produce savings in manpower and materials. Available information indicates that such a shelter would cost $1.50 to $2.00/sq ft. A storage basement under a building on a snowfield would also provide covered storage space at a very low cost. It was concluded that a study should be made to determine the feasibility of lightweight, easily erected, low-cost storage shelters for use on areas of drifting snow. Also, a prototype storage basement should be constructed under a Jamesway with an NCEL steel foundation so that its practicality for storing supplies, small items, and frozen foods can be evaluated.

R-458
Protection of Mooring Buoys, Pt. 8, Results of Seventh, Rating Inspection, Jun 1966, R. W. Drisko, AD636422

This is the eighth of a series of reports on the protection of mooring buoys. Thirteen test buoys were given their seventh rating for extent of coating deterioration, corrosion of steel, and fouling. Two other buoys had previously been removed from testing because of advanced deterioration. The coating systems on three of the buoys were in good condition while those on 10 others showed varying degrees of moderate deterioration. Two sets of 13 panels each, coated with the different systems used on the buoys, were given their sixth rating inspection after 3 yr of exposure. One set was exposed in San Diego Bay and the other in Port Hueneme Harbor. The condition of the coatings on both sets of panels was generally better than that of the buoy coatings, but there was a general correlation between the conditions of the two test groups. On buoys coated with antifouling paints, no detectable antifouling protection remained after 25 mo, but on both sets of test panels, two antifouling paints were still appreciably reducing fouling after 3 yr.

Three of the buoys were cathodically protected with zinc anodes. The level of protection was high enough to mitigate rusting in the underwater portions of these buoys.

R-459
Epoxy Coatings on Water-Tank Interiors, Pt. I, Application of Coatings and Initial Inspection, Jun 1966, R. W. Drisko, AD486411

Each of three proprietary epoxy coating systems was applied to the interior of a different steel water-storage tank at NAS, Lemoore. One of these systems was also applied to a steel water-storage tank at NAS, Point Mugu. A description is given of each coating system and its method of application. Tabular data compare coating coverages and present a labor and material cost breakdown on each tank. The tank interiors were given their first inspection about 8 mo after the coatings were applied. All had some degree of blistering. Additional inspections will be made yearly, and progress reports describing these conditions will be incorporated into Part II of this report.

R-460
Volatile Photodegradation Products of Organic Coatings, Jul 1966, P. J. Hearst, AD636828

Various clear and pigmented vehicle films were irradiated in air with a mercury arc and a xenon arc. The volatile photodegradation products were identified by infrared spectroscopy. The coatings included alkyd, oil, vinyl-alkyd, vinyl copolymer, partially hydrolyzed vinyl copolymer, polyvinyl acetate, epoxy-amine, and epoxy-polyamide films. The major product from all films was carbon dioxide. Eleven other products or types of products were obtained, as well as some unidentified products. The addition of pigments decreased the yields of almost all the products. However, the yields of different products were affected in different degrees by pigmentation, and this difference may in part be related to the penetration of the light responsible for the production of each particular product.

R-461
75-kW Uninterruptible Electrical Power Supply Unit, Jul 1966, E. Giorgi, AD486853L

A 75-kW uninterruptible electrical power supply unit incorporating an ideal electric stored controlled energy system was procured by NAVFAC for test and evaluation by NCEL. Control deficiencies and operational problems encountered during the initial equipment check-out phase resulted in the termination of the scheduled test program before completion. This report presents a discussion of the deficiencies and problems encountered in the test unit,

results of tests conducted before the test program was terminated, and conclusions and recommendations regarding the usefulness of the ideal electric stored controlled energy concept. The use of the ideal electric concept in uninterruptible power supply systems rated 100 kW or less was recommended.

R-462
Modernization of Model E-21 and E-21R2 Portable Automatic G-Agent Alarms, Jul 1966, A. L. Scott, AD486806

NAVFAC has a stock of Model E-21 and E-21R2 alarms capable of detecting G-agents at temperatures above freezing. A contract was let to develop a modernization procedure to enable these alarms to also detect the newer V-agents and to operate at temperatures down to -40F. To test the effectiveness of the modernization procedure, 20 alarms were modified by the contractor. Final tests of the modified alarms were made by the NASL, Brooklyn, New York.

Agent sensitivity, operation at high and low temperatures, and general capability were found to be satisfactory. Minor mechanical refinements should result in an instrument having a 90% reliability.

Other detection systems are being developed by other DOD agencies. For interim emergency requirements, the Army has a stock of Model E-4l alarms with approximately the same capability as the modernized E-21 and E-21R2 alarms.

R-463
Resistance of Tubular Structures to Dynamic Loading, Jul 1966, S. K. Takahashi, W. E. Gates, K. L. Benuska, AD636914

Static and dynamic experimental investigations were conducted to validate the NFEC computer program used to predict the behavior of microwave towers subjected to blast loading.

The following tests were conducted - static and dynamic tests on steel and concrete specimens, static tests on a simply supported tubular beam and on a cantilever model, and dynamic tests on three model towers -free-vibration tests, base-acceleration shock-pulse tests on a vibration machine, and air-blast tests in a 6-ft shock tube.

The failure mode for the statically loaded beam and cantilever tower was of the same type as for the dynamically loaded cantilever tower. A semicircular bulge occurred in the inside and outside steel cylinders at the location of maximum moment in the compression zone. Models tested in the shock tube failed at peak overpressures of 44.4 psi.

The model tests showed the NFEC computer program can predict the behavior of small cantilever towers under different types of dynamic loading, thus increasing the level of confidence in the program's prediction of strength for the prototype tower.

R-464
Polar Transportation Equipment 4x4 Cargo-Personnel Van With High-Flotation Tires, Aug 1966, W. H. Beard

A 4x4 truck chassis fitted with 19.75x20 low-pressure, high-flotation tires and a custom-made van-type body with seating facilities for 20 passengers was used as a shuttle bus for hauling cargo and passengers over all types of roads on dirt, frozen ground, and adjoining areas of ice and snow at McMurdo, Antarctica, during the summer season of Deep Freeze 66. The cargo-personnel van performed quite well in all capacities, requiring minimum maintenance and minor repairs in over 400 hr of operation. No special skills were required in its operation or maintenance. It was driven on roads with grades up to 24%. During the period of 12 Jan 1966 to 1 Mar 1966, it was used as the primary means of transporting personnel and light cargo between McMurdo Station and Williams Field.

It was concluded that the cargo-personnel carrier is suitable for transporting passengers and light cargo on roads over snow, ice, and frozen ground. It is recommended for use at polar coastal stations.

R-465
Differential Neutron Albedo for Thin Slabs, Aug 1965, D. R. Doty, AD637579

Data giving the experimental angular distribution of differential albedo for thermal neutrons incident upon thick scatterers of lead, high density concrete, and iron have been collected. Differential albedo of thermal neutrons on aluminum, iron, and polyethylene as a function of the material's thickness for a given incident and exit angles is shown. These data are compared with a theoretical formula.

Experimental verification of the theoretical formula is quite good for the angular variables. Asymptotic limits of the formula for thick and thin scatterers are as would be expected physically. The exponential dependence of the formula upon thickness agrees roughly within experimental errors. Reasons for inaccuracies in the magnitude of differential albedo are discussed.

An extension to general albedo measurements for thin scatterers at any energy is described. This method, employing elemental scatterers, is shown to yield reliable results in the thermal region when the thickness of the material is less than one mean free path. The method also does away with the need for a collimated detector in differential albedo measurements for thin scatterers.

R-466
Seasonal Damage to the McMurdo Ice Wharf During Deep Freeze 66, Aug 1966, R. A. Paige, AD637185

The existing wharf at McMurdo Station, Antarctica, is formed from old sea ice that has accumulated along the western shore of Winter Quarters Bay. Seasonal damage during Deep Freeze 66 consisted of the ice face at the water level being undercut, the overhang caving in, and the resultant loss of critically needed surface area. Uncontrolled meltwater drainage early in the season eroded gullies and potholes in the wharf surface and contributed to the undercutting.

During the austral summer of Deep Freeze 66 wave action, high surface-water temperatures, and meltwater drainage were the primary causes of undercutting and erosion. Since it is not economically feasible to control the water temperature, the only way to prevent undercutting is to reduce or eliminate the damage from wave action and to control surface drainage.

It was concluded that the face of the wharf should be protected by a splash shield and that the surface of the wharf should be protected by compacted fill and good drainage. It was also concluded that suitable equipment and techniques should be developed for drilling and excavating in the ice-rock mixture at the wharf, and that observations should continue to develop adequate knowledge on the seasonal history of the ice wharf and the protective measures employed.

R-467
Second Corrosion Survey of Steel Sheet Piling, Aug 1966, C. V. Brouillette, A. E. Hanna, AD637044

In-service steel sheet piling was investigated in 1959 at eight Naval stations. In 1965 the piling at five of these stations was investigated again to gather further information on the corrosion rates of steel sheet piling at waterfront locations. The value of applying maintenance coatings from the mean low-water mark to the top of the piling and of using cathodic protection was reaffirmed by this second survey.

R-468
Ice-Grading Equipment - Icedozer for Pioneering in Rough Ice, Aug 1966, S. E. Gifford, AD637137

This technical report covers the development of an icedozer attachment for removal of ice obstructions and rough grading of uneven ice surfaces. The unit consists of

a self-powered, rotating, spiked-tooth cutter mounted on the front of a size 3 crawler tractor. Tests near McMurdo Station, Antarctica, during the summer season of Deep Freeze 66 showed that the icedozer was suitable for rough grading uneven ice surfaces and for producing ice-aggregate fill for roads and runways on ice. The tests also showed that the unit was not entirely suitable for finish grading and surfacing operational areas on ice. The icedozer is considered suitable for pioneer construction and rough grading ice obstacles and uneven ice surfaces, but an iceplane-grader employing the icedozer attachment should be developed for finish grading and surfacing roads and runways on ice.

R-469
Carbon Dioxide Fire Protection Systems for Computers and Electronic Equipment, Aug 1966, C. W. Terry, J. J. Bayles, AD488168L

A study was conducted to improve the design of carbon dioxide dispensing systems used to extinguish fires in facilities housing electronic computers. Information was collected from visits to computer facilities, a literature survey, and interviews with representatives from industry. Tests were conducted in simulated computer cabinets to confirm various fire protection hypotheses, to evaluate nozzle types for fixed-pipe dispensing systems, and to determine the influence of various parameters on the stratification, concentration, and persistence of CO2 in computer cabinets. It was concluded that a Schutte and Koerting steam-jet blower will provide the most effective means of dispensing CO2.

R-470
Undersea Nuclear Power, A Status Report, Aug 1966, E. J. Beck, AD636920

Since the publication in 1964 of Techniques for Underwater Nuclear Power (NCEL TN-545), considerable research and development has been done which has changed the picture regarding the feasibility of using isolated reactors on the ocean bottom. This study considers in some detail the work on fouling, corrosion, and heat transfer accomplished by the C. F. Braun Company, Alhambra, Calif., under Contract NBY-32274.

Also considered are additional problems which might be encountered in using radioisotope decay heat in large (multi-kilowatt) generators or fuel cells in the deep ocean environment.

A cursory up-dating of the known arts related in the earlier study is made, especially in referencing material which has recently become available.

Possible areas for further investigation are delineated.

R-471
Mechanical-Flush Chemical Toilet, Aug 1966, N. L. Drobny, AD487931L

Sanitary facilities normally encountered in the polar regions leave much to be desired. Existing facilities must be improved if a healthy and safe environment is to be provided. Previous studies indicated that the chemical toilet is one desirable means of providing significant improvements to existing facilities. In pursuit of this goal, the mechanical-flush chemical toilet was developed. A prototype was tested extensively and performed satisfactorily. The unique feature of the unit is simplicity. Other significant features include low cost, reliable sanitary operation, odor control, and minimum water usage. It is recommended that the toilet be further developed to include a modified tank and an automatic flushing mechanism, and that it then be incorporated into the advanced base functional component system.

R-472
Light-Duty, Expandable Land Anchor (30,000-Pound Class), Aug 1966, P. A. Dantz, AD640232

This study developed a family of two-fluke, light-duty, expandable land anchors that have ultimate vertical holding strengths of 30,000 to 60,000 lb in sand and clay soils. It also includes a method of installation for these anchors that reduces excavation to the boring of either a 3- or 6-in.-diam hole.

The anchors when closed form a nominal 3- or 6-in. circular cylinder. After installation, two flukes are opened by the soil action to hold the anchor in the soil.

One hundred and fifty-six field tests were conducted to evaluate the anchor design, vertical and horizontal holding strength, structural strength, opening characteristics, fluke length, overburden depth, and installation equipment and techniques. Recommendations on the use of these expandable anchors are included.

R-473
A 7.5-kVA Power Transient Synthesizer, Aug 1966, H. H. Kajihara, AD637826

This report describes a newly developed, electrical-power test unit designated a power transient synthesizer. The synthesizer is essentially a power source which furnishes line-frequency, alternating-current, electrical power, containing a variety of power parameter fluctuations. The power parameter deviations last from 8.3 ms to 5 sec and include fundamental frequency overvoltages and undervoltages, momentary power outages, pulse voltages of 10 to 4,000 V superimposed on the fundamental sine waveform, and frequency deviations of 0.2 cps to 6 cps about the fundamental frequency. Test data taken on a DC power supply is presented to illustrate the capabilities of the synthesizer.

R-474
Static and Dynamic Behavior of Antisymmetrically Loaded Arches, Sep 1966, R. H. Chiu, S. K. Takahashi, AD638316

Four pinned-base steel arches with a 96-in. radius, 143.8-in. span, and uniform cross section were cold-rolled from 4M13 sections and tested under various static and dynamic loads uniformly distributed over one-half the arc length. A maximum static load of 72,000 lb was applied by the NCEL blast simulator using compressed air. A dynamic peak load of 64,000 lb was attained by detonating primacord in the blast simulator. The blast loading had a rise time of about 3 msec and a decay time of about 1.6 sec. An equivalent triangular load-time function was used for the dynamic analysis. The applied loads and the resulting deflections, strains, and reactions were measured. The reduced data are presented in graphical and tabular form.

The theoretical analyses for statically and dynamically loaded arches were based on the discrete framework which represented the continuous arches tested. A 16-bar system was used for both static and dynamic response calculations, and a 40-bar system was used for natural mode and frequency calculations.

In the static analysis, the effects of stress amplification, misalignment, and elastic supports on the response of the arch were considered. Due to the strain-hardening characteristics of the arch material, the idealized stress-strain curve was represented by a trilinear curve rather than by the usual bilinear stress-strain curve.

A simplified dynamic analysis gave results reasonably close to those from more rigorous methods. The values were on the conservative side. Nearly complete correlation between the theoretical and experimental results was obtained.

This work was sponsored by the Defense Atomic Support Agency.

R-475
Blast Attenuation Systems for Ventialtion Openings, Sep 1966, L. W. Hallanger, AD489392L

This manual summarizes the currently available information on the design of blast attenuation systems for ventilation openings in protective shelters. Active and passive methods of blast attenuation are considered, and the problems associated with the interaction of a system with its environment are discussed.

R-476
Creosoted Wood in a Marine Environment, A Summary Report, Sep 1966, H. Hochman, AD639922

A number of notions concerning the behavior of creosote in marine environments are examined. Among these are mechanical loss, leaching, threshold concentration, and bioenvironment. Factors involved in predicting service life are presented and the conclusion is drawn that creosote protects wood for long periods of time in cold-water harbors but not in warm-water harbors having a high population of Limnoria Tripunctata.

R-477
Consolidation Characteristics of Pure Clays and Pelagic Sediments, Sep 1966, J. P. Nielsen, AD639061

This study investigates the validity of the power law for expressing the viscous resistance to compression observed in clays and shows that it can be satisfactorily used for this purpose. However, it is suggested that the three-parameter Ellis model might better describe viscous resistance to compression. It is also shown that the constants appearing in the power law can be related by means of simple equations to the effective normal pressure and to the chemical composition of the clay mineral. Consolidation studies on pelagic sediments indicate that these are highly compressible and normally consolidated. Structures founded on these sediments will be subject to large settlements.

R-478
Dynamic Tests of Structural Aluminum Alloys, Sep 1966, W. L. Cowell, AD640369

A series of dynamic tests was conducted on three grades of structural aluminum alloys--(a) 6061-T6, (b) 6063-T5, and (c) 5456-H321. The effects of strain rate on the mechanical properties of these materials were obtained. In the elastic range of the material tested, the strain rate ranged from a static value of 2.2×10^{-5} in./in./sec to a maximum value of 2.5 in./in./sec.

The mechanical properties of the alloys showed a variety of changes when subjected to nigh strain rates. The 6061-T6 aluminum increased 5% and 10.6% over the static value for yield stress and tensile strength, respectively, at the maximum test rates. The 6063-T5 aluminum showed no change in yield stress and a 5.8% increase in tensile strength at the maximum test rate. The 5456-H321 aluminum was obtained in plate form, and specimens were prepared with their longitudinal axes both parallel and perpendicular to the direction of rolling. The yield stress for specimens prepared parallel to the direction of rolling decreased 3.6%, and the yield stress for specimens prepared perpendicular to the direction of rolling increased 2.5% at the maximum test rate. The direction of rolling did not affect the tensile strength behavior under rapid testing since both groups of 5456-H321 alloy exhibited an average reduction of 5.7% in tensile strength at the maximum test rate. None of the changes in mechanical properties are believed to be of sufficient magnitude to be of concern in design.

R-479
Effect of Photodegradation on Attenuated Total Reflectance Spectra of Organic Coatings, Sep 1966, P. J. Hearst, AD640733

Clear and pigmented films of various coating vehicles were irradiated in air with a mercury arc and with a xenon arc. Attenuated total reflectance (ATR) spectra were obtained before and after the irradiations in an attempt to find an accelerated tests method for determining coating performance. The coatings included alkyd, vinyl-alkyd, partially hydrolyzed vinyl copolymer, vinyl copolymer, epoxy-amine, and epoxy-polyamide films. Although the mercury-arc irradiations produced considerable effects on the air spectra of clear vehicle films, the xenon-arc irradiations produced comparatively negligible effects. Whereas the observable effects of mercury/arc irradiations on pigmented films were less than on clear films, the reverse was true with the xenon-arc irradiations, which produced appreciable effects only on some of the pigmented films. These differences in results may be related primarily to the spectral distribution of the irradiating light and to the resultant differences in penetration and reflection within the film.

Air spectroscopy may prove to be useful in an accelerated method for determining deterioration in pigmented organic coatings, but it does not appear useful for clear films.

R-480
Compacted-Snow Runways in Antarctica Deep Freeze 65 Trials, Sep 1966, E. H. Moser, G. E. Sherwood, AD639660

NCEL conducted snow-compaction investigations on the Ross Ice Shelf adjacent to McMurdo Sound during Deep Freeze 65 following investigations made during Deep Freeze 61 through Deep Freeze 64. A 150 by 6,000-ft runway was constructed by adding a 16-in. layer of compacted snow over an existing layer. Construction was completed on 24 Nov 1964 and the runway was maintained and repaired for aircraft tests until 14 Feb 1965. Snowplow carriers used in clearing the runway of drift snow greatly reduced the time required for this operation over previous methods using a snowplane. A 6 x 6 truck-tractor with high-flotation tires served as a prime mover for maintenance equipment, and resulted in large savings in time over use of a size 2 snow tractor. This wheeled vehicle also eliminated damage to the runway surface caused by track vehicles.

It was concluded that well-processed snow will support a 125,000-lb LC130F aircraft with tire inflation pressure of 85 psi during periods of air temperatures to 32F and snow temperatures to 23F. The same area will support a 135,000-lb LC-130F with tire inflation pressure of 95 psi during periods of air temperatures to 18F and snow temperatures to 16F.

R-481
Breckenridge Blast-Actuated Closure Valve, Sep 1966, R. A. Breckenridge, AD640026

The ventilation systems of shelters providing blast protection must have automatic valves to prevent ingress of damaging pressure waves through the air ducts. This report discusses a blast-actuated closure valve developed, tested, and evaluated at NCEL.

For ventilation the valve has a rated airflow of 700 cfm. It provides protection from blast overpressures up to 150 psi. It also provides protection during the negative phase following any blast wave. When installed as intended, the valve should be relatively insensitive to the thermal pulse and ground accelerations associated with nuclear explosions. It is also insensitive to environmental conditions. Its operation is simple and reliable, and resetting is unnecessary because of the valve's automatic response. It requires no maintenance.

R-482
A Random Walk Treatment of Neutron Diffusion in Slabs, Sep 1966, M. L. Eaton, C. M. Huddleston, AD640260

The concept of a Markov chain has been used to treat the random processes of scatter and absorption which occur when neutrons are incident on a slab of finite thickness, such as a shield or an inside wall of a shelter entranceway. It is assumed that scattering is isotropic in the laboratory system and that the scattering and absorption cross sections do not change during a neutron-scattering history. The encouraging results obtained to date indicate that for thin slabs the analytical random walk method may have important advantages over Monte Carlo calculations (which require lengthy computer runs to obtain acceptably small statistical variances), moments method calculations (which are actually appropriate only for infinite medium cases), and numerical solutions of the neutron transport equation (which are lengthy, tedious, and necessarily approximate).

R-483
Motion of Subsurface Soil Inclusions Subjected to Surface Blast Loading. Results of Series 2 Tests, Oct 1966, L. W. Neller, AD640440

Tests were conducted at NCEL to determine how shape and mass affect the motion of buried inclusions subjected to blast loading applied to the surface of the soil. Five inclusions, representing elemental portions of a buried complex, were placed 6 in. below the surface of a dry sand material sieved into a reinforced-concrete test container. Two of the inclusions had the same shape and stiffness but differed in mass. The three other inclusions had comparable mass and stiffness but differed in shape. The displacement and acceleration of the inclusions and the displacement of the soil at two elevations were measured during a sequence of 13 blast loadings at peak overpressure levels of 5 to 25 psi. Reed gages were attached to one inclusion and cantilevered into the soil to indicate the motion of the inclusion with respect to the surrounding soil.

Accurate measurement of inclusion motion was not made. However, the following results were obtained--(1) the Reed gages indicated that the inclusion displaces into the soil in the direction of the propagated soil stress wave, (2) an increase in the mass of an inclusion by a factor of 13 only halved its peak acceleration, and (3) differences in shape of the inclusions tested resulted in only 10% to 15% differences in their peak accelerations.

A tentative method for estimating the blast-induced differential motion between a structural inclusion and its surrounding soil field is described.

R-484
5-kW Engine-Driven Electrical-Power Generator Set for Amphibious Applications, Oct 1966, K. Giorgi, AD800626L

A 5-kW engine-driven electrical-power generator set incorporating a Lister air-cooled engine and a Lima totally enclosed generator was procured in July 1965, tested, and evaluated by NCEL for amphibious applications. Results of performance tests and an in-service test of 6,400 hr are presented in this report, as well as conclusions and recommendations regarding the use of similar generators in amphibious applications. The use of generator sets of the same type as the test unit in naval amphibious applications was recommended.

R-485
Static and Dynamic Properties of Fire-Resistant Wooden Structural Elements, Oct 1966, F. K. Brink, AD641168

A series of treated and untreated laminated douglas fir beams and plywood panels were subjected to static and dynamic loads to study the effects of pressure-impregnation with fire-retardant chemicals on the mechanical properties of wood and to extend the existing knowledge of the dynamic properties of wood.

Results from the beam tests indicate that designs should be based on use under wet conditions when large timbers are to be pressure-impregnated with fire-retardant chemicals. This is because of the hygroscopic nature of treated lumber. It was also found that the allowable static design load can be applied dynamically without damage to the beam. Ultimate resistance of dry untreated beams to dynamic loads was about 1.6 times the allowable design load for dry wood. For treated beams, the ultimate resistance to dynamic loads was about 1.4 times the allowable design load for wet lumber.

Results from the plywood shear tests indicate that fire-retardant treatments reduce the mechanical properties of plywood in shear and that the reduction is proportional to the amount of salt retained in the wood.

R-486
Evaluation of the Aqua-Chem 200-gph Seawater Distillation Unit, Oct 1966, J. S. Williams, AD801161L

A 400-hr evaluation test of a portable 200-gph vapor compression seawater distillation unit was performed to determine the unit's conformity to existing procurement specifications and its suitability for inclusion in the advanced base functional component system. A new concept in vapor compression distillation is described. In performance, the Aqua-Chem unit was comparable with the conventional vapor compression units but was 40% lighter and 55% less in volume. The unit produced the required 200 gph of distilled water, consuming only 1 lb of diesel fuel for each 300 lb of distilled water produced.

R-487
Snow-Compaction Equipment - Model 36/42 Snow Mixer, G. E. Sherwood, R. W. Hansen, AD800952

Commercially available towed-type construction mixers were modified as snow mixers for depth-processing to produce high-strength snow. The mixers, designated as model 36/42 snow mixers, each employ a high-speed rotor to thoroughly pulverize and intermix the natural snow. Interchangeable 36- and 42-in.-diam rotors 8 ft long are used.

Three-pass offset processing with the model 36/42 mixer was found to be as effective as double depth-processing requiring six mixer passes with the models 24 and 42 snow mixers. A two-pass tailgate processing technique, developed with the model 36/42 mixer during Deep Freeze 66, was found to produce a snow pavement equivalent to that of three-pass offset processing under similar conditions.

It was concluded that the model 36/42 snow mixer is effective in depth-processing natural snow to produce high strengths. Well-trained operators and good overlap techniques are essential for obtaining a compacted-snow area of uniform strength. To improve the strength in processed snow and to reduce the manpower and equipment required for processing, a single-pass, double-rotor snow paver should be developed to replace the model 36/42 snow mixer.

R-488
Wind Duct Studies of Drifting Snow, Oct 1966, N. S. Stehle, AD640967

Problems in logistics and maintenance resulting from blowing and drifting snow confront stations and operations in nearly all portions of the polar regions. Wind duct experiments were conducted in a cold chamber at NCEL to obtain knowledge of the mechanics of snow movement and deposition. These experiments showed that wind velocity and the availability of snow to the wind stream contribute most to the amount of snow deposition or erosion. Temperature becomes influential only when the availability of snow is limited. In addition, snow movement is not significant at wind speeds less than 20 mph unless snow is already present in the wind stream.

Tests using models in the present wind duct are recommended to provide an opportunity to study rapidly the characteristics of blowing and drifting snow around novel and unique structures and other facilities. These tests, coupled with field tests, would make possible study of the most promising shapes as well as the gross characteristics of drifting snow at heights greater than 2 ft and wind speeds greater than 20 mph.

R-489
Hinging in Statically and Dynamically Loaded Reinforced Concrete Beams, Oct 1966, W. J. Yardell, AD642108

The objective was to investigate the hinging mechanism in under-reinforced concrete beams subjected to static or dynamic loads. Two test series on simply supported beams with a 6-ft span length were conducted.

Hinge development was similar in the statically and dynamically loaded beams and resulted from the formation and propagation of a yielded zone or zones in the tension reinforcement. Strain hardening of the tension reinforcement increased the static resistance above the yield value. The increase ranged from 5 to 60%.

Although decreasing the amount of tension reinforcement increased the deflection at certain stages, the ultimate rotation capacity was not significantly affected. In addition, the size of the transverse reinforcement had a negligible effect on the ultimate rotation capacity.

Strain hardening of the tension reinforcement and the ductility of confined concrete were considered in the analysis. Good correlation was obtained between the computed and experimental static load-deflection relationship as well as the static moment-rotation relationship for the centrally loaded beams. However, for the beams subjected to two loads, the deformation capacity beyond the crushing stage was not predicted.

The dynamic resistance was established using the computed static resistance and the measured strain rate at yield. The computed dynamic resistance and beam response were generally in reasonable agreement with the measured values.

R-490
Protective Coatings for Steel Piling - Results of Harbor Exposure on 10-ft Simulated Piling, Nov 1966, R. L. Alumbaugh, C. V. Brouillette, AD8028771.

One hundred and forty-four protective coating systems of various generic types were applied to 10-ft steel panels and the coated panels were suspended from a corrosion dock in the mouth of Port Hueneme Harbor to simulate environments to which steel piling is normally exposed. The bottom portion of each coated panel was subject to continuous immersion, the middle portion to tidal changes, and the top portion to the atmosphere. Fifty of these same coating systems were also applied to 10-ft angle iron panels. The coated panels were driven into the surf of the outer harbor at Port Hueneme so that the top half of the panel was exposed to the abrasive action of the surf.

After exposure periods ranging up to 12-1/2 yr in a shallow water environment, eight coating systems have provided protection superior to that of the saran standard (formula 113/54) and eight additional coating systems have demonstrated protective properties considered equivalent to saran.

All coating systems exposed in the surf showed moderate to heavy abrasion damage within 2 to 4 yr after exposure. Two types of coatings, i.e., phenolic mastics and coal-tar epoxies, have shown the most resistance to abrasion damage.

R-490 Suppl
Cost Comparison of Protective Coatings for Steel Piling, Sep 1967, C. V. Brouillette, R. L. Alumbaugh, AD820163L

Cost data are presented for 28 coating systems for steel piling. Performance of these and other coating systems were reported in NCEL Technical Report R-490.

Since the cost figures in this report are applicable to new construction only, it was recommended that exploratory research and testing be conducted to discover ways that will enable the economical protective maintenance of steel piling from the subtidal zone to the top of the pile.

R-491
Reinforced Plastics as Structural Materials, Nov 1966, R. A. Breckenridge, L. R. Russell, and C. K. Paul, AD642097

A survey is made of existing knowledge regarding the use of reinforced plastics as the load-carrying members in structural systems. Examples are given of existing applications in large buildings, motels, houses, special uses, marine surface craft, deep submersible hulls, and in other areas. A review is made of structural shapes that are commercially available. The basic materials, i.e., resins and reinforcements, are briefly discussed, and the various methods of combining them into a finished item are mentioned. The physical properties are summarized, and the areas of potential degradation are discussed. Problems in the design of reinforced plastics are considered.

The areas in which there appears to be good potential for increased structural applications are presented. Those that might be of greatest interest to NAVFAC include (1) antenna-support systems, (2) waterfront structures and facilities, (3) structures in remote areas that require shipping or that present maintenance problems, and (4) advanced-base structures that must be built under the pressure of military exigency.

R-492
Evaluation of Formaldehyde Concentration Detectors, Nov 1966, N. P. Oldson, AD802608L

Tests were performed to determine whether two low-concentration formaldehyde detectors and one high-concentration formaldehyde detector were suitable for determining concentrations within spaces being decontaminated with formaldehyde vapor. The performance of the detectors was evaluated by comparing the information obtained with a chemical analysis.

It was concluded that the low-concentration detectors, one manufactured by Brothers Chemical Co. and one supplied by Scott Aviation Corp. (manufactured by Dragerwerk in West Germany), were not suitable for determining whether formaldehyde concentrations were adequately low to permit personnel to reenter the space safely. The high-concentration detector, manufactured by Mine Safety Appliance Co., was found to be suitable for determining whether the initial formaldehyde concentration in the space was adequate to accomplish decontamination.

R-493
Cooling Analyses for Protective Structures Located Above and Below Ground, Nov 1966, J. M. Stephenson, AD642431

The objective was to develop techniques for predicting and controlling the effective temperatures in protective structures located both above and below ground.

Two techniques were developed by NCEL for underground structures: (1) a trial-and-error solution described in NCEL Technical Note N-711, and (2) a graphical solution developed for this report. To check their validity, a 2-week field test was performed in a 200-man shelter at the CBC, Port Hueneme, Calif. A trial and error solution for underground shelters, published by the ASHRAE, was also checked. Results indicated that all three solutions were satisfactory.

For above-ground shelters, the technique described in NCEL Technical Note N-734 was expanded to include more types of structures, and the method of solution was made more flexible.

Early in the experimental work, the need for instruments to measure thermal properties of soils in situ was recognized. Subsequently, a contract was awarded to the

Virginia Polytechnic Institute to develop two instruments, (1) a probe to determine thermal conductivity of soil, and (2) a contact device to determine the coefficient of heat penetration into soil. Both instruments were successfully fabricated and tested.

R-494
Crystallographic Studies of Sea Ice in McMurdo Sound, Antarctica, Nov 1966, R. A. Paige, AD642432

The sea ice in McMurdo Sound is used extensively for aircraft operations, travel, and docking areas. The safety and efficiency of utilizing the sea ice depends upon many factors affecting its physical properties throughout the season.

Sea ice is a crystalline solid with physical properties that are highly temperature dependent between -1.8C and -10C. This dependence becomes less with decreasing temperatures. A study of various crystal parameters and structure is essential for a better understanding of their relationship with strength properties. Horizontal banding in the ice sheet was studied to determine the effect of temperature fluctuations on band frequency. Various crystal parameters such as subcrystal platelet width, crystal length-to-width ratios, and crystal size were measured from photographs of thin sections.

Subcrystal platelet width increased with depth from about 0.5 mm at the surface to about 1 mm at 2.8 m. The length-width ratio of single crystals increased from 2 to 1 near the surface to more than 5 to 1 at depths greater than 2 m. The number of crystals per unit area decreased with depth. Strained ice from a pressure ridge showed preferred C-axis orientation and wavy extinction similar to that observed in strained quartz. There is apparently no correlation between strength and crystal structure in a mature isothermal ice sheet.

R-495
Deep-Ocean Biodeterioration of Materials, Pt. 5, Two Years at 5,640 Feet, Nov 1966, J. S. Muraoka, AD642838

As Part V of a series of reports on the biological deterioration of materials in the deep ocean, this report covers the data obtained after exposing metallic and nonmetallic specimens for 24 mo on the floor of the Pacific Ocean at a depth of 5,640 ft. The test specimens were attached to a submersible test unit that was placed on the sea floor on 2 Oct 1963 and was recovered on 22 Oct 1965. Preliminary visual examination of the recovered test specimens was made aboard ship, and the final examination, tests, and analyses of these materials were performed at NCEL.

Most plastic specimens and all rope specimens were covered with bacterial slime. The cotton and manila ropes were severely deteriorated by marine microorganisms. Wood panels and manila ropes were riddled by marine borers. The surface of all the plastic materials in direct contact with wood were deteriorated by these borers. Glass, rubber, and certain plastic materials were not adversely affected.

The results of breaking-strength tests on ropes, hardness and moisture absorption tests on plastics, and insulation resistance and voltage breakdown tests on electrical insulating materials are presented in this report.

R-496
Environment Control in Pressurized Underwater Habitats, Nov 1966, E. J. Beck, AD642835

A study was made to identify those environmental factors which would have to be controlled in order that man could live and work beneath the sea. The state of the art of undersea habitation is described, limitations, and areas of possible major improvements are listed, and possible approaches to major improvements are outlined. The developmental routes suggested are aimed at reducing cost and complexity, establishing more normal environments, and, above all, reducing the hazards of working in the ocean.

Environmental factors considered are atmosphere, sanitation, food storage and preparation, heating, and the effects of special atmospheres on voice communication. The peculiar requirements for providing a tolerable atmosphere at any but the shallowest depths have, by known approaches, produced major changes in all other areas.

Although the treatment in this report is from an engineering standpoint, the problems are largely physiological. An effort is made to describe the problem in terms familiar to engineers working in the field of environment control, although some of the more important references necessarily overlap into medicine and physiology.

R-497
Ice Engineering, Analysis of the Growth of Sea Ice, Nov 1966, A. J. Mettler, N. S. Stehle, AD642837

The major theoretical equations for the growth rate and thickness of sea ice are analyzed in this report in order to facilitate the prediction of ice thickness in areas where direct measurement is difficult. It is shown that the more primitive equations are special cases of the more complex ones, and it is concluded that at present, Kolesnikov's equation should be used for ice-thickness calculations. Based on this equation, graphs illustrating the way in which variables and parameters affect ice thickness, a simplified equation for rapid approximation of ice growth, and a computer program are presented.

R-498
Hardened Antennas for Military Shelter Communications (U), Dec 1966, M. L. Look, Secret

R-499
Airfield Marking Paints, Pt. 2, Effect on Lifting of Slurry Seal, Dec 1966, R. W. Drisko, AD643201

A study was made to determine the basic causes of lifting of slurry seal from asphaltic subgrade under stripes of reflectorized airfield marking paint.

Lifting was greater for double-thickness than for single-thickness stripes, especially for those with paint formulations containing chlorinated rubber. Paints with lower boiling solvents caused less lifting than those with higher boiling solvents. Oleoresinous paints generally caused more lifting than alkyd paints. Oleoresinous formulations with highly aromatic solvents caused less lifting than those with solvents of lower aromaticity. Alkyd formulations with highly aromatic solvents caused more lifting than those with solvents of lower aromaticity, but the amount of aromaticity-associated lifting was less than with oleoresinous paints. The addition of a small amount of carbon black reduced lifting with oleoresinous paints but had little effect with alkyd paints. There was somewhat greater lifting with 12- than 4-in.-wide stripes. Numerous interactions that significantly affected the extent of lifting occurred between the paint variables investigated.

R-500
Airfield Marking Paints, Pt. 3, Deterioration on Unslurried Asphalt, Dec 1966, R. W. Drisko, AD643202

A study was made to determine the basic causes of deterioration of white airfield marking paints on unslurried asphalt. Deterioration was greater for double-thickness than for single-thicknesses stripes, and greater for paints with chlorinated rubber than those without chlorinated rubber. Alkyd resin paints generally performed better than oleoresinous paints. Oleoresinous formulations with highly aromatic solvents performed better than those with solvents of lower aromaticity. Alkyd formulations with solvents of low aromaticity performed better than those with more aromatic solvents. Both alkyd and oleoresinous paints performed better with solvents of lower boiling range. The addition of a small amount of carbon black was slightly

beneficial overall, most notably to double-thickness stripes of alkyd paint. Stripe width was not an important factor in paint deterioration. Numerous interactions significantly affecting paint deterioration occurred between the paint variables investigated.

R-501
Nine Year Program on Marine Atmospheric Exposures of Protective Coatings for Steel, Jan 1967, C. V. Brouillette, AD808282L

Three test sites with marine atmospheres of varying degrees of severity were used to compare the protection provided to steel panels in a marine atmosphere by 49 coating systems representing 10 generic categories.

After exposure periods up to 9 yr, five coating systems proved superior to the specification reference standard saran. These systems were zinc inorganic silicate (post-cured), zinc inorganic silicate (self-cured), zinc-rich catalyzed epoxy, chlorosulfonated polyethylene, and mica-filled asphalt emulsion.

R-501 Suppl
Cost Comparison of Protective Coating for Steel, Nov 1967, C. V. Brouillette, AD822835L

Costs of protecting steel in three types of marine atmospheric environments are tabulated for 15 protective coating systems which were shown to have superior protective properties in NCEL Technical Report R-501. The types of environment vary from severe tropical, which contains continuous wind-blown ocean salt spray, to mild subtropical, which contains light intermittent wind-blown ocean salt spray. For the more severe environment minimum costs of $0.06 (or less) to $0.12/sq ft/yr of protection are reported.

R-502
Dynamic Shear Strength of Reinforced Concrete Beams, Pt. 2, Jan 1967, R. H. Seabold, AD644823

A series of reinforced concrete beams was tested to study shear and diagonal tension in beams under dynamic load. The tests constitute the second phase of a continuing program to determine criteria for the minimum amount of web reinforcement required for developing the ultimate flexural resistance of beams, and to determine the difference between these criteria for static and dynamic loading.

The primary objectives of this Part II series of tests were (1) to determine the minimum amount of web reinforcement necessary to force flexural failures, (2) to confirm, under uniformly distributed loads, a formula for shear resistance recommended by a joint committee of the American Concrete Institute (ACI) and the American Society of Civil Engineers (ASCE), which is based on the analysis of data from tests with concentrated loads, (3) to confirm the coefficients suggested in Part I of this program for the dynamic increase in shearing strength, and (4) to study the influence of stirrup arrangement and type of loading on the location of the critical diagonal tension crack.

Fifteen beams were tested, eight loaded dynamically and seven statically. Each beam was simply supported, and all loads were uniformly distributed. Twelve beams contained web reinforcement in the region of the critical section, and three had none there. Major variables were type of loading (static and dynamic), magnitude of dynamic load, and stirrup spacing.

R-503
Engineering Properties of Marine Sediments Near San Miguel Island, California, Dec 1966, M. C. Hironaka, AD644192

In Apr 1964 study was begun of the ocean floor at the proposed site for emplacing Submersible Test Unit II (STU II) series to determine whether the floor would provide a suitable foundation for the STUs. Eight sediment cores were taken to determine the engineering properties of the sediments in an area approximately 2 miles square in the vicinity of 34 deg 05.5'N, 120 deg 43.0'W, some 14 miles west of San Miguel Island, Calif. In addition, a bathymetric chart of the area was constructed using data from the precision depth recorder and navigational instruments aboard the USS MOLALA. Laboratory tests were conducted on core samples and computations of bearing capacity and settlement were made for the area with the resulting data. The calculated average bearing capacity was 300 lb/sq ft. The applied load of the STU was approximately 110 lb/sq ft. The calculated total settlement was 1.7 in.

The test results were analyzed statistically to determine the relationships (1) between vane shear strength and depth below the sediment surface, liquid limit, and median particle diameter, and (2) between bulk wet density and vane shear strength and sensitivity. The results indicate the correlations are satisfactory for use in site reconnaissance and site selection studies.

R-504
Corrosion of Materials in Hydrospace, Dec 1966, F. M. Reinhart, AD644473

A total of 1,590 specimens of 107 different alloys were exposed by NCEL at depths of 2,340, 5,300, and 5,640 ft at two sites in the Pacific Ocean for 197, 1,064, and 123 days to determine the effects of deep ocean environments on the corrosion of materials.

The corrosion rates, pit depths, types of corrosion, changes in mechanical properties, and analyses of corrosion products of the alloys are presented.

Titanium alloys and two nickel base alloys (Ni-Fe-Cr-825 and Ni-Mo-Cr-C) were immune to corrosion. The corrosion rates of copper alloys and steels decreased with a decrease in the oxygen concentration of the seawater and with increasing time of exposure at a nominal depth of 5,500 ft. The corrosion rates of most of the aluminum alloys increased with increasing time of exposure and with decreasing oxygen concentration of seawater. Muntz metal, and nickel-manganese bronze were attacked by dezincification and aluminum bronze by dealuminification. All the stainless steels except types 316 and 316L, 20Cb, and 17Cr-7Ni-0.7Ti-0.2Al were attacked by pitting corrosion. Only two precipitation hardened stainless steels were susceptible to stress corrosion cracking. The oceanographic parameters varied with depth. Changes in temperature and oxygen concentration exerted the most influence on the corrosion of the alloys.

R-505
Viruses in Polar Sanitation, A Literature Review, Dec 1966, P. G. Legros, N. L. Drobny, AD645601

The literature has been reviewed to collect information on which to base an estimate of the threat to the health of polar camp personnel posed by viruses in human waste. The nature of viruses in general is outlined and the occurrence of enteroviruses, their superior resistance to cold, and the spread of enterovirus infections is discussed. It is concluded (1) that the uncontrolled waste disposal practices characteristic of polar camps make these areas prime targets for the spread of virus diseases, and (2) that the existing hazards could be significantly reduced by (a) the use of chemical toilets, (b) waste incineration, and (c) superchlorination of drinking water followed by dechlorination prior to consumption. It is recommended that (1) an investigation of the survival of enteroviruses in the polar environment be conducted, and (2) chemical or incinerating waste-treatment processes be used for human waste disposal in polar areas.

R-506
Transient-Suppression Networks for Electronic Equipment, Jan 1967, S. J. Wooten, AD644867

Seventeen transient-suppression networks (4 active, 13 passive) were tested with the NCEL-developed 0-to-10,000-V pulse generator in a program to develop protection for sensitive naval communications and computer equipment. The inductive and capacitive passive filters did not provide satisfactory protection to solid-state electronics equipment, but some commercially available active transient-suppression networks gave satisfactory protection if their rated capacity was not exceeded. The best networks, in order of their performance, were (1) an AC-DC-AC filter system, (2) silicon controlled rectifiers, (3) a thyrector circuit, and (4) avalanche controlled rectifiers. The most satisfactory passive circuit was a complex, intermediate pi-section band-pass network. However, although this and other passive circuits offer high reliability and long life, they are inefficient and cause excessive voltage drop with high loads. Active filter networks using silicon controlled rectifiers failed after prolonged application of transient voltages, but avalanche controlled rectifiers (which provided relatively poor attenuation of transients in the tests) did not fail under the same testing. Thyrectors failed under prolonged testing with transient pulses wider than 100 msec.

R-507
Polar Transportation - Analysis of Wheeled Vehicles for McMurdo, Antarctica, Jan 1967, D. Taylor, N. E. Pierce, AD805670L

The Antarctic surface transportatior system has been a source of many problems for the Antarctic Support Activities (ASA). Because little information of value has been reported during the 10 yr of Operation Deep Freeze to assist in resolving these problems, an analysis of the transportation system at the McMurdo complex was made in relation to the existing ASA tracked and wheeled vehicles, cargo-handling equipment, and recently evaluated transport vehicles that appear suitable for operation in the McMurdo environment.

A report has been issued on the analysis of tracked carriers for McMurdo. The present report considers only wheeled vehicles. The principal factors considered are the roads, the operational data for wheeled vehicles, and the uses of wheeled vehicles in the McMurdo area. It is found that the prime requisite for an efficient wheeled transportation system is an easily maintainable, effective road system capable of supporting wheeled traffic with 30-psig tire pressures. Vehicles with high-flotation tires are satisfactory for use on these roads, and it appears that existing military vehicles with standard tires at McMurdo could be equipped with high-flotation tires. It is recommended that the roads at McMurdo be constructed to limits specified in the report, that some of the existing military vehicles be converted for high-flotation tires to meet present peak transportation requirements in the area, and that future new transport vehicle requirements be based upon the accepted new 20-passenger carrier, 1-ton cargo carrier, and 6 x 6 truck-tractor plus 20-ton semitrailer combination so that maintenance and spare parts requirements can be held to a minimum.

R-508
Motion of Subsurface Soil Inclusions Subjected to Surface Blast Loading--Results of Series III Tests, Jan 1967, C. R. White, AD645179

Experiments were conducted in Jun 1965 to extend fundamental knowledge of differential motions of buried inclusions and soil when the soil is subjected to surface blast loadings. Four inclusions of two masses buried at two depths in dry sand were subjected to surface blast pressures from 4 to 250 psi. The heavier masses displaced farther than either the lighter masses or the soil, but the soil displaced farther than the lighter mass at the shallower depth. The density of the soil was intermediate between the densities of the two inclusion masses.

R-509
Practical Thin-Film Heat Transfer in Water Purification, Jan 1967, E. J. Beck, AD644868

While in principle, large increases in heat-transfer surface for a given production of distilled water would allow use of low overall temperature differences, this system leads to high costs because of excessive materials, as well as bulky and heavy machines. This report is the conclusion in a series on the use of improved boiling processes, and, more recently, heat transfer to very thin films. Two methods of forming and maintaining effective thin films are conceived and demonstrated in earlier reports. Here, some of the problems of applying the small-scale findings to more complex configurations necessary for obtaining large areas in compact equipment are discussed. Experiments were made, and quantitative results are given.

It is concluded that significant advances can be made in the development of compact, simplified machines using the techniques demonstrated. The results reported conclude the exploratory research, so further work on these concepts is not contemplated in the research program.

R-510
Preliminary Test on a Shallow Unreinforced Concrete Shell, Jan 1967, J. R. Allgood, R. D. Rail, R. H. Chiu, AD646860

Available information on shallow thin shells with a rectangular plan is reviewed, experience with the sagging membrane casting technique is reported, and the results of tests on three models and one large shell are reported. The experimental results are compared with the membrane and the Haidukov theories.

An unreinforced concrete shell 7/16 in. thick with plan dimensions of approximately 8 by 8 ft and a rise of 5.5 in. sustained a uniform load of 250 psf before failing in a local transitional buckling mode. One of the model shells approximately 19 in. square by 1/8 in. thick carried a uniform plate load of 1,122 psf. Some information on the behavior of these shallow shells under a concentrated load was obtained.

Shallow compressive membranes may be suitable for floor systems in ordinary buildings and bridges, resulting in a considerable reduction in the cost of materials and labor.

R-511
Ice Construction - Methods of Surface Flooding, Jan 1967, C. R. Hoffman, AD645917

Two surface-flooding techniques for improving natural ice areas have been developed by NCEL. Confined flooding, in which the flood is contained by natural barriers or man-made dikes, is used principally for filling and leveling ice areas where deflection of the natural ice is not a problem. Free flooding, in which the outward flow of water is governed by natural forces such as gravity and freezing of the flood perimeter, is generally used for the accelerated buildup of thinner natural ice areas where deflection is encountered.

Adequate methods have been developed for surface flooding a relatively small area with a maximum dimension of 1,200 ft and for increasing ice thickness by as much as 5 ft. Continued investigation is required for the multipump flooding of areas 5,000 ft long, the flooding of deep snow, and the construction of ice roadways through tidal and pressure-ice areas.

R-512
Windows for External or Internal Hydrostatic Pressure Vessels, Part I - Conical Acrylic Windows Under Short-Term Pressure Application, Jan 1967, J. D. Stachiw, K. O. Gray, AD646882

Conical acrylic windows for fixed ocean-floor structures were placed under short-term loading (pressurization from zero to failure at a fixed rate). The windows, of different thicknesses and different included conical angles, were subjected to various applied pressures, and their subsequent behavior was studied.

Acrylic windows, in the form of truncated cones with included angles of 30, 60, 90, 120, and 150 deg were tested to destruction at ambient room temperature by applying hydrostatic pressure to the base of the truncated cone at a continuous rate of 650 psi/min. The pressure at which the windows failed and the magnitude of displacement through the window mounting at different pressure levels were recorded. The ultimate strength of the conical windows (denoted by the critical pressure at which actual failure occurred) was found to be related both to thickness and included conical angle.

Graphs are presented defining the relationships of critical pressure versus thickness-to-diameter ratio, and pressure versus magnitude of displacement for the windows.

Nondimensional scaling factors for critical pressure and displacement applicable to large-diameter windows are discussed and presented in graphic form.

This initial study produced design criteria for conical acrylic windows for any ocean depth under conditions of short-term loading. These criteria may be applied to windows in either an internal pressure vessel used to contain high pressures, and thus simulate the ocean environment, or an external one used to resist high pressures, such as deep submergence structures in the ocean.

R-513
Refrigeration Appliances With Special Coatings for Service in the Tropics, Jan 1967, J. C. King, AD806499L

Preliminary studies of maintenance cost and service life of refrigeration appliances at three stations in the Pacific indicated that corrosive environment causes 85% to 95% of the problems. An economic evaluation indicated that if refrigeration appliances were designed for tropical climates, a saving of $125,000/yr could be obtained. As a result of these preliminary studies, NAVFAC recommended different coatings of synthetic enamel for the outer casings and a moisture- and fungus-resistant varnish for the electrical components. Twenty-four refrigerators were purchased, 12 were refinished at NCEL and 12 were left as received. All 24 units were later sent to the U.S. Naval Base, Subic Bay, Philippines, for in-service testing. Periodic inspection reports and maintenance records will be maintained and the test will continue for several years. An inspection report received after 6 mo of tests indicates that all coatings are providing adequate protection for service in the tropics.

R-514
Incineration Equipment for Classified Materials, Feb 1967, W. W. Watson, AD806521L

A great majority of the incinerators currently used throughout the Navy for the destruction of classified materials are considerably less than satisfactory from the standpoint of maintenance costs, labor operating costs, security, and air pollution. In order to improve upon this situation, NCEL has under investigation a variety of systems and equipment designed specifically for the efficient incineration of classified materials and has prepared a set of performance specifications in support of this objective. New incinerators procured in response to these specifications are expected to be completely automated, reliable, and free of the tendency to promote air pollution.

R-515
Comparative Physical Characteristics of Fine and Coarse Shotcrete, Feb 1967, W. R. Lorman, AD648408

The conclusions concerning hardened shotcrete tested at ages from 7 to 28 days are considered valid for the particular mixtures used, but are not necessarily applicable to all hardened shotcrete.

The density of fine shotcrete (3/8-in. maximum-size aggregate) varies as much as three times that of coarse shotcrete (3/4-in. maximum-size aggregate). Size and type of test specimen are insignificant relative to testing the density of shotcrete. Poisson's ratio of either fine or coarse shotcrete, and flexural strength of coarse shotcrete, are not affected by size of test specimen. Young's modulus, flexural strength, compressive strength, and strength of bond to steel tend to increase with age in both fine and coarse shotcrete. The position of reinforcing bars at the time of gunning has no bearing on bond strength. The 3-cu-in. pull-out test specimens are not sufficient for ascertaining the bond strength of shotcrete walls 6 in. thick.

It is recommended that methods of producing ready-mixed mortar for use as fine shotcrete be revised to improve the distribution of cement throughout the mass when the mortar is discharged from the truck mixer. Also recommended is the use of large shotcrete test specimens for verifying flexural strength and the use of cylindrical rather than cubical test specimens for verifying compressive strength of shotcrete.

R-516
Hydraulic-Pneumatic Floating Fender - Additional In-Service Tests, Second Series, Mar 1967, T. T. Lee, AD648507

Two experimental hydraulic-pneumatic floating fenders underwent in-service tests at two sites in San Diego Bay for 12 mo. A previous series of in-service tests with the same fenders lasted 19 mo - 14 mo in a well-protected harbor (Port Hueneme, Calif.) and then 5 mo in a moderately exposed harbor (San Diego). Each fender consists of a bulkhead (50 ft long) fronted with two air-filled and two water-filled rubber bags, chains with weights to maintain the total assembly in position, and a keel with concrete ballast. Two units are necessary to serve one berth. Each fender assembly has a total minimum energy-absorption capacity of 490 in.-tons and a maximum of 2,300 in.-tons.

During the second series of tests the fenders served approximately 50 Naval and merchant ships satisfactorily.

Despite their high combined initial and maintenance costs, the test fenders would be economical and feasible for both sheltered and exposed locations,where mechanical damage by ships and biological deterioration by marine borers to fixed fender systems constitute a serious problem. The fenders should be useful in increasing the energy-absorption capacity of existing pier fender systems. The cost effectiveness of the test fenders is compared with some other new concepts which are promising and which may be more favorable than the test fenders.

R-517
Behavior of Spherical Concrete Hulls Under Hydrostatic Loading Part I. Exploratory Investigation, Mar 1967, J. D. Stachiw, K. O. Gray, AD649290

Hollow concrete spheres 16 in. in outside diameter have been tested to destruction by exposure to external hydrostatic pressure in seawater to determine the compressive strength and permeability of concrete under such loading. The testing has shown that for the particular mix used, the compressive strength of dry concrete in a spherical hull of 16-in. OD and 1-in. wall thickness under biaxial loading (short-term hydrostatic pressurization to failure at a constant rate) is approximately 48% higher than for identical dry concrete in 3-in.-diam by 6-in.-long solid test cylinders under uniaxial loading conditions. Concrete spheres in which the wall was thoroughly permeated by seawater failed at stress levels approximately 18% higher than

3-in.-diam by 6-in.-long solid test cylinders. The permeability of uncoated spheres to seawater at simulated ocean pressure of 1,500 psi was approximately 6 x 10^{-3} ml/hr/sq in. of area/1 in. of thickness.

R-518
Effects of Long-Term Loads on Prestressed Concrete Beams, Mar 1967, R. A. Breckenridge, P. J. Valent, S. L. Bugg, AD650329

Thirty post-tensioned concrete beams were loaded for 10 to 12 yr, and changes in deflections, prestressing forces, and concrete strains were recorded. All of the beams were simply supported on a 40-ft span.

Twenty-two of the beams were straight and had an I cross section. Eight of these were prestressed with cables. The other 14 were prestressed with high-strength steel bars, and 8 of these beams were grouted after being post-tensioned. The 22 I-beams were subjected to loads varying in magnitude from dead load only to dead load plus 1.5 design live load.

Eight of the beams had a gabled shape with a hollow-box cross section and were post-tensioned with wires running straight through. Six of these beams were uniformly loaded with concrete weights to provide four different loading conditions.

The beams with no live loads continued to deflect upward for about 1 yr. Their total camber was about 2.1 times their initial camber due to prestressing. The loaded beams continued to deflect downward for several years. In 6-1/2 yr the I-beams had undergone about 94% of their total deflection due to live loads, and the hollow-box beams had reached their maximum. The maximum midpoint deflections due to live loads were from 2.2 to 2.8 times the initial deflections due to those loads.

Loss of prestress was a function of the magnitude of the sustained loads. It was highest for beams with no live loads, reaching its maximum of 24% in 7 yr.

R-519
Efficiency of Two Estimators for a Poisson Distribution, Apr 1967, W. L. Wilcoxson, M. L. Eaton, AD649910

A given Poisson phenomenon is characterized by a single parameter. From observed records this parameter may be estimated in at least two ways, namely by the mean and variance estimates from the sample, each computed from the observations. The efficiency of the variance estimate (as compared with the mean estimate) decays rapidly as the value of the parameter increases, and increases slowly with increasing sample sizes.

R-520
Packaged Automatic Fire Protection Systems for Remote Buildings, Apr 1967, J. C. King, AD649939

NAVFAC has requirements for packaged automatic fire protection systems suitable for use in any climate, including polar. A research firm under contract to NCEL evaluated 31 fire-suppressant agents and prepared conceptual designs of five protection systems, ranking the concepts on the basis of fire extinguishing characteristics, initial and maintenance costs, and reliability. The Halon 1301 multicycle total flooding system was first choice, and an automated water sprinkler system was second choice. Fire tests of these two systems by the contractor indicated that the Halon 1301 system is the more promising for an advanced base in a polar climate. However, because a fire protection system was required for immediate use in the Antarctic and the Halon 1301 system would require considerable development time, a water sprinkler system already proven in service was selected. This system designed by NCEL and discussed in this report is fully automated. It is a single-shot system, pressurized with nitrogen, and uses electric heaters to prevent the stored water from freezing.

R-521
An Analysis of Mission Performance Capability of a Construction Battalion Center After Nuclear Attack (U), Apr 1967, J. A. South, Confidential, AD380941L

R-522
Application of Underwater-Curing Epoxies to Steel Sheet Piling at USNSB New London, Apr 1967, R. W. Drisko, AD812944L

Three proprietary underwater-curing epoxy coatings were applied to a deteriorated quay wall of steel sheet piling at U.S. Naval Submarine Base New London (located at Groton, Connecticut). Two different methods of application were used, one method used a patty-cake type of application and the other used a fiberglass screen backing. The first method was simpler and faster. A detailed description is given of the surface preparation and the applications of the epoxies. Only one of the three epoxies presented no application difficulties.

Periodic inspections will be made of the test coatings, and their performances will be reported.

R-523
Experimental Determination of Neutron Energy Spectra in Concrete Ducts, May 1967, L. B. Gardner, A. J. Mettler, B. J. Burdick, AD653076

Neutron energy spectra were experimentally determined at various positions in air ducts through concrete. The ducted concrete structures studied were built as model entranceways for protective shelters. The spectra were determined for the case of 14-mev neutrons impinging on the duct entrance, and were based on activation analysis of threshold foil detectors, foil sandwiches, and bare and cadmium-covered indium foils. The experimentally determined spectra were compared to available spectra calculated by Monte Carlo techniques utilizing the Adonis computer code. From the spectra the dose was calculated and the results were normalized to the dose in free air at 1 cm from the source. The normalized dose, as a function of distance in the duct from the source, is graphically compared for the several analysis techniques. The data presented demonstrate that it is possible to determine the neutron energy spectrum in ducts by the technique of foil activation. Such determinations are useful during the experimental optimization of the protection factor for the duct in which the inclusion of doors, traps, liners, and special wall materials are considered. The data presented herein form a basis for understanding the effect of duct geometry on the protection factor that is the inverse of the dose rate at various positions in the duct normalized to the dose rate at the entrance of the duct.

R-524
Survey of Collapsible Pontoons, Apr 1967, D. Taylor, J. J. Bayles, AD812802L

A study was conducted on collapsible salvage pontoons and similar devices that appeared to have potential for ship salvage purposes. The study included a patent search (1850-1966), an examination of the Navy files on collapsible salvage pontoons (1942-1966), a survey of inflatable collapsible devices readily available in the Federal Supply System and from manufacturers, a review of reports selected from two DDC report bibliographies, and articles in trade journals and scientific publications.

There is a definite place in salvage operations for the modern collapsible salvage pontoons being developed by the Navy. They will supplement, and perhaps eventually replace, the Navy's 80-ton-capacity rigid structural steel pontoons. The collapsible pontoons are durable, can be rolled or folded to minimize stowage requirements, and the weight-to-capacity ratio is about 1 to 25 compared to 1 to 2 for the structural steel pontoon.

R-525
Deep-Ocean Biodeterioration of Materials - Part VI. One Year at 2,370 Feet, May 1967, J. S. Murazoka, AD651124

As Part VI of a series of reports on the biological deterioration of materials in the deep ocean, this report covers the data obtained after exposing metallic and nonmetallic specimens for 13.4 months on the floor of the Pacific Ocean at a depth of 2,370 ft (test site II). The specimens were attached to a submersible test unit that was emplaced in Apr 1965 and retrieved in May 1966. Preliminary examination of the specimens was made aboard ship, and the final examination, tests and analyses were performed at NCEL.

On recovery, most of the plastic materials and all of the rope specimens were covered with bacterial slime. Cotton and manila ropes were severely deteriorated by marine microorganisms. Wood panels, certain plastics, and manila ropes were attacked by molluscan borers. Some of the plastics were attacked by borers directly from seawater environment without the aid of wood bait pieces. Hydroids and tubeworms were found on metal panels. Sea anemone, snails, and crabs were also found attached to various test panels. The surface of a silicone rubber electrical cable insulation was deteriorated by some marine organisms. Typical fouling organisms such as barnacles and bryozoa were not found. Glass, elastomers, and certain plastics were not adversely affected. Data from evaluation of these specimens are presented.

R-526
Hardened VLF and LF Antenna Systems (U), May 1967, M. L. Look, Secret, AD381072L

R-527
Windows for External or Internal Hydrostatic Pressure Vessels Part II. Flat Acrylic Windows Under Short-Term Pressure Application, May 1967, J. D. Stachiw, G. M. Dunn, K. O. Gray, AD652343

Flat, disk-shaped acrylic windows of different thickness-to-diameter ratios have been tested to destruction under short-term hydrostatic loading at room temperatures, where short-term loading is defined as pressurizing the window hydrostatically on its high-pressure face at a 650-psi/min rate until failure of the window takes place. Critical pressures and displacements of windows with thickness to effective diameter ratios less than 1.0 have been recorded and plotted. The critical pressures derived from testing flat windows in flanges with 1.5-, 3.3-, and 4.0-in. openings have been found applicable also to flanges with larger openings, so long as the larger windows are of the same T/D_i and D_o/D_i ratios, where T is thickness of the window, D_i is the clear opening in the flange and therefore the effective diameter of the window exposed to ambient atmospheric pressure and D_o is overall diameter of the window face exposed to hydrostatic pressure. The performance of flat windows under short-term hydrostatic pressure has been found to be comparable to that of conical windows with included angle equal to, or larger than 90 deg.

R-528
Test of Zinc Inorganic Coatings on Work Areas of a Floating Drydock - Results of 25th-Month Inspection, May 1967, C. V. Brouillette, AD816102L

Coal tar coatings used to protect the work areas of U.S. Navy floating drydocks do not satisfactorily resist the effects of chemical agents (e.g., seawater, solvents, fuels, and oils) and physical agents (e.g., sandblasting, acetylene cutting and welding, and dragging of equipment) during the overhaul of ships and barges. Because zinc inorganic silicate coatings are more durable and abrasion resistant than bitumastic, asphaltic, or rubberized coatings, 14 of these coatings and one zinc-rich epoxy coating were applied to 42 deck sections and other work areas of the floating drydock USS ARD-12 for a 2-yr, in-service field test. After 2 yr exposure under conditions of continuous ship repair routine, the postcured coatings, as a class, were obviously superior to the self-cured coatings and to coal tar coatings. The zinc-rich epoxy coating also showed excellent performance.

R-529
A Critical Evaluation of the Markov Matrix Treatment of Neutron Diffusion in Slabs, May 1967, M. L. Eaton, C. M. Huddleston, AD653444

It is known that a method based on the concept of a Markov chain can be used to treat the problem of absorption, transmission, and backscatter when single-velocity neutrons are incident on a plane slab of finite thickness, under the assumption that scattering is isotropic in the laboratory system. Such conditions can exist when neutrons impinge on a slab of material, such as a shield or an inside wall of a shelter entranceway. Since the Markov matrix method is a new approach to the problem, the practical limits in applying the method have not previously been explored. This report outlines the region of usefulness of the matrix method. The solutions to some sample problems are given. Comparisons are made with other theoretical treatments. It is concluded that the Markov matrix method is useful over a wide region of interest. Within its limits of practical applicability, the method gives highly exact answers without requiring exorbitant computing time.

R-530
Portable Total Energy Package for Advanced Base Functional Components, Jun 1967, J. S. Williams, AD653081

Under consideration is the concept of a total energy package consisting of a gas-turbine-driven generator and a waste-heat boiler for use in the advanced base functional component system. The results of a survey show that a total energy package will probably not provide balanced heat and electrical energy demands, making the small gas turbine a poor logistic and economic choice for a prime mover. Suggestions are offered for the utilization of waste heat from diesel generators, where feasible. Included in the report as an appendix is a literature study of high-temperature corrosion of turbine blading in a marine atmosphere.

R-531
Protection of Mooring Buoys - Part IX. Results of Eighth Rating Inspection, Jun 1967, R. W. Drisko, AD654173

This is the ninth of a series of reports on the protection of mooring buoys. Thirteen buoys were given their eighth rating (after a maximum of 4-1/2 yr exposure) for extent of coating deterioration, corrosion of steel, and fouling. Two other buoys had previously been removed from testing in San Diego Bay because of advanced deterioration. The coating systems on three of the buoys were in good condition, while those on 10 others showed varying degrees of moderate deterioration. Two sets of 13 steel panels each, coated with the different systems used on the buoys, were given their seventh rating inspection after 3-1/2 yr of exposure. One set was exposed in San Diego Bay and the other in Port Hueneme Harbor. The condition of the coatings in both sets of panels was generally better than that of the buoy coatings, but there was a general correlation between the conditions of the two test groups. On buoys coated with antifouling paints, no detectable antifouling property remained after 20 months, but on both sets of test panels, two antifouling coatings containing copper oxide were still appreciably reducing fouling after 3-1/2 yr.

Patches of underwater-curing epoxy applied to buoys where localized damage to the coating had been caused by abrasion were in good condition. Some patches had been in place for 3-1/2 yr.

Three of the buoys were cathodically protected with zinc anodes. The underwater portions of these buoys were receiving protection from corrosion 28 mo after anode installation.

R-532
Light Housings for Deep-Submergence Applications - Part I. Four-In.-Diameter Glass Flasks With Conical Pipe Flanges, Jun 1967, J. D. Stachiw, K. O. Gray, AD653293

The objective of the study was to evaluate commercially available glass reaction flasks and cover caps for application as transparent housings for underwater lights. Four-in.-diam reaction flasks and cover caps having conical pipe flanges and flat seating surfaces were imploded under short-term, long-term, and cyclic pressure loading, and their critical pressures were recorded. Six designs for underwater lights utilizing such housings were prepared, built, operated in simulated hydrospace environment, and their performance was rated. The glass housings and the light assemblies withstood pressures equivalent to those at hypothetical ocean depths between 5,000 and 40,000 ft, the critical pressure depending on the size of the light housing, the design of the housing's end closure, and the mode of pressure loading. Under repeated submersion, the maximum operational depth of light assemblies with 4-in.-diam reaction flasks and cover caps serving as light housings is 10,000 ft.

R-533
Compacted-Snow Runways in Antarctica - Limitations of Contaminated Snow, Jun 1967, G. E. Sherwood, E. H. Moser, AD654140

Techniques and equipment have been developed to utilize clean, undisturbed snow as a building material for emergency and temporary roads, runways, and skiways in polar regions. However, these routes are often needed in areas where the snow is contaminated. During Deep Freeze 65, a compacted-snow runway was constructed in an area of contaminated snow near McMurdo, Antarctica. The area had been contaminated by oil spillage, soot and debris from previous operations. Physical property tests were conducted on the compacted snow near the end of Deep Freeze 65 and during Deep Freeze 66.

It was concluded that contaminated snow can be processed to produce load-carrying material capable of supporting C-130 aircraft and other heavy loads at temperatures below 20F, however, because of the extra work involved to clear and process such snow, its marginal load-carrying capabilities at temperatures above 20F, and the possibility of low-strength areas, its use is not recommended where clean snow is available.

New processing techniques resulted in improved quality control of compacted snow, and it was recommended that effort be continued to improve processing techniques.

R-534
Dynamic Shear Resistance of Thin-Webbed Reinforced Concrete Beams, Jun 1967, D. S. Fuss, AD655823

Experiments were performed to obtain information on the dynamic shear and diagonal tension resistance of reinforced concrete I-beams constructed with welded-wire fabric as web reinforcement. These experiments were in support of the ultimate objective of the project, which is to formulate design criteria for thin-shell concrete structures to withstand dynamic loading such as is produced by the detonation of a nuclear weapon.

Under uniformly distributed loads, the dynamic diagonal tension resistance of the beams was found to be significantly greater than the static diagonal tension resistance. The increase in resistance was attributed to the increase in tensile strength of concrete under rapid stressing. The ultimate shear resistance of the beams could not be precisely determined from the tests because only three of the beams failed in shear. However, evidence was found that the dynamic ultimate resistance of such beams is only slightly greater than the static ultimate resistance.

R-535
Radio-Frequency Shielding Provided by Bolted Seams Connecting Armored-Plywood Panels, Jun 1967, N. A. Lasitter, AD816496L

Rooms shielded against radio-frequency (RF) signals are essential to the Navy's research and development and operational use of equipment sensitive to RF interference. A series of shielding-effectiveness measurements of armor-clad plywood sections representative of those used in the construction of radio-frequency shielded rooms has been conducted. Five sections and their bolted seams were subjected to wet cycles of 70F, 100% RH and to dry cycles of 200F, 10% RH. The percent moisture content, thickness variability, DC resistance and surface currents at 12.8 kHz were observed during the wet-dry cycles. DC surface resistance of the seams increased monotonically throughout the test period. Standard deviation of the surface current measurements reached a peak at approximately 12 days. Another series of tests indicated that seams caulked with silver-loaded compounds had distribution of surface currents similar to those of solid armored sheets.

R-536
Static and Dynamic Bearing Tests on a Strip Footing in Saturated Sand, Jun 1967, C. R. White, AD654712

This report describes the static and dynamic loading of a 12-in. wide by 18-in.-deep by 6-ft-long rigid footing, representing the strip footing of a subsurface shelter. Boundary conditions simulated those of a torsionally restrained footing of a flexible arch structure with simulated overburden of 20 ft at one side of the footing. Saturated and partially saturated sand was the test soil. Several soil void ratios were employed, and the effect on the relationship between load and displacement of the footing caused by soil saturation at void ratios higher than the critical void ratio was demonstrated.

R-537
In-Situ, Sea-Floor Plate Bearing Device - A Performance Evaluation, (Including Data on the Short-Term Load-Settlement Response of Cohesive and Noncohesive Bottom Sediments), Jun 1967, T. R. Kretschmer, AD654714

A device was developed by NCEL to determine the short-term, in-situ bearing pressure and settlement response of marine sediments at any ocean depth. The knowledge thus gained will ultimately be used to improve the design and fabrication of foundations supported by the bottom sediment. Measurements of load, settlement, and attitude of the device are transmitted acoustically to a surface vessel where they are monitored and recorded. Two series of tests with both round and square bearing plates were performed in cohesive and noncohesive sediments at ocean depths of 100 and 150 ft, respectively.

The in-situ plate bearing device was found to be a useful tool for investigating the in-situ loading response of marine sediments. The most significant parameter affecting the bearing pressure-settlement relationship in both major sediment types was found to be the size of the plates. Plates loaded to the same bearing pressure level in a nearly homogeneous cohesive soil were found to undergo short-term settlements which were almost directly proportional to the lateral dimension of the plates. Possible methods of extrapolating the data for the design of footings wider than those tested is presented for the cohesive soil. Plates loaded to the same bearing pressure level in a noncohesive soil exhibited short-term settlements which were almost directly proportional to the empirical factor $(2B/B+1)^2$, where B is the lateral dimension of a plate expressed in feet. Data from tests on both cohesive sediments exhibited reasonable conformity to theory currently applicable to terrestrial soils.

R-538
Pioneer Polar Structures - Mobile Foundation for Jamesways up to 64 Feet Long, Jul 1967, G. E. Sherwood, AD656587

In order to eliminate the labor required to completely disassemble and reassemble these buildings for relocating them, a mobile foundation for jamesways up to 64 ft long was developed. This steel foundation is hinged 32 ft from the end to reduce bending moment when more than a 32-ft length is used, and is cross-braced in each 16-ft length to keep it square.

A prototype 64-ft-long foundation was given two tests on snow near McMurdo, Antarctica. It was loaded with weights to simulate the weight of a jamesway, and towed 3 miles without damage over terrain which had ridges up to 2 ft high. The following season, a jamesway was erected on the foundation, and the building was towed 1 mile without damage.

It was concluded that the mobile foundation provides a suitable means for relocating completely assembled jamesways in the same general area, and that its use would produce significant savings in reduced building damage, manpower, and reoccupancy time. It was recommended that the mobile foundation be used in all areas where jamesways up to 64 ft long require frequent relocation.

R-539
Predicting Blast-Induced Body Motions of a Buried Structure With Footings, Aug 1967, J. R. Allgood, W. O. Carter, AD657839

An approximate theory is presented for predicting the absolute and relative body deflections of shallow-buried shelters in order to provide the designer with a rational approach for selecting footing dimensions. The theory consists of two coupled parts, one that describes the motion of the free field and another that defines the motion of a model of the structure, its foundation, and the covering soil.

The soil characteristics are represented by straight-line approximations to the loading and unloading portions of the stress-strain diagram from a one-dimensional compression test. Incremental strains are integrated as the stress wave propagates downward to obtain the absolute free-field displacement at the elevation of the footings. Motion of the structure is represented by a single-degree-of-freedom analog.

Empirical functions are used to represent footing reaction and arching in the model of the structure. These functions are incorporated in the differential equation of motion, which is solved with the aid of a digital computer. The results are compared with available test data, velocities and deflections agree reasonably well but the magnitude of the peak accelerations from the theory are larger than the corresponding measurements.

Computations performed with the computer code indicate that surface loads above about 100 psi cannot be resisted if the maximum relative deflection between the footing and the floor slab is limited to 2 in.

R-540
Polar Transportation - Snow Trails for Light Wheeled Vehicles, Aug 1967, E. H. Moser, G. E. Sherwood, AD819606L

At McMurdo Station, Antarctica, 24-hr-old snow trails built with low-ground-pressure snow tractors were traveled by 10,000-lb (GVW) vehicles fitted with high-flotation tires inflated up to 10 psig. Continued traffic improved these trails except when they became drifted over with deep, soft snow. Even then, traffic was resumed within 8 hr after the drift snow was leveled and compacted.

In high-activity areas such as that around McMurdo Station, snow trails permit the use of wheeled vehicles to provide rapid ground transportation to outlying areas during emergencies and the construction of high-strength snow roads. In low-activity areas such as Byrd Station, Antarctica, unmaintained equipment-packed trails are of marginal value for wheeled traffic with existing vehicles and maintenance techniques.

It is recommended that snow trails be used in polar operations to initially support new and temporary work centers on snow and ice where the requirements and density of traffic demand such support, and that they be used to support outlying areas where speed is required but density and type of traffic do not warrant high-grade snow roads.

R-541
Active Arching of Sand During Dynamic Loading - Results of an Experimental Program and Development of an Analytical Procedure, Sep 1967, H. L. Gill, AD658502

The ultimate purpose of this study of soil arching is to enable the economical design of reliable underground protective structures. Idealized small-scale structures were embedded in prepared specimens of dry sand, and long-duration, dynamic over-pressures of various magnitudes up to 440 psi were applied to the surface of the sand. Foundation area and depth of soil cover over the structures were the primary variables during the tests. Measurements were made to evaluate the interrelationships between depth of soil cover, dynamic overpressure, soil stiffness, structural response, and soil arching.

Soil arching over a particular soil-structure system subjected to dynamic loading was found to be a function of the geometry and the relative stiffness of that system. The geometry is accounted for by the perimeter-area ratio of the structure multiplied by the depth of the soil cover. The stiffness portion of the factor relates the soil stiffness to the stiffness of response of the structure relative to the free-field soil.

R-542
Protection of Mooring Buoys, Part X. Results of Ninth Rating Inspection, Sep 1967, R. W. Drisko, AD659478

This is the tenth of a series of reports on the protection of mooring buoys. Thirteen buoys were given their ninth rating (after a maximum of 5 yr exposure) for extent of coating deterioration, corrosion of steel, and fouling. Two other buoys had previously been removed from the test program because of advanced deterioration. The coating systems on three of the buoys were in good condition, while those on nine others showed varying degrees of mderate deterioration, and one was in such poor condition that it was also removed from the test program. Two sets of steel panels coated with the different systems used on the buoys were given their eighth rating inspection after 4 yr of exposure. One set was exposed in San Diego Bay and the other in Port Hueneme Harbor. The condition of the coatings on both sets of panels was generally better than that of the buoy coating, but there was a general correlation between the conditions of the two test groups. On buoys coated with antifouling paints, no detectable antifouling property remained after 20 months, but on both sets of test panels, two antifouling coatings containing copper oxide were still appreciably reducing fouling after 4 yr.

Patches of underwater-curing epoxy applied to buoys where localized damage to the coating had been caused by abrasion were in good condition. Some patches had been providing protection for 4 yr.

Three of the buoys were cathodically protected with zinc anodes. The underwater portions of these buoys were receiving protection from corrosion 33 months after anode installation.

R-543
Mechanics of Raising and Lowering Heavy Loads in the Ocean. Experimental Results, Sep 1967, B. J. Muga, AD659025

To establish the degree of agreement between theoretical and experimental results, NCEL conducted tests on high-mass, low-drag bodies (a reinforced concrete sphere, a cylinder, and a parallelepiped) suspended from various

lengths of nylon line and steel wire cable. Random excitations were induced in the loaded cables by the roll, heave, and pitch of the drifting test ship from which the loaded cable was suspended. Except for apparent frequency shifts in the response amplitude operators for loaded nylon lines at the greater depths, there was good agreement between the theoretical and the experimental results.

R-544
Ammi Pontoon Field Assembly Procedures, Sep 1967, P. J. Rush, AD658883

This report was prepared for use as a manual by the military crews engaged in the assembly of Ammi pontoons under conditions where all of the conveniences of production shops or yards are not available. The manual covers phases of field assembly including crew and equipment requirements, site selection and preparation, layout, fitting-up, welding, inspection, and launching. Since the principal factor in quality control is the welding operations, these are discussed in considerable detail.

R-545
Strength Studies of Sea Ice - Effect of Load Rate on Ring Tensile Strength, Oct 1967, R. A. Paige, R. A. Kennedy, AD659298

A quick, accurate method of estimating the load-carrying capacity of sea ice subjected to rapidly applied loads such as those imposed by moving aircraft and surface vehicles is needed to promote the safe and efficient use of sea ice by these forms of transportation. Tensile strength is one of the critical parameters in determining load-carrying capacity under these conditions which produce an elastic response in the sea ice. An approximate measurement of this strength can be determined by the ring-tensile-strength test of small specimens. However, temperature, salinity, crystallography, and load rate affect the results of this test.

Ring tensile strength is a function of loading crosshead speed and decreases as much as 91% from crosshead speeds 2.54 to 25.4 cm (1 to 10 in.)/min. A minimum crosshead speed of 50.8 cm (20 in.)/min is required to achieve true elastic failure and is approximately 30 times greater than the load rate of 0.5 kg/cm-squared/sec (7.11 psi/sec) commonly used for sea-ice strength tests.

Apparatus used in the past have not tested specimens at a high enough load rate to assure elastic failure. In addition to low load rates used in the past, processing sea-ice specimens has also been too slow to minimize detrimental brine drainage and temperature changes to non-in-situ conditions. Properly designed test apparatus is required to rapidly collect and process sea-ice specimens and to test them at a crosshead speed of at least 50.8 cm/min.

R-546
Estimating Wave Pressures on a Horizontal Pier, Oct 1967, H. Wang, AD660190

Simple rules are developed to enable the designer to estimate the maximum uplift pressures induced on the underside of a pier deck by various types of incident waves. The ultimate objective of such estimations is to improve the design of important waterfront structures as well as the designer's ability to assess the damage done to them. Theoretical prediction techniques are provided for both the slow-rise pressure component and the fast-rise component (impact) for different incident waves, standing waves, regular progressive waves in water having a constant depth, and dispersive waves.

Laboratory experiments were conducted in the NCEL dispersive wave basin partially to check the validity of prediction techniques and partially to provide additional information so that the prediction techniques can be extended empirically to cover the more complicated but more practical situation of a pier in shoaling water.

R-547
Behavior of Spherical Concrete Hulls Under Hydrostatic Loading - Part II. Effect of Penetrations, Oct 1967, J. D. Stachiw, AD661187

The objective of the study was (1) to show that concrete hulls with window and hatch penetrations for ocean bottom habitats can be built, and (2) to determine if the collapse pressure of such hulls is degraded by the incorporation of properly designed penetrations. All of the experimental work was performed on six concrete spheres (16-in. OD and 14-in. ID) cast from concrete with a uniaxial compressive strength of 10,000 psi. The concrete sphere models failed under hydrostatic pressures ranging from 2,675 psi to 3,400 psi, depending on the type of penetration insert. It was found that the collapse pressure of a concrete hull equipped with properly designed operational windows and hatches was the same as that of a similar concrete hull without penetrations.

R-548
Underwater Tools, Equipment, and Work Techniques - A Survey, Nov 1967, D. S. Teague, L. W. Hallanger, AD662221

In supporting underwater construction activities, the Naval Civil Engineering Laboratory has a vital interest in underwater work. This report reviews published and unpublished information on underwater equipment (tools, communications systems, photographic paraphernalia, and diving gear) and working techniques that can be used by one or two divers at normal diving depths. Underwater work techniques (such as hammering, sawing, and drilling) and the methods and tools used to perform them are discussed. Specific improvements needed in equipment and techniques are listed.

R-549
Acoustic Noise Reduction in Shielded Enclosures, Nov 1967, H. A. Lavitter, AD662394

The acoustic NR (noise reduction) for a shielded enclosure at NCEL has been determined. The instrumentation necessary for measuring NR in the frequency range between 100 and 15,000 Hz has been established. All measurements make use of an airborne signal source which is capable of providing approximately 60 db dynamic range in signal-level measurement. A standard method and a swept-frequency method were used to measure NR. The two methods are compared in this report.

The far-field and near-field NR values have been measured for a 20x20x10-ft shielded enclosure. The vibration level (measured with an accelerometer) at the walls of the enclosure have also been determined. The minimum noise-reduction (near-field) values were on the order of 10 db at 1,500 Hz. Far-field NR measurements yield values from 12 to 45 db from 100 to 10,000 Hz.

R-550
Ammi Bridge Field Assembly and Installation Procedures, Jan 1968, P. J. Rush, AD684780

This report was prepared as a manual for the guidance of military field forces in the assembly of Ammi bridge pontoons from prefabricated components and in the installation of Ammi bridge pontoons and other parts to form configurations of floating or pile-supported bridge structures. Requirements for crews, equipment, tools, and consumables for the separate operations are listed. Techniques of layout, fitting-up, welding, inspecting, launching, positioning, erecting, and pile-driving are discussed. Many of the operations and techniques are illustrated.

R-551
Estimating Strengths of Individual Radioisotopes in a Multiple-Isotope Source - The Imprecision of the Estimates is Partitioned into Poisson, Sampling, and Mechanical Variations, Nov 1967, M. L. Eaton, W. L. Wilcoxson, AD662192

In work related to radiation shielding, the use of radioisotope techniques, and activation analysis, an experimenter must often analyze counting data where counts are caused by the natural background and by the decay of more than one radioisotope. In this report a procedure is developed for estimating the strength of each isotope at different times from several decaying radioactive samples of a single multiple-isotope source. In addition, the procedure provides a method for placing confidence limits on the strengths and a method for partitioning the imprecision of estimating the strengths into three principal causes, Poisson variation, sampling error, and residual error (called mechanical error).

An operational Fortran II-D computer program, SAND, implements the procedure. The procedure and program were tested by using fictitious data with known properties as inputs. The results of the simulation were in reasonable agreement with the theoretical values.

R-552
Plateau Station, Antarctica - Concept, Design, Construction, and Initial Occupancy, Nov 1967, J. P. Cosenza, A. M. Weber, AD823661L

Plateau Station was established during the austral summer of 1965 to function for a period of 2 yr as a scientific station and stopping point for the Queen Maud land traverse.

This technical review of the Plateau Station covers its concept, design, construction, and operation between Jan and Nov 1966. It is based on published documents and interviews with the personnel closely involved with the station.

It was concluded that the premanufactured van concept permits rapid field deployment and occupancy of remote polar stations with a minimum of field construction. The single-building concept for the major activities at such a station is convenient and comfortable but requires careful planning to provide adequate space for all activities. Use of waste heat was effective and economical, and should be suitable for application at many polar stations. Thorough testing and evaluation prior to use is essential for new, untried materials and equipment necessary to the mission of remote polar stations. Continued documentation, including interviews with scientific and operational personnel, is needed to develop complete knowledge in the operational and support requirements for this type of station

R-553
Beta-Ray Backscattering Gage for Measuring Paint Film Thickness, Dec 1967, R. W. Brown, AD663130

An experimental nondestructive paint thickness gage using the backscattered beta radiation from Sr-Y-90 has been developed by NCEL. This gage will measure a variety of commonly used paints having thicknesses ranging from 0.5 to about 30 mils on wood with an error of approximately ±30 mil. Graphs are given demonstrating the performance of this gage in measuring the thickness of films of various Federal specification paints (TT-P-102, TT-P-0055A, TT-E-489) and Paint A, a proprietary paint.

R-554
Harbor Screening Tests of Marine Borer Inhibitors - VIII, Dec 1967, T. Roe, H. Hochman, AD662393

NCEL is exposing wood panels impregnated with various materials to determine the resistance of these panels to attack by marine borers. This report lists the results of harbor tests of treated panels removed from exposure between 15 Aug 1964 and 15 Feb 1967. It also lists all treated panels which have been exposed for 1 yr or more and which have shown no attack or insufficient attack to warrant removal.

R-555
An Improved Lashing and Launching System for the 3x15 Pontoon Causeway, Dec 1967, J. J. Traffalis, AD663131

A lashing-launching system designed to reduce the impact damage to pontoon causeways side-launched from LSTs and to reduce the lashing equipment weight and assembly effort was developed and tested by NCEL. The developed system is adaptable for use on all classes of LST. Engineering testing by the field forces is recommended.

R-556
Airfield Marking Paints, IV. Effect of Paint Flexibility on Slurry-Sealed Asphalt, Dec 1967, R. W. Drisko, AD663562

A field exposure study was conducted on experimental airfield marking paints with relatively high flexibilities. While flexibility must be greater than the minimum required in Federal Specification TT-P-85B for good paint performance, a further increase in flexibility does not necessarily result in better performance.

Short oil length alkyd and oleoresinous paints do not perform well, medium oil length paints performed very well, longer oil length paints generally performed somewhat poorer than medium oil length paints, especially for the alkyd formulations. While incorporation of organic plasticizers into paints generally increased flexibility, it did not usually improve the field performance.

R-557
Zinc Inorganic Silicate Coatings, With and Without Topcoats, Exposed to a Marine Atmosphere, Dec 1967, C. V. Brouillette, AD824226L

Ten zinc inorganic coatings, with and without topcoats, were applied to sandblasted steel and exposed to a marine atmosphere in Port Hueneme, Calif., Kaneohe, Hawaii, and Kwajalein, Marshall Islands. The necessity of using a wash primer over the zinc inorganic coatings when applying certain Mil-Sec topcoatings was demonstrated. During 2 yr of exposure, one proprietary epoxy topcoat nearly failed along a scribed cut. However, in general, all three proprietary vinyl and four of five proprietary epoxy topcoats gave excellent protection. Two of the finyl topcoats have blistered slightly, which may result in loss of bond. The testing is continuing, and additional reports on the performance of these coatings will be forthcoming.

R-558
Neutron and Gamma-Ray Streaming Through a Two-Legged, Thick-Wall Steel Duct, Jan 1968, L. B. Gardner, AD663563

The purpose of this study was to determine the validity of simplified formulas for calculating the protection against streaming neutrons and gamma rays afforded by thick-wall steel ducts. The present report summarizes the results of neutron and gamma-ray dose calculations by Albedo techniques and the results of gamma-ray dose measurements performed for a two-legged, thick-wall steel duct. Original data are presented for: (1) the Monte Carlo calcualtion of neutron and gamma-ray streaming, (2) survey meter measurement of neutron dose, (3) the measurement of neutron energy spectra by foil activation techniques and subsequent calculation of dose, and (4) the measurement of prompt gamma rays by a liquid scintillation detector and by pulse shape discrimination. The dose normalized to the dose at 1 cm in free air is a common parameter, allowing the intercomparison of the different experimental and theoretical results.

The work reported verifies the semiempirical formulas of Song and Chapman for the calculation of normalized dose rates resulting from neutrons and gamma rays streaming

through thick-wall steel ducts. It is also shown that OSR/STATEST and OGRE-G computer codes are considerably more precise than the Adonis code for the same use of computer time. Concrete ducts are seen to offer slightly more protection than thick-wall steel ducts.

R-559
Light Housings for Deep-Submergence Applications - Part II. Miniature Lights, Jan 1968, J. D. Starhiv, K. O. Gray, AD663890

Pressure vessels used in hydrospace simulation facilities require internal illumination equipment for experimental studies that utilize photo-optical instrumentation or visual observation. Three miniature deep-submergence lights with power inputs of 500 or 650 W at 120 V have been found to perform successfully at external hydrostatic pressures of up to 20,000 psi at ambient temperatures from 70°F to 32°F. Commercially available off-the-shelf glass tubing, pipe, and reaction flasks are utilized as the transparent envelopes. The designs are such that the light housings may be readily fabricated in a normally equipped machine shop.

R-560
Effects of Electrical Power System Disturbances on Selected Communications Equipment (U), Jan 1968, E. Giorgi, M. M. Kajihara, AD386525L, SECRET

R-561
Zinc Inorganic Silicates as Protective Coatings for Steel Decks of Floating Drydocks, In-Service Tests of 14 Coatings Exposed for 35 Months, Jan 1968, C. V. Brouillette, AD826459L

Fourteen zinc inorganic silicate coatings were applied to steel deck sections and work areas of a floating drydock. Five postcured zinc inorganic silicate coatings satisfactorily protected these steel surfaces for 35 mo. Self-cured zinc inorganic coatings gave, in general, satisfactory protection for 25 mo.

R-562
Evaluation of Six Heat Reflective Paints, Jan 1968, J. B. Crilly, AD826177L

Six white paints were investigated to determine their ability to keep objects cool by reflecting the sun's heat. Of the six, two specification paints and the proprietary coating Permacool performed satisfactorily. The high-priced proprietary reflective paint Plasticool did not show a significant advantage over lower priced paints conforming to Federal Specification TT-P-0019A or TT-P-0055A or Permacool.

R-563
Bacteria at Oceanographic Stations Off Southern California - Population Distribution in Relation to Depth, Jan 1968, J. S. Muraoka, AD664954

The vertical distribution of bacteria and its relationship to the environmental parameters from the surface of the sea to a depth of 12,000 ft was studied off the coast of southern California near the Santa Barbara Channel Islands. The bacterial population varied randomly with location and depth. The highest bacterial count (12,600 per 100 ml of seawater) was found at depths between 2,300 and 2,700 ft in the minimum oxygen zone. The lowest number of bacteria (about 5 per 100 ml of seawater) was found near the sea floor at a depth of 12,000 ft. The variation of bacterial population density with depth does not seem to be influenced by any single environmental factor. This report also presents data on the bacteriological analysis of sediment samples, a comparison of the number of bacteria present in seawater samples collected with sterile bacteriological samplers and nonsterile water samplers, and incidence of failures of rubber components of bacteriological samplers

R-564
Mix Design for Small-Scale Models of Concrete Structures, Feb 1968, D. S. Fuss, AD664956

An easily applied method of mix design was developed for concretes suitable for use in small-scale models of concrete structures. By use of the method, model concretes of adequate workability can be produced having compressive strengths ranging from 1,000 to more than 10,000 psi.

Data on mechanical properties were collected for model concretes with portland cement and gypsum cement bases. These concretes had maximum aggregate sizes of no. 4 (suitable for many model beams and columns) and no. 30 (suitable for model slabs and shells). Compared to prototype concretes of equal compressive strength, the model concretes using approximately scaled aggregate were found to have about the same splitting-tensile strength and flexural strength, a lower elastic modulus in compression, and, generally, a higher strain at maximum compressive stress.

Described in the report are techniques for the manufacture and testing of small concrete specimens. Information is given on the size of test specimen to use with a particular model as well as on the age for testing the specimen and model.

R-565
Fast-Neutron Streaming Through Concrete Ducts, Theoretical Calculations Using the Albedo Concept Compared with Experimental Results, Feb 1968, Y. T. Song, AD665003

As a part of NCEL's studies of shielding for personnel shetlers, fast-neutron streaming through two-legged rectangular air ducts in concrete was investigated theoretically and experimentally. This is the final report on that investigation.

In the theoretical study of the problem the Albedo concept was employed, and numerical values of neutron dose in the second leg of ducts of various sizes were computed by IBM 1620 computer.

In experiments, counting rates of a spherical dosimeter were measured in both the first and second legs of the ducts described for the neutron sources named.

Comparisons show very good agreement between theoretical and experimental results.

R-566
Computer Reduction of Data from Engineering Tests on Soils and Ocean Sediments, Feb 1968, M. C. Hironaka, AD666311

Because of the tremendous quantity of data generated from tests of ocean floor soils, NCEL has utilized the IBM 1620-II computer to aid in data reduction. Thirteen programs were written in Fortran to reduce the data and to aid in the analysis of the test results. The use of these programs and associated computer techniques affords the benefits of convenience, economy, accuracy, and speed in data reduction. This procedure has also reduced the efforts required in preparing the results in a form suitable for publication. In addition, further analysis of the test results is facilitated by the fact that the results are already catalogued on cards.

R-567
Finite Element Analyses of Solids of Revolution, Mar 1968, S. K. Takahashi, S. B. Dong, AD667235

Two finite element computer programs are described in this report. The programs are quite general and are applicable to a number of different problems, including many which may be encountered by the U.S. Navy in building deep ocean structures. The thin-shell solid-of-revolution program can be used to analyze both the axisymmetrically and the asymmetrically loaded shell composed of an arbitrary number of bonded layers, each with a different thickness and different elastic orthotropic properties. The thick-wall

solid-of-revolution program can accommodate only an arbitrarily axisymmetrically loaded body of revolution. A sample problem is solved for each of the two computer programs presented in this report.

R-568
Measurement of Airfield Marking Paint Flexibility, Mar 1968, E. S. Matsui, R. W. Drisko, AD667234

A method for determining the elongation of free paint films is discussed. The method is more precise than the ASTM and Federal test standard methods which use the Mandrel test, and it provides a more clearcut differentiation between different coating films.

A statistical analysis was performed on 10 experimental airfield marking paints using data from the free-film percent-elongation tests and from performance tests of the same coatings exposed in the field. The results indicate that there is a definite correlation between the percent elongation (flexibility) and the field performance of airfield marking paints.

R-569
Neutron and Gamma-Ray Streaming Through Thin-Steel Shelter Entranceways, Mar 1968, L. B. Gardner, AD667226

Neutron and gamma-ray streaming through a thin-steel, two-legged ducted entranceway was studied, and the dose rate at different positions in the duct was measured and calculated by several different techniques. The results were used to determine the protection afforded by a duct of this type, and they were compared to similar results obtained from ducts having thick steel or concrete walls. The Albedo calculations were found to be in good agreement with the Monte Carlo calculations and the experimental measurements. It was also found that concrete ducts provide slightly greater attenuation of radiation than do steel ducts. Simplified formulas were developed to provide crude approximations to the solution of an optimum duct design.

R-570
Calculating the Dose Variation of Fast-Neutrons Streaming Through an Iron Duct, Mar 1968, Y. T. Song, AD667224

The dose variation of fast-neutrons streaming through an iron duct is computed by using the concept of the differential dose Albedo. The basic concept of the differential Albedo is itself studied and is used to formulate the neutron transport equation.

The Albedo method developed in this report and the Monte Carlo method are used to obtain numerical values of the multicollision absorbed dose in the first and second legs of an 11x11-in. iron duct along the centerline. Comparisons are then made between the values obtained by both methods. Results show good agreement.

R-571
Soil Behavior Around Laterally Loaded Piles, Apr 1968, H. L. Gill, AD667833

Field tests were performed to study the horizontal load-displacement characteristics of natural soil deposits and to associate these characteristics with the behavior of laterally loaded piles. The ultimate objective of the tests was to acquire information essential for the design of laterally loaded soil-supported structures. Three soil conditions were considered: (1) bay mud with a desiccated crust in its natural dry state, (2) bay mud submerged within the area of testing, and (3) a hydraulic fill of granular material classified as SP by the Unified Soil Classification system. Segmental pile tests were performed with three sizes of laterally loaded segments and at various depths below ground surface in the bay mud. (Similar tests in the hydraulic fill were covered in a previous NCEL report.) Lateral load tests on full-scale piles from 4 to 16 in. in diameter were performed at each test site.

Theoretical information, available soil data, and results of the segmental pile tests were compared and combined to establish representative lateral load-displacement relationships for the soil at any depth at the three sites by using rectangular hyperbolas. Theoretical predictions of the response of laterally loaded piles were made using these relationships, and the results were compared with data obtained during the lateral load tests on piles. Experimental data and theoretical predictions compared favorably.

R-572
Photoelastic Investigation of Stress Concentrations in Sphere-Cylinder Transition Regions - Including a Comparison of Results From Photoelastic and Finite Element Analyses Apr 1968, J. K. Takahashi, R. Mark, AD667834

This study investigates stress distributions in sphere-cylinder transition regions of externally pressurized thick-walled vessels. It compares data determined by two different approaches, photoelastic analysis and finite element computer programs. These approaches afford a capability for analyzing complicated deep ocean structures that is of considerable interest to the U.S. Navy.

Two small-scale epoxy models of the prototype structures were loaded by 4- and 10-psi external pressure at a critical temperature (290°F) and then the stresses were frozen by cooling the material. The first model has relatively thin walls (cylinder diameter-to-wall thickness ratio = 15), and incorporated 60% balanced opening reinforcement at the transition. The amount of reinforcement is expressed as a percentage of the material removed from the vessel shell to form the opening. The reinforcement is balanced when equal amounts are placed on the inside and outside of the vessel. The second had a cylinder diameter-to-wall thickness ratio of 4, and 65% balanced opening reinforcement. After stress freezing, the models were sliced longitudinally and transversely and the meridional and circumferential stresses were determined photoelastically with a diffused-light polariscope. The photoelastic solutions were used to verify the stresses calculated by finite element computer programs. Excellent correlation was obtained for the comparison of meridional and circumferential surface stresses by the photoelastic and finite element procedures.

R-573
Dynamic Properties of Small, Clear Specimens of Structural-Grade Timber, Apr 1968, J. R. Keeton, AD668487

About 300 static and 1,100 dynamic tests were made on small, clear specimens of Douglas fir (coast type). Green specimens and dry specimens were tested in shear parallel to the grain, bending, compression parallel to the grain, and compression perpendicular to the grain. Green specimens showed increases in dynamic strength values, with the exception of modulus of elasticity in bending. Dry specimens showed increases in dynamic strengths over static strengths in shear, compression parallel to the grain, and compression perpendicular to the grain. In bending, the strength of dry specimens was drastically reduced at the higher rates of dynamic loading. In bending tests on green specimens, the modulus of rupture at speeds (or strain rates) corresponding to impact and blast loading was a maximum of 54% greater than the MOR at static speeds. On the basis of these results, it was concluded that conventional increased strength allowances for impact loading are excessive by as much as 46%.

R-574
Experimental FM Multiplexing Transponder System for Remote Radio Control and Telemetering, Apr 1968, S. J. Wooten, L. J. Elliott, S. L. Phelps, AD669114

An experimental FM multiplexing transponder system was designed to trigger the ventilation closure valves of protective shelters as soon as the overpressure produced by a

nuclear blast is detected by a pressure transducer. The system would provide complete protection for shelters located 12,000 ft or more from the target.

The system consists of five FM multiplexing transponders transmitting five channels of FM data to the central receiver, one channel at a time, with each transponder initiating the next transponder transmission. Only one carrier frequency is used regardless of the number of transmitters. Also, since the transponders transmit data only on interrogation, battery life is greatly increased.

The flexibility of this battery powered system, its ability to accept a wide variety of emergency inputs, its fail-safe design, and its low cost make it suitable for a wide variety of data transmission applications.

R-575
Schottky Emission in Thin-Film Diodes, Apr 1968, R. D. Hitchcock, AD668694

Temperature-dependent current-voltage (I-V) characteristics have been observed in a new type of thin-film diode. Plots can be fitted by straight lines which show that Schottky emission is the dominant current-flow mechanism over the temperature range of 190K to about 350K. Barrier thicknesses were determined by high-frequency capacitance measurements. Relative work functions, between the aluminum and lead films, were found to lie between 0.25 and 0.50 eV. One of the diodes was tested at 60 Hz for 124 hr without causing a significant change in the shape of the I-V characteristic. It is concluded that nominal refinement of the fabrication technique will lead to a varistor thin-film diode which is inexpensive and which has long-term stability.

R-576
Phase II Tests on Shallow Unreinforced Concrete Shells, May 1968, R. J. Taylor, J. R. Allgood, AD670739

The results of tests on 17 model shells and three large shells are reported. The model shells were approximately 19x19 in. in plan, and the large shells were approximately 8x8 ft in plan.

Four modes of failure were noted in the experiments: edge beam splitting, peripheral shear, transitional buckling, and mechanism development. Conditions under which the various failure modes predominate are discussed. An approximate relation for predicting the buckling load of small shells is proposed.

The sagging membrane technique was found to be a simple method of casting shallow shells of small dimensions. The results of the tests indicate that shallow funicular shells constitute a structurally sound system for floors and roofs of conventional buildings and for special uses such as the decks of docks. They are expected to be particularly useful where a large load capacity is required.

R-577
The Padlock Anchor - A Fixed-Point Anchor System, May 1968, P. A. Dantz, AD669113

The objective of this study was to investigate the feasibility of combining propellant-activated embedment anchors and a structural frame with bearing pads to provide a fixed-point, deep ocean anchorage system. The work was to include the conception, design, fabrication, and evaluation. This report describes the resulting device, termed padlock, discusses its development, and documents the field tests and results.

Essentially the padlock is a tripodal frame terminating in 6-ft-diam bearing pads that are locked to the seafloor through activation of 20,000-lb (nominal holding power) embedment anchors, one per bearing pad. Shallow water tests demonstrated that the components are operationally compatible as a system and that the embedment anchors can be detonated singly or as a group. A limited number of tests showed the reliability of the complete system to be low, mainly because of the performance of the embedment anchors.

R-578
Snow Movement - Drift Control for At-Grade Camps, May 1968, N. S. Stehle, AD668993

Snow movement in polar areas creates logistical problems for at-grade, or surface, camps in areas of positive snow accumulation. Snow drift studies, which were made over a 4-yr period around a single unprotected building and around a cluster of buildings in an area of positive snow accumulation on the Ross Ice Shelf near McMurdo Station, Antarctica, showed that at-grade camps will eventually become covered with drifting snow. Drift control measures, however, can be used to increase the usefulness of such camps.

The drift control measures developed in this report, which cover proper building orientation and camp layout with respect to the major storm winds, can be used to improve access and reduce maintenance for at-grade camps in areas of drifting snow. In addition, mobile foundations should be used for all buildings to facilitate camp moves when snowdrift becomes excessive, and small camps should be built on elevated snow platforms to extend their useful life.

R-579
Limit Gages for Measuring Wind Velocities, May 1968, P. J. Rush, R. L. George, AD669455

Field studies assessing the damage caused by hurricane-force winds have revealed a need for simple methods to determine wind velocities causing structural damage. Development of limit wind gage concepts is described. Two concepts, aerodynamic cones in arrays and omnidirectional venturi with recording manometer, provided consistent airstream velocity readings in wind tunnel tests. It is recommended that units of the aerodynamic cone arrays and of the omnidirectional venturi devices be installed for evaluation at several sites where recording anemometers are available and high winds have been experienced.

R-580
Hydraulic-Pneumatic Floating Fender - Final Evaluation, May 1968, D. A. Davis, AD670475

Two experimental hydraulic-pneumatic floating fenders for a wharf underwent in-service tests at a moderately exposed harbor (San Diego, Calif.) and a protected harbor (Port Hueneme, Calif.) from Mar 1963 until Oct 1967. Each fender consists of a wood-steel-plastic bulkhead 50 ft long, 1 ft 8 in. wide, and 7 ft 3 in. high fronted by two air-filled and two water-filled rubber bags, and chains with weights to maintain the total assembly in position. Combined initial and maintenance cost is high, but the fenders are considered to be cost-effective in sheltered locations, and to a lesser extent in exposed locations, where mechanical damage to ships and marine foulings are significant.

R-581
Antenna-Wire-Supporting Booms Subjected to Wind-Induced Vibration, May 1968, R. H. Chiu, AD675031

Wind-induced vibrations of Wullenwebber antennas and reflector-wire-supporting booms were studied. The objective of the investigations was to develop methods for reducing the high-amplitude vibrations of the booms and the high-band antennas by modifying the existing antenna systems or designing new systems. Instrumented vibration tests were conducted on five existing antenna systems in order to establish the damping factors and natural frequencies of representative antenna booms.

Wind tunnel tests were conducted to determine the aerodynamic effect of various configurations of existing booms. Results indicated that sharp corners of rectangular sections and flanges of circular sections have detrimental effects on the aerodynamic responses of the system. Removal of sharp corners or attachment of rounded gloves or fairings on the corners were found to be satisfactory solutions to the problem.

Antenna-wire-supporting booms were substituted by equivalent systems of beams on elastic foundations in the analysis for wind loading. Comparisons of various systems were made by varying the stiffness, damping, and the modulus of elastic foundation.

R-582
Influence of Soil Modulus on the Behavior of Cylinders Buried in Sand, Jun 1968, J. R. Allgood, J. B. Ciani, T. K. Lew, AD670477

Experimental and theoretical results are given that provide information on the influence of soil properties on the behavior of buried cylinders whose axes are parallel to the surface. Sand Type, sand density, and cylinder stiffness were varied in 12 static tests on 5-in.-diam thin-metal cylinders. The stiffness of these cylinders was less than that of others in the literature for which complete information on soil properties was available.

The main contribution of the research presented is that it provides a unified method for determining deflections and the critical buckling load, both of which are based on the one-dimensional confined compression modulus measured in a standard laboratory test. This has not been done heretofore. Also, a relation for arching across buried cylinders is given which permits computation of the thrust at the haunches. Another feature of the work is the development of a matrix solution for determining the interface pressure distribution from measurements of strains in the cylinder. Thus, in effect, the cylinders can be used as biaxial soil pressure sensors.

R-583
Use of Magnets in Marine Salvage, Jun 1968, J. Quirk, R. L. George, AD835040L

A study was made for the SupSalv NAVSHIPS to determine the usefulness of magnets in underwater applications. A literature search indicates that large electromagnets are useful for salvaging ferrous cargoes in shallow water. They are of little value in deep water salvage because of the low payload-to-weight ratio and the difficulty of positioning an electromagnet at the end of a long line. Tests of 6- to 8-lb permanent magnets on a ship's hull showed they had underwater holding forces of 40 to 100 lb. These values indicate such magnets are useful for securing divers and tools to underwater ferrous objects.

R-584
Static Load Tests on the Ammi Pontoon, Jun 1968, B. R. Karrh, AD835205L

This report contains information from the engineering tests made on the 90x28x5-ft Ammi pontoon. Static loads imposed on the orthotropic rib structural members included simulated wheel and military tank loads. Electrical resistance strain gages mounted on selected members were used to measure resulting strains in the structure. Each test represented a single wheel or a single tank track at a specific location on the pontoon deck. By means of superposition of measured stresses, those stresses which would have resulted from dual loads were derived.

Strain gage data indicate an Aasho M20 wheel load (16,000 lb on each of two rear tires at a 6-ft spacing) produces a maximum stress of 23,000 psi. A 60-ton tank load produces a maximum stress of 15,000 psi. In each case the maximum stresses are principal stresses along the longitudinal axis of the orthotropic ribs, and they occur at the interior supporting diaphragm as a result of bending moment in the deck structure as the load is distributed to other parts of the barge. The Ammi pontoon was structurally adequate for the static loadings imposed during the tests.

R-585
Protection of Mooring Buoys - Part XI. Results of Tenth (Final) Rating Inspection, Jun 1968, R. W. Drisko, AD834980L

This is the eleventh and final report of a series on the protection of mooring buoys. Twelve buoys were given their tenth rating (after a maximum of 65 mo of service to the Fleet) for extent of coating deterioration, corrosion of steel, and fouling. Three other buoys had previously been removed from testing in San Diego Bay because of advanced deterioration. The coating systems were rated good on three buoys, good-fair on six buoys, fair on two buoys, and fair-poor on one buoy. Cathodic protection with zinc anodes resulted in considerably less underwater rust on protected buoys than on the unprotected control buoys. Epoxy patches on localized damage to buoys afforded protection for as long as 5 yr.

Two sets of 13 steel panels each, coated with the systems used on the buoys, were rated after 5 yr of exposure in San Diego Bay and Port Hueneme Harbor. The condition of the panel coatings was generally better than that of the buoy coatings, and all coating systems rated as good or good-fair on the buoys were among those rated highest on the panels. On buoys coated with antifouling paints, no detectable antifouling property remained after 20 mo, but on both sets of panels, two antifouling paints containing cuprous oxide were still appreciably reducing fouling after 5 yr.

R-586
Heat Transfer at High Pulsating Frequencies in a Pulse-Jet Engine, Jun 1968, E. J. Beck, AD835638L

A review of the recent literature on enhancing forced-convection heat transfer by imposing a pressure pulse indicated that if the changes in pressure were great enough or at high enough frequencies, materially higher coefficients could be expected than for the same mass flow rates in steady flow. No experiment was known which used sufficiently high pressures or frequencies to give real advantages. Tests were made on a small pulse-jet engine which showed increases in heat transfer by a factor of about 4. Further, the engine proved to be a uniquely good burner in that no auxilitaries beyond a starting spark were needed. Several possible practical applications of pulse-jet burners for purposes other than propulsion are suggested.

R-587
Desalination Processes for Military Application, Jun 1968, J. S. Williams, A. [illegible]. Hodgson, AD835387L

This report summarizes the desalination processes currently available which lend themselves to military application. Membrane processes (electrodialysis and reverse osmosis) and thermal processes (multistage flash distillation and vapor compression distillation) are explained, and examples of the use of each type of equipment are cited. Design criteria are given for multistage flash distillation units utilizing waste heat from diesel generators. An optimization procedure is also given for similar units using direct-fired boilers.

R-588
Behavior of Spherical Concrete Hulls Under Hydrostatic Loading - Part III. Relationship Between Thickness-to-Diameter Ratio and Critical Pressures, Strains, and Water Permeation Rates, Jun 1968, J. D. Stachiw, K. Mack, AD835492L

Sixteen hollow concrete spheres of 16-in. OD were subjected to external hydrostatic pressure to investigate the relationship between the sphere's shell thickness and (1) its critical pressure, (2) permeability, and (3) strain magnitude. The shell thickness of the spheres varied from 1 in. to 4 in. in 1-in. steps. All spheres were cast from the same concrete mix, cured under identical temperature and moisture conditions, and tested in the same manner. The

strength of concrete in the spheres at the time of testing, as established by uniaxial compression tests on 3x6-in. cylinders, was in the 9,000-to-11,000-psi range. The critical pressure of waterproofed hollow concrete spheres was found to be approximately a linear function of the spheres thickness. The spheres imploded at pressures from 3,240 to 13,900 psi, depending on their thickness. Concrete spheres permeated by seawater failed at hydrostatic pressures 30% to 15% lower than identical waterproofed spheres. In all cases the stress in the spheres at the time of implosion was considerably higher than in concrete test cylinders prepared of the same mix and of the same curing history subjected to uniaxial compression. The resistance of concrete to permeation by seawater into the interior of nonwaterproofed spheres at 2,000-psi hydrostatic pressure was found to be an exponential function of shell thickness. The rate of flow into the spheres interior ranged from 6.1 to 0.197 ml/day/ft sq of exterior surface, depending on the thickness of shell.

R-589
Emergency Fuel Substitutes for Spark-Ignition Engines, Tests Show That Avgas and Mixtures of Avgas and Diesel or Turbine Fuel Can Effectively Power Spark-Ignition Engines, Jun 1968, P. J. Daly, W. W. Watson, AD835513L

Under emergency or combat conditions, motor gasoline for spark-ignition engines may be temporarily unavailable, or at best in short supply. To determine the feasibility of substituting other fuels (avgas-115/145 aviation gasoline, DF-2 diesel fuel, and JP-5 turbine fuel), or mixtures thereof, for motor gasoline, NCEL operated three Hercules water-cooled engines and one Wisconsin air-cooled engine (all of them coupled to generators) on avgas-115/145 or mixtures of avgas-115/145 with DF-2 or JP-5. The tests proved conclusively that engines of this type can be effectively operated on such fuels for moderate periods of time. Specifically, 100% avgas-115/145, a mixture of 20% DF-2 plus 80% avgas-115/145, and a mixture of 30% JP-5 plus 70% avgas-115/145 were found to be satisfactory substitutes for motor gasoline for the periods of test operation (300 to 500 hr).

R-590
Dose Measurements of Gamma Radiation Streaming Through Concrete Ducts With and Without Lead Liners and Through Corrugated Steel Ducts, Jun 1968, J. M. Chapman, T. R. Tree, AD837087

Dosimeter measurements were taken in a 3-ft, two-legged concrete duct, with and without the presence of lead sheets covering the basic scattering areas in the corner, to determine the effectiveness of lead sheeting in reducing gamma radiation. For cobalt 60 radiation, the lead sheets reduced the dose rate in the second leg of the duct down to 46% of the dose rate measured in the second leg of the duct without lead sheets, and for cesium 137 radiation the reduction was down to 36%. Calculations were made to determine the effectiveness of the sheets in different size ducts, and comparisons were made with other methods for reducing radiation.

Measured attenuation factors for a circular, thin-walled, corrugated steel duct were compared to values calculated by a simple computer program for a square, thick-walled steel duct. It appears that the computer code can be used to approximate attenuation factors for a corrugated steel duct.

R-591
Ocean Bottom Breakout Forces - Including Field Test Data and the Development of an Analytical Method, Jun 1968, B. J. Muga, AD837647L

Theoretical and experimental studies were conducted in order to arrive at some appropriate engineering estimates of the force required to extract bodies of various sizes and shapes from the ocean bottom sediments. A review of the literature concerned with breakout forces is presented.

From tests conducted in San Francisco Bay on variously shaped objects having submerged weights of up to 22,200 lb, an empirical formula was found which described well the breakout force requirement.

Results yielded by the empirical formula agreed very well with a complicated theoretical procedure based on an iterative solution of a lumped parameter model of the ocean bottom. Solutions were obtained for various load conditions and bottom (object) geometries.

R-592
High-Frequency Power for Fluorescent Lighting, Jun 1968, L. J. Elliott, S. J. Wooten, AD837554L

High-frequency power for fluorescent lighting offers many advantages over the standard 60-Hz frequency, such as reduced operating cost, less heat per lumen and, from 400 Hz to about 5 kHz, less radio frequency interference.

Economic factors, however, require evaluation since it may take several years to recover the cost of changing over from standard frequency to high frequency even with small, relatively low cost converters. When a 400-Hz power supply with sufficient capacity is available, the benefits of high frequency can be obtained with much less initial investment.

R-593
Freeze Protection for Freshwater and Sanitary Piping Under Open Piers, Sep 1968, N. P. Oldson, S. L. Phelps, AD841105L

Piles carrying freshwater or sewage are often exposed to severe weather conditions under piers and therefore must be protected from freezing. NCEL has studied the problems associated with freeze protection of piping systems, reviewed weather data for U.S. coastal cities having temperatures comparable to those of nearby Navy installations, conducted cold chamber tests on several freeze-protection systems, and developed freeze-protection criteria for exposed piping systems. Results of these studies indicate that freeze protection can best be obtained with conducting mineral electric heating elements insulated with polyurethane foam and protected with a covering of asphalt-impregnated felt coated with asphaltic mastic. In the Colder regions, heaters, insulation, and protective covering are required. In regions of moderate winter cold only insulation and protective covering are required, and in regions having very mild winters, no insulation, protective covering, or heaters are required.

R-594
Layered Permanent Systems - Analysis Related to Design Procedures, Sep 1968, J. P. Nielsen, AD841101L

Theoretical and experimental studies related to the development of a thickness design procedure for airfield pavements are discussed. The pavement is treated as an elastic layered half-space and the moduli of elasticity of the paving materials as the primary design factors. Equations and influence charts derived from the application of elastic theory to two- and three-layered systems are used to interpret the experimental plate-bearing data. Values of the modulus of elasticity are presented for three base materials. It is shown that the modulus of elasticity depends upon the quality of the base, its depth and density, and the stiffness of the contiguous subgrade. The principal failure modes observed in flexible pavements and the suitability of the triaxial test as an adjunct to pavement design are discussed. A suggested revision in the current Navy pavement design procedure is presented. Recommendations for continued research related to layered theory pavement design are also included. A thickness design criterion for portland-cement-stabilized sand bases is presented as part of this study.

R-595
Multistage Flash Desalination Unit Utilizing Diesel Generator Waste Heat, Sep 1968, J. S. Williams, A. S. Hodgson, AD841125L

A multistage flash evaporator utilizing diesel generator waste heat has been developed for desalination. After preliminary experimental studies, a unit was constructed to operate continuously from a variable heat supply and produce between 2,500 and 6,000 gpd of freshwater. Interstage brine transfer is automatically regulated by level controllers in each stage, thus eliminating the need for manual control of the unit as the generator load and hence heat output varies. All-aluminum construction has reduced corrosion, and the unit was performed satisfactorily during tests. Typical experimental data are included.

R-596
10-kV Pulse Generator - Pulse Test on Autodin Filter Demonstrates Generator Capability, Sep 1968, L. J. Elliott, G. H. Kajihara, M. N. Smith, AD841152L

This report describes a newly developed pulse voltage generator which provides up to 10 kV of 2-, 10-, and 100-μ sec pulse voltage. These pulses can be superimposed at any phase angle on the base 60-Hz power provided to operate the test item. Tests with this generator make feasible a more accurate determination of the pulse response behavior of test items under operational conditions because pulse testing is performed with the test item fully energized. To illustrate the type of information obtainable, test data on a radio-frequency interference suppressing autodin power line filter is presented. It was found (1) that this type of filter develops high-frequency oscillatory voltages at the output when the input 60-Hz power contains a pulse voltage, (2) these oscillatory voltages could be suppressed by placing capacitance across the filter input and output, and (3) filters can be designed to be free of high-frequency oscillatory voltages.

R-597
Deep Ocean Power Systems, Sep 1968, E. Giorgi, AD843783L

The objective of a study program on deep ocean power transmission systems was to determine the technical and economic feasibility of transmitting electrical power of 10, 100, 300, 1,000, and 3,000 kW to ocean depths of 600, 2,000, 6,000, 10,000, 15,000, and 20,000 ft.

Environmental conditions of the sea and their effects on the elements of an undersea power system are discussed. Various power system concepts are developed and evaluated in the report. Design approaches and related studies used in the selection of the most cost effective system concepts are presented, as are preliminary designs of a few selected concepts. Recommended programs for the development of system elements considered beyond the state of the art are also included.

R-598
Operational Evaluation of the STATO Mooring Anchor, Sep 1968, R. C. Towne, R. A. Bliss, AD840264L

The STATO mooring anchors were designed to be used in (1) permanent moorings such as fleet moorings, (2) in situations where large holding powers are required such as in salvage operations, or (3) in the temporary mooring of large barges or vessels. In-service tests were requested by NAVFAC to determine any adverse operational characteristics which might become apparent through varying or continuous operational use. STATO anchors were substituted for Navy stockless anchors of equivalent holding power already attached to two fleet mooring assemblies of different capacities in the Navy harbor complex in San Diego Bay during the regular PWC inspection of moorings. This report describes the fabrication and installation of the anchors and the results of a 1-yr operation. The anchors were removed from the water and inspected after the test period. The results of the evaluation showed no adverse operational characteristics and that the anchors performed satisfactorily.

R-599
Nuclear Radiation Shielding in the Design of Hardened Structures, Oct 1968, C. M. Huddleston, D. R. Doty, W. C. Ingold, AD843583

The transmitted dose of initial radiation is related to peak overpressure, weapon yield, and shield thickness. It is shown that the minimum expected weapon size determines the thickness of the radiation shield for a specific overpressure. A simplified method is presented for determining the protection factor for two-legged ducts. The designer can use either graphical methods or a nomogram. A mathematical analysis is included that relates protection factors to percent lethalities due to fallout radiation.

R-600
Nucleation of Steam Bubbles From Large-Diameter Prepared Sites, Oct 1968, E. J. Beck, AD842507L

NAVFAC has, through NCEL, been active for some time in the development of improved desalination equipment to provide potable water at advanced bases. A review of the current literature on the physics of boiling disclosed a consensus that (1) nucleation is necessary for boiling, (2) nucleation is accomplished by sites of certain sizes only, and (3) the amount of superheat above the boiling point that is necessary for bubble formation is a function of site orifice diameter.

Because no supporting theory accompanied the latter two observations, a study was made to determine why these limiting factors should apply - if in fact they do. A simple theory derived by the author indicated, on the contrary, that for a given wetting angle at the solid-vapor-liquid interface, the superheat necessary should be a function of the effective radius of vapor bubbles as determined by the wetting angle and the angle formed by site walls. This hypothesis was tested using a small copper hot plate with several relatively large sites (on the order of 1 to 2 mm in diameter), nucleation proved possible with superheats of only a few degrees Fahrenheit. Although steam would form a bubble, the emergence and growth of the bubble was inhibited by the thickness of the boundary layer, because a large radius bubble would penetrate to the area in which the covering layer was at or below the boiling point.

R-601
Plastic Mooring Buoys - Part II, Compilation of Test Program, Nov 1968, R. W. Drisko, AD845132

Two plastic mooring buoys, fabricated by a private contractor, were described in Part I of this study program. Each buoy had a steel framework filled with closed-cell polyurethane foam. On one buoy this foamed core was covered with an exterior shell of fiberglass cloth impregnated with polyester resin. On the other, the exterior shell was a sprayed-on coating of chopped fiberglass strands in polyester resin.

This report, Part II, describes the 3-yr in-service testing of these buoys in San Diego Bay. While both performed well, the hand lay-up buoy had much less deterioration than the spray-up buoy. Also, it was determined that plastic buoys have much lower maintenance costs than steel mooring buoys.

An improved plastic mooring buoy was designed from the results of the testing program. This design utilizes hand lay-up construction of the outer shell with alternate layers of random chopped-glass mat and woven roving. Such a buoy was fabricated and is currently serving the fleet at Pearl Harbor, Hawaii.

R-602
A Causeway Connection System for the 20-Knot LST, Nov 1968, J. J. Traffalis, AD843781L

A system was developed by NCEL to provide a simple, expedient connection between the new 20-knot, Class 1179 LST and a causeway. The developed system, designated the Abutment Connection System, is compatible with all classes of LST and installation is within the present operational capability of the amphibious construction battalions. Operational testing with the 20-knot, Class 1179 LST is recommended.

R-603
Evaluation of Two Small Impact Wrenches for MCB Use, Nov 1968, C. W. Terry, J. C. King, AD844068L

The capabilities and limitations of two new impact wrenches that are smaller and appear more versatile than those normally carried in MCB tool allowances were determined. One wrench was air driven and the other was hammer actuated. The maximum torque of the wrenches and the torque that causes failure in capscrews were determined, and time studies to compare performance of the wrenches with that of conventional socket wrenches were conducted. Results showed that considerable time can be saved by using the air-driven tool for installing and removing screw fasteners. The hammer-actuated wrench was not faster than conventional wrenches for normal operations, but it was found to be quite effective for loosening frozen bolts and nuts.

R-604
Wave-Basin Study of Runup on Beaches from Simulated Underwater Explosions Near Shore, Dec 1968, D. B. Jones, AD679679

Laboratory data are presented for the runup on a uniform slope of the leading waves of an axially symmetric, dispersive train of surface gravity waves. The waves emanated from an impulsive disturbance, simulating an underwater explosion. Two general classes of wave trains were studied, distinguished by an initial rise of the water surface (a crest at the front of the wave train) in one case and an initial fall (trough) in the other. In both cases, the first wave in the wave train produced the greatest runup. The dominance of the first wave was more marked in the larger disturbances (higher waves).

R-605
Reinforced Plastic Landing Float and Brow - Design, Fabrication, and Installation, Dec 1968, D. A. Davis, AD 679678

A promising new fiberglass reinforced plastic landing float and companion brow have been designed, built, and installed, and are now undergoing in-service tests at the Fleet Landing, Naval Station, San Diego, Calif. The float, which measures 60 by 14 ft in plan, and the brow are built with a unique glass-wrapped, polyurethane-foam core planking material. The resultant float is light (26,000 lb), strong, and unsinkable. The float will undergo tests for 3 yr for the purpose of proving its increased cost-effectiveness over conventional steel, wood, and concrete floats.

R-606
Static Behavior of Buried Reinforced-Concrete Model Cylinders, Jan 1969, J. R. Allgood, H. G. Herrmann, AD682929

Experimental results and empirical relations are given which define the behavior of reinforced-concrete model cylinders that are buried in dry sand with their longitudinal axis parallel to the surface. The model cylinders were 9 in. OD and had a single layer of reinforcement at midsection. Thickness, percent reinforcement, and depth of cover were varied. The 12 test cylinders cracked at uniform surface pressures of less than 60 psi and subsequently deformed in such a way that the ratio of the effective stiffness of the cylindrical inclusion to the stiffness of the soil in the vertical direction remained constant.

Empirical relations which agree reasonably well with the test data are given for permitting estimates of horizontal expansion, arching, thrust, moment, and interface pressure.

R-607
Ablation of Ice and Snow - Protective Coverings and General Criteria for Application, Dec 1968, N. S. Stehle, AD680428

Protective coverings to retard deterioration and ablation of ice and snow are needed in all but dry-snow zones in polar regions. Good drainage is the most important factor in maintaining a surface in usable condition. When ablation exceeds accumulation, any protected area will become pedestalled above the surrounding ice, and loss of the protected area will occur by slumping of the edges. When accumulation exceeds ablation, protective measures are needed only during that part of the summer when ablation and deterioration occur. Of the protective coverings investigated, chipped ice is the easiest to produce and most economical to use in ice areas. However, other materials, such as gravel, sawdust, urethane foam, concrete planking, insulated metal planking, timber decking, and snow, may be more effective and economical for specific conditions.

R-608
Design Criteria for Flexible Utility Connections, Dec 1968, D. G. True, AD680429

The existing design of flexible utility connections used in Naval installations incorporates a flexible bronze hose hanging freely within a corrugated metal tube so that it can move without being highly stressed at the soil-structure interface. A study was made of this design and of possible modifications to it. Theoretical predictions were formulated for flexibility and dynamic strength. The flexibility of a hose was related to the manufacturer's specified minimum allowable bend radius. The dynamic strength was expressed in terms of peak acceleration and hose weight and length in a semi-empirical relationship suitable for use in design. It is recommended that the results of the present study be incorporated in an appropriate design manual, subject to verification by full-scale field tests, and that a summary be compiled of means to predict the relative displacements between a buried structure and the surrounding soil.

R-609
Conditioned Power System Using a High-Speed Power Source Transfer Switch, Dec 1968, A. A. Mahmoud, H. H. Kajihara, AD682936

A conditioned power system is proposed which is potentially one-fifth as costly as power systems employing solid-state or rotary uninterruptible power supplies. The proposed conditioned power system employs high-speed, solid-state power source switching. A 15-kVA, 208-V, 60-Hz, 3-phase demonstration model of the proposed system has been developed and laboratory evaluated. This model accomplished power source transfer in 800 μsec. Because of its fast switching speed between two power sources, the system is potentially capable of conditioning power economically for many critical loads.

R-610
Dynamic Pore Pressure Propagation in Sand, Jan 1969, D. G. True, AD682937

A study was made of pore pressure in sand subjected to a blast overpressure. Results indicated that the lower the permeability of the soil and the shorter the duration of the positive phase of load, the greater the attenuation of the pore pressure at depth. Results also indicated that the

attenuation of the pore pressure at depth is not significantly affected by the magnitude of the overpressure. The influence of moisture content on attenuation was not consistent in the experiment. An attenuation relationship has been developed to represent the experimental results and similar data from other sources. Velocity of pore pressure propagation was found to increase with increasing permeability, decreasing duration of overpressure, and increasing degree of saturation. It was not significantly affected by the magnitude of the overpressure.

R-611
Active Systems for Blast-Resistant Structures, Feb 1969, W. [illegible] Nordell, AD683331

A conceptual study was undertaken to develop systems which could be activated in emergencies to provide additional resistance to nuclear blast loadings. Participants in this study included engineering consultants, teachers, and researchers. The concepts with the greatest potential were found to be those utilizing internal pressurization or movable structural elements. However, slanting for blast will usually be a more effective approach than active systems in the design of blast-resistant structures.

R-612
Plastic Film Coatings for Protection from Marine Fouling and Corrosion, Feb 1969, J. S. Muraoka, AD682938

Saran and polytetrafluoroethylene (TFE) films with a pressure-sensitive adhesive were applied over the surfaces of painted and unpainted carbon steel panels and unpainted stainless steel and K-Monel panels. These panels were submerged in the sea to determine if the plastic film coverings can be effectively used to (1) protect painted as well as unpainted metal specimens from fouling and corrosion, (2) remove marine growth that becomes attached to the plastic film simply by stripping off the covering, and (3) prolong the fouling-free and corrosion-free intervals so as to decrease the total effort required for reconditioning fouled or corroded surfaces. The saran- and TFE-covered panels were exposed in the sea for 5 and 8.5 mo, respectively. When retrieved, the panels were completely covered with marine growth, including numerous large barnacles. Generally, the plastic films protected the test panels from fouling and corrosion. The marine growth could be removed rapidly by stripping off the protective plastic covering. Crevice corrosion will occur under the protective plastic film on susceptible metal panels, such as stainless steel (Type 302), when a small amount of seawater enters through ruptures.

R-613
Mix Designs for Fast-Fix I Concrete, Feb 1969, S. B. Nosseir, M. G. Katona, AD683756

The purpose of this investigation was to obtain information required for the use of Fast-Fix I concrete as a structural material. In particular, the effects of concrete mix design parameters and aging were investigated to determine if varying them would permit attaining compressive strengths in excess of 2,500 psi without the use of retarding agents. In addition, splitting tensile strength and compressive stress-strain reltions were determined for standard control cylinders. Results indicated that for concretes with an age of 1 hr, compressive strengths up to 3,300 psi can be achieved by proper selection of constituents. Attempts to attain higher compressive strengths resulted in unworkably short set times and exorbitant cement contents. The age of the concrete did not alter its compressive strength within the limits tested. Recommendations are presented in the form of design curves which enable one to design a mix for a specified compressive strength and set time.

R-614
Structural Behavior of Reinforced Concrete Beams Made with Fast-Fix I Cement, Feb 1969, S. B. Nosseir, M. G. Katona, AD683757

The objective was to investigate the predictability and effectiveness of reinforced concrete beams made with Fast-Fix I cement. Fourteen simply supported beams were designed with the beam parameters systematically varied in order to observe a wide range of structural response when the beams were loaded to failure. The ultimate strength and mode of failure of test specimens were compared with predicted results based on the ultimate strength design assumptions of the ACI code. In addition, elastic behavior in terms of beam stiffness was compared to calculated stiffnesses based on the working stress design assumptions of the ACI code. The performance of two Fast-Fix beams was also compared with the test results of duplicate beams made with portland cement. Evaluation of the Fast-Fix beam indicated that their ultimate capacity was safely predicted by the ultimate strength theory and that their structural effectiveness was equivalent to beams made with portland cement.

R-615
Laboratory and Field Testing of Asphalt Pavement Marking Paints, Mar 1969, R. W. Drisko, AD849792L

Specially formulated and procured marking paints were applied to asphaltic pavements at several DOD activities both in southern California and Guam. The application and initial performances of the paints are described. Special problems were encountered with paints applied over existing stripes or when applied at double thickness. Deterioration of roadway markings at Guam, a serious problem there, appears to be due mainly to erosion by traffic rather than chipping from the substrate.

Laboratory tests were conducted in order to relate chemical and physical properties of the paints to their field performance and to determine the specification requirements necessary for purchasing a superior paint product. A quick test-tube test and a confirmatory infrared test were devised for distinguishing between alkyd and oleoresinous phenolic varnish paints that have been applied to a pavement and received extensive weathering and deterioration.

R-616
Vulnerability of Shelter Electric Power Generating Equipment (U), Mar 1969, R. S. Chapler, AD850260L, SECRET

R-617
Ring-Tensile-Strength and Flexure-Strength Correlations of Sea Ice, Mar 1969, E. R. Vinieratos, J. E. Dykins, AD685236

A quick, accurate method of estimating the flexure strength of sea ice is investigated. This report analyzes and discusses two methods of correlation between the ring-tensile strength and flexure strength of Antarctic sea ice. The indirect method, using the common parameter brine volume of sea ice, is considered less accurate than the direct method, which associates the data for common calendar periods for both strengths. Neither correlation should be used without taking a larger quantity of ice samples to derive a well-averaged ring-tensile value from the lower one-half thickness of the ice sheet. It is recommended that an effort be made to develop a system for predicting the flexure strength of an ice sheet by correlating the flexure strength with brine volume. This would eliminate the need for any strength testing and would simplify the field work to taking only temperature and salinity measurements.

R-618
Light Housings for Deep-Submergence Applications - Part III, Glass Pipes with Conical Flanged Ends, Mar 1969, K. O. Gray, J. D. Stachiw, AD685637

The objective of this study was to evaluate commercially available glass pipes with conical flanged ends for application as transparent housings for underwater lights and instruments. Flanged-end glass pipes in diameters ranging from 1 to 6 in. and in lengths ranging from 6 to 36 in. were imploded under short-term and cyclic external pressure loading. Collapse pressure and recommended operational depth data are presented for one-way trip, round-trip, and cyclical applications. Recommendations for end-closure systems are also presented. One prototype light design and one prototype instrument housing design are described.

R-619
An Isostatic Study of Northern and Central Greenland Based on Gravity Vlues and Airborne Radar Ice-Thickness Measurements, Mar 1969, E. F. Pawlowicz, AD685237

This report presents an investigation on glacio-isostatic conditions in northern and central Greenland, using free-air and Bouguer gravity anomalies. For the north, ice-thickness profiles are calculated from 30-mHz airborne radar propagation data and later combined with British North Greenland Expedition (BNGE) gravity values, yielding approximate Bouguer anomalies. Gravity and seismic ice-thickness results from the Expedition Glaciologique au Groenland (EGIG) are used in the Bouguer anomaly calculations for central Greenland.

Northern and central Greenland, as suggested by the averaged or regional free-air anomalies, may be in different phases of a cyclic variation in ice thickness. The values along the central region may indicate a relatively recent increase in the ice thickness, while the data farther north are inconclusive. Alternatively, this ice-thickness increase postulated for central Greenland may be due to a blockage of former eastward glacial drainage basins caused by the isostatically rebounding coastal mountains. Northern Greenland, with its drainage basins to the north as well as to the east and west, and smaller horizontal components of surface ice velocity, could be less severely affected by this glacial drainage blockage.

R-620
Strength and Behavior of Laced Reinforced Concrete Slabs Under Static and Dynamic Load, Apr 1969, W. A. Keenan, AD688420

Four reinforced concrete slabs were subjected to uniformly distributed loads, one under static load and three under dynamic loads of short duration. Dynamic loads up to 218 psi were generated by a high-explosive detonation and were essentially triangular in shape and very short in duration. The lacing reinforcement consisted of a grid system of diagonal bars bent in a zig-zag pattern around the exterior face of the transverse and longitudinal reinforcement. It was found that the lacing reinforcement was effective. It prevented shear failures and contained the concrete and longitudinal reinforcement through hinge rotations of 9.2 deg at the supports. Slab behavior was similar under static and dynamic load. The type of loading did not change the extent of cracked or crushed concrete, the collapse mechanism, the mode of failure, or the rotation capacity at supports. A single-degree-of-freedom system adequately described the dynamic response of the slabs. Effects of rotation as well as shear should be considered in designing lacing reinforcement for sections near a support. The rotation capacity of the slab at supports was greater than 9.2 deg under static and dynamic load. Missile fragments from the slab were minor for loads of sufficient magnitude to cause inelastic deflections corresponding to 9.2 deg rotation at supports.

The theoretical relationships developed in this study for longitudinally restrained, clamped slabs under static uniform load provided good correlation between the theoretical and experimental resistance, deflection, and steel stresses at stages of ultimate flexure and initial tensile membrane action. Calculations of dynamic response using a response chart developed in the report demonstrate good agreement between theoretical and experimental results.

R-621
Strength and Behavior of Restrained Reinforced Concrete Slabs Under Static and Dynamic Loadings, Apr 1969, W. A. Keenan, AD688421

Results are reported for a theoretical and experimental study of the resistance and behavior of reinforced concrete slabs under static and dynamic loadings. The scope is restricted to square slabs, clamped and longitudinally restrained along all edges, under uniform lateral pressure. The study deals with the entire range of behavior from elastic through tensile membrane action. The experimental tests are limited to long-duration dynamic loads, but the theory considers very short durations.

In all slabs, tension cracks first became visible at a resistance corresponding to over 70% of Johansens yield line resistance. The slabs failed initially in a flexural mode, followed by total collapse at a much greater deflection. Collapse corresponded to rupture of reinforcement in tension, large cracks on the unloaded face, and disintegration of concrete along the edges and diagonals of the slab. In the case of dynamic loading, collapse included tearing portions of the slab from its support and/or blasting blocks of concrete free from the reinforcing mesh. The thinner slabs deflected more than 2.5 times their thickness under both static and dynamic loading.

R-622
Investigations of Underwater-Curing Epoxies, Apr 1969, R. W. Drisko, AD852997L

Laboratory and field studies were conducted on both viscous underwater-curing epoxies (splash-zone compounds), which must be applied by hand, and brushable underwater-curing epoxies. The splash-zone compounds are more easily applied than the brushable products and can be used to advantage at the present time by NFEC field activities. Brushable underwater-curing epoxies can be applied with relative ease in the laboratory but are difficult to apply in the field.

R-623
Engineering Evaluation of End Connectors for Ammi Pontoons, Apr 1969, B. R. Karrh, AD851856L

A series of mooring tests, connection tests, maneuvering tests, and beaching tests were conducted to evaluate five end-to-end connection systems for the Ammi pontoon: (1) a chain connector (pinned ends), (2) an adjustable chain connector, (3) a wire rope connector, (4) an NCEL connector, and (5) a spring-loaded connector.

During the mooring tests the chain connector failed as a result of excessive abrasion between connector faces and chain links. The other connectors held under similar mooring conditions. The end connection tests showed that the wire rope was subject to being pinched between the male and female couplings and that the chain connector and the adjustable chain connector exposed personnel to potential hazards during the pinning operation. The NCEL connector and the spring-loaded connector proved suitable for connecting Ammi pontoons. Maneuvering tests indicated that the 4 ft of freeboard caused the pontoons to drift in crosswinds. No problems were encountered during beaching tests in moderate surf (up to 5 ft).

R-624
Nuclear Blast Resistant Water Wells, May 1969, J. A. Norbutas, AD687704

A proposed concept and associated design criteria for blast-resistant water wells are presented. Emphasis is on the design of deep wells for the cooling of hardened shelters. The scope of the study is limited to blast overpressures under 300 psi and weapon yields less than 20 mt. A unique feature of the concept is the use of a gel-like material to isolate the well casing from blast-induced ground motions. The concept was developed from the results of a survey of reported well damage caused by earthquakes, earth subsidence, and underground detonations, a search of the literature on isolation and hardening techniques, and an analytical study based on existing, unclassified nuclear weapon effects theory. Recommendations are given to field-test the concept and to direct further work toward extending the weapon effects range.

R-625
Nuclear Blast Attenuation by Ventilation Duct Liners, May 1969, J. A. Norbutas, D. Pal, AD852783L

Tests were conducted to determine the effectiveness of permeable lining materials in attenuating nuclear blast waves in ventilation ducts. Five sample materials were tested individually and in combination. A special support fixture was built to test the samples. The NCEL compressed-air-driven shock tube was used to generate simulated nuclear blasts with shock pressures up to about 36 psig. Shock attenuations up to 80% were measured. Standard pitot tube traverse measurements were made to determine ventilation air flow resistances of the sample liners. Significant increases in ventilation air flow resistance were found to accompany increased shock attenuation ability. It is concluded, therefore, that the area offering the greatest potential for the utilization of permeable liners for blast attenuation is where space limitations rather than operating power requirements are critical, such as might occur when the protection level of an existing structure is to be upgraded.

R-626
Superconducting Line Diodes - Some Preliminary Observations, May 1969, R. D. Hitchcock, AD688104

Superconducting line diodes were constructed by pressing a cylindrical film of oxidized tin against a plane film of oxidized tin. The I-V characteristics at 1.5K were typical of superconducting point-contact and bridge junctions, and contained step structure indicative of Josephson self-resonances up to at least 1,200 gdz. Also, possible evidence of high-order quantum transitions was observed in the form of constant-voltage steps at voltages up to 47.6 mV. Two-junction experiments to determine the detector or emitter capability of the superconducting line diodes, yielded negative results.

R-627
Investigation of a Boundary Layer Attenuation System - Part I, Low Overpressures, May 1969, D. E. Williams, AD688419

An air blast wave attenuation system for use with hardened structures and air entrainment systems was investigated by NCEL. Unfortunately, the analysis of the system which depends upon the relationship between choked flow and non-steady supersonic boundary layer formation is not so advanced that it can be completely described. However, an empirical confirmation is included and the feasibility of such an attenuator was verified experimentally. For example, results from shock tube experiments show that shock front attenuation increased nominally from 70% to 80% as the incident shock pressure was increased from 10 psi to 30 psi. In addition, significant attenuation was noted in the flow-field behind the shock front. Since this attenuator is not opaque with regard to the flow-field, it offers minimal resistance to normal flow. For example, air flow resistance per square foot of cross-sectional area was 0.1 in. of water at 100 cfm which increased to 1.3 in. of water at 500 cfm.

R-628
Survey of Pile-Cutting Techniques, May 1969, W. L. Cowell, AD853371L

A review of conventional pile-cutting techniques is presented for concrete, timber, steel shapes, and steel pipe piles. Particular emphasis was placed on the cutting of steel pipe used in conjunction with the installation of Ammi pontoons. It appears that the most desirable method of cutting the Ammi pipe piles is with a prefabricated linear shaped-charge cutter.

R-629
High-Explosive Field Test of the Breckenridge Blast Valve, Jun 1969, D. G. True, AD690883

A high-explosive field test was conducted under operation PRAIRIE FLAT at the Defence Research Establishment Suffield, Ralston, Alberta, Canada, on 9 Aug 1968. Two Breckenridge blast valve specimens were tested at ground ranges of 370 and 1,150 ft, respectively. The valves were installed in simulated ventilation systems of buried blast shelters. Each system consisted of a blast ventilator shield, a valve, ductwork, and expansion plenum, and a filter unit. The system at the 370-ft station survived the 150-psi peak overpressure and 40-g peak ground acceleration (at a 5-ft depth) without failure or malfunction. The system at the 1,150-ft station exhibited somewhat erratic closure due to the low inlet pressure, but overall performance was satisfactory. Peak pressure inside the shelter was less than 1/2 psi at both stations. The valve is considered suitable for ventilation systems which are designed to provide protection from inlet pressure peaks of up to 150 psi and which have a rated airflow of up to 700 cfm.

R-630
Polar Transportation Equipment - Four-Wheel-Drive Vehicle with High-Flotation Tires, Jun 1969, W. H. Beard, AD854380L

A four-wheel-drive vehicle with a V-8 engine, automatic transmission, 11.00x15 bar-tread, high-flotation tires, and a panel delivery body was tested over improved roads on abutting areas of snow, ice and frozen ground at McMurdo Station, Antarctica, for a 2-yr period between Deep Freeze 67 and 69. It was used to haul light cargo and passengers both summer and winter in all kinds of weather, including temperatures to -50°F. It was driven with ease by numerous drivers with varying degrees of winter driving experience on both smooth and rough roads, through snowdrifts up to 2 ft deep, and up 20% grades covered with patches of ice. Only minor maintenance and repairs were required in 15,000 mi of operation.

During Deep Freeze 68, a four-wheel-drive vehicle similar to the test vehicle except for a station wagon body was adopted by the Naval Support Forces, Antarctica, as a command vehicle for McMurdo Station. The vehicle with either body configuration is recommended for inclusion in the equipment allowance list for a polar coastal station where fast comfortable transportation is essential for effective operation.

R-631
Windows for External or Internal Hydrostatic Pressure Vessels - Part III, Critical Pressure of Acrylic Spherical Shell Windows Under Short-Term Pressure Applications, Jun 1969, J. D. Stachiw, F. W. Brier, AD689789

Model and full-scale acrylic windows in the form of spherical shell lenses with parallel convex and concave surfaces have been imploded by loading their convex surface

hydrostatically at a 650-psi/min rate while their concave surface was exposed to atmospheric pressure. The thickness of the model windows varied from 0.250 to 1.200 in. and of the full-scale windows from 0.564 to 4.000 in., while the included spherical sector angle of the lens and the bevel angle of its edge varied from 30 to 180 deg in 30-deg increments. The low-pressure face diameters of the model windows varied from 1.423 to 5.500 in., while those of the full-scale windows varied from 6.200 to 35.868 in. In addition to critical pressures, displacements of the lens under hydrostatic pressure were recorded and plotted as functions of pressure.

R-632
Cyclic Impact Studies in Dynamic Photoelasticity, Jun 1969, S. K. Takahashi, R. Mark, AD691252

A controlled cyclic loading system and stroboscopic light source was selected to analyze the in-plane loading of plates and frames. Rectangular plates made from Hysol 4485, CR-39, Homalite 100, and PL-4 epoxy were impacted, and clear photographs of static and dynamic isochromatics were obtained with a conventional view camera. Single- and double-bay rectangular frames made from Homalite 100 and CR-39 were loaded under static and controlled cyclic loads. The experimental and computed values of the natural periods checked within 5% for the single-bay frame and within 11% for the double-bay frame. The static and cyclic load stress values for the single frame obtained by the photoelastic data and the computer code were in reasonable agreement.

A Hysol 4485 rectangular frame was subjected to sinusoidal base acceleration, and photographs were obtained. An embedded-polariscope epoxy model was tested under cyclic loads, and it was found that a more intense light source is needed for clear isochromatic photographs.

The controlled cyclic loading system and stroboscopic light source can be used effectively and economically to obtain good photographs with a conventional camera of dynamic isochromatic patterns in low- and high-modulus plates and frames (except for the high-modulus embedded-polariscope models).

R-633
Preliminary Site Survey for Ocean Construction Experiments, Jun 1969, W. E. Hoffman, M. C. Hironaka, AD693085

A literature survey was conducted to determine suitable sites for the anticipated placement of structures on the floor as construction experiments. On the basis of selected site location criteria, five sites are proposed for consideration. These are located near the islands of San Nicolas, Santa Catalina, and San Clemente off the southern California coast, and near the Hawaiian islands of Kauai and Hawaii. Available pertinent information on these sites was accumulated and is presented herein. On the basis of this information, it appears that the sites in the Hawaiian islands are better suited to conduct these experiments than the sites off the California coast.

R-634
Polar Camp Improvements - Structural, Architectural, and Utility Accessories for the Jamesway Shelter, Jul 1969, F. W. Brier, AD692070

The basic Jamesway Shelter has been used for over a decade in polar regions. It possesses characteristics which make it a logical selection for polar use. However, it also has limitations which restrict its usage and decrease its efficiency. Accessories have been developed by NCEL to alleviate the structural, architectural, and utility limitations of the basic Jamesway. Prototypes of the accessories were fabricated or procured by the Laboratory and subsequently tested. Evaluation indicated that they are applicable to polar use and augment the general usefulness of the Jamesway Shelter during long- and short-term occupancy. It is recommended that the accessories presented in this report be added to the advanced-base function component system and be used, when appropriate, for effective application of the Jamesway Shelter.

R-635
Ocean Sediment Holding Strength Against Breakout of Embedded Objects, Aug 1969, C. L. Liu, AD692411

This report concludes 3 yr of breakout force research. The third phase of the field test conducted in the Gulf of Mexico and a small-scale model study are described. All of the experimental results are presented in a new dimensionless correlation (between breakout force and breakout time) based on the mchanism of the breakout.

R-636
Low-Frequency Power Transient Filters, Aug 1969, A. A. Mahmoud, AD693086

Transients in electrical power systems at various military installations are reported to cause malfunctions in and damage to electronic equipment. Investigations to date indicate that harmful transients are injected into the critical power bus by both external and internal transient producers. Oscilloscope recordings show that the harmful transients consist of oscillatory voltages having predominant frequency components as low as 400 Hz and high-frequency disturbances in the form of spike voltages as short as 10 μsec in duration. A study was conducted on the feasibility of developing power filters which could prevent the externally produced transients from reaching transient-sensitive electronic equipment, and prevent load-caused transients from reaching the critical power bus. This report describes that study. Based on the findings, a three-phase filter was designed, fabricated, and experimentally evaluated.

R-637
Movable Shield for Fallout Protection of Above-Ground Structures, Durability Study, Sep 1969, A. L. Scott, AD694030

A movable protective shield, consisting of a number of heavy vertical concrete louvers, designed by Lenard Gabert, AIA, and Associates of Houston, Tex., was evaluated at NCEL to determine its operation, weather resistance, and maintenance requirements. A test stand consisting of three panels, or louvers, was erected and exposed to wind, such, sand, rain, and salt air for 4-1/2 yr. Periodic measurements were made of the torque required to turn the panels after periods of immobility of up to 1 yr. No increase was noted in the torque required to turn the panels during the test periods. On disassembly, the bearings were found to be in excellent condition. It was concluded that the movable shield turns easily and smoothly after exposure for long periods, is not adversely affected by the moderate weather conditions found at Port Hueneme, Calif., and requires no maintenance. Life expectancy is dependent on the effective life of the grease used in the bearings.

R-638
Exploratory High-Explosive Field Test of Flexible Utility Connections, Sep 1969, D. G. True, AD695373

A high-explosive field test was conducted under Operation PRAIRIE FLAT at the Defence Research Establishment Suffield, Ralston, Alberta, Canada on 9 Aug 1968. Eight flexible utility connections incorporating various types of hoses and fittings were subjected to rapid differential motion and acceleration. One was instrumented to measure the lateral and longitudinal forces on the moving end of the flexible hose. All connections withstood the test environment of about a 1.8-in. peak relative displacement and between 15g and 50g peak acceleration without damage. The

measured axial force on the hose was in excess of a theoretically calculated value by a factor of 10, while the measured shear force was too imprecise to allow meaningful comparison with theory. The force measurements were flet to be in error, and the design criteria developed from theory and previous laboratory test results were accepted as valid. No logistical or design advantage was discovered for any particular hose or fitting type. However, the bronze hose was about twice as expensive as the rubber hose, the latter was concluded to be an economical design alternative.

R-639
Harbor Screening Tests of Marine Borer Inhibitors - IX, Sep 1969, H. Hochman, T. Roe, AD695374

This report lists the results of harbor tests of treated panels removed from exposure between 15 Feb 1967 and 15 Nov 1968. It also lists all treated panels which are being exposed and which have shown no attack or insufficient attack to warrant removal.

When impregnated into wood test panels, creosote and 70-30 creosote-coal tar solution are about equally effective against martesia and eredinid attack, but the addition of certain organic and organometallic compounds to creosote or creosote-coal tar solution produces a preservative which is superior to creosote or creosote-coal tar solution alone.

Certain creosote-free treatments which contain a combination of one material specifically toxic to limnoria and another material specifically toxic to teredines are superior to creosote or creosote-coal tar solutions in preventing marine borer attack.

R-640
A 20-μsec Asynchronous Power Source Transfer Switching System, Sep 1969, A. A. Mahmoud, AD695370

A single-phase, 1-kW, 120-V demonstration model switching system which utilizes power transistors and does not require power source synchronization has been developed and laboratory evaluated. This model accomplishes load transfer between two independent power sources at any phase angle and in less than 20 μsec. The utilization of this system in investigating the effects of asynchronous switching on a limited number of electronic equipment indicated that such equipment can tolerate high-speed power source asynchronous switching.

R-641
Sea-Ice Bearing Strength in Antarctica - Aircraft Load Curves for McMurdo Ice Runway, Sep 1969, J. E. Dykins, AD694954

To update the operating criteria for C-121, C-124, C-130, C-141, and C-5 aircraft in the Antarctic, the bearing capacity of the McMurdo annual sea-ice sheet was analyzed for short-term loading. The load curves developed by elastic theory predict the ice thickness required as related to the changing strength characteristic of the ice sheet associated with the seasonal warming trend. These load curves provide operating criteria that are more related to the ice-sheet temperature than the operating criteria now in use. This analysis is only an interim solution in the development of aircraft operating criteria. Continued research is needed to provide a better understanding of the ice sheet response to both short- and long-term loads. The load curves and instructions presented in Appendix B are recommended to replace the present operating criteria appearing in NCEL Technical Note N-888, Interim Aircraft Load Curves for Sea-Ice Runways at McMurdo, Antarctica.

R-642
Dynamic Tests on Selected Structural Steels, Sep 1969, W. L. Cowell, AD695375

Dynamic tension tests and static tension tests were conducted on four grades of structural steels. The steels conform to ASTM grades A36, A242, A441, and A572. Stress-strain curves are presented for each steel at various strain rates, ranging from static to about 1.5 in./in./sec. While all steels showed an increase in yield stress with increasing strain rates, the A36 steel showed the greatest increase. Design recommendations are given for structural steels subjected to high strain rates.

Additional specimens were strain aged, and stress-strain curves were obtained for both dynamic and static tests. Of the strain-aged steels, only the A36 steel showed a significant increase in strength over the nonstrain-aged steels, when loaded dynamically. No adverse effects of strain aging were noted on any of the steels.

R-643
Measurements of Runup on Seawalls of Waves from Simulated Underwater Explosions Near Shore, Sep 1969, D. B. Jones, AD694955

Laboratory data are presented for the runup on plane-faced seawalls of the leading waves from impulsive disturbances simulating underwater explosions. The tests covered walls with faces vertical and sloping 4.1 and 2.1 from horizontal, with foreshore slopes of 1.14 and 1.20. The tests covered two general classes of wave trains - specifically, trains with a leading trough (as produced by explosions in relatively deep water) and trains with a leading crest (as produced by explosions in relatively shallow water). The more important data pertain to the latter class, since significantly large explosions not far from shore are of the shallow-water type. A noteworthy aspect of the tests was the limited dispersion of the wave trains, resulting from the relatively short propagation distance and the large radius of the area covered by the disturbance, relative to the depth.

R-644
Housing for RVN Refugee Oct 1969, R. J. Rush, AD697276

This report is intended as a manual for use by U.S. military advisors engaged in the supervision and construction of housing for refugee native populations in the Republic of Vietnam. Use of indigenous materials, manpower, and methods in self-help operations is presumed. Examples of primitive construction are shown. Problems of site selection and preparation, building functionality, and habitability are discussed. The elements of buildings are presented, materials are explained, and construction methods are proposed.

R-645
Windows for External or Internal Hydrostatic Pressure Vessels - Part IV, Conical Acrylic Windows Under Long-Term Pressure Application at 20,000 psi, Oct 1969, J. D. Stachiw, AD697272

Conical acrylic windows of 30-, 60-, 90-, 120-, and 150-deg included angles have been subjected in their mounting flanges to 20,000 psi of hydrostatic pressure for up to 1,000 hr in the 32°F-to-75°F temperature range. The displacements of the windows through the flange mounting have been recorded and are graphically presented as a function of time, temperature, conical angle, and thickness-to-diameter ratio for the ready reference of the designer. A detailed study has also been made of tye types of failure and of the dimensional and structural parameters that must be considered in the design of safe, operationally acceptable windows for long-term service under hydrostatic pressure of 20,000 psi.

The test results indicate that a minimum thickness to minor diameter ratio of 2 and an included conical angle of 90 deg or larger is required to provide safe and optically acceptable windows for long-term sustained pressure loadings of 20,000 psi.

R-646
Operation PRAIRIE FLAT Project LN312 - Body Motions of Model Silos (U), Oct 1969, T. K. Lew, J. R. Allgood, SECRET

R-647
High-Explosive Field Test of Electrical Generators, Oct 1969, R. S. Chapler, J. M. Stephenson, AD861851L

Emergency electrical power for hardened shelters is provided by diesel-driven generator sets. In an effort to determine the level of air blast protection required for the sensitive equipment, NCEL participated in Operation PRAIRIE FLAT, the detonation of a 500-ton surface-tangent spherical charge of TNT at the Canadian Defence Research Establishment Suffield, Ralston, Alberta, Canada, in Aug 1968. Two small commercial diesel-driven generators placed in grate-covered pits were subjected to a 100-psi overpressure environment. The air blast caused the engines to stop by disrupting the electrical control circuits, but only minor damage was incurred. Emergency electrical generators can be successfully and economically operated in the 100-psi overpressure range if necessary equipment such as batteries and electrical controls are protected and if the grate cover is modified.

R-648
The Stereochemistry and Mechanism of Hydride Reductions of Cyclohexene Oxides, Oct 1969, R. L. Alumbaugh, AD697273

Although the ring opening reactions of epoxides have been investigated rather extensively, the reduction of substituted cyclohexene oxides by the complex metal hydrides has until recently received little attention. In this work, the mixed cis and trans isomers and the pure trans isomers of 1,4-dimethylcyclohexene oxide, 1-methyl-4-T-butylcyclohexene oxide and 4-T-butylcyclohexene oxide were prepared and reduced by the complex metal hydrides. The metal hydrides investigated included lithium aluminum hydride, the mixed hydride (3 $LiAlH_4$, 1 $AlCl_3$) sodium, lithium, and potassium borohydrides, and diborane. The diborane reduction of 1-methylcyclohexene oxide and 1,2-dimethylcyclohexene oxide was also studied. The reductions, where possible, were carried out in ethereal, alcohol, and hydrocarbon solvents in order to access their effect on the course of the reactions. Reaction products were characterized by infrared spectroscopy and vapor phase chromatography. Results indicate that conformational effects are quite important in determining product distributions when lithium aluminum hydride was employed in ethereal solvents. The increased specificity of the mixed hydride reduction in ether (over $LiAlH_4$ in ether) was attributed to electrophilically assisted ring opening by aluminum hydride. Both solvent and conformational effects are important in determining product distributions in the alkali metal borohydride reductions in various solvents. There appears to be a steric interaction between the epoxide and the entering solvated hydride donor which is quite important.

R-649
Structural Response of Unstiffened Toroidal Shells, Nov 1969, W. J. Nordell, J. E. Crawford, R. M. Beard, AD697274

Seven model epoxy toroidal shells were tested, and the results were compared with those from analytical solutions. The toroidal shells had a mean radius about the axis of revolution of 6 in., a mean tube radius of 2 in., and a mean shell thickness of 0.086 in. The static elastic strain response of the epoxy models was in satisfactory agreement with that computed using a finite element analysis for axisymmetric shells. Critical buckling pressures for the models were approximately 85% of the analytical prediction, which was based on the mean dimensions.

R-650
Dynamic Tests of Model Concrete, Nov 1969, J. M. Ferritto, AD699499

The objective of this project was to evaluate the dynamic properties of modeling materials. Dynamic tests were conducted on microconcrete with No. 4 and No. 30 maximum aggregate size, and gypsum concrete with No. 4 maximum aggregate size. The effects of strain rate (up to 2.5 in./in./sec) on ultimate compressive strength were obtained. The results are compared with results of dynamic tests conducted on prototype concrete by others. Microconcrete with a No. 4 maximum aggregate gives good correlation with prototype values of dynamic strength increase. The ratio of dynamic to static modulus of elasticity with increasing strain rate and dynamic strength increase factor also gives good correlation. Microconcrete with a maximum aggregate size of No. 30 gives dynamic increase factors somewhat lower than those of the prototype. The ratio of dynamic to static modulus of elasticity with increasing strain rate is greater than that of the prototype of microconcrete with No. 4 maximum aggregate. Both microconcretes experience higher strains at ultimate load than the prototype. Gypsum concrete experiences dynamic strength increase factors of approximately half those of the prototype. It may be significant that the increase in modulus of elasticity with increasing strain rate for gypsum concrete is not similar to that of prototype concrete. Strains in gypsum concrete at ultimate load are slightly higher than those for prototype concrete.

R-651
Mix Designs for Fast-Fix C-1 Cement Concrete, Nov 1969, D. F. Griffin, AD863264L

The properties of Fash-Fix C-1 cement concrete are compared with the properties of Fash-Fix 1 cement concrete. In addition, tests were conducted to determine the effect of sodium citrate retarder on the setting time and strength of Fast-Fix C-1 cement concrete.

For an aggregate-cement ratio of 1.5 or lower, both concretes compared closely in strength, with the Fast-Fix 1 cement concrete having a slightly higher strength. For an aggregate-cement ratio higher than 1.5, Fast-Fix 1 cement concrete is definitely superior in strength at an age of 1 hr. Fast-Fix C-1 cement concrete continues to gain strength with age, whereas Fast-Fix 1 cement concrete apparently achieves maximum strength within 1 hr. Air-cured Fast-Fix C-1 cement concrete is much stronger than fog-cured concrete at an age of 28 days. Sodium citrate retarder extends the setting time of Fast-Fix C-1 cement concrete by an amount varying from 17 to 22 min. It decreases the compressive strength of Fast-Fix C-1 cement concrete by less than 10% at an age of 1 hr for an aggregate-cement ratio of 1.5 and slightly increases the strength at an age of 28 days.

R-652
Feasibility Study and Comparative Analysis of Deep Ocean Handling Systems, Dec 1969, D. A. Davis, M. J. Wolfe, AD699172

Nine candidate systems for lowering and raising negatively buoyant loads in the deep ocean were compared and evaluated by means of a systems effectiveness model. For both load ranges considered - 20 to 100 tons and 400 to 600 tons at 6,000 ft - a lift system employing a ship with pipe string suspension medium was considered to be the most feasible approach.

Accurate positioning of heavy modular loads can be most readily achieved by resorting to acoustic devices for guiding the translation and rotation of the surface support craft prior to final emplacement. A manned submersible would serve as a useful guidance backup system.

The transport of 10- to 30-ton loads for short distances in the near bottom environment is considered feasible. Final choice between two competing systems, a heavy-lift submersible and a hydrocopter, must await further definition of work missions and load configurations.

R-653
Diver Performance Using Handtools and Hand-Held Pneumatic Tools, Dec 1969, F. B. Barrett, J. Quirk, AD865372L

NCEL, Port Hueneme and the NMC, Point Mugu, Calif., have jointly conducted tests to measure diver performance using handtools and hand-held pneumatic tools. The tools included adjustable pipe and machine wrenches, ratchet and special hand wrenches, screwdrivers and the following pneumatic tools, two drills, a power saw, an impact wrench, and a chipper. The initial tests were conducted on land and in a test tank filled with freshwater. Ocean tests using the same tools were accomplished at a working depth of 50 ft. Performance times of divers using the various tools on vertical, deck, and overhead surfaces in the ocean are reported. Performance decrements for in-tank and ocean tests are compared to land-test performance. Difficulties encountered using the various tools, tethering devices, and tool holding and tranporting devices are reported, and suggestions for improvement are made where applicable. Additional tests conducted in the ocean to determine diver one- and two-arm strength while working on vertical, deck, and overhead surfaces are summarized in Appendix D.

R-654
The Mathematics of Signal Recovery, Dec 1969, D. L. Chaffe, R. D. Benning, AD700244

In spite of the advances in the state of the art of signal measurement instrumentation, the ability to recover wanted low-level signal information in the presence of inherent noise has not overcome the trend for lower and lower signal level processing. In order to recover the intelligence portion of recorded noisy signals when the wanted signals provide only a small fraction of the total signal energy involved, mathematical methods of separation and identification were investigated, and the results are presented. A model for the mathematical solution of this problem is developed and a computer program realizing the mathematical relationships is presented.

R-655
Plastic Mooring Buoys - Cost and Additional Performance Data, Jan 1970, R. W. Drisko, AD701367

Two plastic mooring buoys have provided good service as part of moorings for the fleet in San Diego Bay for a period of 4 yr. One buoy with a hand lay-up fiberglass-reinforced polyester shell is in appreciably better condition than the other one with a spray-up shell of fiberglass-reinforced polyester resin. A third plastic buoy with an improved design is in excellent condition after 1 yr of service to the fleet in Pearl Harbor. An analysis of the costs of purchasing and maintaining steel and plastic mooring buoys is presented. It indicates that after the present supply of World War II mooring buoys is exhausted, NAVFAC field activities should use plastic mooring buoys as replacement becomes necessary.

R-656
Motion of Subsurface Soil Inclusions Subjected to Surface Blast Loading -Results of Series IV Tests, Jan 1970, C. R. White, AD700939

Experiments and analyses between 1966 and 1969 on the behavior of objects buried in dry sand added information on shape effects at blast overpressures from 14 to 250 psi to the previous information about mass effects. Two shapes (cubic and triangular prismatic), each at two different masses (greater and less than the encompassing soil), were tested. Shape had no discernible effect on relative displacement between buried objects and the soil. Shape had a greater effect than mass on accelerations experienced by the buried objects, with the objects presenting a flat face to the stress wave receiving the greater acceleration.

R-657
Desensitization of DC Power Supplies to Momentary AC Power Fluctuations, Jan 1970, K. T. Huang, AD700936

Lightening storms and faults cause momentary voltage dips and momentary power interruptions in the AC power. These brief disturbances reach electronic equipment through fluctuations in the output voltages of DC power supplies. This report describes methods to desensitize DC power supplies to momentary AC power source perturbations. DC output voltage sustaining characteristics for basic transistors and silicon-controlled rectifier power supply circuits are discussed and performance data presented. By the use of an auxiliary energy reservoir circuit, the DC output of a power supply was maintained at its nominally rated value when an AC power interruption of 167 msec occurred.

R-658
Strength of Prestressed Concrete Beams After 12 Yr of Live Load, Feb 1970, W. A. Keenan et al., AD703607

Twelve post-tensioned prestressed concrete I-beams and three hollow box beams were loaded to failure. Four I-beams were tested at 21 days, all others were tested after 10 to 12 yr of live load. Live load ranged from 0 to 1.5 times the design live load. The I-beams were straight, 42 ft long, and 24 in. deep. Five I-beams were post-tensioned with ungrouted cables. Seven I-beams were post-tensioned with steel bars, four were grouted. The hollow box beams were gable-shaped with straight tendons. The box beams were 42 ft long, 33 in. deep, 18 in. wide, and post-tensioned with ungrouted, stranded wire cables. In general, the flexural stiffness of all beams was less than the stiffness computed from the ACI code. The utimate moment capacity of all beams was greater than values computed from the ACI code, the ultimate moment capacity was 13% greater for I-beams with bar tendons, 14% greater for I-beams with cable tendons, and 11% greater for the box beams. The difference was least (7%) for beams with bonded tendons. The best agreement between measured and computed moment capacity was obtained by an iteration method in which the actual stress-strain relationship for the tendons was considered in the computations. The average ratio of clear span to collapse deflection for all I-beams was 64, the ratio was 57 for the box beams. The average factor of safety against collapse was 2.46 for the I-beams and 2.05 for the box beams. It is concluded that prestress loss, type of tendon, time variation of concrete strength, and live-load history did not significantly affect the ultimate moment capacity of the beams.

R-659
High-Explosive Field Test of High-Capacity Blast Valve, Operation PRAIRIE FLAT, Feb 1970, D. E. Williams, R. S. Chapler, AD702039

NCEL has developed and tested a series of experimental valves varying in capacity from 700 to 10,000 cfm, with 1 in. of waterflow resistance. A 2,500-cfm valve evolved

after a series of tests with the 700-cfm buckling plate valve. Although the configuration of the larger valve differed from its predecessor, the concept remained essentially unchanged. Design criteria for a high-capacity valve were established after experimental confirmation of the concept. Based upon such criteria, a 10,000-cfm valve, which consisted of four 2,500-cfm valves in a parallel arrangement within the same housing, was designed and fabricated. The valve was field tested in the 100-psi overpressure range at Operation PRAIRIE FLAT in Canada, with excellent results. The valve closed in 15 msec without damage from the external environment.

R-660
Field Testing of Electrical Grounding Rods, Feb 1970, R. W. Drisko, A. E. Hanna, AD702040

In cooperation with the National Association of Corrosion Engineers, NCEL conducted a 7-yr program of field testing metal rods for electrical grounding. Single rods of galvanized steel, copper-clad steel, Ni-resist cast iron, Type 302 stainless steel, Type 304 stainless-clad steel, zinc, magnesium, and aluminum were tested along with couples of these to mild steel rods. Sets of both single and coupled rods were removed, cleaned, and weighted after 1, 3, and 7 (or 5) years. Potential, resistance, and current measurements were made monthly as far as practicable. Weight losses and electrical data were analyzed for correlations. It was concluded that Type 302 stainless steel and Type 304 stainless-clad steel rods were the best choices for general use.

R-661
An Evaluation of Deep Ocean Research Vehicles, Feb 1970, J. B. Ciani, AD865362L

In an effort to evaluate deep ocean research vehicles and their potential value to deep ocean civil engineering, a submersible was leased and used in familiarization dives by ocean engineering personnel in 1968. The dives are described by the participants, and their impressions are given. A literature search was made, and the capabilities required of a submersible are postulated. The capabilities readily available in six representative, currently operational submersibles are compared with the postulated requirements. It is concluded that deep ocean research vehicles have great potential value in the ocean engineering program and it is recommended that submersibles be used where applicable to specific tasks.

R-662
Hot Water Heating System for Divers Operating at Depths to 1,000 Feet, Feb 1970, S. C. Garg, AD866771L

Thermal protection of divers is essential for long-duration missions under deep sea diving conditions. One way to achieve diver heating is by providing the diver with a continuous supply of hot water flowing through his protective clothing. To achieve this objective, surveys were carried out to determine the best available deck-mounted heating system, hot water heated suits, and hot water hoses suitable for deep ocean service. A complete prototype diver heating system was purchased and subjected to laboratory and field testing evaluation.

The surveys showed that standard equipment to heat seawater did not exist on the market, that only one type of hot water suit was available which met all the requirements, and that there is a critical lack of pertinent data on available hoses to permit their evaluation for deep ocean service. The prototype unit revealed a number of problem areas during testing. Some of these problems were rectified through appropriate modifications whereas others required extensive changes which are recommended for second generation equipment.

Recommendations are made to improve the flow and temperature control systems of the boiler unit and to experimentally evaluate available seawater blending valves, diver suits, and hot water hoses. Further recommendations are made to develop a boiler system based upon electrical heating which could be located in the habitat for future long-duration deep dive missions.

R-663
Evaluation of Meco 200-gph Seawater Distillation Unit, Feb 1970, A. S. Hodgson, AD866652L

A 400-hr test was conducted to evaluate the 200-gph Meco vapor-compression seawater distillation unit. The unit is basically experimental, and its construction incorporates features which have proved advantageous to operation of this type of equipment. Supplying moderate vacuum to the evaporator reduced scale formation below the levels encountered with units operated at atmospheric pressure. The water eductor used to provide the vacuum operated satisfactorily and is a good substitute for the more complex mechanical vacuum pump. The horizontal spray film evaporator was difficult to clean after an extended period of scaling due to poor water distribution in the lower portion of the tube bundle. The all-aluminum construction resulted in a 30% weight reduction compared to copper-nickel alloy units, and apart from minor problems with corrosion of small-diameter aluminum tubing in hot brine this material proved satisfactory. The unit produced an average of 268 lb of water per pound of fuel at the rated capacity of 200 gph.

R-664
Dynamic Behavior of Strip and Spread Footings Buried in Sand, Feb 1970, D. G. True, C. R. White, AD703216

This report describes the response of 1-, 2-, 4-, and 6-in.-sq footings and of 6x72-in. and 12x72-in. strip footings loaded dynamically in dry sand. The load applied to the experimental footing by the NCEL atomic blast simulator through the loading beam - load cell apparatus simulated the load applied by a buried structure to its footings as the result of a nuclear-blast-induced air overpressure acting on the surface of the soil in which the structure was buried. For some of the tests there was no overburden. For others, a static load simulating 20 ft of overburden was applied at one side of the footing. This report also outlines the adaptation of conventional static bearing capacity formulas to explain the dynamic behavior of deeply buried footings in sand. The results are applied in an iterative procedure for calculating the loading and motion of a buried, footing-supported structure, taking into account the effects of soil arching.

R-665
Susceptibility of Selected Communication Equipment to Electrical Transients, Feb 1970, M. H. Kajihara, E. Giorgi, AD866940

This report contains the results of the tests made on two types of currently operational communication equipment and two makes of commercial Autodin RFI power-line filters to determine their susceptibility to electrical transients. These tests substantiate field reports which indicate that small pulse voltages at the input of RFI power-line filters caused larger oscillatory voltages to appear on the load side of the filter. These output waveform perturbations caused operational disruptions in certain communication equipment. The effectiveness of one method of suppressing the oscillatory voltage is illustrated. The communication equipment was also tested singly and collectively to establish the quality of electric power needed for dependable operation of these electronic loads. The Mark II 7.5-kW power-transient synthesizer was used to provide the controlled power-parameter fluctuations. In addition, the effectiveness of the NCEL-developed 5-kW passive power

continuity device and the high-speed asynchronous power-source transfer system was tested with the communication equipment loading. The results are given herein. This investigation illustrates an effective method for precisely establishing the specifications for the proper power conditioner for use between the unconditioned primary power source and the transient-sensitive electronic loads to obtain dependable operation of electronic systems.

R-666
Pressure Vessel Concepts - Exploratory Evaluation of Stacked-Ring and Segmented-Wall Designs with Tie-Rod End-Closure Restraints, Mar 1970, J. D. Stachiw, AD705125

An exploratory experimental study was conducted to evaluate the stacked-ring and segmented-wall pressure vessel concepts. The evaluation consisted of: (1) testing to destruction stacked-ring and segmented-wall pressure vessel models with tie-rod end-closure restraints and (2) evaluating a series of seal designs utilized in the sealing of the joints between the pressure vessel end closures and the cylindrical pressure vessel body. The tests results indicate that the stacked-ring pressure vessel design is approximately 50% heavier than a multilayered pressure vessel of the same internal diameter, length, material, and pressure capability. The segmented-wall pressure vessel design is approximately 8 to 9 times heavier than a multilayered pressure vessel of the same diameter, length, material, and pressure capability. The free-floating, self-energizing radial seal system provided the most reliable and extrusion-proof sealing for vessels with considerable radial dilation and axial end-closure movement.

R-667
Pumps for Salvage of Oil Cargoes from Stranded Tankers, Apr 1970, N. P. Oldson, A. L. Scott, AD705487

The Supervisor of Salvage requested a study of methods for pumping cargo oil from stranded tankers and an evaluation of a submersible 25-hp salvage pump modified to pump oil and other viscous liquids. An investigation was made of (1) the advantages and disadvantages of centrifugal and positive displacement pumps, (2) strengths and head losses through oil transfer hoses of different sizes, (3) power requirements, electric, hydraulic, and pneumatic drives for salvage pumps, and (4) heat required to lower cargo-oil viscosities for salvage. A 25-hp centrifugal salvage pump with modified, interchangeable impellers was tested in oils of various viscosities to determine its capability for pumping various types of oil in cargo salvage operations. The following were concluded: (1) the most practical salvage pump would be an electric, submersible, 18-hp pump capable of operating at 24-hp for limited periods, (2) the modified submersible 25-hp salvage pump is satisfactory for salvaging oil cargoes if the steady-state temperature of the motor windings is limited to 140°C, (3) a 6-in. diam hose system should be used, (4) the standard 30/40-kW generator should not be expected to supply power to more than one 25-hp salvage pump when viscous oil is pumpted.

R-668
Response of Buried Capsules in the High-Overpressure Region, Apr 1970, R. J. Odello, J. R. Allgood, AD705990

This report describes tests of three capsule-shaped structures at the predicted 1,000-psi overpressure range in the 500-ton shot of Operation PRAIRIE FLAT. The purpose of the test program was to determine the effects of backpacking on the motions and stresses transmitted to near-surface buried structures in high-overpressure regions and to provide check data for relevant theoretical analyses.

The capsules, designated C1, C2, and C3, were approximately 6 ft tall and 3 ft in diameter with 3/4-in. thick walls. C1 had no backpacking, C2 was backpacked with polyurethane foam, and C3 was backpacked with foamed cement. They were buried 3 ft below the surface of the ground at the same range with their axes of symmetry normal to the surface.

Data from the 55 channels of electronic instrumentation showed that the backpacking reduced the peak air-induced accelerations by a factor of three and reduced the peak air-induced stresses and the relative displacements between the capsules and the soil by a factor of two. Direct-induced motions and stresses were small compared to air-blast induced stress and were not attenuated by the backpacking. The data provided checks for an empirical arching equation and a finite element computer code analysis.

R-699
Automatic Data Recorder for Vehicular Operations, Apr 1970, L. J. Elliott, AD706334

DOD operates a huge transportation system. Efficient management of this system requires the collection of an immense amount of data and the preparation of voluminous reports. At present, this work is performed manually. The use of a computer-compatible, automatic recorder for collecting vehicular operation data, developed by NCEL, offers significant improvements in speed and accuracy, thus providing for more efficient management of vehicular operations.

R-670
Displacement of Laterally Loaded Structures in Nonlinearly Responsive Soil, Apr 1970, H. L. Gill, K. R. Demars, AD705989

Quantitative information on the response of soil in natural deposits to lateral loadings was obtained by the performance of field tests in conjunction with theoretical studies and in situ and laboratory determinations. The field tests utilized a segmental pile, a lateral plate loading device, rigid poles subjected to lateral loads, and full-scale laterally loaded piles. Results of the final series of field tests and analytical studies in the program are presented in this report, along with the design recommendations formulated on the basis of the research.

Procedures were developed for the prediction of nonlinear lateral soil pressure-displacement relationships applicable to undisturbed deposits of both cohesive and noncohesive soils using easily measured conventional engineering properties of the soil. These procedures were utilized in the development of design procedures for laterally loaded piles in nonhomogeneous layered soil systems. An iterative solution of the laterally loaded pile problem utilizing a digital computer was developed, and a similar iterative solution for hand computations in a tabular form was evolved for use in cases where a computer cannot be used.

R-671
Portland Cement Concrete for Antarctica, Apr 1970, J. R. Keeton, AD705994

A satisfactory concrete mix was developed at NCEL for use in Antarctica. This mix was subsequently utilized at McMurdo Station, Antarctica, during Deep Freeze 1969 to construct simulated floorings and slabs. Techniques were developed in the field which led to formulation of recommended procedures for batching, mixing, placing, and curing of portland cement concrete in Antarctica. The pertinent features of the mix and design and related procedures are as follows:

Cement - 594 lb/cu yd, Portland Type III
Mixing water - 35 gal/cu yd heated at 140°F to 180°F
Total aggregate - 3,210 lb/cu yd (1-in. maximum)
Sand (passing No. 4 sieve) - 1,188 lb/cu yd (37% of total aggregate)
Slump - 3 in.
Air content - 5% to 7% of concrete volume

Calcium chloride - 12 lb/cu yd (2% of cement weight)
Temperature of concrete when placed - 50°F to 70°F
Curing - heat (50°F to 70°F) applied to the concrete surface for 3 days following casting

R-672
Tire-Pavement Friction Coefficients, Apr 1970, H. Tomita, AD705987

An investigation consisting mainly of a literature review and a review of current research done outside NCEL was conducted to determine the methods needed to provide safe, skid-resistant surfaces on Navy and Marine Corps airfield pavements. Much of the information reported herein serves to update the information contained in NCEL Technical Report R-303. For example, new information is included on friction-measuring methods, correlation of the measuring methods, factors affecting friction coefficients, minimum requirements for skid resistance, and methods of improving the skid resistance of slippery pavements. However, some new topics which are of recent interest are also discussed in detail. These topics include hydroplaning, the mechanisms of rubber friction, the friction associated with various operating modes of aircraft tires, the relationship of friction coefficients to pavement surface texture and to surface drainage of water, and the effects of pavement grooving on hydroplaning and on friction coefficients.

All the information from the investigation is summarized, and recommendations are given for research and development efforts needed to provide safe, skid-resistant surfaces for airfield pavements.

R-673
In Situ Strength of Subaqueous Concrete, Apr 1970, W. R. Lorman, AD705993

Cylindrical test specimens of 3-1/2- and 7-in. slump concrete underwent curing, within 1 hr after fabrication, in (1) a sealed vessel filled with 47°F seawater at 269 psi to simulate a 600-ft oceanic depth, (2) in 47°F seawater at atmospheric pressure to ascertain the effect of temperature, and (3) in 73°F fog as the standard for compressive strength. Specimens cured as in (1) and (2) were cast in segmented molds held intact by rubberbands to permit concrete swellage while curing and deformation when loaded to failure under uniaxial compression. Compressive strengths were determined at ages 2, 4, 6, and 8 days.

Maximum size of gravel aggregate was 1 in., equivalent cement (Type III) factor was 7 bags, and water/cement ratios were 0.52 for low-slump and 0.63 for high-slump concretes.

The combined effect of low aqueous temperature and high hydrostatic pressure caused the 7-day strengths, attainable by curing in 73°F fog, to be reduced nearly one-half for low-slump and somewhat more than one-third for high-slump concretes. Further experimentation is needed to ascertain (1) the effect of cement brand on subaqueous compressive strength during the first 24 hr, and (2) the 14- and 28-day subaqueous compressive strengths of concretes identical to those described herein.

R-673S
Supplement to In Situ Strength of Subaqueous Concrete, Sep 1971, W. R. Lorman, AD889084L

The physical effects of an environment similar to that in the Santa Barbara Channel at a depth of 600 ft do not cause appreciable differences in subaqueous compressive strength (at any age from 1 to 28 days) between 3-1/2- and 7-in. slump concretes cast and cured in situ, provided the same brand of high-early-strength portland cement is used in both concretes.

The influence of cement brand (either Victor or Colton) in concretes of equal slump, whether low or high, is inconsequential at age 28 days, but using Colton cement can result in subaqueous compressive strengths at least 1,000 psi greater than those obtainable with Victor cement at ages between 1 and 14 days if the concrete slump is low. During the first 7 days, the unavoidable loss of subaqueous compressive strength of concrete incorporating Victor cement (compared with identical referential concrete which is cured in 73°F fog and tested in 73°F air) can be reduced as much as 25% by substituting Colton cement.

The probable 28-day subaqueous compressive strength of concrete, incorporating either Victor or Colton cement, designed and produced as described in the basic report can be predicted by means of empirical formulas, provided the 7-day compressive strength of identical referential concrete is known.

R-674
Water Permeability of Coating Films Using a Radioisotope Tracer Technique, Apr 1970, E. S. Matsui, AD705988

The report deals with the development of an accurate and rapid method of determining moisture permeability through protective coatings using radiochemical techniques. It demonstrates that the radiochemical method, as compared to the ASTM standard method, is precise, sensitive and rapid. This method has been used to analyze variables which may have a significant effect on the moisture permeability of paint films. The variables analyzed include film thickness, vapor pressure, temperature, generic type of vehicle, type of pigment, pigment concentration and moisture diffusion in liquid or vapor form.

R-675
Stress Analysis of a Conical Acrylic Viewport, Apr 1970, M. R. Snoey, J. E. Crawford, AD708009

This study was initiated to: (1) determine experimentally the structural response of a viewport design, (2) determine the accuracy of the finite element method in predicting viewport behavior by comparing analytical to experimental results, and (3) determine the effect, if any, of the flange surface finish on the structural behavior of the viewport using both experimental and analytical techniques. In the experimental phase, four full-scale conical acrylic viewports, with a nominal thickness-to-minor-diameter ratio of 0.5 and an included angle of 90 deg, were strain-gaged and tested to 8,000 psi. In the analytical phase, the same viewport design was analyzed with a finite element computer program. The finite element results successfully bracketed the experimental results by assuming two extreme boundary conditions, fixed and free, at the viewport-flange interface. The fixed condition assumed an infinite coefficient of friction, and the free condition assumed zero friction. In addition, finite element analysis provided complete internal stress distributions. All results indicated that viewports with this design exhibit both plugging and bending behavior and have two areas of high stress concentration, the center of the high-pressure face and the corner between the low-pressure face and the conical bearing surface. The analytical investigation indicated that the surface finish of the flange significantly affects the viewport stress distribution. A rough flange surface (fixed case) produces stress magnitudes in the viewport which are about 25% less than those in the viewport with a smooth flange surface flange (free case). This was also established experimentally by tests of 15 model viewports under equal load, which indiated that a 125-rms flange finish caused less plastic deformation in the viewports than either a 63- or 32-rms flange finish.

R-676
Development of a Spherical Acrylic Plastic Pressure Hull for Hydrospace Application, Apr 1970, J. D. Stachiw, AD707363

A spherical, acrylic plastic capsule has been designed for protection of man against the external hydrostatic pressure present at continental shelf depths. Experimental and analytical studies have been conducted to evaluate the performance of both the spherical capsule design and the

acrylic plastic construction material at continental shelf depths. Results from testing twenty-two 15-in.-OD models and a large-scale prototype under short-term, cyclic, and long-term hydrostatic pressure indicate that the design and material chosen meet the requirements for safe operation at continental shelf depths. A prototype 66-in.-OD capsule of 2.5-in. wall thickness, and 4,000-lb positive buoyancy in seawater has been specifically developed for the NEMO (Naval Experimental Manned Observatory) system. The NEMO prototype capsule successfully withstood 105 simulated dives ranging from 250 to 2,400 ft prior to being tested to implosion at a simulated depth of 4,150 ft. The experimental data indicate that the full-scale NEMO capsule can be safely subjected to brief proof-test dives to 1,200 ft and routine operational manned dives of extended duration to 600 ft.

R-677
Optimum Positioning of Deep Underground Tunnels in Rock (U), Apr 1970, J. Rottgerkamp, AD509501, CONFIDENTIAL.

R-678
Response of Buried Cylinders in the Near-Crater Region, May 1970, J. R. Allgood, T. K. Lew, R. D. Rail, AD708010

Tests were performed in operation DISTANT PLAIN, Event 6, on a 6-ft-diam reinforced concrete cylinder and on three 9-in.-diam cylinders to obtain information on the behavior of structures in the near-surface, high-overpressure region. All test structures were oriented with their longitudinal axes parallel to the surface and normal to a radius through ground zero. The data obtained were intended for use in checking the results of recently developed nonlinear computer codes.

Thirty-nine of 45 channels of electronic instrumentation yielded data which provide information on the body motions and transmitted shock, the induced strains, and the interface pressures. Information on the failure mode of near-surface reinforced-concrete cylinders was obtained from observation of the small (9-in.-diam) cylinders and from tests of similar cylinders in Operation BACKFILL. Induced stresses and accelerations were smaller than expected even though body motions of the order of 2 ft (vertical and horizontal) were experienced. The data clearly show the rapid attenuation of velocity by the soil - as a consequence of this attenuation, the effective stress on the large cylinder was only 20% of the peak surface pressure. This stress caused no visible damage to the large cylinder. However, two of the model cylinders collapsed, and the other was badly cracked by the overthrusting that was peculiar to Event 6.

Comparison of nonlinear computer solutions (performed under contract) showed poor agreement with the experimental data. Further development of nonlinear codes capable of soil-structure interaction analyses appears to be required to achieve meaningful solutions.

R-679
Failure of Thick-Walled Concrete Spheres Subjected to Hydrostatic Loading, May 1970, H. H. Haynes, R. A. Hoofnagle, AD708011

Two modes of failure for hollow concrete spheres subjected to hydrostatic pressure loadings are discussed, and the experimental results are presented. The first mode of failure was crack development in the plane of the concrete wall, and the second mode was implosion. From experiments using 16-in.-OD spheres, the difference between the pressures at failure for the two modes ranged from 0 to 50%. Expressions to predict the pressures at initiation of in-plane cracking of the concrete wall and the pressures at implosion are presented.

R-680
A Nuclear Experimental Pulse (NEMP) and Light Flash Sensor, May 1970, H. A. Lassiter, AD871279

An electromagnetic pulse and light flash sensor, capable of sensing the occurrence of nuclear blasts, was developed and evaluated by NCEL. This unit is used in conjunction with a blast-closure valve for protective shelters. Environmental tests indicated that the EMP sensor will respond to a 100-nsec rise-time waveform and to a light illuminosity level in the visible region of approximately 30 lumens/sq cm. It will operate properly in temperatures between -19°F and 150°F, in a shock environment up to 35g laterally and 15g vertically, and in an overpressure region up to 90 psi. Also, the sensor is not subject to excessive levels of gamma radiation.

R-681
Relationship Between Marine Fouling and Corrosion Rate of Carbon Steel and Aluminum Alloy at the Surface and at 6,000-Ft Depth, May 1970, J. S. Muraoka, AD708012

Carbon steel (1010) and aluminum alloy (7178-T6) panels were exposed at the surface (23 to 286 days) and at 6,000-ft depth (189 days) in the Pacific Ocean (1) to determine the effects of fouling organisms on the corrosion rate and (2) to compare the biological corrosion rate of identical test panels submerged at the two depths. Seawater samples obtained at the surface and at depth were analyzed for dissolved oxygen concentration, pH, salinity and temperature. Bacteriological tests were also conducted on seawater samples. The test panels were submerged in the sea as follows to obtain data on corrosion rates: (1) enclosed inside an initially sterile plastic cylindrical chamber with both ends sealed with membrane filters (control panels), (2) placed inside a cylinder covered with 210-mesh nylon screen cloth, (3) placed inside a cylinder with both ends uncovered, and (4) attached to a phenolic plastic strip (exposed panels). The control specimens became contaminated, however, from corrosion data obtained on test panels exposed on the seafloor in 6,000 ft of water, it is concluded that slime films played a significant role in accelerating corrosion of test specimens. Test panels exposed at the surface corroded at faster rates than replicate test panels which were exposed on the seafloor in 6,000 ft of water. The corrosion rates of both steel and aluminum alloy panels approach constancy after extended exposure in the sea. The various environmental factors and their effects on the corrosion rates at the surface of the sea and at great depth on the seafloor are discussed.

R-682
Concrete Model Analysis of Structural Elements Developing Strength Reduction Concepts, May 1970, J. M. Ferritto, AD708013

A dimensional analysis develops the scale factors for direct and strength-reduction models. A method is presented for designing model concretes suitable for use in small-scale models that will produce strength characteristics essentially the same as prototype concrete. Bond strength of model concrete reinforcement was studied, and an apparatus was developed to put deformations in wire. Pullout tests were conducted to evaluate the bond strength developed by laboratory-deformed wires.

To develop the concepts of strength-reduction modeling, a series of beam tests was conducted. These tests revealed that models will accurately reproduce prototype failure modes and ultimate strengths. The accuracy of strains and deflections depends on the significance of distortion in the model. The shear strength of the model was found to be dependent upon the square root of the ultimate concrete compressive stress, strength scale factors should be applied to the square root value. Further tests involved columns, prestressed beams, and flat slabs.

R-683
Relation Between Changes in Electrical Properties and Performance of Coatings - Experiments with Thirteen Immersed Coating Systems, May 1970, P. J. Hearst, AD707697

In an attempt to find a relatively rapid method of predicting the performance of coatings, changes in electrical properties were compared with the results of long-term field performance of the coatings. Thirteen coating systems on steel panels were immersed in seawater in the laboratory for 400 days, and the AC and DC electrical properties of the coatings were determined. Earlier experiments had indicated a relationship between changes in electrical properties and performance. New results with coatings of comparatively good performance indicate some correlation between changes in electrical properties and coating performance. However, the correlation is not sufficiently high to allow reliable prediction of the comparative performance of good coatings.

R-684
Salvage Work Projects - Sealab III, Jun 1970, J. J. Bayles, AD709423

The Navy is authorized by public statute to provide salvage facilities to assist both public and private vessels. In keeping with this responsibility, the Supervisor of Salvage, U.S. Navy, is prosecuting a vigorous program to incorporate the latest techniques and equipments into the Navy's salvage forces.

The Sealab III program under the direction of the Ocean Engineering Branch, Deep Submergence Systems Project Office, was initiated to advance the state-of-the-art of man's capability to live and work in the deep ocean environment. It was the goal of the salvage projects for Sealab III to demonstrate and field test some of the more important new salvage devices and techniques.

This report discusses the aquanaut familiarization and training phases associated with the salvage projects planned for Team Two - Sealab III, and the modifications to both equipments and procedures as suggested by the divers. Preliminary results are included with recommendations regarding future plans.

Human factors studies were conducted in conjunction with the training phases in preparation for Sealab III. Goals included assessment of divers' performance, the development of improved underwater work procedures, and improvement of underwater equipment through development of design criteria.

R-685
Blast Resistant Fans for Hardened Cooling Towers, Jun 1970, R. S. Chapler, D. Pal, AD710740

A study was conducted to determine the nuclear blast resistant characteristics of vaneaxial and centrifugal type fans used on cooling towers. Rugged commercial fans, namely, a 27-, 24-, and 21-in. vaneaxial, and a 15-in. centrifugal, were selected for the study. A preliminary analysis followed by an extensive experimental program using the NCEL 12-in. compressed air-driven shock tube was carried out. Test results indicated that the destructive incident overpressures for the 27-, 24-, and 21-in. vaneaxial and the 15-in. centrifugal fans were 8.75, 8.5, 9.75, and 12.5 psi, respectively. Concepts to increase the blast resistant characteristics of the fans were formulated.

R-686
Structural Design of Conical Acrylic Viewports, Jun 1970, M. R. Snoey, M. G. Katona, AD710350

The purpose of this report is to establish a rational engineering approach for the design of conical acrylic viewports. To achieve this goal, a time-dependent, yield-failure criterion was developed and utilized in the analysis of a variety of viewport configurations. Specifically, a range of thickness/minor diameter (T/D) ratios from 0.25 to 1.75 and included angles from 60 to 120 deg were analyzed by the finite element technique. Using the viewport structural analysis in conjunction with the yield-failure criterion for acrylic, time-dependent operating depths were determined as a function of viewport configuration.

Paralleling the above, an experimental investigation was performed to validate the analytical results. Six full-scale viewports were tested for a year under simulated operational conditions that included simultaneous cycling of pressure and temperature, 0 to 4,000 psi and 70°F to 35°F, respectively.

Comparison of analytical and experimental results indicated excellent agreement for the physical location of viewport failure at specified loading histories.

Design recommendations are presented in the form of design curves which enable the design of a conical acrylic viewport for a specified operating pressure and duration under load. To complete the recommendations, design information is given also on sealing with a conventional O-ring, as well as guidelines for elevating a viewport in its flange.

R-687
Protection of Steel Pontoon Floats from Corrosion, Jul 1970, R. W. Drisko, AD873002L

A 3-1/2-yr test program was conducted in San Diego Bay on the use of modern synthetic coatings in conjunction with sacrificial anodes for protecting steel pontoon camel floats from corrosion. The three two-coat, protective systems performed very well, much better than the previously used coal tar system that required annual recoating, and the anodes provided complete protection from rusting to underwater portions of the floats. It was concluded that a combination of one of the coating systems and cathodic protection from sacrificial anodes can greatly reduce the maintenance costs associated with pontoon camel floats.

R-688
Aquanauts Composite Life Support Umbilicals - Sealab III, Jul 1970, J. J. Bayles, D. Taylor, AD874021L

NCEL awarded and monitored several contracts for aquanaut composite life support umbilicals and complementary equipment planned for use in the Sealab III operation. Safety certification testing of the contract items was performed at the contractors' factories and at NCEL. The accepted items were observed in use during Sealab III aquanaut training sessions and were evaluated as to their potential use in an actual operation. It became evident that there is a need for improvement in the reliability and durability of aquanaut umbilicals. Greater care in the handling and maintenance of life support equipment would result in improved performance.

R-689
Ice Engineering - Tensile Properties of Sea Ice Grown in a Confined System, Jul 1970, J. E. Dykins, AD874807

Tensile strength envelopes were developed for horizontally and vertically oriented specimens of saline ice. The upper boundary limit in each case represents 1- to 2-ppt salinity ice for temperature range -4°C to -27°C, while the lower boundary represents 7- to 9-ppt salinity ice for the same temperature. The salinity, density, and petrographic structure of the 7- to 9-ppt natural seawater ice, which was grown in the laboratory, are closely identifiable with the characteristics of sea ice formed in a natural environment. This observation was based on comparison of the upper 44 cm of laboratory ice with a similar thickness of natural sea ice. The tensile strength was found to be a nonlinear function of temperature, there were strong implications, however, that a linear relationship with salinity may exist. The strength was found to be dependent on orientation of the stress field with both the grain (crystal) and subgrain

(platelet) structure. Limited study indicates that the tensile strength of saline ice is appreciably reduced as stress rates increase above 25 psi/sec.

R-690
Reclamite as a Life Extender for Asphaltic Concrete Pavements, Aug 1970, D. F. Griffin, AD875286L

Reclamite, a proprietary product, is described, including its makeup, usefulness, and limitations. Reclamite is said to be a fine-particle-size, cationic, oil-in-water emulsion of a selected blend of the four principal fractions of maltenes. When used properly it is effective in maintaining the service life of an asphaltic concrete pavement. It is also effective in rejuvenating weathered asphalt. This effectiveness has been verified by consultation with such users of Reclamite as Federal, State, and County agencies. Some of these users have employed Reclamite for 10 yr. Prospective users should avail themselves of the consultative services offered by the manufacturer.

R-691
Site Surveying for Ocean Floor Construction, Aug 1970, M. C. Hironaka, W. E. Hoffman, AD712753

The increase in interest by the Navy and other organizations in placement of structures on the seafloor necessitates establishing site parameters relevant to such construction, and equipment for measuring these parameters. Included in this report are the site parameters significant to designing, constructing, operating, and maintaining a seafloor structure, an outline of the site survey procedure, the equipment available for conducting these site surveys, and data handling and reduction techniques. Also included are recommendations for research required prior to placement of structures and equipment.

R-692
Permeability Studies of Reinforced Thin-Shell Concrete, Aug 1970, J. R. Keeton, AD711841

Falling-head permeability tests were conducted on specimens of two normal-weight concretes and two lightweight concretes typical of those used in thin-shell reinforced concrete roofs. Specimens of each concrete with galvanized mesh reinforcement were tested in thicknesses of 1, 2, and 4 in. Initially, the upper face of each specimen was exposed to a 20-in. head of water. The lower faces of the specimens were initially exposed to relative humidities of 25%, 50%, 70%, or 100%, all at a constant temperature of 73.4°F. A lightweight concrete utilizing expanded shale for both coarse and fine aggregate was the least permeable of all the concretes tested. The degree of zinc oxidation from the mesh was determined for some of the specimens. The reliability of the equation for coefficient of permeability (falling head) could not be verified. Any of the concretes tested in this study could be used to make a relatively impermeable thin-shell concrete roof. Since the concrete itself can be made satisfactorily resistant to water passage, cracks are the most significant source of water leakage through thin-shell concrete roofs.

R-693
Concrete Funicular Shells for Floors and Roofs, Sep 1970, R. J. Odello, J. R. Allgood, AD712754

Research is described in which a concrete funicular shell, 35x40 ft in plan with a 2-in. thickness and a 30-in. rise, was tested to define its behavior under various loadings. The shell sustained a uniformly distributed load of 135 psf before failing in local buckling. In a subsequent test on an undamaged portion, it sustained a concentrated load of 10,800 lb over an area 6 in. sq before failing in punching shear. In addition to the test, pertinent construction and analysis techniques are discussed. It was found that double-curved shallow shells may be easily cast over an earth mound. When combined with the lift-slab technique, this mode of construction is expected to provide an inexpensive method for fabricating large shells for floors and roofs. Approximate limit analyses can be used to proportion shallow shells for ordinary purposes; however, no completely satisfactory method is available for treating such members. Elastic analysis provides a reasonable representation of behavior only at low loads. Despite the limitations in current analysis, the technology has developed sufficiently to permit use of shallow shells in military and civilian construction. Naval shore establishment uses include decks of docks and floors and roofs of warehouses. The economic benefits of such shells for use by the Navy are being investigated.

R-694
Plate Bearing Tests on Seafloor Sediments, Sep 1970, T. R. Kretschmer, H. J. Lee, AD712495

A device was developed by NCEL to determine the short-term, in-situ bearing pressure and settlement response of marine sediments at any ocean depth. Tests were performed in cohesive sediments with both round and square bearing plates at ocean depths of 1,200 and 6,000 ft. During a typical test, measurement of load, settlement, and attitude of the device were transmitted acoustically to a surface vessel where they were monitored and recorded. The results of these plate bearing tests were found to be amenable to analyses by modified elastic and bearing capacity theory. A tentative procedure for predicting the short-term settlement of seafloor footings using the results of laboratory tests on core samples was developed on the basis of these two approaches.

R-695
Dynamic Shear Strength of Reinforced Concrete Beams - Part III, Sep 1970, R. H. Seabold, AD713659

Theoretical and experimental work was done at NCEL to study shear and diagonal tension in rectangular, reinforced concrete beams on simple supports and subjected to uniformly distributed dynamic and static loads. The objective was to determine criteria for the minimum amount of web reinforcement required for developing the ultimate flexural resistance of beams, and to determine the difference between these criteria for static and dynamic loading. The main portion of the experimental work consisted of testing 53 beams; 29 were loaded dynamically, and 24 were loaded statically. Emphasis was placed on effectiveness of web reinforcement, 47 beams contained web reinforcement and 6 had none. All of the beams were tested in the NCEL blast simulator. Static loads were applied using compressed air, and dynamic loads were applied using the expanding gas from detonation of primacord explosive. All of the beams were slender, and all of them were rectangular except 10 that were I-shaped. It was found that the shear and the shear strength in the beams were greater under dynamic load than under the same amount of load applied statically. Furthermore, it was found that a beam with enough web reinforcement to force flexural failure under static loading might not have enough to force flexural failure under dynamic loading. The theory was found to predict behavior up to the usable ultimate shear strength within normal engineering accuracy, and to provide a fair estimate of the time, location, and mode of failure.

R-696
Influence of Length-to-Diameter Ratio on Behavior of Concrete Cylindrical Hulls Under Hydrostatic Loading, Sep 1970, H. H. Haynes, R. J. Ross, AD713088

Fourteen hollow concrete cylindrical hulls ranging in length from 8 to 128 in. and having an outside diameter of 16 in. and a wall thickness of 2 in. were subjected to hydrostatic loading to determine: (1) to effect of cylinder

length-to-outside-diameter ratio (L/D sub-zero) on the implosion pressure and strain behavior, and (2) the distance from the edge of the cylinder in which radial displacement was influenced by the end closure. Hemispherical end closures were joined to the cylinders with epoxy, silicone rubber, or steel dowel pins and epoxy. The uniaxial compressive strength of the concrete averaged approximately 9,500 psi. Test results showed that the ratio of implosion pressure to uniaxial concrete strength, P sub-IM/F prime sub C prime decreased as the L/D sub-zero ratio increased from 0.5 to 2, and then the P sub-IM/F prime sub C ratio became constant. Thus, an infinitely long cylinder was one having an L/D sub-zero ratio ≥2, the effect of the end closure on the behavior of the cylinder becoming negligible at a distance ≥1 diam from its edge.

R-697
Air Revitalization Unit for Sealed Survival Shelters, Oct 1970, D. E. Williams, AD714163

An air revitalization unit for use with sealed survival shelters without an external power supply was developed. The unit is capable of supplying oxygen to and removing carbon dioxide and odors from a 100-man personnel shelter for a 24-hr period. The system utilizes (1) a dry chemical absorbent (baralyme) for carbon dioxide removal, (2) pressure cylinders for the oxygen supply, (3) an activated charcoal filter to remove odors, and (4) a battery-powered fan for air circulation. A prototype unit was designed, fabricated, and tested. Following tests of individual components, a 24-hr continuous test of the unit was completed. In general, the test results for the chemical, mechanical, and structural aspects of the air revitalization unit were affirmative. A similar assessment cannot be made for the human element inherently involved with the operation of the unit.

R-698
Toxicity of the Off-Gas Products From Diver Hoses, Oct 1970, M. P. Vind, C. W. Mathews, AD714143

NCEL was requested to ascertain the composition and toxicity of compounds off-gassing from diver hoses and to develop new acceptance tests for the military specifications for diver hoses. A literature survey disclosed that the off-gassing would consist primarily of organic solvents and would contain only traces of plasticizers and deterioration products of rubber. Two acceptance tests were developed at NCEL for measuring the quantities of organic solvents emitted by diver hoses. The equipment used can be purchased for between $2,000 and $3,000. In both tests, measurements of ionizable carbon are employed as indices of the concentrations of solvent vapors and related organic compounds. In the first test, measurements are made of the carbon content of air confined in the hoses for at least 7 days. Concentrations of up to 50 mg/m cubed are permitted. In the second test, measurements are made of the carbon content of air flushed through the hoses at a rate of 3 ft cubed/min. Concentrations of not more than 0.01 mg/m cubed per foot of hose or a maximum concentration of 4 mg/m cubed regardless of hose length are permitted. The concentration of nearly any compound that might off-gas from diver hoses should be at safe levels in breathing mixtures delivered through hoses that pass the above tests. Exceptions are the solvents carbon disulfide and carbon tetrachloride. Military specifications must forbid their use in the fabrication of diver hoses.

R-699
Static, Vibration, and Stability Analyses of Laminated Frames, Oct 1970, S. K. Takahashi, S. B. Dong, AD714164

A two-dimensional frame of n laminations with arbitrary loadings is analyzed by the finite element method. The element is composed of bonded layers, each with a different thickness and different elastic properties. The frame is approximated by a series of short segments interconnected at the nodal points. Variational principles were applied to determine the relationship between the nodal point forces and displacements. A macroconstitutive law for laminated beams which includes the effect of transverse shear deformation is presented. This law involves a composite shape factor, K squared, which accounts for, on a weighted averaging basis, the complex stress state, the variations in strain and material properties, the geometry of the cross sections, and the frequency of loading. With the aid of Castigliano's theorem, the geometric stiffness matrix is derived for problem formulations for stability and vibration under initial stress. The effect of transverse shear deformation is assessed quantitatively with examples on planar structures for which computer codes based on finite elements were used for the analysis. The results show a significant decrease in the stability and the frequencies of vibration under initial load when the geometrical configuration departs from that assumed for the classical theory.

R-700
Holding Strength of Piles in Ice, Oct 1970, N. S. Stehle, AD714165

Piles are used in polar regions for many of the same purposes as in temperate regions, including foundations for structures in areas of permafrost and ice. The bearing capacity of piles set in permafrost and ice depends on the holding, or tangential adfreezing, strength. Tests were conducted at NCEL to determine the influence of pile material, shape, ground temperature, and backfill on tangential adfreezing strength in ice. General criteria for application were developed based on laboratory and field information. It was concluded that ground and air temperatures are the most influential parameters in determining the pile type and backfill. Design load, however, should be based on tangential adfreezing strength after long-term loading, this strength was determined to be one-half to two-thirds the tangential adfreezing strength after no previous loading.

R-701
Epoxy Coatings on Water-Tank Interiors - Part II, Performance of Test Coatings, Oct 1970, R. W. Drisko, AD877337L

Three proprietary epoxy coating systems in different steel water-storage tank interiors at NAS, Lemoore and NAS, Point Mugu were periodically inspected and rated over a 3-1/2-yr test period. The conditions of these systems were compared to those of a vinyl system which performed over a 6-yr test period in tanks at NAS, Lemoore. All systems provided good general protection from corrosion, but all tanks had pinpoint rusting along sharp edges and seams to some extent, and blistering of the coating to some extent. The Plasite 7133 system performed best of all. Because of the small amounts of electrical current required for cathodic protection, tank-to-water potentials were difficult to maintain at a constant level. Also, holes in the bottom of a storage tank were successfully patched with a fiberglass-reinforced polyester system.

R-701S
Epoxy Coatings on Water-Tank Interiors, Part II. Performance of Test Coatings, Dec 1973, R. W. Drisko, A. F. Curry, AD917009L

Three proprietary epoxy coating systems in different steel water storage tanks at NAS, Lemoore and NAS, Point Mugu were inspected 8 yr after application. The conditions of these systems were compared to those of a vinyl system applied 2 yr earlier at NAS, Lemoore. The systems in conjunction with cathodic protection were providing adequate protection to the tank interiors, but all tanks had pinpoint rusting along sharp edges and seams at the tank top and blistering of the coating to some extent. The Plasite 7133 epoxy coating system performed by far the best. A summary of good coating practices is presented.

R-702
Cathodic Protection System for Fleet Moorings, Nov 1970, R. W. Drisko, AD715346

A cathodic protection system was developed for protecting from corrosion both the underwater portion of a mooring buoy and its ground tackle. The final design of this system protected both buoy and chain for 3-1/2 yr, and sufficient zinc appeared to remain for at least another 6-1/2 yr of protection. The system performed well on both a sandy and a muddy bottom. The zinc anodes used onthe ground tackle were specially cast on steel chain links to become an integral part of the chain system. The tight riser-chain secured to the peg-top buoy had the required electrical continuity to permit the necessary flow of current for protection, but it was necessary to use a steel cable woven through the links of each ground leg to achieve electrical continuity there. A cost analysis indicates that use of such a cathodic protection system can result in a considerable reduction in costs associated with maintenance of fleet moorings.

R-703
Dynamic Stress Response of Lifting Lines for Oceanic Operations, Nov 1970, C. L. Liu, AD715771

A vertical lift system was field-tested to determine the validity of an analytical solution for predicting the dynamic stress response of lifting lines in oceanic operations. Synthetic and steel wire ropes handling spherical, cylindrical, and cubical concrete loads were lowered by winch to depths as great as 5,000 ft. The ship acceleration and the line-force fluctuation were recorded on magnetic tape, and later the time-series data were digitized and analyzed by computer. The measured response functions agree within 50% with those calculated by the analytical solution, therefore, the proposed analytical solution for frequency response calculations is recommended. A single-guideline, load-handling system was field-tested in 1,000 ft of water. The test results indicate that a shallow-water, single-line system to restrict the motion of a compact load during emplacement is feasible, and that the lift line tension is not affected by the guideline. Also, performance requirements for a motion-compensating winch were calculated on the basis of vertical motions of five ships.

R-704
Creep and Shrinkage of Reinforced Thin-Shell Concrete, Nov 1970, J. R. Keeton, AD715770

Creep coefficients and shrinkage factors were determined for specimens of three thin-shell reinforced concretes consisting of one normal-weight concrete, one sand-lightweight concrete, and one all-lightweight concrete. Prismatic specimens were tested in thicknesses of 1, 2, and 4 in. at stress-strength ratios of 0.25 and 0.50. Specimens were tested in controlled relative humidities of 25%, 50%, 70% and 100%, with temperature at 73°F in all locations. Curves involving surface-area-to-volume ratios were used to determine time-dependent strains for different humidities, sizes, and stresses. Equations are presented for creep coefficients and for shrinkage, curves are presented for obtaining correction factors to be used in design equations. Correction curves for unit weight were developed with test data from this study. Predicted values for creep coefficients and shrinkage agreed with observed data when computed with equation and correction factors presented herein.

R-705
Airfield Marking Paints for Asphaltic Pavements, Dec 1970, R. W. Drisko, AD716755

Specially formulated marking paints for striping airfields were field tested. The polyvinyl acetate paint at CBC, Port Hueneme was still in excellent condition 4 yr after application. In all cases single-thickness ratings were as good as or better than corresponding double-thickness ratings, especially for the double-thickness alkyd ratings. The polyvinyl acetate paint performed best on the runway at Guam, but the three oleoresinous phenolic varnish paints and one of the two alkyd paints performed slightly better on the roadway. On a runway at NAS, Point Mugu the polyvinyl acetate paint performed the best of the six paints tested. Miscellaneous problems with airfield marking paints at other activities are discussed and solutions presented. Laboratory testing included analyzing water-emulsion paints for possible use as marking paints and developing simple test procedures for identifying alkyd and chlorinated resins in fresh and weathered marking paints.

R-706
Snow Compaction -- Investigation of Metamorphism of Snow, Dec 1970, N. S. Stehle, AD716417

Although processing and compacting increase the density and bearing capacity of surface snow for use as roads and trails, these processes have not been able to achieve the degree of densification that occurs naturally as snow slowly metamorphoses to glacier ice. A study was made at NCEL of the processes and influences of the major mechanisms that control snow metamorphism - grain size, pressure, temperature and solar radiation - in order to provide a basis for developing better techniques for higher strength snow pavements. It was concluded that maximum snow strengths are achieved at or near a critical density of 60 gm/cu cm, followed by bond growth, or age hardening, at temperatures between -12C and -7C. In addition, as distribution of applied loads with depth is essential to the development of operational criteria for such pavements, it is recommended that research be conducted to develop this knowledge.

R-707
Ultimate Horizontal Shear Strength of Prestressed Split Beams, Jan 1971, S. B. Nosseir, R. N. Murtha, AD717352

This report deals with the horizontal shear resistance and behavior of prestressed concrete composite beams when the interface is selected to pass through the centroid of the composite section. Composite beams proportioned in this manner are referred to as prestressed split beams. A total of eight simply supported split beams were statically tested with the major variables being interface roughness and reinforcement parameter RF_y. (R and F_y are the percent and yield point of the web reinforcement across the interface.) All test beams were posttensioned and grouted and had the same nominal dimensions. Beams with rough interfaces showed an increase in the ultimate horizontal shear strength of about 100 psi over that of duplicate beams with smooth interfaces. The ductility and the energy absorption capacity increased with RF_y. The ultimate horizontal shear strength for beams with $RF_y = 0$ was in excess of 400 psi and increased at the rate of about 60 psi per 100 psi increase in RF_y. The two beams with the highest value of RF_y failed in flexure. In spite of developing slip at the interface, these two beams developed the calculated flexural resistance based on full composite action. The horizontal shear resistance of the test beams failing in horizontal shear was much higher than the computed values based on the ACI code.

R-708
Windows for External or Internal Hydrostatic Pressure Vessels -- Part V. Conical Acrylic Windows Under Long-Term Pressure Application of 10,000 psi, Jan 1971, J. D. Stachiw, W. A. Moody, AD718812

Conical acrylic windows of 30-, 60-, 90-, and 120- and 150-degree included angle and 0.500 to 1.250 T/D (thickness to minor diameter ratio) have been subjected in their mounting flanges to 10,000 psi of hydrostatic pressure for 500 and 1,000 hr at ambient room temperature. The displacement of the windows through the flange mounting has been recorded as a function of time and plotted for the ready reference of

the designer. The magnitude of the window displacement has been found to be a function of time, angle, temperature, T/D ratio and pressure.

It is recommended that for safe single sustained operation of 1,000 hr duration at 10,000 psi hydrostatic loading at ambient temperature the windows should have an included conical angle ≥ 90 deg and a minimum T/D ratio of 0.750. For sustained loadings in excess of 1,000 hr the minimum T/D ratio is 1.000.

R-709
Collapsible Salvage Pontoon Development, Jan 1971, J. J. Bayles, D. Taylor, AD880284L

The SUPSALV and NCEL have managed separate contracts for the development of a series of collapsible salvage pontoons since 1966. The pontoons were modifications of time-tested off-the-shelf fuel storage pillow-tanks and commercial, collapsible, bin-type shipping containers. NCEL arranged for testing these pontoons and, with the assistance of the USNS GEAR (ARS-34) and other government agencies, performed the tests near San Clemente and Anacapa Islands, at CBC, Port Hueneme, and at the Long Beach Naval Shipyard, all in California. The following pontoons were tested.

1. Pillow-tank configuration.
   A. Two type I, vertically oriented, 25-long ton rated lift capability.
   B. One type I, vertically oriented, 15-long ton rated lift capability.
   C. Four type II, horizontally oriented, 25-long ton rated lift capability.
   D. One type III, 350,000-lb jacking lift capability.
2. Container-bin configuration.
   A. One tandem assembly of three, 8-ton rated lift capability.

The type I, 25-ton rated pontoons failed, but the 15-ton size (of identical construction) was tested satisfactorily with the exception of a minor leak. The type II and subsequent first modification of the type II pontoons performed unsatisfactorily. However, a second modification of the type II was tested satisfactorily.

The 8-ton container-bin configuration pontoon was successfully tested, is the most easily handled, appears to be the most rugged, and is well suited for use in multiple assemblies.

Further testing of the 8-ton pontoon and investigation of availability of other pontoon fabrics are recommended.

R-710
Cementitious Compounds for Subaqueous Caulking in Salvable Hulls, Jan 1971, W. R. Lorman, AD880055L

Cementitious caulking compounds of putty-like consistency were developed for use in conjunction with patching holes in the hulls of USN ships sunk in harbors. Select compounds were evaluated in the ocean to ascertain their effectiveness when subjected to simulated salvage conditions. These compounds also were investigated in the laboratory relative to the following physical characteristics, workability, setting time, watertightness, strength (bond and compressive), and length change. One compound appeared to satisfy the following arbitarily established physical requirements. In 60-ft-deep seawater at temperatures of 33F, 60F, and 88F (corresponding respectively to polar, temperate, and tropical regions), (1) workability (the property of the freshly mixed compound to resist crumbling or disintegration while being manipulated underwater during the caulking operation) must persist for at least 1/4 hour after completion of mixing, and (2) final set (the beginning of the hardening phase) must occur not earlier than 1/2 hr in any region or later than 6 hr in polar regions, 4 hr in temperate regions, and 2 hr in tropical regions. The apparently satisfactory compound consists of high-early-strength portland cement, seawater, and catalyzed metallic powder.

R-711
Protective Coatings for Steel Piling - Additional Data on Harbor Exposure of 10-ft Simulated Piling, Feb 1971, R. L. Alumbaugh, A. F. Curry, AD881761L

This report supplements NCEL Technical Report TR-490, presenting additional results of the investigation of protective coating systems of various generic types that were applied to 10-ft steel panels. These simulated steel pilings were suspended from a corrosion dock in the mouth of Port Hueneme Harbor so that the bottom portion was in continuous immersion, the middle portion in the tidal zone, and the top portion in the atmosphere. Many of these same protective coating systems were also exposed on 10-ft angle iron panels driven in the surf of the outer harbor at Port Hueneme so that the top half of the panel was exposed to the abrasive action of the surf. Results are given for coating systems that were performing satisfactorily at the time TR-490 was issued as well as a number of additional coatings that have been exposed since then. Exposure times for the 87 coating systems exposed on the corrosion dock and the 65 coating systems exposed on angle iron panels in the surf ranged from 2 to 15-1/2 yr.

R-711S
Protective Coatings for Steel Piling: Additional Data on Harbor Exposure of Ten-Foot Simulated Piling, Mar 1978, R. L. Alumbaugh, A. F. Curry, ADA053504

This final report, supplement to CEL Technical Report TR-711, presents additional results of the investigation of protective coating systems of various generic types that were applied to 10-ft steel panels. These simulated steel pilings were suspended from a corrosion dock in the mouth of Port Hueneme Harbor so that the bottom portion was in continuous immersion, the middle portion in the tidal zone, and the top portion in the atmosphere. Results are given for coating systems that were performing satisfactorily at the time TR-711 was issued. Exposure times for the 85 coating systems suspended from the corrosion dock ranged form 9 to 21-1/2 years.

R-712
Mooring Systems for an Expeditionary Logistic Facility, Feb 1971, R. C. Towne, J. J. Traffalis, W. G. Hatch, J. A. Drelichars, S. J. Oppedisano, AD881354

The purpose of this study was to analyze mooring systems relative to military operations in open and sheltered coastal waters. This included the development of technical approaches and options, assessment of the state-of-the-art, examination of the technical and operational risks, and identification of cost-effectiveness indices and parameters for required performance. The state-of-the-art of some mooring components appears adequate to meet the mooring load requirements, but specialized systems need to be developed to meet the criteria imposed by the operational environment of open coastal sites. Data were obtained for the preparation of a developmental program for open coastal mooring systems. The analysis included the evaluation of individual equipment options, identification of technological inadequacies requiring research and development effort, and the formulation of mooring concepts.

R-713
Polar Construction Equipment - Construction Drilling for Snow, Ice, and Frozen Ground, Feb 1971, C. R. Hoffman, R. A. Paige, AD882447L

A mobile rotary drilling unit with different augers and bits was tested for construction drilling and subsurface exploration in deep snow, sea ice, fast ice with sand and rock inclusions, volcanic rock, and frozen ground in polar regions. The drilling techniques for this equipment are described, and utilization of the equipment and techniques by Naval construction forces at McMurdo Station, Antarctica,

are cited. It was concluded that augers up to 24 in. in diameter can be used to drill construction holes up to 10 ft deep in snow and uncontaminated ice. Tricone bits up to 6 in. in diameter and tube drill bits up to 14 in. in diameter can be used for deep drilling in snow, ice, and ice-rock conglomerate and for drilling holes up to 18 ft deep in frozen ground and volcanic rock. It is recommended that this equipment be used for construction and exploratory drilling in the polar regions. The Naval Support Forces, Antarctica has completed plans to adopt the unit.

R-714
Economics of Shallow Concrete Shells, Mar 1971, R. J. Odello, J. R. Allgood, AD721689

A cost study was performed to determine the economic practicability of large concrete shells for use in Naval shore facilities. To accomplish this, the cost of shallow concrete shells is compared with the cost of three types of commonly used floor and roof systems. Rise-to-span ratios were limited to 1:10.

The results of the study show that shallow concrete shells cost less than the comparative roofs of 50- to 80-ft span and floors of 50- to 300-ft span. Examples of typical applications are given and practical aspects of embodying funicular shells in a complete structural system are discussed.

R-715
Amphibious Assault Landing Craft Program - Large Pallet Development, Mar 1971, J. A. Dielschatz, R. W. Julian, AD721328

To complement the high speed of the advanced craft being developed by the amphibious assault landing craft program, a need exists to consolidate cargo into larger unit loads in order to improve the material handling rates at the terminals of the ship-to-shore cycle. This report documents the design, fabrication, test, and evaluation of four prototype large pallets, 8 x 9 ft in area, each capable of carrying four standard 40 x 48-in. pallets. The prototype pallets include a wooden, a folded-plate, an aluminum, and a strongback design. Each pallet functioned well with respect to its specific design criteria, however, no one pallet was clearly superior to the other three alternatives, and none fulfilled all the design criteria.

R-716
Structural Analysis of a Full-Scale Spherical Acrylic Plastic Pressure Hull, Mar 1971, M. R. Snoey, M. G. Katona, AD882099L

This study was initiated to (1) perform a finite element structural analysis on an acrylic plastic pressure hull, (2) compare the finite element results with available experimental results, and (3) present an operating-depth curve and make recommendations for future designs. The design analyzed was a pressure hull incorporating 12 spherical pentagons of acrylic plastic bonded together to form a sphere with an outside diameter of 66 in. and a wall thickness of 2.5 in. Steel penetrations were located at the two poles. The experimental results were obtained from strain gage data from two independent pressure tests to 500 psi on two acrylic plastic hulls of the same design.

The finite element analysis of the hull structure placed particular emphasis on the acrylic plastic-steel boundary. The boundary conditions at the acrylic plastic-steel interface were two extreme cases, fixed and free. A time-dependent yield-failure criterion for acrylic plastic was combined with the structural analysis to provide an operating depth curve as a function of both time and temperature. Comparison of the finite element and experimental results indicated excellent agreement. At a temperature of 70F and a maximum of 50 hr load duration, the acrylic plastic hull can operate to 1,000 ft with a safety factor of 1.5 based on yield and a safety factor of 2.6 based on collapse. Design recommendations are also presented to provide guidelines for future design of the hull and its integration with an undersea vehicle.

R-717
Impact of Containerization on the Advanced Landing Craft, Mar 1971, R. W. Julian, AD721690

This report documents an investigation of the impact of containers on the advanced landing craft under development by the amphibious assault landing craft program.

Military and civilian container concepts were studied to identify those containers that might be used in amphibious operations. The compatibility of craft and containers was investigated, including the equipment and loads the craft must handle to incorporate containers. Various means of off-loading the containers at or on the beach were analyzed. The results indicate that small containers are compatible with all craft, while large containers, such as the 8 x 8 x 20-ft container, are compatible with all except the smallest landing craft (30,000-lb payload), which cannot handle these containers loaded to their maximum gross weight. Rough terrain forklifts with appropriate capacities and fittings are the best equipment for off-loading containers, except for the case of 8 x 8 x 20-ft containers in the smaller landing craft.

R-718
Precision Mapping of the Seafloor, Mar 1971, R. D. Hitchcock, AD882352L

State-of-the-art systems for mapping the seafloor with relatively high precision are described. The systems are (1) multibeam sonar system operating from surface vessel and providing real-time readout of bottom contours, (2) side-scan sonar on deep-towed vehicle, using data from two separate surveys at different elevations, and (3) stereo-camera system operated from a low-flying manned submersible. An experimental side-scan interferometer system is also discussed.

Component random errors are assumed for each system, and average resultant horizontal and vertical mapping errors are computed relative to a bottom reference point. Component systematic errors are assumed for the side-scan and stereo-camera systems, and overall mapping errors are computed relative to a bottom reference point. Cost analyses are made of the side-scan and stereo-camera systems.

Results of the error and cost analyses indicate that the side-scan interferometer system could be developed to the point where it would be suitable for determining the topography of a seafloor site to be used for a fixed bottom installation.

R-719
Recovery, Inspection, and Analysis of World War II Aircraft After 26 Yr at 560 Fathoms (U), Mar 1971, J. F. McCartney, J. P. Sandlin, J. F. Jenkins, J. S. Muraoka, D. G. True, Confidential, AD514358

R-720
Ice Engineering-Material Properties of Saline Ice for a Limited Range of Conditions, Apr 1971, J. E. Dykins, AD887840I

Increasing operational use of ice areas in polar regions has intensified the need for improved knowledge, techniques, and procedures for utilization of polar ice in shore-based activities and floating platforms. A linear equation relating flexural strength (rupture modulus) with brine volume was developed for temperature range -2C to -10C for normal seawater ice. The analysis included data from large field-tested beams and small laboratory-tested beams. The stress-strain relationship for the small laboratory beams tested for temperature range -4C to -1C under elastic loading condition was found to be linear, while the elastic

modulus was observed to behave as a nonlinear function of temperature. Limited sampling indicates secondary creep is related to stress and can be expressed as a material constant multiplied by stress to an exponential power, both stress and creep are temperature sensitive. In contrast to the results of previous studies, the basal plane of the polycrystalline specimens of saline ice was not observed to be the weakest shear plane.

R-721
Interface Slip Behavior of Composite Prestressed Concrete Beams, Apr 1971, S. H. Nasseir, C. E. Warren, AD722667

This report deals with the interface shear strength and slip behavior of post-tensioned concrete composite beams. The interface between the two composite elements was positioned on the centroidal axis of the composite cross section. Eleven simply supported beams with 8-ft spans were statically loaded to failure. The effect of interface roughness and web reinforcement on relative slip between the composite elements was studied. Web reinforcement crossing the interface and roughness of interface decreased the rate of relative slip and allowed increased magnitudes of slip before failure. Interface roughness and web steel improved the integrity, strength and energy-absorption capacity of the composite beams. The ultimate interface shear resistances determined from the tests were higher than those recommended by the ACI code.

R-722
Beach Materials Handling-Advanced Concepts, Apr 1971, R. W. Julian, AD722668

This report considers means for improving the handling rate of palletized cargo at the craft-beach interface with reference to the advanced landing craft under development by the amphibious assault landing craft program. A base-line unloading rate is established and components of the base-line system are studied to see if modifications to the equipment or off-loading methods can effect an increase in unloading rates. A number of advanced concepts are considered, the more promising of which include a multiple pallet transporter, sliding craft deck, causeway, and portable near-shore breakwater. While these concepts improve unloading rates in specific instances, they may be difficult to justify in terms of their cost and contribution to the overall efficiency of the general unloading phase of amphibious operations. A more desirable option may be to increase the number of rough terrain forklifts and/or develop a more efficient forklift.

R-723
Plastic Mooring Buoys - Design and Cost Criteria, Apr 1971, R. W. Drisko, AD723219

NCEL has investigated the feasibility of using plastic buoys in place of steel buoys in mooring systems. The Laboratory had two buoys fabricated - one with a hand lay-up fiberglass-reinforced polyester shell and the other with a spray-up fiberglass-reinforced polyester resin shell. The two plastic mooring buoys have provided good service as part of moorings for the fleet in San Diego Bay for a period of 5 yr, the hand lay-up shell buoy is in appreciably better condition than the spray-up shell buoy. Later, a third plastic buoy was fabricated with an improved design and was placed in service in Pearl Harbor, after 2 yr, the buoy is in excellent condition. A cost analysis indicates the practicality of using plastic rather than steel buoys as components of fleet moorings. Thus an annual savings of about $6,150 per class BB mooring can be achieved using a plastic buoy in conjunction with cathodically protected ground tackle. Also a purchase specification for a plastic mooring buoy is included for use by Naval field activities.

R-724
Evaluation of a Water Jet Propulsion System for Warping Tug and Similar Naval Applications, Apr 1971, A. L. Scott, AD883687L

A pair of water jet propulsion units was obtained from Western Gear Corporation under NCEL Contract N62399-68-C-0027. They were installed in a 3 x 14 NL pontoon barge by PMIBCB 1 at Coronado, Calif. After a series of performance tests, the barge was outfitted as a warping tug and was in-service tested for approximately 8 mo. Since that time it has been in use by PMIBCB 1 for a year in routine warping tug service. Because of lower efficiency, the water jet units consume more fuel than conventional propeller-type propulsion units. In the surf zone, however, where warping tug performance is critical, the water jet units are far superior to conventional units. For all other warping tug operations they perform as well or better than propeller-type propulsion units currently in use by the Amphibious Construction Battalions.

R-725
Concepts for Drilling and Excavating In and Below the Ocean Bottom, May 1971, E. J. Beck, T. L. Culbertson, P. J. Daly, M. A. Gaberson, A. L. Scott, AD724677

In support of planned development of construction systems for precise excavation and drilling in the deep ocean floor, a study of the potential problems which might be encountered has been made. Two deep ocean technology (DOT) efforts are considered, and two major subsystems are described. The first subsystem is a seafloor excavator which can shape the ocean floor, prepare trenches and drill shallow foundation holes. To avoid the problems of man in undersea environment, this equipment will be unmanned, and remotely controlled by computer and/or numerical techniques. The primary work function will be similar to a conventional milling machine, with similar ability to bore shallow holes. The second subsystem is for penetration of ocean bottom rock with large holes, sealing off the cavity with a prepared steel structure, dewatering, and lateral tunneling at one-atmosphere pressure. Initial penetration will be by equipment similar to large mining or tunneling moles, recent technology in rock disintegration may allow use of a less massive machine with low thrust and torque.

R-726
Dynamic Response of an Isolated Floor Slab - Results of an Experimental Test in Event Dial Pack, May 1971, J. M. Ferritto, AD885576

A horizontal cylinder covered with an earth berm was subjected to pressure and drag forces in the 300-psi overpressure region from the detonation of the 500-ton high-explosive shot of Event Dial Pack. Information on the response of an isolated floor slab placed on a soil fill inside the concrete cylinder was obtained. Data from 17 channels of instrumentation, composed of a pressure cell, velocity gages, and accelerometers, were recorded. The 3:1 slope of the berm and the depth of cover did not appear to provide a fully buried condition. The isolated floor slab significantly reduced the transmitted motions, and sufficient data were obtained to compute the shock isolation requirements for equipment to be stored in the shelter.

R-726S
Supplement to R-726.

R-727
Transportable Breakwaters - A Survey of Concepts, May 1971, D. B. Jones, AD887841L

Published and unpublished reports dealing with transportable (also referred to as "portable" and "mobile") breakwaters were reviewed to collect performance data for a

wide variety of configurations. Data on 106 concepts were assembled into an outline classification of transportable breakwaters on the basis of structural form. The various configurations are shown in sketches, and their performance data are summarized. This state-of-the-art survey establishes a data base to aid in assessing the feasibility of developing an effective, mobile system for use in areas fully exposed to ocean waves.

R-728
Static and Dynamic Tests of Model Pressurized Underground Fuel Storage Containers, May 1971, W. E. Gates, S. K. Takahashi, AD726160

Static and dynamic tests were performed on four model steel tanks in an experimental program designed to provide data on the behavior of buried fuel storage containers under high overpressures associated with nuclear air blast. The model tanks were fabricated from 24-gage T-304 stainless steel sheets. Each model consisted of two 12-in.-long cylindrical sections with 12-in.-diameter hemispherical end caps. The models were partially filled with silicone fluid, used to simulate the effects of liquid fuel. Internal pressures of 100 psi were applied to the tanks prior to external test loading. This pretensioned the tank shell to resist the compressive effects of external loading. External static pressures up to 500 psi and dynamic pressures up to 250 psi were developed in the 4-ft-diameter, small-blast-load generator at the Waterways Experiment Station, where the test was conducted. As a result of the test program it was found that internal pressurization significantly improved the blast-resistance properties of buried steel tanks. The tests provided data which were used to establish design criteria for the prototype structures. Data from the experiment were also compared with analytical results calculated by finite element computer code to verify the analytical model and computational techniques. The experimental data compared favorably with the analytical results.

R-729
Technical Evaluation of Diver-Held Power Tools, Jun 1971, S. A. Black, F. B. Barrett, AD726161

Pneumatic and hydraulic hand-held power tools were evaluated by divers performing realistic underwater tasks. These tasks included drilling steel and aluminum, nut running and tightening, grinding metal, and chain sawing wood. An on-the-site observer monitored diver performance time for each task. Diver skill in effective tool utilization is very important in working underwater. At test depths to 60 ft, hydraulic tools were very effective and practical, while pneumatic tools, although effective, required excessive maintenance. At greater depths, hydraulic tools retain their effectiveness, but pneumatic tools lose effectiveness because of the compressibility of gas. Hydraulic tools generally supply more energy per unit of tool weight than do pneumatic tools. Thus, the diver can perform work more rapidly using hydraulic tools.

R-730
Naval Seafloor Soil Sampling and In-Place Test Equipment, a Performance Evaluation, Jun 1971, K. R. Demars, R. J. Taylor, AD726699

NCEL has developed a stationary piston soil sampler and vane shear and cone penetrometer apparatus capable of performing to a depth of 10 ft in the seafloor. Both devices are subsystems of DOTIPOS (Deep Ocean Test-In-Place and Observation System). This equipment is used primarily as a research tool to determine the in-situ strength characteristics of seafloor sediments. The information obtained with DOTIPOS improves the Navy's seafloor foundation engineering capability. The results of tests at four seafloor sites to a water depth of 5,600 ft, and the evaluation of the two subsystems are presented.

The piston soil sampler and the vane shear and cone penetrometer apparatus have operated satisfactorily to a water depth of 5,600 ft. The relationships between in-situ vane shear and cone penetrometer test results from this equipment fall within the range of previous theoretical and experimental results. Laboratory and in-situ vane shear results are in reasonable agreement. The cone penetrometer is a more economical survey tool than the vane shear, but additional work is needed to further define the implications of the test results.

R-731
Seafloor Foundations - Analysis of Case Histories, Jun 1971, D. G. Anderson, H. G. Herrmann, AD728014

The characteristics, basic foundation design parameters, and foundation performance of a number of seafloor installations are summarized. These installations include offshore towers, habitats, acoustic arrays, and numerous other objects located in water depths from 20 to 12,000 ft. A number of case histories are analyzed. Some findings indicate behavioral problems not normally considered during foundation design. Several unique foundation configurations are documented which have been devised and utilized by a few to overcome the conditions imposed by the unique seafloor environment. Results of this study reveal that a number of foundation failures and near failures have occurred. Of the approximately 400 installations studied, 4% had experienced performance problems and an additional 3% had experienced failure. The causes, or probable causes, of several failures are examined. The value of foundation performance monitoring, both to the operation of an installation and to the field of seafloor foundation design, and the value and need for continued cooperation in the sharing of such information and experience are discussed.

R-731S
Supplement to - Seafloor Foundations - Analysis of Case Histories, Jan 1973, D. A. Raecke, AD757711

Twenty-six seafloor foundation case histories are summarized in a continuing effort by NCEL to collect and evaluate foundation design information. Analysis of such histories for both successful and unsuccessful installations is of significant value in developing design guidelines for future seafloor structures. The installations analyzed included offshore towers, habitats, acoustic arrays, and numerous other submerged structures. The case histories have two distinctive features - 23 of the 26 installations utilized surface-bearing spread footing or mat foundations, and most installations applied only light-to-moderate foundation bearing pressures. Because of the low bearing pressures, few major foundation problems were reported.

R-732
Analysis of Preventive Maintenance Policies for Navy Transportation Equipment, Jun 1971, A. Jokubaitis, AD727582

Four equipment maintenance policies are compared in terms of total operating cost, reliability, and operational readiness of vehicles and related transportation equipment. The four policies compared are

1. Scheduled preventive maintenance service
2. Limited preventive maintenance service
3. Breakdown maintenance service
4. Manufacturer-prescribed preventive maintenance

A digital computer program was used to expedite the analysis and provide cost and performance data. For the 12 vehicle classes analyzed to determine effectiveness of the four maintenance policies, the results indicate the manufacturer-prescribed preventive maintenance policy was the most cost-effective approach.

Changing from the scheduled preventive maintenance policy now used to the manufacturers' prescribed preventive maintenance on the 50,820 vehicles currently in use by the Navy (in categories 91 through 96) would result in a cost savings of $5.9 million/yr.

R-733
Single-Line, Heat-Traced Piping System for Polar Regions, Jun 1971, C. R. Hoffman, AD886566

Single-line piping systems for the distribution of freezable liquids, such as water and sewage, were investigated for Navy polar application. The investigation, which included the testing of three preassembled pipe systems, shows that a commercially available system consisting of preassembled, insulated, jacketed X-50 piping freeze-protected with electro-wrap heat-tracing tape is well suited for Navy polar application. An X-50 piping system containing one to three pipes appears to be more cost effective than an equivalent multiline utilidor piping system, but esthetics or other special considerations may favor a utilidor system of four to six pipes. Proposed outline specifications delineating material options are presented to facilitate procurement of this cold-weather piping system. Also, performance information is provided on the full-scale, single-line, liquid distributing systems at Point Barrow, Alaska, and McMurdo Station, Antarctica.

R-734
Above-Ground Utilidor Piping Systems for Cold-Weather Regions, Jun 1971, C. R. Hoffman, AD728013

Utilidors, which contain multiple pipe systems for the distribution of freezable liquids, were investigated by NCEL. These systems require one of the pipes to carry either hot water or steam which can be used as the heating source for the utilidor. A state-of-the-art survey was made to ascertain design requirements for the utilidor. Sufficient information was obtained to permit detailed designing for specific locations. Assembly and low temperature tests were performed and data were acquired on a 32-ft-long test section. A thermal performance analysis and a computer program are presented for designing a utilidor for a specific location. It is concluded that a single-line, preassembled, insulated, electrically heat-traced piping system appears to be most cost effective for one to six distribution lines. However, the advantage is so slight for four- to six-line systems that the availability of an inexpensive source of heat (heated liquid or steam) or an intangible consideration, such as esthetics, may warrant the use of an utilidor system for a specific Naval facility.

R-735
Influence of Stiff Equatorial Rings on Concrete Spherical Hulls Subjected to Hydrostatic Loading, Aug 1971, L. F. Kahn, J. D. Stachiw, AD731352

Thirteen hollow concrete spheres of 16-in. OD x 14-in. ID and one sphere of 66-in. OD x 57.75-in. ID were assembled from hemispheres fastened together with equatorial joint rings of different stiffness. The joint rings were made from polycarbonate plastic, glass reinforced plastic laminate, aluminum, titanium, low carbon steel, and alloy steel. After instrumentation with electrical resistance strain gages, the spheres were tested to destruction under external hydrostatic loading. Equatorial joints that are either considerably stiffer or more compliant than concrete lower the short-term implosion pressure of the concrete spheres by as much as 27%. The glass reinforced plastic joint ring did not significantly reduce the implosion pressure. It is recommended that equatorial joint rings be designed to have a stiffness approximately equal to that of the concrete shell and be made of glass reinforced plastic. If stiffer joint rings are used, the operational pressure should be 30% lower than that of a sphere without a mechanical lock joint mechanism.

R-736
Design Procedures for Shelter Entrance Structures to Resist Blast Overpressure and Radiation Effects, Sep 1971, J. M. Ferritto, AD732359

This report presents engineering methods to design hardened entrance structures of nuclear warfare shelters to resist the effects of both blast overpressure and radiation. The design overpressure level can be determined from probability data, and the entrance can be sized to accommodate the required traffic flow. Methods are presented to calculate the reflected pressure on the entrance door for various entrance configurations. Using this information, procedures are given to design the door structurally to resist the applied loads. Radiation attenuation methods are presented to evaluate the requirement for additional shielding. Various materials are considered to provide more effective economical shields. Summaries of door tests performed in the operation plumbbob test series are given.

R-737
Cost-Optimization Study of Shelter Entrance Structures to Resist Blast Overpressure and Radiation Effects, Sep 1971, J. M. Ferritto, AD732360

The blast door is an important part of the nuclear blast resistant shelter. If the blast door fails, the protection afforded by the shelter can be drastically reduced. The blast door must be a movable element requiring a support system with a cost very sensitive to the weight and dimensions of the door. A computer program has been developed and is available to study 96 door-entrance combinations for various door sizes and radiation-overpressure levels. The relative costs of various doors, entrances, and door-entrance combinations have been evaluated to obtain the most cost-effective combinations. Steel tension membrane doors and reinforced concrete slab doors are the most economical. Aerodynamic triangular obstructions placed in front of a door, sloped doors, and unprotected doors are the most cost-effective. Entrance tunnels are not as cost-effective, because reduction in shielding costs is less than the added cost of the tunnel. Various trade-off conditions exist at specific overpressure-radiation levels at which lightweight doors with supplemental shielding may be substituted for heavy doors, or entrance tunnels may be substituted for massive concrete shielding required by unprotected lightweight doors.

R-738
Investigation of Empty Wooden Ammunition Boxes for Protective Construction, Oct 1971, J. M. Ferritto, AD732361

Empty ammunition boxes can serve as elements for construction of beams and bunkers to protect troops in the field. Various beam load tests have shown that it is possible to construct beams capable of safely carrying 2 ft of soil. Two specific designs are presented for beams which can span 7 and 10 ft carrying 2 ft of soil with a safety factor of 2. The problem of wood deterioration and loss of beam strength has been investigated and found not to be very significant. Beams placed side by side can serve as foxhole covers. Soil stability data are presented to determine minimum bearing areas required. Bunker construction plans have been developed and evaluated. Tests show the bunkers can be fabricated and will safely support the overhead load produced by 2 ft of soil protection. Blast and fragmentation tests indicate that the amount of protection given by a bunker is adequate against a 155-mm artillery round.

R-739
Use of an Aerodynamic Obstruction to Shield a Blast Door - Results of an Experimental Model Test, Oct 1971, J. M. Ferritto, AD732362

Triangular prismatic aerodynamic obstructions can be used to shield a blast door. The objectives of the project were to evaluate the protection afforded by an obstruction and to determine the relative width of obstruction required to protect a given width of entrance. A study was performed from which similitude relationships were developed. A series of tests was conducted in which a protected and an unprotected model structure were subjected to blast waves from explosive charges. A 45-deg triangular prismatic obstruction was used to shield the protected structure. Fifteen variations of width and position of obstruction were evaluated. Results show that at the 100-psi overpressure level an obstruction 1 door-height and 2 door-widths wide placed from 1 to 2 door-heights away from a structure can reduce the peak reflected pressure by 50%.

R-740
Influence of End-Closure Stiffness on Behavior of Concrete Cylindrical Hulls Subjected to Hydrostatic Loading, Oct 1971, L. F. Kahn, AD732363

Twelve model concrete cylindrical hulls were subjected to hydrostatic loading to determine the influence of end-closure stiffness on implosion pressure and strain behavior of the cylinders. Results showed that variation of end-closure stiffness did not reduce the implosion pressure below that of a cylinder with a free end condition or below the implosion pressure predicted by elastic thick-wall theory. To vary the closure stiffness, concrete hemisphere and steel plate end closures were used to simulate free, pinned, beveled, and fixed end conditions. Strain variations along the length of the cylinders indicated that the influence of the closure was limited to a distance of one diameter from the closure. Recommendations are presented to aid in the design of concrete cylindrical hulls.

R-741
Silo Configuration Evaluation Test (U), Oct 1971, R. J. Odello, C. R. Smith, Confidential

R-742
Nuclear Metering of Soil Density and Moisture Content at Depth, Oct 1971, D. G. True, AD735448

A study was conducted of the potential applicability of nuclear measuring techniques for determining soil density and moisture content at depth, and changes in these properties, for Navy civil engineering purposes. Measurements were obtained under two different types of engineering requirement to assess measurement capabilities, (1) in base material and subgrade soil beneath the pavements at five airfields, to detect long-term variations, (2) in hydraulically placed foundation soils at two construction sites, both before and after densification of the soil was attempted by driving compaction piles, to detect changes due to the densification effort. The data were analyzed and statistical procedures were developed to determine the magnitudes of measurement error. Measurement errors were relatively low compared with the measured temporal variations in the soil properties at the soil densification sites, but were so large as to obscure a large portion of the low-level, long-term changes occurring in the pavement subgrades. Based upon these analyses of error, it was concluded that nuclear depth probe systems can be used to detect variations of interest in soil density and moisture content at depth in situations involving marked changes in soil properties, such as the reported soil densification effort, and that they also can be effective in situations involving relatively small variations in soil properties, such as the long-term monitoring of the properties of a pavement subgrade, provided the sought magnitudes of variation exceed measurement error ranges.

R-743
Stress Analysis of Multicomponent Structures, Oct 1971, S. B. Nosseir, S. K. Takahashi, J. E. Crawford, AD733659

The finite element method was utilized to simulate the response of multicomponent structures exhibiting slippage and/or separation at boundaries of contact between components. At mutual boundaries, contact was assumed to be established only for pairs of nodal points or, in general, for sets of nodal points. The condition that slippage or separation occurs at such nodal-point sets when the shear or the tension resistance is exceeded provided the force constraints. Kinematical constraints associated with these force constraints were introduced in the form of binary relations between displacements of nodal-point sets. With the use of the method of Lagrangian multipliers, the total potential energy expression was modified to account for the kinematical constraints. This called for a modification of the augmented matrix of the multicomponent structure. Subroutines necessary to carry out this modification were introduced into an axisymmetric/plane stress program developed by E. L. Wilson of the University of California, Berkeley. The introduction of the capability of slippage and/or separation at boundaries of contact implies the dependency of the length of contact on the external forces. For this reason the solution was obtained by successive trials. To examine the credibility of the finite element solutions, photoelastic experiments were performed on two-dimensional models of a hatch cover and an airfield-pavement joint. The agreement between the photoelastic and the finite element results justifies the use of the computer model to simulate the response of multicomponent structures exhibiting slippage and/or separation between various components.

R-744
Environmental Factors Affecting the Emplacement of Seafloor Installations, Oct 1971, K. R. Demars, D. G. Anderson, AD732364

The purpose of this study was to evaluate potential environmental problems at a seafloor site. The specific environmental problems of concern are--

Earthquake occurrence and effects
Slope stability
Turbidity currents
Sediment scour and deposition
Seafloor vehicle trafficability

Pertinent information on each problem area is presented including an evaluation of the magnitude, probability of occurrence, and effects on seafloor installations. General information is also presented on the seafloor environment including the geomorphology, bottom currents, and sediments. Guidelines are recommended for evaluating each problem area. Some specific recommendations are to avoid construction sites (1) close to an active fault or on an unstable slope if earthquakes registering 6.0 on the Richter scale have been recorded within 100 miles, (2) on slopes greater than 10 degrees, and preferably on slopes greater than 5 degrees - to minimize creep movement and earthquake-induced failures, and (3) where there is more than a low probability of occurrence of turbidity currents large enough to damage a structure during its useful life. Another factor is that structures near sediment sources may be subject to long-term burial and to local scour effects if current velocities exceed 20 cm/sec. The track and the wheel appear to be the most promising running gear for seafloor vehicles.

R-745
Development of High-Capacity Blast Valve for Hardened Naval Shore Facilities, Oct 1971, D. E. Williams, D. N. Pal, AD890543L

The function of a blast closure valve is to protect both the occupants and contents of a hardened structure from air blast waves which propagate through ventilating ducts after a nuclear event. NCEL has developed and tested a

series of experimental blast valves which will afford protection from 100-psi reflected overpressure. The valves vary in capacity from 700 to 10,000 cfm, with 1.0 in. of water-flow resistance. Although the configuration of the larger valves differs from that of their predecessors, the original concept remains essentially unchanged. The valves are amenable to a variety of configurations and can be used with or without a delay duct, depending on the fragility level of the equipment to be protected. Shock tube tests and field tests have determined that performance of the high-capacity valve is insensitive to ground shock at 100-psi overpressure. The valve is relatively inexpensive and provides better performance (that is, more rapid closure times) than any known blast valve of this capacity.

R-746
Ice Construction - Bottom Freezing Techniques for Constructing Shore and Near-Shore Ice Structures, Oct 1971, T. L. Culbertson, AD889704L

New methods and equipment for thickening and strengthening natural sea ice are needed to advance polar operational capabilities. Of the basic categories of techniques for inducing ice growth (ice injection, cold fluid injection, and recirculating fluid), one recirculation technique--the convection cell--was found to best fulfill the requirements for polar applications. Other techniques imposed greater work or energy requirements. Two basic convection cell systems were laboratory tested, liquid convection and liquid-vapor phase convection. At a -30F air temperature, the Balch liquid convection cell produced 7.75 in. of ice in 90 hr while the long liquid-vapor phase cell produced only 2 in. during the same time period. Because the liquid convection cell was found to be more effective at the mean polar air test temperatures than the two-phase cell, it was selected for field testing at Point Barrow, Alaska. The initial field tests at Point Barrow during the spring of 1969 demonstrated the excellent potential of the balch-type liquid convection cell for thickening, stabilizing, and anchoring near-shore ice structures. Cells suspended in seawater produced ice along the entire submerged length. The production rate was dependent on the seawater temperature, the prevailing air temperature, and the thickness of the ice mass around the cell. In FY70 convection cells were used to form two grounded ice structures offshore at Point Barrow to permit study of their long-term stability. Laboratory research to improve cell performance and field application has resulted in the development of two new liquid convection cells. A simplified vertical convection cell and a horizontal convection cell. For maximum ice growth it was found that cells should be as large as can be conveniently handled and should be painted white to reflect solar heat. For easier field application, premixed 60% ethylene glycol solutions should be used since they are readily available in polar regions. Further tests are recommended for the horizontal cell to determine its operational characteristics.

R-747
Windows for External or Internal Hydrostatic Pressure Vessels - Part VI, Nov 1971, J. D. Stachiw, K. O. Gray, AD736594

Conical acrylic windows with five included angles (α) from 30 to 150 deg and thickness-to-minor-diameter (T/D) ratios from 0.375 to 1.00 have been subjected to 5,000 psi of sustained hydrostatic loading for up to 1,000 hr in the temperature range from 65F to 75F while the axial displacement of the windows through the flange has been monitored. The magnitude of axial displacement was found to be a function of α, T/D ratio, temperature, and duration of loading. Only windows with T/D ratios $\geq$ 1.000, 0.625, 0.500, 0.500 and 0.500 for 30-, 60-, 90-, 120-, and 150-deg conical angles, respectively, were found to be free of cracks. Minimum axial displacements of the windows can be achieved only with T/D ratios of greater than 1.000, 1.000, 0.750, 0.750, and 0.625 for 30-, 60-, 90-, 120-, and 150-deg conical angles, respectively. The minimum axial displacements of D equal 1.000-in. windows with these T/D ratios and conical angles are 0.042, 0.023, 0.023, 0.019, and 0.019 in., respectively. It is recommended that only windows with T/D ratios $\geq$ 0.625 and $\alpha \geq$ 60 deg be used for sustained hydrostatic loading of 5,000 psi at temperatures less than or equal to 80F.

R-748
In-Service Performance of Six Barrier Systems on Marine Borer-Damaged Wood Piles, Oct 1971, T. Roe, AD891471L

This investigation was conducted to determine suitable materials and methods for the application of barrier systems to wood piles, which are being attacked by marine borers, to stop that attack and to prevent further attack. Five different systems were installed and evaluated on bearing piles, and one system was installed and evaluated on fender piles on the target repair facility pier, San Diego. Based on the results of this evaluation, flexible polyvinyl chloride (PVC) or cupro-nickel barrier systems are recommended for use on bearing piles with more than 5% and up to 15% of their cross-sectional area destroyed, mesh-reinforced concrete jackets are recommended where more than > 15% and < 50% has been destroyed. A properly designed metal shoe should be applied to all fender piles and a flexible PVC barrier plus a metal shoe to those with 5 to 15% attack.

R-749
NEMO, a New Concept in Submersibles, Nov 1971, P. K. Rockwell, R. E. Elliott, M. R. Snoey, AD735103

Experimental and analytical studies, conducted to evaluate continental shelf depth performance of a spherical acrylic plastic hull, have led to the design and construction of NEMO (Naval Experimental Manned Observatory). NEMO consists of an acrylic plastic pressure hull with a 61-in. ID and a 66-in. OD, plus life support and operational subsystems. The life support system, which consists of an oxygen supply, CO_2 scrubber, closed-circuit emergency rebreathers, and atmosphere monitoring equipment, provides 8 hr of life support, plus an additional 24 hr emergency backup for two men. Operational subsystems include a main lead acid battery power supply (126 VDC and 24 VDC), electrical distribution and control circuitry, a hydraulic system to operate a self-contained winch/anchor system, and two side-mounted thrusters for rotation and short horizontal excursions. An air ballast system is included for controlling buoyancy. NEMO is certified by the Navy for operation at depths to 600 ft.

R-750
Urethane Foams for Navy Pontoon Structures, Nov 1971, R. W. Drisko, AD736596

The application, advantages, and limitations of foamed-in-place urethane materials for Navy field activities are described. Brief descriptions of the chemical and physical changes that occur during foaming, properties of rigid foams, and different methods of foaming are also presented. Results of limited laboratory testing indicate that urethane foams can be prepared successfully by field activities with little or no previous experience with them if care is taken to (1) thoroughly mix the components, (2) obtain proper ratio of components, (3) avoid contamination of the mixture and forms, especially with water, and (4) avoid excessive heat in large pours. Such foams can be and have been inserted in Navy pontoons and other floating structures.

R-751
Movement of IRW House Module, Nov 1971, W. A. Keenan, AD892646

In March 1971 IRW Corporation trucked a house module 7.1 miles over paved highways to an erection site in Redondo Beach, Calif. In cooperation with HUD, NCEL observed transportation of the module, bump course tests, and placement of the module on its foundation. The house module is 32 ft long, 21 ft wide and weighs 21,000 lb. Transportation did no damage to the house module. Bump course tests produced accelerations of 2g at truck speeds of 5 mph. Lowering the module onto its foundation produced three hairline cracks in interior partitions but no damage to the exterior shell. It is recommended that a standard bump course test be specified for HUD contractors who plan to transport modules to erection sites.

R-752
Deep Ocean Test-in-Place and Observation System (DOTIPOS) for Naval Seafloor Construction Support, Dec 1971, J. R. Padilla, AD736597

The deep ocean test-in-place and observation system (DOTIPOS), is a pyramid-shaped aluminum platform for deploying systems on the ocean floor, data collection, and in-situ testing. It weighs 6,200 lb in air, 2,000 lb in the water and is supported by three square pads. Bolted construction permits disassembly for shipping, the longest section being 15 ft 4 in. long. Permanent equipment mounted on the platform includes a pressure-equalized, steel-cased, 20 kVA transformer (2400/115 VAC, single-phase, 60 Hz). A 24-in OD aluminum sphere houses the control and data electronics. Stainless steel camera housings have acrylic windows in one end and a 250-W mercury vapor light attached to the sides. The TV camera is mounted on a shock absorbing mount, it has 650-line resolution and a 0-8 MHz bandwith. The film camera is 16-mm motorized with a 3 or 6 frames/sec intervalometer. A 12-kHz long-life pinger and special attachment points make up the emergency recovery system. The telemetry system uses pulse position modulation and has a 40-channel down and 21-channel up capacity. A special dieselhydraulic winch with a stowage unit weighing 19,500 lb with the cable, an 8,600-lb, 245-hp diesel, and an 11,500-lb traction unit are required. The brake capacity of the winch is 25,000 lb. The DOTIPOS, tested in 50, 75, 100, 600, 1,200 and 5,600 ft of water, has been deployed from an ARS, LST, and NCEL's pontoon barge.

R-753
Polymer-Impregnated Concrete Spherical Hulls Under Hydrostatic Loading, Dec 1971, H. H. Haynes, N. D. Albertsen, AD736598

Eight spherical models with outside diameters of 16 in. and wall thicknesses of 1 or 2 in. were fabricated of polymer-impregnated concrete (PIC) having a uniaxial compressive strength of 21,000 psi. The spherical specimens were tested under hydrostatic loading conditions of short-term, long-term, and cyclic pressure. The test results show that the PIC spheres respond to hydrostatic loading with linearly elastic behavior and that the implosion pressures are greater by approximately 50% than those for similar regular-concrete spheres. Under short-term loading the specimens having a wall-thickness-to-outside-diameter ratio of 0.063 and 0.125 (1- or 2-in. walls to 16-in. OD) implode at average hydrostatic pressures of 4,810 and 8,475 psi, respectively. Classical elastic theory predicts the strain behavior and implosion pressures of the PIC sphere within engineering accuracy.

R-754
Thawing of Permafrost at Barrow, Alaska - A Method for Stabilizing Floor Foundations, Jan 1972, R. A. Paige, J. A. O'Brien, AD735867

NCEL conducted experiments using steam and cold water as the heat transfer media to determine the best method for thawing the permafrost under a Navy hangar at Barrow, Alaska. Permafrost can be efficiently thawed using either steam or cold water. Steam thawing is generally faster, but more equipment is required and fuel is an important cost factor. Cold-water thawing gives higher efficiency per heat unit and better control of the temperature beyond the thawed zone. The two methods may be economically competitive because the costs for equipment and fuel for steam thawing are partially offset by the large quantities of water and the additional time required for cold-water thawing. Procedures and equipment are suggested for employing either method to thaw the permafrost beneath the floor of the hangar at Barrow. Soil data and information relevant to the thermal behavior of permafrost are also presented.

R-755
Unaided Breakout of Partially Embedded Objects From Cohesive Seafloor Soils, Feb 1972, H. J. Lee, AD740751

NCEL has conducted field and laboratory tests to investigate the effort required to remove partially embedded objects from cohesive seafloor soils. This work is intended to aid in proper selection of elements for Navy salvage and rescue operations. This report presents the results of the tests and an analysis of the results. Procedures are given for use by field engineers in predicting forces required to remove objects immediately and in estimating times required when lesser forces are applied. The accuracy of the force prediction procedure is about ± 50%, the accuracy of the time prediction procedure is about ± 100%. These accuracies are comparable to those usually attainable with other time-dependent soil mechanics problems and should be acceptable for typical object retrieval operations.

R-756
Probabilistic Model for Material Strength Variation and Size Effect, Feb 1972, S. Nosseir, M. Shinozuka, AD740752

The spatial strength variation of structural materials is treated as a random process, and a new interpretation for size effect is proposed. This interpretation includes the classical one as a special case. The procedure for constructing a probabilistic model for concrete is outlined, and the compatibility of this procedure with that of the finite element method is indicated. The incorporation of the probabilistic model into the finite element analysis provides a powerful tool for refined structural failure analysis. A numerical example is given dealing with the simulation of failure of concrete specimens. This example emphasizes the advantages of the proposed approach for predicting the effect of size on strength in a manner that is consistent with laboratory observations.

R-757
Evaluation of Pile Preservatives at Coco Solo and Pearl Harbor, Feb 1972, H. Hochman, AD740753

The final evaluation of a wood preservative system is to observe its behavior in wood piling that is exposed in seawater representing a severe borer hazard. This report describes the manufacture and exposure of two groups of experimentally treated piles. One group, treated by the cooperative piling committee, is being exposed at Coco Solo, Canal Zone, and Pearl Harbor, Hawaii. The second group, treated at NCEL or under its direction, is being exposed in Pearl Harbor, Hawaii. After 5 to 8 yr of exposure, one preliminary finding is that dual-treated piles are more borer-resistant than creosote or creosote-coal tar treated piles.

R-758
Evaluation of a Three-Dimensional Stress Cell for Granular Soils, Feb 1972, T. K. Lew, AD739329

This study presents the results of tests of rigid, solid, spherical, three-dimensional stress cells for measuring the complete state of stress at a point in a soil field under static or dynamic loading. In addition, a theory is presented for defining the behavior of a spherical stress cell embedded in nonlinear materials. The test results indicate that the stress cells are excellent for making static measurements in sand but that their adequacy for dynamic measurements requires further evaluation.

R-759
Self-Contained Sanitation Systems for 2- to 15-Man Polar Facilities, Mar 1972, B. W. Valentine, AD893724L

Commercially available self-contained sanitation systems are compared with the NCEL mechanical-flush chemical toilet for use at Navy camps in polar regions. The basic process alternatives compared with the NCEL unit in a cost-effectiveness analysis are conventional chemical toilets, recirculating chemical toilets, incinerating toilets, and minimum-water flush toilets. Utilizing a decision-weighing model based on pairwise comparisons, a minimum-water flush toilet, model 600 manufactured by Thetford Engineering Corp., Anaheim, Calif., was found to be the most cost-effective system suitable for use at 2- to 15-man polar pioneer camps.

R-760
Cathodic Protection Kit for Fleet Moorings, Mar 1972, R. W. Drisko, AD893722L

A kit was developed to reduce corrosion-related maintenance costs by cathodically protecting fleet moorings. Maintenance costs for fleet moorings in the Naval shore establishment might be reduced by $360,000 annually if the moorings were cathodically protected by this system. The kit consists of special-D zinc anodes, wire rope, and special fittings. It can be used either to install a cathodic protection system in a fleet mooring in situ or to replace consumed link-anodes in situ. A guide is included for use of this kit by field activities.

F-761
Selection of Practical Seafloor Foundation Systems, Mar 1972, M. G. Herrmann, D. A. Raecke, N. D. Albertsen, AD740755

This report presents a systematic analysis of foundation systems for seafloor installations. Current and foreseeable Navy needs for seafloor installations are summarized, and the foundation requirements for such installations are defined in terms of four foundation requirement parameters. These four, and their respective ranges of possible values are (1) reliability from 0.9 to 0.999, (2) maximum allowable tilting of the structure, from 1 to 20 deg, (3) vertical static load capacity of from < 4,000 to > 40,000 lb, and (4) mean lateral dimensions from < 12 to > 40 ft. Environmental conditions and technological capabilities, major influences in the process of selecting a foundation system, are defined in terms of design constraints. These include seafloor type, which ranges from weak and compressible cohesive soil to sound rock, maximum topographic slope, which ranges from less than 1 to 20 deg, and required emplacement capability, which can range from simply setting a single module on the seafloor to in-situ assembly or fabrication of a multimodule installation. The analysis can be used to select an appropriate foundation configuration for a specific situation where the foundation requirement parameters and the design constraints are known. In this report it is used in the selection and description of 11 foundation configurations which can meet all foreseeable near-term Navy requirements. Several of these 11 require further research or development before they can be considered operational.

R-762
Construction Assistance Vehicle (CAV) - The Design, Fabrication, and Technical Evaluation of an Experimental Underwater Vehicle, Mar 1972, S. A. Black, R. E. Elliott, AD740756

An experimental diver-operated construction assistance vehicle (CAV) was designed, fabricated, and evaluated in order to determine the feasibility of and general specifications for a prototype diver work vehicle. The CAV, fabricated from off-the-shelf components, is capable of carrying 1,300 lb of wet weight cargo between the surface and the ocean bottom work site. The craft's pneumatic and hydraulic power is available to operate handheld power tools. Over 100 test dives were conducted in the ocean, with the craft being operated to a maximum depth of 110 ft. Operational testing proved the CAV to be a safe and effective means for delivering cargo and for powering diver tools. Also, when the CAV was compared to other vehicles, it was determined that the CAV is the only system that provides the working diver with total ocean bottom support. The necessary refinements are delineated and general specifications for a prototype vehicle are presented.

R-763
Layered Pavement Systems - Part I. Layered System Design Part II. Fatigue of Plain Concrete, Apr 1972, J. R. Forrest, M. G. Katona, D. F. Griffin, AD742317

Part I describes a recent NCEL study of airfield pavement overlay design that indicates that elastic layered analysis may be a better design approach than any other currently available technique. A finite element theory of analysis has been developed that considers horizontal sliding between layers, and the superimposed load effects of multiple-wheel landing gear. This theory also provides for automatic finite element mesh generation, and automatic plotting of stress, strain, and displacement output data. Fullest exploitation of improved overlay design procedures requires rather precise knowledge of material properties. For rigid overlays, knowledge about fatigue properties of plain portland cement concrete slabs is needed to permit formalization of a design procedure. Part II presents a review of the literature about fatigue of plain concrete. It reveals information about beam and cylinder testing but discloses no conclusive experimental work on the fatigue behavior of uniformly supported pavement slabs. Fatigue behavior estimates based upon beam and cylinder tests would necessarily have to be conservative and therefore self-defeating insofar as achieving economy of design by adoption of minimum feasible thickness of pavement slab overlays.

R-764
Dynamic Response of a Cylinder Buried in an Earth Berm - Results of a Finite Element Analysis, Apr 1972, J. M. Ferritto, AD742338

A cylinder buried in an earth berm and subjected to a blast loading has been analyzed by use of a nonlinear, large-deformation, finite element computer program. The results of the analysis have been compared with experimental data. The orientation of loading, mode of failure, and crack propagation indicated by the analysis agree with experimental observations. The finite element technique and the assumptions made in the solution are discussed as they relate to the problem. A mesh parameter study was performed to optimize mesh size and time increment without degradation of the results. Ground motions were computed and compared with experimental data. Peak velocity data gave good agreement with experimental measurements, whereas peak accelerations gave fair agreement.

R-765
Surveillance and Automatically Controlled Systems for Cathodic Protection of Water Tank Interiors, Apr 1972, R. W. Drisko, AD742339

A surveillance system for monitoring tank-to-water potentials of cathodically protected steel water storage tanks was designed and tested. The system used permanently attached silver/silver chloride reference half-cells, which were joined by electrical wiring to a switch box at ground level. The potentials could be accurately read at the switch box on a portable meter. The system performed well during the 4-yr test period.

The surveillance system was later modified so that the existing anodes and reference half-cells could be used with an automatically controlled rectifier unit to form a completely automatically controlled cathodic protection system. This sytem maintained stable tank-to-water potentials for the 2-yr test period.

It is recommended that automatically controlled cathodic protection systems utilizing one reference half-cell should be installed in steel water storage tanks throughout the Naval shore establishment.

R-766
Field Identification of Weathered Paints, Apr 1972, H. P. Vind, R. W. Drisko, AD743870

A simple procedure and test kit have been developed for identifying the generic type and general composition of cured or weathered paint films. The procedure includes pyrolytic and burning tests, solubility tests, and tests for the detection of such elements as chlorine, nitrogen, lead, and mercury. All the tests can be performed with simple equipment by field personnel having little or no prior laboratory experience. The procedure and test kit were proven by successfully identifying 61 weathered paints that might be encountered at Naval shore activities.

R-767
Snowdrift Control Techniques and Procedures for Polar Facilities, Jun 1972, F. W. Brier, AD744237

Accumulation of windblown snow causes an assortment of problems at polar facilities. In addition to curtailing personnel and vehicular movement, snowdrift accumulation may damage structures and disrupt aircraft operations. In an effort to develop techniques and procedures for alleviating snowdrift accumulation, scale-model studies on building shapes, orientations, and groupings were conducted in wind ducts, and field studies were conducted on snow collection systems. The scale-model wind duct studies of a camp showed that snowdrift accumulation can be reduced by elevating the camp on a snow platform, orienting the buildings 45-deg to the snow-carrying wind, and placing the structures and utilities to permit easy snow removal. The field studies on snow collection systems on airfields showed 3- to 4-ft high windrows with a borrow pit on their leeward side are effective in controlling drift on skiways and runways when located on the upwind side of the surface to be protected.

R-768
Computer Model for Wave Propagation in Concrete, Jun 1972, M. Shinozuka, S. B. Nosseir, AD748580

The main objective of this study was to develop a computer model capable of predicting wave propagation through solids exhibiting random properties and to demonstrate the applicability of the model to structural members made of concrete. The model was developed, and a numerical example was prepared for a concrete control cylinder subjected to an impact load. The modulus of elasticity and the density of the concrete cylinder were assumed to be correlated homogeneous random functions of the axial coordinate. The randomness of the material properties was introduced as a multivariate stochastic process. Realizations were digitally generated for the properties of the concrete control cylinder. The solution for the displacement and stress response was obtained for each realization utilizing the finite element method. Sample statistics for quantities of interest were determined by means of a Monte Carlo simulation.

R-769
Emplacement of a Heavy Load Onto a Seafloor Foundation, Concept Development and Analysis, Jul 1972, J. V. Wilson, R. D. Mitchcock, J. R. Mittleman, AD746844

Emplacement of a heavy load by cable from the surface onto a seafloor foundation in the deep ocean to an accuracy of 1 ft may require a secondary positioning system to supplement the basic ships station-keeping. Four possible systems to effect this control are (1) thrusters mounted just above the load, (2) four-point moor with winches mounted above the load, (3) single-point moor with one winch, one thruster, and a rudder, and (4) haul-down system with load-mounted winch. Analysis of load/cable dynamics and operational considerations shows that for emplacement of heavy loads (20 to 100 tons), thrusters of 1,000 to 2,000 lb thrust would be needed, or submersible winches of 5,000-lb capability, or a haul-down of 10,000-lb capacity at a constant tension. These items are not presently available, but current technology indicates that their development would be more an extension of present equipment than a completely new concept. No system has a clear-cut superiority over the others in all cases. All the systems are sufficiently simple to be potentially reliable.

R-770
Prefabricated Panels for Rapid Fortification by Mobile Marine Forces, Jul 1972, C. E. Parker, AD903484L

The problem of high casualty losses during the early occupancy of a Marine combat defensive position has been studied. Many of these casualties are from fragment shrapnel before sandbag protection has been erected. To alleviate this, various shielding materials and systems were compared. A tentative reusable-design concept that could considerably reduce casualties and labor, but costs more in stateside prefabrication, is discussed. Field tests of the concept were performed. Speed of emplacement and, hence, extent of protection were considerably superior to sandbags.

R-771
Summary of Soil-Structure Interaction, Jul 1972, J. R. Allgood, AD748581

This report summarizes currently available knowledge of soil-structure interaction as it pertains to facilities that provide protection from nuclear weapon effects. The major subdivisions of the subject are discussed in sufficient detail to convey a general understanding of the subject and to provide key references.

The recommended design methodology is illustrated for the horizontally oriented buried cylinder. A parallel approach is suggested for buried structures of other configurations. It is suggested that analysis of resulting designs be accomplished by the finite element method. Illustrations of two-dimensional and three-dimensional solutions by this method are given.

Information on peripheral subjects, such as ground motions, stress wave fracturing, and system optimization, is included to the minimum extent necessary to convey an appreciation of the overall soil-structure interaction problem. Particular emphasis is given to methods for transferring load away from a buried structure to the soil, thereby, permitting economic design and a large increase in resistance.

The summary represents work performed under DNA (formerly DASA) sponsorship over the past 10 yr.

R-772
Flexural Strength of Ferro-Cement Panels, Aug 1972, J. E. Tancreto, M. M. Haynes, AD748582

Ferro-cement boats, barges, and buoys are designed and constructed using severely limited engineering data on the flexural behavior of the material. This report studies ferro-cement panels reinforced with plain steel woven wire mesh and subjected to flexural loads to determine the first cracking, visible cracking, and ultimate strength properties. The reinforcement variables were mesh size (which ranged from 2 x 2 to 14 x 14 wires/in.), wire diameter (which ranges from 0.011 to 0.041 in.), and percentage of steel (which ranged from 1% to 3% by area in the direction of principal stress). Control panels of unreinforced mortar and panels reinforced with chicken wire or steel rods were also tested. Flexural stresses at first cracking and visible cracking were found to increase with wire densities above 10 wires/in. sq. For 1% reinforcement, stresses at first cracking and visible cracking increased from an average of 950 psi to 1,640 psi for changes in wire density from 10 to 370 wires/in. sq, for 2% reinforcement, stresses at first cracking increased from an average of 1,130 psi to 1,920 psi and stresses at visible cracking from 1,130 psi to 3,780 psi for changes in wire density from 10 to 560 wires/in. sq. Ultimate strength was directly dependent on the load-carrying capability of the steel reinforcement. The best overall size of woven wire mesh reinforcement was judged to be 4 x 4 wires/in. of 0.025-in.-diam wire. Using this mesh size in quantities of 2% reinforcement by area, stresses at first cracking, visible cracking, and ultimate load were approximately twice those of a similarly reinforced panel using chicken wire.

R-773
Windows for External or Internal Hydrostatic Pressure Vessels - Part VII. Effect of Temperature and Flange Configurations on Critical Pressure of 90-deg Conical Acrylic Windows Under Short-Term Loading, Aug 1972, J. D. Stachiw, J. R. McKay, AD748583

Conical acrylic windows of 90-deg included angle and 0.083 to 0.775 thickness-to-minor-diameter (T/D) ratios have been tested to ultimate failure under short-term hydrostatic loading. The ambient temperature was varied from 32F to 90F and the relationship between minor window diameter (D) and minor window cavity diameter in the flange (DF) varied from 0.970 to 1.500. The test results show that the critical pressure of identical windows at 90F is approximately 10% to 20% less than at 70F, and at 32F it is approximately 15% to 25% more than at 70F. The increase in critical pressure of windows with identical T/D ratios due to changes in D/DF ratio is as large as 100% from the critical pressures associated with the standard D/DF = 1.00 ratio. As a rule, an increase in D/DF ratio raised the critical pressure of windows with T/D greater than 0.375 significantly, while for windows with T/D less than 0.375, it had no effect or very little. To improve the critical pressure of 90-deg conical acrylic windows, it is recommended that such windows be designed with a window/flange mismatch ratio of D/DF greater than 1.00, the exact magnitude depending on the windows T/D ratio, service, and design considerations.

R-774
Behavior of 66-in. Concrete Spheres Under Short- and Long-Term Hydrostatic Loading, Sep 1972, M. M. Haynes, L. F. Kahn, AD748584

Fourteen unreinforced concrete and mortar spheres, 66 in. OD and 4.125 in. wall thickness, were subjected to simulated deep-ocean loading conditions. The average short-term implosion pressure for wet-concrete spheres was 2,350 psi and for the dry-concrete spheres was 2,810 psi, the average uniaxial compressive strength of the concrete was, respectively, 7,810 psi and 9,190 psi. From control cylinders, it was found that the uniaxial compressive strength of wet concrete was 10% weaker than that of dry concrete. The ratio of implosion pressure to compressive strength, PIM/FC was nearly equal for the wet- and dry-concrete spheres at 0.301 and 0.306. The implosion pressures for the 66-in.-OD concrete spheres could be predicted conservatively from an empirical equation developed from 16-in.-OD mortar spheres. The equation was not valid for 66-in.-OD mortar spheres, which were found 30% weaker in implosion strength than the 66-in.-OD concrete spheres.

Under long-term loading, the concrete spheres failed by static fatigue where the relation between level of sustained pressure and time to implosion was similar to that known for concrete under uniaxial loading. Wet-concrete spheres under seawater pressure as high as 1,670 psi showed an average D'Arcy's permeability coefficient, KC, of 0.13 x 10-12 fps, this KC value was also similar to that known for concrete under freshwater pressure as high as 400 psi. Design guides were developed to predict the short- and long-term implosion pressures and permeability rates of concrete spheres.

TECHNICAL NOTES

N-001
Deterioration of Protective Coatings at the Ordnance Aerophysics Laboratory, Dec 1950, H. McKennis, D. S. Clemetson, ATI209441

The Ordnance Aerophysics Laboratory, located at Daingerfield (Lone Star), Tex., several years ago noted that the settling of iron-ore dust from a neighboring ore-reduction plant upon exterior and interior surfaces appeared to contribute to excessive maintenance costs and depredation of materials. Later, as the neighboring plant became inactive, apparent depredation continued. The cause of this condition was then attributed entirely to the sulfurous fume of a near-by coke and by-products plant which will presumably be continually active. The Daingerfield facilities present a situation in which noisome and injurious vapors from coke ovens probably cannot be eliminated. The many exterior metal surfaces of the Ordnance Aerophysics Laboratory have in the past been protected with oil-base paints. Indications are that the protective-coating life can be materially increased by employing the newer synthetic coatings and eliminating the use of oil-base paints. The material costs of the new types are greater, however, and labor costs and the nuisance of repainting will be determining factors in the selection of coatings. It is, therefore, recommended that test areas be covered by selected synthetics.

N-002
Exhaust Energy Recovery in Automotive Engines Using a Turboflector, Oct 1950, C. R. Freberg

There is considerable loss in energy through the exhaust of an engine. Normally this amounts to from 30 to 50% of the fuel energy. Many designs have been made to recover some of this energy. Aircraft have used jet stacks, jet augmenters, and turbines set up close to the valves to deliver output power or power for the accessories. Using these devices, up to 20 or 25% increased power can be obtained under some conditions. Altitude and speed have made these devices economical only with aircraft. BUDOCKS requested a study of exhaust pipe attachments under Project NY-512-023-4, Test of Vehicle Engine Exhaust Tail Pipe Attachment Turboflector, in an effort to determine the effect on automotive performance. This is a final report on this subject discussing the possibilities of recovering a portion of this wasted energy by changing the engine design and by attachments to the tail pipe.

N-003
Conversion of Inboard Pontoon Propulsion Unit to Diesel Power, Aug 1950, N. J. Sieland

In accordance with Project Directive NY 512-010-6, authorized 10 Jun 1949, a standard model 4C inboard pontoon propulsion unit was converted from gasoline to diesel power. Comparative operational tests indicated that the minor modifications required produced an acceptable unit superior in operation to the standard unit.

N-004
Evaluation of the Buffalo Turbine Sprayer-Duster for Use in Chemical Warfare Decontamination Operations, Nov 1950, R. H. Henley

As a part of a program to develop a combination sprayer-duster for use in chemical warfare decontamination operations, a sprayer-duster manufactured by the Buffalo Turbine Company was field tested under Project NY-310-002-1, assigned to the Laboratory by BUDOCKS. The suitability of the equipment for spraying and dusting DDT was to be determined before any modifications or changes were made to the unit for other tests. The unit was next to be tested to determine its efficiency as a sprayer for both wet and dry contaminating mixtures, then as a sprayer for camouflage paint. When all field tests had been completed, the unit was to be given a corrosion test, and a life test to determine its mechanical sufficiency and to establish a spare parts allowance. During all of the tests, observations were to be made on the practicability of the design of the equipment from the standpoint of fabrication, mechanical adequacy, and portability. Working drawings of any improvements recommended for a pilot model were to be prepared.

N-005
Mobile Radiological Field Laboratory, Jan 1951

A mobile radiological field laboratory received from the Chief, Signal Officer, Department of the Army has been given a preliminary evaluation. The unit was found to be adequate basically for its intended purpose, but the absence of spare parts and operating instructions make it unsatisfactory for use as it now stands. Radioactive calibration standards noted in the equipment list, but not included in the unit received, would also be required for operation in the field. Additional field sampling equipment, particularly for air samples, would be required to permit accomplishment of certain phases of the assigned mission. A number of other recommendations were made for less essential improvements to the unit.

N-006
Supplementary Data on Mark II Lightweight Prefabricated Portable Wanigan, Jan 1951, R. C. Towne, H. R. Harrison, AD42991

This Technical Note includes (1) supplementary data on the manner and method of sealing the panel joints in the Mark II, lightweight, prefabricated, portable wanigan, (2) additional information on movement between the panels when the wanigan is underway and (3) various methods of securing the wanigan to the carrier sled. The tests performed included determination of the compressive strength of the rubber-gasket joint sealer, measurement of tension in the wanigan tie-rods when under load, and rain tests to ascertain the extent of leakage with the transverse interpanel joint spacing compressed to the 1/4-in. clearance shown on BUDOCKS Drawing no. 468,608.

N-007
Performance Tests of an Aeroil Portable Snow Melter at Camp Hale, Colorado, Feb 1951, D. H. Bodtke, AD42992L

This interim Technical Note covers a series of performance tests made as part of a program to evaluate a modified Aeroil Flash Guard Heet Master asphalt-melting kettle as a portable device for producing potable water by melting snow. Tests to determine the effectiveness of the modified unit as a snow melter were conducted in Feb 1950, during the BUDOCKS cold-weather test program at Camp Hale, Colo. Upon return of the unit to the Laboratory at the end of the Camp Hale program, it was modified and shipped, on Barex-50, to the Arctic Test Station, Point Barrow, Alaska, for extensive testing under actual field conditions. This report covers a brief description of the unit as modified for the Camp Hale tests, details of the performance tests at Camp Hale, modifications resulting from those tests, and an outline of the proposed test plan at the Arctic Test Station during the 1950-51 winter season.

N-008
Development of a Transient Pressure Cell, Mar 1951, R. K. Steele, ATI209444, PB154634

In a number of structural and mechanical engineering problems, the measurement of rapidly changing pressures is required. To mention a few of the applications, a transient pressure cell is required to measure blast pressures on buildings, compression in engines, and surges in hydraulic systems. The cell, as designed, was developed to measure the braking pressure of the piston in a Syntron diesel pile hammer in support of Project NY-110-003-2, but can be adapted to other uses by merely redesigning the diaphragm of the cell for the working pressures expected.

N-009
Evaluation of Proposed Method for Measuring Entrained Air in Portland Cement Concrete, Apr 1952, P. N. Petersen, W. R. Lorman, AT1209445

Results of the investigation indicate that the values for percentage of entrained air obtained by the proposed method are unreliable and inaccurate. This is based on data obtained by using two of the three standard ASTM methods as a basis for comparison. It is recommended that the proposed method not be accepted by BUDOCKS as a standard or alternate for determining the amount of entrained air in concrete. Such data should be obtained only through the use of standard ASTM procedures.

N-010
Development and Operating Instructions for Pneumatic (Wood) Ice Auger, Dec 1950, R. C. Stewart

The wood ice auger is an air-powered auger, using a standard double helix for removal of chips, and a special cutter on the lead and auger bits. The auger is capable of drilling holes in ice to a depth of 20 ft.

N-011
Development and Operating Instructions for Manual (Wismer) Ice Auger, Jan 1951, R. C. Stewart

The Wismer ice auger is a hand-operated machine requiring, normally, two men for the most efficient operation. With the Kelly bar extension, it is capable of penetrating ice to a depth of 20 ft. A novel feature of the auger is an ice basket which receives ice chips from the helix and, when filled, may be pulled to the surface and emptied, thus eliminating the need for frequent retraction of the helix and Kelly bar. A step is provided for pressing the auger point down for greater penetrating speed. This step may be manipulated by one of the operators.

N-012
Operating Instructions for Pilot Model Pumping Units, Jan 1951, R. D. Kase, AT1209448, PB154635

The pumping units are Peerless Pump Company volute-type, single-stage, centrifugal pumps, mounted on a skid base with a Hercules model JX4D gasoline power unit. They are capable of furnishing 1,000 gal of water per minute at a total dynamic head of 115 ft. This rating is with a 15-ft suction lift. The pump is connected to the power unit through a disc-clutch, direct-drive power take-off. The power unit and pump are enclosed in sheet-metal compartments with access doors provided for operation and maintenance, and screw-type mounting bases for attachment of accessories.

N-013
Failure of Flexible Couplings in an Outboard Propelling Unit, Jan 1951, L. V. Billota, H. J. Sieland

On 14 Sep 1950, after 1 hr of running time, a NEB training barge became inoperative due to failure of a propulsion unit coupling. Subsequently, another coupling failed after 70 hr. It was reported that these couplings had been thoroughly checked for proper alignment prior to usage. In both failures, the rubber sleeves of the coupling became damaged under pounding and the bronze bushings were rendered completely useless. Failure under these conditions was not in itself of great importance, but the incidents did point to hazards if such failures were met in critical operations. The problem of coupling failure was referred to the Laboratory for detailed examination.

N-014
Effect of Timing and Combustion Volume Changes - Syntron Diesel Pile Hammer, Jan 1951, R. J. Lowe

To evaluate the effect of the timing and combustion volume changes, it was deemed necessary to determine the compression, combustion, and air-brake pressures, the output energy, and the effect of full and one-half throttle settings while operating the hammer on a pile at refusal and while driving piles. Determination of these variables was made with the timing set at three separate positions advanced, neutral, and retarded.

N-015
Altered Anorthosite, Apr 1951, J. A. Bishop, AT1209451, PB154636

In a letter dated 26 Sep 1950 from the OICC, NAMTC, Point Mugu, Calif., to the Chief, BUDOCKS, there is described in general terms a material called anorthosite. The owner has proposed the use of this material as a substitute for a certain percentage of cement in concrete construction to eliminate the occurrence of any harmful reaction which might take place when using locally available aggregate. It was suggested that BUDOCKS might be interested in investigating the feasibility of using anorthosite in concrete construction at Point Mugu.

This paper describes altered anorthosite, and reports the findings of various investigators who have made some qualitative tests on the proposed material.

N-016
Construction and Test of a Thermo-Con Road at Point Mugu Mud Flats, Mar 1951, W. R. Lorman

As a result of a demonstration test of a thermo-con road by Higgins Resources, Inc. at New Orleans in Aug 1950, BUDOCKS requested that an experimental thermo-con road be built on a mud flat and tested to failure or until extreme settlement occurred. Accordingly, an 8-ft-wide thermo-con road was built upon a 100-ft expanse of mud flat at NAS, Point Mugu, Calif., and subjected to vehicular live loads.

N-017
In-Service Life Test of 300 gph Distillation Unit, Sep 1951, P. D. Courter, R. M. Henley

Tests to date on the 300-gph Cleaver-Brooks distillation unit, as originally submitted and subsequently modified, clearly indicates it is not suitable for advanced base use by the Navy.

With due consideration to the final status of the present design, as well as original status of design as submitted, the 300-gph Cleaver-Brooks distillation unit is not recommended for Naval acceptance for advanced base use.

N-018
Full-Scale Test of All-Purpose Crawler Track, Mar 1951, R. C. Stewart, S. J. Weiss

The all-purpose crawler track is so-called since the aim of the project is to develop a crawler track for tractors or other tracked equipment which is equally useful on roads and pavements and in off-the-road operations. The basic design calls for a plate and grouser combination which can be regulated at will by the operator to provide a smooth plate surface for operating on hard surfaces or a deep penetrating grouser for soft going.

N-019
Comparison of Army and Navy Specifications With Particular Regard to Ignition Interference, Mar 1951, A. M. Intrator, AT1209454, PB154637

As military communications and instrumentation equipment have increased in sensitivity and frequency coverage, the suppression of radio interference from ignition systems has become an important problem. To meet this, the various military services have adopted specifications which govern the suppression of such interference, Navy Specification 16E4 (Ships), proposed supplement to 16E4, Army MIL-S-10379 (Signal Corps), and Navy RUAER and Air Force AN-I-27A. This report makes a comparison of the Army and Navy specifications and shows their requirements often to be so vaguely stated, or else so stringent, that many manufacturers find compliance difficult. This is particularly true of the Navy specifications, consequently, overdesigned and expensive suppression kits are often provided. In some instances, the

Navy has been unable to procure reasonable bids on equipment which must meet radio interference specifications.

N-020
Evaluation of Murray and Tregurtha Propeller Puller, Feb 1951, S. Goldstein

In accordance with Project Directive YD-512-3, authorized 10 Jan 1950, tests were conducted upon a puller for removing the propeller from the Murray and Tregurtha Propulsion Unit Model 0-2D. Tests showed that this propeller puller, with slight modifications, is suitable for inclusion as an item in an advanced-base component.

N-021
Dehumidification of Active Warehouse by Means of Selective Ventilation and Comfort Heating, Apr 1951, W. Viessman, ATI210243, PB154638

Preservation of stored materials from deterioration by dehumidification of inactive warehouses has been carried out with a considerable degree of success by adsorption equipment at Naval supply depot warehouses at Mechanicsburg, Pa., and elsewhere. In these warehouses, it is not customary to provide heating, although heating plants are available in most instances.

N-022
Evaluation of the Murray and Tregurtha Model 0-7 Propulsion Unit, Mar 1951, A. G. Schlee

Under Project NY-512-010-5, a Murray and Tregurtha Model 0-7 Propulsion Unit was subjected to limited performance tests to determine its suitability for advanced-base use.

N-023
Tests of Welding Electrodes From War Reserve Stock, Advanced Base Depot, Port Hueneme, California, Mar 1951, R. C. Towne

Large quantities of flux-coated welding electrodes, which normally deteriorate with age, are stored in the war reserve stock at the Advanced Base Depot, Port Hueneme, Calif. At the request of the Advanced Base Depot, the Laboratory performed shop welding tests to determine the usability of this material and to provide a guide for its disposition. A preliminary appraisal of the various electrodes was made in order to select the types suitable for the welding tests. A butt-weld was made between two pieces of steel plate, the bead was observed during welding, and a tensile test was made on the welded plates.

N-024
Development of a Combination Mooring Slip and Drydock (Mark II) for JRM Seaplanes, Mar 1951, A. P. Pratt

The objective of Project NY-620-001-2 was to develop and test a combination mooring slip and drydock, adaptable to advanced-base operating conditions, that would eliminate the task of attaching beaching gear to a floating seaplane prior to towing the plane up onto a specially prepared beach area or ramp.

N-025
The Analytical Treatment of Vehicle Mobility, Apr 1951, R. C. Stewart, S. J. Weiss

The vehicle-mobility research conducted by the Laboratory has arisen through the need of the Naval construction battalions to move material and to carry on operations in the widest possible ranges of weather and terrain. One goal toward which all work has been directed is the development of an analytical method of estimating vehicle performance that will preclude the necessity of conducting extensive go and no-go tests for every specific military vehicle.

N-026
Anderson-Nichols End-to-End Connection for Pontoon Causeways, May 1951, R. C. Towne, H. R. Harrison

Under a program to improve existing NL pontoon gear, an end-to-end connection for causeways was developed by Anderson-Nichols and Company, Boston, Mass. The purpose of this connection was to provide a method of securing causeway sections end-to-end, thus eliminating the overlapping of causeways as now required. The design as developed embodies the use of curved pontoons (designated as T-7s) on the ends of each causeway string, with the T-7 pontoons in the offshore section placed in a normal or deck-up position, and the T-7 pontoons in the inshore section in an inverted or deck-down position. Flat wire straps, chains, and a hinged ramp constitute the end-to-end connection. The hinged ramp attached to the offshore section is to provide for the flow of traffic. A causeway 14 ft wide by 350 ft long, using the end-to-end connection, was constructed and tested by the Laboratory under Project NY-112-006-1.

N-027
Comparative Tests of Four Portable Diatomite Water Purification Units, Sep 1951, J. S. Williams, ATI209575

Comparative tests on four diatomite-type water purification units were made in Apr 1951 to determine which unit should be specified for future procurement. Simultaneous test runs were made on the units to insure identical conditions, and some additional tests were made on the units individually to augment the data obtained on the simultaneous runs. It is recommended that the Proportioneers 25-gpm, utility 3, design 2 unit, because of its simple construction, lower weight and cube, and slightly greater capacity, be considered for procurement. Also that immediate work be undertaken to improve its design. It is further recommended that experimental work be undertaken to determine the feasibility of converting the present Navy standard purification units to include a filter of 19 elements.

N-028 - Cancelled

N-029
Telephone Battery Box, Jul 1951, A. M. Intrator, ATI209576, PB154639

At the request of BUDOCKS, the Laboratory has studied the possibility of designing a battery box for use with telephone set Y and D stock no. 3K15-4 and ringer box Y and D stock no. 3K14-1. A laminated plastic model was prepared for arrangement and dimensional studies, which led to a general molded-plastic design suggested for quantity production. It is recommended that further development of the battery box and procurement be handled by BUDOCKS directly with a manufacturer of plastic moldings.

N-030
Test of Cleaver-Brooks 75-lb Package Laundry Unit, Sep 1951, R. G. Fitzsimons, K. A. Jerney, ATI209577

Limited tests indicate the unit will wash mechanics' and riggers' dirty or greasy clothing satisfactorily at a rate of 42 to 45 lb/hr. The unit is not recommended for advanced base use because of limited capacity, low washability, and skill required for operation.

N-031
Anderson-Nichols Corner Connector for Pontoon Assemblies, Jul 1951, R. C. Towne, H. R. Harrison, ATI209578

Under a program to improve present standard Navy lighter pontoon gear, Anderson-Nichols and Company, Boston, Mass., developed a new type of pontoon corner wedge connector for use in wedging pontoons to assembly angles. The purpose was to provide an assembled connector of reduced weight, economical to manufacture, which would replace the present standard three-piece connector consisting of a

wedge, a hand wheel, and a wedge bolt. The Anderson-Nichols design was developed from the Carr type of fastener. Refinement and modification of the Anderson-Nichols design was accomplished by the Laboratory under Project NY-112-006-1. This report describes the development of the design of the connector to its present proposed stage.

N-032
Review of Polar Camp Sanitation Problems and Approach to Development of Satisfactory Equipment for a Polar Region 100 Man Camp, Aug 1952, W. R. Nehlsen, AD47748

The climate and terrain of polar regions give rise to numerous problems in the collection and disposal of human waste at advanced bases. Consideration of the various methods and equipment in view of these problems indicates that a barracks biological oxidation unit or paper bag toilets with incineration of wastes are the methods which offer the best possibilities of development for handling sanitation in Arctic areas.

N-033 - Cancelled

N-034
Winterization of Lubricator, Mobile, Arctic, Mark III, Jun 1951, S. Goldstein, G. W. Burton, C. T. Radecki, AD42993L

A mobile Arctic lubricator, Mark III, was winterized, including an enclosure and heating and starting facilities, for the purpose of developing a satisfactory lubrication unit for extremely low temperature work. This unit was field tested both at Camp Nale and at Point Barrow, where it was determined that the lubricator was satisfactory structurally, but that the heating and starting systems were not satisfactory. It is recommended that further studies be conducted for the purpose of determining a better winterization scheme.

N-035
Evaluation of New Tools, Jun 1951, A. G. Schlee, B. F. Schnoebelen, AT1209579

This project covered the operational evaluation of three makes and models of powder-actuated tools used to place studs, hangers, and the like on walls, ceilings, and other objects of wood, concrete, plaster or soft steel. The tools were also used to fasten two or more objects together, such as wood battens to concrete walls.

N-036
Field Testing of Delco Frigid Batteries, Jun 1951, G. W. Burton, C. T. Radecki, J. C. Senn, AD42994L

This report covers tests performed on experimental Delco frigid batteries under actual operating conditions at Point Barrow, Alaska during the winter of 1950-51. The batteries under test were used for starting and other regular vehicle loads in M29C cargo carriers. These batteries were pilot models of the lead-acid automotive type, designed by Delco, containing electrolyte of 1.350 specific gravity. It is concluded that insufficient data have been accumulated for final evaluation of the Delco frigid battery. However, results of these tests indicate that superior performance under Arctic conditions may be expected from this battery.

N-037
A Study of the Electronic Plumb-Bob, Jul 1951, E. D. Pettler, AT1209580

The problem of determining the accurate vertical plumb attitude of hollow casings driven into the earth, has, until very recently, confronted the building and construction trades. Formerly using the theory that light from any source travels in a straight line, several crude methods for plumb determination were employed. The information provided by these methods was inaccurate and the errors, in many cases, were costly. A new device, the electronic plumb-bob, designed and manufactured by the Hinchman Corporation, can furnish adequate data regarding the angle and the displacement of the driven casing. The instrument has other uses, such as to determine the direction batter piles are being driven, to measure the width of long vertical columns, etc. Since it is based on sound principles, is more accurate, and provides more comprehensive data than is furnished by other methods, the Hinchman Corp. electronic plumb-bob is recommended for use wherever requirements for remote plumb attitude information exists.

N-038
Evaluation of the Kim Hotstart Heater, Jun 1951, S. Goldstein, G. W. Burton, C. T. Radecki, AD42995L

Kim Hotstart electrical engine heaters were tested by the Arctic Test Station, Point Barrow, Alaska to determine their feasibility for use in starting engines subjected to Arctic temperatures. The heaters provided sufficient heat to permit ease of starting of jeeps and a D-6 caterpillar tractor secured overnight in ambient temperatures down to -50F. It is recommended that these heaters be adopted as standard equipment and that investigations be continued under Project NY-012-158-9 to determine the feasibility of their use on larger items of construction equipment.

N-039
Test of Blueprint Papers for Specifications, Jun 1951, C. A. Leonard, AT1209581

Complaints from the field stated that prints could not be obtained from Dietzgen, Speed F and Keuffel and Esser, Speed 35 blueprint paper being issued from stock of the Advance Base Depot, Port Hueneme. Samples of the paper were processed through frame tests and commercial blue printing machines. Satisfactory prints at acceptable printing speeds were obtained. It was recommended that the field again run the paper in question using exposure time and developing procedures required for the paper, and if failure to print is again encountered, complete details be submitted to the Laboratory for appraisal.

N-040
Test of Cleaver-Brooks 75-lb Packaged Laundry Unit, Jul 1951, R. G. Fitzsimons

Project (to date) covers testing of Cleaver-Brooks packaged laundry unit for compliance with specifications and for washability as compared with BUDOCAS standard (Hoffman) unit. Tests to date do not indicate compliance with specifications insofar as volume or clothes cleaning ability is concerned. It is recommended that tests be suspended until modifications or changes can be made by the manufacturer so that the unit will meet specifications.

N-041
Evaluation of the Murray and Tregurtha All-Steel Flexible Coupling for O-2D Outboard Propulsion Units, May 1952, J. C. Senn, AT1209583

This final report covers evaluation of an all-steel flexible coupling, part no. 15295-R, for the Murray and Tregurtha Model O-2D outboard propulsion unit. The coupling was designed as a replacement for the present part no. 121-9-R, which attains its flexibility through use of rubber inserts. Tests were performed both under actual operating conditions at sea and under controlled conditions on an absorption dynamometer.

N-042
Test and Evaluation of Thorsen Socket Wrench Adapters, Aug 1951, A. G. Schlee, AT1209585

This report covers tests performed on Thorsen socket wrench adapters to determine whether these adapters were manufactured in such a way as not to permit the application of the necessary torque required in normal use. It is

concluded that the adapters are not uniform in manufacture, and that satisfactory performance cannot be obtained unless the method of manufacture is improved. It is recommended that the Navy not accept the subject adapter for use.

N-043
Test and Evaluation of Wright Pneumatic Saw, Dec 1951, A. G. Schlee, AT1209584

This report covers tests performed with a Wright precision power saw and its evaluation as a desirable component for battalion use at advanced bases. As a result of in-servicing testing in the Laboratory shops, it is concluded that the saw is a very desirable item of shop equipment. It is recommended that the Wright saw be added to the standard battalion allowance list.

N-044
Water Supply for Small Polar Region Advanced Bases, Jul 1953, W. R. Nehlsen, AT1210207

Water is an essential supply for advanced bases in any area. In polar regions, water sources are few and unreliable, and the cold climate and permafrost causes many unusual problems. This report discusses the requirements and equipment for supplying water to polar region advanced bases. Most frequently melted snow or surface water will be used to supply the approximate requirement of 20 gal/person/day. Water storage tanks will be contained in heated buildings and distribution provided with insulated water carriers. Disinfection is always necessary, and clarification treatment may be required.

N-045
Procedure II, a Uniform Procedure for Measuring and Reporting Soil Properties in Conjunction With Controlled Vehicle Testing in Homogeneous Soils, a Recommendation of Working Group E, Vehicle Mobility Panel on Vehicles, Committee on Ordnance, Research and Development Board, Jul 1951, S. J. Weiss, R. C. Stewart, AT1209586

Procedure II, proposed herein, is a modification of Procedure I, which was prepared by Aberdeen Proving Ground and Stevens Institute of Technology prior to the establishment of Working Group E, Vehicle Mobility, under RDB sponsorship. Continuing investigations of vehicle mobility characteristics have borne out the importance of quantitative classification of the soil. A uniform procedure will enable a more universal interpretation of vehicle test results. The inclusion of both an in situ direct shear test (soil truss) and a soil strength index (cone penetrometer) may in time provide sufficient data for their correlation. Thus the analytical treatment of the mobility problem may profit by the full-scale test data previously rated by means of the penetrometer.

N-046
Snow Stabilization Tests at Point Barrow, Alaska During 1950-51, Jul 1951, A. B. Bruck, G. W. Burton, C. T. Radecki, AD42996

A 5,000-ft snow road was stabilized in an 18-in. deep snow field strip by four combinations of equipment. This equipment was selected as a result of the construction of 19 test strips. Insufficient density and hardness tests were made for correlation and analysis. Therefore, conclusions are based on visual observations made during limited traffic testing. The combination of a pulvimixer and followed immediately by an 8-ft-diam snow roller produced a stable road that stood up well under traffic. The use of a snow surface heater and water spray in this combination of equipment was of questionable value, and the substitution of a pontoon barge drag for the roller was found undesirable. Maintenance, by steel or wood frame drag was satisfactory when followed by a pass with the 8-ft roller. Additional tests are planned for the 1951-52 winter season at a California Sierra snow camp which should provide the balance of information required for positive recommendations.

N-047
Water Level and Draft Indicating Systems, Aug 1951, W. A. Bowen, D. B. Wright, AT1209587

This is an interim report of the Water Level and Draft Indicating System, Project NY-412-012-1. A study of this problem has been undertaken by this Laboratory to determine the cause for non-reliance upon existing equipment and the extent to which new equipment is needed. The findings to date are summarized as follows: (1) the presently used equipment is either too complicated, too delicate, or the working personnel do not practice simple preventive maintenance and (2) the problem of remote register appears to be as great or greater than the problem of measuring the liquid level. It appears that no completely satisfactory commercial system is available, hence it is recommended that: (1) a program of instruction in proper maintenance and operation of existing equipment be instituted for the personnel concerned; (2) a program of evaluation of commercially available systems be initiated, concurrent with the training program, to ascertain the most suitable system for replacement and for new installations; and (3) should the educational program not improve the reliability of the currently used systems and/or should the evaluation program not reveal a suitable commercial replacement, a program of development be established to develop a system which is satisfactory in all respects, leading to general use on all dry docks.

N-048
Results of Investigations Conducted on a Diesel Pump Nozzle Test Stand, Oct 1951, H. J. Sieland, AT1209588

An investigation was conducted to determine the commercial availability of a single test stand capable of testing the pumps, nozzles, and injectors of diesel engines designated by BUDOCKS. As a result of these investigations it was determined that such a stand can be made available commercially but that a more efficient arrangement would be comprised of two commercial units--one for pumps, the other for nozzles and injectors. It was further determined that the Corps of Engineers have procured a two-unit test system for evaluation. It is recommended that the commercial dual-unit pump and injector test system described in this report be accepted as a standard for procurement, and that a prototype be procured for in-service field testing.

N-049
Test of 150 cu ft Refrigerator (Hussmann), Sep 1951, P. D. Courter, K. A. Jerney, AT1209589

Project (to date) has covered testing of a 150-cu-ft Hussmann refrigerator for compliance with specifications for capacity test and overall heat leakage coefficient test. Tests to date indicate compliance with the overall heat leakage requirements but not with specifications for the capacity test.

N-050
Test of Pol-Flo Paint Cup, Sep 1951, R. G. Fitzsimons, K. A. Jerney, AT1209590

The Plo-Flo paint cup was tested to determine whether a reduction in time and materials could be accomplished by its use and still obtain results equal to or better than those secured by cold paint methods, also to check ease of operation and adjustment, repairs necessary, and life of the unit.

N-051
Advanced Report on Tests of Gar Wood Model 407 Ditcher, Sep 1951, A. G. Schlee, AT1209591

The Gar Wood Model 407 ditcher was tested comparatively against the Barber-Greene Model 44-C ditcher to determine the acceptability of the Gar Wood for Navy use. The Gar Wood was found to be superior as to arrangement of controls, transportability, maneuverability, ease of bucket adjustment, ease of servicing, and speed in digging. The Barber-Greene was found to be easier to steer, easier to

control and more flexible, more adaptable to varying terrain, more stable and easier to learn to operate. The Gar Wood was not operated long enough during these tests to get an accurate idea of its expected life while the Barber-Greene has been proven over a long period of time.

N-052
Performance Tests of an Aeroil Portable Snow Melter at the Arctic Test Station, Point Barrow, Alaska, Oct 1951, J. E. Schroeder, AD42997L

Producing potable water from snow is necessary to supply military operations in Arctic regions. An Aeroil Flash-Guard Meet-Master 55-gal asphalt kettle, equipped to burn kerosene, gasoline, or Arctic-type diesel oil, was converted into a snow melter and sled-mounted for portability. In-service performance tests were conducted at the Arctic Test Station, Point Barrow, Alaska, during the 1950-51 winter season. Except for minor repairs and modifications, the unit proved to be a rugged, reliable, and efficient snow melter. The average production rate for 24-hr operation could provide water for 60 men based on 30 gal of water/man/day. Best performance was achieved using Arctic-type diesel fuel. The human element in operating the melter was a major factor in performance.

N-053
Development of the Panel Type Prefabricated Wanigan - Mark I, Oct 1951, J. E. Schroeder, M. C. Lorenz, AD42998

Successful sled train operations in the Arctic are dependent on providing suitable weather protection for personnel while enroute. Previous efforts to fill this need with conventional-constructed, sled-mounted buildings, called wanigans, have not produced units adequate for military operations. Development of a prefabricated, knock-down, panel-type wanigan to withstand the rigors of cargo sled transportation was undertaken by the Laboratory in 1947. The initial 8-ft-wide, 8-ft-high by 31-ft-long wooden panel wanigan, Mark I, developed under this program showed promise in Arctic trail testing at Point Barrow, Alaska, in 1948 and 1949.

N-054
Test of Torkon Impact Wrench, Oct 1951, R. G. Fitzsimons, K. A. Jerney, AT1209592

Tests made with subject wrench, and opinions of mechanics who used it, indicate that it is easy to use, safe, efficient and has certain advantageous characteristics that are not found in hand, electric, or pneumatic wrenches now carried in stock. Since it requires no outside source of power, it is particularly adapted to field use. It is recommended that the Torkon Impact Wrench be accepted for Navy use. Specifications covering catalog listing are included as part of this report.

N-055
Laboratory Testing of Delco Frigid Batteries, Oct 1951, J. C. Senn, AD42999L

This final report covers controlled cold-chamber tests performed on experimental Delco frigid batteries in order to substantiate the conclusions drawn from previously conducted in-service tests. These tests were conducted under controlled severe low-temperature conditions simulating actual cold weather starting and operating loads. The test batteries were pilot models of the lead-acid automotive type, designed by Delco, containing electrolyte of 1.350 specific gravity. It is concluded that (1) the present models of the Delco frigid battery are superior to the conventional batteries for Arctic use but (2) from reports sent to the Laboratory, the battery developed by the University of Michigan for Army ordnance may perform better at all temperatures than the Delco frigid battery.

N-056
Evaluation of the Reed Thermo-Electro Battery, Oct 1951, J. C. Senn, AD43000L

This report is an evaluation of the Reed thermo-electro battery manufactured by the Reed Battery Corporation, North Hollywood, Calif. It is concluded that although this battery failed by 0.3 min to meet the cranking requirement of Federal Specification WB 131C and Navy Specification 17B4M, failure to meet this requirement is more than offset by its superior performance in other phases of the tests. It is recommended that the Reed battery be approved for advanced base use.

N-057
Interim Report: Miller Ball Bearing Swivel, Nov 1951, R. G. Fitzsimons, AT1209593

The use of Miller ball bearing swivels over a period of 10 mo by the PW Department at NCBC, Port Hueneme, Calif indicates that they reduce labor costs, reduce wear and replacement of wire ropes, are free from repair or breakage troubles, are safe, and have approval of both operators of equipment and leadmen.

N-058
Evaluation of the Clarite Battery, Nov 1951, J. C. Senn, AD43001L

This report is an evaluation of the Clarite battery, manufactured by the Clarite Battery Company, Los Angeles, Calif. It is concluded that this battery does not meet the requirements of Federal Specification WB-131C, nor does it fulfill the claims made by the manufacturer. It is recommended that the Clarite battery not be approved for advanced base use.

N-059
Performance Test of Alhydro Floc Producer, Nov 1951, J. E. Halton, J. S. Williams, AT1209594

The Alhydro Floc Producer was tested and compared with ordinary chemical methods and flocculation for the clarification of water. Because of higher original and operating requirements, pure aluminum requirements, high weight and cube, and the difficulty of operation with certain types of water as compared to chemical methods the Alhydro system is considered unsatisfactory for advanced base use by the Navy.

N-060
Cathodic Protection Applied to the AFDL-12, Long Beach, Nov 1951, W. A. Bowen, AD221814

Cathodic protection was applied to the underwater hull of the AFDL-12, a floating dry dock, on 3 Nov 1950. Its state has been continuously monitored with semi-weekly surveys. A 6-mo study shows that protection can be achieved with a single, properly placed anode and as little as 8 Amp or 35 W of electrical power. The total cost of materials used for the installation design resulting from this study is below $400. The single anode installation is shown to be satisfactory, yet less complex and less costly than previously recommended systems which involve structures to support strings of anodes from the mooring pier or booms holding anodes over the side. Test coupons made of ship hull steel, showed negligible loss of steel at the protected surfaces, whereas, unprotected surfaces may be losing metal from bare areas at the rate of 100 gms/sq ft/yr.

N-061
Radio Interference Tests on a Suppressed 10 kW Kohler-Waukesha Engine Driven Power Plant, Jan 1952, A. M. Intrator, AT1209596

At the request of the BUDOCKS, NAVCERELAB monitored a contract given to the Hallett Manufacturing Company, Inglewood, Calif., to develop a radio interference suppression system for a 10-kW Kohler-Waukesha engine generator. Radio interference tests of the prototype suppression

harness suggest conformance with the interference requirements of Navy Specification 16E4. It is recommended that the suppression system developed be accepted even though excessive ambient noise and instrument limitations make a positive conclusion difficult. The inability of the test equipment above 400 Mc to measure interference within magnitudes established by specification is noted. In view of this, the recommendation is made that a more realistic attitude be taken in the establishment of these limits. A shielded room or building should be erected to provide an electrically quiet area for the performance of similar future tests.

N-062
Mark I and II Mobile Lubricators, Dec 1951, K. N. Tinklepaugh, B. G. Rush, AT1209597

The need for some means of furnishing lubrication to vehicles on the trail under Arctic conditions has long been evident. Two attempts to fill this need are the Mark I and II mobile lubricators covered in this report. The Mark I unit contained the basic components of conventional lubricating units with additions and modifications considered necessary for operation under cold weather conditions. It was contained in a weather-proof housing. The Mark II unit consisted of a skid-mounted Graco unit in a winterized enclosure mounted on runners. Test results of the Mark I showed satisfactory performance of generator, air compressor, and arc welder. Difficulties were encountered in using grease pumps, strip heaters, immersion heaters, oxygen-acetylene welding kit, electric lube dispenser. The Mark II performed satisfactorily with a few exceptions.

N-063
Evaluation of a Portable Battery-Operated Lubricator, Dec 1951, J. C. Senn, J. R. Dawes, AT1209598

This report is an evaluation of the Brown Dynalube portable battery operated lubricator based on in-service use. Various items of construction equipment, such as cranes, tractors, and trailers were lubricated in the shops of the Laboratory. Results of these investigations proved that the machine is simple to operate, easily maneuverable, fast, and dependable.

N-064
Winterization of M29C Cargo Carrier, Dec 1951, B. G. Rush, J. R. Dawes, AD43002

The problem for which this project seeks a solution is the successful operation of a M29C cargo carrier (Weasel) in Arctic weather where temperatures may reach -65F. In-service field tests were accomplished by the Arctic Test Station during the 1950-51 winter season at Pt. Barrow, Alaska. It is concluded that while the winterized M29C cargo carrier is, to date, the most suitable scout vehicle and personnel carrier available for use in Arctic weather, improvements can be made to produce more desirable performance.

N-065
Deterioration of Bituminous Coatings at Guantanamo Bay, Cuba, Nov 1951, G. D. Carpenter, AT1209599, PB154641

The following paper is an interim report of Project NY-530-001-1, Paint and Protective Coatings. As part of this project, this Laboratory is investigating the early deterioration of a bituminous coating applied to marine piling at Guantanamo Bay, Cuba. While a detailed investigation of the problem has not been possible at this date, several preliminary observations and recommendations have been made. They may be summarized as follows: (1) examination of the original enamel chipped from the piling has indicated that the premature deterioration was caused by the improper application of the bituminous coating, and (2) a resume of the conditions necessary for the successful application of bituminous coatings to marine structures in the tidal zone is necessary to serve as a supplement to the existing specification. As a result of the above observations, the following recommendations have been made: (1) prior to coating, all surfaces should be sandblasted and thoroughly dried, (2) at all times, special precautions should be taken to insure the application of the minimum film thickness requirement, (3) the flame-spraying technique should be considered as a method of applying hot bituminous coatings in the tidal zone, and (4) in all cases, coated surfaces should be tested for imperfections with an electrical flaw detector.

N-066
Test and Evaluation of Winterization Kit Components for Heavy Duty Diesel Engines, Oct 1951, E. J. Beck, J. R. Dawes, AD43003

The problem with which this report is concerned is the starting and operation of heavy-duty diesel engines at low temperatures. From the results of the test it is concluded that the winterization kit components tested were, as a whole, satisfactory for starting a diesel engine at -65F but that several modifications should be made.

N-067
Final Report, Test of 150 Cubic Foot Refrigerator (Hussmann), Dec 1951, P. D. Courter, AT1209600

The evaluation of the 150-cu-ft Hussmann portable walk-in refrigerator for compliance with specifications is concluded. All tests performed on the refrigerator, which includes cold storage box and detachable plug-in refrigeration unit, have been successfully passed except the capacity test with the Wisconsin air-cooled gasoline engine. Since present specifications are considered adequate, it is recommended that the cold storage box and plug-in refrigeration unit as modified, be accepted for use at advanced bases of the Navy.

N-067A
Test of 150 Cubic Foot Refrigerator (Hussmann), May 1952, P. D. Courter

Because of the low capacity performance of this refrigerator when driven by the Wisconsin gasoline engine, it was decided to ascertain if the vapor barrier had failed and accumulated moisture and what measures could be effected to assure moisture removal.

N-068
An Investigation of the Conditions Necessary for Camouflage in the Far Infrared, Jan 1952, A. C. Kolb, W. L. Starr, E. R. Streed

The potential vulnerability of the Naval shore establishments to attack by guided missiles has become and will continue to be a matter requiring ingenious preparation and investigation. Interest in this problem has given rise to preliminary studies by this Laboratory of the possibility of passive tactical deception. A review of some of the literature pertaining to recent developments in homing devices for missiles was made to determine the spectral region of the infrared being used by such homing devices and their limitations. This survey has indicated the possibility of extending camouflage techniques to the infrared (8-14 μ). This report is the result of these preliminary studies and considers the factors involved in effecting camouflage conditions. When a body is heated to normal ambient temperatures, the radiation emitted by the body will have a maximum at about 9-10 μ. The intensity of this radiation in the wavelength interval will be dependent on the temperature of the body, the material of which the body is composed, and the wavelength of radiation considered. Thus, for any chosen wavelength, the radiation emitted by a body will be a function of the temperature and the material of the body. Since the homing device of a missile detects a target by differences in radiation emitted by the target and its background, then if the emission of both the target and the background can be made identical for a particular wavelength, camouflage for that wavelength has then been

achieved. This can be accomplished in either of two ways. First, by knowing the temperature of the target and the background, the material of the target can be chosen such that the emission is the same for both. Second, by knowing the materials of the target and the background, the temperature of the target can be controlled such that emission is again the same for both. Experimental results may indicate that a combination of the two methods may be the most practical.

N-069
Miller Ball Bearing Swivel, Mar 1952, R. G. Fitzsimons, ATI209737

The use of Miller ball bearing swivels over a period of one year by the PW Department at CBC, Port Hueneme, Calif., indicated that they reduce labor costs, reduce wear and replacement of wire ropes, are free from repair or breakage troubles, are safe, and have the approval of both operators of equipment and leadmen. All reports and tests indicate that the swivels are superior to standard pin types now in use. It is recommended that they be accepted as standard Navy stock items.

N-070
Formaldehyde as a Possible Component in Catchment Water From Asphalt Runways, Jan 1952, G. E. Sanford, R. L. Alumbuagh, ATI209738, PB154642

Following the reported appearance of formaldehyde in catchment water from asphalt runway at Kwajalein, the question of ultimate potability of catchment water from projected runways in the Grand Bahamas arose. The current study reviews important aspects in the toxicology of formaldehyde. A method for the investigation of formaldehyde in the field has been checked, and evidence indicates that it can be adapted to such use.

N-071
Radio Interference Radiation Tests on an Alternating Current Power System for Automotive Equipment, Jan 1952, D. B. Wright, ATI209739, PB154643

The Leece-Neville alternating current power system for automotive equipment was tested for radio interference radiation as a part of the current Laboratory project. This study revealed that the system as tested has interference levels which are intolerable. This system should not be used as the primary power source for communication equipment until the voltage regulator, which is shown to be the component responsible for creating the interference, is further developed. It is recommended that the manufacturer be encouraged to further develop the regulator so as to reduce or eliminate this interference prior to any further consideration toward replacing presently used systems on Navy vehicles.

N-072
Characteristics for AC Crane Control, Apr 1952, F. L. Poole

Electric cranes which use induction motors and operate directly from alternating-current power systems have the advantage of low cost. However, the control of the position and speed of the hook on these cranes has not been good enough to meet the requirements of some applications. In order to extend the advantage of low cost to these applications, various systems for controlling the speed of induction motors have been devised and developed, making it now possible for cranes using such motors to satisfy practically any service requirement.

N-073
Evaluation of the Francoist Seven Horsepower Portable Hoist, Jan 1952, J. C. Senn

This final report covers the evaluation of the Francoist 7 hp portable gasoline engine-driven hoist. This machine is manufactured and was designed by John S. Franco, Redwood City, Calif. It is concluded that the Francoist portable hoist is satisfactory for continuous use on work within its rating and that all the manufacturers claims for it are substantiated.

N-074
Testing of Biersach and Niedermeyer Company Siren, Jan 1952, P. D. Courter, ATI209742

Project has covered the testing of the siren for compliance with specifications for: (a) general workmanship and operation; (b) preservation, packaging, and packing; (c) radio noise suppression; and (d) sound output. The results of tests indicate compliance with packing and packaging, general workmanship and operation, and sound output, but non-compliance with preservation and radio noise suppression on the siren. It is recommended the siren be considered acceptable only after the engine is suitably shielded for radio noise suppression in accordance with paragraph 5(b) of the Memorandum of Procedure for this project.

N-075
Use of the Soil Truss Mark II in Determining the Shearing Strength Characteristics of a Snow Cover, Jan 1952, J. J. Weiss, ATI209743, PB154644

Tests of the Soil Truss Mark 2 at the U.S. Naval Sierra test site, the Cold Weather Station of the NAVCERELAB have demonstrated the ability of this instrument to classify the shearing strength of snow by means of a technique similar to that used in soil. Classification of the snow cover in conjunction with planned quantitative vehicle mobility tests will afford a basis for the analysis of performance in snow.

N-076
Land Reclamation, Operation Jangle, (U), Feb 1952, C. A. Leonard, Secret

N-077
The Mechanics of Rolling Resistance of Wheels in Soil, Mar 1952, S. J. Weiss

Analysis of the forces produced in the soil by a point on the periphery of a rolling wheel enables the determination of the relationship between rolling resistance, wheel loading, and sinkage. The method of considering the trajectories of points on the wheel periphery may well be applied to the more general wheel problem in view of the acceptable experimental corroboration of this analysis of the zero slip condition.

N-078
An Investigation of the Tilley Floodlight FL-6, Mar 1952, E. D. Pettler, ATI209744

The necessity for conduct of construction work during the hours of darkness establishes the requirement for provision of sufficient illumination to working areas to promote safe and efficient operation. The Tilley FL-6 kerosene-operated floodlight projector has been considered for this type of service. A mean reflected candlepower of about 5,000 has been claimed for this projector by its manufacturer. Tests of this unit verified the manufacturer's claim but also demonstrated its deficiencies for use in connection with night construction work, primarily because of its low level of light output, its large size, and the attendant operating difficulties. The unit is, therefore, not recommended for the proposed application.

N-079
Further Studies of Cathodic Protection Applied to AFDL-12, Long Beach, Jan 1952, W. A. Bowen

This is a supplement to N060. Cathodic protection was applied to the underwater hull of the AFDL-12, a 1,000-ton floating drydock, on 3 Nov 1950. The installation and the results of 6 mo of protection are described in Ref 1. The findings for a full year of study of the installation are

summarized as follows:

1. The simple installation consisting of one anode lying on the bottom and a rectifier supplying less than 8 Amp is sufficient for protection.
2. Additional test coupons showed that bare areas of the underwater hull lost surface metal at a rate of 125 gm/sq ft/yr while protected areas lost 17 gm/sq ft/yr.
3. Except for unexpected complete shutdowns, the power mains showed satisfactory regulation, permitting long unattended periods between monitoring surveys.
4. A laboratory study of paint coatings used on the AFDL-12 showed little tendency for paint stripping due to the protection current.

N-080
Engine Starting Fluid Priming Systems, Mar 1952, E. J. Beck, AD55531

The pressure priming system, employing ether in pressurized capsules with a small amount of light oil, is considered the safest, most reliable device for employing a starting fluid presently known. The report recommends adoption of the pressure priming system as standard for construction battalions and concludes that no further testing of the system is desirable unless significant changes are made.

N-081
Test of a 120-foot Section of Prestressed Timber Lightweight Roadway at Point Mugu Mud Flats, Dec 1951, R. A. Breckenridge, T. L. Johnston, AT1209745, PB154645

Roadway stresses were previously determined by using Westergaards slab formula and also by an alternate method utilizing field-measured deflections as a basis of computation by radius of curvature. As a result of this investigation, it is concluded that the basic design principles of this type of roadway are sound, and that modifications of this design can be developed to permit higher load capacities along the lines proposed in the recommendations contained in this report.

N-082
Methods of Concealment Used for Shore Establishment Defense, Mar 1952, W. A. Bowen

Naval shore establishments offer a target of prime importance in the event of an attack by an enemy versed in the techniques of guided missile warfare. Four main stages of defense may be used to thwart a guided missile attack. (a) the launching party may be recognized and destroyed before the attack is launched, (b) the attaching missiles may be intercepted by counter missiles or ordnance between launching site and the target, (c) tactical deception may be used to prevent recognition of, or guidance to the target, and (d) the target may be armored or dispersed so that no major damage is done by the attaching missiles. Considering the unsatisfactory aspects of the three types of defense just mentioned, it would seem that a large part of the defensive effort should go into the fourth method, namely, tactical deception. Tactical deception involves any means whereby recognition of the target by the enemy is delayed or prevented. Jamming, camouflage, decoys, and concealment are techniques to be considered. Concealment as a passive defensive measure presupposes the existence of detection devices controlled by the enemy. These detection devices may take one of many forms such as visual, photographic, radar, television, infrared, gravitational, magnetic, electrostatic, acoustic, or chemical.

N-083
Evaluation of the 20 gpm Byroad Dual Diaphragm Pump, May 1952, J. C. Senn, AT1209746

It is concluded that the Byroad pump is not equal to pumps now in use for fuel and lubricant transfer from drums. It is recommended that the Byroad pump not be accepted as a replacement for other hand pumps now in use at construction battalion facilities.

N-084
Evaluation of the Flo-King Positive Displacement Rotary Pump, May 1952, J. C. Senn

It is concluded that the manufacturer's ratings and claims for an improved type of fuel transfer pump have been verified. It is recommended that the modifications listed in this report be incorporated in a prototype model Flo-King pump and that this prototype be purchased for final evaluation by the Laboratory.

N-085
An Investigation into the Use of Conducting Lubricants of Shaft-Bearing Noise, Apr 1952, A. M. Intrator, AT1209747, PB154646

Radio interference has been observed to originate in the shaft-bearing area of some rotating machinery and was attributed to erratic discharge through the shaft lubricant of the static charge developed between the shaft and bearing. Provision for a low impedance path between the shaft and bearing would prevent the charge buildup and eliminate this type of interference. A laboratory test setup was designed to study the effectiveness of various conducting lubricants in reducing such interference. None of the lubricants tested offered a sufficiently low impedance path for complete elimination of the noise voltages, although the graphite grease mixtures did lower the measurable noise somewhat. There was no significant performance difference between the various graphite lubricants tested. Molykote (molybdenum disulphide) lubricants were ineffective in reducing the interference and actually exhibited negative qualities in that greater noise levels were observed during its use than when a conventional nonconducting grease was used. It was concluded that only a positive shaft-bearing contact, as offered by a brush or slip ring, can provide a sufficiently low impedance path for complete reduction of the noise voltages.

N-086
Investigation of Glare Problem, Building 253, San Francisco Naval Shipyard, Apr 1952, D. B. Wright, AT1209748, PB154647

The investigation was conducted on 21 Mar 1952, which was a sunny day with a clear bright sky and was, therefore, very conducive to any glare conditions that might have been present.

N-087
Study of Interior Linings for 20-ft by 48-ft Standard Arch-Rib Buildings, May 1952, J. E. Schroeder

It was found from these tests that either type of Upson panel was both economical and satisfactory when a painted surface was desired. Upson plain board was economical for an unpainted surface but would not give satisfactory service unless painted. It was recommended that both types of Upson panels be considered, in conjunction with the Upson lining plan, when a painted surface is desired.

N-088
Final Report, Cold Weather Test of Water Carrier, Mark II at the Arctic Test Station, Point Barrow, Alaska, May 1952, R. D. Mill, A. J. Ameel, C. A. Leonard, AD869404

The Water Carrier Mark II, 500-gal capacity, was tested at the U.S. Naval Arctic Test Station during the 1951-1952 test season to determine its suitability for the transportation of water under severe Arctic conditions. The performance and adequacy of the carrier, pot burner, flue pipe heating system, pump, and engine were determined. The tests showed that the pump engine, the pot burner, and the flue pipe heating system were inadequate for Arctic conditions. The water tank and the pump were found suitable.

N-089
Low-Temperature Cranking Tests of the University of Michigan Experimental Battery, May 1952, J. C. Senn, AD55534

This report covers evaluation of an experimental, laboratory sample, lead-acid automotive battery developed for the Army BUORD by the University of Michigan for extreme low-temperature use. Comparison is made to the Delco frigid battery recently accepted by BUDOCKS as an interim standard for Arctic use. It is concluded that the University of Michigan battery can be expected to have a low-temperature performance equal to or possibly better than the performance of the Delco frigid battery.

N-090 - Not published

N-091
Evaluation of the Nu-Matic Safety Check Valve, May 1952, J. C. Senn

This report covers evaluation of the Nu-Matic safety check valve, manufactured by the Nu-Valve Corporation, San Francisco, Calif. It is concluded that, although this valve affords protection against brake line failure, it increases normal braking distances beyond safe values. It is recommended that Nu-Matic safety check valves not be accepted for use on construction battalion equipment.

N-092
Service Tests of the Dri-Flush Closet at the Sierra Test Site, Jun 1952, W. R. Nehlsen, ATI209750

The Harm Company Dri-Flush Closet was subjected to service tests at the Sierra test site during Jan and Feb 1952. This closet failed to operate satisfactorily and also proved to be unsanitary. No further use or development of the closet is planned under the Polar Camp Sanitation Project.

N-093
Interim Report Field Tests of Cold Weather Lubricants and Hydraulic Fluids, Jun 1952, E. J. Beck, AD55532L

Lubricants developed for warm weather use are, in general, unsatisfactory at very low temperatures. Special low-temperature lubricants and hydraulic fluids have, since 1947, been under field test in construction battalion equipment at the Arctic Test Station, Point Barrow, Alaska. Types of products tested have been (1) crankcase lubricants, (2) hydraulic fluids, (3) greases, and (4) gear oils. Products satisfactory to -45F in all classifications excepting crankcase lubricants have been tested.

N-094
Performance Tests of an Aeroil 7T8 Portable Snow Melter at the Sierra Test Site and Port Hueneme, Jun 1952, A. B. Bruck

A special model Aeroil 7T8 kettle, having a capacity of 175 gal of liquid, was adapted as a snow melter and two standard Aeroil torches 13TS with nine different sized burner plugs for kerosene, gasoline, or Arctic diesel fuel were evaluated to determine their adequacy. Nozzle efficiency tests were conducted at the U.S. Navy Sierra test site, Crestview Lodge, Bishop, Calif., and at Port Hueneme, Calif., in an attempt to determine the most efficient nozzle size for each of the three types of fuels. Unfavorable climatic conditions allowed only very limited in-service tests and use of one type of fuel in the tests at Bishop, Calif. It was found by tests that the 7T8 snow melter is a suitable unit for the production of water for a 100-man camp at a figure of 30 gal/man/day.

N-095
Design of a Protective Panel for Atomic Blast (U), May 1952, R. K. Steele

Designing a structure to withstand atomic blast has posed some of the most interesting problems to structural engineers. This note presents a new approach to the problem of withstanding high, relatively long duration, blast pressures with a structure that is neither massive nor uneconomical. Further, it is possible that certain types of existing building frames may be made blast-resistant through substitution of the panel described for standard wall and roof panels.

N-096
Macchi Structural Slab System, May 1952, J. R. Allgood, ATI209752

Analysis of the recommended design assumptions, which are based on the use of an equivalent unit section, indicated that detailed consideration be given to the shear resisting properties of the Macchi slab. Four slabs, designed to fail in shear, were tested from which it was observed that the diagonal tension resistance of the Macchi slab is comparatively low. Brief consideration was given to the economic possibilities of the Macchi slab, and it was shown that where a ceiling is a desired or required characteristic of a structural floor or roof that the Macchi slab is competitive with the Pan system slab.

N-097
Preliminary Tests and Stress Analysis of a Prestressed Timber and a Plywood Lightweight Roadway, May 1952, R. K. Steele, A. J. Anderson, ATI209753

Twenty feet each of prestressed timber and hollow-core plywood roadways were subjected to field tests to determine their suitability in traversing semifluid areas of moderate bearing capacity. Roadway stresses were determined using Westergaard's slab formula and, alternatively, through use of the field-measured radius of curvature.

As a result of this investigation, it is concluded that the basic design principles embodied in these roadways are sound and that roadways can be developed with higher load capacities.

N-098
Performance Tests of a Toboggan Sled and Toboggan at Point Barrow, Alaska, Aug 1952, R. D. Hill, A. J. Ameel, A. B. Bruck, AD43004

A curved bow, steel frame toboggan with V-shaped keels was fabricated and in-service tested at the Arctic Test Station, Point Barrow, Alaska, during the 1951-52 winter test season. Simultaneously, a toboggan sled identical to the one described above but having 8-in. high box runners was also in-service tested. Both items of equipment stood up well under routine use around the base camp and on the trail, requiring minor maintenance work only.

N-099
Interim Report: Water Purification Equipment, Jul 1952, J. S. Williams

To develop a standardized design for a 25-gpm water purification unit, several prototype models were studied. These models were furnished by their respective manufacturers with only one stipulation, the unit should be capable of producing the required amount and quality of water. No limitations were placed on physical design. The purpose of the test was to select from the models submitted, the superior features of each and to combine these, if possible, into a complete unit. With this theoretical unit as a basis, a new set of specifications will be written.

N-100
Interim Report Test of Oxalid Printer-Developer, Jul 1952, R. G. Fitzsimons

Tests were conducted on an Ozalid printer-developer. The test model was an experimental 30-in. machine with end covers, doors, and burner duct assemblies similar to those of the Ozalid OM model. The unit was tested for its adaptability to advanced base use with two objectives in view: (1) check of physical characteristics including ease of

operation, maintenance, and spare parts required, and (2) determination of the best types of sensitized papers to be used at advanced bases.

N-101
Test of All-Purpose Crawler Track Mounted on D-8 Tractor, Dec 1952, A. G. Schlee

The purpose of this project was to investigate the design of an all-purpose crawler track, to develop the resulting design into a working model, and to test the model under all conditions normally met in the field.

The final phase of the test was conducted with a Caterpillar, model D-8 tractor, with modified tracks. After performing tests in various types of terrain it was concluded that the design of the all-purpose track is not practical for use by the Navy.

N-102
Cold Weather Trail and Livability test of Mark III Wanigan, Jul 1952, R. D. Hill, A. J. Ameel, A. B. Bruck

The Mark III wanigan was designed to provide complete messing and billeting facilities for a sled crew or a small group of men on detached duty. During the 1950-51 test season, the ease of erection and the suitability of the wanigan as mobile living quarters was determined at the Arctic Test Station. Based on the interim report written after the completion of this phase of the test, a revised list of collateral equipment was drawn up and a new interior layout was designed. The trials conducted during the 1951-52 season, which are discussed in this note, determined the suitability of the new collateral equipment and interior layout of the Mark III wanigan in providing satisfactory mobile living quarters.

N-103
Protective Coatings for Steel Tank Exteriors, Jul 1952, G. D. Carpenter, W. L. Starr, ATI209758

The purpose of this project is to determine whether a white or an aluminum paint is more economically desirable as a storage tank coating. The problem originated when experimental tests of the Shell Oil Company found that white paints reduced evaporation losses with substantial financial savings. In making this evaluation, four factors were considered: (1) reflectance of solar radiation, (2) durability, (3) appearance, and (4) initial cost. An investigation of the available experimental data found white paints to be superior in reflectance but inferior in durability and appearance. The initial cost per square ft was found to be approximately the same for both types of paint. It was concluded that in the storage of volatile solvents substantial savings could be gained by using exterior white paints. However, in the storage of crude oils, aluminum paints have been found to be more suitable because of their superior durability.

N-104
Electrolytic Derusting, Mar 1952, D. S. Clemetson, L. J. Hrusovsky, H. L. Gotoff, J. P. Hall, ATI209759

The purpose of this work was to determine the optimum conditions for economical operation. Most efficient descaling was achieved when the operation was performed in two steps. In the first step, seawater was used as the electrolyte while the red rust was being removed. Acid was added for the second step and the process continued until a clean surface resulted.

N-105
Ingersoll-Rand Impactool, Model 34U, Jul 1952, A. G. Schlee, ATI209760

All tests indicate that the tool is suitable for the intended purposes, and would be a valuable addition to heavy repair kits. It is recommended that the tool be accepted for heavy construction equipment repair and maintenance and that it be added to standard battalion allowances P1 and P1A.

N-106
Oil-Slick Removal by the Absorption Method, Aug 1952, S. J. Weiss, C. W. Davis, ATI209761, PB154648

An oil-slick removal machine employing an endless felt belt was designed and constructed by the NAVCERELAB, Port Hueneme, Calif. Operational tests of this machine have demonstrated that this method of utilizing the absorption characteristics of felt is not an effective manner of oil-slick removal, primarily because the wave action set up by passing water-borne traffic causes surging of the belt and repulsion of the oil slick. No further action is recommended.

N-107
Traction Tests in Snow at the Sierra Test Site, Feb-Mar 1952, Mar 1952, S. J. Weiss, AD56801

On the basis of quantitative field testing in the limited environmental condition of the Laboratory's snow test site, it was demonstrated that the Tucker Sno-Cat No. 443, although weighing less than the M29C (Weasel) was able to develop the greater drawbar pull. This relative performance can be explained by the greater track contact area utilizing the cohesive component of the snow shear strength. Attempts to predict the performance of these vehicles by means of the soil truss, an exploratory trafficability instrument developed by the Laboratory, have demonstrated that the initial snow shear strength measured by this instrument is not as directly indicative of the tractive effort developed by a tracked vehicle as is the corresponding measurement in sandy soils. It is believed that the collapse in snow structure and strength subsequent to its initial loading precludes the use of this instrument in its present form for the direct evaluation of tractive performance that has been applied in the case of these soils. The comparatively high initial static strength of the snow as compared with that after the collapse of structure is proposed as a possible field of exploitation.

N-108
Evaluation of Diesel Driven Pile Hammer (Syntron Model 1417), Aug 1952, R. J. Lowe, R. C. Towne

The diesel pile hammer, model no. 1417, is a self-contained, free-piston, compression ignition unit, operating on a two-cycle principle. The ram weighs 5,400 lb, and the hammer has a total weight of 11,000 lb. The Syntron hammer with a 5,400 lb ram will drive similar wooden piles twice as fast as a conventional hammer with a 3,000-lb ram. However, due to several mechanical and design failures presently found in the hammer, it is not recommended for advanced base use. It is recommended that the Syntron diesel pile hammer be modified as described in the body of this report and that further evaluation tests be made to prepare a unit of this type for advanced base use.

N-109
Pontoon Tie-Rod Yoke, Aug 1952, F. N. Ledoux, ATI209763, PB154649

The O in C of the CONUS Detachment, Amphibious Construction Battalion One, U.S. Naval Amphibious Base, Coronado, San Diego, Calif., requested the NAVCERELAB to test experimental type pontoon yokes, A-14-X1 and AX-2, to determine the relative strengths as compared with the standard yoke, A-14. It was requested that the yokes be tested in tension and that the load be applied by A-10 bolts in a manner corresponding to their normal arrangement in a pontoon string.

N-110
Ventilation Study of a 20-ft by 48-ft Quonset-Type Building, Aug 1952, K. B. Edwards, W. Viessman, ATI209764

An analytical investigation was made of the air requirements for a 20 by 48-ft quonset-type building. This building, designed for 16 men in temperate climates, was found to require 3.16 air changes/hr, or 400 cfm when the differential temperature of inside and outside air is 10F

and the wind velocity is 5 mph. For short periods of no wind, the ventilation system should be designed to provide a minimum of 120 cfm. Tests on a 20 by 48-ft quonset-type building having one 16-in. roof ventilator with transition piece and adequate air intake louvers in the lower panels of the doors indicate that side windows need not be operable in temperate climates. End windows that can open would provide against adverse conditions which may be experienced in the temperate zone.

N-111
Preliminary Studies of the Use of Concrete as a Jacketing Material for Timber Piles, Aug 1952, L. J. Walker, AT1209765, PB154650

One of the problems regularly brought to the attention of BUDOCKS through periodic surveys of the condition of waterfront facilities is the requirement for repair or rehabilitation of those structures. One of the major causes for concern is the damage to timber piling attributed to the marine borer. This report considers the feasibility of rehabilitation of such structures by jacketing the individual piles with concrete. The cost of such work is dependent upon conditions at the site and upon the method used. In actual practice the cost has ranged from $4.00 to $34.00/lineal of pile. As originally outlined, the Laboratory was to investigate and determine the most economical method of jacketing timber piles. However, funds were limited, and no field tests were undertaken. A literature survey was made of the subject, and this technical note summarizes the pertinent data from that search.

N-112
Aluminum Foil as a Roofing Material, Aug 1952, K. N. Hellberg, C. R. Freberg, AT1209766

In order to determine the suitability of 0.004-in.-thick embossed aluminum foil as a roof capping, sections of the roof of an existing structure at the former NCEL, Solomons, Md., were resurfaced with single-ply aluminum foil, three-ply aluminum foil, and conventional asphalt and gravel.

It was found that the unit cost of resurfacing the various roof test sections was about the same for the single-ply aluminum foil and the asphalt and gravel, and about 50% higher for the three-ply aluminum foil roof. Therefore, on a strictly cost basis, the single-ply aluminum foil compares very favorably with asphalt and gravel and is considerably lighter. The experience and preference of the contractor and availability of materials could, of course, be the deciding factors in obtaining an installation at minimum cost. Data obtained from the thermal performance tests indicate that the temperatures under the roof were less with the single-ply aluminum foil surface than with the three-ply foil surface and that temperatures were the highest under the asphalt and gravel test section.

N-113
Classified Title, Aug 1952, N. M. Donaldson, R. L. Alumbaugh, Secret

N-114
Modified Anderson-Nichols Corner Wedge Connector for Pontoon Assemblies, Jul 1952, R. C. Towne

The corner wedge connector, which is handled as one piece, consists of three principal parts: the base assembly, a cam, and a shoe. Operation is accomplished by rotation of the cam which wedges the base assembly against the pontoon angle wedge bar and the shoe against the pontoon wedge guide. The corner wedge connector is suitable for adoption if modifications described in the body of the report are accomplished.

N-115
Interim Report Godet Portable Incinerator, PIG P-1, Jan 1953, N. G. Pittsimmons, R. A. Jerney

The 600-lb-capacity Rinle P-G 6-P portable incinerator, built by the Godet Incinerator Co., Chicago, Ill., was tested for advanced base use at the NAVCENELAB. The incinerator did not operate at rated capacity at any time during the test, although, on smaller loads, the combustion was excellent with little smoke and odor. However, the unit failed structurally before all tests were completed. This unit, as presently constructed, is not recommended for advanced base or polar camp sanitation use.

N-116
Final Report on Testing and Evaluation of Automatic Cut Off Compressed Air Hose Couplings, Apr 1953, N. G. Pittsimmons

Tests were conducted on compressed air hose couplings equipped with automatic cut-off which would prevent the air hose from whipping when the connection was broken. Tests indicated that the use of automatic cut-off-type couplings for use on compressed air hose, using 95 to 120 psi was entirely feasible, and eliminated dangers inherent in the standard types of couplings due to hose whip when coupling is accidentally broken.

N-117
Development and Evaluation of 500 Gallon Arctic Water Carrier, Mark III, Jul 1953, J. C. Senn

The water carrier Mk I was inadequately protected against freezing, structural shock, and fire damage, and was too bulky and heavy for shipping economy. The Mk II carrier was satisfactory structurally, but the heating system was unsuited to the rigors of Arctic operations. Complete reports on these carriers are given in A.T.S. Report Water Carrier, Arctic (1950) NAI-050-0013 dated 12 Apr 1950 and NAVCENELAB Technical Note N-088, Cold Weather Test of Water Carrier, Mark II, dated 1 May 1952. This report covers further development of water carriers and tests performed on the Mark III unit at the Sierra test site during the winter of 1952-53.

N-118
Winterization of International Harvester TD-24 Tractor, Oct 1952, R. W. Hill, A. J. Ameel, J. N. Dawes

A winterization kit was fabricated by International Harvester Company for a TD-24 tractor in accordance with specifications given by the Laboratory, under Project NY 012-138-12. This project was undertaken to evaluate the usefulness for Arctic operation of the following winterization kit components: (a) engine coolant heaters, (b) operator's cab, (c) engine enclosure, (d) tracks and track accessories, and (e) engine priming system.

N-119 - Not Published

N-120
Interim Report, Performance Tests of Low Bed Trailer, Model A-10, Nov 1952, A. G. Schlee

The Laboratory tested the Stauffer low bed trailer to determine the adaptability of the unit for transporting materials and equipment in advanced base areas. It was further requested that the Laboratory determine if the advantages of a light low bed, operated economically and speedily, outweighs its disadvantage of not being able to haul heavy loads.

N-121
Evaluation of the Allis-Chalmers Model HD-20G Tractor Loader, Nov 1952, A. G. Schlee

Performance tests with the tractor loader were conducted at the Laboratory and at the Rose Valley test site, and its adaptability for Navy use determined. Testing

covered a period of 350 hr of operation under varied conditions. The unit operated satisfactorily in dry soils but had difficulty negotiating wet, muddy terrain. This was due to the excessive weight of the unit as well as to the use of street pads instead of grousered tracks. The unit is both mechanically and structurally adequate, and maintenance and repairs are considered negligible. However, because of its excessive weight, it is not recommended as an all-purpose, heavy-duty tractor loader for adoption within the Navy supply system.

N-122
Preparation and Properties of a 4% Sodium Hypochlorite Solution, Nov 1952, H. M. Donaldson, E. R. Holden

As a part of a study of AW, BW, and CW decontamination, designed to increase effectiveness and decrease dollar expenditure, Project NY 300-010 deals with the development of a field device capable of delivering alkaline BW- and CW-decontaminating solutions with a 4% available chlorine content. Prior to the initiation of studies in this Laboratory, Wallace and Tiernan, under contract with BUDOCKS conducted certain exploratory studies on the injection of chlorine into sodium carbonate and sodium hydroxide streams on both a laboratory and pilot-plant scale. Initial studies by this Laboratory deal with the practicability of producing 4% available chlorine solution by injecting chlorine into sodium carbonate feed streams in accordance with the requirements of Phase I of this problem. Though the manufacture of sodium hypochlorite from sodium hydroxide and chlorine has for years been carried out under controlled conditions on an industrial scale, little has been reported on the use of sodium carbonate as the alkaline feed for such a process.

N-123
Tests on 200 gph Cleaver-Brooks Distillation Unit, Production Model (720-hr Sea Water Endurance Test), Nov 1952, J. S. Williams, AT1209774

A 720-hr run on sea water was started on 25 Mar 1952. The test was terminated after 703 hr to make room for the 85-gph unit which carried a high priority. The capacity and economy were high enough at this time to preclude any doubt that specifications could be met for 720 hr.

N-124
Split-End Bearing Pile, Jan 1953, U. W. Stoll, AT1209775

The theory of the split-end pile as developed by the writer entails driving the pile to a desired depth and then flaring the tip to increase the end bearing area. Essentially, the function of such a device is to achieve a maximum of effective end bearing area with a minimum of required driving effort. That such a driving and flaring procedure is feasible was demonstrated in a previous investigation of a soil anchor made of 2-in.-diam pipe. When the load on the split-end pile was decreased from 20,000 to 10,000 lb, the recovery movement of the pile and sand was 0.025 in. In case of the 8-in.-diam disk, a load decrease from 3,500 to 1,700 lb resulted in a recovery of 0.017 in. Though no pull-out tests were performed in this investigation, the split-end pile would be inherently superior to the ordinary bearing pile in resisting upward forces.

N-125
Heating Arctic Huts, Jan 1953, S. Giles, R. F. Law

Reports of operations in polar areas emphasizes the inadequacy of present methods of heating personnel living quarters. The purpose of this investigation was to establish design criteria and equipment specifications for Arctic heating systems and to develop a heating system that will (1) minimize temperature stratification, (2) start easily in -65F temperatures, (3) operate with some degree of efficiency in the event of a power failure, and (4) be lightweight, rugged, and inexpensive. From the test results, it was concluded that the most effective heat distribution would be provided by a heating system containing two 50,000 Btu/hr, radiant-type, oil-fired space heaters in combination with two 2,500 cfm, propeller-type ceiling fans located over the heaters.

N-126
Cathodic Protection Studies on Drydock Hulls, Nov 1951-Nov 1952, Jan 1953, W. A. Bowen, P. M. Grant, AT1209776

During the 12-mo period of Nov 1951 to Nov 1952, cathodic protection systems were installed on the AFDB-4, a 7-section drydock, and the AFDL-20, a 1,000-ton drydock. Together with the AFDL-12 system installed in Nov 1950, the underwater hulls of three ships are cathodically protected and serve in a study to determine (a) relative efficiencies and costs of the magnesium and graphite anode systems, (b) influence effects of neighboring independent drydock systems, and (c) a solution to the problems of multiple hulls in a common system.

N-127
Determining Reflection Coefficients by Multiple Reflection, Jan 1953, W. A. Bowen, D. B. Wright

A multiple reflection method for determining the reflectivity of extended surfaces at microwave frequencies was devised in a study of countermeasures which may be used to reduce the susceptibility of shore establishments to attack by guided missiles. Reflection coefficients of engineering value are obtained. The method utilizes standard laboratory equipment and straightforward procedure.

N-128
Radio Interference Suppression of a Prosperity No. 2C-JR Laundry Washer, Feb 1953, A. M. Intrator, E. D. Pettler, AT1209777, PB154651

Measurements indicated that approximately every 20 sec (the time point at which the motor was reversed), narrow high-intensity pulses were radiated from the laundry washer. The magnitude of the pulses was of the order of 10^{5} mV/m at frequencies of 200 kc to 20 mc, measured 5 ft from the machine. The high-intensity pulses were found to be caused by transients resulting from switching of the reversing contactors. It was found that the switching transient interference does not lend itself to elimination by the methods presently used in radio interference suppression. The problem involves reducing the steepness of the wave front caused by the relay or switch. The use of either lossy lines or nonlinear resistors was considered. Only the latter was considered to have promise. It is suggested that the reversing action needed for the washing drum be obtained through mechanical drive, thus eliminating the switching transient.

N-129
Experimental Skis, Toboggan and Track Attachments for 6x6 Cargo Carrier, May 1953, G. W. Burton, C. T. Radecki

This Technical Note is a report of informal field testing of traction aids for a 2-1/2-ton 6x6 cargo carrier conducted during the winter 1950-51 operation of the Arctic Test Station, Point Barrow, Alaska. It is concluded that the use of toboggan or ski attachments at the front of the vehicle actually reduces the overall performance while the use of either commercially available or expedient tire tracks on either the rear wheels alone or on both front and rear wheels materially increases the overall performance.

N-130
Evaluation of Low-Temperature Hydraulic Hose for Construction Equipment, Dec 1952, J. C. Senn, AD55533

The Laboratory was requested in BUDOCKS letter NT4-59/A1-1, P-320 ODC/SP, dated 2 Mar 1948, to execute POO 22-137 PA, Hydraulic Hose, Low Temperature Test of. It was suggested in this order that since field reports had indicated unsuitability of standard hydraulic hoses in Arctic operations, tests should be performed to find a hose suitable for this work.

N-131
Protection of Pump Impellers With Synthetic Rubber Coatings, Mar 1953, W. R. Boren, AD481683

An investigation was made to procure factual data on the durability and efficiency of synthetic rubbercoated impellers for drydock pumps handling silt and sand-laden salt water. Preliminary comparative tests were conducted on 21 different coatings. The five that showed the most promise are brush-on neoprene compounds.

N-132
Interim Report, Testing and Evaluation of Oil-Fired Galley Ranges and Ovens, Including Burners Used Therein, Sep 1952, R. G. Fitzsimons

Due to early and frequent failure of regular stock equipment, it was proposed that several competitive ranges and ovens be procured and tested in the CBC galley, utilizing military personnel. It was felt that the equipment installed there would be subjected to conditions which exist in the field. It was further suggested that the equipment secured should be equipped with various types of burners and that the project should have a dual purpose: (1) to study the range and oven construction and (2) to study the best adapted type of burner.

N-133
Cold Chamber Tests of Winterization Kits on a Willys 1/4 Ton Truck (Jeep), Sep 1953, E. J. Beck, K. N. Tinklepaugh, AD76691

This report covers the testing at NOTS All Weather Test Chamber of three configurations of heating kits. All were applied to the same vehicle, the test jeep, which came equipped with an aluminum cab. Varied in the three tests were: engine heaters and method of connection, personnel heaters, battery boxes and temperature control system, oil pan shrouds (for heating engine oil with heater exhaust), engine enclosure insulation, and priming system. Schematic representations of the engine and battery heating arrangement are shown in Figure 3. Descriptions are given in Table A with references to figures.

N-134
Wilcox Drilling Tool, Mar 1953, J. S. Williams, L. L. McIntyre

BUDOCKS requested in their letter P-311E/KN NP/Pt Hueneme/N8 dated 21 Feb 1952 that a percussion-type drilling tool be tested and evaluated by the Laboratory. The first tests were made on the base at the location used by the schools for drilling instruction. This was an ideal spot to compare the performance of the Wilcox tool with the conventional bit in soft, caving formations. At the conclusion of the tests on the base, the equipment was moved to the Laboratory test area at Rose Valley. Here, hard shale and rock were encountered which provided very rigorous test conditions.

N-135
Interim Report on Test and Evaluation of Murray and Tregurtha Model O-A31 Propulsion Unit, Jul 1953, A. G. Schlee

Tests were made of the propulsion unit to determine the suitability of the unit for harbor use. Tests were run over a measured mile course at sea, using one unit on a 3x7 pontoon barge and two units on a 3x12 pontoon barge. These tests were run with and without payload. In addition, Bollard pulls were made in the harbor and towing tests were made at sea. It is concluded that the unit is suitable for harbor use and with modifications would be suitable for amphibious use.

N-136
Adhesives for Applying Aluminum Foil, Apr 1953, J. V Stalcup

As part of the BUDOCKS program to investigate moisture vapor barrier materials, project NY 530-007-1 was initiated at the NAVCERELAB, Port Hueneme, Calif., to test and evaluate under natural weathering conditions, commercially available adhesives for cementing aluminum foil to interior vertical cement asbestos board walls.

N-137
Zinc Sprayed Coatings, Current Status in Marine Applications, Apr 1953, E. R. Holden, AT1209677

A review of the literature and current developments in the field of zinc-spraying has been made. While numerous types of applications can be cited, in that they have been fairly widely publicized, as yet the results of specific evaluative tests that are available are inadequate. In an effort to appraise their possible usefulness, the properties of zinc coatings as applied by other methods are discussed. The practicability of zinc-sprayed coatings depends much on the nature of the maintenance problems involved.

N-138
Mark III Snow Melter, Apr 1953, K. N. Tinklepaugh

A large portion of the energy consumed by a diesel engine is wasted in the exhaust and coolant. The Mark III snow melter is designed to utilize this waste heat for melting snow or heating water. Heat transfer criteria, calculations, and data controlling the design of this melter will be found in the appendix. It is concluded that this snow melter when connected to a 50-kW generator, and loaded by one man, will produce an average of 145 gal/hr of water from snow, without undue physical labor or excessive attention on the part of the operator. Modifications should be made in pipe size and number of immersion heaters to accommodate generators of different sizes and characteristics.

N-139
Time Studies on the Erection of the U.S. Navy Standard Arch-Rib Prefabricated Steel, 20-ft by 48-ft Building, Mar 1953, G. B. Schaefer, AT1209679, PB154652

This report covers the manpower needs and time requirements for the erection of the Navy standard arch-rib prefabricated steel 20 x 48-ft building. The investigation was divided into two parts: the first consisted of establishing the number of men required for the most economical erection team, and their required training; the second consisted of establishing normal times for the erection of the building using repetitious erections for each component and overall erection manhours.

N-140
Evaluation of a 20-ft by 48-ft Modified Standard Arch-Rib, Prefabricated, Metal, Northern Type, 5-ft 4-in. Module Building, Manufactured by the Great Lakes Steel Company, Stran-Steel Division, Detroit, Mich., Apr 1953, W. R. Mason, P. J. Rush, A. B. Bruck, AT1209681

This Technical Note covers the evaluation of a modified standard, arch-rib prefabricated metal building, designed and fabricated by the Great Lakes Steel Corporation, Stran-Steel Division, Detroit, Mich. The main purpose of this design was to incorporate as many savings in steel-weight as possible on the standard building. Studies and tests to determine the ease of erection, structural adequacy, weathertightness, and adequacy of packaging and crating were made by the Laboratory under Project NY 500-002-17 authorized by BUDOCKS.

N-141
Evaluation of a 20 by 48-ft Straight-Sided, Shed-Roof, Prefabricated, Wooden Emergency Mobilization Unit, Designed and Fabricated by the J. B. Pierce Foundation, Raritan, N. J., Apr 1953, W. R. Mason, J. K. Schroeder, AT1209682

This technical note covers the evaluation of the straight-sided, shed-roof, prefabricated wooden, emergency mobilization unit designed and fabricated by the J. B. Pierce Foundation of Raritan, N. J. Studies and tests to determine the ease of erection, structural adequacy, weathertightness and adequacy of packaging and crating were made at the Laboratory under Project NY 500-002-21, authorized by BUDOCKS.

N-142
Evaluation of York Flakice Machine, Model DER-13, May 1953, P. D. Courter, J. K. Halton

As a part of a program to secure practical methods, materials, techniques, and equipment for obtaining dependable refrigeration equipment for the Navy, the York Flakice Machine Model DER-13, was tested under Project NY412-017-2, NAVCERELAB, Port Hueneme, Calif., to determine the suitability of the machine for advanced-base use and to furnish data for the improvement of procurement specifications for this type of machine.

N-143
Evaluation of a 20 by 48-ft Straight-sided, Gabled-Roof Prefabricated, Wooden Emergency Mobilization Unit, Manufactured by the Home Building Corporation, Sedalia, Mo., Aug 1952, W. R. Mason, J. K. Schroeder, AT1209684

This report covers the evaluation of a straight-sided, gabled-roof, prefabricated, wooden building manufactured by the Home Building Corporation of Sedalia, Mo. Studies and tests to determine the ease of erection, structural adequacy, weathertightness and adequacy of packaging and crating were made at the Laboratory under Project NY 400 002-23, authorized by BUDOCKS. In addition to the primary studies, nine buildings of this design were procured for in-service testing. Results of these tests will be covered in a later report.

N-144
Final Report, Testing and Evaluation of American Laundry Machinery Company Prototype Combination Washer-Extractors and Stock Drying Tumblers, Feb 1953, R. G. Fitzsimons, J. Graham

This test was conducted as part of the program on the development of new portable laundries. A Hoffman 75-lb standard advanced base stock laundry unit was used for comparison. Soiled swatches of the multiple wash variety and the single wash type were secured and the difference in light reflectancy measured. Based on results obtained in the tests, both the 7050-LB and 100-LB prototype combination washer-extractors, manufactured by the American Laundry Machinery Company, are considered to have given satisfactory performance with preference being given to the 100-LB unit since it has the greater capacity and can also wash small amounts of clothing.

N-145
Heating and Ventilating Arctic Huts, Jun 1953, R. F. Law, AT1209686, PB154653

Variations of the system were service-tested in a 20 x 48-ft personnel building at the Sierra test site during the winter of 1952-1953. The variations consisted of relocation of the circulating fans, reduction of the circulating fans capacity, adaption of a thermostatic temperature control to the system, and relocation of the ventilation equipment. From the test results, it was concluded that the most efficient operation is obtained by suspending a 2000-cfm propeller-type circulating fan from the ceiling and directly over each heater. The heaters should be of the 50,000-Btu/HR radiant-type space heaters with vaporizing pot-type oil burners. Heaters should also be equipped with a mechanical thermostat. The ventilation equipment should consist of a 300 cfm exhaust blower and a 6-in.-diam intake vent.

N-146
Investigation of the Kenn Ammo Unit, May 1953, C. K. Wiehle

The Kenn Ammo Unit was constructed and tested by the laboratory to determine its adaptability for advanced base use. Pneumatically applied mortar was used in conjunction with the Kenn formwork to construct the magazine. Tests were then conducted to determine watertightness and strength of the structure. From this investigation it was found that the magazine was not structurally adequate and was not waterproof. In addition, to utilize the floor space to the maximum would necessitate a modification of the parabolic arch shape to produce greater headroom in the vicinity of the arch springing.

N-147
The Development and Preliminary Field Testing of Liquid Chlorine Infuser, Model No. 1, Jun 1953, H. M. Donaldson

The design, fabrication, and preliminary field testing of model No. 1 liquid chlorine infuser is described. Model No. 1 liquid chlorine infuser is a device which continuously generates sodium hypochlorite by passing a mixture of liquid chlorine and soda ash solution through an orifice plate mixer. Generated at the rate of approximately 25 gpm over an ambient temperature range of 58F to 75F, the resulting sodium hypochlorite solution is of uniform and controllable quality of approximately 4% available chlorine and in the desired pH range 8.0 to 9.0, as described in NAVCERELAB Technical Note N-122, Nov 1952.

N-148
Principles of Infrared Camouflage for Low Temperature Targets, (U), July 1953, W. L. Starr, K. R. Streed, A. I. Funai, AD139720, Confidential

N-149
Slippage of Split-Ring Connector Joints in Unseasoned Lumber, May 1953, P. J. Rush, AT1209689, PB154654

Two Groups, comprising 16 specimen joints in each, were subjected to sustained loadings for periods of 60 and 90 days, respectively. Specimen lumber for the 60-day test period was unseasoned Douglas fir stock obtained from a commercial yard, while specimen lumber for the 180-day test was obtained from fresh cut Douglas fir logs brought from Ore. Control specimens, of seasoned Douglas fir lumber obtained from the CBC yard, were used in both 60 and 180-day tests. Both sets of specimens were instrumented to provide information regarding temperature and humidity fluctuations, moisture content changes, dimensional changes, and displacements in joints. Data obtained from the experiment is presented in tabular and graph form.

N-150
Stabilization of Beach Sand With Emulsified Asphalt, Jun 1953, J. A. Bishop, A. S. Rummelsburg, AT1209690

The primary purpose of the work described herein was the determination of the feasibility of providing a stabilized surface of beach sand through (1) the use of emulsified asphalt, (2) the mixed-in-place procedure, and (3) compaction by traffic of the stabilized area. The area so stabilized was planned to facilitate the crossing of a beach area by vehicles during the off-loading phase of an amphibious operation conducted at Camp Del Mar, Calif., during Apr-May 1953.

N-151
Conditioning Water With the Butler Electronolytic Descaler, Jul 1953, J. H. Strimple, G. K. Sanford

Butler electronolytic descalers have been examined for their ability to prevent scale. Even under severe operating

conditions beneficial effects were produced. It is concluded that these effects may justifiably be attributed to action of the descalers. Attention is directed to the fact that blow-down plays an important role in successful usage under severe conditions.

N-152
Advance Base Waste Disposal, Jul 1953, W. R. Nehlsen

This study covers the basic requirements of waste disposal and equipment that may be of value in reducing the cost of waste disposal at advanced bases. Equipment developments which may provide more satisfactory waste disposal are: (1) garbage grinders for advanced base galleys, (2) a package-activated sludge sewage treatment plant, (3) a proprietary high-rate sludge digestion process, and (4) a barracks aeration unit waste disposal system.

N-153
Final Report on Capacity Test of a 10,000 Btu Refrigerating Unit, Electric, Plug-in Type, Victor Products Corporation, Feb 1953, R. N. Lesseberg

The project of testing and evaluating the Victor Products Corporation 10,000 Btu refrigerating unit, electric, plug-in type, Contract no. N160S-7765(52), for use with 675 and 6,800 cu ft prefabricated sectional, walk-in type refrigerator cooler boxes was assigned by BUDOCKS letter P-311F/AO, NP/PT Nuenome/N8 dated 30 Jun 1952. The test was conducted primarily for determining the capacity performance of the Victor plug-in type refrigerating unit as specified in Military Specification MIL-R-15997(DOCKS) dated 15 Jan 1951 and exceptions as amended.

N-154
Interim Report Boiling-Condensing (Vapor Phase) Cooling Systems on Internal Combustion Engines, Jul 1953, K. N. Tinklepaugh, E. J. Beck

The results of testing and evaluation to date indicate that a boiling-condensing cooling system is a definite improvement over conventional cooling systems for operation of equipment at all temperatures from -65F to +165F.

N-155
Evaluation of General Motors 41-DC Engine-Generator Set for Electric Starting of Vehicles, Jul 1953, J. C. Senn, ATI209725

The General Motors model 41-DC engine-generator set, known as Little Joe, is intended for use in cranking vehicles with dead batteries and for drying and heating engines, radio sets, etc. This set was primarily intended for use under conditions encountered in amphibious operations. The laboratory was requested by BUDOCKS to evaluate the set for possible acceptance as standard equipment in BUDOCKS Letter P-311C/ZR LS of 24 Jul 1952.

N-156
C.E.P.I. Water Treating Device, Jul 1953, J. P. Hall

Two C.E.P.I. (Conditionnement Electromagnetique Par Induction) devices were investigated for their ability to reduce the hardness of water. No significant reduction in hardness was achieved by use of the devices.

N-157
Formaldehyde Dispersal, Jul 1953, M. M. Donaldson ATI209727, PB154655

A study was made of both chemical and physical means of dispensing formaldehyde for interior disinfection. A commercially available insecticide sprayer (Midrosol Fog Generator, Model 202) was studied for its ability to spray formaldehyde. Preliminary studies indicate that the commercial model can be adapted to Naval shore establishment use and readily adapted to spray directly from 5-gal storage cans. Chemical methods were studied for ease and safety. Methods which involve the use or possible use of standard Navy stock chemicals were screened for possible utilization.

N-158
Universal Prefabricated Wiring Harness, Jul 1953, K. D. Pottler, ATI209728, PB154656

There are available from manufacturers of electrical cables and building wire, insulating compounds that will prove satisfactory at the temperatures that could be expected in the Arctic regions. The problem then resolves itself to one of designing an electrical distribution harness that will require a minimum of tools and can be applied to the structure with as little exertion on the part of the mechanic as possible. This harness should be so designed as to be universal for all sizes and shapes of structures. A polarized plug-in system is used to make it possible for inexperienced personnel wearing Arctic clothing to easily install this type of wiring system by simple written instructions that would accompany the component parts. Most of the components are prewired with the conductors insulated with a relatively inexpensive compound. It is recommended from the findings of the tests and investigation that prototype harnesses be fabricated and evaluated at Arctic advanced base test sites.

N-159
Static and Dynamic Studies of Three Personnel Shelters; Armco II, Structure 3.15, Structure 3.13A, Jun 1953, J. R. Allgood, C. K. Wiehle, W. A. Shaw

The purpose of this project is to obtain test data that will permit the determination of the optimum depth of earth cover for surface structures subjected to atomic blast. To obtain this data, the intent is to correlate shock load-test response with full-scale atomic blast response of certain structures. In particular, it was desired to obtain (1) strains and deflections of the structures caused by various depths of earth cover, (2) the effect of various depths of earth cover on the damping and frequency of the shock-loaded structures, and (3) the response and strains caused by blast loading. It is hoped that such knowledge will permit the development of an analytical method of predicting the response of earth covered structures. This report covers the pre-blast static tests and shock-load pull tests of two corrugated steel-arch personnel shelters and a precast, reinforced-concrete, gable-bent personnel shelter. Also included are the response, strain, and damage survey data from one of the steel-arch personnel shelters obtained during OPERATION KNOTHOLE. These tests, together with basic data reduction, were performed by the Laboratory in cooperation with Stanford Research Institute (SRI) under Project NY 340-010-4, authorized by BUDOCKS. Data evaluation and analytical studies are to be subsequently conducted by SRI.

N-160
Packaging of Formaldehyde for Decontamination, Nov 1953, A. L. Fong, ATI209729, PB154657

A study was made of the important factors in packaging and shipping of 40% aqueous formaldehyde solutions. The results of this study constituted the basis of formulation of minimal standards for packaging and shipping specifications of such solutions.

N-161
Final Report on Ray Oil Burner Company and Klisha Webb and Son Galley Ranges, Jul 1953, R. G. Fitzsimons

No defects of deterioration occurred in either the Ray or Webb ranges or burners during the testing period after they were properly adjusted. Structurally, either make is satisfactory. From an operational standpoint, however, the Webb is much easier to handle, had no flame failures, and is much more economical. It is also considerably lighter in weight. Consideration should be given to the fact that they will not operate without electrical power and that trained technicians should be available for repair work.

N-162
Final Report on Viking Model V10-434-03 and Special Automatic 72-Inch Four Compartment Bake Ovens, Jul 1953, R. G. Fitzsimons

The insulation, draft, heat distribution, and general principles of construction of the subject ovens are considered satisfactory, but modifications as covered in the discussion section, should be made in future procurement to secure better baking results, less repair and cleaning work, and longer life of the unit.

N-163
Winterization of CB Equipment, Heat Requirements for Engine Heating, Sep 1953, E. J. Beck, AD76692

During the last 6 mo of 1951, considerable data were accumulated on engine heating at the Laboratory. Realizing that methods in vogue in military establishments require individual acceptance tests on each engine-engine heater combination, it became apparent that if sufficient test data could be compiled on various engines and heaters an accurate prediction could be made of what a given heater might do on a given engine without resorting to an expensive test.

N-164
Final Report on Testing and Evaluation of Stamford Manufacturing Company Oil Burner Galley Ranges, Jul 1953, R. G. Fitzsimons

Interim report, Technical Note N-132 outlined the details of test site, instrumentation and various points regarding various ranges. This report discusses conclusions reached after 1,800 hr of test operations.

N-165
Final Report on Testing and Evaluation of Viking V27-03 48-in. Single Oven Galley Range, Jul 1953, R. G. Fitzsimons

This is another report in a series on testing of galley ranges. Conclusions are stated regarding the particular make of range tested.

N-166
Final Report on Anderson-Nichols Partially Knocked-Down Pontoon Jig, Sep 1953, R. C. Towne

Anderson-Nichols and Company, Boston, Mass., under contract by BUDOCKS, prepared a design for a partially assembled To-B pontoon which would save one-half the shipping cubage of the present pontoon and which could be expanded and field-welded at an advanced base so that final dimensions would be identical with the present To-B pontoon. Preliminary assembly tests, reported in NAVCERELAB ltr Serial 1054, dated 1 Aug 1952, confirmed the feasibility of field-welding the pontoons; however, 22-1/2 manhr were required per pontoon. An Anderson-Nichols designed assembly jig was subsequently furnished the Laboratory for assembling the partially assembled pontoons. Planned production rate by Anderson-Nichols in their planning analysis was one completed pontoon per 6 manhr.

N-167
Investigation of an Airform Ammunition Magazine, Aug 1953, C. K. Wiehle, AT1209732

A reinforced concrete-arch ammunition magazine was designed, constructed, and tested by the Laboratory to determine its adaptability for advanced base use. The magazine was constructed by the airform method, which utilizes the application of pneumatically placed mortar directly onto a pneumatic form.

N-168
Model Studies of Tramway Cable Tension Controllers, Oct 1953, W. F. Burkart, D. A. Crane, AT1209733, PB154658

During amphibious warfare operations it may be desirable to transport cargo from ship to shore over barrier reefs or other adverse beach conditions which limit the use of landing craft. The Laboratory is developing a ship to shore tramway system as a method of moving materials over such obstructed beaches. The studies were begun under Project NY-122-005 and are being continued under Project NY-510-016. This technical note reports further model studies in which attempts were made to control the line tension using, (1) an electric differential drive; (2) an electromagnetic, dry fluid clutch; (3) a counterweight; and (4) a cable anchorage independent of the simulated ship. No attempts were made to evaluate components of the systems for durability and dependability.

N-169
Stability of Solutions of Commercial Bleaching Powders, Nov 1953, A. L. Fons, AT1210208

A report on the stability of solutions of commercial calcium hypochlorite bleaching powders with special emphasis on (1) concentration, (2) hydrogen ion concentration, (3) temperature, (4) metal ions, (5) type of water, and (6) the effect of temperature and humidity on the bleaching powder.

N-170
The Resistance of Panels to Static and Dynamic Loads, (U), Nov 1953, J. R. Allgood

A study has been made with the objective of interpreting recent full-scale blast and static load test results of precast panels. An effort has been made to correlate these results with a currently accepted theory of structural dynamics. The various panel test results are found to be in poor agreement as are the test results and theory. Test discrepancies are explained in terms of the physical factors influencing the response of the panels. Question is raised as to the effect of modes of vibration above the fundamental on shear and moment within the plastic range.

N-171
Constant Current Device for Electrophoresis Apparatus, Feb 1954, W. A. Bowen, G. D. Carpenter, AD81146, PB154659

A system for closely regulating the direct current flowing in an electrolytic cell was devised and constructed for use with a Perkin-Elmer, Model 38, electrophoresis apparatus. A substantial increase in current stability was gained through the use of a light spot galvanometer, phototubes, amplifier and associated circuitry. A current stability at 5 mA of the order of ±0.004% was obtained as compared to the ±0.05% obtainable from the modified instrument.

N-172
Tests on Chemical Compounds Used as Corrosion Inhibitors When Applied as Floating Coatings, Nov 1953, C. V. Brouillette, G. E. Sanford, J. H. Strimple, AT1209734

In recent years industry and the Navy Department have employed a number of commercially available preparations which can be floated on compartment water and which provide corrosion prevention by coating susceptible members during the rise and fall of seawater inside ballast tanks, with a protective chemical film. Under Project NY530-001 the NAVCERELAB conducted tests of three such floating coatings. The test period lasted 6 mo, and specially designed equipment tanks afforded visual observation of (1) changes in composition or properties of the floating coatings, (2) progress of rust and corrosion inhibition, and (3) effectiveness of the coating procedure during the entire test. Chemical analyses on the products indicated (1) no anticipated harmful physiological effects, (2) fire hazard potentialities of one product (NO-OX-ID-509), and (3) approximate compositions. The 6-mo test period indicated excellent protection from all three products. Literature references cited many instances where similar preparations or compositions have been used effectively as temporary protective coatings.

N-173
Testing of Chemically Stabilized Sand During Amphibious Operations, Dec 1953, C. V. Brouillette, R. W. Drisko, AT1209735

Investigations leading to the development of chemical formulations and modifications of the wood roadmixer necessary for improved operations in soil stabilization by chemical means under simulated battle conditions have been described in some detail. Comparisons of the results of two different chemical formulations, one using heated solutions, have been shown, and an estimate of the traffic passing over the chemically stabilized roadways has been presented. Recommendations have been made for future studies of the application of soil stabilization utilizing chemical resins in amphibious operations.

N-174
An Interval Controller, Nov 1953, W. A. Bowen

In a series of tests for the determination of the dynamic response of concrete beams to varying loads, a means is required for holding the conditions invariant from test to test. The device used to control the test conditions is required to initiate a set of operations in predetermined sequence and at intervals ranging from 50 to 5,000 ms. Conventional resistance-capacitance delay circuits are known to work very reliably in the above range so their use in connection with thyratron-operated relays is suggested as the basis of an automatic control device to govern the concrete beam tests. In its presently completed form, herein described, it is called an interval controller. The interval controller was designed and built in this Laboratory as part of Project NY-400-019-1, Structural Impact and Vibration Studies. The interval controller is designed for the specific application in which three electrically controlled devices are sequentially energized and de-energized at preset time intervals. A camera and an oscillograph are used to record the dynamic response of loading a concrete beam. The load is applied and released during the recording period.

N-175
Erection and Test of 100-Ton Capacity Floating Crane, Jan 1965, J. J. Mromadik, R. C. Towne, AD81147, PB154660

The design and development of an advance base floating crane of 100-long-ton capacity was considered necessary in order to improve barge crane service at forward areas. The preliminary designs and specifications for the floating crane were prepared by BUDOCKS and a contract was awarded to the Derrick and Hoist Company, Long Island City, N. Y., for the design and fabrication of the derrick structures. Construction of the barge, assembly and erection of the superstructure, and development studies were conducted at NAVCERELAB, Port Hueneme, Calif., under Project YD 520-2.

N-176
Chemical Constituents of Creosote, Feb 1954, G. E. Sanford, AD81148, PB154661

In accordance with Project NY-450-030 which requests factual data leading to the inhibiting of marine borers, a research program on marine borer deterrents has been instituted. This report covers a literature survey made on the physical and chemical properties of creosote, the most common marine borer inhibitor now in use. Chemically, creosote is a mixture of possibly thousands of compounds. Some 220 of these compounds have been identified and are shown in this report. The compounds are predominantly aromatic - 90% or more - containing mainly hydrocarbons, phenols and homologs, and nitrogen bases.

N-177
Comparative Evaluation of Altered Anorthosite as a Pozzolan, Dec 1953, U. W. Stoll, AD81210

The pozzolans which were studied are identified in the report as to type and field performance history. Most of the test procedures were selected from the ASTM symposium on the use of pozzolanic materials in mortars and concretes and the 1949 ASTM standards. The laboratory test program yielded quantitative and comparable values for the significant properties of the pozzolans, these data are presented in the tables and figures. The discussion and conclusions forming the body of the report are based on these test data and on performance criteria established by competent authorities on the subject. In addition, information is currently being obtained on long-time concrete strength and expansion tests which will be submitted subsequently in an addendum report.

N-178
Garbage Disposal With Grinders at Advanced Bases, Jan 1954, J. J. Traffalis, AD81149

Garbage grinders are applicable to small bases having a sewage system. Their use will reduce insect and rodent problems and eliminate garbage handling outside of the galley. Use of grinders at larger bases will depend on local conditions. Recommended types and locations for use in component galleys are presented and trial installations at advanced bases are suggested.

N-179
Cathodic Protection Studies on Single and Multiple Hull Systems, Feb 1954, W. A. Bowen, F. R. Streed, A. I. Funai, AD81150

Mild steel coupons used in the AFDB-4 system indicate the rate of corrosion of underwater areas has been reduced to a negligible value. Similar coupon tests on the FDL-20 indicate a reduction in the corrosion rate of over 80%. Recommendations and plans for improving the operational efficiency and versatility of the graphite anode system as a single unit are presented.

N-180
Insulation of Underground Piping, April 1954, S. Giles, AD81201L

The field and laboratory tests and evaluations conducted have shown that there are many methods in common use for protecting underground piping from heat loss and corrosion. All these systems have limitations which make the selection of a universal insulation and corrosion protective material difficult.

N-181
Instrumentation for the Measurement of Ships and Mooring Forces at Puget Sound Naval Shipyard, Bremerton, Wash., Jan 1954, R. E. Jones, AD81202

Information is presented on instrumentation considered suitable for the measurement of the tension and compression forces on a mooring system used to berth an inactive capital size ship and on instrumentation for the measurement of the pertinent environmental factors (namely, wind, waves, tide, and current). Included are discussions of the design, installation, and functioning of wire strain gage and mechanical-type force and pressure pickups and of photographic and direct writing recorders. Methods of data analysis and correlation are not discussed.

N-182
Performance and Biological Tests of Heavy Metal Compounds as Marine Borer Inhibitors, Aug 1954, E. R. Holden, N. Hochman, T. Roe, AD108025, PB160525

Blocks of southern yellow pine were impregnated with certain soluble and insoluble salts of iron, copper, silver, cadmium, mercury, nickel, lead, and zinc. Performance tests in Port Hueneme Harbor, as a part of Project NY-450-030, indicated a relatively short service life for wood impregnated with these compounds. The soluble forms are leached out too rapidly by the sea to prevent borer attack for more than a few months. Biological tests with Teredo larvae indicated that some of the insoluble forms studied had ions that exhibited toxic properties. These forms did not provide adequate protection to be of practical use because of

their extremely low solubilities. The concentration of the toxic ion was therefore too low to have an effect on the organism.

N-183
Jet and Heavy Wheel Load Problems, Relationship Study, Mar 1954, A. S. Rummelsburg, AD81203

Included in this report are data obtained under Phase 1, Relationship Study of Project NY-420-008-1, Stabilization of Runways for Jet Aircraft. The temperatures measured at the pavement surface under various tailpipe heights and angles and at different locations along a test slab are indicated. Relationships among tailpipe height, angle of inclination, and surface temperature are established, and conclusions are drawn from these relationships.

N-184
Skylighting Patterns for Daylight Illumination of the Bureau Standard Arch Rib Steel Building, 40-ft by 100-ft, and the Bureau Standard Arch Rib Steel Building, 40-ft by 100-ft, Mar 1954, P. J. Rush, AD81204L, PB135914

The criteria used for the theoretical design and installation of various skylighting patterns are described. The methods for obtaining measurements of interior illumination and the resulting data are discussed. In order to satisfy the daylight illumination needs within these utility buildings for such separate categories of occupancy as would be involved with difficult and critical seeing tasks, ordinary seeing tasks, or casual seeing tasks, recommendations are made that kits composed of translucent plastic panels, identical in size and shape with the sheet metal sheeting panels, be made available for installation of skylighting patterns.

N-185
Piles Subjected to Lateral Thrust, Mar 1954, H. G. Mason, AD81205

The details of a test installation in which a full-scale pile was embedded in an earth fill and subjected to lateral loads are outlined. This report describes the instrumentation, including means of measuring pressures and deflections at intervals along the entire pile length. An example of the pressures and deflections obtained is presented, and a comparison is made between measured and theoretical values. Two methods of solving simultaneous difference equations such as those involved in the analysis of the problem of computing lateral earth pressures, deflections, shears, and moments along the embedded length of a pile are introduced.

N-186
Solar Turbine Experimental Slave Engine Heating and Cranking Unit, Apr 1954, J. R. Dawes, J. H. Sams, AD81206L

This is a report on an experimental slave kit designed to furnish quick starts of cold soaked engines. It would be desirable to have the following characteristics in an engine starting slave unit: (1) production of a large amount of heat, 150,000 or more Btu/hr; (2) means to heat the engine coolant; (3) means to heat the engine lube oil; (4) means to provide hot intake air to the engine being started; (5) available electrical power which can be used to crank the engine to be started; (6) as small and light as possible to facilitate handling. A small turbine developed by Solar Aircraft Company for BUSHIPS appeared to be able to produce many of these desired features for an engine starter slave unit, and consequently was obtained for inclusion and test under Project NY-012-015, winterization of construction battalion equipment.

N-187
Polar Field Repair Kit, Apr 1954, K. N. Tinklepaugh, AD81207

In order to eliminate costly delays and to insure delivery of the cargo, it was necessary to develop a mobile emergency repair kit to accompany each sled train. This development was undertaken by NAVCERELAB under Project NY-012-003-2 and later continued under Project NY-012-015, Winterization of Construction Battalion Equipment. Desirable design criteria for this kit have been developed from Arctic experiences. The kit must be versatile, extremely mobile, light-weight, compact, rugged, operational without auxiliary units, readily operable, readily closed for travel, and capable of affording adequate protection to personnel during operations.

N-188
Evaluation of a Concrete Test Hammer, May 1954, D. R. Williams, AD76693

A nondestructive concrete tester, developed by the Swiss engineer, Ernst Schmidt, was evaluated by NAVCERELAB to determine its adequacy for obtaining the approximate compressive strength of concrete in situ.

N-189
Vapor Transmission Properties of a Composite Masonry Wall, Jun 1954, R. J. Zablodil, AD81208

The purpose of this test was to develop the equipment and methods with which to determine the vapor permeance at fixed vapor pressures and dry bulb temperatures of a composite masonry wall. The wall selected is typical of some of the Navy's newer type of dehumidified warehouses and consists of a common red brick facing and a concrete block backing with mortar slushed-in between the units. This type of wall was constructed at the laboratory and the first phase of testing has been concluded. A steady rate of moisture migration has been achieved from a set point of vapor pressures. (Other phases will follow with different sets of conditions.) The first phase produced a moisture migration rate of 9.80 grains/ft sq-hr-in. HG which greatly exceeds rates presently used by designers and engineers for this type of construction.

N-190
Stabilization of Beaches by Application of Sea Water, May 1954, A. S. Rummelsburg, J. R. Keeton, AD81209

The procedure and equipment used to investigate the practicability of applying sea water to sand beaches to improve trafficability conditions are described. Several quantities have been applied to test plots and the trafficability of each as reflected by drawbar pull measurements has been determined. Conclusions have been made concerning the feasibility of this method of stabilizing beach areas during amphibious operations.

N-191
Addendum to Technical Note N-177. A Comparative Evaluation of Several Pozzolans, Jun 1954, U. W. Stoll, P. H. Petersen

This addendum presents further data on strength and shrinkage of the same concretes covered in Technical Note N-177. Additional values of relative efficiency have been computed, based on the strengths obtained at later ages. New data and the merits of pozzolans in general, particularly of those materials included in this study, are discussed.

N-192
Conservation of Cement, Jan 1956, P. H. Petersen. AD108026

For years it has been advocated that the government give adequate consideration to this national problem and that it study ways and means to assure itself and others that unnecessary waste of cement is not being tolerated. Every effort is to be employed to use this critical material to maximum advantage. It is with this latter thought in mind that the following paper is presented, giving suggestions of ways in which waste of cement can be avoided.

N-193
Evaluation of Ajax Prototype Flake Ice Machine, Jul 1954, W. B. Mitchell, M. L. Buus, AD81211

The Ajax Prototype Flake Ice Machine was tested under Project YD-412-7 as a part of BUDOCKS program to establish a qualified products list for flake ice machines. Tests performed were essentially in accordance with Military Specification MIL-T-16361B of 17 Sep 1953.

N-194
Corrosion Rates in Sea Water at Port Hueneme, California, for Sixteen Metals, Jul 1951 - Jan 1954, Oct 1954, C. V. Brouillette, (Reprinted in Corrosion, V. 14, No. 8, Aug 1958, pp. 16-21, with Discussion in No. 12, Dec 1958, pp. 69-70), AD81212

Initial work on corrosion, after the location of the NAVCERELAB at Port Hueneme, Calif., was the placing of various type metal panels into the sea water within the harbor in order to determine the severity of corrosion in this locality. On 17 Jul 1951, five panels each of 16 different metals were mounted on porcelain insulators in racks and placed in the harbor water for continuous immersion. At the end of each 6-mo period, one panel of each type metal was removed from the harbor, and the pitting and weight loss was determined. On 17 Jan 1954, the last (or fifth) panel of each metal was removed, and the corrosion losses were determined. Compared with corrosion data found in Ref 4, the results of this investigation (which continued over a period of 30 mo) indicate no unusual corrosive conditions in this harbor.

N-195
Tests of BUSHIPS Anchors in Mud and Sand Bottoms, Aug 1954, R. C. Towne, J. V. Stalcup, AD81213L, PB154662

The purpose of the tests was to provide comparative holding power data of several lightweight and Navy stockless anchors presently being utilized by BUSHIPS. This report contains a description of the tests together with the results and observations.

N-196
Evaluation of 85 gph Meco Prototype Model Distillation Unit, Jun 1954, J. S. Williams, AD81214L

As part of the program to establish a multiple source of supply for thermocompression distillation units, an 85-gph unit manufactured by the Mechanical Equipment Co., was tested at the Laboratory. The unit failed to pass the first test and was returned to the factory for modifications. The second test was passed without difficulty as far as performance was concerned. Some mechanical trouble was experienced, and this was corrected during the test.

N-197
Final Report on Test of York Flake Ice Machine, Model DER 13, Sep 1954, W. B. Mitchell, M. L. Buus, AD81215L

Technical Note N-142 of 13 May 1953 describes the pilot model DER 13 York Flake Ice Machine and early laboratory tests of the unit. This report, though concerned primarily with results of in-service tests of four model DER 13 York Flake Ice Machines, by MCB No. 7 at Guantanamo Bay, Cuba, also gives results of recent supplemental tests, by this Laboratory, of the pilot model.

N-198
Water Level and Draft Indicator Test Facility, Oct 1954, D. B. Wright, AD81216

In order to determine the operational and maintenance characteristics of water level and draft indicator systems, the laboratory staff designed and installed a test facility capable of simulating the action of docking operations upon these systems. The use of this facility permits the accelerated testing of the level and draft indicating systems with respect to maintenance requirements and operational characteristics of the system components and provides both static and dynamic conditions for test purposes.

N-199
Evaluation of Lummus Topping Plant Mark II, Oct 1954, R. B. McIntosh, AD81217L

The test runs on the Lummus Topping Plant after modifications would indicate that the unit is capable of producing fuels which are acceptable for military use at advanced bases. The modifications made and the new type burners installed, have increased the efficiency of the unit. Further improvement in the furnace draft is necessary to obtain maximum capacity of the plant.

N-200
Dynamic Elasto-Plastic Tests on Small Scale Beams, Oct 1954, J. R. Allgood, W. A. Shaw, AD50018

Phase I of an experimental test program has been completed with the objective of determining the response of small reinforced concrete beams subjected to step concentrated impulsive loads. A description is given on the test beams, the instrumentation used, and the test procedure followed. The response data is presented in tables, graphs, and oscillograms. A study has been made in an attempt to correlate these experimental results with a currently accepted fundamental mode theory of structural dynamics. It is found that the experimental results from numerous test beams are in good agreement with each other but that these results do not agree with fundamental mode theory when effects of damping are neglected. Experimental results do agree with theory when effects of damping are considered. Some conclusions and plans for future study are included. Rewritten as M-130.

N-201
Control of Fungus in Hot Lockers, Oct 1954, H. Hochman, J. S. Muraoka, AD81218

Since the mildew problem is one of concern, primarily in housing in the barracks areas, it was not deemed practical to consider any proposal for its control involving the impregnation of clothing. NAVCERELAB has been conducting studies on the evaluation of low temperature heaters and has studied a possible control of fungus by means of desiccants and a combination of ultraviolet light and ozone.

N-202
Field Assembly and Traffic Loading Tests of a Portable, Prestressed Timber Roadway, Ten-Ton Capacity, Designated as Model X-2, Oct 1954, P. J. Rush, AD81219, PB154663

A portable roadway of prestressed timber was designed to supply a traffic-way capable of sustaining vehicles up to 20,000-lb gross weight in passages over so-called impassable terrain.

Over 500 traffic passes and more than 50 static loadings, or wheeled and tracked vehicles of gross weights ranging up to 74,125 lb, were made on the portable roadway. No serious structural damage was evident during or after the field tests. Deterioration of the supporting soil was apparent during and after loadings in excess of 50,000 lb. Assembly methods employed during the field tests were not rapid enough for tactical purposes.

N-203
Final Report on Testing and Evaluation of Fram Positive Crankcase Ventilation System, Sep 1954, J. R. Dawes, AD108142L

The object of this project was to determine the effectiveness of the Fram positive crankcase ventilator systems on both stationary equipment and mobile vehicles powered with gasoline engines in the elimination of crankcase dilution, moisture, and sludge in the lubricating oil.

N-204
Evaluation of the EZY Pier-Anchor, Feb 1955, J. E. Smith, AD81220L

The EZY pier-anchor, manufactured by Van Dyke Industries of Los Angeles, Calif., was evaluated by the Laboratory to determine its applicability for anchors and piling

at advanced bases. The principal factors evaluated were ease of placement and capacity to resist vertical pulls and pulls applied at various angles from the horizontal.

Screwing the EZY pier-anchor into such foundation conditions as frozen, hard, or rocky ground and ice would be extremely difficult and would probably result in damage to the anchor. However, if placement were accomplished by some other means or when placed by normal means in cohesive soils, satisfactory pullout and bearing capacities could be developed by using an adequate size of anchor or by placing anchors in tandem. In noncohesive sand and coral, holding capacities would be poor. The EZY pier-anchor should be considered for use only in cohesive soils favorable for their placement.

N-205
State Pile Development for Moorings in Sand Bottoms, Nov 1954, J. E. Smith, AD81261

NAVCERELAB conducted tests on stake piles at Port Hueneme, Calif. The ultimate objective was to develop a family of stake piles of different holding powers corresponding to the mooring classes AA (300,000 lb) through G (5,000 lb), which could be used in lieu of anchors in certain type moorings where the dragging of anchors is dangerous or objectionable. The project is divided into two phases, sand and mud bottoms, of which this report covers the first (sand bottom) phase in this development. It was recommended that sand bottom testing be continued to provide data for further refinements on the design with reference to length of stake pile and length and number of fins. It was further recommended that tests in mud bottom should follow the completion of the sand bottom tests.

N-206
Persistence of Chlorine Residuals in Stored Water and Ice, Nov 1954, W. R. Nehlsen, J. J. Traffalis, AD81262

Climatic and terrain conditions in polar regions necessitate distribution and storage of water supplies in sled and barracks tanks. Because of the possibility of contamination during distribution of water at polar camps, a study of the persistence of chlorine residuals in stored water and ice was made to determine to what extent disinfection protection was available after various periods of time. It was found that residual persistence varied with the storage temperature, but that sufficient protection remained from an initial residual of 1.5 ppm after 48 hr. Freezing of chlorinated water concentrates the chlorine in the central part of the ice, and portions of ice melted may contain only a trace of chlorine.

N-207
Test and Evaluation of Telephone Cable (WM-77/U), Dec 1954, R. H. Leseberg, R. B. McIntosh, CONFIDENTIAL

N-208
Final Report on Test and Evaluation of Murray and Tregurtha Models 200-C and 200-G Propulsion Units, Oct 1954, J. R. Dawes, A. G. Schlee, AD81263

The information sought from this test is to determine if the saving in cost accomplished by the design of the Model 200-C and 200-G units compensates for their inferior maneuverability.

N-209
An Investigation of the McPherson, Inc. Sewerless Toilet System, Dec 1954, W. R. Nehlsen, AD108029L

The McPherson, Inc., Sanitor sewerless toilet system was developed by the manufacturer for use in localities where water scarcity or sewage disposal problems prevent use of conventional methods. The McPherson unit was investigated because it showed possibilities of solving the problem. It is concluded that some mechanical components of the system are unsuitable for Navy use, but that the general scheme shows promise for development into a suitable system for these difficult conditions.

N-210
The Use of Acid Injection for Prevention of Scale in Vapor Compression Distillation Units, Sep 1954, J. S. Williams, AD69722

Previous work on scale prevention has been summarized in TM-061. This report covered work done with sand contact stabilizers and with hydrochloric acid injection in the feedwater. Treatment with acid seemed to offer the better possibility for scale control so further work was planned. A repeat test was made with hydrochloric acid on the Cleaver-Brooks 85-gph prototype model. The objectives of this test were to determine the best point at which to inject the acid, to explore various methods or devices for the injection, and to establish an optimum pH value for complete scale removal. Continuous acid injection was used. Because of the inherent shortcomings of hydrochloric acid such as being a dilute acid and being stored in glass carboys it was considered desirable to find a more suitable material for use at advanced bases. Citric acid, which has been used for acid cleaning, was the first consideration because of its crystalline form, low toxicity, and availability.

N-211
Evaluation of a Badger 200 gph Vapor Compression Distillation Unit, Nov 1954, J. S. Williams, AD81264L

A prototype 200 gph vapor compression distillation unit manufactured by Badger Manufacturing Company was tested at the Laboratory to determine whether it was suitable for advanced base use. The 720-hr test on sea water was passed. Considerable difficulty was experienced in maintaining level operating conditions during the test. It is concluded that inexperienced personnel could not operate this unit successfully.

N-212
Accelerated Testing of Water Level and Draft Indicators, Jan 1955, D. B. Wright, AD108248L

Numerous reports and complaints from field activities indicate a general unreliability in the performance of the water-level draft indicators on floating drydocks. The Laboratory has therefore established a program to study this problem. The current phase, reported here, is the systems-test phase and involves five commercially available water-level-test phases and one commercially available telemetering system. Subsequent to an extensive review of manufacturers' literature and recommendations of field representatives concerning the various products, these systems were chosen as those which most nearly fulfilled the requirements. Of those systems tested, one is recommended for modification and in-service testing on an active dock. Further investigation is recommended for one other system and a development program for obtaining a transducer element for the telemetering system.

N-213
Testing and Evaluation of an Ingersoll-Rand "Gyro-Flo" Model DR-315 Rotary Mobile Air Compressor, Jan 1955, J. R. Dawes, AD81265L

The Model DR-315 compressor is a commercially available unit. It is a rotary compressor (in contrast to the usual reciprocating design of practically all other available compressors). The rotary type of compressor is designed to have the following advantages: light weight, compactness, simplicity, low maintenance, low oil consumption, lower compressed air temperatures, and smooth, vibrationless operation. The purpose of this test was to determine the suitability of this type of compressor for Construction Battalion use.

N-214
Evaluation of Two Packaged Forced-Circulation Water Tube Boilers, Mar 1955, R. J. Zablodil, AD81266L

The Advanced Base Components Division, BUDOCKS, has need for steam-generating equipment which is lighter in

weight and more compact than equipment that can now be procured under existing military specifications. To fulfill this need, the Laboratory was requested to purchase certain representative boilers of the lightweight class, test them, and evaluate their suitability for advanced base use. This is an interim report on the water tube boiler and consists of results stemming from efficiency tests, intermittent operation tests, and variable loading tests. Results of these tests have shown the 50-hp boiler to be from 77% to 80% efficient under steady steaming rates and the 60 hp boiler to be 70% to 74% efficient under steady steaming rates. Both boilers passed the intermittent operation and variable loading tests but with decreased efficiencies. Throughout the testing, however, many delays were incurred from component-parts malfunctioning of both boilers.

N-215
Salt Water Corrosion Test of Rolling Surface Bearing Swivels, Apr 1955, W. B. Mitchell, AD81267L

Although the suitability of the Miller Swivel for use with gear subject to sea water immersion was of primary interest, investigation of the qualifications of other makes of rolling surface bearing swivels for this use was desired by BUDOCKS. A canvas of supply sources produced only one other, the Flexo roller bearing swivel. Accordingly, only the Miller and Flexo swivels were considered and two identical samples of each were procured and tested. In addition to Laboratory tests, some information concerning the experiences of the Coast Guard and the State of California, Department of Fish and Game, with the Miller Swivel was obtained. This information is included in this report.

N-216
Portable Roadway, Model X-3, Prestressed Timber, Sixty-Ton Capacity, Mar 1955, P. J. Rush, AD81268, PB154665

In field tests 190 lineal ft of roadway were placed, and many passages of wheeled vehicles up to 46 tons gross weight and tracked vehicles up to 57 tons gross weight were performed. No deterioration of the structure occurred. Some soil deterioration was apparent at the greater magnitudes of loadings, mostly occurring at a point where a water channel passed beneath the structure. Assembly time in the field was at a rate of 34 lineal ft/hr, although assembly rates of 82 lineal ft/hr were accomplished in practice on firm, irregular ground.

N-217
Cathodic Protection Studies, November 1953 to November 1954, Apr 1955, E. R. Streed, AD81269

A graphite anode cathodic protection (CP) system on a group of 10 hulls utilizing current control in individual hull return lines was installed and maintained through the subject period. An experimental electronic servo system has served automatically to control the total CP current for 6 mo. The results of experimentation with several types of commercial and laboratory-fabricated reference cells indicate the need for additional development of a reference cell for continuous use. The effectiveness of CP is being determined by photographic, mold, and coupon methods used before and after intervals of protection. Test facilities for a study of the compatibility of painted coatings and of floating corrosion inhibiting coatings in conjunction with CP are described.

N-218
Development of a Portable Decontamination Shower Unit, Apr 1955, W. R. Nehlsen, S. Giles, E. N. Hellberg, AD81270

A prototype decontamination shower unit incorporating a waste water chlorination and recirculation system has been designed by Laboraotry personnel. Construction, operation and water treatment tests have been made to aid in the further development of the unit, which has a capacity of 60 men/hr. Tests with BW simulants showed that a chlorine residual of 10 ppm at a pH of 6.7 resulted in rapid destruction of the BG and SM test organisms in the recirculated water. An objectionable mist from the showers was carried into the clean section of the unit. The unit will be redesigned to improve the various mechanical features and to incorporate a fan to exhaust the mist from the showers.

N-219
Evaluation of M.I. (Mineral Insulated) Cable for Low Temperature Use, Apr 1955, M. L. Buus, AD81271L

The mineral insulated cable, hereafter referred to as M.I. cable, was tested under Project YD 511-10 for BUDOCKS. Tests were performed to determine the suitability of the M.I. cable for direct burial use in Arctic and sub-Arctic locations and general low temperature characteristics.

N-220
Evaluation of Koehring High-Speed, Track-Mounted Cranes, May 1955, A. G. Schlee, AD81272L

This report covers the performance tests of three Koehring high-speed track-mounted cranes, in desert, temperate, and arctic zones, which were initiated under Project NY 510 003-1 and concluded under Project YD 510-14. It was concluded that the performance of the cranes was satisfactory.

N-221
Investigation of Unpressurized Shelter Requirements and Equipment, May 1955, J. J. Traffalis, W. R. Nehlsen, AD81273

Development of satisfactory entrance and exit methods present the most difficult problems. It is possible to use or convert certain types of existing walls to impermeable walls for gas and aerosol protection. An air supply may then be obtained with diffusion materials or manually operated collective protectors. Development and testing of many items is required, but it appears that useful ventilated unpressurized shelters can be created.

N-222
Development and Preliminary Field Testing of an Experimental Decontamination Apparatus, Jun 1955, S. J. Weiss, AD81274

Under a project directive for the development of an effective decontamination apparatus producing a hypochlorite slurry from liquid chlorine, dry chemical, and water, there has been designed, fabricated, and tested equipment of the following specifications: (1) No power source is required other than that inherent in the supply water. (2) The equipment has a capacity of 25 gpm of hypochlorite slurry at a supply water pressure of 100 psig. The discharge at this operating condition is suitable for direct spraying. (3) A satisfactory effluent is obtained when the water supply pressure is reduced to as low as 50 psig. However, there is a corresponding reduction in capacity of the apparatus and force of the final spray. (4) The physical and functional characteristics of the equipment are such as to allow the use of a variety of dry chemicals as the starting component.

N-223
Evaluation of Covermeter, Jun 1955, U. W. Stoll, AD108250L

The covermeter affords a nondestructive means of measuring the depth to, and location of, reinforcing steel in concrete. The instrument as received displayed only a fair degree of accuracy. The device was recalibrated, taking into account diameter of reinforcement and instrument power source. The modified instrument measured depths up to 1 in. cover to an accuracy of 0.1 in. for reinforcement of 0.1 in. diam or larger, and is capable of measuring depths between 1 and 1-1/2 in. to an accuracy of 0.2 in.

N-224
Final Report on Test and Evaluation of American Pipe and Steel Company 50 Ton Per Hour Mobile Rock Crushing and Screening Plant, May 1956, M. C. Lorenz, AD81275L

The development of a new type of lightweight, high speed, 200-ton/hr rock crusher based on entirely new principles of crushing (including heat, chemicals, supersonic vibrations or high speed impact crushers) was authorized by the Research and Development Board on 22 Jan 1951. The American Pipe and Steel Corporation submitted a plan and tentative design for a 50 ton/hr lightweight mobile rock crusher utilizing a high speed impact crusher for the secondary crusher for consideration under this program. A unit of this type was purchased as a scale model of the 200 ton/hr unit from American Pipe and Steel.

N-225
Development of a Biological Oxidation Package Waste Disposal Unit, Jul 1955, W. R. Nehlsen, AD81276L

The Arctic barracks package sewage disposal unit designed by this Laboratory was field-tested for 4 mo by the personnel of the Army Yuma Test Station. The test revealed that the prototype with its 100-gal aeration tank will handle the sewage for approximately five men. A new unit will be designed with a 200-gal aeration tank intended for use by 12 men. This unit will include an improved toilet bowl designed to overcome the aesthetic objections of the personnel to the first unit tested and to provide better sludge separation to reduce the volume of liquid requiring disposal. It is felt that this equipment will fill a need under certain rigorous conditions.

N-226
Evaluation of Prefabricated Knock-Down Type Wood Furniture for Advanced Base Use, Jul 1955, W. B. Mitchell, J. H. Sams, AD81277L

As stipulated by BUDOCKS, evaluation of the furniture based on in-service and laboratory tests include study of the following factors to the maximum practical extent: (a) ruggedness and durability; (b) ease of assembly and disassembly; (c) resistance to racking stresses; (d) adequacy of overseas crating; (e) cost, weight and size; (f) ease of repair; (g) effects of depot storage, and (h) comparison with BUDOCKS advanced-base standard furniture.

N-227
Development of a Plywood Stressed-Skin Wanigan, Jul 1955, D. A. Crane, J. E. Dykins, J. E. Schroeder, W. F. Burkart, AD707191

In order to apply house-trailer industry construction techniques to the wanigan project, NAVCERELAB contracted with Transa-Housing, Inc., Los Angeles, Calif., to design a plywood, stressed-skin wanigan. A prototype, the Mark IV, was built by Summerbell Roof Structures, Inc., Los Angeles, Calif., and was evaluated at Port Hueneme, but not under arctic conditions. An improved stressed-skin wanigan, the Mark V, was designed and fabricated by NAVCERELAB. This wanigan was evaluated at Port Hueneme and, under arctic conditions, at Fort Churchill. Modifications of the Mark V wanigan are being fabricated at this time for service in Antarctica in Operation Deep Freeze. This report includes the development and evaluation of the Mark IV and Mark V wanigans.

N-228
Evaluation of a Three-Pass, 50-hp Packaged Fire Tube Boiler, Jul 1955, R. J. Zablodil, AD81278L

This is an interim report on the 4-sq-ft fire tube boiler and consists of results stemming from efficiency tests, intermittent operation tests, and variable loading tests. The boiler was efficiency-tested 44 hr at steady firing, intermittent operation-tested for 40 hr, and variable loading tested for 8 hr. Results of these tests show the boiler efficiencies to average from 77% to 85% at various steaming rates with optimum performance in the range of 950 to 1000 lb/hr steam production.

N-229
Hydrophobic Cement, Sep 1955, U. W. Stoll, AD108027L

The resistance to atmospheric deterioration of fresh portland cement can be greatly increased through the use of small amounts of interground oleic acid. Laboratory tests have demonstrated that the addition of oleic acid substantially decreases the effort required during finish grinding of cement, that a more deterioration-resistant fresh cement will result, and that, if the air-entraining tendencies of portland cement so treated are controlled, the resultant mortars and concretes made from oleic-acid-treated cements are similar to untreated cements. An air-detraining agent may be added during the manufacturing process or at the time of field use of the treated cements. The present study indicates that the use of oleic acid is economically feasible.

N-230
Preliminary Tests of Fibrous Glass Reinforced Plastics for Pipe Repair, Sep 1955, J. J. Traffalis, AD108356

Preliminary tests of the evaluation of commercially available fibrous-glass-reinforced plastic patching materials for repairs, temporary and permanent, to underground pipe lines and distribution systems at Naval shore activities have been completed. This pipe patching method offers a means for the rapid, temporary repair for exposed piping in systems handling fluids at less than 300 psi and 200F with over 90% reliability of patches. Repairs can be made under higher pressures than this but with less reliable results. The use of the plastic patch on underground piping appeared limited. The conditions encountered in the repair of underground pipe would make the application of the plastic material extremely difficult. Patches have been installed underground for durability tests. Results will be published as available. Skillful application is required, but a trained operator can make a typical repair in less than an hour. Development of many uses for these materials seems promising.

N-231
Evaluation of the U.S. Airco Model NA 94520 Dehumidifier, Sep 1955, K. B. Edwards, J. H. Sams, W. B. Mitchell, AD108244L

The U.S. Airco Model NA 94520 dehumidifier was tested to determine its capacity and power consumption and to determine its suitability for dehumidification of warehouses. It was concluded that the U.S. Airco dehumidifier is considerably less efficient than desiccant dehumidifiers for maintaining air at 35% relative humidity. But for operation in warm climates where relative humidities of 50% or higher are acceptable, the U.S. Airco unit may compare more favorably with desiccant dehumidifiers. Performance characteristics of desiccant humidifiers operating under the latter conditions should therefore be ascertained. It was further concluded that the U.S. Airco dehumidifier is well built and is arranged for convenient maintenance.

N-232
In-Service Test Evaluation of 20- by 48-Ft Straight-Sided, Gabled-Roof, Prefabricated Steel "Hueneme" Building, Nov 1955, J. E. Dykins, AD108247, PB154666

To secure an evaluation of the Hueneme building, 40 buildings were procured for in-service testing within the Navy establishment. The using agencies were to complete the questionnaires furnished them covering the receiving and handling, erection, and performance phases of their buildings. This report covers the evaluation of the Hueneme building from the data compiled from the in-service test questionnaires.

N-233 - Issued as an Appendix to N-234

N-234
Evaluation of Gilsulate Insulation, Nov 1955, S. Giles, AD108259L

Because installed underground piping is subjected to considerable earth pressure, vibration, and movement, piping and insulation must have structural characteristics that will withstand these stresses and, in addition, the rough handling of shipping and installation. Brittle materials such as cast iron and clay must be handled with reasonable care, backfill material must be carefully placed to prevent breakage, and settling and vibration must be kept to a minimum. The insulation ability or heat flow resistance of the various insulating materials used in underground work must be carefully evaluated. The deleterious effects of moisture and temperature fluctuation appear to be destructive to the efficiency of some materials. This is often the cause of increased plant demand in steam or hot water distribution systems. These problems were considered and investigated in the evaluation of gilsulate in various field and laboratory tests.

N-235
1955 Survey of Water-Level and Draft Indicators in Floating Dry-Docks, Dec 1955, R. D. Hitchcock, AD108260L

Information on the present status of water-level indicator systems in 84 floating drydocks has been compiled from questionnaires and is discussed. Portions of it are presented in tabular form. The systems on 33 docks are considered inoperable or totally disabled. Of the other 51 systems, 22 are considered satisfactory, no evaluation is possible for the remaining 29 because of lack of information. The questionnaires indicate that probably the major cause of failures and unreliability in floating dock water-level systems is lack of proper maintenance linked with pneumatic telemetering. That is, pneumatic telemetering is a basic weakness in these systems, consequently continued maintenance is of prime importance.

N-236
Investigation of West Coast Aggregates, Dec 1955, U. W. Stoll, AD108243L

A study of commercial concrete aggregates obtained from four geographic areas in California is summarized. Concretes of low, medium, and high cement contents were prepared and measured for conventional properties. These observations and supporting data are presented in tabular form. Average property relationships are shown graphically as a function of cement content and aggregate selection. It is concluded that aggregate selection greatly influences the properties of comparable concretes of medium and high cement contents. Particularly the elastic modulus/ strength ratio and the compressive cylinder strength appear a function of aggregate selection.

N-236A
Investigation of West Coast Aggregates, Appendix E. Resistance of Concrete Specimens to Slow Freezing in Air and Thawing in Water, Oct 1956, U. W. Stoll,

N-237
Evaluation of Victor Products Co. and U.S. Thermo Control Co. 10,000 Btu/Hr Plug-In Type Refrigerating Units, Dec 1955, K. B. Edwards, T. G. Grimm, AD108257L

Testing of the Victor Products Unit and the U.S. Thermo Control Unit was brought about by a change in the military specifications for 10,000 Btu/hr units as recommended by a joint inter-service group. The new specifications require a capacity of not less than 10,000 Btu/hr with an ambient temperature of 110F and a refrigerating temperature of 0F. The former specifications required this same capacity at the ambient and refrigerating temperatures of 110F and 10F, respectively. The proposed refrigerating units are intended for use, either singly or collectively, in 675- and 6,800-cu-ft refrigerating warehouses at hospitals, galleys, and refrigerated storage components in fixed locations at Naval advanced bases where electricity is available. The units are also adaptable to gasoline engine power.

N-238
Feasibility and Capability Tests of Electrical Generators Operating in Parallel, Jan 1956, R. H. Leseberg, J. H. Sams, AD108138L

The NAVCERELAB was directed by BUDOCKS letter D-422/NC.MVS NP/Pt. Nueneme/N8 dated 21 Apr 1955 to conduct feasibility and capability tests of electrical generators operating in parallel. The objective of the feasibility test was to determine whether the electrical system of the various CB components, as listed in BUDOCKS P-103, are properly designed. The objectives of the capability test were (1) to determine the largest motor that can be properly started, with across-the-line start, when the power source is already loaded with a steady-state load equal to 50% of the combined capacity of the generators, and (2) to determine the ease of operation of the generators in parallel and the rating level of the operators required to operate such power sources in the field.

N-239
A Proposed System of Building Construction on Snow, Ice, and Permafrost, Jan 1956, S. Giles, AD108246

Field experience and literature on the subject all point to the fact that building structures on permafrost have failed because the thermal balance of the ground eventually becomes disturbed and thawing occurs. The principle of maintaining the thermal balance between the building supports and the cold ground with a system of refrigerated piping was suggested by Mr. I. L. Winsor of Seattle. Tests conducted in the cold chamber of this Laboratory have been very encouraging and indicate that such a system is practical both on frozen ground and on ice.

N-240
Portable Roadway, X-4, 60-Ton Capacity, for Unstable-Terrain Areas, Jan 1956, P. J. Rush, AD108245, PB154667

Assembly of the structure was performed at the rate of 73 lineal ft/hr by a crew of 18 men. Sixty traffic loadings with heavy wheeled and tracked vehicles were performed. A static loading test employing a weight of 90 tons upon a simulated 60-ton tank tread was performed. No structural deterioration of the roadway occurred as a result of the loading tests. Displacement of the supporting soil occurred under loadings greater than 50 tons, resulting in a settlement of the structure but in no impairment of its load-carrying ability.

N-241
Jacketing of Timber Piles, Interim Report on Jackets Within the Tidal Range, Jan 1956, P. H. Petersen, AD108258L, PB154668

The primary objectives of this phase of the study were: (a) to observe the problems relating to forming and placing the jacket, (b) to obtain a comparison of the bending strength of the jacketed portion of pile with that of a sound pile, and (c) to compare the relative costs of each method.

N-242
Evaluation of a Four-Pass 50-hp Packaged Fire Tube Boiler, Jan 1956, R. J. Zablodil, AD108251L

This is an interim report on the 5-sq-ft fire-tube boiler and consists of results stemming from efficiency tests, intermittent operation tests, and variable loading tests. Results of these three tests indicated that boiler efficiencies average from 77% to 84% with optimum performance in the range of 1,050 to 1,300 lb/hr. The boiler did not prime when anti-foaming chemicals were added to feedwater and occasionally primed without anti-foaming chemicals. Cold soaking the "Fireye" controller down to 6F

did not adversely affect operation, and the boiler could not be made to fail unsafe. The boilers is capable of producing 58 hp, 13% over the rated 50 hp. One forced shutdown occurred from malfunctioning of the boiler's fuel oil metering valve.

N-243
Evaluation of Aluminized Steel Mufflers and Tailpipes, Feb 1956, K. B. Edwards, AD108028L

Aluminized steel is made commercially by dipping sheet steel in molten aluminum under a salt flux. The process, known as Aldip, was developed at the General Motors Research Laboratories. For the purpose of identifying materials in this report, the term "aluminized" is used to refer to aluminized steel and the term "steel" to refer to plain steel.

N-244
Instruction Manual for All Winterized Equipment, Nov 1955, E. J. Beck, AD221755, PB154689

The winterization equipment as described has been developed to facilitate the operation of conventional equipment under low temperature conditions with a minimum of special techniques, training, and changes to the equipment.

N-245
Snow Rollers (8-Ft Diameter), Jan 1956, J. E. Dykins, AD869429L

The snow compaction process developed by the Navy consists of pulverizing the snow and immediately rolling the pulverized mass with a heavy, large-diameter roller. During the early test work the optimum diameter, width, and weight of the roller were established. The snow rollers designed and fabricated by NAVCERELAB for Operation Deep Freeze, were improvements over previous models in that they were easier to assemble.

N-246
Snowplane (40-Ft Span), Jan 1956, J. E. Schroeder, AD869424

The snowplane (40-ft span) was designed for both planing and light duty grading operation on compacted snow airfields. This unit is in the second stage of development. The original unit was used in the experimental Arctic Operation Nardtop I - 1953. The new unit differs in the modification of the planing bowl to serve also as a grader blade and the installation of hydraulic controls to replace the manual controls.

N-247
Portable Unloading Platform (R4D Aircraft), Jan 1956, J. E. Schroeder

The portable unloading platform was designed specifically for the on- and off-loading of large, heavy (to 3 tons) items from R4D aircraft. The unit is in the second stage of development having been developed originally for the Nardtop I - 1953 operation. This unit varies from the original in that it is light in weight, has fewer component pieces, and provides for easier adjusting of the platform height.

N-248
Portable Unloading Elevator (Cargo Aircraft), Jan 1956, J. E. Schroeder

The portable unloading elevator (cargo aircraft) was designed for unloading military cargo aircraft which cannot be served by the portable unloading platform described in Technical Note N-247. It is anticipated that the unit will also prove valuable for the on- and off-loading of heavy cargo sleds.

N-249
Instruction Manual for Sled-Mounted Water Carrier (1000 Gallon), Oct 1955, K. N. Tinklepaugh, AD221756, PB154670

The water carrier is an insulated, sled-mounted, 1,000-gal tank, with pumping and heating equipment to allow (1) pumping a tankful of water from an outside lake or tank, (2) heating of the water during transit or standby, and (3) snow melting to obtain water.

N-250
Instruction Manual for Waste Heat Snow Melters (Air-Borne and 1000 Gallon), Oct 1955, E. J. Beck, K. N. Tinklepaugh

These melters are designed to be connected to large stationary engine-generator sets (up to 100 kW) and to utilize the waste coolant and exhaust heat from these engines. A properly designed melter of this type can easily pick up 50,000 Btu/hr from the coolant, and another 50,000 Btu/hr from the exhaust of a large engine, and transfer this heat to the snow in the tank, melting enough snow to make about 150 gal of water an hour.

N-251
Summary Report on Wanigans, Part I - Sleeper Wanigan, Part II - Messing Wanigan, Jan 1956, J. E. Dykins

A total of five wanigans were fabricated by the Laboratory, three to provide sleeping facilities and two for messing facilities. Each sleeper wanigan accommodates 8 to 9 men. The messing wanigan has a capacity of 12 men at one sitting. The basic design for the wanigan had previously been established for an 8-ft-wide unit. Because Deep Freeze required a 10-ft-wide unit, design changes were made to strengthen the roof panel, widen the end wall panels, and lengthen the floor panels. Complete new interiors were designed and fabricated for both types of wanigans. In addition, a package unit containing all pieces of equipment required to supply the utility services for the wanigan was designed and fabricated. This is the first time such a utility package has been developed for wanigans produced by NAVCERELAB.

N-252
Operating Manual for Engines and Waste Heat Snow Melters, Nov 1955, E. J. Beck, K. N. Tinklepaugh

The auxiliary mechanical equipment provided for the sleeping and cooking wanigans consists of: (1) the heaters and engines together with batteries, converters, fuel pumps, and controls; and (2) the two waste-heat devices (namely, the heat exchanger for heating the engine and the snow melter for melting snow to produce water). This equipment is for producing power, light, heat, and water for use in the wanigans.

N-253
Instruction Manual for Power Ice Auger, Nov 1955, E. J. Beck

The power ice auger was originally designed for rapidly drilling holes in sea ice. It is an attachment for a tractor, receiving its power as hydraulic oil under pressure from the tractor's front end hydraulic pump through connections at the rear of the tractor.

N-254
Flooding Equipment, Oct 1955, D. Taylor, AD869406

The Laboratory was asked to select the equipment necessary to construct the airstrip on an uneven ice surface using the flooding technique. This note describes the flooding equipment selected and puts forth some recommendations regarding the equipment.

N-255
Instruction Manual for Skid-Mounted Lube Oil Carrier (500-Gal), Oct 1955, E. J. Beck, AD221757, PB154671

The arctic lube oil carrier is a portable, insulated supply tank for storing, heating and handling viscous lubricating oils at very low temperatures.

N-256
Radio Interference Suppression of Operation Deep Freeze Equipment, NCEL Participation, Dec 1955, D. B. Wright, AD108252L

The purpose of this phase of the operation is to eliminate completely, or reduce to a negligible minimum, all sources of uncontrolled electromagnetic radiation associated with Operation Deep Freeze equipment under the jurisdiction of the Laboratory.

N-256A
Radio Interference Suppression of Operation Deep Freeze Equipment, Deep Freeze Instruction Manuals, Numbers 1 to 18, Sep and Oct 1955, D. B. Wright, AD108024L

N-257
Evaluation of a Jeep-A-Trench Mounted on a Jeep and a Go-for-Digger Mounted on a Jeep, Feb 1956, K. N. Tinklepaugh, A. G. Schlee, AD108253L

This report evaluates the results of testing two jeep-mounted ditchers, with particular emphasis upon the possible incorporation of one or both models in one-half strength mobile construction battalion and the P-1 Construction Battalion components. Possibilities of substituting one or more jeep ditchers for jeeps, or for the ladder ditcher, or supplying the ditcher-unit as a kit to be mounted on a jeep in the field are explored. Jeep ditchers as units are compared.

N-258
Final Report on Euclid Rubber-Tired Tractor, Mar 1956, A. G. Schlee, AD108254L

The purpose of the test was to compile information and data on the operation of subject tractor under temperate and desert environmental conditions, to determine the operational characteristics and its suitability for advanced base use, to determine what modifications are necessary to meet military requirements, and to obtain important and pertinent data for future developments.

N-259
Interim Report on Test of Murray and Tregurtha Prototype Inboard Propulsion Units for Pontoon Barges, Mar 1956, W. R. Mitchell, A. L. Scott, AD108257L

Tests on a prototype set of inboard propulsion units were commenced in Dec 1955 and were temporarily suspended in late Jan 1956 pending accomplishment of proposed modifications to improve the performance of the units. The proposed modifications, and the reasons therefore, are discussed in this report.

N-260
Corrosion Prevention and Protective Coatings for Steel Piling, Mar 1956, A. L. Fowler, C. B. Breuillette, H. Hochman, AD108149

Nineteen paint coating systems and six flame-spray coatings were evaluated by suspending coated steel panels in Port Hueneme Harbor so that one part was continually under water, one part was in the tidal zone, and the remaining part was in the atmospheric or splash zone. Eight of these coating systems appear to merit further evaluation. The most durable system as determined by this 30-mo test was a five-coat vinylidene chloride-acrylo-nitrile copolymer resin (Saran, Navy Formula No. 113). Four vinyl resin paint systems were among those meriting further study. A system consisting of a wash prime coat, an anticorrosive (red lead) coat, and an aluminum-pigmented top coat was rated as the best vinyl combination tested. Other systems requiring further evaluation are a neoprene system, a chlorinated rubber system, and a system based on a vinyl thichol resin blend. The flame-spray coatings were exposed for 10 mo. Sufficient change had not taken place to permit an evaluation of these systems.

N-261
A Proposed System of Utility Piping Installation in Snow, Ice, and Permafrost, Jan 1956, S. Giles, AD108150

For use in cold, the Laboratory has investigated many systems of utilidors and insulations which indicated a possibility of success. As a result of tests conducted in a cold chamber in the early part of 1955, it was suggested that a system of refrigerated tracer lines designed to maintain the thermal balance between the utility piping and the frozen soil be investigated. This idea has a parallel in the system sometimes used under the floors of refrigerated warehouses in temperate climates when warm water is circulated through piping to prevent freezing of the subgrade. In the system proposed by this report, refrigerated brine is circulated to maintain the frozen soil structure of permafrost supporting a heated piping system. This report is a description of those tests and the results.

N-262
Investigation of Evaporative Air Cooling for Military Application, Apr 1956, R. F. Law, W. R. Nehlsen, AD108359L

The Laboratory has been conducting a program of investigation, evaluation, and development in an effort to develop equipment, methods, and application limits for evaporative air cooling military installations. This report summarizes the progress of the evaporative cooling program and sets forth future plans.

N-263
Location and M-Factors of Vapor Barriers Within Insulated Buildings (an Analytical Approach), Mar 1956, R. J. Ashlock, AD108241

One vapor barrier located near the warm surface of an insulated wall may not prevent the condensation of water vapor when outside temperatures enter into the sub-zero range. This condensation destroys the heat-resistant function of the insulation. The addition of properly located vapor barriers of correct permeance will control the movement of vapor and prevent condensation within the insulation. This report is a technical analysis of the problem of controlling condensation in structures subjected to sub-zero ambient temperatures.

N-264
Report of Radio Interference Tests of LVT-1V Polar Fire Fighting Vehicle, Apr 1956, J. C. Senn, AD108358L

This report covers tests performed to determine compliance of an LVT-1V to the radio interference requirements of military specification MIL-I-16910-A. The LVT-1V was modified as a polar fire-fighting vehicle by the Ward LaFrance Truck Company, Elmira, N. Y., under Contract NOY-78778. Cold-chamber tests of the vehicle were reported in NAVCKRKLAB Memorandum Report K-1R-7, dated 14 Dec 1955. Radio interference tests were assigned to the Laboratory by BUDOCKS letter D-421A/LW, dated 9 Dec 1955, with the request that only the contractor-installed equipment be checked.

N-265
Evaluation of Plastic Well Strainers, Apr 1956, D. R. Bennett, AD108360L

The Laboratory was requested by BUDOCKS letter P-911K/MVS LP/Pt Hueneme/NH dated 16 March 1956 to conduct comparative tests on a plastic well strainer and a conventional bronze strainer of the type currently stocked for advanced base use. These tests were to determine the relative abilities of the two strainers to withstand corrosion, erosion, and the effects of acids used for cleaning. The ability of the plastic strainer to withstand breakage in handling and shipping and the shelf life of the solvent cement used in plastic strainer assembly were also to be determined.

N-266
Evaluation of a Two-Pass, 60-Hp Packaged Fire Tube Boiler, May 1956, R. J. Zahlodil, AD108361L

To investigate the feasibility of this equipment for Navy advanced base use, Project NY 512 030 was initiated. A test program was formulated to evaluate the equipment, attention being given mainly to automatic operation, dependability, and efficiency of operation. The goal is to determine whether these new packaged boilers can be used for advanced bases and, if so, to prepare the necessary military specifications for their purchase.

N-267
Interim Report on Evaluation of Large Pontoon (10'x20'x6'), May 1956, J. V. Stalcup, AD108148, PB154672

BUDOCKS proposed the development of a pontoon, larger than the present standard NL pontoon, for use in the assembly of drydocks, causeways, piers, and other advanced base assemblies. This new pontoon is expected to result in a weight saving and in greater buoyancy for the same deck area, provide for more rapid assembly, and be easier to maintain. The pontoon was based on a BUDOCKS concept. A contract for detail drawings and fabrication of pontoons was awarded to Baldwin-Lima-Hamilton Corporation, Eddystone, Pa.

N-268
Cold Chamber Starting Tests of Harnischfeger Diesel Engine, Model 487C-18, May 1956, E. J. Beck, AD108362L

This report covers starting tests at -10F and -25F of two identical 60-kW generator sets powered by Harnischfeger P and H diesel engines, model 487C-18. These tests were conducted in the cold chamber of the NAVCERELAB between 10 and 18 May 1956. The tests were conducted in strict accordance with military specification MIL-E-11278A of 4 Jan 1956, engines, gasoline or diesel, industrial type, methods of test, section 107.2. Only one engine was instrumented.

N-269
Study of the Compatibility of Floating-Type Inhibitors and Cathodic Protection, Jun 1956, F. R. Streed, AD108031L

A controlled study of two proprietary floating-type corrosion inhibitors and cathodic protection for use in floating drydock ballast tanks is described in this report. Test coupon results after exposure for 1 yr indicate that a floating-type inhibitor can effectively retard corrosion in the wet-and-dry and dry zones and will provide at least temporary protection in the wet zone. Cathodic protection, effective only on a submerged surface is shown to achieve a 70% reduction in corrosion under severe exposure conditions. Cathodic currents were reduced by a factor of five when used with a floating inhibitor. No serious interference was detected when the two methods were used together.

N-270
An Electrical Protection System for Wooden Piling, Jun 1956, M. Hochman, T. Roe, AD108242

Laboratory tests showed that teredo larvae are adversely affected by an electrical current. A rack of 15 untreated, wooden piles was designed to test the ability of three electrode systems, and four current densities to repel marine borer attack. Alternating current was supplied from a 6.3-v filament transformer and produced currents ranging from 0.01 to 1.3 A/pile. At the highest and lowest currents employed, there was a noticeable decrease in borer damage. However, at the intermediate currents, the amount of borer attack was increased over that exhibited by the controls. The electrode system, composed of alternately connected copper bands spaced 8 in. apart, was superior to the systems using two copper wires vertically attached to opposite sides of the piles.

N-271
Harbor Tests of Marine Borer Inhibitors, Jul 1956, M. Hochman, T. Roe, AD108030

Organic compounds found to be toxic to teredo and limnoria larvae in the Laboratory's biological screening test were used to impregnate pine blocks used in harbor exposure areas. Soluble silicates, also used for impregnation, were made insoluble by subsequent treatment of the blocks with a dilute acid solution. Results of performance tests lasting 1-1/2 yr in Port Hueneme Harbor, as a part of Project NY 450 030, indicated that some protection is obtained if these materials are used in sufficient concentration. Other blocks in this series are still undergoing exposure tests, and the results of 2-1/2 yr exposure will be made in the next report.

N-272 - Cancelled

N-273
Protection of Salt Water Pumps, Investigation of Selected Brush-On Synthetic Rubber Coatings to Establish Comparative Durability in an Abrasive Jet Stream, Jul 1956, D. Taylor, J. J. Doman, AD481682

Additional tests for durability to abrasion were made on the three synthetic rubber coatings selected in NAVCERELAB addendum report, dated 20 Nov 1953, to Technical Note N-131. A selected group of metals also was tested for comparison to the coatings; and another synthetic coating (GACO N-29 cold bond), normally used as a bonding agent and not previously tested, was found to be superior to all coatings and metals tested for durability to abrasion. It is recommended for application to a drydock drainage pump for in-service test.

N-274
Powered Arctic Cargo Trailer Operational Tests in Sand, Mud, and Snow, Sep 1956, S. J. Weiss, K. Yamamoto, D. Taylor, AD221758

An experimental arctic cargo trailer of 15-ton capacity was developed by the Laboratory to negotiate rough and unstable Arctic terrain in summer and winter. Its purpose is similar to the 15-ton capacity, military-type, full-track cargo trailer, but it has the added features of dual tandem pneumatic tires, removable tire-tracks, and a special powered universal joint through which the trailer is powered by the take-off at the rear of a prime mover tractor. When powered, the tractor-trailer combination has a road speed of 21.6 ft/min. The trailer was tested in mud and sand at Port Hueneme, Calif., and in mud and snow at Fort Churchill, Canada. It has demonstrated considerable ability in sand, mud, and snow.

N-275
Evaluation of a 20- by 48-Ft Straight-Sided, Shed-Roof, Prefabricated Wood Building for the U.S. Air Force, Sep 1956, J. E. Dykins, AD221759

Fabrication of the building was accomplished without difficulty except in areas where the drawings were inadequately detailed. Erection of the building, because of the simplicity of the design, was accomplished in 62 manhr. During the weather test, water leakage occurred around the windows. Until this condition is corrected, the building is unsatisfactory. The building met the specified design loads: for snow, 15 psf; wind, 70 mph; and floor liveload, 70 psf. At design load the measured stress for each type of loading was considerably less than the allowable working stress of the material, indicating the building is overdesigned for the specified loadings.

N-276
Field Tests on Laterally Loaded Instrumented Piles, Fixed-Head Loadings in Sand, Free-Head Loadings in Clay, Oct 1956, M. G. Mason, AD221760, PB154673

Details of the instrumentation used to obtain a fixed-head loading condition for static and repetitive testing are described. The effect that the degree of fixity has on the pressure and deflection patterns is discussed. A comparison is made between the measured deflections and pressured and the theoretical deflection and pressure patterns as developed from the Palmer-Thompson theory. A method is presented by which the Navy facilities may have lateral thrust pile problems solved by IBM calculations at nominal costs.Also presented are details of the instrumentation used in a pile embedded in 40 ft of clay soil, including a new electronic pressure cell. Results of the at rest pressure studies are presented.

N-277
Ventilation System Protection Against BW Aerosols, Jun 1956, W. R. Nehlsen, AD221761, PB154674

Practical passive defense measures against biological warfare aerosols are required to be economical, and every available means must be explored. Since many buildings are equipped with air-handling and filtering equipment that may offer some degree of BW defense, ventilation air filters and air-supply system components have been tested with 0- to 5-μ-size dust, DOP smoke, and a BW simulant organism to assess the protection available against BW aerosols. Results show that a high percentage of particles below 3 μ in diameter will penetrate an air-conditioning system equipped with panel-type ventilation air filters. During a 1-hr BW aerosol test on a NAVCERELAB test shelter, an 80% penetration of the air-conditioning system was experienced, but the aerosol concentration inside the shelter only reached a level of about 50% of the outside concentration because of recirculation and dilution. This degree of protection is too low to be of much practical value for BW defense.

N-278
Comparative Starting Tests of Diesel Engine Primers, Oct 1956, E. J. Beck, AD221762

This report contains the results of low temperature starting tests of an electrically cranked diesel engine at the Cold Chamber, NAVCERELAB, Port Hueneme, on 4 and 5 Oct 1956. The tests were conducted in conformance with the new military specification covering this type of starting device, MIL-P-16912A (ships) of 7 Sep 1956. Satisfactory starts were made with both the "Start-Pilote" and the Chevron system at -20F. One satisfactory start was made with the Start-Pilote at -25F. The Start-Pilote capsules, made of light aluminum, would not hold the fluid under pressures developed by exposing the capsule to the higher temperature called for under the new specification.

N-279
Erection and Structural Evaluation of Murdock Plastic Tank, 250-Barrel Capacity, Nov 1956, C. V. Brouillette, P. J. Rush, C. K. Wiehle, AD221763

This report covers the erection, structural studies, and disassembly of a typical commercially available 250-bbl, glass fiber reinforced plastic, prefabricated tank. The subject plastic tank was found to be structurally adequate. However, it required excessive erection time, and the side-to-bottom joints are deficient. Small leaks remained after careful tightening techniques were used. Tests on the tank material indicated a safety factor of 6.5 under hydrostatic load.

N-280
Evaluation of Front-End Loaders, Oct 1956, R. E. Jochums, AD221764

This report evaluates the results of testing four diesel-engine-driven, 4-wheel-drive, front-end loaders. The evaluation was conducted in order to meet a requirement for a front-end loader in the mobile construction battalion (one-half strength) and to possibly replace the present crawler-type scoop loader in the P-1 component. In addition, there is an increasing requirement for use of this type of loading equipment at the Naval shore establishment.

N-281
Radiological Test of Decontamination Shower Waste Water Recirculation, Oct 1956, W. R. Nehlsen, AD221765, PB154675

Project NY 300 010-4 requires the development of a portable arctic decontamination shower unit incorporating a waste water treatment and recirculation system. An experimental unit was devised using sedimentation and chlorination as a basis of waste treatment. This system was recently tested with a radioactive fallout simulant at the NRDL. Results indicated that over 99% of the simulant was removed from the waste water and was deposited in the shower sump and waste treatment tank. It is concluded that a waste water treatment and recirculation system should be included in the unit design.

N-282
Laboratory and Field Tests on Risco Radio Interference Choke Coils for Overhead Power Lines, Dec 1956, J. C. Senn, AD221766

Results are given for tests made on actual installations on public utility power lines equipped with Risco radio interference choke coils. In addition, results of laboratory insertion loss measurements are reported. It is recommended that choke coils designed for a specific frequency range be used where serious power line interference is occurring in that specific band of frequencies.

N-283
Harbor Tests of Marine Borer Inhibitors, Part 2, Nov 1956, M. Hochman, T. Roe, PB160541

Part 1 is N-.71. One phase of this study includes impregnation of wooden panels with compounds found in laboratory screening tests to be toxic to such marine organisms. The panels are then suspended in the harbor, and their degree of attack is measured periodically. In addition to a study of the impregnation of pine panels with toxic agents, an effort was made to determine the effect of solvent extraction on the serviceability of greenheart panels. Those panels were exhaustively extracted with hot organic and aqueous solvents before exposure in Port Hueneme Harbor.

N-284
Testing and Evaluation of a Davey Model 315, Lightweight, Air-Cooled, Reciprocating, Mobile Air Compressor, Oct 1956, J. J. Doman, AD221767

The purpose of the Laboratory's test was to determine the adequacy of the wheel suspension by towing tests, to further test the unit with suitable air tools under actual operating conditions, and to test the unit under the same laboratory test plan as used for other similar air compressors. Additional identical compressor units are now being held for field use pending the review of this report.

N-285
Test of Flotation-Type Rust Preventives, Nov 1956, C. V. Brouillette

Fourteen proprietary and several laboratory prepared flotation-type rust preventives were investigated in accordance with the procedures of MIL-C-17936 (Ships). Except for one laboratory preparation the greatest corrosion loss recorded during this investigation was approximately one-half the specified limit of 0.0075 in./yr. The simulated ballast tank test procedure does not differentiate between the various protective floating oils on the basis of inhibiting properties.

N-286
Evaluation of Butler Manufacturing Company Model RF-3 Rigid Frame, 40- by 100-ft Straight-Sided, Gable-Roofed, Metal Utility Building, Nov 1956, J. E. Dykins, AD221768

The building had a gross weight of 27,080 lb. Its erection was accomplished in 436 manhr, using a 6- to 8-man erection crew, a crane with operator, and/or a mobile forklift with operator. It was found to be structurally inadequate under loadings of 20-psf snow and 70-mph wind, although some features of the building are more desirable than those found in the standard rigid frame 40- by 100-ft utility building previously evaluated by the Laboratory.

N-287
Arrestance, Resistance, and Dust-Loading Tests on Commercial Air Filters, Feb 1957, E. N. Hellberg, W. R. Nehlsen, AD221769

Biological and radiological warfare weapons may disseminate airborne particulates that are capable of producing large numbers of casualties. Defense against these weapons requires very effective filtration of ventilation air. This report presents the results of an extensive program of testing commercially available ventilation air filters with dust representing BW aerosol particle sizes.

N-288
Final Report on Commercially Available Stone Ejectors for Dual Wheel Trucks, Dec 1956, A. L. Scott

Stone ejectors are not widely used. The few makes available are all so similar that no single make can be considered superior to another. The stone ejector is simple enough that it can be manufactured in the field to suit a specific requirement. If the necessity of stone ejectors is limited, as the Laboratory's investigation indicates, field fabrication by the using forces may be the most economical means of obtaining them.

N-289
Acceptance Test and Evaluation of a Meco 200-gph Distillation Unit, Feb 1957, J. S. Williams

The original contract specified a 500-hr acceptance test on seawater. This was modified later to a 720-hr test. The mechanical equipment company was granted an increase in the contract price to make the necessary changes. The unit failed to meet specifications during five tests performed over a 5-yr period. Factory modifications were made on two occasions in an attempt to improve the performance. In spite of the fact that the unit had a high potential, it fell short of the Navy requirements. The reason for the failure seemed to be the reluctance of the manufacturer to increase the power supply sufficiently to compensate for scaling in the evaporator. The smaller power source was a distinct advantage, however, when this unit was used in tests employing acid injection in the feed water.

N-290
Evaluation of "Little Bull" Power Megaphone, Mar 1957, K. R. Edwards, AD221770

A small lightweight megaphone which was powered by six standard flashlight batteries and contained no electronic amplifier was tested to determine if it was suitable for mobile construction battalion field use. Megaphone characteristics such as voice amplification power, frequency response, sound propagation pattern, battery life, and ruggedness were investigated. Except for a limited and somewhat unstable amplification power, the characteristics were judged to be acceptable for general use.

N-291
Evaluation of a Two-Pass, 50-Hp Packaged Fire Tube Boiler, Standard Navy Stock, Feb 1957, N. R. Joerding, AD221771

The Laboratory tested certain representative boilers of the lightweight class to evaluate their suitability for advanced base use. This is an interim report on the 50-hp 10-sq ft fire tube boiler used to provide control data upon which to base comparisons of the other boilers tested under this program. Results of these tests indicate that this boiler's efficiency averages 86% with optimum performance in the range of 1,388 to 1,760 lb/hr when fired at a steady rate.

N-292
Evaluation of a Ship Motion Meter for Moored Vessels, Feb 1957, J. T. O'Brien, R. K. Jones, D. I. Kuchenreuther, AD221816, PB154676

The ship motion meter developed under contract NOY-13116 was operated to measure the forced motion of a 4x2 NL pontoon barge at Port Hueneme, Calif. The motion measured by the meter is contrasted with that obtained using conventional surveying techniques. It is indicated that the surge-sway pickup is accurate to 0.3 ft anywhere within its range. For a particular case where the tidal range and normal distance from the instrument to ships hull is 4 ft, a surge of approximately 10 ft and sway of 4 ft was measured. Both roll and pitch pickups are found to be satisfactory in that they are accurate to 1/4 deg in 5 deg, and the yaw pickup is unsatisfactory in that its accuracy is only 3 deg in 5 deg. Results of studies to obtain yaw by use of two surge-sway pickups are presented and such a method declared satisfactory. It is concluded that the meter, where two surge-sway pickups are used to measure yaw, is satisfactory (although not nearly the ultimate) for further work in obtaining prototype measurements. Recommendations as to design of a superior meter are presented.

N-293
A Flotation Method for the Treatment and Clarification of Tallow Soap Based Laundry Waste Water, Feb 1957, J. E. Malton, L. L. Silver, J. V. Graham

In order to reduce the fresh water requirements of advanced bases where fresh water is scarce, it is desirable to reclaim and re-use the laundry waste water for laundry purposes. Equipment for this purpose was designed and fabricated under contract by the Prosperity Company of Syracuse, N. Y. The characteristics of the unit have been investigated at NAVCERELAB for use with laundry waste waters contaminated with various detergents and soaps. This interim report covers the treatment and clarification of tallow soap based laundry waste waters.

N-294
Evaluation of High Speed Shore Party Crane, Mar 1957, R. E. Jochums, AD221772

The high speed shore party crane was designed and developed to Navy specifications in order to obtain a versatile crane with characteristics not presently incorporated in cranes obtainable commercially. These characteristics include the ability to be easily landed and quickly assembled, fast travel and operating speeds, ability to operate on unstable soils, high capacity, and high versatility. This report evaluates the comparative testing of the high speed shore party crane with a representative conventional drive crane (Byers Model 83). These cranes are of equal rated capacity and are both powered by General Motors 3-71 diesel engines. Previous laboratory reports have dealt with preliminary phases, desert and cold weather tests, and the general engineering tests and evaluations. Results of all these previous tests are considered in the overall evaluation of the results reported in this note.

N-295
Test of a Biological Oxidation Package Waste Disposal Unit, Apr 1957, W. R. Nehlsen, AD221773

An experimental biological oxidation waste disposal unit was tested in use at the Construction Battalion Center brig for a period of 2-1/2 mo. Although designed for a capacity of 12 men, the unit proved to have a capacity for less than 9 persons and was unsanitary. No further experimentation with this unit is planned.

N-296
Self-Contained Shelter Kit for Atmospheric Control of Sealed Shelters, Mar 1957, W. R. Nehlsen

Provision of chemical, bacteriological, and radiological warfare shelters for large groups of personnel are necessary to insure adequate passive defense of Naval installations. The expense involved must be reduced as far as practical. Project NY 300 006-3 required the investigation of air supply devices and entrance methods for sealed shelters to improve the usefulness of this inexpensive type shelter. A study of the factors involved indicated that an air blower was essential to provide entrance facilities. A method using a hand-operated flower for air supply and entrance facilities was tested to determine design factors and limitations. Three other methods - chemical air supply, diffusion barrier materials and engine driven blowers - were tested or studied for applicability to the problem of inexpensive shelter facilities.

N-297
Review of Decontamination Shower Unit Tests and Plans, Mar 1957, W. R. Nehlsen, AD221774, PB154677

BUDOCKS asked the Laboratory to develop a portable arctic decontamination shower unit incorporating a waste water treatment and a recirculation system. An experimental unit was devised using sedimentation and chlorination as a basis of the waste treatment. This system was tested with a biological warfare simulant and a radioactive fallout simulant with favorable results. No testing was done with chemical warfare simulants but technical information was received from the Army Chemical Warfare Laboratory which indicates that this simple waste treatment scheme was not adequate for chemical warfare use. In this interim report the test data and the technical information are summarized, and problems associated with various applications are discussed.

N-298
Sparkability of Metallic-Aggregate Floors, May 1956, D. F. Griffin, J. M. Hayhoe, AD221775

Various proprietary products have been used in the fabrication of floors for ordnance structures, presumably in accordance with NAVDOCKS Specification F4A. These floors have been assumed to be nonsparking in accordance with the requirements of the specification. Information received by BUDOCKS cast considerable doubt as to the effectiveness of the nonsparking characteristics of such floors. Moreover, since many floors of this type have been and are continuing to be constructed, it is important from a safety standpoint that adequate test criteria be developed. No accepted method for testing floors for conformance with NAVDOCKS Specification F4A, has been available, hence, the Laboratory was requested to initiate a study to: (1) Undertake the development of a test for sparking Type B floors from mechanical causes which could be incorporated in NAVDOCKS Specification F4A. The test and equipment required to perform the test was to be as simple as possible and the results used to classify the floors as either sparking or nonsparking. BUDOCKS concluded visible sparking as being the most practical criterion. (2) Make a series of tests with the objective of providing criteria for revision of specifications for conductivity of floors in ordnance structures. With the above directives in mind, the design of the testing apparatus was initiated. Several machines were conceived, fabricated, evaluated, and rejected prior to the development of the Mark II. This latter device gives consistent results with a minimum degree of error on the part of the operator.

N-299
Development of Evaluation Procedure for Load Transfer Devices, Apr 1957, J. R. Keeton, AD221818, PB154678

The results herein reported indicated that the radius of relative stiffness (L) as measured by the extent of slab deflection under load is considerably greater than would be expected from a theoretical analysis of the slab. This appears to indicate a need for re-examination of the basic design equations for joints. The results also show that in all probability an evaluation procedure for load transfer devices can be developed with relative slab deflection under load as the principal criterion.

N-300
Electrolysis of Sea Water, May 1957, T. Roe, H. Hochman, AD221776, PB154679

Two electrolytic cells for the production of sodium hypochlorite from sea water were designed and fabricated. Data from their operation under varying conditions of flow rate and current density showed that both are capable of producing 2,000 ppm available chlorine in a single pass. Recommendations are made for improved cell design and use of cooling equipment to lower the rate of decomposition of the sodium hypochlorite produced.

N-301
Radio Interference Evaluation of Cold Cathode Fluorescent Lighting Installations, Apr 1957, H. M. Shroyer, D. B. Wright

Production models of Cold Cathode Lighting Corporation, Long Island City, N. Y., fluorescent lamps were studied to determine the practicability of substituting them directly, or with slight modification, in place of standard fluorescent lamps. A typical installation was simulated in the center section of a welded-steel, shielded building measuring 100 ft long by 40 ft wide by 20 ft high. The results showed that although the cold cathode lamps had a lower radio interference output than the standard lamps, the interference levels still exceeded specifications. Also, the light intensity of the cold cathode lamp was less than one-half that obtained from a standard cool white lamp. It was concluded that the cold cathode fluorescent lamps are not suitable as direct replacements for standard 4- and 8-ft fluorescent lamps.

N-302
Performance of the AN/URM-37 for Radio Interference Measurements, May 1957, D. D. Hughes, AD221777, PB154680

The AN-URM-37 was found to lack the required sensitivity for the direct correlation with standard conformance testing equipment and procedures given in BUSHIPS Specification MIL-I-16910A. It was also determined that moderately high ambient levels of radio frequency energy, modulated at an audio frequency rate, can prevent operation of this type of equipment. The AN-URM-37 does exhibit desirable characteristics when used as a broadband voltmeter.

N-303
Hydrophobic Cement, Jun 1957, D. F. Griffin, W. R. Lorman, AD221778

Experiments were made to incorporate tri-n-butyl phosphate with cement at various locations in a commercial production plant conveyor system. The entrained air contents of mortars made with the cement thus produced were not lowered by the tri-n-butyl phosphate. It was subsequently discovered that tri-n-butyl phosphate reacts with oleic acid-treated cement to form either calcium phosphate or calcium butyl phosphate, deactivating the tri-n-butyl phosphate as an air-detraining agent. Elevated temperatures of the cement during the production runs accelerated the chemical reaction (or reactions). The same reaction took place at usual room temperatures over longer periods of time. Hence, little would be gained by cooling the cement in storage before incorporating tri-n-butyl phosphate.

N-304
Testing and Evaluation of Three Prototype Portable Batching Plants, Apr 1957, R. G. Fitzsimons, AD221779

The use of portable batching plants was suggested for the charging of 16-S concrete mixers to increase production of mixed concrete from approximately 35 to 125 cu yd/day and

to expedite the frequent moves required at remote locations of advanced base construction jobs without excessive loss of materials because of ground storage. It was desired that the portable batching plants meet standards for capacity, mobility, and prevention of material loss.

N-305
Evaluation of Size 1/2-in. Sq Drive Electric Impact Wrenches, Jun 1957, A. L. Scott, W. B. Mitchell, AD221780

BUDOCKS requested the Laboratory to compare four makes of electric impact wrenches, including the Thor Model 55 (now Model 56) and the Ingersoll-Rand Model 4U, and to evaluate each on the basis of tests conforming to the provisions of pertinent military specifications. Each wrench performed satisfactorily under test, and each met the general requirements of specifications except for the Thor Model 56, which was deficient in a minor respect. On a basis of quality of performance and construction, the wrenches were rated in order of preference.

N-306
A Zn Cathodic Protection System on the AFDL-20, Jun 1957, E. R. Streed

The cathodic protection system performed satisfactorily for 18 months in a sea water environment. Six 60-lb anodes were suspended around the hull periphery of the AFDL-20. No electrical maintenance was necessary though operational maintenance was required for removal of the anodes for relocation and periodic inspections. Insulation of the hull from adjacent metallic structures was continuously maintained. Results show that surface corrosion significantly was reduced and pitting eliminated with a minimum danger of accelerated paint deterioration. Anodes of special high-purity zinc can be used for extensive periods in sea water without forming hard anodic films that impede the current-producing capabilities of the anode. If a galvanic anode system is preferred to an impressed current system on the basis of simplicity, cost and maintenance, zinc is recommended.

N-307
Test of Murray and Tregurtha Prototype Twin Inboard Propulsion Units, Jul 1957, W. B. Mitchell, A. L. Scott, AD221781

Prototype Murray and Tregurtha twin inboard units were installed aboard a pontoon barge at Port Hueneme, Calif., and found to be inefficient as constructed. Modifications did not improve the units sufficiently to compete with existing outboard types for general purpose application but further development of the tunnel-stern feature is recommended in order to exploit the possibility of inboard propulsion for shallow water application.

N-308
Evaluation of 60-kW Aluminum Diesel-Electric Generator Sets (GMC), Jul 1957, R. H. Leseberg, L. Cromwell, AD221782

In 1948 the Laboratory began evaluating diesel-electric generators for the purpose of satisfying cargo reduction and material conservation objectives. Two 60-kW GMC diesel-electric generator sets were tested in 1955 for 10 mo under adverse desert conditions and found to be unsatisfactory for advanced base use without certain modifications.

N-309
Protective Coating for Steel Piling, Results of 6-Mo Tests, Sep 1957, R. L. Alumbaugh, C. V. Brouillette, A. L. Fowler, AD681739, PB135133

Twenty-three protective coating systems for steel piling were evaluated at the Laboratory. After 6 mo in Port Hueneme Harbor, eight of the coating systems were selected for further evaluation, and 15 were eliminated because of defects caused by the driving operation and exposure conditions. A Saran resin coating gave almost complete protection during the 6-mo exposure period, and seven other coating systems appeared to provide adequate protection in all exposure zones (atmospheric, tidal, mudline, and underground areas).

N-310
Evaluation of 150-kW Diesel-Electric Generator Sets (Cummins), Aug 1957, R. H. Leseberg, J. H. Sams, L. Cromwell, AD221783

In 1948 the Laboratory began evaluating diesel-electric generators for the purpose of satisfying cargo reduction and material conservation objectives. Two Cummins Engine Company, Inc. diesel-electric generator sets were tested and evaluated at the Laboratory and found to be unsatisfactory without modifications for advanced base use.

N-311
Evaluation of 60-kW Diesel-Electric Generator Sets (Caterpillar), Aug 1957, R. H. Leseberg, J. H. Sams, L. Cromwell, AD221784

Two 60-kW caterpillar diesel engine generator sets with Louis Allis Company AC generators were purchased to determine whether this design was suitable for adoption as standard advanced base equipment. Some changes are recommended to improve the quality and the performance of the sets.

N-312
Evaluation of Prototype Chrysler Outboard Propulsion Units, Sep 1957, W. B. Mitchell, A. L. Scott, AD221785

This report deals with the testing of two prototype Chrysler outboard units which were found no better suited for barge propulsion in shallow water than existing types. The units did, however, show promise for general purpose application, and further development is recommended.

N-313
Evaluation of Two 30-kW Diesel Engine Generator Sets (BUDA) Sep 1957, R. H. Leseberg, L. Cromwell, AD221786

Two 30-kW Buda generator sets with Century Electric Company AC generators and the Buda Company Model 6DT-317 diesel engines were purchased and were assigned to the Laboratory for evaluation on 11 Feb 1952. Evaluation testing, performed during the period 20 Aug 1952 through 12 May 1955, is described in this report.

N-314
Evaluation of 150-kW Diesel Engine Generator Sets (GMC), Jul 1957, R. H. Leseberg, J. H. Sams, L. Cromwell, AD221787

Testing of the current production generator sets indicated that the Model 62503 RA diesel engine is an improvement over the original Model 62500 RA diesel engine and that injector failures were eliminated during the Laboratory tests. Modifications made by the Laboratory during the test improved the performance of the generator sets. These modifications, along with other modifications, are recommended to improve further the design and performance of the sets.

N-315
Evaluation of 100-kW Aluminum Diesel Engine Generator Sets (GMC), Sep 1957, R. H. Leseberg, J. H. Sams, L. Cromwell, AD221788

A series of evaluation tests were made using two units, and the results indicated that modifications on all units were necessary to correct the slip-ring and voltage regulator deficiencies. The six units were returned to the manufacturer and modified in accordance with BUDOCKS request. Minor deficiencies were encountered during the second series of evaluation tests, and it is recommended that these units not be accepted for advanced base use without incorporating the modifications suggested by this report.

N-316
Evaluation of 60-kW Diesel Engine Generator Sets (Harnischfeger), Sep 1957, R. H. Leseberg, L. Cromwell, AD221789

At the request of BUDOCKS, the Laboratory undertook to evaluate diesel engine generator sets being developed to satisfy cargo reduction and material conservation objectives. A piston seizure on no. C40114 caused the tests to be discontinued after only 3.4 hr of operation on 10 Aug 1954. The two units were returned to the manufacturer for modifications on 18 Feb 1955.

N-317
Evaluation of Diesel Generator Sets (10 kW Witte), Sep 1957, J. Weinroth, R. H. Leseberg, L. Cromwell, AD221790

During the low temperature starting test on 5 Feb 1957, a camshaft bearing seizure caused a breakdown on Unit 33317. From the inspection and evaluation tests conducted by the Laboratory, it has been concluded that the two 10-kW Witte Model 100RDA, diesel engine-driven generator sets, Numbers 33316 and 33317, do not meet fully the specifications required by MIL-G-10327A(CE), but, with suggested modifications, could be made suitable for advanced base use.

N-318
Evaluation of Small Diesel Generators (Fairbanks Morse), Sep 1957, R. H. Leseberg, J. Weinroth, L. Cromwell, AD221791

At the request of BUDOCKS, the Laboratory undertook to evaluate diesel-electric generators of small size, suitable for advanced base use. As a result of the overall poor performance, numerous deficiencies and final failure of both units as outlined in the preceding paragraphs, it is concluded that these units are not suitable for advanced base use without modifications.

N-319
Development and Evaluation of a Knockdown Antenna Mast, Sep 1957, J. E. Schroeder, J. J. Traffalis, AD221792, PB154681

This report covers the design criteria, a description of the developed mast, test procedures, and conclusions reached from the evaluation of test results. It is recommended that the developed mast be accepted for advanced base use.

N-320
Suitability of Lightweight Steam Boilers for Advanced Bases, Oct 1957, R. J. Zablodil, AD221793

To determine the feasibility of using a newer type of lightweight and compact steam-generating equipment at advanced bases, five lightweight boilers were purchased and tested at this Laboratory. Two were water tube boilers of the forced circulation flash type and three were fire tube type. One standard Navy boiler purchased under existing military specifications was drawn from stock to obtain control and comparative data. Each boiler was given an ASME type of test for operational characteristics and a 2,000-hr duration test for inherent weaknesses. All boilers completed the ASME tests with varying degrees of success, and all but one water tube boiler completed the 2,000-hr duration test. Performance, for the most part, equaled that of the control boiler. It is concluded that the newer type of lightweight, compact boiler, except the model failing to complete the duration test, is satisfactory for advanced base use. It is recommended that only lightweight fire tube boilers be considered for advanced bases and that military specifications be prepared to permit their purchase.

N-321
Evaluation of the Modified Todd Insecticidal Fog Applicator (Model 40E), Oct 1957, E. N. Hellberg, AD221794

BUDOCKS requested NAVCERELAB to conduct tests on the TSC-manufactured, modified TIFA Model 40E to determine its suitability, ruggedness, and dependability for use by decontamination crews in applying disinfectants in the form of fog to the interiors of buildings. The unit performed satisfactorily in all operational tests. However, the unit vibrated badly and minor difficulty was experienced with some of the smaller components on the machine, and this resulted in some down time. It was determined that the unit was difficult to handle because of its weight and lack of convenient lifting points. It was concluded, therefore, that the modified TIFA, as tested, did not meet the logistic requirements. It was recommended that further work be done in collaboration with the manufacturer to develop a machine lighter in weight, and that other makes of fog generators be investigated.

N-322
Static Resistance of Reinforced Concrete Beams Through the Elastic and Plastic Ranges, Oct 1957, G. R. Swihart, J. R. Allgood, W. A. Shaw

A theory is presented for determining the static resistance characteristics of simply supported, reinforced concrete beams. Four loading conditions are considered in the presentation: (1) a concentrated load at midspan, (2) equal concentrated loads at the third points, and (3) a uniform load on the entire span length. The theoretical plastic region is shown for each of the four loading conditions. Static test data for 11 beams is reported which includes the first three loading conditions listed above. Load-deflection curves are plotted for each of the 11 specimens and are compared with theoretical calculations.

N-323
Evaluation of Silent Glow Model 300 Portable Incinerator, Oct 1957, K. B. Edwards, J. J. Traffalis, AD221795

A high incidence of part failures and the discovery of a number of deficiencies caused the tests to be suspended. It is recommended that tests be terminated and that the Silent Glow Model 300 portable incinerator not be adopted for advanced base use.

N-324
Test and Evaluation of the Hydraulically Operated Walk Wagon, Jan 1958, O. P. Bak, AD221796

The Laboratory was asked by BUDOCKS to compare the characteristics of the hydraulically operated walk wagon with those of a standard trailer-mounted unit which requires a separate tow vehicle. It was concluded that, subject to the manufacturer making the modifications recommended, the unit is acceptable. It is recommended that a limited number of the units be assigned to Navy shore establishments and advanced base units. It is suggested that a study be made to develop a simple universal adaptor or adaptor group for coupling the hydraulic pump to the primary units.

N-325
Impregnation Plant Improvement Tests, Jan 1958, W. R. Nehlsen, J. E. Halton

BUDOCKS passive defense operations require the use of impregnated protective clothing. This clothing is prepared in modified laundry equipment, and chemical preparation equipment to convert a 100-lb combination laundry for impregnation of clothing was designed for development of improved chemical handling. Through a series of tests, a new mixer and tank were developed, and procedures were simplified. It is recommended that a single dye compound be prepared for impregnation use. A unit to incorporate the new mixer and procedures will be designed.

N-326
Infrared Examination of Protective Coatings, Feb 1958, J. B. Crilly

The tests showed that the identity of paint vehicle resins can be established by infrared spectrophotometry. A sample in suitable solvent was placed on a potassium bromide

disk. After solvent evaporation, the sample was examined in a spectrophotometer over a chosen frequency region. The identity of the sample was established by comparison of its spectrum with spectra of samples of known constitution previously prepared. The experimental error is ±3%.

N-327
The Electro-Alarm Proximity Warning Device, Dec 1957, R. E. Jochums, AD221797

There is no question as to the desirability of an alarm system that would warn crane operators whenever a crane approached a high voltage line. The objective of this test then was to determine the reliability and possible life expectancy of a specific, commercially developed unit - the Electro-Alarm Proximity Warning Device. This report evaluates the testing of device. The unit was mounted on a high speed shore party crane. Results of all phases of testing, including those phases reported on in previous letters, are evaluated in this note.

N-328
Corrosion Inhibitors for Lithium Chlorine Solutions, Jan 1958, C. V. Brouillette, AD221798, PB154611

The results of the studies and experimentations showed that in the presence of inhibitors the stainless steel test panels did not corrode but that the stainless steel fire extinguishers corroded severely. The corrosion in the extinguishers was confined almost entirely at the welds and crevices, which were not present on the test panels. The series of copper panels tested showed greater corrosion losses than did the stainless steel or brass series. Yet, the copper extinguishers, because of the lining of lead, appeared to be satisfactory for use with inhibited lithium chloride solutions. In instances where copper surfaces were exposed through the lead lining, corrosion did occur. The series of brass panels tested in the presence of the sodium dichromate-oxalic acid inhibitor or the sodium dichromate citric acid inhibitor resisted corrosion better than did the series of copper panels. No brass fire extinguishers were available for use in the full scale corrosion tests. However, extinguishers manufactured of drawn brass are commercially available, are heavily lead lined, contain no solder, and are pressure tested to 500 psi. Inasmuch as pressures near 500 psi are possible, if a restriction occurs in the delivery hose, the brass extinguishers would be more desirable than the copper extinguishers, which are tested for 350-psi pressure.

N-329
Thomas Boom Stop System Versus Cheesman Boom Snubbers, Feb 1958, R. E. Jochums, AD221799

This report evaluates the comparative testing of the Cheesman Boom Snubbers and the Thomas Boom Stop System. The test systems were mounted on similar high speed shore party cranes. It was concluded that a combination crane boom stop system consisting of oil filled telescoping arms, such as the Cheesman Boom Snubbers, and vacuum operated controls, such as those in the Thomas Boom Stop, would be desirable for military use. The adoption of such a system for military use was recommended.

N-330
A Dual Rail Track System Installed on Caterpillar D2 LGP Snow Tractors, Apr 1959, J. J. Doman, J. R. Dawes, D. Taylor, AD250618

Contract NBY-3122 was initiated on 7 Jan 1957 for the development and fabrication of a dual-rail track system by the conversion of the existing single-rail system of the Laboratory's no. 4, LGP D2 caterpillar tractor. Contract NBY-3135 was awarded to the Shepherd Machinery Company on 1 May 1957 for a new caterpillar D2 LGP snow tractor with a dual-rail track system, and this became the Laboratory's no. 5, LGP D2 snow tractor.

N-331
Effects of Driving on Long Precast Concrete Piles, Feb 1958, R. J. Lowe

The purpose of this investigation was to determine the stresses in precast, reinforced concrete, long piles from the time of manufacture to the time of application of a service load, and to determine the extent to which a concrete pile can be driven without damaging its capacity as a load bearing member.

N-332
The Ionics Sea Water Demineralizer, Apr 1958, J. S. Williams, J. W. Burdick, AD221800

Two performance runs were made with the Ionics sea water demineralizer. Each test was scheduled to run for 200 hr. The first was 156 hr in duration, producing a product containing 207-ppm total solids at an average rate of 99 gph. Average power required was 12.5 kW/h. The second run continued for 164 hr, making water averaging 398-ppm at a rate of 120-gph. Power requirements were 17 kW/h. In each case the test was terminated because severe scaling occurred within the concentrate sections of the stacks.

N-333
Use of Volatile Corrosion Inhibitors for Preserving the Interior Surface of Steel Pipe, Feb 1958, C. V. Brouillette, AD221801, PB154612

The deterioration of the interior surface of steel pipe during periods of outdoor storage has long been a serious corrosion problem. Work at the NAVCERELAB and other laboratories has shown that VCI will protect the steel surfaces of enclosed spaces. These inside surfaces can be cleaned by light flushing prior to use and in many cases need no cleaning. The VCI, cyclohexylamine carbamate, can be easily prepared from the reaction between cyclohexylamine and carbon dioxide (dry ice). Cyclohexylamine carbamate prepared in situ is recommended for use in preventing corrosion inside of steel pipe which is stored outdoors. Metal closures are effective seals for the ends of the steel pipe.

N-334
Assembly and Evaluation of a 100-Ton Capacity Floating Crane (Single-Tier Barge), Mar 1958, R. C. Towne, J. J. Hromadik, AD221802

This report covers the study of necessary barge reinforcement required on a single-tier barge, theoretical analysis of the flotation of the single-tier barge, engineering evaluation, conclusions, and recommendations. The results of the engineering evaluation of the single-tier barge was satisfactory. Subsequently, the barge crane was towed to Coronado, Calif., for operational tests.

N-335 - Not published

N-335A
Characteristics of Coral Aggregates from Selected Locations in the Pacific Ocean Area, Apr 1958, W. R. Lorman, AD828461L

Section 13 contains 33 statements concerning physical characteristics inherent to the corals investigated. These statements, together with corroborative information presented elsewhere in the paper, lead to an important corollary, which is expressed as follows: the most desirable coral concrete aggregate is a coralline limestone possessing a structural quality rating of 70% or better.

N-336 - Not published

N-337 Rev.
Instrumentation of San Nicolas Diesel Engine Power Plant Engines With Boiling Condensing Cooling, Rev. Jun 1958, E. J. Beck, AD221803

NCEL, Port Hueneme, Calif., cooperated in the instrumentation of an engine at the plant of the supplier for the San Nicolas Power Plant expansion engines, and cooperated in conducting exploratory testing of the engine at elevated steam pressures. The initial instrumentation was designed primarily to detect possible sealing ring problem areas, but allowed partial analysis of the heat transfer and temperature distribution in the area of junction of cylinder and head, including the upper portion of the piston ring travel. The analysis, with isothermal plots under four conditions of loading and cooling is given, including one run with forced circulation of low temperature coolant. A proposal for simple but more precise instrumentation of one of the two 8-cylinder engines to be installed on San Nicolas Island is made. From the tests made, it was concluded that probably critical metal temperatures were well within established safety limits.

N-338
Bond Allowance for Grouted Prestressed Steel, Apr 1958, P. J. Rush

Determinations were accomplished by evaluating grout consistency, grout-compressive strength, the use of admixture materials, and grout placement procedures, for their effects on bond-strength. All work was performed at NCEL, Port Hueneme, Calif.

N-339
The Evaluation of a Power Assist Load Divider Dolly for Wheeled Trucks, May 1958, O. P. Bah, AD221804

This subproject was directed by the Chief of Civil Engineers, U.S. Navy, after preliminary review indicated that the power assist dolly offered the possibility of savings in capital equipment costs. This report presents the test results and conclusions on the subject dolly substitution. The dolly, in conjunction with small truck tractors, was not recommended as a substitute for large truck tractor prime movers.

N-340
Teledyne Crane Moment Indicator System, Jun 1958, J. J. Bayles, AD221805

The Teledyne Crane Moment Indicator System was procured from Fredric Flader, Inc., Toledo, Ohio, in Oct 1953 for in-service testing on a locomotive crane at the Naval Gun Factory, Washington, D.C. Following several unsuccessful attempts to obtain satisfactory operation of the Teledyne system, testing was discontinued. The Laboratory was directed to continue the test and to evaluate the results. A locomotive crane was obtained on loan from the NSY, Long Beach, Calif., and the Teledyne System was forwarded from the Naval Gun Factory and installed on the crane by Laboratory personnel. First, a source of power that furnished constant frequency and voltage was found. Testing was then accomplished and components of the Teledyne system were found to function properly. It was determined that by redesign of the system a usable and practical crane safety device could be developed.

N-341
Analysis of Surge Forces on a Moored Ship in Progressive Waves, Sep 1958, E. Silberman, AD705995

The Laboratory is engaged in collecting and analyzing data on the forces induced by waves in ship moorings in order to improve mooring designs and increase knowledge of the forces imposed upon waterfront structures and offshore structures and moorings. An approximate equation of motion in surge for a ship moored in progressive waves is derived and an example of field data from a spread-moored drilling tender in the Gulf of Mexico is analyzed using the equation. The particular measurements needed for data analysis are discussed. In the example of field data analyzed the results were unsatisfactory because of an error in the surge accelerometer calibration. It is concluded that the damping force due to friction is negligibly small in surge and that the mooring chains play a minor role, the ship oscillating with the wave as though adrift. Further there is coupling between the motions of the ship, suggesting that one of the other degrees of freedom may determine the force in the moorings. It is recommended that an investigation be conducted into pitch and the coupling between pitch and surge. Also, the correct calibration of the surge accelerometer should be used to recheck the application of the equation of motion.

N-342
The Ionics Brackish Water Demineralizer, Oct 1958, J. S. Williams, J. W. Burdick, AD221806

After 2 yr of intermittent operation, during which time a number of unsuccessful attempts were made to meet the contract specifications, a performance run of 396 hr was completed. The demineralizer operated at an average rate of 121 gph. The feed water averaging 3,475 ppm was reduced in total solids to 175 ppm. The power requirement was 2.79 kW. The test was terminated when excessive leakage in piping and fittings, plus erratic operation of acid feed equipment, made continuation impractical. A special trip was made to visit a brackish water unit being operated for the City of Coalinga, Calif. Data from this unit were very favorable. They are included in the report to furnish a comparison of two different sets of conditions.

N-343
Architectural Concrete Surface Finishes, Sep 1958, J. M. Mayhoe, R. B. McIntosh, AD221807

To investigate techniques and materials for producing various textures and finishes for new and for old portland cement concrete surfaces, exclusive of paints and coatings.

N-344
Introductory Background Theory for Electromagnetic Interference Analysis, Aug 1958, L. Cromwell, AD221815, PB154687

The problem is essentially that of a source of radio interference, for example at an insulator in a power transmission line, that can either be radiated directly, or conducted down the line and re-radiated along all or parts of the line. Theoretically, to understand this phenomenon, it is necessary to have background in: (a) the propagation of waves and antenna theory (the line acts as an antenna) which includes a knowledge of electromagnetic theory, based on partial differential equations and vector analysis, and (b) the theory of the transmission line itself. These reports represent a summary of the essential parts of the theory to give the necessary initial background. Prior contact with the elements of the theory is assumed; and, although many of the relationships have been explored fully, the more rigid mathematical proofs are not stated but referenced to standard books on the subject. This particular report covers (a) only. Another report published simultaneously will pertain to (b). The rationalized MKS system of units is used throughout. A list of symbols and of the rationalized MKS system of units precedes the report proper. A summary of the fundamentals of vector analysis is contained as an appendix.

N-345
Basic Transmission Line Theory for Electromagnetic Interference Analysis, Aug 1958, L. Cromwell

This report is a continuation of the basic theory outlined in another report published simultaneously by the same author entitled, "Introductory Background Theory for Electromagnetic Interference Analysis." Whereas that report was concerned with wave propagation in general, this report covers only propagation over a line. The symbols used are identical to those of the previous report, and units, likewise, are in the rationalized MKS system. Three appendices

are included on the representation of sinusoids, hyperbolic functions, and the solution of the transmission line basic differential equation.

N-346
Analysis of the Free Oscillation in Surge and Sway of a Ship as Spread Moored, Dec 1958, D. L. Bender, AD221817, PB154688

Measurements are being made of the forces induced by waves in the moorings of an LST (about 5,300 long tons displacement) as spread-moored to act as a drilling rig tender by six 2-1/16-in. and one 1-1/4-in. stud link chains in about 45 ft of water in the open Gulf of Mexico off New Orleans, La. This report presents results of an analysis of the likely behavior of the ship in still water as background for a projected dynamic analysis of the force data collected. By use of field measurements of mooring chain geometry, as adjusted in the office by use of the catenary equations in a specially developed graphical form, a satisfactory position of static equilibrium was calculated. The tension at the ship end of the various chains is found to vary from about 7 to 35 kips for the equilibrium position.

N-347
Compacted-Snow Parking Area for the 1960 Olympic Winter Games, Aug 1958, J. E. Dykins, R. C. Coffin, E. H. Moser

This report presents a study of constructing and maintaining a 125-acre compacted-snow parking area on the meadow in Squaw Valley, Calif., during Jan and Feb 1960, for the Olympic Winter Games. Following the success of the compacted-snow parking lot built during the 1957-58 Squaw Valley Winter Trials, this study was to provide information should the Navy be requested to participate in the 1960 project.

N-348
Evaluation of Modified LVT(4) Polar Fire Fighting Vehicle, Dec 1958, A. L. Scott, W. B. Mitchell, AD221808

This report summarizes the work done by the Laboratory toward preparation of the polar fire fighter for Antarctic use and attempts some evaluation of the vehicle in spite of very limited experience with it.

N-349 - Cancelled

N-350
A Comparison of Evaporative Air Coolers for Desert Application, Dec 1958, C. R. Hoffman, AD221809

Procurement of large quantities of poor quality evaporative cooling equipment by the armed forces during and immediately following World War II has resulted in a definite need for better military purchase specifications for evaporative coolers. As a result, the Laboratory has been authorized to conduct a program to determine operational and design characteristics of the three basic types of evaporative coolers functioning in varied climatic environments so that adequate procurement specifications may be prepared. The tests which have been completed at the 110-deg dry bulb-70-78-deg wet bulb conditions have shown the rotary coolers to be about 8% more effective than the drip-type coolers and nearly 25% more effective than the slinger-type coolers. It has also been noted that cooler effectiveness increases as the relative humidity of the outside air decreases. This project will be completed with testing at 90-deg dry bulb-70-78-deg wet bulb conditions. Until that time, no conclusions or recommendations will be made.

N-351
Polar Structures, Erection of Attwell Shelter Under Adverse Weather Conditions, Dec 1958, J. E. Dykins, AD221810

This report covers the erection of an Attwell Shelter, manufactured by Attwell, Inc., of Everett, Wash. A 16x24-ft shelter was procured for conducting an adverse weather erection to determine its potential as a camp component. It was a standard production model of the same type that is being extensively used by arctic contractors.

N-352
Comparative Evaluation of Certain Industrial Sweepers, Jan 1959, J. J. Bayles, AD250619

The Chief, BUDOCKS, assigned the evaluation of certain industrial and warehouse sweepers to NCEL in order to determine the best machine, or machines, for use by governmental agencies and to permit competitive procurement. In addition to the sweepers evaluated in this project, certain other makes and models of sweepers merit consideration.

N-353
A History of the Distillation and Desalting Program at NCEL, Feb 1959, J. S. Williams

The Laboratory was requested by BUDOCKS to prepare a chronological history of the salt water conversion program, delineating the contributions which have been made to the state-of-the-art. In addition, the projected program for future research and development was desired. A review of the past endeavor presents an interesting metamorphosis in the scope of work that has been undertaken. The program originally consisted almost entirely of evaluation of equipment. This expanded into development, and the Laboratory is now engaged in applied research on desalting problems. It becomes evident from examination of the records that criteria have changed during this period. At first the factor of operational economy was stressed. As this economy was improved, the requirement for simplicity and dependability became the controlling factors. It is the desire of the Laboratory to achieve the dependability without sacrificing the economy already attained.

N-354
Shelter Habitability Studies. The Effect of Odor in a Shelter and Ventilation Requirements, Nov 1960, J. S. Muraoka, AD250620, PB154689

Rewritten as R-146.

N-355
Bibliography on the Civil Engineering Aspects of Missile Launching Platforms and Facilities (U), May 1960, R. A. Breckenridge, AD319329, CONFIDENTIAL

N-356
Evaluation of Electric Incinerating Toilet, Mar 1959, W. R. Nehlsen, AD250621

Polar region operations by Naval SEABEE Operating Forces are difficult and expensive because of the severe climatic conditions. It is impossible to construct normal water carriage sewage systems, and waste disposal arrangements are makeshift and uncomfortable. Availability of a satisfactory incinerating toilet would be a considerable advance in comfort and sanitation for polar operations and the Incinomode Electric Toilet is being considered for this use. Results showed the unit is well-constructed and operates reliably. Considerable odor is discharged from the stack and the catalytic odor reducer incorporated in the unit seems ineffective. Further tests are planned, and means to reduce the odor discharge will be sought.

N-357
Preservative Ability of Teflon Film to Protect an M38A1 Jeep Exposed to Marine Air of Southern California, Mar 1959, R. J. Zablodil, AD250622

The film on external surfaces began to fail within 6 mo permitting rust to form in varying degree of severity depending on relative exposure to marine air. Following the initial 12-mo exposure, an inspection of the internal portions of the jeep revealed the film on the surfaces of the

engine, transmission, and differentials to be in excellent condition. Exposure will continue. A second inspection will be made following an additional 12-mo exposure.

N-358
A Knock-Down Angle Dozer Installed on a Caterpiller D2 LGP Snow Tractor, Jun 1959, J. J. Doman, J. R. Dewes, D. Taylor, AD250623

Operations Hardtop I and II have demonstrated the need for an angle bulldozer to round out the complement of accessories for the D2 LGP snow tractor. The standard 2A bulldozer C frame will not fit over the wider D2 LGP with its 40-in. tracks, and the standard angle dozer blade is not wide enough to clear a path for the overall track width of the LGP tractor. A quick solution for providing a suitable dozer appeared to be available by modifying a standard 2A bulldozer. This was accomplished under Contract NOY 73263 by the Pettibone Wood Manufacturing Company of North Hollywood, Calif. This contract provided for the design and fabrication. Further modifications were made under Contract NBY-3110 by the Shepherd Machinery Company of Los Angeles, Calif.

N-359
Separation of Saturated Hydro-Carbons from Creosote and Their Toxicity to Marine Boring Organisms, Aug 1959, R. W. Drisko, H. Hochman, AD250624, PB154690

Although a number of methods are reported in the literature for the separation of saturated hydrocarbons from creosote, none was found to give a complete separation. A chromatographic adsorption procedure has been developed which can separate the saturated hydrocarbons from the other constituents of creosote. Davison Grade 922 silica gel is used as the adsorbent, and n-hexane is used as the effluent. Saturated hydrocarbons added to wholly aromatic creosote were recovered quantitatively by this procedure. Ultraviolet spectral analyses of the saturated hydrocarbon fractions separated from both creosote and creosote-petrolatum blends proved the absence of aromatic contamination. Saturated hydrocarbons separated from creosotes produced at lower carbonization temperatures were relatively nontoxic to adult limnoria and to teredo larvae.

N-360
Corrosion Studies Associated With an Air Blast Closure Unit, Jul 1959, C. V. Brouillette, AD250625, PB154691

The efficient operation of a mechanical device is very dependent upon the ease of movement of its various working parts. Eleven months' exposure of an air blast closure unit, fabricated from a combination of several different metals and alloys, resulted in the formation of a sufficient quantity of corrosion products to render the closure unit of doubtful operational value. It is recommended that neoprene rubber gasketing be used throughout, that the louver door frame and support brackets be fabricated from 6061 aluminum alloy; that all pins be cadmium plated and coated with an inhibited soft grease such as AN-C-124A, AM3 Type II; and that all springs be heavily coated with the inhibited soft grease.

N-361
Analysis of Creosote by Column Chromatography, Oct 1959, R. W. Drisko, H. Hochman, AD250626

An effective method of separating saturated hydrocarbons from creosote and petroleum oils was developed. The coke oven creosotes investigated had extremely low saturated hydrocarbon contents, while creosotes produced at lower carbonization temperatures contained significantly greater amounts. The saturated hydrocarbon fractions from both creosotes and petroleum oils were all relatively nontoxic to limnoria and teredo.

N-362
In-Service Test of a Selected Neoprene Coating on the Internal Surfaces of an AFDL Dewatering Pump, Aug 1959, D. Taylor, J. J. Doman, AD250627

A neoprene coat, 0.054 in. average thickness, was applied to the impeller and internal surfaces of the shell, suction cover base, and the cover packing box of a dewatering pump on the AFDL-6 at the Naval Repair Facility, San Diego. The pump was operated 8 hr during 8-1/2 mo in-service use of the floating dock. Inspection of the coating disclosed a few blisters on the impeller and suction cover base near the wearing rings. A blister was removed from each of the parts. There was considerable rust under the blisters, but the cause was not determinable. The coating thickness and hardness had not changed materially over the service period, and other than the blisters it was in good condition. The pump was reassembled and returned to service in Mar 1959. It will be inspected again about Mar 1963.

N-363 - Reissued as R-119

N-364 - Reissued as R-061

N-365
Rusted Components of Material in Storage, Oct 1960, J. C. King, AD250628, PB154693

NCEL is conducting a 5-yr storage test program to evaluate various storage environments and preservation levels for materiel under LJDOCKS technical cognizance. Similar paired items were stored in different storage environments: an open air slab, a shed, a standard warehouse. One of each pair has light domestic preservation treatment, and the other full contact preservation treatment. The storage protection of each environment is determined by periodic Class II inspections. Results of 4 yr of storage show that protection is poor in the open air, fair in the shed, good in the standard warehouse, and better in the RM warehouses. Compared to domestic treatment, contact preservation decreases rust incidence about 58% for open air and 50% for shed and standard warehouse storage. After one more year of testing, all items will be completely disassembled for a final Class III inspection.

N-366
Effect of Sprinkler Head Particle Sizes and Distribution on Fire Extinguishment, Aug 1959, R. J. Zablodil, R. S. Chapler, AD250629

In order to obtain maximum utilization from a limited supply of storage tank water of an NCEL-developed, advanced base, packaged sprinkler system, certain commercially manufactured sprinkler heads were investigated to determine which produced particle sizes and distribution for superior extinguishment of a laboratory Class A test fire. Sixteen runs each were made on 11 different types of sprinkler heads (four manufacturers). Four were made to establish distribution, eight to determine fire extinguishment times, and four to obtain samples for particle size measurements. It was found that of the sprinkler heads tested, those delivering particle sizes in the range of 260 to 340 m diam at distribution in the range of 0.035 to 0.040 gpm/sq ft generally gave best performance in extinguishing a specific laboratory Class A test fire. It was shown mathematically, however, that sprinkler heads providing distribution of approximately 0.28 gpm/sq ft would give optimum extinguishment performance.

N-367
Ship-to-Shore Bulk Fuel Delivery System (Bottom Laid), Jun 1959, J. E. Schroeder, AD250630

This report describes the design and testing of a lightweight steel pipe system, the design and testing of a standard weight steel pipe system, and the design and development of a system utilizing National Diamond "B" Buttress Thread, Grade J-55, Range 2, oilfield casing. The results

of operational tests conducted by PHIBCB-ONE are also included. It is recommended that the ship-to-shore bulk fuel delivery system (bottom laid) utilizing the subject oilfield casing be considered for adoption as a standard fueling system for amphibious assault operations. It is planned to continue development work in order to simplify the current equipment and to develop a higher capacity, 600-gpm, 6-in. pipeline system.

N-368
Development of a Ship-to-Shore Bulk Fuel Delivery System (Buoyant), Aug 1959, J. E. Schroeder, J. J. Traffalis, H. D. Larson, AD250631

This report describes the development of a powered hose reel system, consisting of a tension relieved 4-in. rubber hose, powered hose reel of 3,500-ft capacity, and miscellaneous equipment for installation and maintenance. Techniques for the installation, operation, maintenance, and retrieval of the system were also developed. The results of operational tests conducted by PHIBCB-ONE are also included. As a result of the tests to date, it is recommended that the present system be subjected to further operational tests using the diesel-powered reel now under development. Plans for further development have been formulated to carry out this recommendation.

N-369
Evaluation of Small Diesel Engine-Driven Generator Sets (15-kW Hobart), Aug 1960, R. H. Leseberg, J. M. Sams, AD250632

It was concluded that the two units perform satisfactorily for either individual or parallel operation, require minimum maintenance, and are basically well-designed, being compact and lightweight. Because the results of the limited number of performance tests were favorable, further consideration appears warranted; and it is recommended that a complete laboratory evaluation be made.

N-370
Infilco Portable Sewage Treatment Plant, Project History and Comments, Apr 1959, W. R. Nehlsen, AD250633

A portable sewage treatment plant designed and constructed by the Infilco Company was tested at NCEL during 1953 and 1954. These tests showed good results but certain design changes were recommended. Subsequently, BUDOCKS purchased a redesigned plant for in-service testing at Guantanamo Bay. Construction and testing were to be done by Construction Battalion at that location, but before construction was complete, the Battalion was no longer available for this work. The redesigned plant was then shipped to Port Hueneme, Calif., for installation by the Laboratory at the Marine Training Camp at Bridgeport, Calif. This construction proved to be too expensive, and the project is terminated with this report. A technical review of the plant drawings indicates that the plant is designed within acceptable sewage treatment criteria and could be expected to perform satisfactorily.

N-371
Diesel-Powered Hose Reel, May 1960, J. J. Traffalis, AD250634, PB154695

A diesel-powered hose reel was developed for use with a 4-in. buoyant fuel system. The reel, powered by a 15-hp, 2-cyl, air-cooled, diesel engine, has a capacity of 3,000 ft of 4-in., collapsible, discharge hose. It can be mounted on, and efficiently operated from, either a warping tug or LCU. This report describes the reel, acceptance tests, installation tests, and modifications made as a result of the tests. The installation tests consisted of seven installations of 1,000 ft of 4-in. collapsible hose and two installations of 6-in. flat hose. It is recommended that the diesel-powered hose reel be assigned to the fleet operating forces for in-service testing.

N-372 - Reissued as R-124

N-373
Evaluation of External Corrosion Protection Methods for Cold Pipes in a Desert Soil, Jun 1959, K. B. Edwards, AD250635

After being underground for 7 mo, the pipe specimens with various external surface treatments exhibited no significant corrosion, not even the bare pipe specimens. An analysis of the ground water which covered a portion of the test piping at the time of inspection revealed that the water contained sufficient chloride and sulphate ions to promote electrochemical corrosion of a cell. Apparently no cells were formed, however, because there was no detrimental corrosion present.

N-374
The Effects of One Megacycle Ultrasonic Vibration on the Compressive Strength of Portland Cement Mortar, Sep 1959, J. M. Hayhoe, AD250636, PB154696

The object of this report is to present the findings of a limited investigation in which 1-Mc ultrasonic vibration was applied to portland cement mortar paste.

N-375
Separation of Missile Launching Pads From Railroads and Adjacent Launch Pads, Jul 1959, R. A. Breckenridge, S. L. Bugg, W. F. Burhart, R. A. Mitchell

The object of this report is to disseminate information obtained during a study of: (1) the hazards involved in the explosion of a large missile on its launching pad and (2) the safety distances required between launching pads and inhabited buildings, railroads, or adjacent launch pads.

N-376
Decontamination of Pavements by Motorized Sweepers, Operational Requirements, Sweeper Characteristics, and Developmental Program, Nov 1959, W. R. Nehlsen, AD250637

BUDOCKS passive defense responsibilities require that equipment and techniques for rapid decontamination of paved areas be available. Operational requirements for decontamination sweepers are determined, and available equipment is analyzed. Sweeping to residual numbers of 0.01 and 0.10 is a feasible objective for practical equipment. A sweeper developed by the Tennant Company for the Air Force will meet operational requirements for rapid radiological recovery, but other types of street and runway sweepers can be used in later fallout clean-up. Except where re-entry of decontamination crews is required before 24 hr, operator protection can be provided by practical amounts of shielding. Where earlier re-entry is required, remote control operation in direct vision range is more practical. Development of shielding and dust control equipment is required for existing runway and street sweepers.

N-377
Waste Disposal Systems for Polar Camps, Nov 1959, W. R. Nehlsen, AD250638

Polar climates and terrain make construction and use of normal water and sewage systems difficult or impossible for polar camps, and sanitary facilities for Navy forward bases in these regions have generally been unsatisfactory in the past. This study used a 25- to 500-man station as a basis for studies on improvement of sanitary facilities and classifies problems with respect to the availability of fresh or salt water. Systems used at various types of camps in the past have included incinerating toilets, chemical toilets, pit latrines, tank and bucket arrangements, and waste water re-use systems. Incinerating toilets and salt water waste systems are selected as most likely to provide practical facilities, and further studies on these items are needed. Study of disease transmission resulting from discharge of sewage and ground garbage to ocean areas is required.

N-378
Evaluation of a 100-kW Diesel-Electric Generator Set (Caterpillar), Dec 1959, R. H. Leseberg, J. H. Sama, AD250639

A Caterpillar Tractor Company 100-kW diesel engine-driven generator set with a Caterpillar Model D318G turbocharged diesel engine and an Electric Machinery Company AC synchronous generator was procured to determine whether this type unit was suitable for advanced base equipment. The unit was tested and evaluated at NCEL to ascertain general compliance with contract and military requirements using military specifications MIL-G-10327A - Generators and MIL-G-10228A - Methods of Test. It is recommended that the Caterpillar 100-kW generator set not be accepted without making certain corrections and modifications contained in this report.

N-379 - Reissued as N-389

N-380
Properties of Materials in Deep-Ocean Environment, A Progress Report, Mar 1960, K. O. Gray, AD489585

The Deep-Ocean Study Program at NCEL, during the period covered by this report, has been aimed at discovering, by bibliographic research, correspondence, and personal contact, the extent of knowledge concerning the environment of the ocean floor at 15,000 ft and its effects on various construction materials. The investigation disclosed that, outside of a small amount of data on the behavior of trans-atlantic cables in deep water, almost no factual data on materials is available. It is recommended that high-pressure laboratory equipment capable of simulating the deep-ocean environment be procured and operated under a program designed to test the properties of various materials, protective coatings, and devices in a salt-water environment at a pressure simulating 15,000 ft of depth in the ocean.

N-381
Analysis of the Critical Shielding Volume for Underground Shelters, Feb 1960, J. C. Ledoux, AD250640, PB154697

BUDOCKS has assigned NCEL the responsibility of developing design principles for constructing atomic warfare shelters for Naval shore establishments. Part of this problem is evaluating various shelter systems for protection against nuclear radiation. This report presents the results of an investigation to determine which part of the earth covering a buried shelter is the most important as a radiation shield. Computations have been completed for slab and hemisphere geometry for fractions, F, of 0.99 and 0.999. For slab geometry, X is equivalent to the thickness of the slab shield. For hemispherical geometry, X is equivalent to the sum of the radius of the hemisphere plus the minimum cover over the arch. In order to preserve the shielding integrity of the shelter system, the shielding volume defined by the critical angle should not be violated by openings of any sort such as vents, ducts, and entranceways.

N-382
Evaluation of Shunk "Gator Twistooth" Blade, Jul 1960, J. J. Bayles, R. E. Jochums, AD250641

A comparative evaluation of the Shunk "Gator Twistooth" test blade and two commercially available conventional blades for earth-moving equipment was conducted by the Laboratory in order to determine the relative merits of design and blade material. No evaluation of the blades was made in field operations regarding design effects on ease or speed in cutting and loading.

N-383
Attenuation of Gamma Radiation Through Two-Legged Rectangular Ducts and Shelter Entranceways, an Analytical Approach, Jan 1961, A. B. Chilton, J. C. Ledoux, AD264022

An analytical approach is developed to permit determination of gamma radiation attenuation as it passes through two-legged rectangular ducts and shelter entranceways. The approach used employs the albedo concept for wall scattering and includes correction terms necessary to account for the "corner lip effect." With appropriate simplifying assumptions, moderately simple engineering formulas are obtained. Actual use of the formulas requires better knowledge of differential angular albedo than is presently available, however by assuming isotropic distribution of the albedo function, a very good comparison of experimental information with results calculated by this technique is obtained.

N-384
Test of Preservative-Lubricants and Rust Inhibitors, Jul 1960, J. M. Stephenson, AD250642

NCEL is conducting a continuous outdoor exposure test to evaluate preservative-lubricants and other rust inhibitors with respect to handling and effectiveness in preventing corrosion, eliminating cyclic inspections, and reducing reactivation time for a variety of mechanical equipment. Thirty-four materials have been applied to critical areas on tractors, jeeps, and pumps. After 1-1/2 yr of testing, 12 materials failed in at least one area. Many areas are still in excellent condition and will continue to be inspected every 4 mo until they fail or have been in place 5 yr. As the test for each preservative is concluded, its respective area is depreserved and given a detailed inspection. Materials are worked into the test when practicable.

N-385
Progress in Radiation Shielding Research for Protective Shelters, Jun 1960, A. B. Chilton, AD250643

The present status of radiation shielding technology is reviewed, with particular emphasis on protection against radiation resulting from nuclear weapon explosions. The exposition, oriented toward an audience of civil engineers, describes the basic concepts and presents brief descriptions of important research work carried out in various institutions in this country during the past decade. An extensive list of source material is provided.

N-386
Study of Pile Driving by Vibration, Feb 1961, R. E. Jochums, A. A. Denny, AD252860

An investigation, currently in progress at the Laboratory, has included liaison with United States firms engaged in developmental work in vibratory pile driving, a literature search for authoritative information in this field, and the preparation of a bibliography.

N-387
Evaluation of 60-kW Gasoline Engine-Driven Generator Sets (Stone), Aug 1960, R. H. Leseberg, J. H. Sama, AD250644

Two 60-kW, prototype, lightweight, gasoline engine-driven generator sets, with Chrysler Corporation industrial model IND-56, V-8, gasoline engines, and Ideal Electric and Manufacturing Company synchronous alternators, developed under contract no. NO-83651 with Stone Industrial Power, Inc., and assembled by Stewart and Stevenson Services, Inc., Houston, Tex., were procured to determine whether this type of generator set was suitable for advanced base use. The results of the limited number of performance tests were within military specifications, but the numerous failures experienced with the two sets during the short period of operation at the Laboratory (21.3 hr for Unit No. 1 and 27.3 hr for Unit No. 2) indicated that considerable redesign work would be required.

N-388
The Tundra Truck History, Dec 1960, D. Taylor, AD249480

NCEL, Port Hueneme, Calif., originally conceived an amphibious vehicle (Tundra Truck) having an LVT engine and power train driving two 60-in.-wide endless rubber track belts on large spring-mounted buoyant rollers. The vehicle

task, one of the first assigned to the Laboratory, was performed under various contracts and has a long history of delays. The test and evaluation is reported in NCEL Technical Report R-094.

N-389
Determination of Parameters in an Empirical Function for Build-Up Factors for Various Photon Energies, Aug 1960, A. R. Chilton, D. Moleviak, L. K. Donovan, AD249195, PB153908

In the computation of gamma-ray attenuation, it is desired to use a simple expression for build-up factors. In this note a simple analytical expression was used for dose build-up factors from a radioactive isotropic point source. The parameters of the expression were determined by the method of least squares to obtain an optimum fit to experimental data for build-up factors for aluminum at various photon energies.

N-390
Relative Strengths of Artificial Ice, Nov 1960, A. J. Funai, AD250645

Relative strengths of rings and beams fabricated from several types of laboratory-produced fresh and sea-water ice with and without reinforcement were measured to assist in the evaluation of ice construction methods. The study covered the effects of flooding, rolling, and reinforcing. Specimens reinforced with various amounts of fiberglass were as much as 10 times stronger than unreinforced specimens. The maximum stress which could be applied to the reinforced ice was usually limited by the amount or rate of specimen deformation rather than by actual specimen failures. The maximum difference between mean strength values for the various types of unreinforced ice was not more than a factor of two. Tensile strengths computed from ring specimens from a given type of ice decreased considerably when the diameter of the center hole through the specimen was increased from 1/2 to 7/8 in. This relationship must be studied more thoroughly before ring-test values can be used as measures of the true tensile strengths of these types of ice.

N-391
Fuel-Transfer Pontoon Barge, Aug 1960, J. J. Traffalis, AD250646

NCEL designed a 10,000-gal fuel barge for use during amphibious operations. It consists of a 3x12 NL pontoon barge which stores fuel in the middle eight pontoons of its center string. This report describes NCEL efforts toward the design and fabrication of the pontoon fuel barge prior to termination of the task by BUDOCKS.

N-392
Slab Floors on Permafrost, A Model Study, Sep 1960, J. M. Stephenson, AD250647, PB154700

Building foundations which will remain stable for the life of their superstructure are difficult to construct in permafrost areas. At present, as one example of producing stability, buildings are raised several feet on piles set in the permafrost. Conventional slab floors were studied as a substitute for piles in a model test environment built to simulate a permafrost area and its seasonal soil and air changes. Dimensional analysis appropriately scaled the time, temperature, and linear dimensions. A small refrigeration coil, placed under the slab of the model building, attempted to keep constantly frozen soil beneath the model. The test was maintained for 41.5 days, equivalent to 3 yr of full-scale slab, and soil temperatures were taken under and around the model floor. The results showed too much thawing of the soil and a slight rise in floor elevation.

N-393 - Reissued as R-138

N-394
The Mechanical Subgrade, A Pavement Load-Transmission Testing Device, Oct 1960, R. J. Lowe, AD250648, PB154701

A unique piece of pavement-testing equipment called the "mechanical subgrade" has been installed at NCEL and given load and calibration tests. The device was built by the FAA (formerly CAA) during the late 1940s to obtain basic information about flexible pavement design. In the device a test pavement is supported on a flooring of small steel plates mounted on plungers and calibrated springs so that when the test pavement is loaded, a yielding support, simulating a subgrade, is provided. The unit pressures transmitted by the loading system through the test specimen are recorded by deflection measuring bars. Calibration of the subgrade indicated that pavement deflections can be read to ±0.003 in. accuracy and that the springs available with the equipment have subgrade moduli of 22, 62, 87, 155, and 325 pci.

N-395
Plastic Concrete Quality Control, Jan 1961, W. R. Lorman, AD252861, PB155114

Presents the basic philosophy for controlling uniformity of concrete during the mixing phase. Quality of fresh concrete is fixed by three principal features, mixing water, mix proportions, and aggregate ration. Primary factors complementing the three principal features are cement content, water-cement ratio, workability, and unit weight. Indicates highlights of those testing methods holding appreciable promise and discusses various associated approaches. A selected bibliography of more than 500 items traces developments during the past 60 yr in this area of concrete quality control.

N-396
Butler Descaler, Oct 1960, J. S. Williams, AD250649

The Butler Descaler is supposed to remove old scale and prevent new scale and corrosion in heating boilers. The manufacturer claims that in addition it will neutralize carbon dioxide, thereby preventing condensate-line corrosion. NCEL conducted two tests, the first to determine whether the descaler would remove old scale and prevent new scale from forming, the second to evaluate the ability of the descaler to remove carbon dioxide from the steam generated in the boiler.

N-397
Permanent South Pole Station. Design Limitations and Concepts, Jan 1961, J. E. Schroeder, AD612148

This is a preliminary review of the construction limits affecting the final design of a permanent 25-man station at the south pole and the evaluation of 12 possible design concepts. The three principal limits selected as those which will have the greatest effect on the final design of the station are: (1) logistical requirements, (2) construction season, and (3) construction force.

N-398
A Creosote Tolerant Marine Bacterium, Nov 1960, T. B. O'Neill, R. W. Drisko, H. Hochman, AD249656, PB154068

In a study of the marine biological environment in which creosoted piling are located, a previously unreported species of bacteria was isolated. This species was detected on creosoted piling from eleven widely differing locations and was the predominant species of bacteria found on these pilings. The new organism was identified as a gram negative rod belonging to the genus pseudomonas and has been named pseudomonas creosotensis. It has been completely described by the standard morphological and biochemical tests.

N-399 Rev.
Spectrochemical Analysis of Oils Using a Modified Electrode, Nov 1960, Rev. Jan 1961, R. J. McGowan, AD647262

A method for spectro-chemical analysis of oil samples using the vacuum cup electrode has been developed, which permits analysis of the oil sample directly without ashing.

N-400
Outline for an Engineering Handbook for Construction in Deep Ocean Areas, Feb 1961, W. F. Burhart, AD252862, PB155313

An outline of an engineering handbook for construction in the deep ocean areas is presented in fulfillment of the objective of subtask YF015-01-001(A).

N-401 - Cancelled

N-402
Wave-Induced Motions of a Rocket Vehicle Drifting in a Vertical Attitude, Jan 1961, J. J. Leendertse, AD252880, PB160834

Results are presented of a theoretical and experimental study in the laboratory of the movements of a large solid-propellent rocket vehicle drifting in a vertical attitude in uniform waves and in the open sea. Measurements were made of the movements in heave and pitch of a 1:120 scale model of a million-lb vehicle, 175 ft long, and about 12-1/2 ft in diam. Heave measurements agree well with those calculated, and pitch calculations were made. The study indicates that the movements of the vehicle in pitch and heave can be decreased significantly by lowering its flotation chamber and by attaching fins or plates and a weight near its tail end.

N-403
Chromatographic Analysis of Extracted Creosote Oils, Jan 1961, R. W. Drisko, N. Hochman, AD250700, PB156506

A number of creosote oils extracted from marine piling which have shown great differences in their resistance to attack by marine wood boring organisms have been analyzed chromatographically for saturated hydrocarbon content.

N-404
Evaluation of External Corrosion Protection Methods for Buried Cold Pipes at China Lake, California, Mar 1961, N. R. Joerding, AD252863

The third inspection of the pipe specimens was completed during the third week of Oct 1960. After 28 mo underground, no significant corrosion was found on the pipes protected by plastic tape or impregnated glass cloth. Class III and Class IV corrosion was found on the bituminous-coated steel pipe. The uncured and heat-cured gilsonite-insulated black steel pipes have a Class IV heavy rust scale with some nodules. The bare copper pipe is corroding and has the appearance of copper cleaned in an acid solution. Class I rust was found on the bare black steel pipe, and only a discoloration was apparent on the bare galvanized steel pipe. The three new pipelines installed 3 mo before this inspection revealed a loose rust powder on the bare black steel pipe and the bare galvanized steel pipe but no significant corrosion on the bare copper pipe.

N-405
Feasibility Study of an Adjustable Causeway, Mar 1961, J. J. Nromadik, AD253975, PB155336

Various concepts of adjusting a causeway section length are considered with respect to desirable characteristics. Those having merit are further reviewed to arrive at the most feasible concept, which is presented.

N-406
Incinerating Toilets, Mar 1961, W. R. Nehlsen, AD253976

NCEL has investigated or tested several commercial incinerating toilets over the past several years. None of these units has proven suitable for polar camp use.

N-407
Development of a Container for a Master Repeater Unit (U), Feb 1961, R. K. Jochums, AD379361, SECRET

N-408
Techniques of Installation for the 4-in. Bottom Laid System (Ship-to-Shore Bulk Fuel Delivery), Apr 1961, J. J. Traffalis, AD258901

Recommended techniques are given for installing and operating the 4-in. bottom laid system (ship-to-shore bulk fuel delivery) in an amphibious operation. Described are the general features and limitations of the system, including its equipment, layout, installation, operation, and shipping requirements.

N-409 Rev.
Discussion of Reports by the California Company and the National Engineering Science Company on the Reduction and Analysis of the California Company Experimental Data on Wave Forces on Piles, Feb 1961, Rev. May 1962, J. T. O'Brien, AD254154

It is concluded that both NESCO and CALCO methods should be applied to pertinent problems and the differences in answers reconciled on the basis of engineering judgment, for cases outside the scope of the CALCO method, the values for the coefficients in the NESCO method should be selected on a conservative basis. Further, wave force measurements should be made at water depths significantly greater than those at the CALCO model, generally to advance knowledge and specifically to check predictions by, respectively, NESCO and CALCO methods.

N-410
Comparative Measurements by Static and Dynamic Methods to Determine Young's Modulus and Poisson's Ratio of Plain Concrete, Feb 1961, W. L. Cowell, N. L. Slover, AD258[illegible]1

The dynamic method (resonant frequency measuring device) of determining Young's modulus of elasticity for concrete was found to be a more reproducible method of testing than the static method (compressometer), however, other investigators question whether the two methods measure the same thing or are related. Dynamic measurements were made for the transverse, torsional, and longitudinal resonant frequencies of each concrete cylinder. Compressometer readings were then taken at 100 and 1,000 psi, the cylinder was then compressively loaded to failure. Three curing conditions, three sizes of cylinders, and three strengths of concrete were used; the cylinders were tested at seven different ages within 336 days from the date of casting. No conclusive proof was found to demonstrate a definite relationship between the dynamic and static methods of determining the value of Young's modulus. Future work will employ a statistical experimental design for similar tests using an improved sonic device, the compressometer, and, in addition, a new static method using electrical resistance strain gages.

N-411
Evaluation of a 150-kW Turbocharged Diesel Engine-Driven Generator Set (Caterpillar), Jun 1961, R. N. Leseberg, J. N. Sams, AD261187

A 150-kW Caterpillar Tractor Company turbo-charged diesel engine-driven generator set with a Caterpillar Model D 337-F diesel engine and an Electric Machinery Company AC synchronous generator was tested to determine whether this type of unit was suitable for advanced base equipment. Military specifications MIL-G-10327A - Generators and MIL-G-10228A - Methods of Test were used as guides.

N-412
Further Analysis of Gamma Ray Attenuation in Two-Legged Rectangular Ducts, Sequel to N-383 May 1961, A. B. Chilton, AD256503

The use of the Albedo approach for the analytical prediction of attenuation characteristics of two-legged rectangular ducts transmitting gamma rays is extended to cases involving the asymmetrical location of source and/or detector. Illustrative problems are presented and solved.

N-413
Evaluation of M-9M2 Airfield Landing Mat, May 1961, T. J. Garcia, AD259989

Limited tests were conducted on 12 panels of the modified M-9M2 airfield landing mat on dry unstabilized beach sand to evaluate the ease of handling, assembly, and disassembly, and its performance under vehicular loads and traffic. The handling of the 12 panels on the shipping skid pallet with a pneumatic-tired forklift or towing with a light military vehicle on dry sand was not feasible. Periodic observations of the assembled mat section over a period of 6 mo revealed that military and construction type vehicles caused no damage to the panels. On one occasion, however, a heavy crawler type tractor caused damage to some of the connectors on one of the panels.

N-414 - Cancelled

N-415
Controlled Atmosphere for Spectrochemical Analysis, Jun 1961, R. J. McGowan, AD259353

A technique for spectrochemical analysis of various materials which will eliminate the cyanogen bands formed during carbon arcing.

N-416
Preliminary Investigation of Jet Blast Deflectors, Dec 1961, H. Tomita, AD327403

A preliminary investigation of jet blast deflectors was conducted to determine the feasibility of undertaking a development program on deflectors to protect areas at the ends of runways and warm-up pavements from aircraft jet engine erosion. An overall study of the problem was made for this investigation. It included previous studies and ideas on deflectors, restrictions imposed on obstructions at runway ends and end zones, and summaries of some publications on the characteristics of jets. It is concluded that concrete paving on which aircraft may exhaust during pretakeoff operations offers the most feasible solution of the problem. It is recommended that no further study of deflectors be undertaken.

N-417
Coatings for Butler-Type Buildings, Oct 1961, C. V. Brouillette

Silver bright aluminum-asphalt paint was shown by laboratory tests and by outdoor weathering in a marine atmosphere to be inferior to a specification oil-base paint, a specification synthetic enamel, and a specification aluminum paint applied to either mild steel or galvanized steel. Of the three specification paints, the oil-base paint showed superior performance when applied to galvanized steel. All three specification coatings gave equal protection on rusted steel test panels and were protecting both mild-steel and galvanized-steel buildings satisfactorily after 5 yr of exposure to the marine atmosphere at Port Hueneme, Calif.

N-418 - Reissued as R-187

N-419 - Cancelled

N-420
S. G. Concrete Mix Tester, Sep 1961, W. R. Lorman, AD266605

Refers briefly to the basic philosophy of controlling the quality of concrete and emphasizes the need for precise control of the W/C. Describes the design and operation of the proprietary apparatus. Presents the experimental results, and their significance, relative to the effectiveness of the instrument as an indicator of the acceptability of freshly mixed concrete with reference to the W/C of the intended concrete mixture. Indicates the limitations of the proprietary instrument and the characteristics to be featured in its improved version.

N-421
Epoxy Asphaltic Concrete Overlay, NAS, Point Mugu, California, Jan 1962, R. J. Love, AD271684

To investigate the problems involved in the manufacture and placing of epoxy asphaltic concrete and to observe its performance over an extended period of time, a 120x335-ft overlay, 3/4 in. thick, was placed in an operational area at NAS, Point Mugu, Calif. Surface preparation, plant modifications, and problems involved with the short "pot life" of the epoxy material are discussed. The requirements for proper mixing, temperature control, and placing are presented. Costs of the overlay plant modifications and results of the first year of observations are given.

N-422
Erection of Quarters Building for Pioneer Polar Camp, Sep 1961, R. W. Hansen, C. R. Hoffman, E. H. Moser, AD266579

NCEL, Port Hueneme, Calif., is developing a 25-man pioneer polar camp under task YF015-11-102. This camp is to be suitable for construction and operational efforts in remote polar locations. Its anticipated use at a single location is from 60 days to 12 mo, depending on the operational requirement. For short-time use it must be suitable for 50-man occupancy and for long-time use, 25-man occupancy. The 16x48-ft modified Jamesway hut described in this technical note has been selected as the basic structure for the pioneer polar camp. The equipment and furnishings to convert it to a 9- to 18-man living quarters were used in mock-ups made during the camp development. In the final plans for the camp, some of the items of equipment and furnishings for the living quarters have been changed, and others are being reviewed for greater simplicity, reduced space, or improved performance. Even so, no change in the basic concept of the quarters is planned unless the technical evaluation at NAF, McMurdo, Antarctica, during Operation Deep Freeze 62 shows a need for change.

N-423
Application of Queuing Theory to the Design and Location of Personnel Shelters, undated (Jun 1962), J. R. Kettenring, AD281694

We would like to find a measure of the effectiveness, in terms of serviceability, of the shelter location, the passageway design, and the entranceway width. The problem is characterized by the inherent randomness or variability which is present in the distribution of times for entry into the passageway. The specific model used in this paper is designed for shelters which must handle roughly 100 or more personnel and where the ratio of arrival-to-service rate does not exceed 0.9. The result is a method which will handle a large class of situations where people arrive, wait in a single file, and enter one at a time into the passageway. It is assumed that the distribution of arrivals is Poisson, and the distribution of service times is exponential. The paper includes instructions for implementing the methods, verifying assumptions on randomness, and finding estimates of the required parameters.

N-424
Summary and Discussion of the Replies to the Questionnaire sent to the Naval Shore Establishment on the Use of Camels, Feb 1962, D. F. Green, AD279220

The replies to the questionnaire sent to 33 agencies of the Naval Shore Establishment concerning the use of camels are presented and discussed. The use of camels in the ports surveyed has been limited to large logs, rafts, or pontoons which effectively have no provision to absorb energy. The camels have been used to separate berthed ships and also to separate berthing ships from the wharf. Damage to the wharf during berthing has occurred at nearly all major establishments several times per year. The damage has generally been caused during the berthing of large ships during times of high winds. The total amount of damage per year at all Naval establishments who replied is estimated at $500,000

N-425
Separation of Saturated Hydro-Carbons from Creosote-Coal Tar Solutions by Column Chromatography, Dec 1961, R. W. Drisko, H. Hochman, AD267467

A chromatographic method of analyzing creosote for saturated hydrocarbons was described in NCEL Technical Note N-359. The present note describes a modification of this method for application to creosote-coal tar solutions.

N-426 Rev.
Field Survey of Interior Coatings for Water Tanks, Jan 1962, Rev. May 1962, A. P. Demarco, AD281064

A field survey of the Naval Shore Establishment was conducted to assess the magnitude of coating deterioration and tank corrosion on the interior of steel tanks used to store water. Data collected from the survey were also analyzed to ascertain the factors contributing to such deterioration. Improper surface preparation and choice of paint systems were noted as important factors allowing corrosion in such tanks. Surface preparation by sandblasting before application of coatings was recommended for maximum coating life.

N-427
Dynamic Tests on High Strength Steel, Feb 1962, W. L. Covell, J. R. Keeton, AD271804

The test results indicate that the percent increase in dynamic yield stress for the high strength steel is lower than that previously reported for conventional reinforcing steels. Compared with static test results, the dynamic loading resulted in a small increase in ultimate strength and no significant change in area reduction or in percent elongation at rupture. Dynamic tests were conducted on two types of machines - hydraulic and pneumatic - to provide information about the operating characteristics of the machines. This information was used to formulate the specifications for a dynamic testing machine. Because of the limited number of tests involved in this study, additional tests should be made on high-strength steel to corroborate the findings.

N-428
An Investigation of the Gaseous Mode of Moisture Migration Through Portland Cement Concrete, Apr 1962, W. C. Naylor, AD280625

For this purpose, several samples of concrete were obtained, their transmission rates for argon and helium were investigated, and their transmission rates for water vapor as an ideal gas were calculated. These calculated gaseous rates were then compared with actual total rates obtained in this and previous experiments with similar concrete samples. From the comparison of the calculated gaseous rates and the measured total rates of water vapor transmission, it was concluded that the gaseous mode is not a significant moisture migration mode through concrete.

N-429
Preliminary Observations on the State of the Arts in Locating Objects in Deep Ocean, Feb 1962, A. M. Brown, AD396059

A review of the existing state of the arts in locating objects in deep ocean has revealed that capabilities and equipment now exist for carrying out the various task objectives at ocean depths of less than 2,000 ft. At depths to 2,000 fathoms, present equipment could be modified to accomplish task objectives. For ultimate objectives of 6,000 fathoms, the pressures and distances are so great that successful locating, viewing, and manipulation of equipment at that depth cannot now be assured.

N-430 - Reissued as R-204

N-431
Correlation of Water Level Variations with Wave Forces on a Vertical Pile for Non-Periodic Waves, May 1962, B. J. Muga, T. Sakou, AD283298

Filter techniques employing Fourier transforms as evolved by Rein (1958) are used to study measurements of hurricane generated waves and forces induced thereby on vertical circular piles 2, 3, and 4 ft in diam.

N-432 - Reissued as R-228

N-433
Inflatable Causeway - Modular Design, Apr 1962, J. J. Hromadik, J. J. Traffalis, R. A. Bliss, AD275298

Utilization of an inflatable-type causeway that can be multi-tiered in side carry on an LST may offer a marked logistic advantage over the present type of causeways. A modular concept of such a causeway was developed and tested by the Laboratory. Each causeway section consists of 24 steel modules assembled into two 12-unit strings with angles and supported on inflatable pontoon cells restrained in cavities. The assembled superstructure resembles an inverted muffin tin. Air inflation of the cells is achieved by a source external to the system, a limited auxiliary air supply is housed internally for emergency use. Tests indicate that the modular design is satisfactory for use as an inflatable-type causeway. Operational evaluation is recommended.

N-434
Shock Absorber for Joining 3x15 Causeway to LST, May 1962, R. C. Towne, AD280990

This report describes the initial development and tests of three proposed spring-type shock-absorber systems for joining the 3x15 causeways to an LST. The results of tests and observations to date indicate that a spring type shock absorber is feasible. Development work is continuing.

N-435
Shielding and Grounding Techniques, Undated (c. Apr 1962), D. B. Clark, AD279882

This paper prepared for presentation at BUDOCKS Electrical Design Conference, Washington, D.C., Feb 26-Mar 2, 1962.

N-436
Temporary Polar Camp Concept and Design Criteria, Mar 1962, J. E. Schroeder, G. E. Sherwood, J. E. Dykins, AD280043

This is a preliminary report on the development of a temporary-type, airborne, packaged camp for polar use. The camp, based on a 50-man component, is being developed for surface installation on all types of polar terrain, including snow, ice, and permafrost. Specific design criteria are delineated for the three 3 elements considered essential to surface polar camps. These elements are environmental

adaptation, basic facilities for each camp function; adequate space allocation for confined living; suitable structures for a cold environment; functional yet comfortable outfitting; reliable yet simple utilities for heat, power, water supply and sanitation; protective systems for camp safety; and construction aids for camp construction and operation.

N-437 - Cancelled

N-438
Plastic Pipe In-Service Test (12ND), May 1962, R. J. Zablodil, AD280784

The plastic pipe has carried 766,162 lb of steam condensate from 17 Aug 1961 to 2 Jan 1962 without fixed dimensional changes, visual evidence of degradation, or color change.

N-439
Performance of the Swedish Rapid-Closing Anti-Blast Valve, May 1962, E. N. Hellberg, AD275196

A 14-in.-diam Swedish anti-blast valve was tested for air flow and weatherability. Air flows from 1,830 to 3,980 cfm produced pressure losses from 1.28 to 4.56 in. of water when air is drawn through the valve. Air flows from 1,830 to 4,750 cfm produced pressure losses from 0.25 to 2.56 in. of water when air is exhausted from the valve. Without the shear pin holding the closure disc fixed, fluttering became serious at air flows in excess of 900 cfm. The free movement of the closure disc was unaffected by 10 mo of outside storage and the valve in general was virtually rust-free.

N-440
Maintenance Equipment for Public Works Departments, May 1962, A. L. Scott

A research task was initiated to determine what maintenance tasks are performed, what equipment is being used, and what equipment can most efficiently do this work. A questionnaire was prepared to obtain data but it was later decided that better information could be obtained by personnel contacting bases of typical sizes and environments. A few stations were visited, but the task was cancelled before any conclusive data were collected.

N-441
Evaluation of Methods for Protecting Buried Cold Pipes from External Corrosion at China Lake, California, Jun 1962, H. R. Joerding, AD283061

The fourth and fifth semi-annual inspections of cold water pipe lines were made in Jul 1961 and Feb 1962. Since only about 2 ft of pipe is exposed at each inspection, the condition of pipes reported herein may not apply over their entire lengths. The pipe wrapped in plastic tape and that wrapped in resin-impregnated glass cloth were rust free and still in excellent condition. However, the bare galvanized pipe, more recently installed, had lost its zinc plating and was covered with a light to medium rust. Furthermore, the bare dielectric-coupled galvanized pipe installed 25 mo earlier was covered by a light loose rust, and splotches of the zinc plating had suffered galvanic corrosion and is now black in color. The remaining pipes are continuing to deteriorate.

N-442
Ignition of Fires and Fire Spread by Thermal Radiation, Jun 1962, F. W. Brown III, AD277575

This report presents a discussion of the problem of primary and secondary fires resulting from a nuclear weapon explosion. The relationship between the incidents of secondary fires and earthquake-produced fires in the United States is discussed. Relationships between the area destroyed by fire and blast as a function of yield of nuclear weapons is presented. It is concluded that the ratio of fire damage area to the blast damage area increases with the yield of the weapon. Primary fire will be a significant factor, and the elimination of potential fire sources is of the utmost importance. The probability that a fire storm can be prevented by the use of adequate firebreaks augmented by the use of fire retardant paint is proposed. It is recommended that existing military installations be resurveyed to see what protective steps are feasible and necessary.

N-443
Gamma Dose Rates and Energy Spectra in a 3-ft Square Duct, Jun 1962, J. M. Chapman, AD278119

Dosimeter measurements and gamma-ray spectra were taken in a 3-ft-sq concrete duct. The spectra are used to determine the dose rate contributions from the individual scattering areas and to determine the percentage of these dose rate contributions due to multiple scattering in the first leg. Dose rates are compared with calculated values, and it is found that calculated values are always low. This discrepancy is attributed to the effects of multiple scattering.

N-444
Performance of Buried Plastic Electrical Conduit Under Static Loads, May 1962, T. J. Garcia, H. Tomita, AD276913

An investigation was conducted to determine the vertical deflection and change in diameter of plastic electrical conduits when buried under 2 ft of compacted dry sand and loaded on the sand surface. Three sizes of conduits examined were 2, 4, and 6 in. in diam. The conduits were tested in a steel box (NL T-6 pontoon). The span of the conduit was 7 ft. Plate loads up to 20 kips in increments of 5 kips were applied on the surface of the sand. It appears from this investigation that all of the tested conduits are able to withstand a load of 20 kips on a 15-in. plate, approximately 113 psi, applied at the soil surface when buried in 2 ft of thoroughly compacted dry sand.

N-445
Deep-Ocean Core Boring and Soil Testing Investigations, May 1962, R. J. Smith, AD283560

A survey of past work relative to ocean bottom soil sampling and testing has been conducted to implement subtask YF015-01-001(G), oCre Borings in Deep Ocean. In this it was determined that for areas of deeper water few reliable test results are available and that suitable means for obtaining undisturbed cores remain to be developed. The results of the physical testing of the Mohole core samples should become available in the near future. Procedures for sampling and testing in shallower water environments by use of adaptations of normal techniques are fairly well advanced. Possible application of the potentially important indirect methods of securing bottom data are described. On the basis of presently existing techniques, an outline has been prepared of anticipated general procedural steps involved in order to execute submarine foundation investigations in the future. Recommendations are made as to suggested research directions necessary to attain facility with such procedures.

N-446
Effects of the Deep-Ocean Environment on Materials, A Progress Report, Jul 1962, K. O. Gray, AD281941

A submersible test unit carrying 1,318 specimens of 301 different materials was placed on the ocean floor on 29 Mar 1962 in 5,300 ft of water for an exposure period of 6 mo. Five additional units are proposed one each for 12- and 24-mo submersion at 6,000 ft and one each for 6-, 12-, and 24-mo submersion at 12,000 ft on the ocean floor. A system of medium-sized (9-in.-ID) pressure vessels capable of simulating various aspects of the deep-ocean environment, with a pressure range from 0 to 20,000 psi has been fabricated and will be in operation early in FY-63. A large

(18-in.-ID) pressure vessel with similar capabilities is under procurement and is expected to be in operation in FY-63.

N-447
Preliminary Studies Concerning Structures in the Deep Ocean, Jun 1962, P. J. Rush, AD278457

Much of the work has been devoted to literature studies and conferences to establish directions for future research in the field of deep ocean structures. Basic design for a tower-like structure known as the submersible test unit (STU) was accomplished. This promises to be a valuable tool for investigating the deep ocean environment as it can be immersed for long time periods. Some conclusions derived from these preliminary studies are presented as is a broad survey of the state-of-the-art in various aspects of the deep ocean structures problem.

N-448
Concepts for Very High Vertical Radiators, Aug 1962, P. J. Rush, AD285055

The need for unconventional types of very low frequency antenna systems as alternatives to the costly conventional systems is discussed. Possibilities of using very high vertical radiators of various structural types are explored. The loads and forces that must be sustained by 3,000-ft-high structures are described. Materials suitable for unusual structural concepts are set forth. Concepts encompassing 3,000-ft-high guyed towers, compression-tension towers, free-standing towers, mass structures, and retractable towers are briefly analyzed; and structural, erection, and economic feasibilities of the various concepts are presented.

N-449 - Reissued as R-214

N-450
Ultraviolet Degradation of Paint Films, Jun 1963, J. B. Crilly, AD410168

A cell has been built to contain the gaseous degradation products from coating films and paint films placed on the inner surface of the cell and then exposed to ultraviolet radiation. These products may be identified by their infrared spectra. The cell has been used to identify the degradation products of linseed oil and an alkyd resin. It may be used to measure the protective qualities of various pigments in vehicles by comparison of degradation rates of vehicle only with degradation rates of complete paints.

N-451 - Reissued as R-235

N-452
Special Duty Refrigeration Appliances, Aug 1962, J. W. Chapin, AD283516

A preliminary fact-finding survey of three representative stations in the Pacific area confirms the existence of a real problem in the rapid deterioration of refrigeration appliances. Ambient conditions at tropical or subtropical locations accelerate the decay of equipment so that service lives are substantially decreased. Early replacement and constant maintenance add costs that appear to justify the development of special duty units for use in corrosive environments.

N-453 - Reissued as R-263

N-454
Rapid Tunneling Equipment and Techniques, Sep 1962, D. Taylor, AD284694

A study of existing reports and information for commercial tunneling equipment and methods was conducted to provide information about rapid tunneling, and to determine which equipment can be adopted by Naval construction forces at advanced bases to permit underground operations. An outline is given for a manual on rapid tunneling equipment and techniques.

N-455
Methods for Lining or Coating Installed Metal Piping, A Literature Survey, Nov 1962, T. Roe, R. L. Alumbaugh, AD290543

Two methods are discussed, either of which can be used for the repair of in-place piping which is corroded internally: (1) cleaning followed by coating with an organic material, and (2) installation of a plastic liner. Field experience has shown that both methods are effective.

N-456
Low Ground Pressure Caterpillar D4 Snow Tractor Specifications, Aug 1962, D. Taylor, AD283559

During the past 12 yr NCEL has developed a series of crawler snow tractors for use in the polar regions. The developmental details are being consolidated in a series of specifications which can be used in the purchase of future units or as a basis for further development as the need dictates. This report provides specifications for a low ground pressure Caterpillar D4 snow tractor with a dual-rail track system.

N-457
A Deep-Ocean Sediment Sampler, Sep 1963, R. E. Jones, AD421116

The techniques and systems for construction in deep ocean areas must be developed to support the new concepts of Naval warfare. Knowledge of seafloor sediments, including their mechanical and biological properties, is needed to support studies of the behavior of materials in the deep ocean environment. Therefore, a scoop-type, bottom sediment sampler and its successful operation in deep as well as shallow waters is discussed. Photographs and design drawings are presented.

N-458
Emplacement of the First Submersible Test Unit on the Sea Floor One Mile Deep, Feb 1963, R. E. Jones, AD404524

A series of deep ocean materials exposures has been planned, the first of which is described herein. The criteria for a suitable study site, the locating techniques used for establishing its accurate position, and the installation of a 3-1/2-ton submersible test unit (STU) containing engineering materials specimens (metallic and nonmetallic) at the selected site are described. The behavior of plastic ropes under load and special procedures dictated by their use are discussed. The precautions taken to assure retrieval of the STU are presented in detail. The collection of environmental data is described.

N-459
Low Ground Pressure Caterpillar Model 955 Trancavator Specifications, Sep 1962, D. Taylor, AD284695

During the past 12 yr NCEL has developed a series of crawler snow tractors for use in the polar regions. The developmental details are being consolidated in a series of specifications which can be used in the purchase of future units or as a basis for further development as the need dictates. This report provides specifications for a low ground pressure Caterpillar Model 955 Trancavator with a dual-rail track system.

N-460
Preliminary Development and Tests of a Blast-Closure Valve, Sep 1962, R. A. Breckenridge, AD293980

The ventilation systems of shelters providing blast protection must have automatic valves to prevent ingress of damaging pressure waves through the air ducts. This report

discusses a 600-cfm blast-actuated closure valve being developed at NCEL for overpressure up to 100 psi. A series of air-flow and blast tests have been performed which show that the valve has the potential to satisfy all of the desirable cr teria but requires further development.

N-461
Barges Versus Pontoons, Oct 1962, B. N. Bryner, AD287982

A comparison is made of the pontoon, inflatable, and an integral hull (barge) type causeways to provide a basis for deciding if developmental work on a barge-type causeway is warranted. The attributes of the three types of causeway are tabulated and discussed. A weight for each attribute is assigned, and a comparison is made on this basis. In the overall picture, the barge type does not appear to have a significant advantage over the other types to warrant development.

N-462
Influence of Initial Deformation on the Bending of Arches, Feb 1963, A. A. Dadeppo, AD299710

This study is part of a long-range program to obtain information which will serve as a guide in developing design methods for underground structures. In tests of buried arches one of the perplexing problems is the variation in moments from one test to the next due to surface loads. It was hypothesized that the variation was due to the initial shape of the arch induced by backfilling. The results obtained show that the initial deformation is, indeed, important in controlling the flexural response of thin arches.

N-463
Specifications for the Model 80 Snow Plane, Oct 1962, N. E. Pierce, E. W. Moser, AD289842

Outline specifications for procurement of special equipment for compaction of snow in polar regions are being prepared by the Laboratory. This technical note contains the specifications for the model 80 snow plane presented in NCEL Technical Report R-110, Snow Compaction Equipment -Snow Planes. This unit, which is a ski-mounted, towed-type piece of equipment, is used for leveling and grading natural and compacted-snow areas. Its 80-ft span makes it especially suitable for use on long-wave sastrugi, or wind-driven snow, where the crest-to-crest distance exceeds 50 ft and the crest-to-trough height is 12 in. or more.

N-464
Rusted Components of Materiel in Storage, Sep 1962, J. C. King, AD402376

Results of the test show that protection is poor in open-air storage, fair in a shed, good in the standard warehouse, and excellent in the controlled humidity warehouses. Five components - internal-combustion engines, gear boxes, fuel-injector sets, hydraulic brake systems, and cooling systems - had a high incidence of rust regardless of storage environment and with lit'le regard to preservation level. Compared to domestic treatment, contact preservation decreases rust incidence about 58% for open air, 44% for the shed, and 30% for the standard warehouse; no rust due to storage environments occurred in the controlled-humidity warehouses for either preservation level.

N-465
Gamma Ray Attenuation in a 12-in.-Diam Round Concrete Duct, Nov 1962, T. R. Fowler, C. H. Dorn, AD289349

Dosimeter and geiger tube measurements were made along the centerline of a 12-in.-diam circular concrete duct with two right-angle bends. Measurements showed that the build-up factor in the first leg was the same as that found in earlier work for the square duct. The dosage received down one leg of the duct follows closely the functional form KX(Exp)-M, where X is the distance along the axis of the duct, and K and M are empirical constants. The value of M for a round duct has been found to be about 10% smaller than that found for square ducts of similar size. The attenuation of the corner, however, is greater for a round duct than for a square one. A theoretical treatment of the first leg using single-scattering theory is included in the appendix.

N-466
Summary of NCEL Reports on Pre-Engineered Buildings, Feb 1963, W. Q. Ginn, AD297878

From Jan 1952 to Dec 1962, 33 technical documents evaluating 32 prefabricated buildings were published by NCEL. This technical note is an annotated bibliography of those documents and includes a tabulation of test results, arranged according to size and type of building. Of the 32 buildings tested about 60% were found to be structurally adequate. Twenty-eight percent of the structurally adequate buildings were rejected because of other deficiencies. The erection time of the 20x48-ft buildings ranged from 319.0 to 649.3 man-hr. The total shipping weight of all buildings tested varied from 2,347 to 39,289 lb, and the total shipping cubage varied from 138.5 to 1940.0 cu ft.

N-466A
Summary of Data Concerning Pre-Engineered Buildings, Oct 1966, P. J. Rush, R. L. George, D. S. Harrington

This addendum is a compilation of current information concerning pre-engineered and/or prefabricated buildings suitable to the purposes of NAVFAC in operations requiring optimum shipability, erectability, and demountability. The information is based upon data and claims supplied by manufacturers and other sources and has not been verified by field or laboratory tests or by mathematical analyses. Some opinions of NCEL engineers, based upon experience and informal observations, are included to supplement incomplete data.

N-467
Cellular Glass Insulation for Underground Hot Lines, Oct 1962, R. J. Zablodil, AD286877

One-hundred-and-ninety ft of 6-in. pipe used to carry steam condensate was installed with Foamglas insulation at NSY, San Francisco, Calif., during May 1962. Installation was made to evaluate the performance of Foamglas, with particular attention given to improving the quality, efficiency and economy of installation techniques. Measurements of the temperature difference across the insulation indicated that Foamglas was satisfactory as a thermal insulator. The effectiveness of Foamglas as a moisture barrier is supposedly very good, but it will not be possible to check this property as the water table is below the pipe most of the time.

N-468
Chemical Wood Preservative Plant, May 1963, J. W. Chapin, AD404240

A small plant for treating marine piling has been constructed at NCEL. Although primarily designed for creosote service, the plant is readily adaptable to other treatments and simulates equipment in use by commercial treating firms. Pre-service tests and initial operations indicate the treatment plant performs as expected and is ready for service applications.

N-469
Some Applications of a Semiempirical Formula for Differential Dose Albedo for Gamma Rays on Concrete, Nov 1962, W. C. Ingold, AD291133

This theoretical study illustrates the usefulness and versatility of a semiempirical formula through its application to three specific problems: (1) in generating a table of albedo values for various combinations of angles of scatter, (2) in studying first reflection contribution to dose rate in a round duct compared to that in a square duct,

(3) in developing of a relatively simple and unsophisticated program for multiple scatter contributions.

N-470
Mathematical Model Simulation of the Logistical Support for Amphibious Operations, Nov 1962, R. C. Towne, B. H. Bryner, AD289093

The purpose of this task is to develop improved transfer systems capable of handling all materials utilized in amphibious operations and initial advanced base supply. This report describes the initial development of a computer simulation of the logistic support of amphibious operations. The results of this work indicates that the mathematical simulation in its present form will not provide reliable answers, but with proposed improvements a computer program can be developed to compare and evaluate logistic systems and components. Development work is continuing.

N-471
Gravity Ventilation of Protective Shelters, Jul 1963, E. J. Beck, AD414093

The obvious alternative to a power-operated ventilation system for a protective shelter is natural draft. The possibilities, limitations, and some alternatives for simple augmentation of natural draft are outlined. These include the use of a flame in a flue, both with and without thermoelectric power generation. A simple design procedure and demonstration test program are outlined.

N-472
Study of Queuing Theory in Shelter Entranceway Design, Jan 1963, D. B. Ryder, AD297001

Experimental data are presented which test the assumptions on which Technical Note N-423, Application of Queuing Theory to the Design and Location of Personnel Shelters, is based. A method outlining the development of design criteria of general usefulness is also given.

N-473
Cooperative Marine Piling Investigation, Phase 1 - Pile Driving at Coco Solo, Canal Zone, Apr 1963, H. Hochman, AD405914

The Cooperative Marine Piling Committee and BUDOCKS exposed 54 specially treated piles at Coco Solo Annex, Rodman Naval Station, Canal Zone. The treatments being evaluated are chromated copper arsenate followed by creosote, ammoniated copper arsenate followed by creosote, and phenylmercuric oleate in creosote-coal tar solution. Unmodified 70/30 creosote-coal tar solution is being used as the comparison standard. This report describes the installation of these piles at the test site.

N-474
Large Power Impulse Noise Generator for Evaluation of RFI Shielding and Filtering, Nov 1962, D. B. Clark, AD289840

A unique noise generator has been developed which provides a large output of impulse noise pulses with gaussian amplitude and time distribution. Filters with 100 db of attenuation can be tested for impulse characteristics with continuous spectrum impulse noise up to 1,000 Mc. Evaluation of several commercial interference filters are presented, and some show greatly reduced effectiveness against impulse noise as compared to CW specifications. The noise generator, which consists of thousands of tiny capacitors charging and discharging through spark gaps in an inert atmosphere across a 50-ohm coaxial load, provides repetition rates to 20 Mc and output levels to 170 db above 1 μV/Mc peak. The impulse noise output can be easily modulated to simulate natural noise sources by modulating the AC or DC driving voltage. The noise generator construction and operation are described in detail, and evaluation of its performance is presented.

N-475
Investigation of Manipulating Devices for Deep Ocean Equipment, Jan 1963, W. J. Phalen, AD295999

Accelerated interest in the deep ocean has focused attention on the manipulating devices to be attached to deep ocean vehicles. The object of this task is to investigate the manipulating devices that can be used in the undersea environment. The amount of work that can be accomplished by the vehicle is dependent on the agility and sophistication of its manipulating devices. The report gives details on 10 manipulating systems with requirements and desirable features for manipulators included.

N-476
A Development Program for Polar Camp Sanitation, Dec 1962, W. R. Nehlsen, AD294309

A study has been made of the problems and current developments in the field of polar sanitation. The major portion of this study was a contract effort by Clark and Groff Engineers, with additional information drawn from NCEL work in the field. It is concluded that research and development work should continue or be undertaken in the following fields: (1) improved application of water carriage sewage systems, including development of minimum water use appurtenances and criteria, and studies of heating and insulating sewers, and (2) development of surface and subsurface sea intake systems.

N-477
Protective Coverings for Sea Ice, Dec 1962, N. S. Stehle, AD295742

Trials to determine the ability of protein-based aqueous foams to protect ice surfaces from solar radiation and deterioration were conducted by contract with Onondaga associates at Point Barrow, Alaska, during the spring of 1962. Foaming equipment difficulties necessitated the use of a marginal foam formulation for the tests and also delayed the field work, but it was demonstrated that a protective coating of foam would delay, if not prevent, ablation of the ice. For example, 16 days after thaw about one-quarter of a foam-protected test plot was still intact, some 18 in. above the surrounding unprotected ice. The trials indicated a need for a foaming generator suitable for field use and evaluation of the most promising of the Onondaga foam formulations under field conditions before considering further development of protein-based aqueous foam formulations. In the interim, other materials, including rigid and flexible urethane foams, are being screened for their ability to protect ice surfaces during melt.

N-478
A Mathematical Approach to Economy of Experiment in Determinations of the Differential Dose Albedo of Gamma Rays, Dec 1962, C. M. Huddleston, N. F. Shoemaker, AD291904

Treatments of the differential dose albedo of gamma rays on concrete have supposed that the albedo value is a function of: the energy of the incident gamma radiation, the polar angle of incidence, the polar angle of reflection (or scatter), and the azimuthal angle of reflection. It is demonstrated here that, if certain reasonable assumptions are made regarding the mechanism of reflection, it is not necessary to investigate variations in albedo with azimuthal angle of reflection. Once differential dose albedo has been determined for a complete set of incident and reflected polar angles with zero azimuth, albedo at any azimuth can be derived by a suitable transformation.

N-479
Methods for the Time Series Analysis of Water Wave Effects on Piles, Jun 1963, W. J. Pierson, AD409966

The object of the task is to obtain coefficients of drag and mass for vertical circular piles in a hurricane wave environment by the analysis, using non-periodic techniques, of force and water level measurements versus time as obtained in the open Gulf of Mexico. Three methods for the

analysis of water wave effects on piles are outlined and compared, namely, bump-counting, time domain operations, and spectral operations. Computational requirements of the time-domain representation as introduced by Reid (1958) are contrasted with those required by the corresponding spectral representation. The joint distribution of the velocity (U) and the acceleration (dU/dT) is given, from which the probability density function of the horizontal component of the force on the pile, $F(T) = K1U\,U + K2U$, is derived where K1 and K2 are constants containing, respectively, coefficients of drag and mass. A detailed procedure for evaluating the probability density function is included.

N-480
Field Evaluation of Exterior Concrete and Masonry Paints, Feb 1964, A. P. Demarco, C. V. Brouillette, AD600357

A large-scale field application to evaluate four currently specified exterior concrete and masonry paints has been undertaken. The paints were applied on the ocean side of a large concrete building in such a way that each paint received the same set of slightly varying exposure conditions. Since the ocean side of the test location faces directly south, the paints under evaluation are subjected to natural weathering under the influence of solar radiation and salt spray. Present findings indicate that one of the four paints, a cement-water paint, has an undesirable water absorbing characteristic under exposure to continuous rainfall.

N-481
Simulated Cold Weather Radiological Decontamination of Recovery Equipment, Jan 1963, A. E. Hanna, AD296248

NCEL was requested to develop suitable AW decontamination materials equipment and techniques for use in temperatures down to -10F. Tests were conducted in NCEL's cold chamber, in which compressed air, steam, vacuum, water, and antifreeze solution were used to remove a fluorescent fallout simulant from a large tractor. It is concluded that antifreeze solution and water, if warmed, are the most effective materials, steam may be acceptably effective, and air and vacuum have limited use. Additional work is recommended.

N-482
Pioneer Polar Structures - Specifications for Jamesway Shelter Accessories, Apr 1963, G. E. Sherwood, AD404663

Accessories were developed for improving the Jamesway in order to provide a suitable, lightweight, quick-erecting shelter for use as quarters, messing, galley, utilities, administration, and other such applications in pioneer polar camps. These accessories include, a heavy duty floor and foundation system, a wall extension kit, special entry kits, an improved electrical distribution system, and special utility accessories. This technical note contains the specifications for the Jamesway shelter accessories presented in NCEL Technical Report TR-241, Pioneer Polar Structures - Accessories for the Jamesway Shelter.

N-483
Pile Driving by Vibration, Jun 1963, R. J. Lowe, AD422088

This paper discusses the history of pile driving by vibration, abstracts information available on the subject and reports on its use in the USSR, China, and USA. Recommendations are made for comparison driving and subsequent load testing of steam versus vibratory driven piles to aid in developing acceptance criteria necessary for the adoption of a vibratory driving principle.

N-484
Temporary Polar Structures, Preliminary Evaluation of the Modified T5 Barracks, Dec 1962, J. P. Cosenza, AD297398

Preliminary evaluation of the modified T5 barracks at NCEL showed that the size, weight, cube, and erection time for the new building was about 55% greater than for the experimental T5 barracks, and its potential compartmented occupancy density was about 80% greater. The new building is simple to erect and with experience can be assembled in less than 60 manhr using a six-man erection team.

N-485
Pontoon Barge Speeds and Fuel Transport Studies, Mar 1963, R. C. Towne, J. J. Traffalis, A. L. Scott, AD299871

The purpose of this task is to determine the most practical and economical equipment and methods for transporting fuel by water under the specific conditions listed in the task objectives. This study covers that part of the task dealing with the investigation and test of pontoon barges and associated accessory gear as a solution to the task objectives. It was concluded that the pontoon barge is suitable as a cargo transfer vehicle and the Murray and Tregurtha models 6DH-71 or 6LP-12-71 propulsion units will propel the barge at the minimum designated speeds specified in the task objectives. Investigation of other types of barges and methods of propulsion is continuing.

N-486
Body Motions of a Buried Arch Subjected to Blast Loading, Aug 1963, J. R. Allgood, D. Dadeppo, AD416475

An approximate method is developed for predicting the deflections of the footings of a buried arch subjected to a blast wave traveling along the surface. Results from the theory are compared with measured values from Operation Plumbob Structure 3.3A. The influence of the dominant parameters is discussed. It is shown that duration of loading is exceedingly important in governing the magnitude of footing deflections. The theory is presented in a form suitable for use in the design office.

N-487
Structural Behavior of an Advanced Base Pier Deck Under an Induced Wave-Uplift Load, Mar 1963, J. P. Murtha, AD299575

The pier is considered to be analogous to a single degree of freedom spring-mass system. The free period of vibration of a typical deck stringer is calculated as about 0.03 sec. This period is so much shorter than that of any likely wave impulse (10 to 120 sec) that the stringer and other structural members can be analyzed on the basis of statics, provided that the rise time of the wave impulse is also larger than the structure period. When the ratio of applied impulse-pressure rise time to the stringer-vibration time is less than unity, a response chart relating the ratio of dynamic loading to static loading for different ratios of ductility for this wooden elasto-plastic system is given. It is concluded that, for the standard pier deck, the ultimate resistance is determined by the connections.

N-488
An Ion Gun for a Time-of-Flight Mass Spectrometer, Feb 1962, R. D. Hitchcock, AD403787

Details on the design and performance of the ion gun are given. Testing of the gun has shown that its sensitivity is 10^{-14} A/μ of inlet pressure for an unchopped ion beam. At a chopping frequency of 10^{6} pps and a pulse width of 10 nsec, the sensitivity would be large enough for an electron-multiplier ion detector. A mathematical analysis of the proposed TOF spectrometer is given in the Appendix.

N-489
Impact Reduction Method for Side Launching Pontoon Structures - Inflatable Cushion, Mar 1963, J. W. Stalcup, AD405623

When pontoon structures are side-launched from LST's, the high impacts cause damage to the structures that results in excessive maintenance and replacement costs. In previous efforts an expendable fibre-board cushion was designed; procedures for assembling and attaching it were developed. Impacts and apparent damage to the pontoon structure were reduced to acceptable levels with the fibre board cushions.

For reasons of economy the investigation was continued into the use of reusable inflatable cushion mateials. These were found to be less effective; and are also undesirable and impractical for reasons of handling. Use of the inflatable units for impact reduction is not recommended.

N-490
Evaluation of the Impregnite Analyzing Kit M-26, Jun 1963, J. W. Cobb, T. Roe, AD414378

A series of tests were performed on the CC2 suspensions to evaluate the M-26 analyzing kit. With certain modifications the M-26 kit can provide a very accurate and convenient way of determining the percentage of active CC2 in suspension.

N-491
Preliminary Tests of the Stephenson Valve, Mar 1963, J. M. Stephenson, R. S. Chapler, AD400309

NCEL has designed and tested several blast valves using commonly available resilient materials. One of these, called the Stephenson Valve, consists of a steel tube containing polyurethane open cell foam balls. The balls are actually cylindrical in shape, approximately 1-3/4 in. in diam and 1 in. long. A special shock tube was used to test the ability of the valve to attenuate blasts. The valve was 8 in. in diam and was connected to a 45-cu-ft tank representing the shelter. Shock waves with overpressures up to 90 psi and with positive durations of 2 sec were applied to the valve. The maximum pressure recorded in the shelter was 2 psi. Air flow tests were also made on the 8-in. valve, and it was calculated that a 48-in.-diam valve could transmit 1,200 cfm of air with a pressure drop of 0.175 in. of water. This valve is also capable of filtering dust from the air, but no tests were made to determine dust arrestance characteristics.

N-492
Evaluation of Pipe and Pontoon Handling Fork Lift, Apr 1963, A. A. Denny, AD405039

An international TD-15 tractor with Drott fork lift attachment was evaluated by the Laboratory to determine its suitability for pipe handling operations involved in installing and retrieving the 4- and 6-in amphibious fueling systems and for handling pontoons in the assembly of floating structures on shore. The fork lift was not acceptable in its original configuration and was modified by International Harvester Company representatives. The modified version was tested by the Laboratory and is capable of handling the 4- and 6-in. pipe but is not suitable for use in assembling floating structures on shore.

N-493
Magnesium Removal Experiments for Control of Scale in VC Stills, Mar 1963, C. Saturnino, AD402421

An experimental study was initiated to determine the effect of the concentration of magnesium ion in sea water upon the scaling characteristics in vapor compression stills. An attempt was made to determine the rate of scale formation at reduced magnesium concentrations. The use of an ion-exchange resin was found to be impractical for maintaining a constant value for magnesium. Further investigation depends upon the feasibility of controlling magnesium by controlled precipitation and filtration.

N-494
Sea Ice Studies on McMurdo Sound During Deep Freeze 62, Jun 1963, C. R. Hoffman, N. S. Stehle, AD410182

A study of thickness, density, and salinity of various ages of sea ice on McMurdo Sound, Antarctica, was conducted during the summer season of Deep Freeze 62. During the sampling period, the 1- and 3-yr ice decreased in thickness about 3 ft on the bottom, no loss occurred in the older 30-ft thick ice. The sampling interval of 4 to 5 was at 3- to 5-ft depth intervals was too great to permit the development of summer trends in salinity, density, and strength. Because of the lack of knowledge on the characteristics of antarctic sea ice, further sampling of natural and flood-produced ice in McMurdo Sound are planned by the Laboratory.

N-495
Modification of Murray and Tregurtha Model 02D Propulsion Unit, Apr 1963, A. L. Scott, AD404241

A new Murray and Tregurtha Model 02D propulsion unit was removed from stock and modified by installing hydraulic elevation and steering, strengthening the swing joint gear group, and providing a 2-way oil pressure system for the tail section. A 20-hr test in Port Hueneme Harbor indicated that the modified components should operate satisfactorily. The unit is to be sent to an amphibious construction battalion for in-service tests.

N-496
The Superconductor Energy Gap and its Explicit Utilization in Radiation Detection, Aug 1963, R. D. Hitchcock, AD416006

Specific results of the theory of superconductivity of Bardeen, Cooper, and Schrieffer are given, which can be used to calculate the expected performance of superconductors used for the detection of electromagnetic and particle radiation. The experiments of Glover and Tinkham, Giaever and Mergerle, and others are described which give direct evidence that a temperature-dependent energy gap exists in the electron spectrum of a superconductor. Data from these experiments are given which indicate that this gap is centered at the fermi level and is approximately equal to 3.5 knot at absolute zero. Calculations, based on the theoretical results and experimental data, are given which give an estimate of the expected performance of proposed superconductor devices for detecting radiation. Proposed techniques for the detection of ionizing particles are also described. These include a cascade cryotron flip-flop device and a cascade tunnel structure. The predicted counting rates for the flip-flop detector are estimated to be at least 10 times higher than typical crystal counting speeds.

N-497
Study and Analysis of Damage by Typhoon Karen of Guam, Mar 1963, R. M. Webb, J. T. O'Brien, E. J. Beck, AD460834

An engineering study was made of the effects of Typhoon Karen, which struck the island of Guam on 11 Nov 1962, with sustained winds estimated up to 193 mph. The assessments of damage and the recommendations in this report are based on on-site observations in the aftermath of the storm by a team of NCEL engineers, on interviews with PWC personnel of Guam, and on reports by other observers. Recommendations, proposed research and development, and suggested new criteria are detailed in Part 5 of the report. Parts 2, 3, and 4 deal with observations and recommendations in regard to structures, waterfront and harbor installations, and utilities and mechanical facilities.

N-498
Electrical Resistivity of Metallic-Aggregate Floors, Jun 1963, J. H. McCarthy, AD412700

This report summarizes the variations in electrical resistance of five commercially available metallic aggregate floor finishes that occurred during a test period of 2-1/2 yr. Variations in electrical resistance were caused primarily by the continuously changing characteristics of concrete as a function of its age and also by fluctuations in ambient relative humidity.

N-499
Evaluation of Modifications to 85- and 200-gph Vapor Compression Distillation Units, May 1963, J. S. Williams, AD404106

A contract was awarded to Aqua-Chem, Inc. to conduct a modification study of the present standard 85- and 200-gph water distillation units. A report summarizing the work done by Aqua-Chem recommended that modifications to these units should include the installation of an acid feed system, a blowdown regulator, and an increase of compressor speed to provide additional capacity. The contractor was unable to provide a satisfactory feedwater controlled evaporator pressure regulator. One unit of each size was modified in accordance with the recommendations and sent to NCEL for in-service testing.

N-500
Specifications for a 25-Man Pioneer Polar Camp, Jun 1963, G. E. Sherwood, AD413316

A 25-man pioneer polar camp was developed to provide comfortable living conditions during initial phases of occupancy in the Arctic and Antarctic. The camp design includes structures, air conditioning, water supply, sanitation, and other such facilities integrated to form a functional component. The buildings are outfitted for use as quarters, messing, galley, utilities, administration, communications, medical, head, laundry, storage, and equipment maintenance. This technical note contains the specifications for the camp presented in NCEL Technical Report TR-267, A 25-Man Pioneer Polar Camp.

N-501
Modification of the MECO 10,000-gpd Distillation Unit, Apr 1963, J. W. Chapin, AD403637

A hydraulic ejector has been installed on the MECO vapor-compression distillation unit to investigate the feasibility of replacing the more complex mechanical vacuum pump. Short-term testing was very favorable and further investigation of ejector use on distillation equipment is planned.

N-502
Optional Electric Methods Investigated as Substitutes for the S. G. Concrete Mix Tester, Apr 1963, W. R. Lorman, AD407906

The proprietary S. G. tester previously was found incapable of detecting variations in water-cement ratio as small as ±0.01 (by weight). Accordingly, three optional electric methods were investigated, namely: (1) resistance to alternating current, (2) power loss, and (3) induction conductivity. Cement pastes, representing water-cement ratios (by weight) ranging from 0.40 to 0.60, were used as the media. The direct-current resistance method, as exemplified in the proprietary version of the S. G. tester, is considered the most promising. This electric method can serve satisfactorily in detecting water-cement ratio (by weight) discrepancies within a ±0.05 tolerance.

N-503
Cooperative Marine Piling Investigation, Phase 2. Pile Driving at Pearl Harbor, Hawaii, Jul 1963, H. Hochman, AD417175

This report describes the installation of these piles at Pearl Harbor.

N-504
Specifications for the Model 40 Snowplane, Apr 1963, N. E. Pierce, AD404242

Outline specifications for procurement of special equipment for compaction of snow in polar regions are being prepared by the Laboratory. This technical note contains the specifications for the Model 40 snowplane presented in the NCEL Technical Report R-110, Snow Compaction Equipment - Snowplanes. This unit which is a ski-mounted, towed-type piece of equipment, is used for leveling and grading natural and compacted-snow areas. Its 40-ft span makes it suitable for use on medium-wave sastrugi, or wind-driven snow, where the crest-to-crest distance is less than 40 ft.

N-505
RFI Evaluation of Commercially Available Alternator Type Battery Charging Systems, May 1963, H. A. Lositter, AD406880

Two battery charging systems have been evaluated to determine the interference levels produced in the RF spectrum from 14 kc to 1,000 Mc. The major difference in the two systems is the method of regulation. One makes use of an electromechanical regulator whereas the other is completely transistorized. Techniques used to measure the radiated and conducted noise levels are discussed. The operation of each of the charging systems is also presented.

N-506
Plastic Pipe In-Service Test (12ND), Second Report, May 1963, R. J. Zablodil, AD410238

This report pertains to a thermosetting plastic pipe used as a steam condensate carrier. The pipe has carried 2,487,500 lb of condensate from 17 Aug 1961 to 31 Dec 1962 without fixed dimensional changes, visual evidence of degradation, or color change. Tests are continuing.

N-507
Specifications for the Model 42 Snow Mixer, Apr 1963, N. E. Pierce, AD405485

Outline specifications for procurement of special equipment for compaction of snow in polar regions are being prepared by the Laboratory. This technical note contains the specifications for the model 42 snow mixer presented in NCEL Technical Report R-108 Snow-Compaction Equipment -Snow Mixers. This unit, which is a ski-mounted, towed-type piece of equipment, is used to pulverize and intermix (depth-process) the natural snow. The model 42 snow mixer is especially suitable for use in deep snow fields where its 42-in. depth can be used to produce a snow mat up to 28 in. thick for greater load-bearing capacity.

N-508
Investigation of Scale Removal From the Exterior of Horizontal Tubes Evaporating a Thin Film of Sea Water, May 1963, R. M. Lisler, AD405480

The purpose of this test was to investigate scaling in horizontal tube, spray-type evaporators that have high heat transfer coefficients. These evaporators employ circulation through spray nozzles which produce a falling film over heating surfaces. It was concluded that this type of evaporator had scale problems very similar to conventional-type evaporators and that the same type of scale control treatment is effective.

N-509 - Reissued as R-261

N-510
Byrd Station Snow Tunnels - Wall Clearing Study, Apr 1963, C. W. Terry, AD407076

Present data on the closure rates in most of the tunnels at new Byrd Station, Antarctica, indicates that trimming of the walls to maintain desirable clearances will not be required before Deep Freeze 65. A review of the Byrd Station drawings showed that about 75% of the tunnel wall surfaces will allow a relatively high degree of mechanization for economical wall trimming. Buildings and other obstructions will necessitate hand clearing in the remaining 25%. On a basis of tunnel clearing work at Camp Century,

Greenland, tentative methods and equipment for trimming the walls and disposing of the waste snow were selected for Byrd Station. It was concluded that specific rates of closure and maximum allowable safe closures for the Byrd tunnels should be established at an early date. Also, precise techniques and equipment should be determined for each different tunnel situation during Deep Freeze 64.

N-511
Devils Lake Area, North Dakota - Winter Test Site for Winter Equipment, May 1963, N. E. Pierce, AD406272

An investigation of the Devils Lake Area in North Dakota indicates that this area fulfills the current requirements for a laboratory winter test site. Its winters are dry and cold, and the ice on Devils Lake averages 36 in. in January and February. Also, considerable ice is beached and rafted along the shore each winter. Temperatures during these 2 mo range from 0F to -40F, and the ground is normally covered with 4-12 in. of dry, granular snow. The area is accessible by road, rail and air. Good accommodations are available at the North Dakota National Guard's Camp Grafton, which is located on Devils Lake.

N-512
Construction Problems With Pilot Sanitary System at Point Barrow, Jun 1963, W. R. Nehlsen, AD412428

A pilot sanitary system was designed to serve five family quarters buildings at the Arctic Research Laboratory at Point Barrow, but construction problems and system failures have thus far prevented use of the system. The design included sea water intakes, a distillation unit and distilled water distribution system, and a sea water sanitary sewer system. Problems encountered include insulation failures caused by ground water, pipe breakage resulting from faulty joints and heating wires, and pipe freezing.

N-513 - Reissued as R-270

N-514
Response Characteristics of the 48-Inch Diameter Mosler Blast Closure Valve, Jul 1963, E. N. Hellberg, AD414407

The 48-in.-diam Mosler Blast Closure Valve was tested to determine its air flow characteristics, closure time, and response to blast pressures. At an air flow of 13,000 cfm, its pressure drop was 0.48 in. of water when air entered the valve (intake position) and 0.14 in. when air left the valve (exhaust position). The closure time of the valve was about 110 msecs, but this does not include the reaction time of the sensing element, which was about 50 msecs. The valve did not fail from tests in the NCEL Atomic Blast Simulator at pressures up to 180 psi. It was concluded that the valve was acceptable within the limits of the test.

N-515
Evaluation of a Hydro-Pneumatic Type Floating Fender or Camel, Jun 1963, T. T. Lee, AD414357

This work is part of an effort to develop a family of camels (floating fenders) which will be lower in combined first cost and maintenance costs and will reduce damage to ship hulls or to pier fender systems. The performance in Port Hueneme (Calif.) Harbor of a pair of 50-ft-long hydropneumatic type camel has been studied over a 4-mo period. It employs a floating bulkhead, fronted by two each 40 x 60-in. pneumatic and hydro rubber ship-fenders. The hydrofenders can exert their greatest resistance at the high-frequency impact of the ship, while the pneumatic fenders are capable of absorbing more energy when the impact is of small magnitude and low frequency. Since the launching of these camels on 8 Mar 1963, a total of 15 ships (8,000 to 20,000 tons) have been served. The camel is considered to have been satisfactory, except for the creation of cargo-handling problems.

N-516
Preliminary Investigation of Fluid Distribution Systems for Temporary Polar Camps, Jun 1963, W. R. Nehlsen, AD412633

Fluid distribution and collection lines for polar camps are expensive and unsatisfactory. A detailed investigation of means of improving conventional designs is given, including a study of limited use of synthetic pipe materials, testing of existing designs and equipment, and development of a leak detector. In addition, a radical redesign using unconventional materials is recommended as the best approach to a greatly improved system for future use.

N-517
Preliminary Development and Test of an Infrared Water Level Pickup, Jun 1963, F. E. Nelson, AD410551

Tests in the laboratory indicate that the pickup can measure with acceptable accuracy the change in the vertical position of a light at a distance of 3 ft when the rate of change of position is from 0.0 to 0.1 cps. The observation distance is limited by the sensitivity of the photo cells used.

N-518
Forces Induced by Ocean Waves on Piles, Jun 1963, B. J. Muga, AD412965

The object of this task is to obtain data on the forces induced by ocean waves on piles which will be useful to designers. Probalistic techniques employing spectral operations as evolved by Pierson (1963) are used to analyze measurements of forces induced by hurricane-type water waves on a vertical circular pile 3.71 ft OD. This forms a leg of an oil well drilling platform located 30 miles offshore Leeville, La., in water 100 ft deep in the open Gulf of Mexico.

N-519
Non-Periodic Water Wave Effects, Jul 1963, B. J. Muga, AD414863L

The objective of the study is to obtain coefficients of drag and mass for a vertical circular pile as located in a hurricane wave environment. Filter techniques employing Fourier transforms as evolved by Reid (1958) are used to study measurements of hurricane-generated waves and forces induced on vertical circular piles 2, 3, and 4 ft in diam. It is concluded that the filter technique is an excellent method for the analysis of ocean wave force measurements.

N-520
Investigation of a Technique for Placing Sand in the NCEL Blast Simulator Pit, Jun 1963, J. Nielsen, AD420127

Previous methods of placing dry sand in the blast simulator pit have not been as successful as desired. A technique used in model foundation studies was slightly modified in an attempt to realize the objectives of this task. Basically the technique consists o dropping the sand through a perforated container, such as a sieve, from a fixed height. The results of these tests indicate that a dry density of 104.5 lb/ cu ft can be obtained by dropping the sand a distance of 36 in. This is equivalent to a relative density of about 58%. The results also indicate that very little segregation will occur using this method and that higher densities can be obtained by vibration after deposition. This report also contains a concept for design of a prototype perforated container for use in the NCEL blast simulator pit.

N-521
Experiments in the Identification of Paints by Attenuated Total Reflectance, May 1965, R. J. McGowan, AD615951

In order to obtain a spectrum of the nonvolatile vehicle of paint samples with infrared transmission spectrophotometry, the pigment must be separated from the vehicle. This separation is time consuming and costly; therefore, an investigation of the use of attenuated total reflectance was

conducted to determine if it would eliminate the need to separate the pigment from the vehicle in order to obtain a qualitatively useful spectrum. This technique was shown to be effective in producing an infrared spectrum qualitatively similar in certain regions of the spectrum to that obtained by the conventional methods.

N-522
Coatings on Untreated and Creosote and Creosote-Coal Tar Treated Wood Test Panels for Harbor Exposure, Sep 1963 T. Roe, AD417412

Several series of untreated and creosote and creosote-coal tar treated test panels have been brush coated with various generic types of coatings. They are now being exposed in Port Hueneme Harbor and Pearl Harbor.

N-523
Analyses of Heat Dissipation Techniques for Protective Shelters, Jul 1963, J. M. Stephenson, C. L. Herndon, AD416490

Several cooling techniques were investigated and analyses were made to determine how practical each technique would be if incorporated into a 100-man shelter. The techniques were as follows: buried pipe grids using water as the heat transfer medium, a crushed rock heat sink using air as the heat transfer medium, vapor compression and absorption systems, well-water, ice storage utilizing mechanical refrigeration, compressed air, and liquid oxygen. Each system was examined with respect to the length of time it could be effectively operated, and its auxiliary requirements. None of the techniques appear to be satisfactory in all respects; however, the use of well-water is very attractive, providing it is readily available at a cool enough temperature. Since power requirements are closely allied with cooling systems the problems associated with power supplies are discussed. The last section of the report is devoted to the total energy concept utilizing gas turbine package systems.

N-524
Survey of No Break Power, Sep 1963, D. R. Bennett, AD421528

The problem of precise and reliable power for the Naval establishment is one which has attracted increasing attention as the use of digital computers has increased and satellite tracking and communications capabilities have come into being. This technical note reviews the problem and current commercial equipment that has application to its solution, and concludes with several recommendations that concern future efforts of BUDOCKS in further defining and solving specific aspects of the problem.

N-525 - Cancelled

N-526 - Reissued as R-257

N-527
Response Operators for Water Wave Particle Velocity and Acceleration, Jun 1963, R. E. Schiller, AD413923

Response operators in the form of Fourier series are presented for horizontal component of water wave particle velocity and acceleration at elevations (Z). It was found that the digitizing (integration) interval (DT) giving adequate fit with theory was different for velocity as compared to acceleration.

N-528
Development of Vacuum System for Multi-Stage Flash Evaporators, Jul 1963, J. H. Wright, AD412370

To develop a reliable vacuum system for sea water desalting systems, a variety of sizes and combinations of water-operated air ejectors were tested. Results showed that the three air ejectors tested produced the same closed suction vacuum, that only the staged system improved operation, and that there was no optimum combination. The 2-1/2-in. air and water ejectors were selected for further testing. The results of these tests indicate that the air ejector appears suitable for operation of desalting equipment. Cost of equipment, operation, and maintenance is attractive compared to that for present vacuum systems. Further investigaton of ejectors is planned.

N-529
Performance of the AMF 36- and 48-Inch Blast Closure Devices, Aug 1963, D. N. Hellberg, AD417900

The 36- and 48-in. AMF Blast Closure Devices were tested to determine their air flow characteristics, closure times, blast resistance and weatherability. The effects of 3 yr of weathering indicated that a severe corrosion problem exists unless the valves receive proper maintenance.

N-530
Wave Measurements Off Oxnard, California, Aug 1964, W. E. Hoffman, AD451129

The intent is to furnish a description of a mainly water level (wave) measuring complex in about 18 in. of water behind and in the vicinity of an off-shore breakwater for a small craft harbor. The breakwater serves as a trap for sand which is by-passed periodically around the jetties of a major harbor about 1 mile downshore (Port Hueneme, Calif.). Instruments and methods are discussed for the complex as progressively improved over a 10-yr period beginning in 1953. Types of measurements made are presented. The data is intended to improve the understanding of behavior of waves and beaches behind and in the vicinity of an off-shore breakwater. Effective Jul 1964, the Los Angeles District of the Corps of Engineers assumed responsibility for the complex.

N-531 - Cancelled

N-532 - Reissued as R-261

N-533
Naval Isotope Applications, a Selected Bibliography, Aug 1963, R. H. Seabold, J. Jacovitch, AD420596

Publications on radioisotope applications are listed. Emphasis is placed on possible radioisotope uses for Naval civil engineering in construction, facility and equipment maintenance, harbor engineering, engineering surveys, and engineering research.

N-534
Calculations for the Calibration of Navy RIFI Meters Using a Vertical Rod Antenna, Sep 1963, R. D. Hitchcock, AD417549

From curves of vertical electric fields and disturbance errors versus distance, it is shown how calibration factors for an RIFI meter can be obtained by taking measurements at the surface of a conducting body of briny water, such as the Great Salt Lake, Utah.

N-535
Plastic Covers for Potable Water Reservoirs, Sep 1963, C. A. Dittus, AD420067

Work on this task has been discontinued. This report summarizes data and information gathered to date on plastic films which may be used as covers to protect potable water in storage reservoirs. Important properties and characteristics of the films selected for an outdoor exposure test are listed, together with a price comparison of the unreinforced films. The procedure, including the statistical design, for an outdoor evaluation of selected films is described, and technical information on cover construction and cover attachment techniques is presented.

N-536
Pre-Gel Preservatives, Nov 1963, A. P. Demarco, P. J. Nearet, AD426540

Pre-gel preservative compounds are coatings of grease-like consistency for ballast tanks of floating dry docks, as alternates to flotation-type rust retarding compounds. Of four compounds procured under a revised purchase description dated July 1960, only one preservative met all specification requirements and three did not meet the specifications. Additional properties of various pre-gel preservatives were investigated.

N-537 - Reissued as N-273

N-538 - Reissued as N-273

N-539
A Mathematical Derivation of Contour Lines for Constant Albedo of Gamma Rays on Concrete, Oct 1963, C. M. Huddleston, N. F. Rhoemaker, AD422861

The differential dose albedo of gamma rays on concrete depends on the energy of the incident gamma radiation, the polar angle of incidence, and the polar and azimuthal angles of backscatter. A mathematical method is developed to derive iso-albedic contours, i.e., contour lines on the surface of a hemisphere where backscattered radiation dose will be constant, when the angle of incidence is fixed and the point at which scattering occurs is at the center of the hemisphere. Graphs are presented showing iso-albedic contours for gamma radiation from Co-60 and Cs-137, incident at polar angles with cosines, 1.00, 0.75, 0.50, 0.25, and 0.10.

N-540
Specifications for a Temporary Polar Camp, Oct 1963, G. K. Sherwood, AD423712

A temporary polar camp was developed to provide comfortable living conditions for 2- to 5-yr occupancy in polar areas. The camp is suitable for use on snow, ice and permafrost as well as firm ground. The design includes structures, air conditioning, water supply, sanitation, electrical power and other such facilities integrated to form a functional component. A basic camp capacity of 50 men is planned with expansion in 50-man increments to 200-man capacity. This technical note contains the specifications for the camp presented in NCEL Technical Report R-288, Temporary Polar Camp.

N-541
Coating Material for Prevention of Ice and Snow Accumulations, a Literature Survey, Nov 1963, N. A. Perte, T. K. Nappier, AD423715

The known principles and materials which have applications in preventing the formation of ice and snow on outside surfaces have been reviewed. Field experience has shown that there are no coatings presently available which are effective over extended periods of time. On the basis of the ice adhesion strength of the various coatings, it appears that it would be very difficult if not impossible, to obtain a material with the necessary physical properties to eliminate the accumulation of ice.

N-541 Add.
Coating Material for Prevention of Ice and Snow Accumulations - Further Investigations, Apr 1964, P. J. Nearet, AD600425

The possibility of obtaining or developing a coating material to prevent ice and snow accumulation was further investigated. Qualitative ice adhesion and frost retention experiments indicated that all available materials would accumulate ice under the proper conditions. Although it might be possible to develop suitable coatings with low adhesion to ice, rather than no adhesion, the potential usefulness of such coatings to BUDOCKS does not appear to be sufficient to warrant further research at the present time.

N-542
Ground Rod Metals - a Field Test Installation, Dec 1963, A. E. Hanna, AD428043

NCEL was requested to investigate various metals now in use as ground rods, and metals which might be acceptable substitutes. NCEL cooperated with the National Association of Corrosion Engineers in the latter's, "Driven Ground Rod Test Program," by installing a series of test rods at the Laboratory. A description of the site and details of the actual installation of the rods are given along with similar information relative to a short-term test being conducted at the Naval Air Station, Point Mugu, Calif. Results will be included in a forthcoming report.

N-543
A Proposed System for Supplying Air to a Hypothetical Undersea Seabee Base, Nov 1963, N. P. Vind, M. J. Noonan, AD424095

Paramount for the development of manned undersea bases will be the design of a simple and economical system for supplying air to the bases and to the construction crews that build them. A three-stage process has been conceived at NCEL for utilizing the air dissolved in the ocean as an underwater source of oxygen, and subsequently utilizing the deoxygenated sea water as a carrier to remove carbon dioxide. Fresh air will be removed from the sea water under reduced pressure and stale air returned at an elevated pressure. It is not anticipated that the process will be used in the deep ocean basins but rather on the continental shelves at depths of about 600 ft or less. More advanced processes for deeper waters will probably employ synthetic oxygen-carrying-compounds resembling hemoglobin in reactivity with oxygen.

N-544
Preliminary Study of 400 Cycle Electrical Power Use by Naval Shore Facilities, Nov 1963, R. J. Wooten, AD423423

The Bureau of Yards and Docks has initiated this task with the following objectives: (1) to determine the feasibility of greater use of 400-cycle power at Naval shore facilities, in order to gain the advantage inherent in such systems, and (2) to prepare a final report on all work accomplished and recommendations concerning the use of 400 cycle power by the Bureau. This report gives some pertinent excerpts from available literature and information obtained from engineers of NCEL, Los Angeles Department of Water and Power, Sperry Rand Corporation, the Bureau of Ships, and the American Gas Association. Some very useful information is presented on the destroyer Timmerman which was especially designed to use 400-cycle power. This report considers conditions under which it is technically and financially desirable to use frequency conversion equipment.

N-545
Techniques for Underwater Nuclear Power, Feb 1965, K. J. Beck, F. W. Brown III, J. R. Crilly, F. A. Dante, K. F. Debord, P. J. Fritz, K. O. Gray, R. D. Hitchcock, R. J. Muga, J. S. Muraoka, R. J. Smith (reissue), AD451646

This study considers known or suggested problems in locating, handling, placing, cooling, and maintaining an unattended nuclear power plant on the floor of the deep ocean. It does not discuss the problems of reactor design and construction except as its size, shape, and effects on the environment affect the general logistic situation. The report does not state categorically that the concept is feasible with present technology, and possible avenues of approach are suggested for those areas of known deficiency.

N-546
Development of the B-D Blast-Closure Valve, Dec 1963, J. J. Bayles, AD428044

The Bayles-Denny valve was designed as a low cost blast-actuated closure device for shelter air system openings. It uses an arrangement of pressure plates and compressible plastic foam to close off the air pipe when

struck by a pressure wave. Several experimental combinations of plates and plastic were tested for air flow and filtration characteristics for normal ventilating use and for blast closure effectiveness. The tests indicated that the valve performance varied greatly with changes in the pore size of the plastic media. Small-pore media restricted the air flow excessively. Large-pore media gave a more useful degree of filtration and better air flow characteristics, but decreased the blast wave attenuation. All configurations reduced the shock wave to a gradual pressure rise.

N-547
Snow Transport Equipment - Peter Junior Snow Miller Tests, Sep 1963, R. W. Hansen, AD418196

During the summer season of Deep Freeze 62 tests were made with a Peter Junior Snow Miller to determine its suitability for clearing drift in a surface camp on snow and to determine the feasibility of transporting construction snow with a snow plow. These tests were made on the Ross Ice Shelf near McMurdo Station in air temperatures ranging between 20F and 30F. Mechanical performance of the snow plow was satisfactory at these temperatures, and it could be worked in close to a building with ease and safety. However, it was concluded that the plow was not practical for clearing drift in camps on snow unless the surface in the camp area was hard and firm. A test on the transport of snow for constructing elevated snow-compacted roads and runways showed that a snow plow appeared feasible for this work. It was concluded that the investigation on the transport of construction snow with a snow plow should be continued using a tractor-mounted plow as the test vehicle.

N-548
Compass Rose Magnetic Anomalies at Whidbey Island, Oak Harbor, Washington, Nov 1963, S. J. Vooten, AD425155

The magnetic anomalies on the Compass Rose, Ault Field, Oak Harbor, Wash., prevent it from being used for magnetic compass calibration on aircraft. The present newly constructed pad does not comply with MIL-STD-765. Analysis of the magnetic anomalies measured on the pad show them to be numerous and widely dispersed. Degaussing the compass pad would not solve the problem since the degaussing would be a temporary measure, and the magnetic anomalies of the rock fill and concrete would soon align themselves again with the earth's magnetic field. Chemical analysis shows the rock fill contains 1.4% magnetic iron (average) by weight and the concrete contains about 1.9% magnetic iron by weight. It is recommended that a new compass pad should be constructed at Ault Field using a controlled amount of nonmagnetic rock aggregate. This report suggests a guide to determine aggregate for the new Compass Rose.

N-549
Accelerated Testing of Paints, Dec 1963, F. J. Hearst, AD430910

Results of a literature search of accelerated methods of testing paints are presented and discussed. Emphasis is placed on coatings applied to steel surfaces. No accelerated test methods are available for predicting reliably the service performance of paints. Some methods have limited usefulness in indicating probable performance.

N-550
Modified T-5 Barracks - Erection and Outfitting As a Quarters Building, Dec 1963, J. P. Cosenza, AD427974

The U.S. Naval Civil Engineering Laboratory, Port Hueneme, Calif., is developing a packaged temporary polar camp. This camp is designed for polar stations with an expected life of 1 to 5 yr. It consists of a 50-man size camp expandable in 50-man increments to a 200-man camp. The 28-ft-wide by 56-ft-long by 10-ft-high modified T-5 barracks described in this report was used as the basic structure in the temporary polar camp design. With one exception, the partitions, the equipment and furnishings used to outfit this building as a 10-man living quarters are essentially the same as those used in the camp design. The air conditioning system was scaled down to a single building size. This was necessary as each two buildings in the camp were joined by a utility core to form a duplex.

The building and its outfitting is being shipped to Hallett Station, Antarctica, during Deep Freeze 64 for technical evaluation under polar conditions. It will be erected, outfitted and maintained by the station personnel. This Technical Note has been developed as a guide for erecting the building and installing and operating the equipment.

N-551
Heated Element Sectioning of Plastic Core Liners and Core Barrels, Oct 1963, R. J. Smith, L. Nunes, AD421915

The core boring in Deep Ocean Subtask of the Overall Structures in Deep Ocean Program necessitates procuring undisturbed soil samples from the sea floor to test their engineering properties. Many gravity and piston oceanographic coring tools in use retain the sediment obtained within plastic liners or directly in a plastic core barrel. Some difficulty has been experienced by investigators in maintaining samples in undisturbed condition during the process of sectioning the plastic prior to testing, usually done by means of pipe-cutters, saws, or different types of bladed tools. Experimentation with a heated cutting element attached to a gun-type soldering iron has shown that plastic tubing can be efficiently and rapidly cut by this means to very close tolerances. This procedure is now being routinely applied to soil analysis work.

N-552
A Perspective on Anchorages for Deep Ocean Constructions, Dec 1963, J. E. Smith, P. A. Dantz, AD426202

A preliminary survey of anchorages for deep ocean construction was made to define areas where present technology is lagging. This report summarizes the findings by discussing requirements, present technology, and major problems. A proposed program to develop a deep ocean anchorage capability is offered.

N-553
The Application of Absorption and Scattering Coefficients for Concentric Spheres to the Problem of EMI-Free Enclosures, Nov 1963, R. A. Eldred, H. A. Lantter, J. Roberts, AD424933

With the purpose of increasing the information about the lower frequency shielding effectiveness of closed structures composed of various arbitrary materials, an idealized problem is considered of the scattering and absorption of a plane electromagnetic wave impinging on a spherical shell. The region between the outer and inner radius of the sphere contains an arbitrary material, the other two regions are free space. The absorption and scattering coefficients for the incident plane wave are expressed as an infinite sum of spherical waves, using spherical Bessel functions. The coefficients are calculated numerically and are shown for a large range of complex material parameters and frequencies from 100 kc to 1000 Mc. Equations were programmed in Fortran, and numerical calculations accomplished on the IBM 1620 computer. Combinations of complex material properties of permeability, permitivity and conductivity were sought which gave large, broadband absorption coefficients. Several promising compositions have resulted, and are presented. The effects of varying the individual parameters are also discussed.

N-554
Evaluation of All-Electric Regulating Systems for 15 kW Hobart Generator Sets, Jan 1964, R. H. Leseberg, AD431226

The all-electric regulating system provided excellent frequency (speed) regulation for the 15 kW Hobart Generator sets; however, the voltage regulation was found to be unsatisfactory on all tests. The two particular systems evaluated by NCEL are unacceptable.

N-555
Radiation Shielding Studies at NCEL, Nov 1963, C. M. Huddleston, AD424387

During the past several years, NCEL has, through sponsorship and direct effort, carried out an intensive study of the streaming of gamma radiation through air ducts in concrete because of the importance of such studies to the shelter entranceway problem. Results of findings to date are presented, and the current shielding research program at NCEL is discussed.

N-556
Study of Relationship of Normal Maintenance Cost and Size of Facilities, FY62, Feb 1964, J. A. South, AD608646

Maintenance cost as a function of facility size is studied statistically using data pertinent to three selected types of Naval Shore Facilities. It is shown that useful normal mathematical models are possible. However, the data available for analysis do not contain sufficient pertinent information.

N-557
Study of Ground-Motion Effects on the Contents of Buried Structures, Oct 1963, E. J. Beck, AD426249

This paper considers the many facets of ground-motion damage to the contents, both animate and inanimate, of buried shelters used for protection against nuclear weapons. It includes a discussion of possible shock-mitigation and evasion schemes. An extended experimental program based on design accelerations, velocities, and transient displacements as measured in weapons tests is outlined. The economics of various isolation systems are discussed, major design and test areas are delineated, and priorities for work in the experimental program are suggested.

N-558
Public Works Maintenance Cost Data Analysis, Dec 1963, D. B. Ryder, AD425777

Some preliminary thoughts concerning the analysis of Navy-wide maintenance cost data are presented. The goal of this analysis is the development of "functional norms" (unit maintenance costs) for use in budgeting for future expenditures and in appraising past performance in the area of real property maintenance.

N-559
Interim Calibration and Procedures for GM Detector, Mar 1964, L. B. Gardner, B. Burdick, AD600358

The interim calibration of a GM nuclear detector is described. Interlaboratory comparison of calibration data was utilized. The geometry, backscatter, self scatter and self absorption, air and window absorption, window scatter, and shield and holder scatter corrections were determined for weightless point sources upon backless material. Corrections were also determined for spread sources up to 2 in. in diam. These corrections may be utilized in future experiments to obtain the disintegration rate of activated neutron foil detectors from measurements of the foil counting rate. Such data is necessary when foils of different thickness are utilized as will be done in the study of neutron energy distribution in ducts.

N-560 - Issued as a letter report.

N-561
Effectiveness of a Grid in a Blast Simulator, Undated, V. N. Crow, AD600564

Test results are presented which demonstrate the effectiveness of a layered grid in increasing the duration of the loading in the NCEL Blast Simulator. The tests were performed to check the hypothesis that long-duration loads could be obtained in a semi-closed load generation system without developing objectionable reflected pressures. This information was needed to check out a principle of operation for a proposed traveling wave blast simulator.

N-562
Protective Shelter Systems. An Annotated Bibliography of U.S. Naval Civil Engineering Laboratory Publications, Jan 1964, R. H. Seabold, AD452178

This annotated bibliography lists publications by NCEL on atomic, biological, and chemical protective shelters, and on the testing of mechanical equipment and advanced base buildings which could be adapted for shelter use. Classified references are listed, and unclassified references are listed and annotated. The references are grouped with regard to their subjects. Within these groups, they are arranged in chronological order.

N-563
Migration of Fused Fallout Simulant into Soils, Jan 1964, A. E. Manna, AD609645

NCEL conducted a study of the migration of fused fallout simulant into alternately frozen and thawed soils. Four different soils or soil mixtures were used; Monterey sand treated with barium-140 and sodium silicate was the fallout simulant. Radiation levels were measured after each of 12 thaw-freeze cycles. It was concluded that the fused fallout simulant did not migrate into the soils. Further work is recommended using actual fallout debris.

N-564
Protective Coatings in Drydocks at Guam, Feb 1964, C. V. Brouillette, AD440141

After 36 mo exposure, data from analysis of exposed laboratory test specimens show slightly greater protection by the Yosemite pre-gel coating to pre-rusted test specimens and equal protection by Yosemite pre-gel, Eureka pre-gel and flotation oil (MIL-R-21006) to the cleaned sandblasted specimens. However, from visual field inspections inside the ballast tanks, the protection of the steel surfaces by the Yosemite or the Eureka pre-gel was considered equal. The flotation oil failed to protect overhead areas satisfactorily. Except for areas which were mechanically damaged, the test specimens coated with cold-applied coal tar (34 YC) or epoxy-tar (Tarset) received excellent protection.

N-565
Sea Ice Studies on McMurdo Sound During Deep Freeze 63, Dec 1963, N. S. Stehle, AD430698

Studies of 1-yr-old sea ice and very young sea ice were conducted during the austral summer of 1962-63 at McMurdo Station, Antarctica. During the observation period on the 1-yr-old sea ice approximately 18 in. of ice were lost solely on the bottom surface. Average salinities and densities of the total ice thickness decreased slightly with time. Average shear strength values for the total ice thickness changed very little with time, however, a decrease in shear strength was noted in the middle portion of the ice sheet. This corresponded closely with the level at which drainage of brine was noted. The very young sea ice was observed in a 6-1/2 x 7-ft well in the 1-yr-old ice. Ice growth and salinity of the newly accreted ice, older ice, and the well water were checked every 2 to 3 days. Although sampling was done primarily during January, the well study of very young ice appears to be very promising, and further studies of this type are planned.

N-566
Generation and Tests on Aqueous Foam Stabilized With CMC-7MP, Dec 1964, N. S. Stehle, AD431549

These tests were conducted at Port Hueneme, Calif., because it closely approximated a field situation with the higher relative humidities encountered at a coastal installation where the foam would be used and yet had a high incident solar radiation which approximated the curing conditions under which the foam had originally been tested.

Although the sand base on which it was tested had limitations, these were not considered significant when compared with the curing conditions desired. The average solar radiation for a 24-hr period at Port Hueneme was found to closely approximate that at a location such as Point Barrow during spring thaw. During these tests, the expansion ratio achieved using a formulation recommended by Onondaga Associates was less than one-half that recommended for maximum lasting ability. At the end of 8 days, the foam was completely collapsed and had never acquired the dry cellular texture of the contractor's laboratory tests. In addition to being low, the expansion ratios achieved were variable.

N-567
Comparison of Experimental and Theoretical Gamma Ray Albedo - An Interim Report, Jan 1964, C. M. Huddleston, AD431671

An intercomparison is made between the results of Monte Carlo calculations and two independent experimental determinations of values for the differential dose albedo of gamma rays on concrete. The validity of a semiempirical formula for gamma-ray albedo is examined. Information is presented on the current status of our knowledge of gamma-ray albedo, and the direction of future work is indicated.

N-568
The Electrochemical Behavior of Armco Iron in Sulfuric Acid, Jan 1964, H. A. Porte, T. E. Nappier, AD600563

The polarization behavior of Armco iron in sulfuric acid solutions was investigated. Anodic and cathodic polarization curves were obtained using aerated and deaerated solutions of 1N and PH1 sulfuric acid by galvanostatic and potentiostatic methods.

N-569
Specifications for the M-29 Cargo Carrier Pickup, Jan 1964, N. E. Pierce, AD428448

Outline specifications for procurement of special equipment used in support of construction operations in polar regions are being prepared by the Laboratory. This Technical Note contains the specifications for the conversion of a standard model M-29 cargo carrier, or Weasel, to a pickup with an enclosed two-man cab.

N-570
Rapid Analysis of Marine Sediments for Calcium and Magnesium Carbonates, Jan 1964, E. Matsui, AD431738

The complexiметric titration method using ethylenediaminetetraacetic acid (EDTA) for quantitative determination of calcium and magnesium carbonates is often difficult to use on marine sediments because of high concentrations of the interferring metal ions usually present. Potassium cyanide was investigated as an inhibitor to suppress this interference. The accuracy of this method was determined by replicate analyses of standard solutions.

N-571 - Cancelled

N-572
Laboratory Methods to Evaluate Preservatives for Marine Timbers, Jul 1964, H. P. Vind, M. J. Noonan, AD445862

A new method has been developed at NCEL to evaluate the potential of various chemicals for preserving marine timbers. Matchsticks are treated with the test chemicals, then mounted in aquaria through which warm sea water flows, and finally exposed to marine borers of the species limnoria tripunctata. Creosote and a number of copper and organotin compounds protected matchsticks from marine borers for a long time, but mercury compounds, organic dyes, organic insecticides, silver salts, and many other proposed preservatives failed to provide lasting protection. Of all the mixtures tested, those containing a tributyltin or triphenyltin compound at a level of one percent tin or those containing solubilized copper oxinate at a level of two percent copper gave the best protection.

N-573
Preliminary Studies of Air Curtains for Refrigerated Warehouses, Jan 1964, C. L. Herndon, AD431732

A study of existing installations indicates air curtains can be effectively used in most refrigerated warehouses. Installations at Naval Supply Depots have been ineffective at times because visibility at the entrance was reduced by fog. This fog is caused by cold inside air mixing with warm, moist outside air. As each installation has different problems and manufacturers do not agree on design and operation criteria, it seems desirable to make tests where installation and operation may be closely supervised. From such a study, design and operation criteria could be prepared and the economic advantages of air curtains determined.

N-574
Maintenance Information for the LGP Caterpillar D4 Series Snow Tractors, Mar 1964, D. Taylor, AD440157

This note was prepared for insertion in the caterpillar service manuals for the low ground pressure D4 series C snow tractors serial no. 40A4868 and 40A5143 to provide a record of the USN and caterpillar reference numbers, a list of the tractor modification drawings, a list of spare parts for 2000 operating hours, and special instructions for maintenance and operation of the tractors.

N-575
Portable, Electronic Dial Telephone Systems, Feb 1964, S. J. Wooten, AD441630L

A survey was made of the present state of the art of portable, electronic dial telephone systems. The purpose of the survey was to become aware of the developments in the field of electronic telephone systems, and to determine if the assembly of a mobile electronic type dial system up to 200 lines in capacity is technically and economically feasible. The survey included a study of portable dial telephone equipment used commercially and by other organizations of the Defense Department, especially the signal corps. The survey shows there are a number of systems available commercially which satisfy the task requirements and are described in this report.

N-576
Flotation Type Corrosion Inhibitors, Jun 1964, C. V. Brouillette, AD442405

Studies were made to determine the corrosion inhibiting effects of various chemical compounds when added to uncompounded oils. The test methods used were those of two military specifications covering the purchase of flotation-type corrosion inhibiting oils for use in ballast tanks of floating drydocks. It was found that many flotation-type ballast tank protectives formulated in the laboratory did pass satisfactorily the requirements of the simulated ballast tank tests of these military specifications.

N-577 - Incorporated into R-379

N-578
Analysis of a Timber Pier as Loaded During a High Level Storm, Dec 1964, W. J. Tudor, AD611408

The intent of this report is to add to the meager knowledge of the effects on a pier exposed to storm-excited winds, waves, currents, and floating debris. An analysis is made of a timber pier loaded to damage during a high level storm, specifically, the municipal fishing pier at Ventnor, N. J., during the storm of 5-9 Mar 1962. This analysis includes the response of a typical pier bent to static

loading, to dynamic loading induced by collision with floating debris or the storms wind, waves, and currents. It is concluded that significant damage could have resulted from collision with current-driven floating debris (a large steel tank) but not by the storm environment itself. The high water was below deck level for this storm, and important waves broke shoreward of the damaged pier bents.

N-579
Layered Pavement Investigations - Test Procedures, Mar 1964, J. Nielsen, AD600511

The NCEL mechanical subgrade is a device which simulates the action of a natural subgrade. This apparatus is intended for use in evaluating materials for airfield pavement construction. The adoption of a test procedure is a preliminary step in the evaluation of all types of airfield pavement materials using the mechanical subgrade and the concepts of the layered pavement design method as presented by Donald M. Burmister.

N-580
Chemical Cleaning Materials and Processes, Mar 1964, C. Saturnino, AD440160

Sanitary cleaning chemicals and methods used by the Navy, other government agencies, and commercial organizations were surveyed to discover means of improving the effectiveness of BUDOCKS sanitary cleaning programs. It was found that current Bureau methods in this field differ from current general practices by not including use of multipurpose detergent-sanitizers.

N-581
Barrier Systems for In-Place Wooden Piling, Mar 1964, T. Roe, AD440349

This report presents the methods presently in use for the application of barrier systems to increase the service life of wooden piling which has been attacked by marine borers.

N-582
Television and Photographic System for Development of Undersea Illumination Techniques, Mar 1964, R. D. Hitchcock, AD440350

This report describes an undersea observation system which uses closed-circuit television monitored at the surface. Details are given on the control console, the winch for the electrical cable, and the submersible unit which is a spread-U structure, containing a Vidicon television camera, a 35-mm still camera, and light sources for both cameras. The system was constructed under contract and designed for use at depths to 1,000 feet, for the purpose of developing improved techniques of undersea illumination and televiewing in connection with harbor and deep-ocean structures and construction operations. A frequency and time-multiplexing telemetry system is used for controlling and monitoring specific functions in the submersible unit.

N-583
Analysis of Wood-Preservatives in Exposed Test Panels, undated, R. W. Drisko, N. Hochman, AD600565

Wooden panels pressure-impregnated with creosote or 70/30 creosote-coal tar solution had been exposed for 2, 4, or 6 years in a submerged marine environment in a study conducted by the Oregon State University Forest Research Laboratory. These panels were extracted with solvent to determine the amounts of preservative remaining, and the extracts were analyzed to determine any chemical changes that had occurred to the preservatives. The analytical data obtained are presented in a series of tables.

N-584 -- Reissued as a letter report

N-585
Static and Dynamic Shear Strength of Dry Sand, Apr 1964, R. L. Lytton, C. R. White, AD600356

The tests reported here were made to determine the strength properties of a specific sand used in large quantities for dynamic soil-structure interaction experments and dynamic bearing capacity experiments at NCEL. Another purpose was to disclose the effect of loading rate on the shear strength of dry sand. Results were found to be similar to those obtained by other researchers, i.e., loading rate has little effect upon the shear strength of dry sand. Cohesion of the sand was zero. Static angle of friction was 44.0 deg and dynamic angle of friction was 43.1 deg. Auxiliary tests revealed the effects on dynamic angle of friction of small amounts of absorbed moisture, grain size segregation, and grain shape.

N-586
Anticipated Problems and Preliminary Evaluations of Equipment to be Used in Protective Shelters, Nov 1964, R. M. Gisler, AD451464

This report highlights a preliminary study on the anticipated problems associated with the use of standard, readily available equipment which may be used in protective shelters. The equipment under study consists of generators, air conditioners, air blowers, air filters, lighting fixtures, chemical toilets, and water pumps. The problems that need further investigation and/or testing appear to be equipment shock tolerance, the overpressure effect on operating engines, equipment cooling, and equipment maintenance. Other problems include the possible contamination of shelter atmosphere with toxic gases generated by the equipment, equipment fire hazards, radio noise, and audible noise that may be generated by the equipment. Suggested approaches to the solution of these problems are discussed, and a general evaluation of equipment is given in tabular form.

N-587
Pioneer Polar Structures - Erection of Portable Maintenance Shelter, May 1964, R. W. Hansen, G. E. Sherwood, AD601373

NCEL has developed a shelter for the maintenance and repair of construction and other equipment in pioneer polar camps. The shelter, which is 20 by 24 feet, will accommodate equipment as large as a standard size 4 tractor. It consists of a skid-mounted aluminum frame of knock-down construction and a canvas cover. Accessories include a gantry-mounted, 2-ton traveling hoist, an electrical harness, and a personnel side entry. An 8- by 20-foot skid-mounted wanigan outfitted with tools and shop equipment has been developed as a companion item for the shelter. It is called an equipment-repair wanigan. This technical note provides a guide for erecting and outfitting the shelter and the wanigan.

A detail description of the portable maintenance shelter is given in NCEL technical report R-317, and a detail description of the NCEL family of wanigans is given in NCEL technical report R-309.

N-588 REV
Test Procedures for Protective Shelters, Mar 1965, W. R. Nehlsen, AD460522

Protective shelters must be maintained in good condition to function properly when required. This report lists equipment that should be checked annually or more often to ensure that shelters can operate as designed. Procedures for testing several special items of shelter equipment are also given.

N-589
Semiempirical Formula for Differential Dose Albedo for Neutrons on Concrete, Mar 1964, Y. T. Song, AD600684

A semiempirical formula is developed which yields values for the differential dose albedo of neutrons on concrete. Neutrons of incident energies 0.1, 0.25, 0.5, 1, 2, 3, 5, and 14 MEV are considered. Results show that a

one-parameter formula gives satisfactory agreement with Monte Carlo calculations. A simple analytic form also gives satisfactory results except in low energy regions.

N-590
Effect of Ultrasonics on Limnoria, Apr 1964, M. Hochman, AD602289

A cursory examination of the effects of these vibrations on the test animal, Limnoria tripunctata, at two frequency ranges revealed that (a) the test animals were killed in the 40 kc range when they were close to the transducer, i.e., at high energy levels and (b) the 350-400 kc range, whose half wavelength was of the same order of magnitude as the test animal, was much less effective. The rate of loss of effectiveness with distance from the transducer, even at 40 kc, was so great that the use of ultrasonics to control marine borers would require tremendous amounts of power and would be uneconomical when compared with other methods of wood preservation.

N-591
Arching in Soil Due to the Deflection of a Rigid Horizontal Strip, Oct 1964, C. V. Chelapati, AD451506

A study is made of the amount of arching developed in an ideal soil of finite depth due to the deflection of a rigid horizontal strip or base when the soil is subjected to high static pressures. Solutions are obtained using the equations of plane strain in the form of an infinite series. A condition is imposed that the net pressure on the base cannot be tensile. It is shown that arching in this case is a function of the parameters B/H, PH/DE, and MU, where 2B is the width of the base, H is the depth of soil, P is the pressure on the base with no deflection, D is the amount of displacement, E is the modulus of elasticity, and MU is Poisson's Ratio of the soil. The first six terms in the series are evaluated using a digital computer for a wide range of parameters. The accuracy of the final solution is shown to be quite adequate. Graphs are presented showing the pressure distribution on the base and the amount of arching over the base, and an example is given to demonstrate the use of these plots.

N-592
Airfield Pavement Evaluation, U. S. Marine Corps Air Station, El Toro, California, Apr 1964, R. J. Lowe, AD442401

The evaluation of the U. S. Marine Corps Air Station, El Toro, California, is presented with safe maximum gross load capacities of the runways, taxiways and parking aprons for single, dual and dual tandem, wheel assembly aircraft as computed from the evaluation tests. Information is also included covering the construction and maintenance history and the current aircraft traffic. The results of the evaluation show that only a few of the pavements are being overloaded repeatedly by some of the aircraft presently assigned to the air station.

N-593
Effect of Jet-Engine Exhausts on Blast Fences, May 1964, H. Tomita, AD440500

Jet-impingement tests were conducted on standard and modified BUDOCKS blast fences and on Lynnco C-1.98AB-2 blast fence. Temperatures, pressures and frequencies of vibration were measured, and motion pictures of the dispersion and deflection of the exhaust intercepted by the standard BUDOCKS fence and Lynnco fence were taken. Only frequencies of vibration were measured on the modified fence. A recommendation is given to review the design of the standard BUDOCKS fence and incorporate vanes which are more effective in deflecting the exhaust gases and less susceptible to vibration in the resonant range. Recommendation is also given to periodically inspect the Lynnco Blast Fence at MCAS, El Toro.

N-594
Snow Movement Literature Review, May 1964, N. S. Stehle, AD600700

Polar areas are plagued with drifting snow, with resulting problems in logistics and maintenance. A literature search on present knowledge of drift and drift control shows that laboratory tests on the physics of snow movement should be conducted using snow and material simulating snow for scale model studies. These tests then would allow further knowledge of drifting snow more quickly than can be obtained by field observation alone. However, the laboratory studies must be coupled with field tests in order to establish their validity.

N-595
Polar Engineering and Construction - 1963 Observations of Greenland Stations, May 1964, R. C. Coffin, AD440501

An NCEL engineer visited three stations in Greenland during the fall of 1963. Of the stations visited, Camp Tuto is located on glacial moraine at the edge of the ice cap. Camp Century and Dye II are both situated on the perennial ice cap. Camp century is a subsurface facility, while Dye II is an elevated, composite structure. Observations of the construction techniques employed are reported. Some of the unique technical features and problem areas of the stations are also described.

N-596
Polar Structures - Specifications for the NCEL Wanigans, Jun 1964, G. E. Sherwood, AD601511

A family of wanigans was developed to provide portable shelters for use in polar regions. These wanigans are of two types: sled wanigans mounted on cargo sleds for trail use, portable camp wanigans built with a skid system for limited movement around a camp or work area. All of the wanigans are 20 feet long and 8 feet high. Both types are made in standard 8-foot widths for assembled air shipment, and in extra-wide 10-foot widths for flexibility in interior arrangement. Standard accessories for the wanigans are, a heating and ventilating system, an electrical harness, and a side-mounted fuel tank. This technical note contains the specifications for the NCEL wanigans presented in Technical Report R-309.

N-597
Investigation of New Concepts for Collective Protection, Jun 1964, N. Oldson, W. Nehlsen, AD601897

The feasibility of various filtration and sorbtion processes for use in collective protectors was studied with a view to reducing the overall cost of collective protection. Reports on electrostatic precipitation, venturi scrubbers, catalytic oxidation, fluidized beds, and other techniques were reviewed. It is concluded that pleated paper and charcoal filters still offer the most advantages in simplicity, reliability, durability, and cost, and that no new techniques or materials offer an improvement in overall effectiveness.

N-598
Determination of Damping Constants for a Dry Friction-Viscous Damped Oscillator, Aug 1964, D. A. Dadeppo, AD445028

The method of least squares is applied to the problem of analyzing a decay record to determine the damping constants for a dry friction-viscous damped, single-degree-of-freedom system. Solution of the set of nonlinear equations which yield the constants is obtained by applying the Newton-Raphson method of iteration. Sample calculations show that the method is not well-suited for manual computation. A program is presented for calculating the damping constants by means of a digital computer.

N-599
Evaluation of High Strength Steel Bolts as a Fastener on Pontoon Structures, Jun 1964, J. J. Traffalis, AD442073

Utilization of a fastener that would give reasonable assurance of maintaining a sound connection on pontoon structures would offer an advantage over present fasteners. High strength steel bolts, installed using the turn-of-nut method as described in specification for structural joints using ASTM A-325 bolts were evaluated as fasteners on pontoon structures. Tests indicate that the high strength steel bolt when properly installed, is superior to the standard A-6 bolt as a fastener on pontoon structures.

N-600
Surveillance of NAS Alameda Runway Pavement, May 1964, J. A. Bishop, AD601388

A high-type asphaltic concrete overlay of a badly deteriorated runway at Nas Alameda, California, is being monitored to determine changes in properties with time. Changes in the compressive strength of cores taken from the pavement and changes in the penetration of the asphalt cement binder taken from these cores during the first three years following construction are presented. Though the data are somewhat scattered, it is apparent that the compressive strength is increasing and the penetration is decreasing. A prediction is made of values of these quantities expected 7 years after construction.

N-600A
Surveillance of Nas Alameda Runway Pavement, Dec 1967, G. S. Priniski, AD827520L

The surveillance of Nas Alameda runway pavement began in February 1961. Test data obtained from February 1961 to March 1964 was compiled and reported in TN-600 in May 1964. This supplement updates TN-600 with additional data obtained from cores taken in December 1964 and September 1967.

N-600B
Surveillance of Nas Alameda Runway Pavement, Nov 1968, K. R. Demars, AD843884L

This supplement updates TN-600 and 600A.

N-601
A Computer Program for Differential Neutron Flux Calculation, Aug 1964, L. B. Gardner, N. F. Shoemaker, AD449674

A computer program is written for the calculation of differential neutron flux spectra in the high energy region. This program utilizes as input data the saturated specific activity of threshold foil detectors, the cross section as a function of energy for the foil's primary reaction, and a first guess of the incident neutron flux spectrum. The program is an iterative type not depending upon the assumption of any particular spectrum shape. Output data consists of the differential neutron flux energy spectrum and error statement. Experience has shown that this program converges after a few iterations to within 10 percent of the spectrum given by the last previous iteration.

N-602
Pioneer Polar Structures - Specifications and Outfitting for the Portable Maintenance Shelter, Jun 1964, G. E. Sherwood, AD441175

A portable maintenance shelter was developed to satisfy the requirement of shelter for maintenance and repair of construction and other equipment in pioneer polar camps. The 20- by 24-foot shelter is a canvas-covered aluminum arch-rib structure mounted on skids for portability. It includes a travelling hoist, a personnel entry, and an electrical harness. This technical note contains the specifications for the shelter and the outfitting for the equipment-repair wanigan presented in Technical Report R-317.

N-603
Evaluation of Acid Eaters, Jun 1964, A. L. Scott, AD442706

Acid eaters are small fiberglass pads impregnated with an alkaline substance that neutralizes acid to prevent corrosion of vehicle battery terminals. They will neutralize about a gram of battery acid, and their life span depends on the rate of acid accumulation at the battery terminal. The pad contains a chemical indicator that turns red when the pad is neutralized; however, this did not prove to be a reliable warning that the pad must be changed. Acid eaters are cleaner than the greases and alkaline asphaltic compounds frequently used to retard battery terminal corrosion. Use of acid eaters could extend the time between required servicing of some battery terminals, but whether this would result in any economic advantage is questionable.

N-604
The Engineering Applications of a Report Entitled, The Motions of a Moored Construction Type Barge in Irregular Waves and Their Influence on Construction Operations, Aug 1964, W. J. Pierson, P. Holmes, AD607213

The contents of the reference report (Kaplan and Putz, 1962) are summarized. The ways that this report can be used at three different levels of complexity are described. These three ways are (a) to determine the behavior of the particular barge of the report in the particular seaways treated in the report, (b) to determine the behavior of the particular barge of the report in seaways other than those treated in the report, and (c) to determine the behavior of barges of different design configurations in arbitrary seaways. The first way, (a), that this report can be used is illustrated by an example in which pertinent data are extracted from the report and discussed. The other two ways, (b) and (c), are described briefly. Were (b) and (c) developed further, their final output would be similar to that of (a)

N-605
Preliminary Examination of Materials Exposed on STU 1-3 in the Deep Ocean (5,640 Feet of Depth for 123 Days), Jun 1964, R. M. Reinhart, AD601892

Preliminary results of corrosion of materials, based solely upon visual examinations, exposed in 5,640 ft of water in the Pacific Ocean for 123 days showed only a few cases of deterioration different from those usually found in moving surface sea water. The clad layers on two aluminum alloys corroded at a much faster rate than normal for surface sea water. The lace work and undersurface types of attack on certain stainless steels appear to be similar to types of attack by stagnant surface sea water; this could be attributed to low oxygen content as well as lack of a significant movement of deep sea water. Other materials, both metallic and non-metallic, were not seriously deteriorated and some showed absolutely no evidence of deterioration.

N-606
Recent Applications of Radioisotopes, Aug 1964, L. B. Gardner, AD606253

This technical note summarizes applicatons found during a literature search which are suitable for Naval use. Prime emphasis has been placed on determining those applications suitable for field applications. Secondary consideration is given to research applications. Specifically excluded from this report is the application of radioisotopes to space heating since that subject is part of another task. During the literature search, applications were sought which would reduce costs, improve efficiency and quality control, and open new fields for the Naval Shore Establishment.

N-607
Earthquake Damage to Anchorage Area Utilities, Jun 1964, J. M. Stephenson, AD602943

On 27 March, 1964 at 5.36 pm, an earthquake struck Anchorage with an intensity of IX, as measured by the modified Mercalli scale. Between 3 and 13 April, a representative from NCEL visited Anchorage and surveyed the damage to

utilities resulting from this giant earthquake. The cost of repairing the damage to utilities in this city of 48,000 people will probably range from 5 to 8 million dollars.

N-608
Ice Construction - Specifications for the Mobile Pump Wanigan, Sep 1964, G. E. Sherwood, AD448745

A pump wanigan was developed for use in confined flooding operations. The packaged unit is an NCEL extra wide camp wanigan outfitted with all required pumping equipment. This wanigan is 10 ft x 20 ft, and is skid-mounted for movement around a work area. Outfitting includes a diesel-driven stationary pump, two hand-carry submersible pumps, hose and fittings, storage racks, two portable electrical generators, and floodlights. This technical note contains the specifications for the pump wanigan presented in Technical Report R-339.

N-609
Polar Transportation Equipment - Tests on a Model 4 VL Trackmaster, Jun 1964, N. E. Pierce, E. H. Moser, AD441970

A 7-passenger model 4 VL Trackmaster was tested on hard snow, sea ice, tundra, permafrost, sand and gravel in the Point Barrow, Alaska, area between January 1960 and October 1962. In 360 hr of testing, the vehicle was used intermittently to haul passengers and tow an army weasel sled loaded with one-ton of cargo. During the tests, it was found that small grousers on the track cleats improved turning characteristics on hard snow and smooth sea ice. It was also found that some mechanical redesign was required to improve reliability and ruggedness for all season use in polar areas. It was concluded that the trackmaster appears promising as a general purpose vehicle for transporting personnel and light cargo in polar regions.

N-610
Snow Transport Equipment - Tractor-Mounted Snow-Plow Tests, Jun 1964, R. W. Hansen, AD442074

During the summer season of Deep Freeze 63, tests were made with a tractor-mounted snowplow to determine its suitability for clearing drift in a surface camp on snow and for transporting construction fill snow. The tests were made at the NCEL camp on the Ross Ice Shelf near McMurdo Station, Antarctica, in air temperatures ranging between 15F and 30F. Mechanical performance of the tractor-plow unit was satisfactory except for high mortality of the auger shear bolts. It was concluded that the investigation on the transport of construction fill snow with a snowplow should be continued using the ski-mounted, towed-type snowplow carrier concept developed during the Deep Freeze 63 tests.

N-611
Chemical Cleaning Materials and Processes for BUDOCKS Requirements, Jul 1964, C. Saturnino, W. R. Nehlsen, AD443257

This technical note contains information on chemical cleaning materials and methods obtained from government and commercial practice to improve the Naval Shore Establishment cleaning program. Current BUDOCKS field cleaning practices are outlined and compared with the current technologies in this field.

Practices can be achieved by further studies of detergent-sanitizers and alkaline spray cleaning. It is recommended that expanded BUDOCKS manuals on sanitary cleaning and on chemical cleaning be prepared, and that a continuing program of collection and dissemination information be established in conjunction with an existing government laboratory engaged in cleaning research.

N-612
Review of furnishings for Polar Camps, Jun 1964, G. E. Sherwood, AD601893

A survey was conducted to determine availability of suitable furniture and floor covering for outfitting polar camps. It was determined that lightweight, compact, durable furniture which is both comfortable and attractive is available through commercial sources. Interlocking floor tiles which require no mastic for installation and yet are quite serviceable, are also commercially available. It was concluded that commercially available furnishings have many desirable features which cannot be obtained from standard Navy sources; therefore, outfitting for polar camps should not be limited to standard Navy sources.

N-613
Devices for Measuring Internal Strains in Hardened Concrete, Jun 1964, W. R. Lorman, AD445892

Describes the results obtained with two McCarthy-type electric-resistance strain gages embedded in concrete. A study of the technical literature dealing with embeddable devices shows that the following four types are worthy of further investigation: the Carlson miniature elastic-wire strain meter, the Baldwin brass-foil-envelope (Valore type) electric-resistance strain gage, the Tokyo plastic encapsulated electric-resistance strain gage, and the Deakin Phillips (Potocki type) electro-acoustic strain gage.

N-614
Polar Structures - Design Concept for a Heavy Equipment Field Repair Shelter, Jul 1964, G. E. Sherwood, E. H. Moser, AD602932

This technical note presents the concept and design of a one/two stall repair shelter for the maintenance and repair of equipment up to size 6 snow tractors. A canvas-covered, arch-framed structure with steel members was used for the design. The shop area was located adjacent to the repair areas for convenience and efficiency, and the entire shelter was mounted on skids for portability. The one-stall shelter and its outfitting will cost about $29,000; it will weigh about 30,500 lb packaged for shipment. This cost is about 10 percent more and the weight is about 30 percent more than the portable maintenance shelter and its shop wanigan. The two-stall shelter and its outfitting will cost about $37,400; it will weigh about 41,400 lb packaged for shipment. This cost is about 20 percent less and the weight is about 30 percent less than the temporary maintenance shelter. It is concluded that a prototype of the heavy-equipment field repair shelter should be evaluated at an outlying work center or construction project at an existing polar station.

N-615
Polar Structures - Specifications and Outfitting for a Heavy-Equipment Field Repair Shelter, Jul 1964, G. E. Sherwood, AD442273

A heavy-equipment field repair shelter was developed to satisfy the requirement of shelter for maintenance and repair of construction equipment up to size 6 snow tractors in remote work centers at established polar stations. The shelter is constructed of steel arch ribs with a canvas cover. The basic shelter is 28 by 24 ft with a 12- by 28-ft shop at one end. An expansion unit can be added to the shop end to form a second repair stall. Outfitting for the shelter includes a 4-ton traveling hoist, an electrical harness, an overhead forced-air heater, shop equipment and tools. This technical note contains the specifications and outfitting for the shelter described in NCEL Technical Note N-614.

N-616
On-Site Evaluation of No Break (Uninterruptible) Power Supply Sets - U. S. Naval Communication Station (San Francisco), Rough and Ready Island, Stockton, California, Jun 1964, E. Giorgi, AD443978

An on-site evaluation of two no-break power supply sets consisting of a motor-generator, flywheel, electrical coupling, and diesel engine was made to determine the performance and reliability of these sets under actual operating conditions. A description of the sets, method of operation, performance characteristics, malfunctions or failures, and recommended improvements are presented.

N-617
Problems Pertinent to Lowering and Raising Loads in the Ocean, Jun 1964, J. T. O'Brien, J. W. Macisaac, AD444104

A survey of literature and specialists indicates there is need for RDT&E in deep ocean load lifting techniques to provide (1) improved load handling lines of higher strength and durability; (2) improved winches with higher speeds and storage capacities; (3) improved emplacement techniques; (4) better knowledge of the dynamic loadings induced in the load bearing lines, particularly by wave action; (5) improved load recovery techniques, especially when ocean bottom gook is present.

N-618
Feasibility Study of Pontoon Barge Water Jet Propulsion and Steerage, Jun 1964, B. H. Bryner, AD602933

The results of the study indicate that a water jet propulsion system can be built which will have performance characteristics equivalent to those of the model 06DH propeller unit while operating in deep water. Such a system will be superior to the 06DH unit in surf operations because the water jet system has few operational problems in the surf zone. This improved performance carries with it a penalty in the higher power requirement and fuel consumption. Adequate power units are available, but no suitable commercial pump can be obtained as a shelf item. Fabrication of a pump with the necessary operational characteristics is within the present state-of-the-art.

N-619
Preliminary Tests of the Stephenson Valve - 2nd Report, Jul 1964, J. M Stephenson, AD444483

The Stephenson Blast Valve consists essentially of a resilient media in a steel tube or other blast-resistant container. To study the capability of the valve, numerous tests were made on different resilient media with respect to their resistance to air flow, blast attenuation and dust arrestance. The most successful media was a conbination of nonporous polyurethane cylinders (1-3/4-in. diam x 1-in. long) and cylinders of the same material and size with a porosity of 20 pores per inch. The ratio was 1/1 and the depth 12 inches. The air flow was 103 cfm through an 8-inch tube, or about 300 cfm per sq ft, with an air resistance of 1-in. water. When subjected to an overpressure of 76 psi with a duration of 2 sec, the initial impulse in the surge chamber was 0.25 lb-sec/sq in. The performance of the media as a prefilter was excellent. A problem in the use of the media as tested was its tendency to remain in a semi-compressed condition after being subjected to a high overpressure. The cylinders appeared to be too large for the 8-in. diam tube. More preliminary work is required before a design can be finalized.

N-620
Airfield Pavement Evaluation - USMCAS Yuma, Arizona, Jun 1964, R. J. Love, W. R. Chamberlin, AD444328

The evaluation of the U. S. Marine Corps Air Station, Yuma, AZ, is presented with the allowable gross load capacities of the runways, taxiways, and parking aprons for single, dual, and dual tandem wheel assembly aircraft as computed from the evaluation tests. Information is also included on the construction history, climatic data, and current aircraft traffic. Results of field and laboratory tests on the pavement and subsurface materials are included in the tables. The results of the evaluation show that only the old portion of the operations parking apron is being overloaded by military aircraft at the air station.

N-621
Power System Transients and a Power Transient Simulator, Jul 1964, H. H. Kajihara, AD603420

This note summarizes the work conducted on the power line transient analysis and a power system transient simulator, portions of the high-grade electrical power task. The results of the literature study on transients in power systems are presented. The methods currently available and employed by the Navy to protect against power parameter transitory excursions existent in raw commercial power are reviewed. Results of field measurements are presented. Preliminary operational specifications for a power transient simulator are outlined. The simulator is currently under development and is expected to become available by July, 1965.

N-622
Tsunami Damage at Kodiak, Alaska, and Crescent City, California, From Alaskan Earthquake of 27 Mar 1964, Nov 1964, W. J. Tudor, AD455763

A survey of water wave damage to waterfront facilities at Kodiak, Alaska, and Crescent City, California, made about one week after the 27 Mar 1964 Alaskan earthquake of about 8.3 Richter scale, indicates light to moderate damage from 4 to 10-ft inundation and heavy damage from impact by wave-driven ships and debris. The series of six seismic sea waves at Kodiak had crests ranging from 15 to 24 ft above MLLW and periods varying from 27 to 90 min. The largest wave at Crescent City reached 21 ft above MLLW and had a period of 55 min. It is concluded that at Kodiak and Crescent City, piers with moored ships had decking damaged, piers with adequate deck-pile connections did not have decking uplifted. Fishing boats moored in harbor were damaged by breakaways, grounding, and sinking. Single-story, light-frame structures did not survive well; multi-story buildings demonstrated good resistance. Powerplants, communication lines, equipment and vehicles had functional failure when submerged. Reconstruction of all low-lying sections of cities and ports should consider defense against tsunami.

N-623
Tests of a Motion Pickup of the Infrared Type, Oct 1964, F. E. Nelson, AD611419

Tests were conducted in the Laboratory of a development model of a motion pickup using an infra-red source (light bulb) as the motion sensor. Tests indicate that with an object oscillating at frequencies of from 0.50 to 0.22 cycles/sec and at double amplitudes of 0.2 to 0.5 in. at source-to-pickup distance of 10 to 20 ft, that the average of the double amplitudes as measured by the pickup is about 0.99 of the actual. It is concluded that such a pickup is suitable for the measurement of water level variations in the ocean. Cost and time for construction of a prototype pickup capable of adequately measuring water level variations in the ocean at distances up to 1,500 ft is estimated at 1 yr and $15,000.

N-624
Glow Ignition of Woods Caused by High Thermal Radiation - Ponderosa Pine, Aug 1964, F. W. Brown, III, AD450941

The limits for glow ignition of Ponderosa Pine have been measured as function of thermal irradiance and time for thick (1/2-in.) wood samples containing from 3 to 100 percent moisture by weight.

N-625
Potentiodynamic Investigation of the Corrosion of Iron, Sep 1964, H. A. Porte, AD450221

The anodic polarization of iron in sulfuric acid was investigated by the potentiodynamic method. Polarization was performed with an electronic potentiostat which was programmed by a synchronous motor. The effects of potential traverse rate and direction, and electrode pre-treatment are discussed.

N-626
Design Parameters for Two-Layered Pavement Systems, Aug 1964, J. Nielson, AD447528

This report presents the values of the modulus of elasticity and Poisson s ratio obtained for three base materials used in airfield pavement construction. These bases were constructed of sand, select base, and crushed rock. Each base was prepared to form a two-layered system with an artificial subgrade. The Burmister layered pavement theory was used to interpret the test results. Values for Poisson's ratio ranged from 0.30 to 0.35. The moduli of elasticity varied from 6,600 to 15,400 psi.

N-627
Analysis of Two-Layered Pavement Systems, Aug 1964, J. Nielsen, AD448473

This report presents in detail the method of analysis used to interpret plate bearing test data using the Burmister layered pavement theory. The method is applicable to the analysis of any two-layered pavement system.

N-628
Budget Preparation and Allocation of Maintenance Funds, Sep 1964, M. L. Eaton, J. A. South, AD449818

This technical note sets down a simple formula for use by BUDOCKS to compute a desirable annual budget for Public Works maintenance. It also sets down a simple formula for allocation of funds received by BUDOCKS, to the various field engineering offices (FEO), and to the various activities in each FEO. It points out the important necessity of supplementing budget and allocation computations with sound inspection and management principles to assure efficient use of funds expended.

N-629
Study of 400 Cycle Power Use by Naval Shore Facilities, Aug 1964, S. L. Wooten, AD449374

This report presents information on the generation, transmission, distribution and economic factors involved with high frequency electrical power. The report also covers frequency conversion from one frequency to another in connection with fluorescent lighting, high speed electrical motors and equipment.

N-630
Nonconformance of Navy Paints to Specifications, Aug 1964, J. B. Crilly, AD453989

Many paints from Navy stock fail to meet specification requirements. Data on paints analyzed at Mare Island Naval Shipyard over the last 6 yr are presented. Well over half the paints submitted for preliminary analyses at NCEL were found to fail tests for weight per gallon, viscosity, total solids, or pigment content.

N-631
Airfield Pavement Evaluation - USMCALF Camp Pendleton, California, Aug 1964, R. J. Lowe, W. H. Chamberlin, AD448119

The evaluation of the U.S. Marine Corps Auxiliary Landing Field, Camp Pendleton, is presented with the allowable gross load capacities of the runway, taxiways, and parking apron for single, dual, single tandem and dual tandem wheel assembly aircraft. Information is also included on the construction history, climatic data, and current aircraft traffic. Results of field and laboratory tests on the pavement and subsurface materials are included in the tables. The results of the evaluation show that the runway, the connecting taxiway, and the parking apron are being overloaded by both the C-119 and KC-130 aircraft.

N-632
A Linear Programming Scheduling Model, Aug 1964, A. G. Azpeitia, AD447536

The problem of scheduling several projects each of whose completion requires a known length of time and known amounts of different types of skilled manpower per unit of time is considered. It is assumed that the starting dates for each project may vary between given limits and that the availabilities of manpower per each unit of time are known. A linear programming model is constructed which generalizes other known models. A computation technique is proposed and a small example is analyzed.

N-633
Ground Rod Metals - Results of Two One-Year Tests, Oct 1964, A. E. Manna, AD455911

NCEL has been investigating various metals now in use as ground rods, and metals which might be acceptable substitutes. NCEL cooperated with the National Association of Corrosion Engineers by installing a series of test rods at the Laboratory. A smaller set was installed at the Naval Air Station, Point Mugu, Calif., as a short-term test. Test results are given for the first group of rods from the NCEL site and for the set from Point Mugu. It is recommended that corrosion-resistant iron alloys be authorized for use in grounding systems.

N-634
Heat Dissipation From Above Ground Shelters, Sep 1964, J. M. Stephenson, AD450224

Above ground structures which have been officially designated as fallout shelters pose a number of ventilation problems which require attention to insure that the thermal environment of the protected area will be habitable. The various materials and configurations of the structures and the effect of solar radiation requires that the heat transfer through the walls and other surfaces be considered separately. To provide heat transfer data for those structures which are of thick wall construction, a widely accepted analytical solution was programmed for the 1620 computer. A modified psychrometric chart was developed so the sensible heat factor technique can be used to determine ventilation requirements for above ground shelters subjected to unusual climactic conditions.

N-635 - Cancelled

N-636 - Cancelled

N-637 - Cancelled

N-638 - Cancelled

N-639 - Cancelled

N-640
Accelerated Weathering of Paints, Aug 1964, P. J. Hearst, AD605568

The results of a literature search on accelerated weathering of paints for predicting the performance of coatings in atmospheric environments are presented and discussed. Present accelerated weathering tests probably

would have only a limited usefulness in the prediction of performance of maintenance coatings. Suggestions for further investigations are presented.

N-641 - Cancelled

N-642 - Cancelled

N-643
Eye Protective Devices, Sep 1964, W. B. Plum, J. B. Crilly, AD450637

The biological effect of infrared radiation on the retina of the eye is discussed. Experimental data are presented on filter systems recommended for eye protective goggles which will reduce the level of high intensity thermal radiation. The filter systems are designed to reduce the infrared radiation in the beam to a negligible level, since this radiation does not perform a useful function insofar as vision is concerned. This Note also contains an Appendix by R. D. Hitchcock describing a laboratory method for evaporating a chromium coating on the filter glass.

N-644
Pneumatic Conveying System for Removal of Sand From Drydocks, Dec 1964, J. J. Doman, AD457898

The pneumatic conveying system for removing sandblasting material from drydock floors, and transporting it to a dump truck on the drydock decks is described. Some of the early results of the "in-service" tests are given.

N-645 - Cancelled

N-646
Near-Infrared Attenuating Fluids, Oct 1964, E. Lumsdaine, AD450573

The attenuation of near-infrared radiation by a spray of water droplets with and without additives was studied experimentally by varying droplet size and flow rate. Three distinct droplet size distributions were used; each distribution was tested with three different flow rates. The data was evaluated in terms of relative effectiveness of a spray of droplets of pure water as compared to water containing additives. The experimental results are compared with a theoretical study of absorption and scattering of radiation by large particles. An approximation technique is used to determine the absorptivity of water with and without additives.

N-647 - Cancelled

N-648 - Cancelled

N-649
Trafficability on the Ocean Floor (Conquering the Benthos), Jan 1965, J. J. Bayles, AD460823

The available information on the character of the ocean bottom (Benthos) has been correlated with that on dry land areas to assess potential trafficability on the ocean floor. Because, relatively speaking, very little is known about the ocean bottom, there is an urgent need for development of vehicles with which to continue the exploration and exploitation of this "last frontier."

N-650
Byrd Station Snow Tunnels - Maintenance Equipment Studies, Sep 1964, G. E. Sherwood, AD449673

Equipment and techniques are being developed for maintaining the snow tunnel walls at Byrd Station, Antarctica, to prevent excessive closure of the walls. The present rate of closure indicates that maintenance will be required within two or three years. The equipment tested by Byrd Station in Jan 1964 included a chain saw and guide for scoring the closure snow and tools for chipping off this snow and finishing the walls. The waste snow was man-hauled to the main tunnel where it was picked up and moved outside by station equipment. It was concluded from the 1964 tests that a more suitable system for maintaining the tunnel walls and disposing of the waste snow should be developed and tested. It is planned to test such a system at Byrd Station in FY-65.

N-651
A Simple Method for Calculation of Gamma-Ray Shielding Properties of Shelter Entranceways, Oct 1964, C. M. Huddleston, AD451688

An empirical equation is described for calculating the attenuation factor for gamma radiation within a ducted entranceway into a shelter. Some sample problems are worked, and a discussion is given of the accuracy of the formula.

N-652
Application of Z-Transform Methods to Markov Chain Problems With a Maintenance Example, Oct 1964, S. F. Love, AD450636

This technical note develops an application of the theory of the Z-Transform to the problem of finding the nth power of a transition matrix, motivated by the need of such a solution in the theory of Markov chains. To illustrate the theory, an example involving vehicle maintenance is presented in detail. The results of the example may be compared with those of Philip M. Morse, "Markov Processes," in Notes on Operations Research, 1959, The Technology Press, Massachusetts Institute of Technology.

N-653
NCEL Ice and Snow Laboratory, Oct 1964, J. E. Dykins, AD452209

To provide a means for more fundamental investigations on polar transportation, construction and operational problems, NCEL has added an ice and snow laboratory to its facilities at Port Hueneme, Calif. Its principal purpose is to study construction materials including ice and snow for polar regions, but within limits it is suitable for performance tests on small items of equipment and componeats for large equipment. The laboratory includes three interconnected environmental chambers ranging in size from 8 by 27 ft to 12 by 32 ft. Test temperatures from 50 to -55F can be maintained at an atmospheric pressure for extended periods with a minimum of maintenance. Special devices have been procured and developed for investigating ice and snow construction, camp drift and liquid distribution in polar camps. Others will be added as the need arises.

N-654
Ice Construction - Experimental Submersible Electric Pump for Free Flooding, Nov 1964, C. R. Hoffman, AD451689

Investigations on leveling and thickening floating ice sheets by surface flooding at Point Barrow, Alaska, between 1958 and 1960, resulted in the development of a free-flooding technique for improving relatively smooth natural sea ice. In this technique, the flood water is discharged around the pump and allowed to seek its own boundary. An elevated diesel-engine-driven pump was used to test this technique at Point Barrow. Its disadvantages resulted in the development of an experimental 1,600-gpm, 15-ft-head, 16-ft-long, 16-in.-diam., electric-motor-driven submersible pump for free flooding. Tests on the experimental pump at North Star Bay near Thule, Greenland, showed that a submersible pump was well suited for free flooding. It was simple to install and recover, it required no priming, and it was easy to keep ice-free during periods of non-use. These tests resulted in the development of an improved submersible pump for free flooding. Currently, a prototype of this pump is being fabricated for field testing.

N-655
Ice Engineering Research - Ice Thickness Measuring for Water-Borne Ice, Nov 1964, W. H. Matsukado, AD453176

It is concluded that the advantages and disadvantages of the two ultrasonic techniques be considered and one selected for development. The requirements on accuracy and range are suggested as 3 to 6 in. and 2 to 20 ft, respectively.

N-656 - Cancelled

N-657
Environment of Deep Ocean Test Sites (Nominal Depth, 6,000 Feet) Latitude 33 Degrees 46 Minutes N, Longitude 120 Degrees 37 Minutes W, Feb 1965, K. O. Gray, AD461145

NCEL has exposed specimens of a large number of construction materials on submersible test units (STU) in 5,300 and 5,800 ft of water. The purpose is to determine what materials are most suitable to withstand the effects of this environment. The environmental factors considered significant are presented. The sea water at these sites is uncontaminated and "normal" for this part of the Pacific Ocean. The particular depth at which the STUs are located places them in an environment with a relatively low dissolved oxygen concentration. In this area, the oxygen minimum zone is located at a depth between 1,800 and 2,800 ft with dissolved oxygen values as low as 0.20 ml/l. Measurements averaging from 1.26 to 1.50 ml of dissolved oxygen per liter of seawater, 2.53 to 2.40C for temperature, and 34.56 to 34.59 ppt for salinity were obtained from the near bottom waters at these two depths (5,300 and 5,800 ft).

N-658
Gamma-Ray Attenuation in Coplanar and Non-Coplanar Three-Legged Concrete Ducts, Nov 1964, J. M. Chapman, J. S. Grant, AD453022

Experimental measurements were made of dose rates in a three-legged 11-in. square concrete duct using a cobalt 60 gamma-ray source. Measurements were obtained for two cases: (1) the axes of the three legs all lay in the same plane (coplanar), (2) the axis of the third leg was normal to the plane defined by the first two legs (non-coplanar). It was found that the dose rates in the third leg were a factor of two lower for the non-coplanar case.

N-659
Investigation of Possible Methods for Testing Gas Filters, Nov 1964, J. R. Gilder, AD452746

It was found that the idea of using an odor to test filters may have merit, but mercaptans appear too hazardous for this purpose. There are, however, other sources of odor that can be investigated. Using human sense of smell for detecting gas leaks may be practical, but it is not as easy to do as it might appear. Most of the more quantitative methods that are being used at the present time lack sensitivity, but gas chromatography is worthy of further consideration.

N-660
Substitution of JP-5 for Diesel Fuels Ashore, Feb 1965, W. W. Watson, J. J. Wise, AD458070

Severe logistic problems outside CONUS have made it necessary to reduce the number of fuels carried in Navy stock. NCEL has, therefore, been directed to conduct a series of tests to determine the suitability of JP-5 aviation turbine fuel as a replacement for DF-2 diesel fuel in construction type equipment. Preliminary findings have disclosed that the JP-5 fuels currently available on the West Coast can be successfully used in the diesel engines assigned to the Naval Construction Forces without the use of additives or precautions, other than increased attention to the cleanliness of the fuel and the fuel system.

N-661
Coatings on Untreated and Creosote and Creosote-Coal Tar Treated Wood Test Panels for Harbor Exposure, Nov 1964, T. Roe, AD452956

Several series of untreated and creosote and creosote-coal tar treated panels have been brush coated with various generic types of coatings, and are being exposed at Port Hueneme Harbor and Pearl Harbor. This report describes the condition of all panels removed during the first year of this test.

N-662
Underwater Mooring System, Apr 1965, J. J. Bayles, R. E. Jochums, AD461146

The test cable had a proven breaking strength of 1,600 lb. The test consisted of an underwater mooring of a 32-ft-long, 20-in.-diam. cylinder with 700 lb of positive buoyancy. This cylinder container was lowered to a depth of 130 ft at its lower end, held by the test cable attached to a 1,500-lb concrete clump anchor. The design life of the test cable was 6 mo. The container was found adrift approximately 1 mile from its moored position on 23 Sep 1964, 3 yr and 2 mo after installation. There are reasons to believe that the test cable's useful life far exceeded its design life due to the protection against sea water corrosion of steel cable provided by polyethylene coating.

N-663
CO_2 Systems for Protection of Computers and Electronic Equipment, Dec 1965, C. W. Terry, J. J. Bayles, AD626371

This note summarizes information obtained through a survey of literature and through laboratory tests of CO_2 systems designed to control fires in electronic equipment. It reviews basic engineering considerations pertinent to the task. Analyses of preliminary test results are included.

N-664
Prepacked Concrete, Nov 1964, W. R. Lorman, AD453088

Twenty-four hardened plain concrete wallettes, each 31 in. high by 25 in. wide by 6 in. thick, were sawed into various rectangular parallel-epipeds. The wallettes represented three groups of prepacked concrete: reference aggregate intruded with fresh-water grout, coral aggregate with fresh-water grout, and coral aggregate with sea-water grout. Each group consisted of three grout-mix designs: strong, normal strength, and weak. Over 400 prismatic test specimens were involved in the program for determining the effects of type of mixing water, type of wire-mesh cover atop the wallette form, test specimen location within the wallette before sawing, and reef coral in contrast to reference aggregate which was conventional sand and gravel. Bulk density, Young's Modulus, volume change as exemplified by weight loss and shrinkage, and flexural and compressive strength constituted the physical properties investigated. Observations of test specimens extended to age 8 yr. Periods of moist curing ranged from 3 mo to 8 yr. Ages at which drying shrinkage measurements began ranged from 3 to 12 mo, and storage incident to volume-change observations continued for at least 84 mo and at most, 93 mo.

N-665
Government and Industrial Use of Alkaline Spray Cleaning Process, Dec 1964, C. M. Saturnino, N. L. Drobny, AD457353

This note contains information from a survey of alkaline spray cleaning materials and equipment in government and industry use. Spray cleaning is used extensively in production finishing, and it is becoming popular in maintenance cleaning. It is evident that in some applications it is replacing steam cleaning. Although spray cleaning appears to possess certain advantages, there is a lack of data to conclusively compare one method against the other.

N-666
Flushing Chemical Toilet for Temporary Polar Camp, Nov 1964, W. R. Mehlsen, J. E. Halton, AD453359

A flushing chemical toilet designed for use with a temporary polar camp has been tested under controlled usage conditions. Careful observations of odor control, chemical action, and mechanical functions were made. The chemical used was satisfactory, but timer and pump maintenance requirements were excessive. It is concluded that chemical toilets can be used for a temporary polar camp. This unit will be modified and used at an NCEL facility near McMurdo Sound in Antarctica to gain additional data from field usage. Study of a simplified unit is recommended.

N-667
Total Non-Condensables Released From Sea Water in Simulated VC, 200 gph VC, and Flash Evaporator Distillation Processes, Nov 1965, L. E. Fuller, AD626149

This detailed study of the non-condensables released from sea water under simulated and actual distilling conditions was made to provide necessary data for development of efficient venting techniques. Experimental work on a simulated vapor compression unit constituted the major portion of the investigation. Material on 200 gph VC and flash evaporation processes was added for comparison. The relation between the amount of non-condensables released and the residence time of the water in the evaporator is discussed. The correlation of carbonate ion hydrolysis, residence time, and carbon dioxide evolution is shown to be a function of the feed to blowdown flow ratio.

N-668
Uplift Pressures Under a Pier Deck From Water Waves, Dec 1964, W. J. Tudor, AD460518

The intent of this report is to present data from measurements of uplift pressures on a small pier in order that prototype predictions can be made. A 6 ft long, 1 ft wide, steel plate pier in 18 in. water depth and a 4 ft long, 4 in. wide, wood pier with cross bracing in 9 in. water depth were placed in both uniform and impulsive-type wave trains with wave amplitudes (still water to crest) from 0 to 6 in., periods from 0.75 to 4 sec, and lengths from 4 to 30 ft long in a long wave flume and also in a rectangular wave basin at NCEL. Measurements of the uplift pressures, both positive and negative, were then made on the underside of the piers with initial still water levels ranging from 0 in. to 3 in. below the pier decks. The predicted uplift is in agreement with one visual prototype measurement. For purposes of design and damage assessment the maximum uplift pressures should be used. Once the water wave reaches the underside of the pier deck a fully developed shock can occur.

N-669
Sea Ice Studies on McMurdo Sound During Deep Freeze-64, Nov 1964, N. S. Stehle, AD453222

Studies of 1- and 2-yr-old ice were conducted during the austral summer of 1963-64 at McMurdo Station, Antarctica. Approximately 75 cores were taken. During the observation period, approximately 3-1/2 ft of ice were lost from the bottom surface of the 2-yr ice, which was found to be very irregular. Observations of the 1-yr ice sheet were concluded halfway through the test season due to breakup. A study of the variation of individual values from the average showed that the maximum salinity and density variations occurred in the top foot of ice; maximum shear variations occurred in the middle third of the 1-yr ice and the middle and top thirds of the 2-yr ice. Low density, low salinity and high confined shear strength were the most likely values to have high variations from the average.

N-670
Lateral Plate Tests on Dry NCEL Test Sand, Nov 1964, H. L. Gill, T. R. Kretschmer, AD454265

A series of lateral plate tests was performed in NCEL test sand for the purpose of determining the variation of the coefficient of horizontal subgrade reaction, K_h, with overburden pressure and deflection. The test procedure consisted of applying a static overburden pressure to the surface of sand while slowly forcing a 9.75-in.-diam circular plate horizontally through the soil and recording the corresponding loads and deflections of the plate. Seven tests were performed at overburden pressures from 1 to 16 psi. In conjunction with these tests, studies were made which indicated that (1) the coefficient of earth pressure at rest, K, decreased with increasing overburden pressure, approaching a value of 0.38; (2) there was approximately a 40% reduction in horizontal pressure on the plate due to soil arching associated with slight inward movement of the plate compared to the case in which no movement was allowed; and (3) vibration of the soil surface during backfilling caused the at-rest horizontal pressure on the plate to increase by nearly a factor of four times that which occurred when the soil was shoveled into place.

N-671
Snow Accumulation on the Ross Ice Shelf, Nov 1964, N. S. Stehle, AD453273

Polar areas are plagued with drifting snow which results in problems of logistics and maintenance. To obtain knowledge of the amount of accumulation and ablation on the Ross Ice Shelf near McMurdo Station, investigations were conducted annually from 1961 to 1964. From these measurements, it was concluded that to prevent accumulation, an area on the Ross Ice Shelf near McMurdo Station must be elevated more than 0.7 ft above the natural snow surface and must be re-elevated at least 0.4 ft each year to maintain this elevation. Windrows perpendicular to the storm wind will increase accumulation by almost 50% on a surface level with the natural snow surface.

N-672
Experimental Wood Piling Treatments FY-64, Dec 1964, T. Roe, Jr., H. Hochman, AD456491

Twenty-ft sections cut from 40-ft class B Douglas fir piles were treated with creosote and creosote plus additives in the NCEL wood treating plant. Retentions of preservative were determined by weight increase and by core analyses.

N-673
A Computer Approach to Making a Fourier Analysis of Distorted Power Waveforms Using the IBM 1620, Jan 1965, J. E. Rieber, AD457839

This report describes the IBM 1620 computer program for the study of power line disturbances, using Fourier analysis. The mathematical background of the program and its operation are described in the report, using its possible application as an example. Detailed instructions for the use of the program are given in appendixes.

N-674
A Study of Sound and Noise Level Reduction in Buildings, Jan 1965, M. J. Erbland, M. A. Lasitter, M. L. Look, AD457354

Several techniques that are presently used to determine the acoustic transmission and absorption losses through walls have been investigated. Experimental techniques and results obtained from measurements are presented. The theoretical aspects of sound generation, attenuation and absorption are discussed, since these concepts are the foundation for work in acoustics and noise reduction investigations. A summary of the work done at NCEL is given, showing techniques used and demonstrating a capability in the field of acoustic theory and measurement. A comprehensive review of the literature on acoustics is presented, along with a brief glossary of terms commonly used in this field.

N-675
Method and Criteria for Survey of Water Shortages at Naval Stations in 1965 and 1980, Dec 1964, W. R. Nehlsen, AD811160

Information on water shortage areas around the world has been reviewed and Naval activities in these areas have been listed. The nature of water shortages is discussed. Sample questionnaires to be circulated to district offices for additional data on the activities in water short areas are included.

N-676 - Issued as R-376

N-677
Driving of Piles Treated With Creosote Containing Additives, Dec 1964, N. Hochman, AD458071

The Laboratory is exposing in Pearl Harbor 20-ft piles that have been treated with experimental treating solutions. All solutions used creosote as an active solvent and, except for the control set, contained one or two solutes.

N-678
Flexible Utility Connections for Underground Protective Shelters, Jan 1965, N. Tomita, AD454794

A brief investigation was made of current flexible utility connection designs for buried protective shelters, design criteria for the connections, and information on differential soil-structure displacements caused by nuclear explosions. Some designs of flexible utility connections were found, but no design criteria were found. Only a meager amount of information was found on differential soil-structure displacements.

N-679
Heat Transfer Promoters in Condensation and Evaporation, Feb 1965, A. M. Repscha, AD457745

This critical survey of literature on the promotion of high and reliable heat transfer rates both in evaporation and condensation was made and it was concluded that of the many systems under investigation, the use of a grooved surface, the small convulutions of which promote thin film heat transfer, offers the greater promise for continued study. A simple experiment for the establishment of the heat transfer characteristics of such convoluted surfaces, both in evaporation and condensation, is described.

N-680
Measurement of Drier Metals, Jan 1965, J. B. Crilly, M. T. Roberts, AD458429

A spectrographic method for the determination of the drier metals cobalt, lead and manganese is described. It is useful for measurements in the range 5 parts per million to 2,000 parts per million in paint vehicle.

N-681
Foamglas Insulation for Buried Hot Pipe Lines, Jan 1965, R. J. Zablodil, AD456875

A limited investigation was made in California concerning installations of Foamglas for hot pipe lines buried directly in the ground. This investigation was to determine the suitability of Foamglas for possible Navy use for underground heat distribution systems. Areas visited were those of San Francisco, Los Angeles, and San Diego. Information obtained indicates that Foamglas, with a suitable joint treatment, wrapping and coating has performed satisfactorily for direct burial application above the water table.

N-682
Snow Movement Characteristics - Wind Duct Borax Tests, Dec 1964, N. S. Stehle, AD456887

Polar areas are plagued with drifting snow which results in problems of a logistics and maintenance nature. To accurately determine the physics and mechanics of drifting snow, studies must be conducted in the controlled conditions offered by a cold chamber. A 2- by 2- by 23-1/2-ft wind duct was designed and constructed by NCEL for use in a cold chamber and calibrated at ambient temperatures in the ice and snow laboratory at NCEL. Initial tests of the duct showed that it is adequate for use in snow movement studies. Functional tests of the duct using borax as a snow simulator allowed successful determination of characteristics similar to those which will be determined for snow.

N-683
The Motions of a Moored Platform Due to Impulsively Generated Water Waves, Mar 1965, P. Holmes, AD462248

The unit impulse response function derived theoretically from the frequency response operator of a moored model platform 5 ft long, 8 in. wide and 6 in. deep is used to predict the model motions in heave due to particular trains of impulsively generated waves with typical wave heights of 3 to 5 in. in water 2.5 ft deep. Experiments carried out in the NCEL wave basin are described, and a comparison is made between analytically predicted motions and those measured. It is found that the agreement is fairly good, and it is concluded that with improved accuracy in the determination of the frequency response operator, the technique may readily be applied in the determination of the response of a floating vessel to impulsively generated water waves.

N-684
Airfield Pavement Evaluation - USNAS Alameda, California, Dec 1964, R. J. Lowe, W. H. Chamberlin, AD455039

The evaluation of the U.S. Naval Air Station, Alameda, is presented with the allowable gross load capacities of the runways, taxiways, and parking aprons for single, dual, single tandem, and dual tandem wheel assembly aircraft. Information is also included on the construction history, climatic data, and current aircraft traffic. Results of the field and laboratory tests on the pavements and subsurface materials are included in the tables. Results of the evaluation show the runways to be in excellent condition and the taxiways and parking aprons to be in poor to fair condition.

N-685
Degradation of Organic Coatings by Irradiation With Light. I. Volatile Products From Ultraviolet Irradiation in Air, Dec 1964, P. J. Hearst, AD458231

Various clear vehicle films were irradiated in air with a mercury arc lamp, and the volatile products were identified by infrared spectroscopy. The films included alkyd, oil, vinyl-alkyd, vinyl, vinyl acetate, epoxy-amine, and epoxy-polyamide films. A number of new absorption peaks were obtained from the products and some of these were identified. The major product of all the films was carbon dioxide.

N-686
State of the Art Uninterruptible Power Systems, Jan 1965, E. Giorgi, AD457831

The need for uninterruptible power supply systems at Naval shore activities has increased tremendously in the past several years. Various concepts have been proposed and utilized for providing a continuous supply of electrical power to critical loads. One or two basic concepts have been used in the development of large uninterruptible power systems which are currently operational. The seriousness of the difficulties encountered with operational systems and the increasing demand for continuity in provision of electrical power have made it necessary to re-evaluate the basic system requirements and to establish definitive criteria for the development and application of these systems. A state-of-the-art study was initiated concurrently with the investigation of operational requirements to establish a basis from which development work could proceed. The technical note reviews the state of technology achieved in the development of uninterruptible power supply systems and discusses

in some detail developmental and operational problems to be resolved in the application of these systems at Naval shore facilities.

N-687
BUDOCKS Ten-Year RDT&E Amphibious Program Formulation, (U), Dec 1964, J. J. Mromadik, R. C. Towne, B. N. Bryner, Secret, (not available for distribution)

N-688
Mooring Systems for Pacific Missile Range Buoys at Eniwetok Atoll, Feb 1965, T. T. Lee, AD458803

A taut line type mooring with minimum hydrodynamic and mechanical noises is designed for a surface Richardson type telemetering buoy (5,000 lb positive buoyancy by Geodyne Corp.). The buoy is intended to remain for at least 1 yr in up to typhoon loading (winds to 60 knots, waves to 10 ft high and 10 sec period, currents to 1.5 knots) in the Eniwetok Lagoon along with six other identical buoys as part of the all weather impact location system of the U.S. Air Force. The recommended system uses polypropylene rope of 1-in. diam to gravity type anchors (steel clumps, 3,300 lb in air) as the mooring lines and a separate 3/4-in.-diam polypropylene rope imbedded with stretchable conductors from surface buoy to the sound sensor (hydrophone) on the lagoon bottom. Detailed calculations, schematic drawings and specifications are presented for all four systems.

N-689
Polar Construction Equipment--Weight Reduction in a D4 Series D Snow Tractor, Mar 1965, D. Taylor, AD458411

A low ground pressure (LGP) D4 Series D snow tractor is being fabricated under Contract NBY-32285. The design objective is a tractor with less weight than previous LGP D4's. Although the basic tractor is heavier than previous models, the modified version will be about 1,250 lb lighter than D4C snow tractors fabricated in 1963, because the track shoes are being made from aluminum extrusions instead of the usual rolled steel section, and the allowable ground bearing pressure has been raised to 4.5 psi. Therefore, the track shoes are being made narrower, the track gauge has been reduced, and other components of the track system are being made lighter.

N-690
Prototype Incinerator for the Destruction of Classified Materials, Apr 1965, W. W. Watson, AD461147

A contract for the performance of this work was let with the Electric Furnace Company of Anaheim, Calif. The resulting unit was subsequently installed at the Naval Supply Center in San Diego, and acceptance testing was successfully completed in June of 1964. The unit, as erected, consisted of a multiple-chamber retort type incinerator, designed to meet the requirements of the Los Angeles Air Pollution Control District, and was equipped with forced and induced draft fans, primary and secondary gas burners, a flue gas washer, and automatic controls.

N-691
Modeling Run-Up Effects of Dispersive Water Waves, Feasibility of, May 1965, J. M. Jordaan, Jr., AD619053

Studies were made in a laboratory test basin to determine the feasibility of modeling run-up effects of explosively generated water waves on beach and waterfront structures. Results were compared with (1) analytically derived predictions, and (2) wave measurements (but not run-up) made in the ocean with high-energy (HE) explosives as the generating source. It was found that run-up measurements in the basin are predicted reasonably well by an existing technique, i.e., that of Kaplan in BEB TM No. 60, 1955.

N-692
Preliminary Study of the Magnesium-Silver Chloride Seawater Battery, Feb 1965, R. D. Mitchcock, G. L. Mazam, AD458230

A literature study is presented of the magnesium-silver chloride seawater battery. Typical batteries used for propulsion of torpedoes are described. A theoretical analysis is presented of the factors which would affect the operating voltage of a Mg-AgCl battery. Polarization and ohmic-drop counter voltages reduce the calculated open-circuit voltage of a Mg-AgCl seawater battery from better than 2 V to around 1 V per cell. At pressures around 1,000 atmospheres (34,000 ft of water) hydrogen evolution should effectively cease and a higher operating voltage should result. The weight and size of a 10-kW, 120-V battery, operating for 10 hr, is calculated to be around 3,000 lb and 10 cu ft, respectively. An appendix is included which gives the results of measuring voltage and current versus time for different seawater cells using magnesium as the negative electrode and operating in seawater at atmospheric pressure.

N-693
Heavy Equipment Operators' Evaluation, JP-5 Versus DF-2, May 1965, J. J. Wise, S. Phelps, AD462464

The results of previous tests have shown that JP-5 aviation turbine fuel is a suitable substitute for DF-2 diesel fuel in the diesel engines powering the equipment of the Naval construction forces. However, several conflicting opinions were expressed concerning the alleged variation in performance which might be detected by heavy equipment operators while using the substitute fuel. The results of this experiment indicated that well-trained operators could sometimes detect a very slight power loss with JP-5, but that otherwise engine operation is completely normal and adequate. This slight power loss is primarily due to increased leakage of the less viscous JP-5 around the fuel injection plungers. The loss does not appear to be of sufficient magnitude to warrant any change in injector rack settings.

N-694
Degradation of Organic Coatings by Irradiation With Light, II. Attenuated Total Reflectance Spectra of Coatings Exposed to Ultraviolet Light, Feb 1965, P. J. Hearst, AD460142

Clear and pigmented films of various vehicles were irradiated in air with a mercury arc lamp and attenuated total reflectance spectra were obtained before and after irradiation. The films included alkyd, vinyl-alkyd, vinyl, epoxy-amine, and epoxy-polyamide vehicles. Most of the major peaks in the ATR spectra decreased on irradiation, but some were unaffected and some peaks increased in intensity. The changes in the spectra of pigmented films were usually similar but less pronounced. This work is part of a study to discover better accelerated test methods for coatings.

N-695
Examples of Corrosion of Materials Exposed on STU II-1 in the Deep Ocean (2,340 ft of Depth for 197 Days), Feb 1965, F. M. Reinhart, AD614903

Preliminary results of corrosion of materials, based solely upon visual examinations, exposed in 2,340 ft of water in the Pacific Ocean for 197 days showed only a few cases of deterioration different from those usually found in moving surface sea water. The clad layers on two aluminum alloys corroded at a much faster rate than normal for surface sea water. The lace-work and under-surface types of attack on certain stainless steels appear to be similar to types of attack by stagnant surface sea water. This could be attributed to low oxygen content as well as lack of a significant movement of deep sea water. Other materials, both metallic and nonmetallic, were not seriously deteriorated and some showed absolutely no evidence of deterioration. In order to obtain meaningful results, considerable critical examination of the various specimens will be required.

N-696
Investigation of Portal Crane Float Requirements, Aratu Ship Repair Center, Brazil, May 1965, J. J. Bayles, AD461583

There is no mathematical technique for determining the design of portal crane track transition curves. A problem exists because of the geometry of the rigid frame crane in its relationship to the track on such a curve. This problem is one of providing correct limits to lateral movement of wheels (float) to accommodate to changing gage requirements. These changes occur as the crane progresses over the transition curve from straight track to another straight track or to a circular curve. At the point of circular curvature, the track gage reaches its extreme reduction and then remains constant. Gage requirements are different for front and rear trucks as the crane passes any given point on a transition curve. Solution of this problem for portal cranes to be used on proposed trackage at the Aratu Ship Repair Center, Brazil, revealed that a minimum of 1 1-in. inward and 5-in. outward float capability will be required.

N-697 — Issued as R-586

N-698
Atomic Defense Studies - Movable Shield for Fallout Protection of Above-Ground Structures, Apr 1965, J. T. Quirk, AD461338

This note briefly describes the movable shield for fallout protection of above-ground structures and outlines the four year test program that is to be conducted. The shield will be tested for operation, weatherability and required maintenance.

N-698 Suppl.
Atomic Defense Studies - Movable Shield for Fallout Protection of Above-Ground Structures, Jun 1965, S. L. Phelps, J. T. Quirk, AD465766

This note briefly describes the construction and test of the movable shield for fallout protection of above-ground structures. The shield is being tested for operation, weatherability and required maintenance.

N-699
Ice Grading Equipment - Experimental Ice Dozer for Pioneering in Rough Ice, Jun 1965, S. K. Gifford, AD465586

This Technical Note covers the development of an experimental ice dozer for preliminary grading of rough ice areas. It consists of a rotating, spiked-tooth cutter mounted on the front of a crawler tractor. Engineering tests were performed on the unit at Port Hueneme, Calif., and Devil's Lake, N.D. It exhibited good ice cutting characteristics, but lacked sufficient control for level cutting. It was modified for improved control in 1964 and shipped to McMurdo, Antarctica for field testing during the summer season of Deep Freeze 65.

N-700
A Survey of Pipe Corrosion at Naval Activities, Mar 1965, J. M. Stephenson, AD614259

To determine the effectiveness of methods used in the field to protect pipeline systems from corrosion within a group of government activities, engineers from NCEL made on-site investigations of piping distribution systems in 23 Naval activities located in various places of the Pacific Coast, Atlantic Coast, Gulf Coast, Hawaii and inland Calif. The data collected from the sites were more commonly from service pipelines such as steam, hot water, potable water, sea water, sewage, air, gas and oil. One hundred and six pipe installations were investigated. Information as to site, soil characteristics, type of coating or covering, date of installation, length of pipe involved, and reports on the success or failure of the systems are recorded in tabular form. The most serious failures reported are in underground hot pipeline systems where, in most cases, the lines are installed below the water table.

N-701
Field Testing of Plastic Mooring Buoys - Part I. Condition of Buoys After Five Months Service, Mar 1965, R. W. Drisko, AD460523

The condition of two experimental plastic mooring buoys is described after five months service to the Fleet. The buoy with the hand lay-up outer shell had received practically no deterioration after five months of very light service. The buoy with the spray-up outer shell had received considerable damage to its top edge and side after five months of heavy service.

N-702
An Experimental 10,000-V Pulse Generator, Apr 1965, S. J. Wooten, AD615564

Transient voltages, varying from about 100 V to over 10,000 V occur on electrical power lines supplying sensitive Naval cryptographic and computer equipment. These transients are capable of destroying, interrupting, or introducing errors into such equipment. To evaluate the attenuation characteristics of suppression devices and networks to combat these transients, it was necessary to develop a suitable transient generator developed at NCEL for this purpose, and the method of its employment in a test procedure. Testing by this method has been shown to be simple, reliable, and inexpensive, accurate in pulse amplitude and pulse width, and relatively free of circuit ringing. The pulse generator discharges approximately 4 μF of capacitance at 0 to 10,000 V, with a resulting maximum energy of 200 joules.

N-703
Investigation of Commercially Available High-Speed High-Frequency Electrical Power Generating and Conversion Equipment, May 1965, K. Giorgi, AD463468

Gas turbine engines are normally provided with speed reduction units when used as prime movers for electrical power generating sets. These speed reduction units have many undesirable features such as vibration, noise, frictional losses, added maintenance and high cost. The desirability of eliminating such units becomes apparent particularly when related to the continued increase in the use of gas turbines in electrical generating sets. A task was therefore initiated to investigate the feasibility of coupling a gas turbine directly to an electrical generator. This not only results in a more compact system but also provides a means of generating high-frequency power. With static frequency-conversion equipment, a single, highly transportable electrical generating system would be available for applications requiring multiple sources of electrical power having different voltage and frequency characteristics. The results of an equipment survey and a literature search conducted by the laboratory are presented, together with discussions on potential advantages, disadvantages, and problems or difficulties anticipated in the procurement and utilization of high-speed high-frequency power equipment.

N-704 — Issued as Letter Report

N-705
Retrieval of Submersible Test Unit Using Acoustic Beacons for Navigation, Nov 1966, R. K. Jones, R. A. Krutenat, AD808814L

NCEL has placed several large structures on the sea floor. Retrieval of the structures, which are not provided with surface markers, is a matter of precise ship navigation and grappling. This report contains details of a successful method for navigation.

N-706
Electrical Methods for Predicting Paint Performance - A Literature Survey, Mar 1965, P. J. Hearst, AD613549

The results of a literature search on electrical methods of testing paints are presented and discussed. Particular attention is given to electrical methods that might predict or might help in predicting the performance of coatings on an accelerated basis as compared to normal exposure tests. Although it has been claimed that reliable predictions can be made with the results from some electrical methods, there is very little substantiating evidence in the literature. These methods, especially the measurement of dissipation factors and of DC resistances, should be further investigated.

N-707
The Variation of Dose Attenuation of Two-Legged Concrete Ducts With Incident Gamma-Ray Energy, Apr 1965, J. M. Chapman, AD462614

Gamma-ray dose attenuation factors were measured in a 2-ft-sq and an 11-in.-sq duct using Au-198 (0.412 Mev), Cs-137 (0.662 Mev), and Co-60 (1.25 Mev) gamma-ray sources. Attenuation factors for given geometries were compared as a function of the incident gamma-ray energy. It was found that the attenuation factor decreases monotonically with increasing energy. Measured attenuation factors were compared with values obtained using a computer code based on the Albedo concept. It was found that calculated attenuation factors are high by as much as 78% for Au-198 in the 11-in. duct.

N-708
Survey of Antarctic Water Supply and Waste Disposal Facilities, Practices, and Problems, Apr 1965, N. L. Drobny, AD617533

Low temperature conditions initiate physical, biological, and chemical changes in the environment. These, in turn, pose significant problems in the design, construction, and operation of facilities for the distribution of water and for the collection, treatment, and disposal of waste. In addition, remoteness is a sizeable problem in the south Polar region. Distance greatly slows the rate at which material can be supplied for the purposes of construction, maintenance, and repair. As a result, logistics problems assume unusually significant proportions. The need for simple systems is paramount. A survey of water supply and waste disposal problems at existing United States stations in the Antarctic is presented. Problem areas are identified, and potential research and development efforts are suggested.

N-709
Neutron Streaming Through Hydrogenous Media, May 1965, L. B. Gardner, A. J. Mettler, D. L. Peterson, AD615518

NCEL is studying the design of various entranceways for protective structures. The particular portion of the work reported herein is concerned with air ducts in concrete. One of the essential parameters for the design optimization of such ducts is the neutron energy spectra as a function of position in the duct. From this parameter may be determined the type and quantity of shielding materials necessary to achieve a specified protection factor. Also described is the sequence of computer programs which process and analyze the radiometric data of such foils. These programs were specifically designed to handle the foil data associated with the experimental determination of neutron streaming through ducts; however, they are suitable for handling other radiometric analysis problems. By their use, radiometric analysis data may be rapidly processed with reasonable assurance of freedom from numerical error. Maximum utility of these programs is obtained when using automatic counting that punches data directly on cards usable as the computer input.

N-710
Transient Voltage Suppressors, Aug 1965, S. J. Wooten, AD468424

Sensitive Naval communications and computer equipment presently in use at NAVCOMSTA, NAVRADSTA and at Naval computer centers generally cannot tolerate transient voltages from the power line, which may range from less than the line voltage to thousands of volts over the line voltage. The objective of this Technical Note is to survey the various types of transient suppression networks and equipment commercially available today, and to provide the electrical characteristics and transient suppression characteristics of some of the networks found in the survey. The survey revealed that passive and active transient suppression networks are commercially available that will effectively attenuate the transient voltage pulse to a satisfactory level. Suppressors using passive elements were found to offer greater reliability and longer operational life, though they generally cannot regulate the over-all 60 cps voltage. Thyrectors have high reliability, low cost, ease of installation and high attenuation of transient voltages and were, therefore, found to be the simplest answer to the suppression of transients.

N-711
Thermal Transient Response of Underground Shelters, Sep 1965, D. F. Sampsell, AD621377

The sound design of environmental control systems for underground shelters is based on knowledge of the thermal transient response under certain climatic conditions. To gain insight into the transient response of underground shelters, a series of test using a scale model shelter was conducted. Model-prototype considerations resulted in several model temperature distortions which could be accounted for by analytical techniques. The corrected model results agreed well with results from an analog computer study which considered the same prototype shelter. The model results also indicated that shelter shape does not significantly affect its transient response. Another phase of this study was the development of a non-computer design procedure for determining the environmental control system capacity required for a given set of climatic and soil conditions. The design procedure was applied to a number of shelter locations and climatic conditions to test its performance. As expected, the solutions indicated that ventilation rate and air-conditioning capacity depend heavily on climate, initial soil temperature, and shelter area per person.

N-712 - Cancelled

N-713
The Proper Role of Detergent-Sanitizers in Sanitary Maintenance Cleaning, Jun 1965, N. L. Drobny, AD465767

This report defines the role that detergent-sanitizers should play in sanitary maintenance cleaning within the Naval Shore Establishment. The experiences of other agencies with detergent-sanitizers have been monitored and are reported herein. The basic chemical aspects of detergent-sanitizers are also included. This information is integrated into a discussion of advantages and disadvantages of detergent-sanitizers for Navy use. Because of the generally poor performance and the higher cost of detergent-sanitizers, it is concluded that when good detergent cleaners are available, the use of detergent-sanitizers should be discouraged for general sanitary maintenance cleaning.

N-714
Survey of Water Storage Tank Interiors, May 1965, R. W. Drisko, AD467615

A field survey was conducted throughout the Naval Shore Establishment to determine the type of corrosion and maintenance problems existing in the interiors of water storage

tanks and to make recommendations as to further investigations in the area. BUDOCKS personnel were contacted at both the division and field level by a Laboratory representative who found that relatively little information on the condition of tank interiors was available.

N-715
Investigation of Material Handling Equipment for Amphibious Landings (Over-the-Beach Conveyor), May 1965, R. C. Towne, B. H. Bryner, G. D. McDougall, AD617257

This investigation describes the parametric studies and comparisons made between existing ship-to-shore cargo handling systems and a proposed over-the-beach conveyor. Results of the analysis of physical and operational factors preclude the construction of an assault conveyor system.

N-716
A Survey of Energy Sources for Emergency Power for NAVCOMSTA, Aug 1965, S. J. Wooten, AD470751

A survey was made of solid-state electrical power equipment and modern direct energy-conversion systems, with a view to their possible adoption as standby AC power sources for critical Naval communication and computer facilities. Fuel cells, nuclear reactors, fission batteries, biochemical cells, thermoelectric generators, magnetohydrodynamic generators and thermonuclear generators were under study to determine their ability to supply emergency power. Solid-state inverter and converter units were found to be commercially available for use with the currently feasible energy sources. The over-all study revealed that, of the seven energy systems evaluated, the fuel cell used with an SCR inverter is the system most worthy of further evaluation and study. The other systems have some capabilities for future applications for NAVCOMSTA but not at this time. Further work is planned to develop a satisfactory system.

N-717
Factors Influencing the Modulus of Deformation of Pavement Bases, Jun 1965, J. P. Nielsen, AD466269

This note is one of a series concerned with the NCEL research effort in the area of airfield pavements. Specifically, this note is concerned with the factors which influence the modulus of deformation (elasticity) of paving materials. It is shown that this parameter is influenced by the weight of the overlying bases in a pavement system. It is also demonstrated that this parameter increases with increasing depth of base and that bases incorporated in a multi-layered system develop higher moduli than those which are part of a two-layered system.

N-718
Airfield Pavement Evaluation - USNAS Miramar, California, May 1965, R. J. Lowe, W. H. Chamberlin, AD465796

The evaluation of the U.S. Naval Air Station, Miramar, is presented with the allowable gross load capacities of the runways, taxiways, and parking aprons for single, dual, single tandem, and dual tandem wheel assembly aircraft. Information is also included on the construction history, climatic data and current aircraft traffic. Results of field and laboratory tests on the evaluation show that the runways, taxiways, and parking aprons with the exception of parking apron 2 and the 8-in.-thick section in parking apron 5 are capable of withstanding the loads imposed by current aircraft. However, some localized areas in the asphaltic concrete portion of runway 6R-24L did not meet the present requirements.

N-719
Pioneer Polar Structures - Skid-Foundation Study for a 64-Ft Jamesway, Jun 1965, G. E. Sherwood, AD465266

An experimental, 64-ft-long, rigid steel foundation was tested on a fairly hard snow area near McMurdo, Antarctica, in Feb 1965. During the tests, the foundation was high-centered over a hard ridge of snow and the cantilever action caused it to separate at the mid-point. It is now being redesigned to provide a hinge-joint at the center, thus eliminating the bending moment. Test and evaluation of the hinged foundation are planned during the summer season of Deep Freeze 66.

N-720
Initial Testing of Pavement Striping Tapes, May 1965, R. W. Drisko, AD466522

The application of two proprietary striping tapes to asphaltic pavements and their condition after a limited period of time are described.

N-721
Sea Ice Studies on McMurdo Sound During Deep Freeze 65, Oct 1965, R. A. Paige, C. W. Lee, AD623881

The sea ice adjacent to McMurdo Station, Antarctica, has been used extensively since 1956 for aircraft operations, travel, freight hauling, and loading and unloading ships. A study of some factors affecting the safety and efficiency of these operations was made during the summer of 1964-65. The factors included cracks, seal holes, pressure ridges, and breakout of the ice in this area at the end of the 1964-65 summer season. It was found that cracks which did not penetrate the ice sheet, and seal holes in thick ice did not seriously affect the bearing capacity of the ice; however, flooding in pressure zones and around seal holes on the ice sheet created a hazard to travel where the ice was covered with snow. In addition, it was observed that breakout of the ice south of McMurdo Station began about 3 weeks after the ice exhibited minimum strength, maximum temperature, and a rapid decrease in thickness, and 4 to 6 weeks after maximum daily air temperatures were observed at McMurdo Station. It was concluded that additional research is needed to provide adequate knowledge on the influence of those factors affecting the safe and efficient utilization of sea ice in Antarctica.

N-722
Modification of a Two-Wheeled Tractor for Movement of Sand in Drydocks, Jul 1965, J. J. Doman, S. Phelps, AD467386

A previous study revealed that the areas near keel and bilge blocks in drydocks did not allow sufficient overhead clearance for mechanical sand removal equipment. The Gravely two-wheeled walked tractor, which is in use in many Navy yards in the sand removal operation, was modified in order to provide a low profile unit that could readily move under the ship in most docking situations. This description is given so that Navy yards can accomplish the modification at a minimum cost if it can be used profitably in their installations.

N-723
Review of Climatological Influences on the Deterioration of Ice and Snow, Jun 1965, N. S. Stehle, AD465277

The climatological factors of high solar radiation and air temperature contribute to ablation and deterioration processes in ice and snow. Local environment and climate are as important as elevation and latitude in determining the importance of these factors to the ablation and deterioration processes. At present however, these processes cannot be predicted from climatological data alone. Studies are needed on the influence of solar radiation and temperature on ice and processed snow. The albedo of these surfaces will determine the amount of solar radiation absorbed and, in areas of high solar radiation but below freezing temperatures, it may determine the amount of ablation and deterioration of the surface.

N-724
Requirements for Liquid Distribution Systems in Polar Camps, Oct 1965, C. R. Hoffman, AD623618

The distribution of freezable liquids in polar camps poses special problems seldom encountered in domestic piping systems. Preliminary cold chamber tests have been conducted to obtain basic freezing rate information on water flowing through test loops of 2-in. galvanized steel, PVC plastic pipe and type K copper tubing. It was found that heat is lost more slowly from plastic and copper pipes than from steel pipe. Also, at high fluid velocities, significant amounts of heat are generated which effectively reduce the air temperature at which freezing occurs.

N-725
Testing of Transient Suppression Networks, Aug 1965, S. J. Wooten, AD470889

Data taken from the testing tends to indicate that the most effective over-voltage transient suppression system available today is the active filter network. The thyrector, presently being manufactured by the General Electric Company, was found to be the least expensive, simplest in operation and highest in reliability of the filter systems tested, and second only to the active filter network in attenuation. The NCEL developed lossy line is very effective for the suppression of transient voltages when used on the primary side of the distribution transformer where the voltage is high and the current is relatively low.

N-726
Applications of Radioisotopes for Naval Field Establishments, Sep 1965, L. B. Gardner, A. E. Hanna, H. E. Stanton, AD621440

Techniques employing radioisotopes were investigated in order to determine their usefulness to public works departments of the Naval Shore Establishment. These techniques include absorption, detection of location, and backscattering. The last mentioned seemed to be the most promising and offered several applications for waterfront maintenance. Several Naval field establishments were visited during the course of the work to ascertain problem areas.

N-727
Ice Construction - Prototype Submersible Electric Pump and Extension Tube, Oct 1965, C. R. Hoffman, AD625320

Sea ice has been used extensively in polar regions for roads, runways, camp sites and other operational purposes. It has been found, through field experiments, that free flooding ice at sub-freezing temperatures is an effective method of improving the surface and load bearing capacity of natural ice sheets. In this technique, water is pumped from below the ice, discharged around the pump, and allowed to seek its own level. The successful performance of an experimental submersible electric pump in this application at Thule, Greenland, led to the design and fabrication of a prototype casing and extension tube for high-volume, low-lift pumps. Functional testing of a 1,600-gpm, 12-ft-head prototype in the Port Hueneme Harbor indicated that it should be well suited for flooding natural ice surfaces from 1 to 30 ft or more in thickness. Following correction of the corrosion and electrical connection problems encountered in the Hueneme tests, the unit will be tested in a polar environment.

N-728
Cathodic Protection of Mooring Buoys and Chain, Part I, Initial Field Testing, Jun 1965, R. W. Drisko, AD617259

A study was conducted into the feasibility of cathodically protecting a fleet mooring. The original cathodic protection system utilized sacrificial magnesium anodes with automatic control heads designed to maintain the desired potential level. This system did not operate satisfactorily. A modification using uncontrolled zinc anodes gave a higher level of protection to the buoy and riser chain, but insufficient zinc was present on the ground legs to provide the necessary potential.

N-729
Degradation of Organic Coatings by Irradiation With Light. III. Volatile Products From Simulated Solar Irradiation in Air, Jun 1965, P. J. Hearst, AD617244

Various clear vehicle films were irradiated in air with a xenon arc, and the volatile products were identified by infrared spectroscopy. The films included alkyd, oil, vinyl-alkyd, vinyl, vinyl acetate, epoxy-amine, and epoxy-polyamide films. The volatile products obtained were qualitatively similar to those obtained by mercury arc irradiation of the same films, but the relative amounts of the various products were changed in many cases. The products from the mercury arc irradiation contained acetylene, but those from the xenon arc irradiation did not contain acetylene. These differences in the products show that the more rapid deterioration in the ultraviolet light from the mercury arc differs from the deterioration obtained in the simulated sunlight from the xenon arc.

N-730
Survey of Control Systems for Auxiliary Power Equipment, Aug 1965, R. H. Leseberg, AD468416

This technical note covers a survey of commercially available control system components which might be adopted for use with Naval standby power equipment requiring close voltage and frequency control, with particular reference to solid-state devices. It is concluded that (1) "off the shelf" commercial control system components are generally not suitable for direct application in control systems where "high quality" power output is required, (2) to satisfy the requirement for "high quality" power output, the complete control system should be carefully engineered and each control component in the system should be individually selected, designed and manufactured to become an integral and compatible component within the complete control system, and (3) the new developments and improvements for control system components that have resulted from the use of new solid-state devices and magnetic core materials are all adaptable for use.

N-731
An Unattended Power System Waveform Recorder, Jun 1965, H. N. Kajihara, AD470351

This note reviews the in-house RDT&E work conducted in FY-65 towards the development of an unattended power system waveform recorder.

N-732
An Investigation of X-Ray Analyses of Paint Pigments, Jun 1965, S. H. Bassett, J. B. Crilly, AD467073

The feasibility of using X-ray techniques in the chemical analyses of paint pigments was investigated as a part of the task on spectrographic analysis of paint. It appears to be feasible, with certain qualifications considered in this note, to make an analysis of pigment compounds suspended in paint by the use of X-ray techniques.

N-733
The Use of Antarctic, Multi-Purpose (MP-1) Fuel in Space Heaters, Camp Stoves, and Lanterns, Sep 1965, W. W. Watson, J. J. Wise, AD471241

The specifications for a multi-purpose fuel, MP-1 (MIL-F-23188) have been developed by the Bureau of Naval Weapons. This fuel, proposed for use at Antarctica in aircraft turbines, diesel engines, and space heaters, has received prior approval for use in C-130 and C-135 aircraft. The current study was undertaken to determine its suitability for use in space heaters, emergency camp stoves, and lanterns. The tests indicate that, as a fuel for "pot type" space heaters, MP-1 is superior to the presently used DF-A space heater fuel. MP-1 is not recommended as a regular fuel for pressurized camp stoves and lanterns which normally burn white gasoline. Under emergency conditions, however, MP-1 can be used in these units for short periods of time.

N-734
A Proposed System for Supplying Air to a Hypothetical Undersea Seabee Base. II. The Venturi Gas Exchanger, Jun 1965, H. P. Vind, A. Langguth, AD467500

A device called a "Venturi Gas Exchanger" was designed and constructed. The function of the device is to continuously scrub the interior atmosphere of a simulated underwater chamber in sea water. The only source of oxygen in the experimental chamber is that removed from the sea water during the scrubbing process, and the only means for removing carbon dioxide from the chamber is the same scrubbing process. A micro-burner can be kept burning indefinitely in the chamber, and two rats were maintained in the chamber for an entire 8 hr day. During their stay in the chamber, the rats appeared to be comfortable and they suffered no discernible ill effects from the experience. Future plans call for the construction of a submersible model of the Venturi Gas Exchanger which will be employed to ventilate a submerged chamber.

N-735
Exterior Concrete and Masonry Paints, 1st Semiannual Evaluation of, Aug 1965, J. B. Crilly, AD621714

Eight paints have been exposed on four masonry substrates: concrete brick and block, cinder block and expanded aggregate block. Three exposure sites, Kwajalein, Marshall Islands, Kaneohe, Hawaii, and Port Hueneme, California, have been used. After 6 mo on Kwajalein, paints based on styrene-butadiene and styrene-acrylate solutions have begun to fail. These paints have recently been covered by Federal Specification TT-P-0097.

N-736
Experimental Wood Piling Treatments FY-65, Aug 1965, T. Roe, Jr., H. Hochman, AD468687

Sixty-six 20-ft piles cut from 40-ft class B Douglas fir piles were treated with creosote-free preservatives containing combinations of compounds in the NCEL wood treating plant. Twelve piles were treated with two of these solutions to which some creosote was added. Retentions of preservative were determined by weight increase. The treated piles are being exposed at Waipio Point, Pearl Harbor, Hawaii.

N-737
Failure Modes of Sand Surrounding a Laterally Displaced Pile Subjected to Static and Impact Loads, Jul 1965, L. W. Heller, AD470096

An experimental investigation has been conducted to define the patterns of soil movement in the vicinity of a laterally displaced pile under static and impact loadings. A 2-in.-sq, 30-in.-long stiff model pile section was embedded 18 in. into a box of uniform dry sand which had a colored grid pattern. The pile was loaded laterally, the sand was wetted, allowed to drain, and was vertically sectioned to photographically record the characteristic patterns of sand movement. The data reveal that the horizontal sand movement about the lower portions of the embedded pile are similar for both static and impact loadings, but that impact loadings produce larger sand movements near the surface. Influence values and volume factors for the sand motion in the vicinity of the pile are given for both static and impact loads. Inertial pile loading, developed as a consequence of the soil movement, can be determined from these quantities.

N-738
Refraction of Dispersive Waves on a Beach, Jun 1965, J. R. Evans, D. G. True, AD618876

Dispersive type surface gravity waves were generated in water 2.5 ft deep by a single quick immersion or withdrawal of a small plunger located along one wall of a 90-ft square tank of water with beaches on the remaining three sides. Measurements of water level variation were made at about 20 points on and in front of the 1 on 13.6 sand beach opposite the plunger. These were reduced so as to provide the amplitude and position of the wave refraction pattern on the beach. It was found that the measured wave crest refraction pattern and amplitude are predicted adequately by Snell's Law and by a modification of Green's Law.

N-739
Survey of Standby Power Systems, Aug 1965, R. H. Leseberg, AD619895

This Technical Note describes current research and development effort, by industrial and other organizations, in the field of internal combustion engines for possible future application to standby engine-generator sets for Naval shore stations where high-grade electrical power is required. Since the results of this research and development activity will not become available for practical use for many years, it is concluded that any replacement of standby engine-generator sets at Naval shore stations in the near future must be by standard engines from current manufacture, improved only in design details to attain higher efficiency and reliability.

N-740
Truck Tractors and Semitrailers in MCB Operations, Feb 1966, D. Taylor, J. J. Doman, AD876497L

A study was made of the Naval Construction Force truck tractor-semitrailer combinations in furtherance of the findings in NCEL Technical Report R-342. Combinations of these vehicles in the MCB allowance list, MCB equipment pool, and the P2 and P25 advanced base functional components, and the vehicles in the Bureau of Yards and Docks mobilization reserve stocks that would be used in these components, were examined in respect to the capability of the vehicles with the anticipated maximum loads when operating on and off the highway. The vehicles are generally adequate for the anticipated loads, excepting the code 0607 M52 truck when it must tow a semitrailer loaded with the largest MCB augmenting equipment items. It is recommended that the code 0638 M123 be used in these instances.

N-741
Compilation of Operational Performance Records for Uninterruptible Electrical Power Supply Equipment, Nov 1965, E. Giorgi

Numerous problems and failures have been experienced by Naval shore activities in the operation of uninterruptible electrical power supply systems. A performance evaluation of these systems was therefore initiated by the Laboratory as a phase of an over-all task to develop reliable uninterruptible power supply equipment. Various Naval activities have cooperated in submitting performance records on equipment currently in service at each activity. A compilation of the performance records received during the period of 1 Jan 1964 to 20 Jun 1965 is presented as an interim report. Background information on the Laboratory's task effort and a preliminary analysis of operational failures are also included.

N-742
MP-1 as a Fuel for Diesel Engines (Ambient Temperature Phase), Sep 1965, W. W. Watson, J. J. Wise, AD473167

The specifications for a multi-purpose fuel, MP-1 (MIL-F-23188), have been developed by the Bureau of Naval Weapons. This fuel, proposed for use at Antarctica in aircraft turbines, diesel engines, and space heaters, has received prior approval for use in C-130 and C-135 aircraft. The current study was undertaken to determine its suitability for use as a fuel in compression-ignition engines. Results of a 500-hr endurance run and a series of dynamometer tests indicate that MP-1 fuel is an entirely acceptable substitute for DF-A fuel in medium and high speed diesel engines, under temperate weather conditions. Tests to determine the extreme low temperature capabilities of MP-1 are currently in progress, with complete approval anticipated.

N-743
The Use of JP-5 Aviation Turbine Fuel in Large Bore, Low Speed Diesel Engines, Nov 1965, W. W. Watson, AD474043L

In view of substantial economies anticipated in the field of fuel logistics, an investigation was conducted to determine the feasibility of substituting JP-5 aviation turbine fuel for standard DF-2 diesel fuel in large bore, low speed diesel engines. The investigation included: (1) consultation with engineering and service representatives of engine and injection equipment manufacturers, (2) detailed examinations of typical engines following lengthy operation on JP-5 fuel, and (3) on-the-spot inspection and analysis of reported large bore engine-fuel difficulties. From this investigation it was concluded that JP-5 can be substituted for DF-2 in large bore, low speed diesel engines with no appreciable ill effects to the engine or injection equipment, provided only that certain basic precautionary measures are observed.

N-744
Acceptance Test and Evaluation of the Meco 4,800 GPD Distillation Unit, Sep 1965, S. L. Phelps, J. S. Williams, AD470752

An evaluation test of a 200-gph vapor compression distillation unit was conducted to determine its conformance to the purchase specifications. The unit is described in detail. The results of the test are given in both graphic and tabular form. Production during the 400-hr test averaged 230 gph at a ratio of 320 pounds of water per pound of diesel fuel. Performance with and without acid injection is also given.

N-745 - Issued as N-819

N-746
Laboratory Experiences With a Gas Turbine Powered Power Package, Oct 1965, E. J. Beck, AD474250

This report covers the initial inspection and testing of a 100-kW electrical power unit driven by a Boeing 300-hp gas turbine. The unit had provision for producing steam, both through recovery from the turbine's exhaust and firing of a separate but integrally mounted water tube boiler. The steam producing equipment was operated only for short periods due to lack of adequate instructions and diagrams. At 850 hr of operation, the gas turbine lost power from erosion and/or corrosion of the blading in the nozzle box immediately after the combustors. Severe abrasive wear of the first stage power blading from petroleum coke lodged in the nozzle blading could also have contributed to the power loss. These and other operational difficulties are reported in this note.

N-747 - Cancelled

N-748 - Cancelled

N-749 - Issued as R-429

N-750
Analysis of Reinforced Concrete Thin Shells - A Preliminary Study, Oct 1965, R. R. Craig, AD624197

This study is part of a long-range program to obtain information pertinent to the analysis and design of concrete thin shell structures subjected to dynamic loads. A brief bibliography of some of the literature related to this subject is included. The remainder of this report is devoted to the theory of shallow shells. The equations governing the dynamic behavior of shallow shells are derived, and the Galerkin method is employed to obtain a solution for the free vibration of a clamped, elliptic paraboloid shell such as might be used to support the floors in a multistory building.

N-751
Analysis of Ocean-Floor Soil Samples by X-Ray Diffractometry and Infrared Spectroscopy, Jan 1967, G. R. Glenn, AD822263L

Because of the special problems of analyzing ocean-floor soils, procedures were devised and experiments were made to test the suitability of using X-ray diffractometry supplemented by infrared spectroscopy for identifying the constituents of core samples. The results indicate that the techniques are effective means of identification. X-ray diffraction records and infrared spectra of selected core samples are presented, and experimental data are tabulated and analyzed in light of reference data for minerals most likely to be found in ocean-floor soils. The principal D-spacings and infrared absorption bands are provided as a basis for the identifications.

N-752
Locomotion of Ocean Bottom Vehicle by Shifting Ballast, Dec 1965, C. L. Herndon, AD625321

This report describes a feasibility study of shifting ballast in a rolling unit as a means of locomotion for deep ocean vehicles over terrian likely to be encountered on the ocean floor. It was determined that this was not a practical approach at the present time, because of excessive power requirements. To move the vehicle 1 mph requires 20.5 hp, which increases to 73 hp to move it 2 mph.

N-753
Essential Features of Alkaline Spray Cleaning Studies, Jul 1965, N. L. Drobny, AD468251

Continued investigation of the alkaline spray cleaning process is reported. Relevant information obtained from a field survey of BUWEPS spray cleaning tasks at MCAS Cherry Point and a NAS Alameda is summarized. The conclusions of this survey are that experimental studies are in most cases essential to permit selections of spray cleaning equipment and materials, and that the cleaning jobs must be specified in detail before the experimental evaluations can begin.

N-754
The Modified OCD Blast Closure Valves, Test and Evaluation of, Pt. 1, Sep 1965, J. Andon, AD471408

Eight OCD blast closure valves are being evaluated by NCEL. These valves range in size from 600 cfm to 2,500 cfm and are either blast actuated or can be closed pneumatically. Tests performed in FY-65 include normal force determinations, pneumatic operation of triggered valves, air flow characteristics, and strength of latch mechanism under negative pressure. The rated blast performance and reliability tests are planned for FY-66.

N-755
The Conversion of 16-In. Projectiles to Pressure Vessels, Jun 1965, K. O. Gray, J. D. Stachiw, AD625950

Pressure vessels for use with fresh water and sea water at pressures up to 20,000 psi have been fabricated from modified 16-in. high capacity Naval projectiles. Details for modification of projectiles and the fabrication of supporting equipment are presented. Proof-testing procedure and data are described and discussed.

N-756
Blast Resistance of Check and Gate Valves, Nov 1965, K. R. Bockman, J. D. King, R. S. Chapler, AD626831

The objective of this task was to determine the blast resistance of standard check and gate valves which may be used in protective shelter equipment and utility systems. Commercially available 3-in., 200-psi WOG (water, oil, or gas) bronze check and gate valves were subjected to transient air pressures to about 390 psi and to transient hydraulic pressures to about 2,000 psi. Subsequent visual examination, operational tests, and hydrostatic leak tests revealed no damage to the valves, and test data indicated relatively low magnitudes of strain. In order to determine

whether or not the valves may be dynamically loaded when subjected to a nuclear blast wave, the natural frequencies of the valves were obtained and compared to the rise time of nuclear explosions. This showed that if a blast wave reaches the valve without attenuation, dynamic loading could occur. If, however, the wave must propagate through a piping system to reach the valve, the wave front may be relatively unchanged, or it may steepen and possibly increase the dynamic loading, or it may be attenuated so that little or no dynamic loading would occur. In the case of shocks generated by the test equipment, it was shown that dynamic loading was not applied. Because the most severe loading conditions could not be produced by the test equipment, the exact configuration in which valves are to be used must be considered before recommendations can be made as to their blast resistance.

N-757
Snow Transport Equipment - Specifications for the Model 40 Towed-Type Snowplow Carrier, Sep 1965, S. E. Gifford, AD471858

This Technical Note contains outline specifications for procurement of a model 40 snowplow carrier developed by NCEL. Its development is given in Technical Report R-417. This unit, which is a ski-mounted, towed-type piece of equipment, was developed for elevating roads, runways and similar areas on snow. It was designed to gather snow from borrow pits and transport it through the air onto these areas. The snowplow carrier also can be used for clearing drifted snow from operational areas on snow and ice.

N-758
Mechanical Properties of Sea Ice With Reference to Structural Behavior of Ice Sheets, Sep 1965, K. S. Pister, AD621042

A reasonable starting point for developing constitutive equations for the mechanical behavior of sea ice would be the fundamental theories advanced in the research of metals at elevated temperatures. In some areas, the advanced theory appears to be adaptable to the study of mechanical behavior of sea ice, while in others, constitutive equations will have to be developed. Emphasis is needed in researching the problems of short-term behavior, long-term creep and parametric effects of temperature, age and brine content on strength, as well as repeated loading and cumulative damage.

N-759
Active Arching of Sand During Static Loading, Nov 1966, H. L. Gill, D. G. True, AD684455

Tests were performed to provide quantitative information on soil arching over a buried structure. Idealized small-scale structures were buried in prepared specimens of dry NCEL test sand, and static overpressures of various magnitudes up to a maximum of 150 psi were applied to the surface of the specimens. Foundation area and depth of soil cover over the structures were the major variables during the tests. Measurements were made to evaluate the interrelationships between depth of soil cover, static overpressure, soil stiffness, structural motion, and soil arching. The magnitude of soil arching over a particular soil-structure system subjected to static loading was found to be a function of a factor accounting for the geometry and the relative stiffness of that system. Geometry is accounted for by the perimeter area ratio of the structure multiplied by the depth of soil cover. The stiffness portion of the factor related the soil stiffness to the stiffness of response of the structure relative to the free-field soil.

N-760
Construction Equipment for Handling Heavy Loads in the Ocean, Mar 1966, B. J. Muga, AD808820L

Information concerning key pieces of equipment employed in raising and lowering heavy loads in the deep ocean is summarized and conveniently displayed. Recommendations for research, development, testing and evaluation are given.

N-761
Airfield Pavement Evaluation, USNAS Point Mugu, Calif., Sep 1965, R. J. Lowe, W. H. Chamberlin, AD474564

The evaluation of the U.S. Naval Air Station, Point Mugu, is presented with the allowable gross load capacities of the runways, taxiways, and parking aprons for single, dual, single tandem, and dual tandem wheel assembly aircraft. Information is also included on the construction history, climatic data, and current aircraft traffic. Results of the field and laboratory tests on the pavements and subsurface materials are included in the tables. Results of the evaluation show the runways, taxiways, and parking aprons with the exception of connecting taxiways 9 and "C" and parking aprons 2, 6, and 7 are capable of withstanding the loads imposed by current aircraft.

N-762 - Cancelled

N-763
Calculation of the Energy-Angular Relationship for Neutrons From a Neutron Generator, Sep 1965, C. M. Huddleston, N. F. Shoemaker, AD621473

A relativistic calculation is made to determine the energy of neutrons emitted from the NCEL neutron generator as a function of the angle of emission. Both the tritium reaction, with a neutron energy of approximately 14 MEV, and the deuterium reaction, with a neutron energy of approximately 2.5 MEV, are considered. Values of neutron energy as a function of angle are tabulated and plotted.

N-764
Monte Carlo Calculations of Gamma-Ray Albedo, Sep 1965, C. M. Huddleston, N. F. Shoemaker, AD621441

A Monte Carlo computer program has been used to generate values for the differential dose albedo of gamma rays on concrete. The values have been fit to a semiempirical formula containing two adjustable parameters. Values for the parameters are reported as a function of gamma-ray energy.

N-765
Allocation of Vehicles at Centers, Sep 1965, H. Gonshor, C. E. Parker, AD621154

This Technical Note develops a model for the problem of allocating vehicles to centers where the total number of vehicles available is fixed. An algorithm for obtaining the optimal allocation is illustrated by means of an example. This model assumes the demand distribution for vehicles is known and that a penalty for lack of a vehicle at each center can be postulated. In Appendix A the total number is permitted to vary. A Fortran program to solve this problem on the IBM 1620 has been written and verified, and is listed in Appendix B.

N-766 - Cancelled

N-767
Protective Coatings in Shallow and Deep Ocean Environments, Aug 1965, C. V. Brouillette, R. W. Drisko, R. L. Alumbaugh, AD472701

A number of organic coating systems, topcoated zinc inorganic systems, and splash zone compounds were exposed on steel specimens in shallow and deep ocean environments. Performance was generally better at shallow depths. Notable exceptions were soft asphaltic and coal tar coating systems that are susceptible to barnacle damage in surface waters. Organic coating systems of 13-mil or greater dry film thickness performed markedly better than those of less thickness. Post-cured zinc inorganic systems tended to perform better than those self-cured.

N-768
Factors Affecting Utilities Consumption and Cost, Sep 1965, M. A. Leupp, AD471461

This report describes research on the relationship between utilities consumption and cost at selected Naval activities and various descriptive statistics for the activities. The statistics included activity population, replacement value and square feet of various types of facilities. Multiple regression analysis was the method used in the research.

N-769
Model Studies of Large Vented Openings - Phase II, Oct 1965, D. S. Teague, AD474104

A study was made of the optimum location for blast protection of generators in pits and shelters. The factors considered were cost, blast overpressure, dynamic pressure, operational dependability, and cooling air requirements. Ground shock and radioactivity were not considered. As could be expected, underground locations give the most protection but are the most expensive. Least expensive is the open pit, which gives the least protection. If the above-ground building can withstand the overpressure, it is as effective a location for generators as the underground compartment. Heat, noise, vibration and exhaust create problems when generators are located within shelters. Open pits with gratings provide economical protec' .on from dynamic pressure. A filter cover using compressible cylinders should provide sufficient protection at moderate cost, but needs further development.

N-770
Polar Transportation Equipment - Hydraulic Cranes for Cargo Vehicles, Sep 1965, G. E. Sherwood, W. H. Beard, AD472837

A hydraulic crane mounted on a 6 by 6 truck-tractor was tested at McMurdo, Antarctica, during the summer season of Deep Freeze 65. The crane had a maximum lifting capacity of 7,600 lb with a 5-ft boom radius. Its maximum boom radius was 18 ft, and its maximum lifting height was 23 ft. It could be rotated 360 deg, and it was easy to operate without special training. The crane was useful in assembling equipment, moving fuel drums, loading and unloading cargo, and camp maintenance. The boom rotation and extension provided good control for accurate and easy placement of material. Similar cranes are commercially available in a variety of sizes for most any size wheeled or tracked cargo vehicle. It was concluded that a hydraulic vehicle crane is a useful support item for polar coastal stations and that its use at outlying stations should be investigated.

N-771
Improvements to Polar Camps, Use of a 64-Ft Jamesway, Sep 1965, G. E. Sherwood, AD623010

Certain practical considerations have usually limited the length of Jamesways to 48 ft; however, by using a side entry and heating the building with a forced air furnace, its length can be extended indefinitely. Although economy of construction and heating increase with length, a limit of 64 ft was set for fire safety and possible tow as an assembled building. This length is easily adaptable to the NCEL 25-man pioneer polar camp. This Technical Note presents an evaluation of practical limits for the length of a Jamesway, using accessories developed for this shelter by NCEL. This evaluation is based on tests with 64-ft Jamesways in an experimental camp operated by the Laboratory near McMurdo, Antarctica, during the summer seasons of Deep Freeze 64 and 65.

N-772
Sea-Ice Construction - Specifications for the Skid-Mounted Pumping Units, Sep 1965, S. E. Gifford, AD473168

This Technical Note contains outline specifications for two skid-mounted pumping units for sea-ice construction. One is a high-pressure, low-volume unit principally for confined flooding, and the other is a low-pressure, high-volume unit principally for free flooding. Their development is given in Technical Report R-356. These units, which are self-contained and totally enclosed, are suitable for operation in air temperatures to -40F. They are suitable for surface and above-surface operation. A suction hose or metal suction tube through the ice sheet is used to deliver water to the pumps, and distribution hose is used to deliver it to the flood area.

N-773
Critical Pressures for Radially Supported Cylinders, Jan 1966, C. V. Chelapati, AD627082

A study is made to find the critical pressures fo. radially supported cylinders with simple ends and subjected to uniform radial pressure. The large deflection theory developed by Langhaar and Boresi is used to find (1) the critical pressures, considering only infinitesimal deflections (Euler load), and (2) the critical pressures for snap-through buckling (energy load or Tsein's critical pressure).

N-774 - Cancelled

N-775
An Improved Stepwise Regression Analysis Procedure, Dec 1965, W. L. Wilcoxson, J. R. Wohlever, AD625328

Stepwise regression analysis is a least squares method for estimating an empirical linear relationship between variables. This method is implemented by the computer program STRAP with format, version 2, for the IBM 1620 card or paper tape data processing system with 20,000 positions of storage and no special features. Some of the capabilities of this program are found only in programs for very large machines, if at all. The many statistics, optional output and flexible data formats provide a powerful program to satisfy the requirements for many applications at the Laboratory.

N-776
Theoretical Analysis of Dynamic Pressure Propagation in the Pore Fluids of Soils, Oct 1965, J. W. Fead, AD474156

A study has been made of the propagation of pressure waves through the pore fluid of a soil. Dry, saturated, and partially saturated cases are considered for cohesive and cohesionless soils. Tentative recommendations are made concerning assumptions to be made and methods to be used in predicting the pore pressures resulting from impulsive loadings.

N-777
Damage Caused by Hurricane Betsy at Certain U.S. Naval Shore Installations in Southeast United States, Jan 1966, P. J. Rush, T. T. Lee, N. A. Goldin, H. T. Hurst, AD627637

Observation and analyses were made of certain damage caused by Hurricane Betsy which occurred in the Bahama Islands and in the southeastern portion of the United States, Sep 6-10, 1965. Damage was caused by direct wind forces, by windblown debris acting as missiles, by wind-toppled structures and vegetation, by wind-induced water-waves and tides, by uncontrolled waterborne structures and objects, by direct rainfall, and by flooding of streams and other water areas. Particular note was made of damage to buildings and other framed structures, waterfront and harbor structures, and exposed electrical and mechanical facilities. In the hope of reducing susceptibility of such installations, certain recommendations and proposals for research and development are presented.

N-778
Maintenance Information for the LGP Caterpillar D4 Series D Snow Tractor, Oct 1965, D. Taylor, AD475111

This Technical Note was prepared for insertion in the Caterpillar service manuals for the low ground pressure D4 series D snow tractor serial no. 78A2827 to provide a record of the USN and Caterpillar reference numbers, a list of the tractor modification drawings, a suggested list of spare parts for 2,000 operating hours, and special instructions for maintenance and operation of the tractor.

N-779
Test and Evaluation of the Modified OCD Blast Closure Valves, Nov 1965, J. Andon, AD475769

Eight OCD blast closure valves were tested and evaluated by NCEL. Three sizes of valves were included - 600 cfm, 1,200 cfm, and 2,500 cfm. The valves are designed to be closed by blast actuation and/or pneumatically by air cylinders. The tests performed include closure force determinations, pneumatic operation of triggered valves, air flow characteristics, strength of latch mechanism under negative pressure, air blast performance, and reliability tests after exposure to the weather. The valves performed satisfactorily except during the air blast tests. There was a thread failure of the stud holding the valve disk to the valve stem at shock pressures above 4 psi. This failure could be remedied by increasing the shear area of the threads subjected to impact loading.

N-780
Nuclear Blast Vulnerability of Shelter Electrical Generating Equipment - Diesel Engine Overpressure Tolerance, Nov 1965, J. Andon, AD684462

Nuclear blast tolerance of internal parts of an operating diesel engine was tested by exposing the exhaust system, and simultaneously the intake and exhaust system to simulate overpressure air. Peak overpressures as high as 100 psi were applied. When the engine exhaust was subjected to overpressure, the engine speed was momentarily but noticeably reduced, and the combustion chamber peak pressure was slightly increased. With the intake and exhaust system exposure to overpressures, the engine speed was only slightly affected, and the peak combustion chamber pressure was greatly increased. This pressure reached 4,400 psi at 100 psi overpressure, thus, increasing the internal load to over four times that of normal engine operation. The diesel engine under test withstood repeated overpressure applications of 100 psi without any failures. To complete the evaluation of blast vulnerability of diesel-driven generator sets, external parts tolerance tests will be necessary.

N-781
Effect of Deep Ocean Environments on the Corrosion of Selected Alloys, Oct 1965, F. M. Reinhart, AD626586

This is a partial report covering eight materials selected as representative of the different classes of alloys exposed in the Pacific Ocean at depths ranging from 2,340 to 5,640 ft for periods of time ranging from 123 to 1,064 days. Aluminum alloy, 5086-H34, was attacked by intergranular corrosion which was manifested by pitting and edge penetration. It was also attacked by crevice corrosion. Its corrosion rates and pit depths increased with time of exposure. Copper alloy no. 715, alloy steel AISI 4130 and the extra high strength low alloy steels corroded uniformly, their corrosion rates decreasing with increasing time of exposure regardless of depth. The nickel base alloy, Hastelloy C, was uncorroded. The austenitic stainless steel 20-CB also was uncorroded except for crevice corrosion after 197 days of exposure at a depth of 2,340 ft. No significant effect of pressure on the corrosion behavior of these alloys is evident from the data presented.

N-782
Recovery of Submersible Test Unit I-1, Oct 1965, C. K. Paul, AD475041

The first submersible test unit (STU I-1) emplaced on the ocean floor on 29 Mar 1962 had evaded all recovery attempts for almost 3 yr. The relatively long exposure duration of the STU's engineering materials specimens made its recovery highly desirable. The positioning of the STU during its original emplacement constituted the major problem in the recovery of the STU. The positioning system used during the successful recovery cruise is described. Three grappling techniques utilized during the search cruise are described. The methods used to pinpoint the STU's bottom location and to physically retrieve it to the surface are explained in detail.

N-783
Collective Protector Design and Development, Interim Report, Nov 1965, N. P. Oldson, R J. Zablodil, AD625402

Filtration of ventilation air is necessary to protect personnel in a shelter area against radiological, biological, and chemical warfare agents. A collective protector unit includes three filters, in series with a blower, which will remove contamination from the ventilating air entering the shelter. The objective of this work unit is to develop a family of modern, lightweight collective protector units, which will incorporate easy replacement of filter elements, and easy interchange of power units. In this connection, various filtering media were to be investigated to determine the feasibility of using some of the new concepts of air filtering.

N-784
Reinforced Plastics Laminates Panels - Exposure and Initial Physical Tests, Feb 1966, T. Roe, AD684405

Sets of glass-reinforced epoxy and polyester panels, both coated and uncoated, have been exposed at China Lake and Port Hueneme, Calif., and at Kwajalein, Marshall Islands. A fourth set of panels is being maintained as a control. Results of physical tests on the first group of these control panels are reported

N-785
Exterior Concrete and Masonry Paints, Second Semiannual Evaluation, c 1966, J. B. Crilly, AD849556L

Eight paints have been exposed on four masonry surfaces: concrete brick, concrete block, cinder block, and expanded aggregate block. Three exposure sites, Kwajalein, Marshall Islands, Kaneohe, Hawaii, and Port Hueneme, Calif., have been used. After 12 mo on Kwajalein, paint based on styrene-butadiene solution has failed.

N-786
High Speed Power Switching System, Nov 1965, R. Donaldson, AD625660

The operation of critical electronic equipment at Naval installations is impaired by very brief power discontinuities. This note is a progress report documenting the experimental investigation part of developing a suitable switching system. It contains details on the system and circuits of a preliminary breadboarded model 6-msec, 3-kVA power source switching system.

N-787 - Cancelled

N-788
Snow-Compaction Equipment, Load Test Trailer, Nov 1965, S. L. Goldberg, AD476168L

Techniques and equipment have been developed to process snow in place for use as a construction material for roads and runways. A test device to simulate aircraft wheel loadings is needed to determine bearing capacity of the compacted snow and to search out possible processing misses

in the material so that they can be repaired before landing aircraft. To satisfy this need, a 20-ton semi-trailer was modified to receive two interchangeable aircraft test wheels mounted under the deck. Any desired load up to 38,500 lb is applied to the test wheel through a power-operated hydraulic system. Ballast placed on the deck of the trailer serves to resist uplift caused by the reaction of the test wheel on the snow. The two test wheels have tires with maximum inflation pressures of 95 and 135 psi. The lead test trailer will be used to study bearing capacity of compacted-snow test areas near McMurdo, Antarctica, during Deep Freeze 66.

N-789
Current Techniques of High Frequency Lighting, Nov 1965, S. J. Wooten, AD476173L

The first phase of the work unit reported herein is an investigation of present techniques used in high frequency fluorescent lighting systems, and frequency converters for use with the optimum systems. The initial study covered rotary motor-generator units, silicon controlled rectifier units, transistorized units, transformer multiplier units and vacuum tube units. The study determined that there are three major ranges of frequencies presently being used for HF lighting: the 840-1,000 cps range, the 3,000-5,000 cps range and the 10,000-20,000 cps range. The distribution type of system, which uses a high power central converter and distributes the power over a large area, uses frequencies below 3,000 cps. The individual converters, which are mounted in the fixture, are being developed at frequencies from 3,000 cps to 20,000 cps. The study also determined that systems which use central converters and distribute power over large areas are relatively expensive to install, cause construction and decorating problems, and for these reasons are not generally replacing existing 60 cps systems.

N-790
Surface Hardening of Compacted Snow by Controlled Solar Radiation Absorption, Nov 1965, N. S. Stehle, AD684406

The snow surfaces of compacted-snow roads and runways often do not have adequate surface hardness and wearing ability for repeated traffic. Laboratory tests were conducted at NCEL to study the increase in surface hardness and wearing ability of compacted snow by melting and refreezing the surface snow through controlled absorption of solar radiation by black plastic on the snow surface. In 6- to 8-hr test exposures, the greatest increase in shear strength in the top 6 in. of the snow, the measure of surface hardness for these tests, occurred at +5F after 6-1/2 hr of exposure to 1.10 Langleys/min, equal to 1.1 gm cal/cm sq/min or 243.3 Btu/ft sq/hr. Results indicate that solar radiation was not effective in promoting surface hardening at air temperatures below -10F or above +20F. During the summer at McMurdo Station, Antarctica, average air temperatures within this range occur frequently from late October through mid-December and from late January through March. The capabilities and limitations of this method of compacted-snow surface hardening cannot be determined until more detailed information on daily solar radiation in polar areas is available.

N-791
On the Relationship Existing Between the Number of Transportation Equipment at 28 Naval Air Stations and Their Annual Mileage for 1958-1961, Dec 1965, W. L. Richardson, AD684475

Data are analyzed with a requirement to develop practical formulas for determining transportation equipment allowances. A technical approach, using regression analysis, is applied, and the correlation between number of vehicles, at each of 28 Naval Air Stations, and their annual mileage is determined. Data for 1958-1961 is examined and statistical measures derived. Statistical measures are also derived using only 1961 data. The two periods are compared on the basis of how well the data characterizes the transportation equipment utilization at these Naval Air Stations. It is observed that a significant variation in transportation equipment utilization is present at the Naval Air Stations.

N-792
Design Optimization for a Small Multistage Flash Evaporator, Feb 1966, D. E. Williams, AD684607

A study was made to optimize design for a small multistage flash evaporator for remote base operation using waste heat from a 100 kW, 4-cycle diesel generator, carrying continually varying electrical load. The design of such an evaporator is controlled by practical considerations to a greater extent than for a large stationary evaporator, where efficiency might be the most important factor. Since the cost of the unit increases with its coefficient of performance, the selection of design parameters depends upon the relationship between unit cost and the quantity of fresh water produced expressed as a function of available heat. It is shown that cost increases disproportionately with respect to coefficient of performance. However, justification for the additional expense is presented. The recommended design is an air-transportable 16-stage evaporator arranged in two adjacent 26-ft-long sections connected in series. A discussion of some possible alternate designs is included.

N-793
Visual Observations of Corrosion of Materials on STU I-1 After 1,064 Days of Exposure at a Depth of 5,300 ft in the Pacific Ocean, Nov 1965, F. M. Reinhart, AD643490

Visual observations of materials exposed on the bottom of the Pacific Ocean at a depth of 5,300 ft for 1,064 days showed that the corrosion of most of the alloys in the mud was different from the corrosion in the water 6 ft to 10 ft above the bottom. The stainless steels exhibited a honeycomb type of attack very similar to the type of attack by stagnant surface sea water. The 5000 series aluminum alloys showed deep pitting. This could be explained on the basis of the low oxygen content combined with the nearly stagnant condition of the sea water. The 70% Ni-30% Cu alloy which was partially embedded in the sediment showed pitting that undoubtedly was caused by the composition of the peculiar environment in the water-sediment interfacial zone. The plastic materials were unaffected except for those portions encased in wood which were attacked by wood boring animals. Hydroids attached themselves to and grew on both metallic and non-metallic materials with no apparent deteriorative effects.

N-794
Some Research Applications of Radioisotope Techniques at NCEL, Dec 1965, H. E. Stanton, AD684472

Specific applications of radioisotope techniques in three areas of the research program at NCEL are studied and evaluated. The areas include measurements of the diffusion of isotopically labeled water in concrete, the measurement of small distortions in a hollow sphere, and the measurement of film thicknesses, both liquid and solid, when covering other materials.

N-795
Electrical Properties of Coatings as Related to Performance; Experiments With Five Immersed Coating Systems, Dec 1965, P. J. Hearst, AD627311

Five coating systems on steel panels were immersed in salt water for up to nearly 2 yr. AC electrical properties of the coatings were determined and were compared with the performance of the coatings. There was appreciable correlation between electrical properties and performance.

N-796
A Study of Amphibious Logistics With a Computer Model, Jan 1966, R. C. Towne, B. H. Bryner, G. D. McDougall, AD828460L

This task was authorized by BUDOCKS to develop improved cargo-transfer systems capable of handling rapidly and efficiently all cargo utilized in amphibious operations and advanced base supply. A mathematical model was developed to simulate the assault phase of amphibious operations on a computer. The computer program is designed to compare and

evaluate the performance and costs of logistic systems and their components, and thus to facilitate the establishment of design criteria for more efficient logistic equipment. Though the basic area of application of the computer program is the simulation and analysis of amphibious landings under a variety of conditions and combinations of equipment, any system or procedure which can be expressed in terms analogous to those of the program may be simulated and studied.

N-797 - Cancelled

N-798 - Cancelled

N-799 - Cancelled

N-800
A Dynamic Programming Approach for Determining Minimum Operating Cost of an Electrical Generating Plant, Mar 1966, K. M. Daniel, R. D. Spencer, AD684408

The problem of determining the minimum operating cost of an electrical power generating plant composed of distinguishable pieces of generating equipment is considered. A dynamic programming model is formulated for solving such a problem, assuming that cost functions of the equipment are concave and deterministically known.

N-801
Avalanche Rectifiers as Transient Suppressors, Mar 1966, S. J. Wooten, AD684409

To prevent high transient voltages which occur on the commercial AC power line from interfering with or damaging critical communications and computer equipment, special filter networks are needed. The present inductive and capacitive types of passive filters in use at Naval communications stations are generally unsatisfactory for equipment employing solid-state transistors and diodes because of their greater susceptibility to overvoltages. This Technical Note describes a relatively new suppression device, an avalanche controlled rectifier (ACR). The tests indicate ACR's, which can handle extremely high power transients without failure, can be used to protect the active SCR transient suppression filters designed for continuous operation on commercial AC lines.

N-802
Shelf-Life of Protective Coatings, Mar 1966, E. S. Matsui, AD684410

A number of physical and chemical analyses of protective coatings are being conducted to determine their storage stability for a duration of 3 yr. Of the 52 coating components reported, only a few were found to fail as the result of developing an unacceptable condition in container, but all changed in viscosity, nonvolatile contents, and drying time in varying degree during the 3-yr storage period. There are some indications that the two-component systems are more susceptible to aging than the one-component systems.

N-803
20-Knot LST to 3x15 Causeway Connection System, Mar 1966, R. C. Towne, J. J. Traffalis, G. D. McDougall, AD684468

The development of a 20-knot class LST has necessitated the development of a new method of LST-to-causeway connection which accommodates the new-type LST as well as the old. This report describes a theoretical study of the problems involved with the 20-knot-LST connection, the development and test of the NCEL proposed abutment connection, and the analyses and test of the BUSHIPS stand-off connection. It is recommended that development of both abutment and stand-off connections systems be continued.

N-804
Improvements to Polar Camps. Jamesway Ceiling Hanger Bracket and Curtain Rods, Mar 1966, G. E. Sherwood, AD684464

New ceiling hanger brackets and curtain rods were developed to increase the speed of installation of curtain partitions in Jamesways and to provide a more sturdy assembly. The new ceiling hanger brackets are supported by existing bolts in the arch rib, thus eliminating the requirement of making any measurements or drilling holes for installation. In addition to supporting curtain rods, the hanger brackets can be used to support heating ducts, electrical wiring, light fixtures, and ceiling panels. It is estimated that installation time of the new ceiling hanger brackets and curtain rods will be about one-third the time required to install the curtain rods used previously. Based on the average cost of Seabee labor in Antarctica, this represents a saving of $152 in outfitting a 12-bedroom Jamesway quarters. It is planned to use the ceiling hanger brackets and curtain rods to outfit a 64-ft Jamesway as a 12-man quarters for in-service test at McMurdo, Antarctica, during Deep Freeze 67.

N-805
Investigation of Free-Fall Embedment Anchor for Deep Ocean Application, Mar 1966, J. E. Smith, AD808818L

The concept of a free-fall type of anchor that could be rapidly and surely placed and used to secure small to moderate size objects, such as buoys, floats, and barges, on station in great depths of water was investigated. Two experimental anchors were designed and tested. Major problems were encountered in (1) achieving adequate velocity through the water, which resulted in a lack of adequate penetration into the bottom; (2) in accommodating the anchor line, and (3) in maintaining weight, size and proportions within practicable bounds. Consequently, the free-fall anchor concept as it is applied to specified objectives and criteria was found to be not feasible. However, the anchor fluke designed for one of the experimental anchors and the method used for anchor line payout during its free-fall placement are considered worthy of further investigation in conjunction with other contemplated operations.

N-806
Deep-Ocean Reactor Placement Study, Apr 1966, J. T. Quirk, AD808819L

A summary and evaluation is made of research and development studies conducted by the Bechtel Corporation related to the placement, assembly, connection, and control of a nuclear power reactor on the deep-ocean floor at depths up to 20,000 ft. Two proposed systems for reactor placement are presented: the all-surface system, and the vehicle-assisted system. In addition to this report's discussion of the two proposed systems for reactor placement, Appendix A summarizes the technical aspects of other placement approaches that were considered. Since the precise requirements of deep-ocean placement projects have not yet been established, these alternate concepts and discussions may well, by coincidence, contain important solutions to future deep-ocean operational problems.

N-807
Pioneer Polar Structures, Skid Foundation for a 64-Ft Jamesway, Apr 1966, G. E. Sherwood, AD684463

A skid foundation for a 64-ft Jamesway was developed to save manpower in relocating polar camps at outlying work centers and construction projects on snow and ice. Use of such a foundation would eliminate the labor required to completely disassemble and reassemble buildings that have to be moved due to changing requirements, drifting snow, or site contamination. This steel foundation is hinged at the center connection to reduce bending moment, and is cross braced in each 16-ft length to keep it square.

A prototype 64-ft-long foundation was loaded with weights to simulate the weight of a Jamesway and given tow tests on beach sand at Port Hueneme and on snow at McMurdo,

Antarctica. There was no damage to the foundation even when warped over ridges up to 2 ft high, and it remained square through a 3-mi tow test on snow.

It is planned to erect a 64-ft Jamesway, outfitted as a 12-bedroom quarters, on the prototype foundation during Deep Freeze 67, and conduct tow tests to determine the effect of towing on an erected building and its outfitting.

N-808
Bamboo Reinforced Concrete Construction, Feb 1966, F. E. Brink, P. J. Rush, AD684411

This report has been prepared to assist field personnel in the design and construction of bamboo reinforced concrete. The information in this report has been compiled from reports of test programs by various researchers and represents current opinion. Comments on the selection and preparation of bamboo for reinforcing are given. Construction principles for bamboo reinforced concrete are discussed. Design procedures and charts for bamboo reinforced concrete are given, and conversion methods from steel reinforced concrete design are shown. Six design examples are presented.

N-809
Airfield Pavement Evaluation, USNAS Moffett Field, California, Feb 1966, R. J. Lowe, W. H. Chamberlin, AD684412

The evaluation of pavement at the U.S. Naval Air Station, Moffett Field, Calif., is presented with the allowable gross load capacities of the runways, taxiways, and parking aprons for single, dual, single-tandem, and dual-tandem wheel assembly aircraft. Information is also included on the construction history, climatic data, and current aircraft traffic. Results of the field and laboratory tests on the pavements and subsurface materials are included in the tables. Results of the evaluation show that runway 14L-32R, the east taxiway, the diagonal taxiway, the 6-in.-thick pavement in parking apron 1, the 7-in.-thick pavement in parking apron 2, and the pavements inside hangars 1, 2, and 3 are being overloaded by the current aircraft stationed at NAS Moffett Field, Calif.

N-810
Laboratory Manual for Design and Analysis of Experiments, Mar 1966, M. L. Eaton, AD684413

This manual consists of two parts. In Part I the main guidelines for design of an experiment is presented. Part II consists of a series of short appendices, each written to discuss in technical detail definitions, basic probability and statistical concepts and operations, methods of data analysis, and a few designs not mentioned in Part I.

N-811
Improvements to Polar Camps, Jamesway Electrical Wiring Harness, Apr 1966, G. E. Sherwood, AD684470

A new wiring harness was developed to increase the speed of installation of electrical power in a Jamesway and to improve the quality of lighting. The new harness is made up of insulated cable so that each circuit can be wired together and coiled for shipment. Light fixtures, located over the center of each room, have a cord and plug cap for plugging them into convenience outlets to eliminate wiring them into the system in the field. The only field connections required are in wiring the circuits into the distribution panel and connecting the vestibule and outside lights into the system. It is estimated that installation time of the new harness will require about one-fourth the time needed to install the electrical harness used previously. Based on the average cost of Seabee labor in Antarctica, this represents a saving of $256 in outfitting a 64-ft-long Jamesway. It is planned to use the new electrical wiring harness to outfit a 64-ft Jamesway as a 12-bedroom quarters for in-service test at McMurdo, Antarctica, during Deep Freeze 67.

N-812
A Multi-Machine Replacement and Maintenance Model, Apr 1966, K. H. Daniel, AD684414

The problem of optimal sequential investment and replacement decisions for various power generators is treated by methods of discrete dynamic programming. The objective cost function to be minimized, subject to appropriate constraints, is iteratively determined for a proposed finite n-period as well as for an infinite period model. In the latter case the iteration procedures serve as an approximation of the solution of a functional equation.

N-813
Airfield Pavement Evaluation, USNAS North Island, California, Apr 1966, R. J. Lowe, W. H Chamberlin, AD684415

The evaluation of the U.S. Naval Air Station, North Island, is presented with the allowable gross load capacities of the runways, taxiways, takeoff mats, and parking aprons for single, dual, single-tandem, and dual-tandem wheel assembly aircraft. Information is also included on the construction history, climatic data, and current aircraft traffic. Results of the field and laboratory tests on the pavement and subsurface materials are included in the tables. Results of the evaluation show the runways and taxiways, with the exception of the asphaltic concrete portion of taxiway 2, are capable of withstanding the loads imposed by current aircraft. Parking aprons 2, 3, 5, 6, 7, 8, and the 6-in.-thick concrete portion of apron 4 show ratings below that required for some of the current aircraft.

N-814
Modulation of a Helium-Neon Gas Laser, May 1966, H. A. Lasitter, AD684467

The modulation of a 38-cm gas phase laser operating at a wavelength of 6,328 Angstroms was accomplished through the use of amplitude modulation techniques. The modulation was applied directly to the DC-excited plasma tube through a suitable transformer in series with the tube and power supply. Modulation was limited by the natural Gaussian frequency distribution of the Doppler-broadened gas plasma and by optical beat notes occurring in the output beam of the laser. The experimental results obtained with ammonium dihydrogen phosphate crystals used as optical modulators are reported. Minimum light shutter action has been observed when as much as 6 kV was applied to the faces of thin crystals.

N-815
Technical Progress Survey, Byrd Station, Antarctica, Jun 1966, C. R. Hoffman, AD684416

A technical survey was conducted at Byrd Station, Antarctica, in Dec 1965. The purpose of the survey was to obtain information on current construction problems and design adequacy in the undersnow camp. The survey showed the camp to be in generally good condition with most systems functioning well. Areas in greatest need of improvement include summer tunnel cooling, control of surface air entry and circulation, increased water production and improved maintenance on systems for surface venting of combustion gases and noxious fumes.

N-816
Experimental Snow Plenum Air Cooling System for Byrd Station, Antarctica, Jul 1966, C. R. Hoffman, AD684417

Since mechanical refrigeration is beyond economic consideration, tunnel cooling systems for Byrd Station, Antarctica, are dependent on the utilization of the immense heat sink represented by the snowfield on which the camp is built. A system has been proposed which would draw surface air through porous cold snow into an undersnow plenum and deliver the cooled air to inhabited tunnels. Study of this system showed it to be the most probable method for successfully cooling Byrd Station tunnel L-7. It was also found

that insufficient data is available for accurately calculating the performance of a snow plenum of specific size. As a result, construction of an experimental snow plenum is recommended.

N-817
Exterior Concrete and Masonry Paints, Third Semiannual Evaluation, May 1966, J. B. Crilly, AD849545L

Eight paints have been exposed and their performance evaluated for the third time on four masonry surfaces: concrete brick, concrete block, cinder block, and expanded aggregate block. Three exposure sites, Kwajalein, Marshall Islands, Kaneohe, Hawaii, and Port Hueneme, California, have been used. Relative severity of the three exposures is assessed.

N-818
Airfield Power Check Facility Survey, Feb 1966, N. E. Pierce, R. J. Lowe, AD684457

A visual inspection of 16 power check facilities located at Naval and Marine Corps Air Stations in the eastern, southern, and western areas of the continental United States was conducted during the first quarter of FY66 to observe their present condition and determine if they were performing satisfactorily after several years of in-service use. The inspection revealed that some power check facility pavements are performing satisfactorily, while others are in poor condition. Results of this inspection show that some modifications to the specifications and construction methods, relocation of longitudinal joints in the 60-ft-wide pavement, relocation of static ground receptacles, relocation of mooring eyes, and reexamination of design and use of the securing fitting are desirable.

N-819
Survey of Bioscience Problems at BUDOCKS Activities, Nov 1965, M. P. Vind, T. B. O'Neill, AD684418

NCEL has been reviewing bioscience-oriented problems at field activities of BUDOCKS. The primary purpose of the bioscience study is to ascertain if specific biological research is justifiable on the basis of its contribution to the Bureau's mission. Another objective of the study is to determine if there are areas of biological investigation that should be pursued at NCEL, and, if so, to delineate those areas. Information for the study was gathered principally from BUDOCKS field activities, government laboratories, marine biological laboratories, and universities. It was concluded that several of the many diverse functions under jurisdiction of BUDOCKS are in areas in which biological research might contribute significantly. Major areas in which research is recommended are biodeterioration of engineering materials, harbor pollution, biological oceanography, and marine biotechnology.

N-820
Proposed Technical Approach for Obtaining Tempo Planning Factors, Jun 1966, J. D. Fowers, AD849555L

This report describes research required in order to develop planning factors which identify the change in maintenance, utilities, and transportation support required at a Naval shore field activity. Examples of equations are provided which could be obtained based on data expressing the needs of an activity at the branch level.

N-821
Field Testing of Plastic Mooring Buoys, Pt. 2, Modification and Initial Exposure of Modified Buoys, Jun 1966, R. W. Drisko, AD684419

Two experimental plastic mooring buoys, one with a hand lay-up and the other with a spray-up fiberglass-reinforced outer shell, were taken ashore after 5 months service to the Fleet and modified with a heavier fendering system. Laboratory tests of the exterior shells at this time indicated that moisture penetration of the hand lay-up shell below but not above the water line had reduced the strength of the shell in this area. The spray-up shell was equally strong above and below the water line and somewhat below the reduced strength of the hand lay-up shell below the water line. The buoys were readily patched both where the specimens were cut from the exterior shells and where the spray-up buoy had suffered some impact and abrasion damage. After 5 months of additional in-service testing, both buoys were performing well.

N-822
The Modulus of Deformation of Asphaltic Concrete, Jun 1966, J. P. Nielsen, AD684420

It is demonstrated that the modulus of deformation of an asphaltic concrete is independent of the modulus of the base course(s). The strength of a flexible pavement is derived from its base as shown by theoretical considerations and the results of the eight pavements evaluated. Additionally, it is demonstrated that the Burmister theory can be successfully used to calculate maximum subgrade pressures and load-deflection relationships for flexible pavements. The importance of considering the dynamic behavior of pavement systems is discussed.

N-823
Snowdrift on the Ross Ice Shelf, Jun 1966, N. S. Stehle, AD684421

Drifting snow in polar areas results in problems of logistics and maintenance. To obtain knowledge of snowdrift and accumulation on the Ross Ice Shelf near McMurdo Station, Antarctica, NCEL has been measuring drift in camp and storage areas, and around depressed and elevated roads and runways since 1961. The data from 1965-66 are summarized in this report. From these measurements, it was concluded that elevated surfaces accumulate little drift during storms, and should be used whenever possible for roads, runways, and equipment storage. At- and below-surface areas often accumulate considerable snow during storms and their use should be avoided. Where at-surface areas must be used, berms and other obstructions should be eliminated or minimized.

N-824
Water Waves From Underwater Explosions in Shallow Water, Pt. 1. A Mathematical Model for Waves in Constant Depth and in Shoaling Water, H. Wang, AD684473

Theoretical predictions of the water waves generated by explosions in shallow water - wave propagation at constant depth and wave amplification in shoaling water - are presented based on the pulsation of a gas-filled right circular cylinder. At constant depth, the waves are asymmetric with respect to the still water level and have a primary orbital oscillatory motion which is dispersive in nature and a secondary rectilinearly oscillatory Seiche-like motion with a much longer period. In shoaling water, specific waves in the incident wave train are found to have specific amplification factors. It is concluded that the theoretical predictions tend to agree, at least qualitatively, with certain observed effects of shallow water explosions.

N-825
Removal of Oil and Debris From Harbor Waters, Jul 1966, G. E. Beduhn

This Technical Note comprises a short survey of methods and equipment utilized in major harbor systems to clean water of oil and debris. Oil spills are removed by mechanical or chemical means. Most mechanical equipment employs an oil skimmer, vacuum nozzles, or rotating cylinders to collect the oil. Chemical agents - in general liquids - are sprayed on the oil slick through nozzles. Rated against a list of requirements, none of these methods are completely satisfactory. Debris collection methods are outdated and mostly done by hand for lack of suitable equipment. Some of these methods are recommended for future development.

N-826
Flexible and Rigid Systems for the Distribution of Freezable Liquids at Low Temperatures, Jun 1966, C. R. Hoffman, AD849553L

An investigation is being conducted on rigid and flexible pipe and hose materials with electric heat tracing and thermal insulation preapplied. The information obtained will be used in the development of prototype systems for the distribution of freezable liquids at low temperatures. This Technical Note presents the results of an availability study of electrically heat-traced rubber hose, and the results of a low-temperature evaluation of a commercial piping system with preapplied electric heat-tracing elements, insulations and protective outer cover. The latter work included assembly at -30F and tests of the heat-tracing system at temperatures to -45F. Results of these studies indicate that the manufacture of insulated and electrically heated rubber hose is feasible. It was also found that the preinsulated commercial piping system is well suited for assembly and use at low temperatures, but improvements are required at joints in the heating element, insulation and outer jacketing.

N-827
Preliminary Investigations of Prestressed Cellular Concrete Structures, Nov 1966, P. J. Rush, AD684422

This Technical Note describes work accomplished during the first phase of a research and development program concerned with concrete cellular block units joined in prestressed configurations to form structural elements. The preliminary work involved a literature survey, which included a search of patents on related concepts, and an experimental program involving testing of two 5-ft square slabs assembled of concrete cellular block units with steel rods used as prestressing tendons. Applied loadings were of concentrated and of distributed loading patterns. Parameters evaluated during these experiments included interface reactions of the blocks, changes in magnitude and patterns of prestress, and ultimate load-bearing capacity of the two slabs. Separate experiments involved tests of concrete strength, prestress rod strength, and assemblages of the blocks and rods in the form of beams and columns. Parameters to be investigated later include variations in block unit configuration, changes in block unit concrete strength, block unit reinforcing of mat and random types, and the effects of high-bond filling material at the block interfaces.

N-828
First Semiannual Inspection of Silicone Alkyd Paints, Jul 1966, J. B. Crilly, AD849565L

Two silicone alkyd based paints have been compared to two specification paints as topcoats after 6 months exposure at Kwajalein, Marshall Islands, Kaneohe, Hawaii, and Port Hueneme, California. The silicone alkyd paints are performing marginally better.

N-829
Outline Specifications for the Mechanical-Flush Chemical Toilet, Sep 1966, J. P. Cosenza, N. L. Drobny

A mechanical-flush chemical toilet has been developed to satisfy the need for a simple, reliable, low-cost, sanitary toilet at advanced polar bases where water is in short supply and where logistic support is limited. The unit has been tested under controlled usage conditions, and has performed satisfactorily. This Technical Note contains the specifications for the toilet. The development and operation of the unit is fully discussed in Technical Report R-471.

N-830
Airfield Pavement Evaluation - USNAF China Lake, California, Jul 1966, R. J. Lowe, W. H. Chamberlin, AD684402

The evaluation of pavement at the U.S. Naval Air Facility, China Lake, California, is presented with the allowable gross load capacities of the runways, taxiways, and parking aprons for single, dual, single-tandem, and dual-tandem wheel assembly aircraft. Information is also included on the construction history, climatic data, and current aircraft traffic. Results of the field and laboratory tests on the pavements and subsurface materials are included in the tables. Results of the evaluation show that the runways, taxiways, and aprons are capable of withstanding the loads imposed by current aircraft with the exception of the south end of taxiway 14-32 and the old portland cement concrete in parking aprons 1, 2, and 3.

N-831
Biological Corrosion at Naval Shore Facilities (With Appended Bibliography on Biological Corrosion), Jul 1966, H. P. Vind, M. J. Noonan, AD684423

Experiments were undertaken at NCEL to ascertain if the presence of microorganisms is necessary for corrosion to occur. It was shown that, in aerated sea water, iron corrodes fairly rapidly whether or not microorganisms are present. But that, in sea water from which oxygen is excluded, iron rusts very slowly unless sulfate-reducing bacteria or their metabolic by-product, hydrogen sulfide, is present. To induce rapid anaerobic corrosion, the bacteria must be supplied with carbohydrates or other nutrients. Anaerobic conditions and bacterial nutrients might both be found in the layer of slime that accumulates on the surfaces of structures placed in the ocean. Another experimental finding was that the carbonic anhydrase inhibitor, acetazolamide, is an effective inhibitor of sea water corrosion.

N-832
Cathodic Protection of Mooring Buoys and Chain Part II. Further Field Studies, Feb 1967, R. W. Drisko, AD684474

An investigation was conducted into the use of specially cast zinc anodes to cathodically protect the ground tackle of a Fleet mooring. While part of the mooring was completely protected by these anodes, a lack of good electrical continuity in parts of the ground legs prevented complete protection there. A cable joined periodically along one of the ground legs provided the necessary continuity and permitted complete protection of the leg.

N-833
Laboratory Studies of Underwater-Curing Epoxies, Aug 1966, R. W. Drisko, J. W. Cobb, AD818487L

The bonding strength was measured for a number of underwater-curing epoxies applied to steel and concrete specimens. It was also measured for a number of formulations modified by different combinations of silica, asbestos, and silanes. Each of these additives had a definite effect on bonding strength in varying degrees. The use of 1% of one silane (3,4 epoxycyclohexylethyltrimethoxysilane) as an integral blend additive was greatly beneficial in the vast majority of cases.

N-834
Investigation of Embedment Anchors for Deep Ocean Use, Jul 1966, J. E. Smith, AD849563L

Two commercial types of explosive embedment anchors, the Seastaple manufactured by the National Water Lift Company and the Hove II produced by Weston Instruments, Inc., were tested to investigate their potential for application in deep ocean anchorage systems. Tests were conducted in sand and mud bottom conditions in shallow water and in depths to 6,000 ft. Components of the anchors were subjected to pressures as great as 10,000 psi in the deep ocean simulation laboratory. Successful discharges and embedments were achieved with the Seastaple in depths to 6,000 ft and the Hove II in depths to 1,200 ft. In general, a large percent of the tests resulted in malfunctions or in below nominal rated holding capacities. However, causes of malfunctions were traced to correctable causes in most cases, and the low holding powers were believed due in part to control of anchor attitude when discharged into the bottom and to operational problems. It is concluded that

the principle of explosive embedment anchors offers reasonable potential for development of deep ocean anchors better than any now known to exist. Also, both commercial types of explosive anchors possess approximately equal potential but with different deficiencies to overcome.

N-835
On the Identification of a Tempo Change at CONUS Naval Shore Field Activities, May 1966, J. D. Fowers, W. L. Richardson, G. W. Morris, AD849564L

This draft documents research on the relationship between the factors considered in identifying the existence and magnitude of the tempo problem. It presents the population of those activities considered to have undergone a tempo change and the reasoning behind such a consideration.

N-836
Spalling of Concrete in USN Waterfront Structures, Feb 1966, W. R. Lorman, AD849562L

The purpose of this report is to show how concreting practice used by the Port of Long Beach and the Port of Los Angeles differs in general from that used by BUDOCKS.

At any coastal harbor, in a region where air temperatures are above the freezing point, some concrete structural members in various waterfront installations are subjected to continual cycles of alternate wetting and drying and some are continually submerged. The causes of cyclic wetting are mist, spray, or waves, or any combination thereof. (Rainfall is considered as being intermittent rather than cyclic.) BUDOCKS is concerned with the quality needs of structural concrete that is so exposed to sea water.

N-837
Padlock Anchor System, Phase I - Operation Feasibility of Major Components in Shallow Water, May 1966, P. A. Dantz, AD818486L

This report is Phase I of a two-phase investigation to determine the feasibility of combining propellant-actuated embedment anchors and bearing pads into a fixed-point, deep ocean anchorage system called the Padlock Anchor System. Phase I included the fabrication and shallow water testing of a tripod frame with 6-ft-diam bearing pads and 20,000-lb embedment anchors at the end of each arm. The shallow water tests of the system demonstrated that the components are operationally compatible as a system. It was further shown that embedment anchors can be used in groups and that they may be detonated singly or collectively.

On the basis of the shallow water test results, it is recommended that Phase II be initiated - the determination of the operational feasibility of the padlock anchor system for deep ocean use.

N-838
An Experimental Radio Paging System, Sep 1966, J. L. Brooks, AD849547L

New techniques are reported herein for providing two-way radio contact between selected personnel during a normal working situation in or around a building complex. The communications are provided by small private-channel portable transceivers linked to and interconnected through an automatic central control system located within the building.

An experimental system was designed, fabricated, and tested. This was a four-unit system designed to operate at 38.4 Mc FM. The results of laboratory tests have indicated that while the basic hardware developed functions satisfactorily, the overall system has two serious drawbacks. The first of which is that the field strength levels generated throughout a building complex vary considerably depending on the type of material from which the building is constructed and the nature of inherent internal wiring systems. The second is that the necessary tight specifications of such a workable communications automatic system results in a high cost and complexity compared to the lower cost and simplicity of commercially available one-way paging systems.

N-839
Vibration Study of Electrical No-Break Power Supply Units, U.S. Naval Communication Station, Rough and Ready Island, Stockton, California, Sep 1966, G. E. Beduhn, AD849546L

This Technical Note comprises a short study of the vibration response of two 200-kW no-break power units located at the NAVCOMMSTA, Stockton, Calif. Mechanical and structural deficiencies of both units have caused continuous difficulties since their installation. Excessive vibrations were believed to be the main cause of these problems. A preliminary investigation indicated that a number of mechanical alterations and balancing of rotating components would improve the situation. Most of this work has now been completed.

Final tests and vibration measurements were conducted in Mar and Apr 1966 and have resulted in a set of spectra which described the vibration response of the no-break power units. Examination of the measurements revealed that both units presently operate within tolerable vibration limits.

N-840
Ice and Snow Terrain Features McMurdo Station, Antarctica, Sep 1966, R. A. Paige, AD684465

The ice and snow terrain around McMurdo Station, Antarctica, is used extensively by the U.S. Navy Antarctic Support Forces for runways, temporary camps, travel and cargo-hauling routes, and occasionally as docking areas for cargo ships. The safe and efficient use of this terrain requires the recognition and solution of many problems caused by a variety of factors, such as climate, topography, internal and external changes in the ice and snow areas, movement of the ice shelf, and annual breakout of the sea and shelf ice.

Movement of the McMurdo lobe of the Ross Ice Shelf causes pressure ridges, crevasses, and periodic calving that requires careful selection of runway sites and road routes to assure safe and long-term operations. Movement of the ice shelf between Pram Point and Williams Field varies from 230 to 281 ft/yr. The probable critical thickness beyond which the ice shelf does not calve varies between 90 to 100 ft west of Williams Field to 50 to 60 ft near Pram Point. Hidden subsurface melt pools occur in the glacier ice at outer Williams Field, and, during summer, seriously hamper trafficability of the alternate ice runway at this location.

Dangerous sea ice conditions are caused by late-season differential thinning and deterioration, seal breathing holes, hidden slush zones in deep snow, pressure ridges and flooded, downwarped areas of ice in the embayment south of McMurdo Station. Sea-ice-to-land and sea-ice-to-ice shelf ramps require almost constant repair to maintain the necessary over-ice road network.

N-841
Surface Hardening of Compacted Snow in Antarctica, Sep 1966, N. S. Stehle, G. E. Sherwood, AD684424

Studies were conducted in the Antarctic to increase the surface strength and wearing ability of compacted snow by rolling the snow when it had excess moisture, during periods of high temperature and solar radiation, and by melting and refreezing the surface snow using controlled absorption of solar radiation.

The increase of strength in the areas rolled indicated that the addition of moisture increased the strength in the top 8 in. provided the surface was rolled more than once but probably less than 10 times. Although the excess moisture in the snow during these tests was due to weather conditions, water from an outside source during rolling should promote surface hardening. Field tests to investigate the addition of water before rolling are planned for the 1966-67 Antarctic summer.

The controlled radiation absorption tests, which were conducted late in the summer season, showed that there were limits to the effectiveness of solar radiation absorption in promoting surface hardness.

N-842
Preliminary Evaluation of Spray Cleaning for Use by Naval Shore Activities, Sep 1966, J. J. Wise, N. P. Oldson, AD849551L

A survey of nineteen Naval activities was conducted to determine the cleaning techniques presently in use, the cost of cleaning operations, and the cleaning operations which appeared to be suitable for spray cleaning. This survey indicated that spray cleaning of transportation and construction equipment had the greatest possibility for reducing costs of cleaning.

Tests made on spray cleaning equipment indicated that very high pressure spray units were effective in removing large quantities of mud, grease, and oil. Medium and low pressure units were adequate for maintenance and preoverhaul cleaning.

Recommendations are made to determine the most effective spray cleaning method for transportation and construction equipment, to compare it to the most effective cleaning method now in use, and to propose that the most efficient method be included in a cleaning manual.

N-843
A Revised Formula for the Calculation of Gamma-Ray Shielding Properties of Shelter Entranceways, Oct 1966, C. M. Huddleston, W. C. Ingold, AD808821L

An improved formula has been devised for the calculation of gamma-ray dose attenuation in two-legged air ducts through concrete. Comparisons are given between the predictions of the simple empirical formula and the results of measurements as well as predictions obtained by a more complicated computational technique. The accuracy of the empirical formula is discussed. It is shown that the formula is highly accurate, having essentially zero bias and a standard deviation of less than 14% of the correct value.

N-844
Electrical Contact Resistance Between Flat Metal Surfaces, Oct 1966, R. D. Hitchcock, AD684471

Low-voltage D-C contact resistance, similar to that in seams and door closures for electromagnetically shielded rooms, was measured between flat specimens of metal with overlap areas between 1 and 20 sq mm. Also, some RF impedance measurements were made. Contact resistance and reactance is plotted against normal force, and the results are compared with theory. It was found that salt-air exposure of metals electrolytically plated with zinc, cadmium, or chromium produced surface films which could not be penetrated by normal pressures up to 500 gm/sq mm and wiping distances to 1 mm. A sulfur-dioxide atmosphere had negligible effect on the contact resistance of most specimens.

N-845
Short-Cut Procedures for Soil Cement Construction in Sandy Soil, Oct 1966, AD684430

This guide to short-cut procedures for soil cement construction has been prepared primarily for NAVMOBCONSTBN forces in areas where time and the exigencies of field operations preclude the use of the more elaborate procedures and equipment normally employed. In the presentation we are mindful of the diverse range of understanding of soil cement construction techniques and trust that no one will feel that his intelligence has been insulted in the handling of some of the seemingly simple procedures described.

We are most appreciative of the cooperation extended in the preparation of this guide by the Portland Cement Association. With their consent we have made free use of their pictures, manuals, and pamphlets, and much of the written text has been extracted from their publications. For more detailed study of soil cement construction theory and practice, the attention of the reader is invited to the texts cited at the end of this guide.

N-846
Conceptual Study of Air Revitalization Systems for Protective Shelters, Oct 1966, R. J. Zablodil, J. M. Stephenson, D. E. Williams, AD817186L

A study was made to originate concepts for a system which would maintain tolerable limits for oxygen and carbon dioxide and mask or absorb undesirable odors in a sealed-up protective shelter.

Chemicals and equipment currently in use, or being contemplated for use in submarines and space capsules, were investigated. The study included nonregenerative systems which can be hand-operated, but are ephemeral, and regenerative systems which must be powered, but can operate indefinitely.

Five concepts were originated. It is recommended that a nonregenerative system using pressure cylinders for oxygen supply and baralyme or lithium hydroxide for carbon dioxide removal should be developed for early use in NAVFAC shelters. And that a nonregenerative system using pressure cylinders or chlorate candles for oxygen supply and a solution of carbonate and bicarbonate salts plus the enzyme of carbonic anhydrase be studied in detail for possible future use.

N-847
Measurement of Paint Film Thickness by Beta-Ray Backscattering, Oct 1966, F. W. Brown, AD684431

A nondestructive paint thickness gauge using the backscattered beta radiation from Sr-Y-90 has been developed. This gauge will measure white lead linseed oil paint (type TT-P-102) of thickness ranging from 1/2 mil to about 30 mils on wood with an error of approximately ±0.2 mils. The possible use of this gauge with other type pigments on other surfaces is discussed. A graph is given demonstrating the performance of this gauge in measuring the thickness of films of paint (TT-P-102). It is concluded that development of this gauge should be continued with the aim of developing a nondestructive gauge that can be used by Public Works personnel for routine paint thickness measurements on wood.

N-848
Subaqueous Concrete Placement, Oct 1966, R. J. Odello, AD818485L

This paper presents the results of a literature search to explore the adaptability for deep ocean use of present subaqueous concrete placement methods. The advantages and disadvantages of each of the following methods are discussed - tremie, bottom-dump bucket, prepacked, fabriform, precast, and pumped concrete. The logical manner of comparing methods is by prototypical construction in the deep ocean.

N-849
Sea Ice on McMurdo Sound, Antarctica, Preliminary Thickness and Temperature Studies, Oct 1966, R. A. Paige, AD684460

The thickness of sea ice in McMurdo Sound, Antarctica, and its variations throughout the season and from year to year affects the safety and efficiency of travel and air operations by the U.S. Navy Antarctic support activities.

The annual sea ice growth stages are: (1) youth - the ice sheet is actively growing in thickness and extent, (2) maturity - growth ceases, maximum thickness is attained, and (3) old age - the ice sheet is nearly isothermal and begins to thin rapidly by bottom melting. Growth rate and ultimate thickness varies locally depending mainly upon snow cover and proximity to land or the ice shelf. Bottom melting begins in mid-December and progresses rapidly until breakout. Thinning is differential, depending upon location. The Cape Armitage sea ice area becomes dangerously thin when most of the sea ice in McMurdo Sound remains thick enough for safe travel. Measurements of thickness, air, ice and water temperature, and snow cover during the entire season are needed for correlation with accumulative degree-days to develop load-carrying curves and to predict thickness.

N-850
A Nuclear Overpressure Warning System, Nov 1966, S. J. Wooten, AD816915L

The NOTF describes the development of a nuclear blast overpressure sensing system that will close air ventilation valves of a protective shelter when the overpressure reaches the 2-psi level. The 2-psi level was chosen because it is above any known and recorded overpressure caused by the natural phenomena.

The system consists of a number of blast overpressure detectors located on the ground around the shelter, at some distance from it, and a control unit at the shelter, together with the necessary communication links. It provides complete protection from surface bursts. However, the degree of protection against air blasts above the shelter varies, depending on the horizontal distance of the shelter from ground zero and the altitude of the blast.

N-851
Controlled Heat Release With Varying Temperature Source, Nov 1966, S. L. Phelps, AD849559L

Methods of controlling the rate of heat release from a heat storage system were investigated. Various high-temperature heat storage media and storage systems were considered. This problem involved finding a method to vary the U factor to compensate for the dropping temperature of the medium. An experiment was designed but not built.

N-852
Investigation of New Instrumentation and Techniques for Rapid Evaluation of Load Bearing Capacity of Temporary Roads, Runways and Compacted Areas (Snow and Soil), Oct 1966, C. W. Terry, AD684432

The purpose of this study was to develop instrumentation that would allow rapid evaluation of trafficability and load bearing capacity of roadways, airstrips and certain areas.

The basic approach was through use of a recording probe or penetrometer, a device that records resistance to penetration vs. depth. Two models were tested. One was manually operated and the other was power operated by a hydraulic power unit and cylinder.

Both devices were found to operate satisfactorily and both gave data sufficiently accurate for initial evaluation of the areas designated. Correlation with data from other instruments indicate that use, and further development of the devices is warranted. They should assist in rapid assessment of load bearing capacity of soil and of snow.

N-853
Ground Rods Metals - Results of a Three-Year Test, Oct 1966, A. E. Hanna, AD684433

NCEL has been investigating various metals now in use as ground rods and metals which might be acceptable substitutes. NCEL cooperated with the NACE by installing a series of test rods at the laboratory. Test results are given for the second (or 3-yr) group of test rods from the NCEL test site. The 300 series of stainless steels are recommended for use in grounding systems.

N-854
Deep Ocean Communication Considerations, Nov 1966, J. L. Brooks, AD818488L

This report constitutes a study of the application of high permeability material to transmission lines intended for underwater communication systems. The application of high permeability material to the exterior of copper conductors is a well-known technique of increasing signal losses in a transmission line. The purpose of this study is to determine whether or not the judicious application of the high permeability material can have the reverse effect of lowering the signal losses.

Theoretical studies indicate that a hollow copper conductor coated on the inside will exhibit less than normal losses over a discrete frequency range. This effect is investigated in detail.

Measurements indicate however that the advantages gained by the special configuration are overshadowed by practical considerations which severely limit the usefulness of this technique, and further study is not recommended.

N-855
Maintenance Painting of Buildings - First Progress Report, Nov 1966, J. B. Crilly, J. H. Mitchell, AD849561L

A maintenance painting work unit has been set up to find the most economical treatment, per year of protection, for repairing thick layers of paint which are cracking and flaking. The CBC hospital, a wooden building, has been included in the program during a time consistent with the PW repainting schedule as a preliminary experiment with oil- and water-based paints. An oil-based paint (TT-P-102A) and three water-based paints (a linseed oil emulsion, a linseed oil solution, and a safflower oil emulsion) were used on the hospital. An additional water-based paint (an acrylic emulsion) and TT-P-102A were used to repaint two metal Butler buildings at NCEL. A long-oil alkyd-based blister-resistant paint (MIL-P-52324 (MO)) and a safflower-oil polyvinyl-acetate emulsion are scheduled to be applied to other metal buildings at NCEL.

The water-based paints were easier to apply and were faster drying than the oil-based paints. The water-based paints extended the painters working day because the water-based paints are not affected by the early morning dew and the afternoon fog as the oil-based paints are.

Additional buildings are scheduled to be painted at NCEL and cooperative maintenance painting experiments with other Naval activities are being attempted.

N-856
Reliability Engineering for Naval Shore Equipment, Nov 1966, E. Giorgi, AD684434

Continuity in operation of defense communications and other military tactical systems is of utmost importance. Electronic equipment and components for these facilities are currently procured to meet specified reliability requirements. However, very little emphasis has been placed on up-grading the reliability of the supporting subsystems. Most critical of the supporting subsystems are the electrical power supply and the environmental control of equipment spaces.

Recognizing this need, a work unit was assigned to CEL by NAVFAC to develop techniques, methods, and experience in application of reliability engineering to critical subsystems supporting vital Naval shore facilities. Results of studies accomplished during the period of 1 Jul 1965 to 30 Jun 1966 is presented in the form of an introduction to the basic theory and methodology of reliability engineering as it might apply to Naval shore facilities. Some management aspects which affect the success of a reliability program and the role of reliability engineerng in system effectiveness are also discussed.

N-857
Preliminary Study of the High-Power Superconducting Transformer, Dec 1966, R. D. Hitchcock, AD684441

A mathematical analysis is given of the concept that the size of a heavy-duty power transformer can be significantly reduced by using superconducting windings. By solving the differential equations for an iron-core transformer with resistanceless windings, and deriving a general expression for leakage inductance, it is shown that the iron core is indispensable no matter how small the cross section of the winding conductor. Calculations, based on the D-C behavior of niobium-tin superconducting wire, lead to a lower limit of around 50% for the reduction in overall weight of transformers in the 10-MVA class.

Overall efficiency is computed for a superconducting transformer cooled by a Carnot refrigerator or a gas liquefier. An appendix describes experiments at NCEL on small superconducting transformers.

N-858
Terrain Relief Models and Operational Sketches as Used in the Task Force 65 Nuclear Weapon Recovery Effort, Nov 1966, R. J. Smith, AD684442

The aircraft SALVOPS mod search and recovery effort off of the coast of Spain for a missing nuclear weapon that extended from 17 Jan to 7 Apr 1966 required the application of several unproven types of equipment and the development of some unique operational procedures for its satisfactory completion. As the effort progressed it became evident that various types of graphic representations would be of assistance in the work. The aids devised for this purpose consisted of a terrain relief and sediment model of the total search area, a detailed relief model of the specific location where the weapon was found and recovered, a detailed terrain sketch of this same area, detailed sketches of specific working situations and post-operational drawings of events that from their nature could not be recorded by photographic means. The preparation of some of these representations necessitated novel approaches to both gather and record the information. The techniques used are considered of importance in that in some instances these methods are the only ones presently available to arrive at a picture of the situation existing at a working site. Procedures similar to those applied will presumably have to be used in the future on other operations carried out at locations involving conspicuous sea floor relief.

N-859
Corrosion Rates of Selected Alloys in the Deep Ocean, Nov 1966, J. B. Crilly, W. S. Haynes, AD823249L

Corrosion rate data are given for several sets of metals and alloys exposed to the deep ocean environment off the coast of Southern California at a depth of 5,300 ft for 1,064 days. The sets include some aluminum alloys, stainless steels, brasses and bronzes, titanium alloys, alloys containing nickel, chromium and other metals, a nickel-copper alloy, as well as sets of copper, lead, and wrought iron. All specimens of six of these sets did not corrode at all. In some of the other sets there was relatively uniform corrosion up to rates of about 6 mg/dm-sq/day, but in others the individual specimens varied considerably in their corrosion rates.

N-860
The Evaluation of NAF China Lake Airfield by Layered Theory With Soil Cement Equivalency Ratings, Dec 1966, J. P. Nielsen, AD684443

The techniques of the layered pavement method for the design of flexible pavements have been used to evaluate the flexible pavements having cement-treated bases at NAF, China Lake, Calif. This evaluation has produced in-situ moduli of deformation for all components of the flexible pavements. A load rating analysis has yielded thickness equivalencies for the soil cement bases.

N-861
Shock Resistant Water Wells for Shelter Cooling, Feb 1967, J. C. King, J. A. Norbutas, AD684459

A series of studies was conducted to determine the feasibility of using water wells for underground shelter cooling. A study of ground water temperatures and shelter cooling requirements revealed that practical and efficient cooling systems utilizing well water can be designed for all parts of the country except the southern tips of Tex. and Fla. A survey of well damage resulting from earthquake and subsidence ground motions disclosed that the oil industry has developed successful casing stress reduction methods such as gel-packed bell holes and casing expansion joints. A study to predict well casing stress loads resulting from surface nuclear detonations was made, under contract, by Agbabian-Jacobsen Associates. Loads resulting from ground motions induced by weapon yields up to 20 Mtons with surface overpressures ranging from 15 to 300 psi were predicted, the casing stresses in a significant number of situations were shown to be well in excess of normal material strengths. It was concluded, however, that existing stress relief methods, such as those developed by the oil industry, can effectively reduce casing stresses to a safe level.

This report presents the results of the NCEL studies, discusses significant findings of the contractor's investigation, and outlines plans for future work.

N-862
Development of Shock Wave Simulator for Shelter Equipment Testing, Dec 1966, J. A. Norbutas, AD684461

A series of studies was initiated by NCEL to determine the feasibility of constructing an equipment test machine capable of producing motions predicted to occur in shelters exposed to nuclear weapons effects. To establish the machine performance criteria, Agbabian-Jacobsen Associates contracted to investigate the response of typical equipment support elements to environments resulting from weapon yields ranging from 1 to 20 Mtons with overpressures ranging from 15 to 500 psi. The Ralph M. Parsons Company contracted to develop a machine concept capable of producing the criteria motions. To establish the performance capabilities of the machine components, it was proposed to design and construct a model machine using the operating principles and critical components of the basic concept. To this end, the Ralph M. Parsons Company performed the preliminary design of a complete test facility with a specimen capacity of 10 by 30 in. by 89 in. high and 400 lb weight. Cost estimates of both the full scale and the model machines established the feasibility of this proposed program.

N-863
Breakout Forces, Sep 1966, B. J. Muga, AD836130

Description of test procedures and preliminary analysis of the first of a 3-yr effort on a study of breakout forces is presented. It is found that breakout is not a serious problem for the great majority of marine salvage operations, since the vessels are often rotated or pivoted before lifting. It is concluded that a theoretical procedure can be developed which will be useful in planning operational procedures.

N-864
The Attenuation Of Au-198 Gamma Rays in an 11-in. Steel Duct, Dec 1966, J. M. Chapman, AD684456

Gamma-ray dose-attenuation factors were measured in an 11-in. sq steel duct using a Au-198 (0.412 Mev) gamma-ray source. These attenuation factors were compared with those found using Cs-137 (0.662 Mev) and Co-60 (1.25 Mev) gamma-ray sources.

It was found that the attenuation factor for Au-198 was always greater than for Cs-137. However, for short second legs, the attenuation factor for Co-60 was greater than both Au-198 and Cs-137.

The measured attenuation factors for Au-198 were compared with values obtained using a computer code based on the Albedo concept. It was found that calculated attenuation factors are about 20% higher than measured attenuation factors.

N-865
Experimental Study of Superconducting Thin-Film Tunnel Diodes, Feb 1967, R. D. Hitchcock, AD684444

A vacuum deposition method is described for fabricating superconducting thin-film tunnel diodes which consist of an oxidized aluminum (Al) film in contact with a lead (Pb) film. The method produced stable diodes by growing the oxide film in a low-pressure atmosphere of dry oxygen; pressure during metal-film deposition was around 10^{-5} torr.

In some of the diodes the superconducting transition temperature of Al was near 2K. Thickness measurements and energy-gap determinations, based on negative resistance in the tunneling curves, yielded a plot of transition temperature versus thickness in rough agreement with theory.

Zero-voltage current was observed in some of the A-C driven diodes, at temperatures below 1.8K. The temperature dependence of this current, near the transition temperature of the Al, was found to be in rough agreement with a theory of the D-C Josephson effect.

An experiment was conducted to determine the response of an $Al/Al_2O_3/Pb$ superconducting thin-film diode to incoherent submillimeter radiation. At wavelengths between 0.2 and 0.8 mm, no change was observed in the 60-Hz current-voltage characteristics at temperatures down to 1.5K. It is concluded that the absence of response was due to a large impedance mismatch between material and space at the junction.

N-866
Byrd Station Snow Tunnels - Side-Cutting Wall Trimmer, Jan 1967, G. E. Sherwood, AD684445

To prevent excessive snow-tunnel closure, equipment and techniques were developed for trimming the closure snow from the tunnel walls at Byrd Station, Antarctica. The system developed is satisfactory but time-consuming and laborious. At the present average 2-in./yr rate of closure, the walls must be trimmed at least every 3 yr so that the space between the tunnel walls and the buildings does not become too restricted for the maintenance equipment.

To permit less frequent clearing of the tunnel walls and to simplify the operation, a concept was developed for a side cutter which clears the tunnel walls in advance of the maintenance equipment, thus requiring no work space between the closure snow and the buildings. Based on the present rate of closure, this device could extend the frequency of clearing up to 9 yr, resulting in both a labor and monetary savings over the existing system.

N-867
Airfield Pavement Evaluation - USNAF El Centro, California, Dec 1966, R. J. Love, W. N. Chamberlin, AD684449

The evaluation of the pavement at NAF, El Centro, Calif., is presented with the allowable gross load capacities of the runways, taxiways, and parking aprons for single, dual; single-tandem, and dual-tandem wheel assembly aircraft. Information is also included on the construction history, climatic data, and current aircraft traffic. Results of the field and laboratory tests on the pavements and subsurface materials are included in the tables. Results of the evaluation show that many of the pavements are being overloaded by current aircraft operating at the air facility.

N-868
Second Semiannual Inspection of Silicone Alkyd Paints, Jan 1967, J. B. Crilly, AD849560L

Two silicone alkyd-based paints have been compared to two specification paints as topcoats after 12 mo exposure at Kwajalein, Marshall Islands; Kaneohe, Hawaii; and Port Hueneme, Calif. One silicone alkyd paint is performing better than the comparison standards while the other is about the same as the standards.

N-869
Economic Comparison of Contract Versus In-House Performance of Public Works Services, Feb 1967, N. A. Leupp, AD815156L

This note concerns itself with the problem of accomplishing valid economic comparisons between contract and in-house performance of PW services. It does this by applying economic principles to correctly identify relevant costs. There is a detailed discussion of each type of cost commonly incurred in PW services. A method for accomplishing routine cost comparisons without excessive labor is proposed.

N-870
An Improved Linear Programming Scheduling Model (Model II), Feb 1967, A. G. Aspeitia, AD815594L

This note describes an optimizing method for scheduling a group of tasks which can be defined by earliest starting date, latest completion date, duration of the task, and resources required to accomplish the task. The method uses the linear programming algorithm to optimize one objective such as minimizing manpower requirements.

N-871
Coatings on Untreated and Creosote and Creosote-Coal Tar Treated Wood Test Panels for Harbor Exposure - Evaluation of Panels Removed After More Than One Year of Exposure, Feb 1967, T. Roe, AD849549L

Untreated and creosote and creosote-coal tar treated panels to which organic surface coating systems were applied have been exposed at Port Hueneme and Pearl Harbor. Within 1 to 3 yr all coating systems had failed or were beginning to fail.

N-872
The Effect of Alternating Electrical Currents on Marine Fouling, Jan 1967, T. Roe, AD684451

A study was made on the effects of alternating electrical currents on the prevention or attenuation of marine fouling. There was no correlation in the data obtained from the system in use at Power Plants No. 2 and 3, Pearl Harbor NSY, where fouling has been reduced, and from test units exposed at Port Hueneme, where fouling was little affected by impressed currents.

N-873
Dynamic Compression Tests on Polyurethane Foam, Oct 1966, W. L. Cowell, G. M. Dunn, AD849548L

A limited number of specimens of rigid polyurethane foam have been tested in compression using NCEL's dynamic testing machine. Specimens tested were in the shape of a 2-in. cube, loaded either parallel or perpendicular to the direction of foam expansion. Density of the specimens ranged from 2 to 12 pcf, and strain rates were varied from static to about 15 in./in./sec.

Individual specimens showed a wide range in results but as a general trend the compressive strength increased as the rate of applied strain increased. Compressive strength of rigid polyurethane foam has been found to be a function of foam density, strain rate, and the direction of foam expansion.

N-874
Pipe Coupling Methods for Liquid Distribution Systems in Polar Camps, Feb 1967, C. R. Hoffman, AD849557L

The construction of piping systems in polar regions for transporting freezable liquids such as water and sewage is particularly difficult because of low ambient temperatures, short construction season, and the need for insulation and heat tracing. A study of liquid distribution systems for polar camps is being made in an effort to improve system designs, construction procedures, and techniques.

As part of this study, investigations have been made of different couplings and fittings, including tests at low temperatures, to determine the most suitable method for joining pipes of various materials. Important points considered in evaluating the different couplings were tools and skill required, exterior configuration of the fitting as it related to subsequent application of insulation, and ease of assembly at temperatures to -30F.

None of the coupling methods evaluated were ideally suited for polar camp liquid distribution systems; however, specific couplings and fittings are suggested for use with the different pipe materials.

N-875
Fourth Semiannual Evaluation of Exterior Concrete and Masonry Paints, Mar 1967, J. B. Crilly, AD8495581.

Eight paints have been exposed and their performance evaluated for the fourth time on four masonry surfaces: (1) concrete brick, (2) concrete block, (3) cinder block, and (4) expanded aggregate block. Three exposure sites, Kwajalein, Marshall Islands; Kaneohe, Hawaii; and Fort Hueneme, Calif., have been used. Two specification paints and two proprietary paints are still giving good performance.

N-876
Modification and Blast Test of a 16-Inch OCD Valve, Mar 1967, R. S. Chapler, AD8495521.

In 1965 NCEL performed a series of blast tests on several OCD valves, and it was discovered that the valves failed at overpressures as low as 4 psi. The failures occurred in the threads of the stud holding the valve disk to the stem.

One of the 16-in. valves was subsequently modified by using tougher steel for the stud and nut and by increasing their threaded areas. In a series of blast tests on the modified valve as described in this report, the new parts were satisfactory, but the valve disk developed serious cracks, the stem was elongated and the port adjusting handle was broken when the adjusting rod was struck by the valve stem stud. The overpressures in the tests ranged up to 16 psi. It is apparent from these results that the OCD valves will require major modifications before they can sustain blast closure at design overpressure without structural damage.

N-877
Guide for Shielded Enclosure Construction Problems, Mar 1967, AD8318281.

This Technical Note has been prepared by NCEL as a guide for Naval facility personnel involved in contracting, inspecting, and supervising the construction and performance testing of electromagnetic shielded enclosures. It is the aim of this guide to point out areas of difficulty which have occurred repeatedly in the construction and testing of shielded rooms so that the necessary precautions may be taken to minimize or prevent the recurrence of such problems.

N-878
Biological Structures in the Deep Ocean - A Literature Study, Mar 1967, P. J. Rush, T. R. O'Neill, AD8120711.

A study, limited to literature surveys, was made to determine if natural structural arrangements in deep sea life are appropriate for adaptation to artificial structures in similar environments.

Few references concerned with the structural aspects of sea life were located. From the standpoint of structural considerations, the literature research has produced configurations that are novel, but which would offer great challenges of design and fabrication if followed in artificial form. There also seems to be considerable promise in studying deep sea animals since, in addition to structural uniqueness, many of these creatures have unique means for anchoring to the bottom, mobility by buoyancy and by leg mechanisms, propulsion methods involving fin and tail movements as well as water jet systems, and nature has provided certain ocean animal species with highly developed neuro-systems capable of extremely fast reactions and with clever systems of camouflage. The sensing apparatus of various sea animals includes highly developed optical, acoustical, and tactile systems as well as an apparent sixth sense which appears to have echo-ranging capacities based on minute changes in water pressure.

N-879
Cooperative Marine Piling Investigation - Phase II - Inspection After Four Years Exposure, M. Hochman, AD8113371.

The cooperative marine piling committee and NAVFAC exposed 54 specially treated piles at Coco Solo Annex, Rodman Naval Station, Canal Zone, and 66 piles at Pearl Harbor, Hawaii, in 1963. In Nov 1966, after 3-1/2 yr of exposure, the piles at Pearl Harbor were still undamaged by marine borers. In Mar 1967, after 4 yr of exposure, 8 of the 54 piles at Coco Solo have been attacked by Limnoria and one was also attacked by Martesia. All of the attacked piles were impregnated with essentially creosote or creosote-coal tar solutions. None of the double-treated piles showed any evidence of borer attack.

N-880
Polar Sanitation - Incineration for Waste Disposal in a Pollution Control System, Mar 1967, N. L. Drobny, AD811238.

Improved methods for disposal of human and other wastes are required in polar regions to prevent pollution of the environment. The problem of pollution due to inadequate methods of waste disposal is more severe in polar regions because of reduced metabolic rate of microorganisms and extended survival time resulting from the low temperatures.

From a discussion of waste treatment methods and their application, it is concluded that incineration provides the most suitable method for disposal of polar camp wastes. Equipment required for incineration is available commercially but has not been evaluated under polar conditions. Detail study of a total disposal system incorporating the single-incinerator concept is recommended.

N-881
Preliminary Scale Model Snowdrift Studies Using Borax in a Wind Duct, Mar 1967, G. E. Sherwood, AD8120731.

Camps in areas of drifting snow, such as Antarctica, where there is no depletion of the annual supply, quickly become inundated, requiring continual digout and eventually movement of the camp. In an effort to alleviate drift problems, preliminary scale model drift studies were conducted in a wind duct using borax as a snow simulator. Models of 64-ft Jamesways were tested in various orientations and group layouts. The effect of elevating these models on snow platforms above the surrounding surface was observed, and tests were conducted on building shapes not commonly used in polar regions. It was concluded that the drift accumulation rate around the type of buildings presently in use can be reduced by orienting them 45 deg to the wind, and by elevating them above the surrounding surface on snow platforms. It was further concluded that buildings should be constructed with as few corners as practical to reduce the rate of drift accumulation.

The drift pattern around a structure near Byrd Station, Antarctica, oriented 45 deg to the wind during the winter of 1966 verified the findings for this orientation. Based on the results of the scale model snowdrift studies, two buildings from the NCEL camp near McMurdo were placed on an elevated snow platform and oriented 45 deg to the wind when they were relocated in Dec 1966.

Additional scale model drift tests are planned to determine drift accumulation rates over longer periods of time, establish a time scale for models in the wind duct, and study the effect of building area and height upon drift patterns and accumulation rates.

N-882
Shielding Considerations in the Design of Hardened Structures, Mar 1967, C. M. Huddleston, D. R. Doty, AD8121541.

An evaluation has been made of some of the factors to be considered in the design of hardened structures. In particular, radiation shielding requirements have been specified for various weapon sizes, distances from impact point, and blast overpressure. It has been shown that an envelope of curves can be constructed to allow the specification of shielding criteria to insure that radiation protection is commensurate with the survivability of a structure from blast effects.

Also, a mathematical analysis is given of the relationship between protection factors and percent lethalities due to fallout radiation.

The results described in this note should be directly applicable to the promulgation of design criteria for radiation shielding.

N-883
Performance of Epoxy Coatings on Water-Tank Interiors – Part I. Condition After One and One-Half Years, Apr 1967, R. W. Drisko, AD814701L

The interiors of four epoxy-coated and one vinyl-coated water storage tanks were inspected 1-1/2 yr after application of the epoxy coatings. All proprietary coating systems had some degree of blistering, but all were providing satisfactory protection. The condition of the Plasite 7133 coating system was noticeably better than that of the other test coating systems.

N-884
A Preliminary Subsurface Heat Transfer Study of Thickening Sea Ice, May 1967, E. R. Vinieratos, AD815384L

Any method of accelerating the growth of an ice sheet results in thicker and, in most cases, stronger ice. To eliminate the problems of excessive salt and a temporary isothermal temperature gradient associated with surface flooding, three methods of accelerating bottom freezing of an ice sheet were investigated. These were a high-pressure, low-temperature air method; a cold-coil, working-fluid controlled-refrigeration method; and an ice chip-seawater aggregate injection method. Investigation was primarily concerned with the heat transfer and feasibility of these methods.

The controlled-refrigeration and the ice chip-seawater aggregate methods were concluded to offer possibilities for accelerated subsurface thickening of limited-size and large ice areas, respectively; the high-pressure, cold-air method was considered impractical because of the power input required for a small refrigerating effect. The maximum ice thickness attainable for a natural ice sheet, however, was concluded to be dependent on the prevailing air temperature.

N-885
Electrical Properties of Coatings as Related to Performance. II. Experiments With Seven Additional Immersed Coating Systems, Apr 1967, P. J. Nearst, AD816474L

Seven coating systems on steel panels were immersed in salt water for up to nearly 2 yr. AC and DC electrical properties of the coatings were compared with the performance of the coatings in the laboratory, in shallow water, and in the deep ocean. Four of the systems showed comparatively little deterioration, and these coatings maintained high AC and DC resistances. Two systems which showed greater deterioration in exposure to sea water had high resistances initially, but subsequently developed lower AC and DC resistances. One system, consisting only of inorganic coatings was very conductive and its electrical properties thus could not be related to performance. Long term performance data for correlation with electrical measurements are not yet available. No definite relationship between dissipation factors of the coating systems and performance could be established, nor could a relationship between water permeability and performance be established.

N-886
Protection of Floating Pontoons From Corrosion – Part I. Installation and Initial Performance of Test Floats, Apr 1967, R. W. Drisko, AD815512L

A test program has been initiated that is aimed at reducing the maintenance costs associated with the recoating of deteriorated pontoon camel floats. Three 2-coat protective coating systems have been applied to pontoons on three test floats, and a material and labor cost analysis has been made on coating pontoons with each of these systems. A separate phase of the investigation is aimed at corrosion mitigation by cathodic protection. One of the test floats is currently being protected with zinc anodes, another with aluminum anodes, and the third float is serving as an unprotected control. After 6 mo service to the Fleet, the test pontoon camel floats were in good condition. No coating deterioration was noted, and the cathodic protection systems were providing electrical potentials that insure complete protection from corrosion to any exposed steel.

N-887
Polar Construction Equipment – Investigation of Drilling Equipment, Apr 1967, W. H. Beard, C. R. Hoffman, AD814605L

The drilling of holes in snow, ice, and permafrost is important in polar operations but presents problems not generally encountered in normal earth and rock drilling. Holes are required both for determining the nature of the subsurface and for placing utility poles, piling and other structural elements. This Technical Note presents the results of preliminary tests being conducted to improve drilling methods and techniques, and describes a rotary-type drill with 12-ft folding tower being used in this work. Results of these tests indicate that additional work is required for improving methods of drilling both deep holes and large-diameter holes in snow, ice, and permanently frozen ground.

Future work will include evaluation of a tri-cone roller rock bit and a 14-in. pipe drill with tungsten-carbide hardfaced cutting edge.

N-888
Interim Aircraft Load Curves for Sea-Ice Runways at McMurdo, Antarctica, May 1967, J. E. Dykins, AD815393L

Methods for analyzing the load-bearing capability of an ice sheet are limited due to the lack of detailed understanding of the gross mechanical properties and failure mechanisms of the ice sheet. The interim curves presented are based on best estimates of the ice properties for McMurdo annual sea ice using standard theories. The solution techniques used for the curve development appear to provide fair agreement with empirical criteria used for aircraft operation on ice sheets. Of the parameters involved in the solution, the most reliable are judged to be the flexural strength and its temperature association. Less confidence is placed on the elastic modulus values and the consideration of aircraft load distribution.

A continued concentrated effort is recommended to obtain a better definition of the failure mechanisms of the ice sheet and to develop a structural theory for predicting the plate response for a particular load.

The load curves presented in the appendix are an interim solution to the bearing capability of the annual McMurdo sea-ice sheet. They are based on as finite an association with the local ice conditions as present knowledge permits, and are recommended as criteria for aircraft operation until more detailed knowledge becomes available.

N-889
Pore Pressure Propagation in Uniform Rounded Quartz Sand, Apr 1967, D. G. True, H. G. Herrmann, AD684452

The first experiment in a series was conducted as part of a study to gain a better understanding of the behavior of the pore pressure in a soil system subjected to blast loading. In such a system, the pore pressure has a direct influence on the loading and foundation support conditions associated with buried structures. A 10-ft-high, 8-in.-diam column of uniform, rounded Ottawa sand was loaded with dynamically pressured air from above with the NCEL atomic blast simulator. Pore pressure and total soil pressure were monitored at various depths.

Data yielded information about propagation velocity and attenuation of pore pressure and effective soil stress. For the overpressure magnitudes (6, 30, and 140 psi) and durations (1-1/4 sec) used, pore pressure was found to propagate slower and with less attenuation than previously estimated by extrapolating from results of tests utilizing loads of shorter duration. Effective stress data was unrealistic due to stress transfer to the pipe sidewalls through friction.

Data on nearly saturated soil indicated that the degree of saturation was not sufficient to cause the soil to behave as theoretically predicted for the condition of 100% saturation - the measured velocities were not as high as predictions.

The study is to continue with the next experiment scheduled for a graded sand with different saturation conditions.

N-890
In-Service Test of the Stato Mooring Anchor, Apr 1967, R. C. Towne, R. A. Bliss, AD813928L

The Stato mooring anchor was designed to be used in a permanent type mooring; i.e., where the bottom soil characteristics can be determined in advance of the anchorage installation. In-service tests were requested by NAVFAC to determine any adverse operational characteristics which might become apparent through varying or continuous operational usage. Equivalent holding power Stato anchors were substituted for existing standard anchors already attached to two of the mooring assemblies in San Diego Bay. Substitution of the anchors was made at two mooring sites of different capacities in the Navy harbor complex during the regular FWC inspection of moorings. This report describes the fabrication and installation of the anchors.

Upon completion of one year's operation, the anchors will be removed from the water, evaluated and the results reported.

N-891
Tunnel Cooling for Byrd Station, Antarctica - Progress Review, May 1967, C. R. Hoffman, AD814606L

Deformation of the snow tunnels at Byrd Station, Antarctica, attributed in part to above 0F tunnel temperatures, threatens the structural integrity and useful life of the undersnow camp. Observations in Feb 1967 indicate that continued deformation of the snow tunnels will require major reconstruction in the near future.

Lower tunnel air temperatures in 1967 at most locations throughout the station are attributed to recent installation of doors at tunnel passageways which prevent entrance and circulation of warmer surface air.

Priority construction of a full-scale tunnel cooling system with potential capacity for lowering tunnel temperatures is recommended in view of the continued deterioration of tunnel L-7. When this is completed, NCEL will instrument and evaluate the performance of the system.

The major problems in operation and maintenance of the Byrd Station facility are of an engineering nature. As a result, the station complement should include an experienced engineer thoroughly familiar with past station operation and current procedures and requirements.

N-892
The Evaluation of NAF El Centro Using Layered Theory, May 1967, J. P. Nielsen, AD815385L

The techniques of the layered pavement method for the design of flexible pavements have been used to evaluate the flexible pavements at NAF, El Centro, Calif. This evaluation has provided in-situ moduli of elasticity for all components of the flexible pavements. The pavement surface course is composed of an asphaltic concrete having an average depth of 5.5 in. The moduli of elasticity for this course varied from 308,000 to 382,000 psi. A sandy gravel was used for the base which had a mean depth of about 17.3 in. and a range in moduli values from 30,800 to 35,200 psi. The subgrade consisted of a fine-grained clayey silt or an inorganic clay of medium compressibility. The subgrade moduli varied from 6,000 to 14,000 psi. These analyses indicate that the Burmister layered theory can be used to give a realistic indication of the load-deflection response of flexible pavements.

N-893
Natural Materials for Protecting Ice and Compacted Snow, May 1967, N. S. Stehle, AD815491L

In much of the polar regions, many facilities are constructed on ice and permanent snowfields. During the summer, high solar radiation and near- or above-thawing temperatures decrease the wear resistance of ice and snow surfaces. Tests were conducted on the ability of sawdust, snow, and chipped-ice coverings to protect ice from melting and deterioration due to high solar radiation and near- and above-thawing temperatures. These results were compared with the results of other similar tests performed with urethane foam. It was concluded that field situations in which the air temperature is not above freezing for long periods of time but solar radiation is high, chipped-ice and snow covers 3 in. thick or more can be used as effectively as 1/4 in. of sawdust or a 1/4-in. slab of flexible urethane foam to protect ice surfaces. In similar field situations where the air temperature is above freezing for extended periods of time, however, 1-in.-thick covers of rigid urethane foam in slab or granule form should be used.

N-894
The Formulation of a "Primary Film" on Materials Submerged in Sea Water at Port Hueneme, California, Jul 1967, T. B. O'Neill, G. Wilcox, AD820261L

Samples of structural materials were placed in the water at Port Hueneme and were removed after immersion periods of 1 hr to 10 wk. The object of the investigation was to study the qualitative and quantitative aspects of microbial attachment to surfaces prior to macroscopic fouling.

At one site, an orderly sequence of microbial succession occurred. The initial organisms of attachment, the bacteria, were supplanted by diatoms, hydroids, algae and barnacles, respectively.

At the same site, in a different year, the clear delineation of phases was not discernible. The number of bacteria was comparatively small in the initial stages of fouling and the first organisms present in great numbers on the slides were diatoms. It appears that the presence of bacteria accelerates fouling but their absence does not negate fouling.

When slides were simultaneously placed at two different sites and one of these sites was in the immediate vicinity of existing heavy fouling, the sequence and rate of fouling was altered. The initial stages were brief in duration and consisted of yeasts as well as bacteria and diatoms. The latter stages of primary film formation consisted of a wide variety of organisms similar to those already existing nearby.

N-895
Laboratory Study of Seiching Induced on an Offshore Shelf, Feb 1967, L. E. Robson, D. R. Jones, AD653711

An exploratory investigation was made in the NCEL wave tank to determine (1) whether with existing equipment an oscillation (seiche) of the water over a submerged shelf just offshore could be induced by an incident train of shorter waves and (2) if so, whether the run-up from the wave system on the beach would thereby be affected significantly. This study was a phase of current work at NCEL dealing with the run-up and other shore effects of surface gravity waves from underwater explosions.

The near-shore bottom boundary consisted of a plane, impermeable barrier (representing a beach), lying on a slope of 1:10 and extending 6 in. below the mean water surface to a horizontal shelf (representing a submerged topographic bench). Beyond the shelf the depth was 24 in. The primary variables were the length of the shelf (from 4 to 8 ft) and the period setting of the flat-type wave generator (from 0.6 to 3.7 sec), which was located about 75 ft away. Water-level fluctuations over the shelf and at the shore were recorded and the latter were analyzed for low-frequency components.

From these results it was concluded that a seiche existed in some of the runs. It is believed that the principal reason why no oscillation was detected in other runs is that the heights of the incident dispersive waves (which could not be increased) were too small.

When the wave-maker was set to generate long wave, the initial waves at the shelf were those of the periodic train. These waves were adequately high, but the wave periods approached those of a shelf seiche and no conclusion as to whether or not a seiche was induced could be drawn.

N-896
Preliminary Investigation of Solid-Borne Acoustical Signals Generated by the Teletypewriter (U), Jun 1967, R. D. Benning, H. A. Lasitter, AD500331L, Secret

N-897
Transportation Equipment Allowance Formulae for CONUS Naval Air Stations, Jun 1967, W. L. Richardson, AD816150L

This report examines historical data characterizing the expenditure of transportation resources by 28 U.S. Naval air stations located within the continental United States. Formulae are developed by performing multiple regression analysis on historical data to forecast vehicles required. Historical NAS characteristics (e.g., base population, station area, etc.) were used to forecast mileage which was in turn correlated to a vehicle requirement. Data characteristic of FY-1961 and FY-1964 were studied. Formulae are developed which estimate transportation vehicles classed in terms of U.S. Navy numbers 91 through 96 as a function of NAS characteristics. Results are an initial attempt at expressing years of practical experience as a formula. The primary advantage of using a formula is management consistency in vehicle allocation throughout Naval air stations. The formulae developed yield a basic allowance which is easily modified as station characteristics change.

N-898
Experimental Wood Preservative Systems. Treatment, FY-66, Driving, FY-67, Jun 1967, M. Hochman, T. Roe, AD816825L

As part of work unit Y-R005-07-01-007, Chemical Wood Preservative Treatments, the Laboratory exposed in Pearl Harbor 20-ft piles that have been treated with experimental treating solutions. Some piles received a single treatment and some received double treatment. The first treatment was generally a water solution. The second treatment, where employed, was a solution of a water-insoluble material in an organic solvent.

N-899
Measurement of Gamma-Ray Attenuation in a Full-Size Shelter, Jun 1967, J. M. Chapman, AD818197L

Dose rate attenuation factors for Co-60 radiation were measured along the entranceway of the 100-man shelter at NCBC, Port Hueneme, Calif. These dose rates were compared with those calculated by a computer code and found to be within a factor of two agreement.

An attempt was also made to measure the protection factor of the entire shelter proper. It was determined that the protection factor is about 200,000. Since the protection factor near the outlet of the entranceway is about 40,000, radiation streaming through the entranceway is seen to be important.

N-900
Corrosion of Materials in Hydrospace - Part I. Irons, Steels, Cast Irons, and Steel Products, Jul 1967, F. M. Reinhart, AD818171L

A total of 1,300 specimens of 47 iron base alloys were exposed at depths of 2,340; 2,370; 5,300; 5,640; and 6,780 ft at two sites in the Pacific Ocean for 197; 402; 1,064; 123; 751; and 403 days, respectively, to determine the effects of deep ocean environments on their corrosion behavior.

Corrosion rates, pit depths, types of corrosion, changes in mechanical properties, effects of stress, and analyses of corrosion products are presented.

The corrosion rates of all the alloys, both cast and wrought, decreased asymptotically with duration of exposure and became constant at rates varying between 0.5 and 1.0 mils/yr after 3 yr of exposure in sea water and partially embedded in the bottom sediments at a nominal depth of 5,500 ft. These corrosion rates are about one-third those at the surface in the Atlantic Ocean.

N-901
Preliminary Study of Hinging in Reinforced Concrete Frames, Jul 1967, W. J. Nordell, AD817681L

Three knee connections were statically loaded and two were dynamically loaded as part of a preliminary study of the hinging characteristics of beam sections adjacent to beam-column intersections. In all knee connections, the mechanical and geometrical properties at the critical section were the same. The results were compared to those obtained in tests on similarly reinforced, centrally loaded beams.

The knee connections failed when the concrete failed in bearing at the location of the corner bend in the tension reinforcement. The comparison of the knee connection and beam test results indicated that the maximum resistance at hinge rotation at maximum resistance for the knee connections were both less than the corresponding values for similarly reinforced beams. The reductions were attributed to the inadequate anchorage of the tension reinforcement. Although the dynamic resistance was not as great as expected, the rotational capacity at maximum resistance in the dynamic tests appeared to be equivalent to that in the static tests.

N-902
Airfield Pavement Evaluation, USNAS Los Alamitos, California, Jul 1967, R. J. Love, D. J. Lambiotte, W. H. Chamberlin, AD819862L

The evaluation of the pavement at NAS, Los Alamitos, Calif., is presented with the allowable gross load capacities of the runways, taxiways, and parking aprons for single, dual, single-tandem, and dual-tandem wheel assembly aircraft. Information is also included on the construction history, design pavement section, climatic data, current aircraft traffic, and subsurface materials are included in the tables. Results of the evaluation show that runway 4L-22R, taxiways B and 10, and the old concrete and asphaltic concrete portions of parking aprons 1 and 2 are being overloaded by aircraft currently operating at NAS. In addition, abandoned runway 16-34 is being overloaded by aircraft using it for ordnance loading and unloading.

N-903
Survey of Naval Ship-to-Shore Telephone Facilities, Jun 1967, E. Giorgi, AD817682L

The advent of worldwide military communication networks has imposed increased telephone service requirements at piers and moorings for Naval vessels while in port. In the interest of the improved efficiency of operation, NAVFAC assigned work unit Y-F015-12-06-911 to the Laboratory for the purpose of investigating operational deficiencies of existing ship-to-shore telephone facilities. The initial effort was directed toward conducting a survey of selected Naval stations and shipyards to identify specific deficiencies and problem areas. Results of this survey, including conclusions and recommendations, are presented.

N-904
Field Testing of Plastic Mooring Buoys - Part III. Condition After 1-1/2 Years Service, Jul 1967, R. W. Drisko, AD818558L

The conditions of two experimental plastic mooring buoys are described after 1 yr and after 1-1/2 yr of service to the Fleet in San Diego Bay. Both were performing very

satisfactorily at these times. One buoy with a hand lay-up type of fiberglass-reinforced plastic outer shell showed no apparent deterioration. The other with a spray-up type of fiberglass-reinforced plastic outer shell showed some superficial damage, especially on the top shoulder. The fouling on both buoys was similar in type and amount to that on steel buoys in the same area.

N-905
Static Versus Dynamic Testing of Deep Slabs (U), Aug 1967, S. K. Takahashi, J. R. Allgood, Confidential

N-906
An Analytical Solution to a Vehicle Allowance Model, Aug 1967, A. G. Azpeitia, P. E. Lacroce, AD818627L

The analytical model presented in this note can be used to describe the number of vehicles allocated to a Naval air station as a function of activity factors and functional factors. A modified least squares approach was used to determine the three activity factors per each station (K, M, and N) and the seven functional factors (F(I), I = 1,7) related to organizational functions at each station. The modified least squares approach utilized a logarithm transformation to convert a product to a sum.

N-907
The Effect of Environment on the Corrosion of Metals in Sea Water - A Literature Survey, Jul 1967, H. A. Porte, AD820155L

NAVFAC is interested in developing methods to combat metallic corrosion as a means of reducing maintenance costs of the Naval shore establishment.

A literature survey was made to determine the effect of environmental variables on the corrosion rates of metals submerged in sea water. The most important variables were found to be dissolved oxygen concentration, velocity, and temperature. Other factors which influence the corrosion rates are pH, salinity, and micro-organisms. It is recommended that a coordinated research program, consisting of basic research studies and corrosion testing, be initiated in controlled sea water environments.

N-908
Comparative Performance of Automobile Refinishing Paints, Jul 1967, C. V. Brouillette, AD818629L

Eight automobile refinishing systems were applied to Navy automobiles in Key West, Fla. Because of the subtropical environment, the refinishing normally used reportedly becomes unsightly in a short time. Four of the eight systems gave good initial gloss readings. The DuPont alkyd enamel system was the easiest to apply and gave the highest initial gloss of any of the eight systems. Primer TT-E-485D could not be wet- or dry-sanded to a smooth finish. The finish coats of TT-E-489D applied over this primer were not as smooth as finish coats of systems applied over primer-sealers.

N-909
Reinforced Plastics Laminates Panels - Physical Tests of Panels Removed After the First and Second Exposure Periods, Jul 1967, T. Roe, AD818696L

Sets of glass-reinforced epoxy and polyester panels, both coated and uncoated, have been exposed at China Lake and Port Hueneme, Calif., and at Kwajalein, Marshall Islands. A fourth set of panels is being maintained as a control. Results of physical tests of panels exposed at the three field locations for two different time periods and results of the same tests on control panels are reported. No significant changes in mechanical properties have occurred, but polyester-glass panels rated above epoxy-glass panels in all four physical tests.

N-910
Construction and Preliminary Evaluation of an Environmental Test Chamber, Jul 1967, H. A. Porte, AD819822L

Details of construction of an environmental wet test chamber are presented. Preliminary test results are reported for mild steel in a salt water environment. It is recommended that further tests be conducted to determine the feasibility of using this apparatus in accelerated tests for coatings.

N-911
Investigation of Commercially Available Two-Way Electrical Connectors and Techniques Used With Dissimilar Conductors (Aluminum-Copper), Jul 1967, M. N. Smith, AD821320

The use of aluminum conductors is relatively new throughout the Naval establishment. Problems have been encountered at the points where connections between aluminum and copper conductors were made. The desirability of eliminating such problems becomes apparent particularly with the increasing use of aluminum as an electrical conductor. A task was initiated to investigate the suitability of commercially available two-way connectors for use with dissimilar electrical conductors (aluminum-copper). The results of a literature search and a survey of Naval and industrial experience conducted by the Laboratory are presented in this report together with a discussion, conclusions and recommendations on the use of two-way connectors with aluminum-copper conductors.

N-912
Backscattering of Radiation From Slabs, Aug 1967, Y. T. Song, C. M. Huddleston, AD819595L

It frequently happens that one is interested in determining the thickness or mass density of a thin layer of material on a thick backing. This note describes how radiation backscatter may be used to solve such problems. Theoretical considerations are discussed and the method of invariant imbedding is described.

N-913
Review of Portable Structures for Polar Regions, Aug 1967, G. E. Sherwood, AD820263L

Polar camps in remote areas or in outlying work centers near established stations usually require frequent relocation due to changing requirements, burial by drifting snow, or site contamination. Commercially available portable structures developed for use in remote oil fields or construction sites have been used in Antarctica to meet the need of portability even though they are principally designed for use in warmer areas. Both unitized-frame and knockdown portable structures are presently in use in Antarctica. They appear satisfactory for the present applications, but lighter-weight structures with better joint seals, wider skids, and more adequate space layouts are required for general utilization of these structures in all polar areas.

It is recommended that existing complexes of portable structures in Antarctica be observed to determine the continuing adequacy of these structures for the assigned functions and the maintenance required to keep these complexes operational. It is also recommended that design criteria be established for the development of portable structures suitable for general utilization in all polar regions.

N-914
Cathodic Protection of Mooring Buoys and Chain, Part 3. Field Studies With Cables Providing Electrical Continuity, Aug 1967, R. W. Drisko, AD820996L

An investigation was continued into the cathodic protection of a fleet mooring with sacrificial anodes. The zinc anodes used on the ground tackle were specially cast on chain links so that they became an integral part of the ground tackle. The tight riser chain had the required

electrical continuity between chain links to permit the flow of electrical current, but it was necessary to use steel cables periodically joined to the ground legs to give them continuity. The completed system provided full protection to the underwater portion of the buoy and to the entire ground tackle.

N-915
Corrosion of Materials in Hydrospace, Part 2. Nickel and Nickel Alloys, Aug 1967, F. M. Reinhart, AD821256L

A total of 635 specimens of 75 different nickel alloys were exposed at two different depths in the Pacific Ocean for periods of time varying from 123 to 1064 days to determine the effects of deep ocean environments on their corrosion resistance. Corrosion rates, types of corrosion, pit depths, effects of welding, stress corrosion cracking resistance, changes in mechanical properties and analyses of corrosion of the alloys are presented.

N-916
Polar Sanitation - Synthetic, Nonfreezing Waste-Carriage Media, Aug 1967, N. L. Drobny, AD820260L

Extreme environment and remote location create significant problems for sanitary facilities in polar camps. A reusable synthetic, nonfreezing fluid as a waste-carriage medium appears feasible for polar camp flush-toilet sanitary systems. Such a medium could eliminate the need for heating and insulating exterior piping, as must be done for conventional water-carriage systems. Based on a preliminary cost analysis of various nonfreezing fluids and uninsulated fuel distribution systems in polar areas, it is concluded that reusable synthetic, nonfreezing waste-carriage media have promise for reducing costs for polar camp sanitary systems. The synthetic waste-carriage media concept should be investigated experimentally, and systems for use should be further analyzed on the basis of the experimental data.

N-917
Preliminary Investigations of Metallized Alkyds, Aug 1967, M. Hochman, AD820369L

Several alkyds were treated with aluminum enolates and titanium alkoxides. These compounds caused gel formation when incorporated into short linseed oil and medium safflower oil alkyds. A long linseed oily alkyd was prepared having a high acid number which was compatible with these compounds. The resultant metallized alkyd has a shorter drying time and greater apparent hardness than the unmetallized alkyds.

N-918
Shock Resistant Water Wells for Shelter Cooling, FY-67, Aug 1967, J. A. Norbutas, AD819863L

This report presents the development of a nuclear blast resistant water well concept. The well is intended to survive the effects of nuclear weapon yields up to 20 megatons at ranges resulting in blast overpressures up to 300 psi. The concept will serve as the basis for the development of shock resistant water well design criteria. Significant features of the concept include a gel isolated well casing, a submersible motor pump, a blast-resistant manhole enclosed well head, and the use of chemical grout for surrounding soil conditioning.

N-919 - Cancelled

N-920
Requirements and Concepts for Service Shelters in Polar Regions, Sep 1967, G. E. Sherwood, AD820262L

Much of the maintenance of equipment and other services at outlying stations and work centers in Antarctica is performed in the open, with no protection from the elements. Where shelters are used, they are often makeshift structures field-fabricated from available materials. A study of requirements revealed that shelters are needed for aircraft ground support equipment, maintenance of aircraft, heated field shops, and unheated storage of some equipment, materials, and critical supplies.

N-921
Corrosion of Materials in Hydrospace, Part 3. Titanium and Titanium Alloys, Sep 1967, F. M. Reinhart, AD821257L

A total of 475 specimens of 10 titanium alloys were exposed at two different depths in the Pacific Ocean for six different periods of time varying from 123 to 1064 days to determine the effects of deep ocean environments on their corrosion resistance. Specimens of the alloys were also exposed in surface seawater for 181 days for comparison purposes. Corrosion rates, types of corrosion, pit depths, effects of welding, stress corrosion cracking resistance and changes in mechanical properties are presented.

N-922
Blast Activated Closure Valve for High Capacity Ventilation System, Aug 1967, D. E. Williams, J. M. Stephenson, AD822545L

Five blast exclusion systems evolved from the NCEL-conceived buckling plate concept. The concept was confirmed after a series of tests with three of the five systems. Valve closing time increases with the mass and/or the mass moment of inertia of the valve element. With the buckling plate concept, very short closing times can be effected for high capacity valves by increasing valve element length while minimizing width. Complete blast exclusion, however, is not possible with valves actuated by direct air blast, unless some indirect triggering method with or without a delay duct is employed. Because of their characteristically short closing time, the valves using the buckling plate concept are singularly adaptable to use with either adjacent or remote triggering devices. System IV, 2,500 cfm valve module, which incorporates several features proven experimentally appears the most promising, and its development will be continued.

N-923
Destruction of Cable Insulation by Rodents and Other Biological Agents, Aug 1967, H. P. Vind, AD820728L

Though bare insulated cable is very susceptible to damage by insects and rodents, cable protected by 5-mil steel tape or by 10-mil copper tape is relatively immune to animal attack. Numerous attempts are being made to replace the metal tapes by lighter weight polymeric sheaths to which insect and rodent repellent chemicals have been added. Statistical analysis discloses that chemical barriers do afford some protection against rodents, and the barriers retard or prevent attack by insects and microorganisms.

N-924
High Pressure Cleaning, Sanitary Cleaning, and Biocatalytic Drain Cleaning for NAVFAC Facilities, Aug 1967, J. C. King, AD822554L

High-pressure cleaning of automotive and construction equipment, sanitary or custodial cleaning of floors, walls, restrooms, and related fixtures, and biocatalytic compounds for drain cleaning are presented. The high-pressure cleaning includes two types of machines - small units with capacities up to 6 gpm at 1,000 psig, and large units with capacities up to 12 gpm at 8,500 psig. The report gives general information on performance of high pressure cleaners in laboratory and field tests and, accordingly, recommends appropriate size machines and relative compounds for certain cleaning jobs. It discusses two new methods of sanitary cleaning and outlines a test program designed to reduce sanitary cleaning costs in the Naval Shore Facilities. For drain cleaning, it presents comparisons of ten commercial products, showing that it is not harmful to use one brand after another in the same drain, and recommends use of biocatalytic compounds in drains that frequently cause trouble.

N-925
Bonding to Steel of Underwater-Curing Epoxies, Sep 1967, R. W. Drisko, AD821145L

The bonding strength to steel of a number of different underwater-curing epoxy formulations was measured. The effect of different forms of silica and the effect of a number of silanes in such formulations was determined. Wetting of epoxy components with sea water before mixing was found to be detrimental to bonding. Faster curing and better bonding occurred at higher curing temperaures. Use of two accelerators failed to appreciably increase bonding strength when specimens were cured either at normal or low temperatures.

N-926
Trade-Off Study of Equipment for Navy Construction Forces, Sep 1967, J. A. South, AD822363L

Three use factors for evaluating equipment are developed. F_1 evaluates the equipment compared to other equipment for six types of jobs. F_2 evaluates the equipment compared to other equipment for all types of jobs. F_3 evaluates the equipment in terms of the type of job where it is used most of the time. These use factors are useful when considering trade-off values of equipment and areas of greatest payoff for development or replacement with new and better equipment. They also provide quantitative weighting factors for comparing costs, weights, and importance of repair parts. A continued study is recommended based on the F_2 and F_3 values.

N-927
Sea Ice on McMurdo Sound, Antarctica - Deep Freeze 67 Thickness and Temperature Studies, Sep 1967, R. A. Paige, AD821319

Annual sea-ice thickness varies seasonally between 8 and 11 feet by the end of the growth period. Thinning by bottom melting starts about mid-December and continues until breakout in late January or early February. The average ice-sheet temperature has increased each season since Deep Freeze (DF-65), and becomes essentially isothermal about the same time bottom melting begins. For operational safety, the ice sheet should be monitored for thickness and temperature as described in this report.

N-928
Civil Engineer Corps Career Planning Model Study, Oct 1967, J. C. Story, AD822352L

This Technical Note documents all work accomplished to date on the Civil Engineer Corps Career Planning Model Study. The results of extensive literature research related to the problem are documented. Significant information obtained by interviews at other activities is documented. Problem definition, meaningful objectives, and technically feasible solutions which, if implemented, could meet the defined objectives are disclosed and recommended.

N-929
Oxidative Degradation of Asphalt, Sep 1967, H. P Vind, AD823572L

There are striking differences in the resistance of different asphalts to deterioration. The numerous standard specification tests fail to distinguish those that are durable from those that deteriorate rapidly. Knowledge that the deterioration of asphalt is primarily an oxidative process leads to three general approaches for preventing the deterioration of asphaltic construction mixtures: (1) Agents might be added or other measures might be employed to lower the intrinsic reactivity of asphalt with oxygen, even when the availability of oxygen is not limited; (2) sacrificial oxygen-consuming agents might be added to the construction mixtures to limit the amount of oxygen available for reacting with the asphalt; and (3) impermeable surface coatings might be applied or fine particles might be added to clog or seal the pores, thereby retarding the diffusion of oxygen through the asphaltic mixtures. The three proposed approaches are applicable irrespective of the involvement of bacteria in the degradation of the asphaltic construction mixtures. Other measures for prolonging the service life of special asphaltic compositions might be the application of heat reflective white coatings to prevent solar heating, or the incorporation of water-absorbing additives to prevent penetration by water.

N-930
Airfield Pavement Evaluation, USNAS Seattle, Washington, Sep 1967, D. J. Lambiotte, W. H. Chamberlin, AD824127L

The evaluation of airfield pavements at U.S. Naval Air Station, Seattle, Washington, is presented with the allowable gross load capacities of the runways, taxiways, parking aprons and helicopter pads for single, dual, single-tandem and dual-tandem wheel assembly aircraft. Information is also included on the construction history, design pavement sections, climatic data, current aircraft traffic, and pavement and subsurface materials. Results of the evaluation show that most of the pavements are being overloaded by aircraft currently operating at the air station.

N-931
The Effectiveness of Lead Grills in Decreasing Gamma Radiation Streaming Through a Two-Legged Duct, Sep 1967, J. M. Chapman, AD824438L

Dosimeter measurements were taken in a 3-foot square, two-legged duct, with and without the presence of lead grills in the corner. The lead grills reduce the dose rate in the second leg to 50% of the value without grills for Co-60 radiation, and to 40% for Cs-137 radiation. Calculations of the reduction by a computer code using the albedo concept agree well with the experiment.

N-932
Effect of Exposure Angle on the Atmospheric Performance of Coatings - I. Results of Two-Year Exposures, Oct 1967, P. J. Hearst, C. V. Brouillette, AD822961L

In tropical locations, the solar radiation received by a test panel can be considerably increased by changing the exposure angle from 45 deg to the angle of the latitude. Results of two-year exposures at 45 deg and at 9 deg at Kwajalein, Marshall Island, of scribed and unscribed panels coated with zinc inorganic silicates and organic topcoat systems are compared. The 9-deg exposure may be more severe as judged from the protective properties of the coatings, but the results are not conclusive over this limited period of time.

N-933
McMurdo Ice Wharf - Surface and Subsurface Observations During Deep Freeze 67, Oct 1967, R. A. Paige, AD822004L

The wharf at McMurdo Station, Antarctica, consists of a limited area of fast ice, or old sea ice, that has accumulated along the western shore of Winter Quarters Bay. This facility is critically needed for safe, efficient unloading of cargo ships for Operation Deep Freeze. Since Deep Freeze 64 (DF-64), when the fast ice was first used as a wharf, surface erosion, undercutting of the vertical ice face by wave action, and the caving off of large slabs of the surface during summer have damaged and deteriorated the usable wharf area. Observations during DF-67 showed that wave action is the primary cause of undercutting, and indicates that surface erosion has been essentially eliminated by proper drainage control. It is concluded that measures are urgently needed to protect the wharf from further loss of surface area.

N-934
Miscellaneous Field Experiences With Airfield Marking Paints, Oct 1967, R. W. Drisko, AD822962L

Deterioration of white alkyd marking paint occurred on asphaltic runways at several military airfields in Southern

California. Oleoresinous phenolic varnish paint generally gave much better performance at these installations. Better service was also received when all of the slurry seal (both damaged and undamaged) in the area to be painted was removed and replaced before restriping.

N-935
Application Study of Universal Engineer Tractor for Navy Construction Force, Dec 1967, A. L. Scott, J. A. South, AD824790L

The Universal Engineer Tractor (UET) is special equipment developed by the U.S. Army Engineers. It combines in one machine the capabilities of a bulldozer, scraper, dump truck, armored personnel carrier and cargo carrier. It is self-propelled. As a scraper it is self-loading and dumping. It will do rough grading. It floats and is self-propelled in calm water. It is supposed to be air-transportable and dropable, though this feature has not been tested. While still undergoing engineer service tests by U.S. Army Engineers, it is sufficiently developed that six production models have been ordered. It is recommended that the U.S. Navy Civil Engineer Corps purchase one of these machines for testing under Navy/Marine Requirement Conditions.

N-936
Blast Attenuation by Tunnel Liners, Nov 1967, J. A. Norbutas, AD825836L

Tests were conducted to determine the attenuating effects of special acoustic lining materials on nuclear blast-induced air shock waves in ventilation tunnels. The two sample materials tested, together with their support fixtures, restricted normal air flow by less than one-half inch water pressure drop. The NCEL 8-inch shock tube generated the simulated nuclear blasts varying in peak overpressure from 6-36 psi. Shock pressure reductions of 40-60% were recorded for the test sample-support fixture combinations. One material produced 15% attenuation and the other produced 30% attenuation. In each case, the effect was independent of incident shock pressure level. These results demonstrate that, within the test pressure range, diffusion type attenuating materials in the proper configuration can significantly reduce nuclear detonation-induced air shock pressures in ventilation tunnels and ducts.

N-937
Polar Construction Equipment - Drilling Tests in Ice and Ice-Rock Conglomerate, Nov 1967, C. R. Hoffman, E. H. Moser, AD824445L

A trailer-mounted rotary drilling unit with a 12-ft tower, a 4-3/4-in. tricone bit, and a special 14-in.-diam, 9-ft-long tube drilling bit were used for wet-drilling tests in ice, and ice with inclusions and layers of volcanic sand and gravel and basaltic rock rubble near McMurdo Station, Antarctica, during the summer of Deep Freeze 67. Wet drilling with these bits in warm sea ice was satisfactory, but auger drilling is more efficient where the ice is completely penetrated by the auger. The tricone bit was used to drill exploratory holes to depths up to 56 feet, and the tube drilling bit was used to extract a 38-ft-long, 12-in.-diam core in the ice-rock conglomerate, using the wet-drilling technique. Both bits also appeared suitable for construction drilling in this material. Additional tests, including in-service construction drilling, are planned at McMurdo Station during the summer of Deep Freeze 68.

N-938
Power Filter Insertion Loss Evaluated in Operational Type Circuits, Dec 1967, D. B. Clark, R. Benning, P. Kersten, D. Chaffee, AD824915L

Insertion losses of several different manufacturer's 100 ampere power filters were measured in the frequency range 100-Hz to 2-MHz and at a range of power current loads utilizing a newly developed current injection probe. The measurements were made using a technique, which in compliance with IEEE measurement standards, provides a constant voltage source in a filter-in, filter-out measurement circuit, where source and load impedance parameters are known. Theoretically derived curves for the power filters installed in circuits with complex source and load impedance are compared to measured curves. Theoretically derived curves for current or voltage attenuation are also compared to insertion loss curves. Significant departures from the MIL-STD-220A specification curves were obtained using this new, current injection probe measurement method. Strong saturation effects were found with several of the filters. Wide pass-band excursions were obtained as predicted by the theoretical treatment. The new measurement technique is described in terms of its relation to IEEE standard definitions of insertion loss. A discussion is given of present and proposed methods in relationships to what is felt is the most useful means of describing a filter's operational characteristics.

N-939
Airfield Pavement Evaluation, USNAS Whidbey Island, and USNOLF Coupeville, Washington, Oct 1967, D. J. Lambiotte, W. H. Chamberlin, AD826363L

An evaluation of the pavements at U.S. Naval Air Station Whidbey Island and U.S. Naval Outlying Field Coupeville, Washington is presented with the allowable gross load capacities of the runways, taxiways, and parking aprons for single, dual, single-tandem, and dual-tandem wheel assembly aircraft, information is also included on the construction history, design pavement sections, climatic data, current aircraft traffic, and pavement and subsurface materials. Results of the evaluation show that asphaltic concrete taxiway B and all portland cement concrete pavements with thicknesses of less than 8 inches, including the pavement at NOLF Coupeville, are being overloaded by some aircraft currently operating at the air station.

N-940
Airfield Pavement Evaluation, USNALF Monterey, California, Dec 1967, D. J. Lambiotte, AD826372L

The evaluation of the pavement at the U.S. Naval Auxiliary Landing Field, Monterey, California, is presented with the allowable gross load capacities of the runways, taxiways and parking aprons for single, dual, single-tandem, and dual-tandem wheel assembly aircraft. Results of the evaluation show that none of the pavement is being overloaded by aircraft using the station, with the exception of very infrequent landings by C-141 aircraft. USNALF Monterey is shared on a joint-usage basis by Navy, commercial, and private aircraft.

N-941
A Versatile Data Tape System for Static and Dynamic Tests, Jan 1968, R. H. Seabold, AD826036L

A tape data system has been developed at NCEL to gather, record, reduce, and present data obtained in static and dynamic tests. The system has been instrumental in effecting a marked reduction in the time and cost of processing test data. The tape data system can be considered as consisting of two separate systems. The gathering and recording functions comprise one system at the site of the experiment. The reducing and presenting functions comprise another system located at the NCEL computer facility. The tape data system is modular, provides time reference, and provides for time base expansion and contraction. Final results can be presented in convenient forms including oscillograms, pen recordings, various types of plots, punched cards, typewritten pages, and photographs of an oscilloscope.

N-942
Sanguine Versus High Overpressures (U), Jan 1968, J. R. Allgood, W. A. Shaw, SECRET

N-943
Preliminary Experimental Study of the Thin-Film Superconducting Transformer, Nov 1967, R. D. Hitchcock, AD827933L

Two types of thin-film superconducting transformers have been investigated experimentally, (1) the interleaved spiral and (2) the one-turn sandwich. The superconductive metals, PB and SN, were vacuum deposited on room-temperature glass substrates by resistance-heating techniques. Silicon monoxide was used for insulation in the stacked-turns transformer. Spiral transformers were constructed by lathe scribing. Measurements of load voltage versus frequency revealed that inductive coupling in a thin-film superconducting transformer is the same as that in a normal-conducting transformer in which turn resistance approaches zero. Operation of a superconducting thin-film transformer near the field-induced transition point revealed that the secondary wave-form is the same as that of an iron-core transformer operating at saturation during part of each half cycle. Stacked-turn transformers with more than one turn per winding could not be fabricated by vacuum deposition methods. Pulse trains appeared on the secondary voltage waveform of a thin-film sandwich transformer in which the turns became shorted during immersion in liquid helium. It is assumed that the pulses resulted from a cryotron ring-oscillator mechanism.

N-944
The Survival of Viruses at Low Temperatures, Jan 1968, T. R. O'Neill, N. S. Stehle, G. L. Wilcox, AD826371L

Sanitary facilities in polar regions are often very primitive, and disposal practices may be haphazard and random. The resultant potential hazard to the health of personnel in the polar environment has received little attention and is generally underestimated. Consequently, a laboratory investigation was instigated on the survival of viruses at low temperatures. The results of this preliminary study show that viruses in sewage frozen at temperatures as low as -40°C remain viable and may even increase in number. After 4 months of storage at temperatures as low as -33°C, 10 to 20% of the viruses remained infective. That any viruses remained for any period of time is significant since very minute amounts of enteroviruses can initiate disease in humans. Because so little is known on the survival of viruses at low temperatures, additional research is needed to delineate more completely the circumstances under which viruses do survive and, hence, constitute a menace to health.

N-945
Water Waves From Underwater Explosions in Shallow Water, Part II -Characteristics of Waves Near the Shoreline and Method of Estimating Wave Forces on a Vertical Barrier, Jan 1968, H. Wang, AD665799

The characteristics of dispersive water waves - wave celerity, water particle velocity, and wave deformation - were studied in the laboratory in a region adjacent to the shoreline on a beach that has a 1/14 slope. The waves were generated by immersing a plunger at a distance from the shoreline in water of constant depth. A numerical scheme for the calculation of mean water particle velocity in the horizontal direction was developed according to the principle of continuity. This scheme is highly stable and is suitable for small computer facilities such as the IBM 1620. Methods for the estimation of wave forces and pressures on a vertical barrier, mounted as a seawall, were developed. The methods are based on momentum consideration and require knowledge of the water particle velocity in the horizontal direction and the shape of the incident wave.

N-946
Liquid Distribution Systems - Preinsulated and Heat-Traced Piping for Polar Camps, Feb 1968, C. R. Hoffman, AD827791L

Freeze-protected piping systems suitable for installation in temperatures to -30°F and operation in temperatures to -65°F are required for distributing water and collecting sewage at polar installations. A study is being made of piping, insulating materials, field-assembly techniques, and maintenance procedures to develop design criteria for preassembled piping materials and fittings suitable for these systems.

N-947
Airfield Pavement Evaluation, USNALF San Clemente Island, California, Feb 1968, D. J. Lambiotte, G. S. Prinishi, W. H. Chamberlin, AD830025L

The visual condition survey at U.S. Naval Auxiliary Landing Field, San Clemente Island, California, is presented, including information on the construction history, climatic data, and aircraft traffic. The overall condition of the portland cement concrete slabs was excellent, with only minor maintenance problems, such as weed growth and occasional poor joint seals noted.

N-948
Piston Velocities of a Single-Impulse, Deep-Ocean Hydrostatic Ram, Dec 1967, P. A. Dantz, J. R. Ciani, AD831131L

A single-impulse, hydrostatically powered ram device was designed, fabricated, and tested by CEL in a hydrostatic environment simulated with an accumulator tank. Fifty-four tests were conducted in which the velocities were measured for three weights of pistons driven by pressures up to 2,000 psi. The experimental piston velocities were compared with theoretical values. It was concluded that piston velocities could be predicted for the application of a power ram similar to that of this tank.

N-949
Semiempirical Formula for Differential Dose Albedo for Fast Neutrons on Iron, Aluminum, Soil and Concrete, Feb 1968, Y. T. Song, AD829410L

Presented in this paper is a four-parameter formula for differential dose albedo, which is based on the current of fast neutrons reflecting from iron, aluminum, soil, and concrete. The fast neutrons have energy ranging from 0.1 to 14 MEV. The types of soil considered are dry, 50% saturated, and 100% saturated. The agreement between values of differential dose albedo obtained by the four-parameter formula and values obtained from the dose-reflection factors by Allen et al. averages about 30%. Further, there is even better agreement in the total dose albedo, which is the integrated values of the differential dose albedo over the entire hemisphere of the reflecting surface.

N-950
Corrosion Rates of Uranium Alloyed Steel in Marine Hydrospace, Feb 1968, C. V. Brouillette, AD829844L

Corrosion rates in hydrospace environments were primarily controlled by the dissolved oxygen concentrations and to a lesser extent by temperature. Segregation of uranium in the steels, which possibly could have occurred during production, could not be detected. Profuse micro-pitting over the surface of the uranium alloyed stainless steel was attributed to the uranium. Corrosion rates of steel in deep ocean were low.

N-951
Airfield Pavement Evaluation, USMCAF Santa Ana and USMCHOLF Mile Square, California, Feb 1968, D. J. Lambiotte, AD832160L

The evaluation of the pavements at the U.S. Marine Corps Air Facility, Santa Ana, California, and at the U.S. Marine Corps Helicopter Outlying Field, Mile Square, California is presented. Allowable gross load capacities of the runways, taxiways, parking aprons, etc., are listed for single, dual, single-tandem and dual-tandem wheel assembly aircraft. Allowable gross loads for helicopter-type gear configurations are also given for asphaltic concrete pavements. Results of the evaluation show that at MCAF Santa Ana, Runway 6-24, the main mat, and the outlying helicopter

pads are being overloaded by some of the aircraft currently using the station. At MCMOLF Mile Square, none of the pavements are being overloaded.

N-952
Fiducial Intervals for Differences, Feb 1968, M. L. Eaton, M. F. Shoemaker, W. L. Wilcoxson, AD830056

A recurring problem at NCEL is estimating the accuracy with which noisy phenomena can be analyzed. Such a problem often arises in the laboratory and in the field when measurements of phenomenon of interest are subject to an additive random background. Treated in this Note is the problem of observing a Poisson phenomenon with parameter λ_2 in the presence of Poisson noise, parameter λ_1, so that only occurrences from phenomena with λ_1 and λ_2 equal λ_2 plus λ_1 as parameters are observable in isolation. A fiducial interval for the noise-free λ_2 is derived and discussed. Numerical tables of results are contained in Appendix A. Two similar problems relative to normal phenomena are discussed in Appendices B and C.

N-953
Reaction Forces for Bottom-Fixed Structures Subjected to Water Shock, Jan 1968, J. P. Murtha, W. J. Nordell, AD667720

This report covers the development of a mathematical model for describing the approximate response of a fixed, ocean-based structure to a shock wave. The equation of motion for the structure during the diffraction phase is established on the basis of an approximation to the velocity potential of the fluid. Numerical calculations for a neutrally buoyant structure are presented and indicate that for the degree of restraint considered herein the response in the diffraction phase will be similar to that of a free cylinder. To study the response after flow around the structure has developed fully, applied force was taken to be a function of velocity drag and fluid inertia. The equation of motion is presented, and will provide the basis for planning model experiments.

N-954
Estimation of Transformer Capacity Required to Service Berthed Ships, Apr 1968, R. D. Spencer, D. W. Van Arsdale, AD831709L

Knowing the combinations of ships, by classes, expected to require hotel electrical service simultaneously at a waterfront facility it is desired to select the proper transformer size to meet the demand. Utilizing hourly ampere data solicited from the Atlantic Fleet a kilo-volt ampere requirement for ships in the responding classes is calculated giving a specified small probability of overload. Computer simulation of simultaneous servicing indicates that a demand factor may be applied to the sum of the individual requirements of ships. It is recommended that the Table of Class Requirements (Appendix C) and the Demand Curve (Figure 6) presented here be incorporated into the present transformer sizing criteria.

N-955
A Guide to Short-Cut Procedures for Soil Stabilization With Asphalt, Apr 1968, B. A. Vallerga, AD668699

A guide to short-cut procedures for soil stabilization with asphalt has been prepared primarily for Naval Mobile Construction Battalion Forces in areas where time and the exigencies of field operations preclude the use of the more elaborate procedures and equipment normally employed. For those with considerable experience in asphalt construction, who may feel that simple steps are covered in more than enough detail, we point out that the guide is designed also for use by individuals to whom these procedures may be less familiar. The Navy uses both asphalt and portland cement for soil stabilizing purposes. Use of the latter is covered in Technical Note N-845.

N-956
Airfield Pavement Evaluation, USNOLF San Nicolas Island, California, Apr 1968, D. J. Lambiotte, R. B. Brownie, AD835386L

The evaluation of the pavement at the U.S. Naval Outlying Field, San Nicolas Island, California is presented with the allowable gross load capacities of the runways, taxiways, and parking aprons for single, dual, single-tandem and dual-tandem wheel assembly aircraft. Results of the evaluation show that the asphaltic concrete pavements at the station are overloaded on an infrequent basis only by the heavier cargo-type aircraft using the station. The portland cement concrete pavements at the station are not being overloaded.

N-957
Cooperative Marine Piling Investigation - Phase IIIA - Inspection After Five Years Exposure, Apr 1968, H. Hochman, AD831178L

The Cooperative Marine Piling Committee and the Naval Facilities Engineering Command exposed 54 specially treated piles at Coco Solo Annex, Rodman Naval Station, Canal Zone, and 66 piles at Pearl Harbor, Hawaii in 1963. In November 1966, after 3-1/2 years of exposure, the piles at Pearl Harbor were still undamaged by marine borers. In March 1967, after 4 years of exposure, 8 of the 54 piles at Coco Solo have been attacked by limnoria and one was also attacked by martesia. By March 1968 the piles at Pearl Harbor were still unattacked, but the number of piles at Coco Solo that had been attacked had increased to 18. Sixteen of the piles were damaged by limnoria only, one by martesia only, and one by animals of both genera. Although most of the damaged piles can be classed as controls, 5 of the double-treated piles had initial limnoria attack.

N-958
Hardened Cooling Tower Feasibility Study, Apr 1968, J. A. Norbutas, AD831858L

This report presents a summary of the results of a study conducted to ascertain the feasibility of developing a hardened cooling tower provided blast-resistant fans are available. The study included a literature search, an evaluation of slanting potential, preliminary hardening analyses and conceptual designs. Introductory sections describing pertinent cooling tower and weapons effects loading characteristics have been included in the report. Preliminary cost estimates indicating the magnitude of potential savings are included. It is concluded that, while it is not feasible to slant harden existing conventional units, it would be possible to custom-build hardened or semi-protected cooling towers if blast-resistant fans were available. It is also concluded that spray ponds are inherently much more rugged and, consequently, should be given special consideration for hardened cooling systems.

N-959
Comparison of Concretes Used in Navy Airfield Power Check Facilities, May 1968, W. H. Chamberlin, AD835370L

The in-service performance of 16 concrete power-check facilities located at Navy and Marine Corps Air Stations in the eastern, southern, and western areas of the United States was reviewed, evaluated and related to National Bureau of Standards tests made at the time the facilities were constructed and described in contract reports to determine which type of pavement is the best for power check facilities and if revisions to the specifications are necessary. The facilities used concrete containing dense aggregate and two varieties of lightweight aggregate concrete. Some of the latter consisted of concrete made with portland cement, and some contained high-alumina cement. At 11 of the facilities serious surface defects could be seen. Results indicate that minor changes in the guide specification would be beneficial. Changes are recommended in the standard design as related to location of longitudinal joints and the relocation of embedded items. It is recommended that expanded shale aggregate with high-alumina cement not be used.

N-960
Response to Blast Loading of Gate of Dry Dock 1 of the Long Beach Naval Shipyard, Apr 1968, B. R. Karrh, AD670740

The results of a theoretical study of the response of dry dock gate structures to nuclear blast loads are presented. The gate is transformed into an equivalent spring and mass system with a single degree of freedom and no structural damping. A numerical solution to the equation of motion is used. A step-by-step outline of the damage assessment of a dry dock gate is developed. Methods to determine the mass and the stiffness distributions are included along with the parameters necessary to define the pressure-time curve for explosions in the air. A criterion for determining the amount of damage incurred by a gate is defined as a function of the gate deflection when first yielding occurs.

N-961
Corrosion of Materials in Hydrospace Part IV - Copper and Copper Alloys, Apr 1968, F. M. Reinhart, AD835104L

A total of 1050 specimens of 46 different copper alloys were exposed at two depths, 2,500 and 6,000 feet, in the Pacific Ocean for periods of time varying from 123 to 1064 days in order to determine the effects of deep ocean environments on their corrosion resistance. Corrosion rates, types of corrosion, pit depths, stress corrosion cracking resistance, changes in mechanical properties and analyses of corrosion products of the alloys are presented.

N-962
Nuclear Electromagnetic Pulse Effects Design Parameters for Protective Shelters, Jun 1968, H. A. Lasitter, D. B. Clark, AD837844L

The operation and installation of various protective devices designed to provide power, signal, control and data line immunity from NEMP effects covers one aspect of the Technical Note. In addition, where engineering data has been available on these protective devices, favorable aspects along with inherent difficulties which may arise as a result of their installation are described. Maximum shielding protection from direct radiated or induced NEMP field is obtained using continuous metal surfaces, such as welded steel enclosures. However, a limited amount of protection is afforded by making use of existing structural reinforcement steel (or wire mesh) imbedded in concrete walls, floors and ceilings. Structures designed to reduce the NEMP fields will be degraded when openings are made into the structure. These include ventilation and air conditioning ducts, conduit penetrations, water and gas line entrances, etc. Methods for coping with these penetrations into an NEMP-free or reduced environment are discussed in this Technical Note. Data concerning the magnetic field strengths, the NEMP wave impedance, NEMP frequency spectrum distribution, and NEMP criteria are available to qualified requestors. The addendum is classified SECRET and may be requested from NCEL.

N-962S
Nuclear Electromagnetic Pulse Effects Design Parameters for Protective Shelters (U), Jun 1968, H. A. Lasitter, D. B. Clark, SECRET

N-963
Airfield Pavement Evaluation, USNS Adak, Alaska, May 1968, D. J. Lambiotte, R. B. Brownie, AD835858L

The evaluation of the pavement at the U.S. Naval Station, Adak, Alaska is presented with the allowable gross load capacities of the runways, taxiways, hard stands and parking aprons for single, dual, single-tandem, and dual-tandem wheel assembly aricraft. Results of the evaluation show that both runways and most taxiways and hard stands, with the exception of portland cement concrete Parking Apron 1, are being overloaded by the larger transport aircraft using the station. A visual condition survey of the pavements at the station show that pavement conditions ranged from very poor to good with the average pavement rated as fair to good.

N-964
Removal of Oil From Harbor Waters, Feb 1968, A. L. Scott, S. E. Gifford, AD834973L

Oil spilled on harbor waters is a fire hazard and is aesthetically undesirable. At the present time this oil is removed physically by mechanical skimmers or by manually spread and retrieved adsorbents such as straw, or is treated with chemicals consisting of detergents that emulsify and disperse the oil but do not remove it from the water. This report outlines the physical methods and equipment used at various Navy installations and describes a prototype oil skimmer developed by NCEL. The prototype incorporates many desirable features of existing oil skimmers in a single craft.

N-965
In-Service Performance of Six Barrier Systems on Marine Borer Damaged Wood Poles - Second Inspection Report, May 1968, T. Roe, AD835234L

Five barrier systems for marine borer damaged wood bearing piles and one system for fender piles are being in-service tested at San Diego. The results of a second diver inspection are reported.

N-966
Blistering of Paints in Hydrostapce, May 1968, C. V. Brouillette, AD835233L

If excess water were absorbed or imbibed by paint films during exposure in the deep ocean, too rapid a reduction in hydrostatic pressure upon retrieval could cause blistering of the paint film. Investigation of absorption was made at a pressure equivalent to 6,000 feet of sea water and at ambient laboratory atmospheric pressure. The high hydrostatic pressure was not found to affect blistering or water absorption of paint films.

N-967
Portable Smoke and Gas Removal Unit for Personnel Shelters - Feasibility Study, May 1968, A. S. Hodgson, AD837191L

A feasibility study has been carried out to determine if a portable unit is a practical approach to the problem of removing smoke and gases produced by small fires in personnel shelters. The literature survey revealed that, although air purification in sealed shelters has been thoroughly investigated, no equipment exists which is suitable for this application. It has been found that an appropriate combination of filtration and adsorption elements combined into a single unit will satisfy the requirements. These elements will remove particulate matter, carbon dioxide, carbon monoxide and other toxic gases from the polluted air. However, in view of the assumptions that have been made and the lack of experimental data on some of the elements, it will be necessary to construct and test a prototype unit before a definite conclusion can be reached on the usefulness of the concept.

N-968
Decontamination Unit for Biological and Chemical Warfare, May 1968, A. S. Hodgson, R. S. Chapler, AD837509L

A study has been made of a new system developed to update and improve biological and chemical warfare decontamination equipment. An apparatus was required to meter, mix and disperse five specified solutions in water from separate storage tanks with the relative flow rates of the fluids to be maintained with considerable accuracy. The preliminary development of a unit is described. Fabrication of the unit was not pursued because its weight and cost were large enough to suggest that the five solution decontamination mixture must be further evaluated on a laboratory scale to completely justify the necessity of this equipment.

N-969
The Effects of Polymer Additives on Friction Pressure Drop and Heat Transfer Characteristics of Fluids Under Forced Convection, May 1968, S. C. Garg, AD835621L

A literature survey of the published information on the effects of polymer additives on friction pressure drop and heat transfer characteristics of fluids under forced convection has been carried out. The survey has shown a critical lack of systematic experimental data in both these areas. The existing analytical and semitheoretical predictions were found to be limited to purely viscous non-Newtonian fluids which do not exhibit the complex rheological behavior of the viscoelastic fluids. Absence of significant analytical and experimental work in the published literature was found to be justified due to a lack of understanding of the mechanism of drag reduction and due to the complex, and usually unstable, behavior of viscoelastic fluids.

N-970
Constant Back Pressure Receiver for Ocean Hydraulics, Jun 1968, D. Pal, AD837792L

Hydrostatic pressure of the ocean can be utilized to develop mechanical power to actuate small hydraulic devices for deep sea operations. This can be accomplished by using a constant back pressure receiver as a low pressure sink. This report deals with the various parameters affecting the design of such a device. The analysis has shown that the energy capacity of a 5-ft-diam spherical shaped aluminum 3003 receiver filled with ammonia or evacuated or filled with Freon 114 is about 1 horsepower hour at a depth of 1,000 ft. The analysis has further indicated that by using an aluminum 5454 alloy sphere, it is possible to operate at depths up to 29,000 ft, thereby developing 4 horsepower for as long as 7.8 hr. Other data has been derived for receivers of stainless steel 316 and glass.

N-971
Ocean Areas Where Divers Breathing Mixtures Might Be Regenerated by Gaseous Exchange With Sea Water, Jun 1968, M. P. Vind, N. Underwood, AD838949L

To depths of 50 m, a gaseous exchange process for regenerating breathing mixtures with sea water is almost universally feasible. At such depths the concentration of dissolved oxygen is usually in excess of 4 ml/l, the energy for pumping sea water against ambient pressure is not excessive, and scuba divers do not require helium-containing breathing mixtures. The concentrations of dissolved oxygen are adequate for regenerating breathing mixtures at all depth in the Arctic and Antarctic Oceans and at all but intermediate depths in the Atlantic Ocean. The Pacific and Indian Oceans are rather deficient in oxygen at all but very shallow depths.

N-972
Protection of Floating Pontoons From Corrosion - Part II - Condition of Test Floats After Two Years, Jun 1968, R. W. Drisko, AD837192L

A test program had been initiated to reduce the maintenance costs associated with steel pontoon camel floats. Three 2-coat protective coating systems had been applied to pontoons on three test floats. One test float is cathodically protected with zinc anodes, another with aluminum anodes, and the third float without cathodic protection is serving as the control. After two years of service to the fleet in San Diego Bay, the test pontoon camel floats were all in good condition. No coating damage, other than that caused by abrasion, was noted, and the cathodic protection systems were providing complete protection from corrosion to the underwater portions of the floats.

N-973
A Method for Determining Steady-State Officer Levels in the Civil Engineer Corps, Jul 1968, N. A. Loupp, AD839305L

A computer program which calculates steady-state officer levels based on a 30-year cycle is described. The program calculates the levels based on annual Ensign input, transfer policy, promotion policy, and attrition data. The results are tabulated by grade and years of service.

N-974
Effect of Length to Diameter Ratio of Concrete Cores in Splitting Test, Jun 1968, J. P. Cosenza, J. A. Bishop, AD837421L

Formed concrete cylinders, cylinders cored from concrete slabs, and formed concrete beams were cured and tested to investigate the usefulness of the splitting tensile test in determining the flexural strength of portland cement concrete pavements. Three length-to-diameter ratios of cylinders, three types of bearing pads, and cylinders with and without reinforcing wire were investigated in this study. Test data analysis established that the length-to-diameter ratio which should be used is two (2) and defined an equation for converting splitting tensile strength to flexural strength. Data showed that test results from either formed or cored specimens could be used to indicate flexural strength, that the presence of wire reinforcement had little effect on results, and that the type of bearing pad was of little consequence.

N-975
Cathodic Protection of Mooring Buoys and Chain - Part IV - Additional Field Studies With Cables Providing Continuity, Aug 1968, R. W. Drisko, AD839338L

An investigation was continued into the cathodic protection of a fleet mooring (both buoy and chain) with sacrificial anodes. The zinc anodes used on the ground tackle were specially cast on steel chain links so that they become an integral part of the ground tackle. The tight riser chain secured to the peg-top buoy had the required electrical continuity between adjacent chain links to permit the flow of current, but it was necessary to use a steel cable periodically joined to each of the four ground legs to impart complete continuity to them. On two of the legs the joining was accomplished by silver-soldering and on two by the use of pipe clamps. The system provided full protection from corrosion to the underwater portion of the buoy and to the entire ground tackle. This was determined both by visual inspection and by periodically taking an electrical potential profile. It is estimated from the performance to date that the anodes can provide full protection for five years.

N-976
Advanced Surveying Instruments, Jul 1968, W. J. Pierszalowski, J. C. King, AD838257L

NCEL investigated the latest technological advances in instruments and techniques for surface and subsurface land surveys. The following appeared promising for Navy field forces and are described in this report: (1) electronic distance measuring devices, (2) laser instruments, (3) section meters, (4) seismic timers, and (5) improved conventional instruments. Three improved conventional instruments, an automatic level, a theodolite, and a transit, were purchased and assigned to Mobile Construction Battalion Nine for field tests in Vietnam. Evaluation reports for 9 months show that the equipment has operated satisfactorily with no maintenance or adjustments required. A seismic timer is on order, and plans are to include it in the field test program.

N-977
Performance of Epoxy Coatings on Water-Tank Interiors - Part II - Condition After 2-1/2 Years, Aug 1968, R. W. Drisko, AD839527L

The interiors of four epoxy-coated and one vinyl-coated water storage tanks were inspected 2-1/2 years after application of the epoxy coatings. All proprietary coating systems had some degree of blistering, but all were providing satisfactory protection. The condition of the Plasite 7133 coating system was noticeably better than that of the

other test coating systems. Also described were a treated-water storage tank of very unusual design and corrosion problems that are typical of a bolted water storage tank.

N-978
Surveillance System for Water Storage Tanks, Aug 1968, R. W. Drisko, AD840239L

A surveillance system for monitoring tank-to-water potentials in cathodically protected water storage tanks was fabricated under contract and installed and tested in a tank at CBC, Port Hueneme, California. After very minor modifications the system performed well for a 2-year period.

N-979
Investigation of Fiber Reinforcement Methods for Thin Shell Concrete, Sep 1968, H. H. Haynes, AD676553

Steel fiber and asbestos fiber reinforced mortars were tested to determine their flexural strength. The general objective of the tests was to provide improved tensile strength of cementitious materials for use in thin shell structures. Good flexural behavior was obtained from steel fiber reinforced mortar by using a construction technique that produced very close fiber spacings. Fiber reinforced mortar behaved as a composite material and was analyzed using appropriate modifications of combined action theory. Increases in flexural strength of as much as a factor of 4.5 were achieved with steel fiber reinforced mortar. In addition, significant energy absorbing behavior was also observed. However, it was found that steel fibers did not increase the flexural strength of concrete by any significant degree and that asbestos decreased the flexural strength of mortar.

N-980
A Study of Fire Alarms and Fire Alarm Systems, Aug 1968, D. L. Chaffee, AD842496L

This Technical Note presents the results of a survey and comparative analyses of available types of fire detection systems. It compares signaling systems and the basic means of detection, as well as the sensitivity and response times to fire by-products, lethal gases and vapors typical of combustion environments. These analyses are supported by limited measurements results, but rely heavily on information provided by fire detector system manufacturers. The Technical Note concludes wired-in signaling systems are still much the best from the standpoint of performance and reliability, and that fire combustion products detectors are the best choice for general Navy use. For single family dwelling applications, more economical-detector systems which utilize audible alarms for the signaling system and operate from available power service outlets are recommended.

N-981
Survey of Buildings of Prefabricated, Expandable, Inflatable, or Chemically-Rigidized Types Suitable for Military Use, Aug 1968, P. J. Rush, AD839339L

This Technical Note is compilation of data concerning premanufactured buildings suitable for use in remote deployments. The buildings could be used for personnel housing and services, office and shop enclosures, equipment shelters and storage warehouses. The buildings were intended for easy transport, quick erection, relocatability and resistance to environmental forces. Information is reported as received, no analyses or evaluations were performed.

N-982
Exploratory Studies on the Performance of Selected Paint Systems When Subjected to Gamma Radiation in Simulated Deep Ocean Environments, Aug 1968, L. B. Gardner, A. K. Hanna, AD841102L

A nuclear radiation effects test program was performed on selected paint systems which could be used as protective coatings on radioisotopic power sources exposed in a marine environment. The paint systems were exposed to gamma rays, determined from dose rate measurements by a 4 cm graphite wall ion chamber. The dose rate was held constant over a 3-month exposure of the paint systems simulating a deep ocean environment. No effects of pressure and a relative insensitivity to temperature were observed. No gross chemical changes were found in the simulated sea water solution. Based on a rather limited test and various instrumentation difficulties, an aluminum filled hydrocarbon and an epoxy were most resistant to the combined effects of gamma radiation and simulated deep ocean. This report describes the details of experimental design performance and data analysis. It delineates the limitations under which the above systems might be recommended for use.

N-983
Chemical Treatment of Oil Spilled on Harbor Waters, Aug 1968, T. L. Culbertson, A. L. Scott, AD839558L

Chemicals used to treat spilled oil in harbors are primarily emulsifiers that disperse the oil, rather than remove it from the water. As it requires a minimum of labor and specialized equipment, the chemical emulsifier treatment is often the least expensive method of quickly removing the fire hazard and surface pollution caused by spilled oil. However, as the oil remains in the water it may be harmful to marine life, and this method is, therefore, prohibited in some areas by conservation authorities. In an initial investigation of this procedure, 14 chemical agents were tested by NCEL to determine their effectiveness. Jansolv-60-Degreaser proved to be the most effective, but Gam-O-Sol produced the most stable emulsion.

N-984
Comparative Weathering of Automobile Refinishing Paints, Aug 1968, C. V. Brouillette, AD839967L

Except for initial gloss, the Navy enamel (TT-E-489D Class A) compared favorably with four leading synthetic enamels used in the automotive industry. Lack of initial high gloss was attributed to use of an undercoat, enamel, rust-inhibiting (TT-E-485D) which could not be sanded smooth prior to application of the enamel topcaot. An undercoat having good holdout (primer surfacer, TT-P-6648) is recommended for future investigation.

N-985
Spare Parts Trailer, Aug 1968, J. C. King, AD842564L

The objective of the work covered by this report was to develop a group of trailers suitable for storing essential spare parts required by Mobile Construction Battalions during overseas deployments. These trailers were to be capable of transporting parts to the site, and then functioning as integrated parts distributing facilities immediately upon arrival at the site. From a review of battalion deployment reports and interviews with personnel returned from overseas, NCEL selected the standard military 30-foot, 12-ton semitrailer van for modification as a parts trailer. Three of these vans were procured and two were completely modified for this use. The modifications included the installation of steel storage units along the trailer walls and in the center, a 110 and 220 volt electrical wiring system, a retractable air-conditioning unit, windows, and a personnel access door.

N-986
Airfield Pavement Evaluation, Royal Thai Navy Station, Ban U-Tapao Airfield, Thailand, Aug 1968, D. J. Lambiotte, R. B. Brownie, AD839078L

The evaluation of the pavement at the Royal Thai Navy Station, Ban U-Tapao Airfield, Thailand is presented with the allowable gross load capacities of all airfield pavements for various aircraft gear configurations. Included is a narrative-type pavement condition survey with a defect summary and supplementary photographs.

N-987
Air Revitalization for Sealed Survival Shelters, Dec 1968, D. E. Williams, AD681009

A mechanical unit for shelter air revitalization has been designed. The unit will be used during those periods when a protective shelter is sealed and isolated from the outside world, with no external power supply. The unit will control the chemical environment. That is, add oxygen and remove carbon dioxide and odors. The chemical and mechanical aspects of the development have been resolved. Human factors continue to be an influence, in that unforeseen operational problems may persist and must be accommodated. The design of the unit and the selection of its components was based on evaluation of operational, functional, and economic parameters.

N-988
Comparative Study of Vibratory Rollers, Sep 1968, R. M. Beard, D. J. Lambiotte, T. L. Culbertson, AD841314L

At the request of the 31st Naval Construction Regiment this investigation was initiated to evaluate the capabilities of six different vibratory rollers to compact a range of engineering soils. Each roller was tested on three lift thicknesses of each of the three soils used, a gravel base course, a beach sand, and a sand-clay mixture. Results are presented in the form of density growth curves plotted from density/ moisture determinations made periodically during soil compaction. After completion of the evaluation it became evident that no one vibratory roller is generally superior in compaction results or mechanical features, although several proved superior in specific phases of the evaluation.

N-989
Glass Reinforced Polyester Coatings for Steel in Marine Atmosphere, Sep 1968, C. V. Brouillette, AD843139L

Polyester mterials have been used successfully with fiberglass reinforcing as mastic type coatings for the inside of concrete tanks and for repair of steel tank bottoms. Their use of protective coatings for steel in marine atmospheric exposure was tested and evaluated with and without the glass component. The glass used was either glass flake or fiberglass. It was found that without a suitable rust inhibiting primer the polyester coatings, with or without the glass component, were not satisfactory because of rapid undercutting. However, those polyester coatings containing glass flake were superior to those containing fiberglass.

N-990
Forces Induced on a Vertical Carrier by a Dispersive Wave Train, Sep 1968, D. A. Davis, AD678323

The pressure/force effects induced by an explosively generated dispersive wave train on a vertical barrier were studied in the laboratory. The barrier was in surf 1 on a beach having a 1 to 14 slope. The induced force was found to have two phases: (1) an impact phase, and (2) a slowly varying phase which is mostly hydrostatic. The ratio of peak impact force to maximum hydrostatic force was 3.26. Example problems utilizing the test data are presented. The results suggest that wave-induced impact is most serious for breakwaters and seawalls constructed of several courses of large blocks which rely solely upon friction for shear resistance between courses.

N-991
Reinforced Plastics Laminates Panels - Physical Tests of Panels Removed After the Third Exposure Period, Sep 1968, T. Roe, AD842565

Sets of glass-reinforced epoxy and polyester panels, both coated and uncoated, have been exposed at China Lake and Port Hueneme, California, and at Kwajalein, Marshall Islands. A fourth set is being maintained as a control. Results of physical tests of panels exposed at the three field locations and results of the same tests on control panels are reported. Comparisons of the mean and standard deviations of the tensile strength, compressive strength, flexural strength and flexural modulus of elasticity of the panels are presented. Weather data for the exposure sites are also presented. To date, polyester-glass panels have higher ratings than epoxy glass panels, and panels gel-coated rated higher than panels which were spray-coated.

N-992
Water Vapor Diffusion Through Protective Coatings - Part I - A Method of Measuring Water Vapor Permeability of Coating Films by Radioisotope Tracer Technique and Its Application, Oct 1968, E. S. Matsui, AD843739L

A method of measuring the permeability constant and the diffusion rate of water vapor through a polymer film by the radiochemical method is elaborated. It demonstrates that the radiochemical method, as compared to the ASTM standard method, is precise, sensitive and rapid. The radiochemical method is also useful in the investigation of other parameters which influence permeability of water vapor.

N-993
Sensitivity Analyses of Profitability, Index Computations, Oct 1968, M. L. Eaton, J. A. South, AD844063

Various types of sensitivity analyses are described by using a simple example in which the area of a parallelogram is estimated from imprecise measurements. These types cover a wide spectrum of possibilities, extending from simple to sophisticated. Then all of these types are applied to the estimation of a profitability index for a possible modernization in which three buildings are to be replaced by a single new structure.

N-994
An Intense Noise Generator for Possible Use in Tunnel Clearance, Oct 1968, E. J. Beck, AD843468L

A small pulse jet engine formerly used for heat transfer studies was operated briefly in a section of a model tunnel, the size of which is representative of those found in Vietnam. Because the noise had been a continual problem in doing the original heat transfer research, it was predicted that a larger version might be suitable for tunnel clearance, provided the sound intensity attenuation with distance from the tunnels mouth was not too rapid. Free field tests as well as those in single right angle of a 3x3 ft cross section duct showed that attenuation was not rapid. It was concluded that a larger engine suitably mounted at the tunnel mouth might provide a lightweight, convenient noise source for the intended purpose.

N-995
Comparison of Sliding Plate Microviscometer and Conventional Asphalt Tests, Jan 1969, G. S. Priniski, D. J. Lambiotte, AD845746L

Asphalt deterioration in past years has been studied using the empirical penetration and ductility tests. However, in recent years a sliding plate microviscometer has been developed which is capable of determining the viscosity of asphalts, thus reflecting a fundamental property. In the report an attempt is made to correlate the viscosity of aged asphalts with the empirical conventional asphalt tests. Viscosity test data were compared with penetration and ductility test data for selected aged asphalts from four Navy airfields. Also, one new asphalt was tested.

N-996
McMurdo Ice Wharf - Pullout Strength of Piles, Oct 1968, N. S. Stehle, AD679654

Slightly saline fast ice along the western shore of Winter Quarters Bay, McMurdo Station, Antarctica, has been used as a wharf since January 1964. Progressive damage to this wharf has necessitated design and construction of a protective dock face supported by piles set in the fast ice. To provide data on the resistance of such piles to rapid

pullout and long-term tension loads, model piles set in ice were tested at ice temperatures between -10 and 31°F. Piling for the McMurdo protective dock should be installed as outlined in this report, and the bottom of the dock face should be stabilized against inward movement to minimize rapid-tension loads because of wave action and ship movement. Additional laboratory tests should be conducted on larger structural shaped in both low- and high-salinity ice to broaden the application of structural members in ice and to provide more reliable engineering data for structures anchored in fast ice and sea ice.

N-997
Airfield Pavement Evaluation, NAAS Fallon, Nevada, Nov 1968, D. J. Lambiotte, R. B. Brownie, AD845177

The evaluation of the pavement at the U.S. Naval Auxiliary Air Station, Fallon, Nevada is presented with the allowable gross load capacities of the runways, taxiways, hardstands and parking aprons for single, dual, single-tandem, and dual-tandem wheel assembly aircraft. Results of the evaluation show that both runways and most taxiways, with the exception of portland cement concrete Parking Apron 2, are being overloaded by the larger transport aircraft using the station. A visual condition survey made at the station showed that most portland cement concrete pavements rated excellent, except for Parking Apron 1 which was poor to fair. Asphaltic concrete pavements were poor to good, with the average pavement rating being fair.

N-998
Chemical Heat Source for Wet Suits, Nov 1968, P. J. Hearst, AD844923L

An internal chemical heat source for wet suits, based on the heat of crystallization of a chemical or mixture of chemicals, has been proposed. Initial experiments indicate that this method shows considerable promise, and lithium nitrate trihydrate, M.P. 30°C (86°F), is a good candidate material. The inside of sample suiting containing this material was maintained within a 5-deg range for 50 minutes when immersed in ice water. Preliminary tests with prototype vests have been performed and further investigations are planned.

N-999
Seal Systems in Hydrospace, Phase I - Mechanical Integrity of Flange Seal Systems, Nov 1968, J. F. Jenkins, F. M. Reinhart, AD843582L

Long-term effects of hydrospace on seals and gaskets are under investigation at NCEL. Phase I includes investigation of the mechanical integrity of 15 seal systems by means of tests in pressure vessels. There was no seal extrusion or leakage of any of the configurations investigated. Long-term ocean exposures and cyclic loading of seal systems in pressure vessels are planned.

N-1000
Concrete for Antarctica - Aggregate and Mix Design for McMurdo Area, Dec 1968, J. R. Keaton, N. S. Stehle, AD680017

The ability to mix, cast, and properly cure concrete for use in construction of land-based polar facilities would provide permanency to installations, as well as reduce the quantity of imported construction materials. To determine the feasibility of using portland cement concrete at McMurdo Station, Antarctica, investigations were made of local aggregate materials and of suitable concrete mixes. Based on a field survey and laboratory examinations, it was concluded that sufficient suitable rock is available at McMurdo Station for concrete aggregate. However, it must be adequately crushed to produce sufficient fines for portland cement concrete.

N-1001
Effect of Electrohydraulics on Chemicals in Aqueous Solution, Dec 1968, H. Hochman, AD845927

Electrohydraulics is the phenomena resulting from the discharge of an electrical arc beneath the surface of a liquid. It has been used to rid water of biological contaminants and was tested in this report on three chemical compounds that could be encountered as contaminants in water supplies. The rate of destruction of these chemicals varied with the voltage and capacitance employed, and the amount of destruction increased with an increasing number of discharges.

N-1002
NCEL Underwater Air Supply System, May 1969, D. Pal, C. R. Hoffman, J. C. King, AD687716

This report summarizes the results of a feasibility study and cost effectiveness analysis of the NCEL underwater air supply system. The study was limited to a five-man habitat occupied with a 30-day resupply cycle suitable for depths from 500-600 ft. It is concluded from the study that the system cannot compete (on a cost basis) with other systems, such as those using high pressure oxygen cylinders and lithium hydroxide cannisters, even if the system is used for five men for a period of two years. The volume, weight and power requirements were shown to be greater than those required by other systems.

N-1003
Preliminary Scale-Model Snowdrift Studies - Series II, Dec 1968, F. W. Brier, N. S. Stehle, AD680427

On perennial snowfields, the problem of windblown snow is particularly acute because there is no depletion of the yearly snow accumulation. In an effort to alleviate drift problems, preliminary scale-model drift studies were conducted in a wind duct with a 2-ft-sq cross section, using borax as a snow simulator. This series of tests was directed principally toward developing information on long-duration drift around spheres, hemispheres, cylinders, and multisided shapes. Because of the limited size of the wind duct, the building models were restricted to a scale of 1/100. This, in turn, limited comparison of building heights and sizes. To alleviate this problem, a new 5-ft-wide, 2-ft-high wind duct was designed. Another scaling problem developed because of the lack of field data on snow-accumulation rates with which to compare the laboratory accumulation rate. Preliminary measurements concluded that 3 hours of wind-duct operation simulated 3 years of snow accumulation on the Ross Ice Shelf near McMurdo Station, which has an average annual accumulation of about 1 ft. Additional field measurements are being made to provide information on drift where the annual accumulation is near 1/2 ft and 2 ft.

N-1004
Preliminary Study of the Feasibility of Underground Pressurized Containers, Jan 1969, S. B. Dong, AD684820

A study of a concept for fuel storage containers for protective shelters is reported. It involves the use of a flexible tank together with internal pressurization for improving the resistance to high overpressure loading. The objective of the study was to form a judgment on the practicability of expending further effort on developing methodologies for designing pressurized fuel tanks. To permit forming a valid judgment, a study was made which included a literature survey, a preliminary design of a tank, and an evaluation of the cost of fabrication, erection, and placement of the tank. The tank considered consisted of two 15-ft radius hemispherical heads enclosing a cylindrical section of 30-ft length and 2-in. thickness. The peak value of the dynamic overpressure which was considered was 1,000 psi. The tank was analyzed to determine its deformation, stability and cost characteristics and to determine the amount of internal pressure necessary to preclude buckling. It is concluded that the pressurized container concept

possesses considerable merit from both the structural and economical design points of view and that further developmental effort is warranted.

N-1005
A Potentiostatic Dezincification Study, Jan 1969, N. A. Porte, AD848309L

The objective of this study was to determine the dezincification rate of commercially available valve stems containing varying amounts of zinc. Potentiostatic anodic polarization tests were conducted on copper and four copper alloys in laboratory tap water at 25°C (77°F) and 50°C (122°F) and in 0.5 molar aqueous sodium chloride (0.5M NaCl) at 25°C. These tests suggest that the potentiostatic method is applicable as an accelerated test for detecting susceptibility to de-alloying attack in copper alloys.

N-1006
An Engineering Survey of Alternative Concepts for Pressure Testing Submersibles, Jan 1969, M. J. Wolfe, J. G. Hammer, CONFIDENTIAL, AD847367L

N-1007
Corrosion of DSRV Materials in Sea Water - Three Months Exposure, Jan 1969, F. M. Reinhart, AD682954

A sea water exposure program was initiated to determine (1) the effects of galvanic and crevice corrosion on selected combinations of alloys, and (2) the efficacy of sealing compounds, paint coatings and galvanic anodes for preventing corrosion, crevice corrosion and galvanic corrosion.

N-1008
Corrosion of Materials in Hydrospace Part V - Aluminum Alloys, Jan 1969, F. M. Reinhart, AD683334

A total of 900 specimens of 40 different aluminum alloys were exposed at depths of 2,500 and 6,000 ft in the Pacific Ocean for periods of time varying from 123 to 164 days in order to determine the effects of deep ocean environments on their corrosion resistance. Corrosion rates, types of corrosion, pit depths, stress corrosion cracking resistance, changes in mechanical properties and compositions of corrosion products are presented.

N-1009
Ground Motions From Nuclear Blasts on the Deep Ocean Floor, Engineering Estimates (U), Jan 1969, N. L. Gill, CONFIDENTIAL, AD395749

N-1010
Adsorption of Polymers, Jan 1969, J. B. Crilly, AD848013L

An ellipsometer has been used to study the thickness of films of seven phthalate esters adsorbed onto magnetite, magnetic iron oxides surfaces. Desorption of two of these has been studied. The correlation between film thickness and measurements made on models is very good for all esters tested.

N-1011
Airfield Pavement Evaluation, USNAS Imperial Beach, California, Feb 1969, D. J. Lambiotte, L. J. Wolosznyski, AD849862L

The evaluation of the pavement at the U.S. Naval Air Station, Imperial Beach, California is presented with the allowable gross load capacities of the runway, taxiways, and parking aprons for single, dual, single-tandem, and dual-tandem wheel assembly aircraft. Results of the evaluation show that the runway, most taxiways, and portland cement concrete Parking Apron 1 are being overloaded by the larger transport aircraft using the station. A visual condition survey of the pavements at the station show that pavement conditions ranged from fair to good with the average pavement rated as fair. One 1,000-ft portion of the runway was in very poor condition, however, and was considered at the point of incipient failure.

N-1012
Mixtures of Petroleum and Creosote as Preservatives for Marine Timbers, Jan 1969, N. P. Vind, AD848994L

Mixtures of various petroleum products dissolved in coal tar creosote were evaluated as preservatives for marine timbers. The evaluations were performed with matchstick sized specimens of wood impregnated with the experimental mixtures and exposed in sea water aquaria to the boring activity of Limnoria tripunctata. It was reasoned that it might be economically advantageous to dilute creosote with a low cost petroleum oil if an oxidation catalyst were also added. The latter conclusion was based on only partially substantiated theory.

N-1013
Tunnel Cooling for Byrd Station, Antarctica - 1968 Progress Review, Feb 1969, C. R. Hoffman, AD684788

Byrd Station is an underground facility occupying snow tunnels in the Continental Ice Shelf of Antarctica. An experimental supplementary snow-plenum air-cooling system is being installed in the principal heat-producing tunnel at this station towards maintaining the 0°F design air temperature in this tunnel during summer. Military construction progress on the plenum during the summer of Deep Freeze 68 (DF-68) is presented along with instrumentation of the snow mass over the plenum by NCEL. Transient temperature gradients based on winter temperatures in this snow mass are also presented for the winter of Deep Freeze 68-69. NCEL observations on the Byrd tunnels during the summer of DF-68 are compared with other inspections at Byrd Station. These include air temperatures, ventilation and maintenance problems in both the heat-producing and nonheat-producing tunnels.

N-1014
A Hand Tool Selection Procedure for Navy Construction Battalions, Feb 1969, B. C. Witherspoon, AD850903L

A methodology is developed whereby the most cost-effective hand tools commercially available can be identified, evaluated, and incorporated in the authorized NMCB hand tool allowance. Several tools are evaluated via the methodology illustrated. Essential future program efforts necessary for the optimization of NMCB tool allowance are identified.

N-1015
Marine Corps Divers Backpack/Battery Assembly, Jan 1969, D. Taylor, J. J. Bayles, AD849521L

A divers backpack/battery assembly was developed for the Naval Medical Research Institute for eventual Marine Corps use in shallow water diving. The assembly was a modified MK VIII underwater breathing apparatus backpack with a 28-volt Silvercel battery in a housing mounted in place of the left hand unit of the twin 11.5 liter gas cylinders. A syntactic foam molding was used to offset most of the in-water weight of the battery and housing. The completed assembly weighed 101 lb in air and 4.5 lb in fresh water, and measured overall 30 in. long, 20 in. wide, and 10 in. front to back. The assembly was tested for swimmability, balance, and comfort in the U.S. Naval Construction Battalion Center pool at Port Hueneme. The diver found the assembly satisfactory in all aspects.

N-1016
High Expansion Foam Fire Protection Systems, Feb 1969, A. S. Hodgson, AD682928

An investigation has been made regarding the suitability of high expansion foam fire protection system for use in Naval Shore Facilities. It is concluded that presently

available high expansion foam equipment becomes cost-effective only in special situations. Certain types of storage facilities and remote buildings requiring self-contained systems are typical locations where high expansion foam should be considered for fire protection. New concepts in generator design and development of improved foam concentrates should be examined as this work is anticipated to produce less expensive and more effective systems in the near future.

N-1017
Fourth Annual Evaluation of Exterior Concrete and Masonry Paints, Feb 1969, J. B. Crilly, AD848622L

Eight paints have been exposed for nearly 4 years and their performance evaluated on four masonry surfaces: (1) concrete brick, (2) concrete block, (3) coal cinder block and (4) expanded aggregate block. Three exposure sites, Kwajalein, Marshall Islands, Kaneohe, Hawaii, and Port Hueneme, California, have been used. None of the paints tested is still giving good performance at all test sites on all substrates. Resistance of the coatings to a wind-driven rain test has been investigated.

N-1017S
Supplement to Fourth Annual Evaluation of Exterior Concrete and Masonry Paints, Jan 1974, J. B. Crilly, AD916981L

Because of the unexpectedly poor performance of concrete and masonry test paints based on styrene-butadiene resin and on styrene-acrylate resins as reported in NCEL TN-1017, 1969, the exterior durability of these resins as well as three proprietary coating systems has been studied further during a 3-year exposure test. Styrene-butadiene TT-P-97 and styrene-acrylate copolymer TT-P-1181 systems do not perform well in a severe environment, and show no advantage over TT-P-19 in the milder climate at Port Hueneme. A barium metaborate pigmented acrylic emulsion system appears to be a modest improvement over TT-P-19.

N-1018
Site Survey of the Southern Portion of the San Juan Seamount, May 1969, J. B. Ciani, J. R. Padilla, AD690881

As coparticipants with the Naval Underseas Warfare Center, San Diego in a program to install the transmission end of an interseamount acoustic range, NCEL conducted a site survey of the southern portion of the San Juan Seamount. A detailed topographic chart was developed for the area, underwater photographs were taken, and water and sea floor samples were collected and analyzed. It was found that the surface of the area is irregular and rough. It is volcanic in origin, consisting of vesicular basalt bearing a ferro-manganese coating. The current at depth is judged to be slight - no greater than 1 knot. It is anticipated that unless the biological and chemical environment is materially changed locally by acoustic energy or heat emission from the operation of the installed equipment, no more than normal corrosion or fouling will result.

N-1019
Requirements for Aircraft Protection in Vietnam (U), Feb 1969, W. J. Nordell, CONFIDENTIAL, AD500381

N-1020
Marine Fouling of Acrylic Plastics Pressure Treated With Organo-Tin Compound, Feb 1969, J. S. Muraoka, AD850019L

Clear, transparent acrylic plastics were treated with BIS (Tri-N-Butyltin) oxide (TBTO) under hydrostatic pressure of 3,000 psi and 10,000 psi. In addition, some panels were simply dipped in TBTO. These were tested and evaluated in biologically active water to determine the effectiveness of the treatment against fouling attachment. For comparison purposes, non-treated control panels were also submerged in the sea. The acrylic panels pressure treated with TBTO under 3,000 psi were relatively free of fouling attachment after 9 days exposure. The 10,000 psi pressure-treated panels and control panels were relatively free of marine growth after 18 days exposure. The visibility through the test panels was very good. However, after 30 days submergence, the various pressure-treated, dip-treated and control panels became covered with marine growth. In general, TBTO treatment protects treated panels from fouling attachment only during the early stages of exposure. Application of thin TBTO coating may protect the viewports of submersibles from marine fouling organisms when engaged in short term sea operation (few days). However, TBTO coating may not adequately protect viewports or windows of manned undersea stations from fouling which will be placed on the sea floor for long periods of exposure (several months).

N-1021
Construction Battalion Systems Analysis Model (CB SAM), Feb 1969, G. A. Werle, AD849530L

The Construction Battalion Systems Analysis Model (CB SAM) was developed to rapidly identify the homeporting requirements of mobile construction battalions (MCBs) in terms of required facilities as the number of MCBs varies and as the student base load is allowed to vary. The application of the CB SAM contained in this report was an MCB homeport configuration analysis. This was accomplished by expanding the CB SAM to identify all the costs associated with homeporting an MCB at a CBC.

N-1022
Seal Systems in Hydrospace, Phase II - Cyclic Loading of Flange and Hatch Seal Systems, Mar 1969, J. F. Jenkins, F. M. Reinhart, AD684080

Long term effects of hydrospace on seals and gaskets are under investigation at NCEL. Phase II includes investigation of the effects of cyclic loading on 15 seal systems by means of tests in pressure vessels. Fourteen of fifteen test systems withstood 20 pressure cycles to 5,000 psi without leakage or visible seal damage. Long term ocean exposures of seal systems are planned.

N-1023
Corrosion of Materials in Surface Sea Water After 6 Months of Exposure, Mar 1969, F. M. Reinhart, AD684081

A total of 880 specimens of 215 different alloys were completely immersed in surface sea water for 6 months to obtain data for comparison with deep ocean corrosion data. Corrosion rates, types of corrosion, pit depths, and changes in mechanical properties were determined.

N-1024 - Cancelled

N-1025
Creep and Shrinkage of Reinforced Thin Shell Concrete (Phase I), Mar 1969, J. R. Keeton, AD850016L

This report presents some results of an experimental program to determine creep and shrinkage of thin-shell reinforced concrete. The ultimate objective is to develop relationships that will permit prediction of creep and shrinkage of concrete shell elements or structures in any environment. To accomplish the objective, creep and shrinkage tests are being performed on prismatic specimens of normal weight and also of lightweight concretes. Parameters include variations in each of the following: concrete mix designs, percentage of steel mesh reinforcement, relative humidity, specimen size, and stress-strength ratio.

Data presented in this report enables construction of S/V (ratio of exposed surface area to volume) charts for prediction of creep and shrinkage of full-size, thin-shell members of similar concrete.

N-1026
Effects of Temperature and Pressure on Splash-Zone Compounds, Mar 1969, R. W. Drisko, A. E. Hanna, C. V. Brouillette, AD850612L

Specimens consisting of pairs of sandblasted steel panels were bonded together under sea water with splash-zone compounds (a type of underwater-curing epoxy) and exposed to different environmental conditions of temperature and hydrostatic pressure to determine (1) the effects of these conditions on curing and bonding and (2) whether environmental conditions occurring in the deep ocean might affect bonding strength. Test results indicated that (1) these conditions have little, if any, effect on the bonding strength to steel of cured splash-zone compounds and (2) any effect of pressure on uncured splash-zone compounds would be unimportant, as compared to the adverse effect of low temperatures in the deep ocean in retarding curing.

N-1027
Liquid Distribution Systems - Pipeline for Fuel Transport Over Deep Snow, Mar 1969, V. L. Linton, C. R. Hoffman, AD691251

Aircraft operations in Antarctica and resupply of inland stations require the transport of more than 3,000,000 gallons of bulk fuel annually from storage at McMurdo Station to Williams Field on the Ross Ice Shelf. This has been accomplished by pumping JP-4 aircraft fuel through a temporary surface hoseline crossing annual sea ice and by trucking lower use fuels. A study of permanent fuel-line systems crossing deep snow indicates that an elevated hoseline supported from a steel messenger cable on simple towers is feasible for reducing the man-effort required in placement, recovery and maintenance of a surface-laid system. The elevated system, which can accommodate differential movement in the ice shelf and permits reelevating the line as snow accumulates, requires no new technology but does require field evaluation to determine tower foundation and anchor requirements in deep snow. Based on this study, it is recommended that an experimental section of elevated fuel line be constructed to gain needed data for design and construction of an operational fuel-transport system.

N-1028
Muse Gas Turbine Generator Sets - An Interim Report, Jun 1969, E. J. Beck, AD855773L

The Naval Facilities Engineering Command, in support of the world-wide Naval Shore Establishment, maintains a large number of emergency mobile utility units, including generator sets, air conditioning units, air compressors, etc., which can be called into rapid service if installed equipment or commercial power should fail. In late 1967, NCEL was asked to keep a running account of failures and repairs, and abreast of the developing technology in gas turbines. This report summarizes the operational experience to date, including such history as was available before this study began. The units in the field have not been without trouble, but there appears to be a continuing need for the increased capacity in a trailerable gas turbine plant, which cannot be accomplished with an alternate engine drive or direct conversion technology.

N-1029
Airfield Pavement Evaluation, USNALF Crows Landing, California, Apr 1969, D. J. Lambiotte, J. A. Garcia, AD851933L

The evaluation of the pavement at the U.S. Naval Auxiliary Landing Field, Crows Landing, California, is presented with the allowable gross load capacities of the runways, taxiways, and parking apron for single, dual, and dual-tandem wheel assembly aircraft. Results of the evaluation show that both runways, most taxiways, and the parking apron are not being overloaded by aircraft using the station, with the exception of the P3 and occasional C-130 aircraft operations. A visual condition survey of the pavements at the station show that pavement conditions ranged from poor to excellent with a majority of the pavement rated as very good.

N-1030
McMurdo Ice Wharf - Physical Characteristics and Criteria for Protection, Apr 1969, R. A. Paige, AD687715

Since January 1964, fast ice along the western shore of Winter Quarters Bay near McMurdo Station has been used with a great deal of success as a wharf for ship unloading. Because of the importance of this facility, investigations were begun in Deep Freeze 66 (DF-66) to determine the extent and properties of the ice wharf and to develop criteria for possible protective measures. Based on this investigation, it was concluded that use of the natural ice wharf at McMurdo will be severely curtailed by DF-72 if measures are not taken immediately to prevent further loss of the fast ice. A protective dock has been designed by NAVFAC that will cover the face of the ice wharf to protect the ice from wave action. However, early construction of this dock is essential to prevent further loss of the fast ice. Once protected from wave action and uncontrolled drainage, the internal temperatures of the ice wharf are sufficiently low to prevent any extensive melting and deterioration.

N-1031
Mechanisms Controlling Snow Metamorphism - Preliminary Laboratory Tests, Aug 1969, N. S. Stehle, AD692071

Although processing and compacting increase the density and bearing capacity of snow for use as roads and trails, these processes have not been able to achieve the degree of densification that occurs naturally as snow slowly metamorphoses to glacier ice. A literature review and preliminary laboratory study at NCEL showed that additional experiments are needed to determine the optimum snow temperature range at which processing and compaction are most effective and to determine the load distribution in a snow pavement. In addition, statistical and engineering analyses of the physical properties of natural and processed snow should be conducted using available field data in order to define the stress distribution within a snow pavement.

N-1032
Effectiveness of Zinc Coating on Reinforcing Steel in Concrete Exposed to a Marine Environment, Jul 1969, D. F. Griffin, AD856906L

This investigation was made to determine whether or not galvanized steel reinforcement is more suitable than non-galvanized steel reinforcement in concrete exposed to a marine environment. The criterion of comparative suitability is time-dependent cracking of reinforced concrete walls caused by expansive forces resulting from build-up of corrosion products. From the results of the investigation, the important conclusions are that galvanized steel reinforcement is, at best, no better than non-galvanized steel reinforcement, and air-entrained concrete inhibits corrosion of either galvanized or non-galvanized steel reinforcement compared to non air-entrained concrete.

N-1032 Suppl.
Effectiveness of Zinc Coating on Reinforcing Steel in Concrete Exposed to a Marine Environment, Supplement, Jun 1970, D. F. Griffin

N-1033
High Capacity Blast Valve Development, Jun 1969, D. E. Williams, AD690882

NCEL has developed and tested a series of experimental valves varying in capacity from 700 cfm to 10,000 cfm with 1.0 in. of water-flow resistance. A 2,500-cfm valve evolved after a series of tests with the 700-cfm buckling plate valve. Although the configuration of the larger valve differed from its predecessor, the concept remained essentially unchanged. Experimental work with the 2,500-cfm valve module indicated that a pressure balance across the piston caused the shock catcher to be ineffectual, particularly at low overpressures. Remedial measures included decreasing piston clearance, installing an O-ring seal, and venting the downstream end of the shock-catcher barrel.

Following a series of successful tests, a 10,000-cfm high capacity valve, which consisted of four 2,500-cfm valves in a parallel arrangement within the same housing, was designed and fabricated. The valve was field-tested at Operation Prairie Flat with excellent performance results. The valve closed in 15 msec without damage from the external environment.

N-1034
Water Permeability of Asphaltic Concrete Cores, Jun 1969, M. Tomita, AD856923L

A laboratory water permeameter was used to measure the permeability of asphaltic concrete specimens obtained from Naval and Marine Corps airfields. The resulting coefficients of permeability, K, were compared with some of the physical properties of the asphaltic concrete in an effort to find correlations related to aging of the material.

The test results indicated that wide variations in the K of asphaltic concrete are present between airfields and between specimens taken from a test location which is approximately 2 ft in diameter. For asphaltic concrete pavements which have been seal coated, the value of K is influenced by a thin surface layer. The thickness of the surface layer was not determined by this investigation. However, the results indicate that the water permeability test can be used to evaluate the effectiveness of seal coats. No logical correlation was obtained between mean K values and durability of the asphalt cement or other physical properties of asphaltic concrete. The properties included those which are related to water permeability of soils and to air permeability of asphaltic concrete.

N-1035
In-Service Performance of Six Barrier Systems on Marine Borer Damaged Wood Piles - Third Inspection Report, Jul 1969, T. Roe, AD855924

Five barrier systems for marine borer-damaged wood bearing piles and one system for fender piles are being in-service tested at San Diego. The results of a third diver inspection are reported.

N-1036
Experimental Testing of Several Methods of Detecting Buried Mines Using 14 MEV Neutrons, Jul 1969, J. M. Chapman, T. R. Tree, AD857981L

Three methods of detecting buried non-metallic mines using neutron-induced reactions were experimentally tested. The first method, detecting voids in silicon, was shown to be unfeasible if the mine is covered by 6 in. or more of earth. This is due to the fact that the high activation of silicon very near the surface will hide the radiation from silicon deeper in the earth. If the mine is covered by 3 in. or less of earth, it can be detected by this method. However, the rate of detection would be very slow. The second method, detecting 0.51 MEV gamma rays produced by the N14(N,2N)N13 reactions, was shown to be unfeasible due to the masking by highly activated silicon. The third method, detecting prompt and inelastic scattering gamma rays from nitrogen, is unfeasible due to the massive shielding required to reduce the gamma rays produced by neutrons in or around the detecting crystal.

N-1037
Corrosion of DSRV Materials in Sea Water - Six Months Exposure, Jul 1969, F. M. Reinhart, AD857325L

In order to provide information needed about specific corrosion problems involved with the design of the DSRV, a sea water exposure program was initiated to determine (1) the galvanic and crevice corrosion on selected combinations of alloys, and (2) the efficacy of sealing compounds, paint systems and sacrificial anodes as protective measures. Titanium alloy 6Al-4V and A-286 stainless steel fastened to anodized and painted 6061-T6 aluminum alloy caused the aluminum alloy to corrode galvanically at areas of paint failure. Sacrificial anodes protected alumirum alloys and Type 321 stainless steel from corroding.

N-1038
An Experimental Evaluation of a New Approach to Concrete Overlay Design for Flexible Pavements, Jul 1969, J. P. Nielsen, M. G. Katona, AD856136L

This report is concerned with the design of concrete overlays for flexible pavements. The conventional Westergaard analysis for the design of concrete overlays is reviewed and its weaknesses are enumerated. A review of layered theory indicated that an elastic layered solid approach to overlay design would predict an overlay thickness thinner than that suggested by Westergaard and, thus, it offers a dollar savings in construction costs without a loss in rated load capacity. A field test section consisting of overlays of different thicknesses was constructed and load tested to evaluate the appropriateness of the new theoretical approach and also to verify the assumed failure criterion. The results of the tests indicate that the theoretical approach advanced herein for concrete overlay design is justified. The initial tension cracks occurred at the strain levels expected and, thus, their appearance tended to verify the assumption of the failure mode. The elements of a formal design procedure for concrete overlay for flexible pavements are presented as well as suggestions for additional items of research.

N-1039
Beach Materials Handling, Sep 1969, R. W. Julian, AD860411L

This report considers the application of the large pallet concept to advanced landing craft operations at the surf/beach interface. A large pallet size is selected, various methods for off-loading the pallet are analyzed, and the optimal unloading rate is studied. The results indicate a large pallet 8x9 ft in area, carrying four standard pallets, is most desirable. The best equipment for handling this pallet is a rough terrain forklift. An internal boom on the landing craft is not recommended.

N-1040
Performance of Epoxy Coatings on Water Tank Interiors - Part III -Condition After 3-1/2 Years, Jul 1969, R. W. Drisko, AD857497L

The interiors of four epoxy-coated and one vinyl-coated water storage tank were inspected 3-1/2 years after application of the epoxy coatings. All proprietary coating systems had some degree of blistering, but all were providing satisfactory service. Most of the observed deterioration appeared to be due to either improper coating application or over-cathodic protection. The condition of the Plasite 7133 coating system was noticeably better than that of the other test coating systems. Also described were deterioration and repair problems associated with a bolted steel water storage tank.

N-10[illegible]
The Effect of Coatings and Surfaces on Dropwise Condensation, Jul 1969, S. C. Garg, AD691394

A literature survey of the published information on the effect of coatings and surfaces on dropwise condensation has been carried out. The survey has shown that research to date in promoting dropwise condensation has been limited mostly to small scale laboratory experiments. There appears to be a serious lack of data on methods of application of various dropwise promoters, useful life of promoters, effective concentration, and frequency of promoter renewal. This lack of information is highlighted by the total absence of dropwise condensation as a factor in design of condensers in industry. Recommendations are made to initiate an experimental program to evaluate the effects of vibrating the condenser surface upon dropwise condensation and the coefficients of heat transfer.

N-1042
Corrosion of Iron in 0.5M NaCl - A Rotating Disk Electrode Study, Jul 1969, M. A. Porte, AD859279L

The corrosion of iron was studied in 0.5 molar sodium chloride solution by the rotating disk technique. Limiting diffusion currents were measured in nitrogen-saturated, air-saturated, and oxygen-saturated solutions at rotational speeds of 0, 100, 400, 900, 1600 and 2500 rpm. Corrosion potentials and corrosion rates at the corrosion potential were also determined. The observed limiting diffusion currents showed good agreement with limiting diffusion currents calculated from the Levich theory for the rotating disk electrode. Measured corrosion rates (currents) were found to be lower than the limiting diffusion current, which is explained on the basis of a corrosion product film on the surface of the electrode.

N-1043
Field Study of Fencing Materials in a Marine-Atmospheric Environment -Results of 12 Months of Atmospheric Exposure and 4 Months of Salt Spray Tests, Aug 1969, E. S. Matsui, AD859668L

Thirteen different corrosion-resistant chain-link fencing systems were installed at NCEL to evaluate their performance in a marine-atmospheric environment. These included metallic, plastic-coated and alloy wire fencing. The test fences were inspected periodically and evaluated for performance during and up to 12 months of exposure. Samples of the same fencing materials were also subjected to the salt spray (fog) test to determine if a correlation exists between the results of the accelerated laboratory test and field performance. Material, labor and total installation costs are also presented.

N-1044
Protection of Floating Pontoons From Corrosion - Part III - Condition of Test Floats After Three Years, Aug 1969, R. W. Drisko, AD858830L

A test program had been initiated to reduce the maintenance costs associated with steel pontoon camel floats. Three two-coat protective coating systems had been applied to pontoons on each of three test floats. One test float was cathodically protected with zinc anodes, another with aluminum anodes, and the third without cathodic protection was designed to serve as a control. Two of the three test floats were lost during the past year, and so the third is now kept in a secure area. All three protective coating systems are performing well, and the underwater portions of pontoons continue to receive full cathodic protection from zinc anodes.

N-1045
Cathodic Protection of Mooring Buoys and Chain - Part V - Continued Studies With Cables Providing Continuity, Aug 1969, R. W. Drisko, AD693087

An investigation was continued into the cathodic protection of fleet moorings, both the underwater portion of the buoy and the ground tackle. Sacrificial zinc anodes used on the ground tackle were specially cast on steel chain links so that they became an integral part of the ground tackle. The tight riser chain secured to the peg-top buoy had the required electrical continuity between chain links to permit the flow of current, but it was necessary to use a steel cable woven through the links of each of the ground legs and periodically joined to them to impart complete continuity between links. The cathodic protection system was shown to impart complete protection from corrosion to both the underwater portion of the buoy and to the ground legs, whether the latter were on either a sandy or a muddy bottom. It is estimated that this system can provide such protection for a total of at least five years.

N-1046
Fortran Computation of the Response of an Electrical Filter to an Arbitrary Input, Aug 1969, D. L. Chaffee, R. D. Benning, R. D. Hitchcock, AD694953

This report presents a Fortran IV computer program for calculating the response of an electrical filter to an arbitrary input, e.g., a transient. The program utilizes the fast Fourier transform, which is a time-saving computational technique for transforming a time function to a frequency function (or vice-versa) by means of the discrete Fourier transform. Details are given on the procedure for setting up the card decks, which are used to feed in data on the input waveform and the circuit parameters of the filter. Examples are given, including the case of a hypothetical power-line filter driven by a triangular pulse.

N-1047
Non-Lethal Control of Bird Pests, Aug 1969, M. P. Vind, AD696029

In an investigation conducted at NCEL, chloroacetophenone, commonly known as tear gas, was evaluated as a non-lethal agent to prevent marine birds from roosting and depositing their droppings on mooring buoys, floats, piers, and other waterfront structures. A literature review disclosed that chloroacetophenone is a relatively inexpensive wax-like lachrymator melting at 58°C and boiling at 245°C. It dissolves readily in organic solvents but is almost insoluble in water. Hence it can readily be applied as a surface film which will not readily evaporate or wash away. Masonite panels 8 sq ft in area were coated with chloroacetophenone and placed on the railing of a dock reserved for testing purposes. Control panels free of the lachrymator coating also were placed on the railing. At first the birds seldom roosted on any of the panels. Bread scraps were then placed on the panels and soon after sea gulls became regular visitors even to the lachrymator-coated panels. In similar tests conducted in a field frequented by sparrows and pigeons, hen scratch and bird seed were used as bait. The birds fed with equal vigor from untreated and lachrymator-treated panels.

N-1048
1969 Inspection of Experimental Marine Piling, Sep 1969, M. Hochman, AD859356

The 273 piles at Pearl Harbor, Hawaii, and the 54 piles at Coco Solo, Canal Zone, were inspected during the weeks of 10 Feb and 3 Mar 1969, respectively. Two of the 70/30 creosote-coal tar cooperative piles at Pearl Harbor showed initial limnoria attack after 6 years. Half of those on Coco Solo showed light to moderate damage in the same period of time. None of the double-treated piles were attacked at Pearl Harbor, whereas four of the 12 double-treated piles containing CCA (chromated copper arsenite) were attacked at Coco Solo. None of the double-treated piles containing ACA (ammoniacal copper arsenite) were attacked at either location. The NCEL-treated piles containing creosote solutions, inorganic treatments and double treatments show no signs of borer attack. Twenty-two of the 78 piles treated with xylene solutions or combinations of toxic chemicals have shown either slight limnoria attack, abortive martesia attack or both.

N-1049
First Annual Report of In Situ Test and Evaluation of a Reinforced Plastic Float and Brow - Fleet Landing, San Diego, Oct 1969, J. A. Drelicharz, AD861626L

After 1 year of in-situ test and evaluation, a prototype fiberglass reinforced plastic landing float and brow have performed satisfactorily. The float and brow of a unique glass-wrapped foam plank construction is located at the Fleet Landing Naval Station, San Diego, California. Damage to the installation has been confined to the fendering system and can be considered normal wear for the 160,000 dockings.

N-1050
Power Line Impedance Determination Using the Three Volt-Meter Measurement Method, Aug 1969, H. A. Lasitter, AD694930

One of the problems associated with power line filter specifications is adequate knowledge of the source impedance into which the filter should be designed. In order to establish an average impedance with high and low bounds, a number of measurements have been made at various Navy installations. Results at present indicate that the impedance magnitude extremes lie between 0.47 and 4.7 ohms at a 4 kHz and 4.8 and 68 ohms at 100 kHz. These values are based on data taken at 15 locations at 33 discrete frequencies with a 95% confidence that 72% of measured values be within these extremes. The procedure that was used to determine source impedances utilizes an adaptation of the three voltage method. A known impedance is placed in series with the desired impedance and a measurement voltage, is tuned to the test frequency of interest. The magnitude of the impedance is found by comparison of the voltages across the known and unknown impedances. Phase information is obtained by construction of a vector diagram made up of the voltages measured across the known and unknown impedances and the measurement voltage.

N-1051
Investigation of an Insulating Material for Deep Ocean Habitat Environments, Sep 1969, S. C. Garg, AD694466

For missions requiring saturation dives at depths exceeding 300 ft, a warm and comfortable environment of a habitat is necessary from which divers can make many excursions of limited durations in time. Effective thermal insulation of such a habitat is necessary to reduce the heating power requirements. In the first of a series of test programs reported here, expected habitat conditions for dives at an ocean depth of 600 ft were simulated in a pressure chamber. The test program consisted of determining the effectiveness of 2-in.-thick reconstituted cork board for habitat insulation in an environment of 300 psi helium at 90°F and 70% relative humidity. It was found that at a compression-decompression rate of 2.5 psi/min, the reconstituted cork board was ineffective as a thermal insulation. Based upon these results, recommendations are made to extend the investigation to include other insulating and moisture impermeable materials, and to extend the test program to include deeper diving conditions.

N-1052
Hydrodynamic Response of Ammi Causeway in Surf Zone - VLAP, Jan 1970, J. A. Drelicharz, AD865367L

The results of the tests performed on the lightweight Ammi barge models (scale 1-40), in two-dimensional shoaling waves tend to indicate that a highly buoyant system will respond to the excitation wave by either equaling or exceeding it in amplitude under certain conditions. If the barges are restrained, these motions tend to produce substantial forces against the restraining media, thus resulting in restricted use as a causeway or floating pier. Based on the estimated motion of the end barge with respect to mean sea level or the actual sea water surface, operations which require LST or a ship/barge mating would be significantly restricted if a lightweight, highly buoyant causeway system were to be used.

N-1053
Dynamic Line Force and Oscillatory Motion of a Vessel Being Winched Down in Ocean - Two Computer Solutions, Oct 1969, C. L. Liu, J. A. Drelicharz, AD697275

Two computer programs written in Fortran language have been developed, one to estimate the line force response to waves of a surface buoy with taut mooring, and the other to estimate the oscillatory motions of a submerged vessel moored in an ocean current. A mechanical impedance approach was used to obtain transfer functions of taut buoy mooring systems. Nylon rope was found superior to steel wire rope for reducing the wave-induced dynamic line forces in a selected example. The effect of sub-surface current on the mooring tension, buoy equilibrium position and the frequency of oscillation were calculated by catenary equations and pendulum analogy. The static line force in mooring was found to increase greatly with horizontal current increases.

N-1054
Twenty Years of Progress in Seawater Desalination at NCEL, Sep 1969, A. S. Hodgson, AD859984L

This report contains a history of the seawater desalination work at NCEL and includes the contributions made by NCEL in the development of equipment. Background information is provided for the development of the latest Meco Vapor Compression Distillation Unit which incorporates several new design features suggested by NCEL.

N-1055 - Cancelled

N-1056
Fluidic Devices for Mixing Two Fluids - Feasibility Study, Sep 1969, D. Pal, AD861027L

The current state-of-the-art in fluidic devices having no mechanical moving parts that have potential applications for mixing two fluids has been reviewed. This report is based on an extensive survey of the published literature and information obtained from companies engaged in development of fluid amplifiers. The study covers specific areas such as selection of suitable elements, design procedures, sensors, and transducers, fabrication techniques, and test equipment. Finally, various concepts for mixing two fluids are discussed. It is concluded that the concept of mixing fluids through the use of fluidic devices is feasible. However, their successful application will require further development work. It is recommended that an experimental program to develop suitable fluidic elements be initiated.

N-1057 - Cancelled

N-1058
Airfield Pavement Evaluation, Royal Thai Navy Station, Ban U-Tapao Airfield, Thailand, Dec 1969, D. J. Lambiotte, M. C. Chapman, AD865104L

The re-evaluation of the pavement at the Royal Thai Navy Station, Ban U-Tapao Airfield, Thailand, is presented with the allowable gross load capacities of all airfield pavements for various aircraft gear configurations. Included are a narrative-type pavement condition survey with a defect summary, supplementary photographs, and estimates of remaining runway pavement life.

N-1059
Implosions in Pressure Vessels, Experimental Results, Feb 1970, H. M. Kusano, AD702731

Pressure vessels were subjected to implosion-generated hydrodynamic pressures/impulses. The experimental results indicate the hydrodynamic pressure and the dynamic response of the pressure vessel vary, depending upon (1) model size, (2) implosion pressure, and/or (3) distance from implosion. Graphs showing these relationships are presented. Implosion pressures up to 19,000-psi were obtained. The higher implosion pressures occurred in the 20,000-psi pressure vessel and caused damage to O-rings and mounting facilities inside the pressure vessel, and loosened pipe connections from the top cover plug. High-speed motion pictures showed that the collapse of air cavities was generally asymmetric and inconsistent. The critical model sizes for maximum pressure drop or energy release in pressure vessels were determined. The effects of implosion on pressure vessels can be reduced greatly by filling the test sphere with water.

N-1060
Field Guide for Portland Cement Concrete Construction in Antarctica, Oct 1969, J. R. Keeton, AD8615201.

This Technical Note was prepared for field use by military crews in producing, placing, and curing portland cement concrete in Antarctica under summer temperatures down to 15°F. Since the principal factors are mix control and mix temperature during production and exposed surface temperature control for 3 days following placement, these steps are discussed in considerable detail. The technical information presented in this document is based on field experiments at McMurdo Station, Antarctica, during Deep Freeze 69.

N-1061
The Effect of Geometric Factors in Boiling Heat Transfer Equipment, Oct 1969, A. S. Hodgson, AD690969

The effect of geometric factors in boiling heat transfer has been reviewed. The factors, such as length, rod bundle geometry, bends, obstructions, weld intrusions, have all been found to have some effect on boiling heat transfer coefficients. Empirical correlations are available to predict many of the effects of these factors, but others are virtually ignored. An experimental program is recommended to evaluate the effects of geometric factors on boiling heat transfer coefficients, commencing with an investigation of tube bundle performance with variable geometric parameters.

N-1062
Rigid Body Response of an Elastically-Restrained Cylindrical Deep Ocean Structure to Detonation - Induced Underwater Shock, Nov 1969, N. S. Zwibel, J. G. Hammer, AD8618481.

A workable computer program for predicting peak accelerations and maximum displacements of the structures being considered has been developed. The implications of using the acoustical approximation are explored, and it is concluded that the procedure predicts the peak acceleration, since in all cases of practical interest this acceleration occurs prior to the development of significant viscous drag. A result is obtained for maximum displacement of the structure, which in some cases is an upper bound, but further study is indicated to determine the effect of the perturbation caused by the viscous drag.

N-1063
Airfield Pavement Evaluation, USNAS Olathe, Kansas, Oct 1969, D. J. Lambiotte, L. J. Wolosynski, AD8634101.

The evaluation of the pavement at the U.S. Naval Air Station, Olathe, Kansas, is presented with the allowable gross load capacities of the runways, taxiways, and parking aprons for single, dual, single-tandem, and dual-tandem, wheel assembly aircraft. Results of the evaluation show that each of the two major runways and, to a lesser extent, the major taxiways and original portland cement concrete portions of Parking Aprons 1 and 2, are being overloaded by the larger patrol and transport aircraft using the station. A visual condition survey of the pavements at the station show that pavement conditions ranged from poor to good with the average pavement rated as poor to fair.

N-1064
Splash-Zone, Underwater-Curing, Epoxy Coatings, Oct 1969, R. W. Drisko, AD8530301.

Laboratory studies were conducted on both viscous underwater-curing epoxies (splash-zone compounds), which must be applied by hand, and brushable underwater-curing epoxies. A purchase specification was prepared for splash-zone compounds. These products generally cure well at water temperature above 60°F, but require modification and/or preheating of compounds for curing at temperatures appreciably below 60°F. Presently available underwater-curing brushable epoxies do not have all the desired application and curing properties and, thus, need further improvement before they can be effectively utilized by NAVFAC field activities.

N-1065
Shoe Cleaners for Protective Shelters, Nov 1969, D. Pal, R. S. Chapler, AD8612121.

A study was conducted to determine the suitability of mechanical shoe cleaning devices for removing shoe-borne contaminants from protective shelter personnel. Use of shoe cleaning devices such as Central Vac, Liberty, Ultra-Clean, Neet Kleet, mechanical floor mats and polyurethane foam mats was observed. Cleaning device selection depends on the facility, environmental factors, and degree of usage, but the evaluation study showed that the Ultra-Clean machine with built-in vacuum system is the most desirable shoe cleaning device for normal usage. It is recommended that an appropriate shoe cleaner installation be field-tested to determine its effectiveness relative to Navy requirements.

N-1066
A Study of Power Line Filter Ringing - Filter Modification to Reduce Ringing and Development of a Portable Power Line Pulse Generator, Dec 1969, D. L. Chaffee, F. R. Reinsten, D. R. Clark, AD700917.

This Technical Note presents a description of the development of a small, portable impulse generator for inducing a fast-rising and short-duration voltage pulse on an AC power system. The theory of operation is given along with complete circuit diagrams and construction details. Experimental test results obtained with commercially available AC power filters are included and various applications of the device are discussed. Means of damping power filter ringing are investigated and results presented along with recommendations for improved AC power filter design for applications where isolation from pulse type power voltage modulations is desirable.

N-1067
Skiway for C-130 Aircraft at Palmer Station, Antarctica, Dec 1969, R. A. Paige, AD699155.

Palmer Station, Antarctica, which is located on Anvers Island west of the Antarctic peninsula, has been supported entirely by ice-breakers and cargo ships during the austral summer. A capability for air support would extend this season, improve the movement of essential cargo and personnel, and provide for emergency support. This Technical Note presents the feasibility of establishing a skiway for ski-equipped C-130 aircraft on the Marr Ice Piedmont about 4 miles from the station. It also describes the reconnaissance techniques used in February 1969 to locate the skiway site and safe access route through the marginal crevasse zone between this site and Palmer Station for 1-ton capacity tracked carriers. If the procedures set forth in this Technical Note are followed, the skiway and access route at Palmer Station are safe for operational use. It is also concluded that most Piedmont glaciers in polar regions can be used for ski-equipped C-130 aircraft landings when they meet the air and ground reconnaissance requirements described in this Note for such landings.

N-1068
In-Place Application of Protective Coatings to Sheet Steel Piling, Dec 1969, C. V. Brouillette, R. W. Drisko, AD8648261.

In-place application, curing, and bonding of metalized and catalyzed coatings to sandblasted sheet steel piling above MLW was found to be quite feasible. Only partial success was obtained during field application of coatings underwater to in-place sheet steel piling. More promising coatings and application procedures are under investigation for future field trials.

N-1069
The Effect of System Parameters on the Maximum Bubble Diameter in Saturated Nucleate Pool Boiling of Liquids, Dec 1969, S. C. Garg, AD699528.

A survey of the published literature has been carried out to determine the effects of system parameters on the maximum diameter in saturated nucleate pool boiling of

liquids. The survey has shown the system pressure and the surface tension to be the two most important parameters upon which the maximum bubble diameter depends. Although various other system parameters have also been found to affect the maximum bubble diameter, it has not been possible to predict the effect of these parameters either qualitatively or quantitatively due to a serious lack of systematic experimental data. An analytical expression has been proposed which can be used to convert the measured maximum bubble diameters from narrow, flat heating surfaces into equivalent maximum bubble diameters from a large flat heating surface, for cases where the bubble diameter exceeds the width of the heating surface. Recommendations are made to initiate an experimental program to systematically determine the effects of various system parameters on the maximum bubble diameter.

N-1070
Fire Protection for Advanced Bases, Dec 1969, T. T. Fu, AD865093

A study was made of the fire protection concepts suitable for use on the 40x100-ft Butler-type advanced base warehouse buildings for the ambient temperature range of -65°F to 140°F. It was concluded that automatic detection and extinguishment systems should be provided, but the designs must be based on the first aid principle whereby the fire is knocked down during the incipient stage with a back-up force used to complete the fire extinction. To cover the wide ambient temperature range, it was necessary to divide such automatic systems into three subsystems - detection, extinction, and auxiliaries. Ionization and radiation detectors are recommended for the detection subsystem. High expansion foam and all purpose dry chemicals are recommended for the extinction subsystem. The auxiliary subsystems will consist of items such as a detector-actuated opening for foam generation and drop curtains for warehouse partitioning. Performance evaluation of the proposed subsystems must be made in order to come to specific recommendations. Shock tests were conducted to determine the survivability of the fragile components for the candidate detection subsystem. Two detectors were found satisfactory after being shock-tested in accordance with MIL-STD-810A.

N-1071
Protective Properties of Coatings as Measured by Dew-Cycle Accelerated Weathering, Jan 1970, P. J. Hearst, AD866657L

With a new set of test conditions in an accelerated weathering machine, it was possible to determine protective properties of coatings under conditions of cycling light, heat, and humidity and in a salty environment. This salt-dew-cycle test combines the environment of the dew-cycle weather-ometer and of the underrust test. The scribed panels are periodically dipped in salt water, and increased rusting, blistering, and undercutting at the scribe is thereby obtained.

N-1072
Seal Systems in Hydrospace, Phase III - Effects of Long Term Hydrospace Exposure on Seal System Integrity, 189 Days at 5,900 Feet, Jan 1970, J. F. Jenkins, F. M. Reinhart, AD865361L

Long term effects of hydrospace on seals and gaskets are under investigation at NCEL. Phase III includes the evaluation of 15 seal systems and 5 metallic seal flange materials after exposure to the marine environment for 189 days at a depth of 5,900 ft in the Pacific Ocean. No seal failures due to flange corrosion or seal deterioration were noted. Galvanic anodes reduced flange corrosion. Corrosion-resistant metal overlays prevented flange corrosion.

N-1073
Tunnel Cooling for Byrd Station, Antarctica - 1969 Progress Review, Jan 1970, C. R. Hoffman, AD700938

Byrd Station is located in snow tunnels more than 20 ft below the surface of the Antarctic Continental Ice Cap. The accumulation of heat lost from the buildings and other facilities in the tunnels and summer surface air temperatures to +25°F necessitates supplementary air cooling to maintain the 0°F design air temperature in the tunnels. To accomplish this, an experimental cooling system utilizing the heat sink represented by the surrounding snow field was constructed by military personnel and placed in operation in November 1969. Instrumentation installed by NCEL has conclusively demonstrated the feasibility of this system for cooling undersnow camps, but shows the need for greater capacity if the 0°F target is to be maintained. It is also found that improved air exhaust systems are required in the high-heat-source tunnels to prevent heat buildup in winter and permit independent operation of the plenum-cooling system for conservation and restoration of its cooling capacity. NCEL observations on the Byrd tunnels during the summer of DF-69 are compared with other inspections at Byrd Station. These include air temperature, ventilation, and maintenance problems in tunnels with and without internal heat sources.

N-1074
Test and Evaluation of 2,500 GPD Seawater Reverse Osmosis Unit, Jan 1970, A. S. Hodgson, D. Pal, AD865368L

A two-stage seawater reverse osmosis unit has been operated on a continuous basis to determine the design integrity of the unit and its components, effective service life of the membranes, and optimum cleaning and pretreatment methods. The high operating pressure of the first stage of the unit (1000-1200 psi) combined with the corrosive nature of seawater resulted in many problems. Several first stage modules suffered structural failure, and membrane failures occurred regularly. Corrosion of first stage auxiliary components required repairs to be carried out on a continuous basis after the first few hundred hours of operation. The second stage, operating at a lower pressure (600-700 psi), with less concentrated brine had fewer module failures, and operation was relatively simple. The average effective service life of the membranes has been determined as 750 operating hours, although several modules were ineffective after only a few hours and others were serviceable for longer periods of time. A review of reverse osmosis membrane cleaning procedures was carried out and several methods have been tested.

N-1075
Airfield Pavement Evaluation, USNAS Glenview, Illinois, Jan 1970, D. J. Lambiotte, R. B. Brownie, AD866626

The evaluation of the pavement at the U.S. Naval Air Station, Glenview, Illinois is presented with the allowable gross load capacities of the runways, taxiways, and parking apron for single, dual, single-tandem, and dual-tandem wheel assembly aircraft. Results of the evaluation show that both active runways, both taxiways, and the parking apron are not being overloaded by the aircraft using the station. A visual condition survey of the pavements at the station show that pavement conditions generally ranged from poor to good with the average pavement rated as poor to fair.

N-1076
Airfield Pavement Evaluation, USNALF Orange Grove, Texas, Jan 1970, D. J. Lambiotte, R. B. Brownie, AD866480L

The evaluation of the pavement at the U.S. Naval Auxiliary Landing Field, Orange Grove, Texas is presented with the allowable gross load capacities of the runways, taxiways, and parking apron for single, dual, single-tandem, and dual-tandem wheel assembly aircraft. Results of the evaluation show that both runways, all taxiways, and the parking apron are not being overloaded by aircraft using the station. A visual condition survey of the pavements at the station show that pavement conditions ranged from fair to excellent with the average pavement rated as good to very good.

N-1077
Adhesive Hydrocolloids Secreted by Microscopic Marine Algae, Feb 1970, N. P. Vind, AD867080L

The adhesion of microscopic marine algae to the walls of small containers of sea water has been studied at NCEL. Infrared spectra of extracts and films of algae were analyzed and compared to spectra of known hydrocolloids. The NCEL studies indicate that the gels holding algae together in films are composed primarily of polysaccharide polymers similar to the seaweed hydrocolloids, carrageenan and alginic acid, but that the adhering layer of substance joining algae to foreign surfaces is mostly protein. Like all proteins in their native states, it is also a hydrocolloidal gel. Recognition that adhesive systems of marine fouling organisms are hydrocolloidal gels tells a great deal about their nature and delineates the most logical areas in which to undertake research on methods to prevent attachment of fouling organisms.

N-1078
Ice Construction - Investigation of Accelerated Bottom-Freezing Techniques, Feb 1970, C. R. Hoffman, T. L. Culbertson, AD702732

Methods for thickening and improving the structural characteristics of natural sea ice are needed to advance polar operational capabilities. Surface-flood and bottom-freezing techniques are equally effective for improving floating ice sheets; however, for constructing near-shore grounded ice structures such as piers, docks and causeways at polar coastal bases, the accelerated bottom-freezing technique is more effective. Investigations on accelerated bottom-freezing systems including field tests at Point Barrow, Alaska during the spring of 1969 showed that liquid convection cells have excellent potential for thickening, stabilizing, and anchoring near-shore ice structures. Cells protruding through a natural ice sheet into sea water will produce ice along the entire length of cell with the ice production rate dependent upon the seawater temperature, the prevailing air temperature, and the thickness of the ice mass around the cell. For maximum ice growth, it was found that the cell should be of maximum size congruent with handling equipment and painted white to reflect solar radiation. It was concluded that additional laboratory and field tests should be conducted to improve cell performance and field application.

N-1079
The Turbulent Free Convection Flow Above A Heated Horizontal Circular Plate, May 1970, T. T. Fu, AD707698

The turbulent free convection of air above a 2-ft diameter, heated horizontal plate was studied. The experimental and numerical results are given.

N-1080
Airfield Pavement Evaluation, USNAS Kingsville, Texas, Feb 1970, D. J. Lambiotte, R. B. Brownie, AD869170L

The evaluation of the pavement at the U.S. Naval Air Station, Kingsville, Texas, is presented with the allowable gross load capacities of the runways, taxiways, and parking aprons for single, dual, single-tandem, and dual-tandem wheel assembly aircraft. Results of the evaluation show that all runways, taxiways, and parking aprons are not being overloaded by the aircraft based at the station. A visual condition survey of the pavements at the station show that pavement conditions ranged from poor to very good with the average pavement rated as fair to good.

N-1081
Deep-Ocean Biodeterioration of Materials - Six Months at 6,000 Feet, Apr 1970, J. S. Muraoka, AD869397L

This Note reports the data obtained after exposing metallic and nonmetallic specimens for 6.3 months on the floor of the Pacific Ocean at a depth of 6,000 ft (Test Site I). Preliminary examination of the specimens was made aboard ship, and the final examination, tests, and analyses were performed at NCEL.

N-1082
Jetted-In Marine Anchors, Feb 1970, M. S. Stevenson, W. A. Venezia, AD704488

Twenty-three lightweight anchors consisting of a 10-ft by 2-1/2-in. pipe with a metal cone welded at the tip end were emplaced and tested in 25 ft of water at Lameshur Bay, St. John Island, U.S. Virgin Islands. The anchors were jetted into the coral sand bottom by forcing water through the pipe and out an aperture in the cone. Two divers guided the anchors into the sediment using the jet of water to excavate the soil beneath the cone. Four of the anchors were emplaced with a cement slurry to increase the holding power. It was found that the emplacement procedures were straightforward and posed no problems to the divers. However, the injection of the cement slurry was very time-consuming due to numerous problems. The pullout results and theoretical analysis showed the jetted anchors to be capable of developing 2,000 to 10,000 lb holding capacities in the soil at the test site. The holding capacity may be increased by increasing any of the following - anchor cone diameter (area), emplacement depth, compaction of the overburden sediment, or use of a cement slurry. Tests indicate that the use of these lightweight jetted-in anchors may be of practical use where bottom tie-downs and light anchorages are required. Further testing is recommended.

N-1083
Shock and Vibration Testing - Current Theory and Uncertainties, Mar 1970, H. A. Gaberson, AD867453L

A review of current shock and vibration testing technology, based upon literature study, conferences with testing personnel and shock and vibration experts, and the personal experiences of the author is presented. The technological frontiers of the many aspects of shock and vibration testing are outlined. Those areas of research which would most significantly improve reliability or economy are indicated. The report also indicates those practices and theories which are not based upon fact and necessarily involve uncertainties.

N-1084
Reinforced Plastics Laminates Panels - Physical Tests of Panels Removed After the Fourth Exposure Period, Mar 1970, R. L. Alumbaugh, T. Roe, AD867599L

Sets of coated and uncoated glass-reinforced epoxy and polyester laminate panels have been exposed to the atmosphere at Port Hueneme and China Lake, California, and at Kwajalein, Marshall Islands. A fourth set has been maintained at NCEL as a control. Results of physical tests of panels exposed at the three field locations for periods of 36 to 44 months and results of the same tests on control panels are reported. Comparisons of the mean and standard deviations of the tensile strength, compressive strength, flexural strength and flexural modulus of elasticity of the panels are presented. Weather data from the three exposure sites are also presented for the last exposure period. To date, polyester-glass laminate panels have higher ratings than epoxy-glass laminate panels, and panels gel-coated rated higher than panels which were spray-coated. Also panels exposed at China Lake rated higher than those exposed at Kwajalein or Port Hueneme.

N-1085
Response of Rock Inclusions to Air Blast, Jun 1970, R. J. Odello, AD872810L

Three instrumented granite rocks were buried at 2-, 3-, and 4-ft depths at the 78-ft range from ground zero in the 100-ton AN/FO (ammonium nitrate-fuel oil) test conducted at the Defence Research Establishment Suffield (DRES), Ralston, Alberta, Canada on 28 August 1969. The test was part of a study to access the vulnerability of buried cables to damage by rock inclusions in soil. The objective of the test was to provide field data on the relative displacement due to air blast between rock inclusions and the surrounding soil and to compare these data with the results of available theories. Results showed that the peak surface overpressure

was 515 psi and the maximum relative displacements of the rocks were 0.90, 0.20, and 0.40 inches at the 2-, 3-, and 4-ft depths, respectively. The small relative displacement of the 3-ft deep rock was caused by soil arching over the rock; for the other rocks the theories predicted relative displacements within 40% of the measured values. These findings led to the conclusion that a theory developed by L. W. Heller at NCEL provides, with minor modifications, a simple and conservative method for predicting relative displacements of rock inclusions near buried cables. Based on this theory, a criterion is recommended for the thickness of sand and other cushion required to avoid penetrations of the cable by rocks in the adjacent field.

N-1086
Airfield Pavement Evaluation, USNAS Guantanamo Bay, Cuba, Apr 1970, D. J. Lambiotte, R. B. Brownie, AD869376L

The evaluation of the pavement at the U.S. Naval Air Station, Guantanamo Bay, Cuba, is presented with the allowable gross load capacities of the runways, taxiways and parking aprons for single, dual, single-tandem, and dual-tandem wheel assembly aircraft. Results of the evaluation of McCalla Hill Field show that the runway and taxiways are not being overloaded by aircraft using the field. The 6-in.-thick portion of the portland cement concrete parking apron is being overloaded by C54s operating at maximum gross weight. The evaluation of Leeward Point Field shows that the runway, taxiways, and Parking Apron 1 are slightly overloaded by C124 and C141 aircraft operating at maximum gross weight. Parking Apron 2 is overloaded by most aircraft using the station. A visual survey of the pavements at the station show that pavement conditions at McCalla Hill Field range from very poor to excellent and at Leeward Point Field from poor to excellent.

N-1087
Sealab III - Divers Isotopic Swimsuit-Heater System, May 1970, J. J. Bayles, D. Taylor, AD708680

The Atomic Energy Commission and the Deep Submergence Systems Project Office included the development and evaluation of an isotopic swimsuit heating system in the Sealab III Program to demonstrate a use of atomic energy as a method for providing supplemental heat to divers. The task of developing a swimsuit heating package was assigned to NCEL. The package utilizes AEC furnished plutonium 238 capsules for heating water which is pumped through a closed cycle system including a diver's undergarment fitted with closely spaced plastic tubing. The diver wears a wet suit over this undergarment to aid in retaining the heat provided. The package or isotope heater shell segment is designed to be attached to a modified Mark VIII mixed gas breathing apparatus backpack. The specifications, based upon available information at the time of initial development stages, did not provide for sufficient isotope to produce adequate supplemental heat. However, the final design did not materially affect the diver's capabilities, and the system was successfully tested with respect to its design operational characteristics.

N-1088
Airfield Pavement Condition Survey, USMCALF Camp Pendleton, California, Apr 1970, D. J. Lambiotte, AD871580L

The results of a condition survey of the airfield pavements at the U.S. Marine Corps Auxiliary Landing Field, Camp Pendleton, California, is presented. The survey established statistically based condition numbers (weighted defect densities) which were direct indicators of the condition of the individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and study of the requirements for future pavement evaluation efforts.

N-1089
Airfield Pavement Condition Survey, USMCAS El Toro, California, Apr 1970, D. J. Lambiotte, AD871576L

The results of a condition survey of the airfield pavements at the U.S. Marine Corps Air Station, El Toro, California, is presented. The survey established statistically based condition numbers (weighted defect densities) which were direct indicators of the condition of the individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts.

N-1090
Thermal Analysis of Above-Ground Liquid Distribution Systems (Utilidors) for Polar Application, May 1970, C. K. Smith, AD707695

In polar regions, service distribution pipes for water, sewage, and heating present special problems because they cannot be buried in the normal manner. One solution to this problem is to install an above-ground utilidor, which consists of a thermally insulated box-like structure through which the service lines run. One or more of the service lines provides the source of heat necessary to avoid freezing of all the other lines. This Technical Note presents a general analysis and resulting computer program suitable for prediction of the thermal performance of various multi-pipe utilidor designs over a wide range of boundary conditions. The computed results are shown to compare favorably with experimental data for a particular design. The computer program is described, and sample calculations are presented.

N-1091
Nuclear Electromagnetic Pulse Protective Measures Applied to a Typical Communications Shelter, Apr 1970, H. A. Lasitter, D. B. Clark, AD707696

A detailed study of a typical communication facility has been made to determine the requirements for the installation of nuclear electromagnetic pulse (NEMP) protection measures. Necessary hardening measures have been determined on the basis of a single point failure analysis and the assignment of priorities to the various systems and components encountered. Protective measures have been applied to power control and signal lines entering and within the complex as well as to electrically powered life support systems. NEMP hardening techniques and methods have been applied to non-electrical shelter penetrations as necessary and other applicable areas within the facility such as non-strategic lines, grounding systems, and cable routing. Updated protective measures and NEMP hardening design parameters are provided in the Appendix, including new techniques of inductively loading long shelter penetrating conductors to more effectively remove conducted pulses.

N-1092
Zinc Rich Organic Coating Systems Exposed to a Marine Atmosphere, May 1970, C. V. Brouillette, AD871186L

Zinc rich epoxy coatings, with and without topcoats, were exposed to marine atmospheric environments at Kwajalein, Marshall Islands, Kaneohe Marine Corps Air Station, Kaneohe, Hawaii, and Port Hueneme, California, for periods up to 3 years. These coatings were found to be excellent coatings for protecting steel in marine atmospheric environments. The alkyd enamel, TT-E-489C, applied directly over the zinc-rich epoxy and topcoated with a silicone alkyd proved to be the best topcoat system. A modified Navy Saran coating containing 5 lb of zinc dust per gallon of coating gave excellent protection to steel in marine atmospheric environments.

N-1092S
Zinc-Rich Organic Coating Systems Exposed to a Marine Atmosphere - Three-Year Exposure of Zinc-Rich Saran, Mar 1971, C. V. Brouillette, AD883682L

Three-package or two-package zinc-rich epoxy coatings, with or without topcoats, and a zinc-filled modified Saran (5.3 lb of zinc per gallon), with or without a modified Saran topcoat, will give long term protection to steel in a marine atmospheric environment.

N-1093
Feasibility of Plastic Piling in the Marine Environment, May 1970, J. A. Drelicharz, AD871404L

Plastic pilings are economically feasible in specific problem areas where the longevity of standard wooden structures is short since plastic piles possess a potential energy absorption in excess of 1000% of wood of comparable size. Such pilings are within the state-of-the-art provided existing materials can withstand the marine environment.

N-1094
The Spherical Acrylic Pressure Hull for Hydrospace Application - Part III - Comparison of Experimental and Analytical Stress Evaluations for Prototype NEMO Capsule, Mar 1970, H. Ottsen, AD709914

A comparison is presented of results obtained from analytical and experimental stress analyses of the NEMO pressure hull (an acrylic submersible with steel polar penetrations). The general procedures of the analytical investigation are reviewed and the assumptions stated. Excellent agreement between the two sets of results was observed for the acrylic portion of the hull. Due to the severe structural simplification necessary in the analytical simulation of the steel polar penetrations, discrepancies were noted in the two sets of stresses obtained in these regions; general trends were, however, similar. It was concluded that the acrylic-to-steel transitions incorporated in the prototype design provide an optimum transfer of load without inducing a concentration of stresses.

N-1095
Airfield Pavement Condition Survey, USNAS Brunswick, Maine, May 1970, D. J. Lambiotte, AD871644L

The results of a condition survey of the airfield pavements at the U.S. Naval Air Station, Brunswick, Maine, are presented. The survey established statistically based condition numbers (weighted defect densities) which were direct indicators of the condition of the individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station pavements, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts.

N-1096
Corrosion of DSRV Materials in Sea Water - 12 Months Natural Exposure and 98 Cycles in Pressure Vessels, May 1970, F. M. Reinhart, J. F. Jenkins, AD871192L

In order to evaluate specific corrosion problems involved in the design of the DSRV (Deep Submergence Rescue Vessel), a corrosion test program was initiated to determine: (1) the effects of galvanic and crevice corrosion on selected combinations of metals, and (2) the efficacy of selected paint coatings, sealing compounds and galvanic anodes for mitigating corrosion, crevice corrosion and galvanic corrosion. Composite specimens representative of proposed DSRV construction materials and methods were exposed for 370 days at mean tide level in sea water and to cyclic exposure to pressurized sea water. This report presents an evaluation of these composite specimens after exposure.

N-1097
Airfield Pavement Condition Survey, USMCAS (H) New River, North Carolina, May 1970, D. J. Lambiotte, R. B. Brownie, AD872326L

The results of a condition survey of the airfield pavements at the U.S. Marine Corps Air Station (Helicopter), New River, N.C., is presented. The survey established statistically-based condition numbers (weighted defect densities) which were direct indicators of the condition of the individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts.

N-1098
Test and Evaluation of Boiler and Water Heaters, Jun 1970, S. C. Garg, R. S. Chapler, AD871566L

A 20-hp Steamaster boiler, a 2100-gph Patterson-Kelley water heater, and a 1300-gph Rite packaged hot water generator were subjected to a laboratory test and evaluation program to establish their performance and to evaluate their suitability for Naval use. The test program consisted of continuous tests of each unit for 6 days at full load, tests at intermittent operation of each unit, and the effect of a step load change upon the temperature of hot water output. This report details the findings of the test program. Recommendations are made to alleviate the problems encountered during the tests.

N-1099
Taut Guideline for Ocean Load Handling System, Experimental Results, Jun 1970, H. M. Kusano, C. L. Liu, AD709601

Load suspension tests were conducted in approximately 1,000 ft of water to determine the feasibility of using a single taut guideline system to lower and position objects on the seafloor. Concrete spheres attached to a synthetic line were guided along a taut wire rope to various depths. A spacer bar was used to maintain constant distance between the test load and the guideline and to prevent line entanglement. During the tests, dynamic stresses in the load line and guideline, vertical acceleration of the ship, current speed and direction, load inclination, and load rotation about the taut line were measured. The results indicate that a single taut guideline system can be used in relatively calm waters to position objects on the seafloor repeatedly around the guideline anchor at a radius equivalent to the spacer length. During the tests, entanglement between the guideline and load line was not encountered. Dynamic stresses in the guided load line were similar to those of the unguided system.

N-1100
Airfield Pavement Condition Survey, USNAS North Island, California, May 1970, D. J. Lambiotte, L. J. Woloszynski, AD871645L

The results of a condition survey of the airfield pavements at the U.S. Naval Air Station, North Island, Calif., is presented. The survey established statistically based condition numbers (weighted defect densities) which were direct indicators of the condition of individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station pavements, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirments for future pavement evaluation efforts.

N-1101
Naval Forces Amphibious Assault Bulk Fuel System (AABFS) - Lightweight Pipe, May 1970, J. J. Traffalis, AD870970

The requirement exists to improve the efficiency of logistic support systems employed during the amphibious assault and follow-on assault operations. New materials become available, which, if properly used, could greatly improve the operational effectiveness of the system.

This report documents the results of an investigation made to determine the potential improvements possible from the use of lightweight aluminum or fiberglass reinforced plastic pipe in the 600 gpm bottom-laid AABFS. Findings of the investigation indicate that the operational and logistic problems resulting from the requirement for counterweighting or anchoring of the lightweight pipe will nullify any potential improvements to be gained from its use in the 600 gpm bottom-laid AABFS.

N-1102
Airfield Pavement Condition Survey, USMCAS Cherry Point, North Carolina, May 1970, D. J. Lambiotte, AD873008L

The results of a condition survey of the airfield pavements at the U.S. Marine Corps Air Station, Cherry Point, N.C., is presented. The survey established statistically based condition numbers (weighted defect densities) which were direct indicators of the visual condition of the individual asphaltic concrete and portland cement concrete airfield pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station pavements, compilation of data on current aircraft traffic and aircraft types using the station, and a study of the requirements for future pavement evaluation efforts.

N-1103
Airfield Pavement Condition Survey, USNAF El Centro, California, May 1970, D. J. Lambiotte, L. J. Woloszynski, AD873043

The results of a condition survey of the airfield pavements at the USNAF El Centro, Calif., is presented. The survey established statistically based condition numbers (weighted defect densities) which were direct indicators of the condition of the individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts.

N-1104
Airfield Pavement Condition Survey, USNAS South Weymouth, Massachusetts, Jun 1970, D. J. Lambiotte, L. J. Woloszynski, AD873009L

The results of a condition survey of the airfield pavements at the USNAS South Weymouth, Mass., are presented. The survey established statistically based condition numbers (weighted defect densities) which were direct indicators of the condition of the individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station pavements, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts.

N-1105
Deep Ocean Exposure of Zinc-Rich Organic Coatings on Steel, Jun 1970, C. V. Brouillette, AD872294L

Zinc-rich organic coatings, with and without topcoats, were exposed at a 6000-ft depth in the Pacific Ocean for 6 mo duration. Two air-dried zinc-rich epoxies, without topcoats, and one of these with an air-dried epoxy topcoat, blistered during the 6 mo of exposure. In contrast zinc-rich catalytically cured epoxies, with or without catalytically cured epoxy or coal-tar epoxy topcoats gave excellent protection to steel test panels. Also, a zinc-filled modified orange saran gave excellent protection to steel panels for 6 mo in deep ocean. Modified white saran topcoats did not improve the protection given by the zinc-filled modified orange saran.

N-1106
Signal Recovery Studies of Solid-Borne Acoustic Emanations (U), Jun 1970, R. D. Benning, D. L. Chaffee, SECRET (not available for distribution)

N-1107
Chemical Overlays for Seafloor Sediments, Jun 1970, T. Roe, Jr., J. S. Williams, N. J. Migliore, AD874577L

Various materials and methods have been investigated to control the turbidity caused by the disturbance of seafloor sediments. The method selected as the most promising consists of the formation of a plastic film by extruding over the sediment a solution of a water-insoluble resin and plasticizers in a water-soluble solvent.

A formulation has been developed, and pilot model equipment to dispense it has been designed, fabricated, and is being evaluated.

N-1108
Heat of Crystallization as a Heat Source for Divers, Jun 1970, P. J. Nearst, AD873143L

The heat of crystallization, which is given off by a molten chemical when it solidifies, is a convenient source of heat for divers exposed to cold water. The most promising concept is a chemical heat source placed inside of wet-suiting material. Lithium nitrate trihydrate, which crystallizes at 30C (86F), appears to be the best chemical for this purpose. Experimental mittens containing a 1/2-in. layer of this material provided 2 hr of protection in ice water.

A chemical heat source based on the heat of crystallization is also a potentially practical method of providing emergency heat to divers in personnel transfer capsules. Such heat could be provided by chemicals in panels placed on the walls of the habitat or by a chemical heat source contained in a cannister.

N-1109
Full-Scale Load Tests of MACV Annex Building, Jun 1970, W. A. Keenan, R. C. Elstner, AD876124L

The structural safety of the existing MACV Annex Building, Ton Son Nhut, Republic of Vietnam, was evaluated from full-scale load tests. The load tests were conducted in accordance with Chapter 2 of the ACI Building Code (318-63) for service live loads of 50 and 80 lb/sq ft. Seventeen load tests, involving 11 different patterns of uniform load, were applied to the second and third floors of two bays. Loads were applied by 24 hydraulic rams which pushed down on 23 whiffle trees on the floor and reacted against 24 water-filled Navy pontoons set on the first floor. Instrumentation included deflections at 25 locations and strains in steel and concrete at 46 locations, including slabs, beams, girders, columns, and bar joists. The load tests showed that the building is safe under service live loads of 50 psf if steel shims are placed on steel T-columns. For service live loads of 80 psf, the building is safe if the timber beams are removed, cambered, and rehung with additional hangers. Bar joists, hung under corridor beams, carry about 10% of the beam load but are not necessary for the floors to safely carry live loads of 100 psf in the corridor and 80 psf in other bays.

N-1110
Airfield Pavement Condition Survey, USNWL Dahlgren, Virginia, Jun 1970, D. J. Lambiotte, L. J. Woloszynski, AD873104L

The results of a condition survey of the airfield pavements at the U.S. Naval Weapons Laboratory, Dahlgren, Virginia, is presented. The survey established statistically based condition numbers (weighted defect densities) which were direct indicators of the condition of the individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts.

N-1111
Insertion Loss and Pulse Response of Power Line Filters, Jun 1970, D. L. Chaffee, D. B. Clark, AD711317

This report presents the results of test and evaluation of commercially available AC power filters, and examines the filter pulse response in light of its measured and calculated pass band characteristics. The power line source impedances encountered in insertion loss measurements have been measured and modeled by an equivalent circuit. A coaxially shielded bench set-up for convenient insertion loss measurement of power filters utilizing the NCEL current injection probe method was devised. The insertion loss and pulse response have been determined theoretically and compared with experimental measurements for some unique filters designed to prevent inductor saturation. The effects of resistive damping to improve a power filter's pulse response have been investigated, and recommended damping techniques presented. The effect of varying the load power factor upon the resistive damped filter performance has been determined.

N-1112
Evaluation of Underwater Welding and Cutting Equipment Available in 1969, Jun 1970, T. L. Culbertson, W. H. Beard, AD873856L

A market and users survey and comparative tests on commercially available and Navy standard underwater welding and cutting equipment were conducted to determine the most suitable presently available equipment for Navy underwater salvage operations. This investigation confirmed that low weld ductivity and the inadequacy of arc-welding equipment prevent, in that order, general acceptance of this system for underwater construction welding. While all of the arc-oxygen underwater cutting torches available in 1969 needed improvement for effective and safe utilization in Navy underwater salvage, the comparative tests showed that any of the available production-model commercial torches would provide a slightly better torch than the present Navy standard torch. For immediate improvement in Navy underwater salvage operations it is recommended that the present Navy standard torch be replaced with a commercial torch. Development of an advanced arc-oxygen underwater cutting system is recommended for medium-range improvement.

N-1113
The Spherical Acrylic Pressure Hull for Hydrospace Application, Part II - Experimental Stress Evaluation of Prototype NEMO Capsule, Oct 1970, J. D. Stachiw, K. L. Mack, AD715772

The prototype 66-in. diameter spherical hull of NEMO (Naval Experimental Manned Observatory) with 2.5-in. wall thickness has been subjected to a series of hydrostatic tests under simulated hydrospace environment to determine its structural integrity. After repeated long term and cyclic tests in the 220 to 2400-ft depth range, the hull was tested to implosion at 4150 ft. The magnitude of strains measured on the hull during cyclic and long term loadings, as well as the short-term implosion depth of 4150 ft indicate that the hull satisfies the 1000 ft design depth requirement and can be without any further tests incorporated into any man-rated system approved for operation in the 0- to 600-ft depth range.

N-1114
Allocation of Maintenance Funds, Navy Family Housing, Nov 1970, J. A. South, AD715617

This report covers an investigation at activity level of the causes of operation and maintenance (O&M) problems. Direct investigation in the field showed that major O&M problems with Navy family quarters are common to all activities, but because of established policies, the local housing manager has little control over factors causing maintenance problems. A higher level study of life cycle costs of family housing is recommended. By using regression analysis, those factors which best measure O&M requirements were determined. Work sheets are derived which can be used to forecast O&M fund requirements, to make an equitable distribution of O&M funds, and also to measure effectiveness.

N-1115
In-Service Performance of Six Barrier Systems on Marine Borer-Damaged Wood Piles - Fourth Inspection Report, Aug 1970, T. Roe, Jr., AD874578

Five barrier systems for marine borer-damaged wood bearing piles and one system for fender piles are being in-service tested at San Diego. The results of a fourth diver inspection are reported.

N-1116
1970 Inspection of Experimental Marine Piling, Jul 1970, H. Hochman, AD873228L

The 54 cooperative piles at Coco Solo, Canal Zone, and the 273 cooperative and NCEL experimental piles at Pearl Harbor, Hawaii, were inspected during the weeks of 9 and 23 Mar 1970, respectively. After 7 yr of exposure at Coco Solo, 9 of the 12 piles treated with creosote-coal tar showed borer attack of varying degrees of severity. Only minor attack was noted on 2 of the 18 dual-treated piles. None of the cooperative piles at Pearl Harbor was attacked by borers after 7 yr but 33 of the 207 NCEL experimental piles showed attack by one or more martesia after 3-1/2 to 6 years. Some were also attacked by limnoria. The most severely attacked piles were those treated with CCA-Type B, chromated copper arsenate, by a commercial treater.

N-1117
Operational Testing of Causeway Connection Systems for the 20-Knot LST, Aug 1970, B. R. Karrh, AD874594L

The introduction of the new 20-knot (class 1170) LST into the Fleet required the development of a causeway connection system for off-loading cargo over the bow ramp. Two connection systems, the abutment connection and the stand-off connection, were developed. The operational tests of the connection systems with the USS NEWPORT, LST 1179, are described in this report. It was found that the bow anchor system used with the stand-off connection presents handling problems with existing Amphibious Construction Battalion equipment. With the original abutment connection, the ship had difficulty maneuvering its bow into the central V-notch of the abutment fender after making initial contact with the fender. To aid the ship in positioning its bow, a modified abutment fender with sides sloping toward the central notch was constructed and tested. The modified fender performed well during tests and is the likely basis for a future prototype fender design. The development of an operational abutment connection is recommended.

N-1118
Airfield Pavement Condition Survey, USNAS Lemoore, California, Aug 1970, D. J. Lambiotte, L. J. Woloszynski, AD875388L

The results of a condition survey of the airfield pavements at the U.S. Naval Air Station, Lemoore, Calif., is presented. The survey established statistically based condition numbers (weighted defect densities) which were direct indicators of the condition of the individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts.

N-1119
Airfield Pavement Condition Survey, USNAF Johnsville, Pennsylvania, Aug 1970, D. J. Lambiotte, L. J. Woloszynski, AD875374L

The results of a condition survey of the airfield pavements at the USNAF Johnsville, Pa., is presented. The survey established statistically based condition numbers (weighted defect densities) which were direct indicators of the condition of the individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts.

N-1120
Airfield Pavement Condition Survey, USNAS Moffett Field, California, Aug 1970, D. J. Lambiotte, R. B. Brownie, AD875508L

The result's of a condition survey of the airfield pavements at the U.S. Naval Air Station, Moffett Field, Calif., is presented. The survey established statistically based condition numbers (weighted defect densities) which were direct indicators of the condition of the individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts.

N-1121
Operational Testing of the Mexeflote Lashing and Launching System for Pontoon Causeways, Aug 1970, R. R. Karrh, J. J. Traffalis, AD874579L

The operational tests with a new system (Mexeflote) for the lashing and launching of causeways to a landing ship tank (LST) are described. The Mexeflote system was developed originally for the NL pontoon causeway system. At the request of the Naval Facilities Engineering Command (NAVFAC), the operational tests were conducted in conjunction with the operational evaluation of the 22-ft-wide ammi causeway. Since the alternate causeway system lashing requirements differed from the NL pontoon system, the operational data should be evaluated in this context. It was demonstrated that the Mexeflote system was feasible, but that operational handling of some of the components was difficult in a seaway. By extrapolation, some of the results may be related to the NL pontoon causeway system.

A comparison of the Mexeflote and controlled launch systems indicated the former to be more effective operationally. However, from a cost-effectiveness viewpoint, controlled launch appears superior for existing ships because of the high cost for ship modification required for the Mexeflote system. It is recommended that the Mexeflote or a similar system be considered in future LST design.

N-1122
Airfield Pavement Condition Survey, USNAS Miramar, California, Aug 1970, D. J. Lambiotte, R. B. Brownie, AD875382L

The results of a condition survey of the airfield pavements at the U.S. Naval Air Station, Miramar, Calif., is presented. The survey established statistically based condition numbers (weighted defect densities) which were direct indicators of the condition of the individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts.

N-1123
Airfield Pavement Condition Survey, USNAAS Fallon, Nevada, Aug 1970 D. J. Lambiotte, R. B. Brownie, AD875355

The results of a condition survey of the airfield pavements at the U.S. Naval Auxiliary Air Station, Fallon, Nevada, is presented. The survey established statistically based condition numbers (weighted defect densities) which were direct indicators of the condition of the individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts.

N-1124
Animal Undermining of Naval Seafloor Installations, Aug 1970, J. S. Muraoka, AD715618

In-situ foundation performance experiments are being conducted by NCEL ocean engineers by placing 4-ft-diam cylindrical concrete footings for undersea structures on the ocean floor in 120 ft of water. During periodic monitoring of footing performance, excessive settlement was noted and the resulting inspection of the footings by divers showed several animal burrows under the footings. As a result of this finding, a field study was initiated to investigate and to identify burrowing animals which may undermine the footings of Navy undersea structures. A control method which will prevent animals from burrowing underneath objects placed on the ocean bottoms was investigated. A limited literature search was also conducted to determine what type of burrowing animals may be present in the vicinity of the Pitas Point test site.

N-1125
Emulsion Paints on Steel Exposed to Marine Atmospheres, Aug 1970, J. B. Crilly, AD876719L

Two acrylic emulsion paint systems have been evaluated in marine atmospheric exposure. One system compares well with the alkyd systems usually recommended for this service. Mixed systems of an acrylic emulsion topcoat over alkyd primers appear to offer no improvement over conventional solvent systems either in application or performance characteristics.

N-1126 - Cancelled

N-1127
Flat Disc Acrylic Plastic Windows for Man-Rated Hyperbaric Chambers at the USN Experimental Diving Unit, Nov 1970, J. D. Stachiw, AD716751

Flat disc acrylic plastic windows have been designed, fabricated, evaluated and delivered to experimental diving unit for replacement of glass windows used to date. The

large D_0 = 6.950 in., T = 1.650 in., and the small D_0 = 4.450 in., T = 1.040 in.) windows have been found on the basis of an extensive evaluation program to be more than adequate for man-rated service under 450 psi maximum operational pressure in steel flanges with D_i (diameter of opening in flange) of 5.000 and 3.000 in. All windows were proofteated to 675 psi pressure at 120F ambient temperature prior to delivery.

N-1128
AC Power Continuity Device, Nov 1970, K. T. Huang, AD716409

The feasibility of utilizing an energy reservoir consisting of a passive 60 Hz tuned L-C tank circuit for providing power continuity over momentary source power loss has been investigated and analyzed. Results show that such a power continuity device can provide power carry through for a few cycles at low power level. However, the device is impractical for extending power carry through time at high power level. For inductive loads, the usefulness of the network is further limited by the excessive time required to disconnect the energy reservoir from the source.

N-1129
Air Blast Wave Attenuator Development, Nov 1970, D. E. Williams, AD716013

A passive air shock wave attenuator has been proven effective - up to 80% shock front attenuation - over a variety of input conditions and a wide range of overpressures from 10 psi to 3000 psi. Pure viscous attenuation was studied by using square wave inputs. Peaked wave inputs, which attenuate more rapidly but are more realistic simulations of nuclear blast waves, were also studied.

Normal airflow resistance was considered carefully since most passive devices are unduly restrictive. A tradeoff between acceptable normal flow resistance and blast wave attenuation, based upon experimental work and a limited facility requirement study, leads to a length-to-diameter ratio of 300 for most applications.

Finally, attenuator configuration and mechanical design were considered. A variety of configurations are proposed, the most promising of which, from a fabrication viewpoint, is a parallel plate arrangement. However, the potential of this configuration has not been confirmed experimentally.

N-1130
Improved Techniques for the Non-Destructive Testing of Diesel Engine Pistons, Oct 1970, W. W. Watson, AD715619

Repeated and catastrophic piston failures in a group of large diesel engines deployed in Vietnam for power generation purposes revealed the urgent need for the development of a fast, reliable means for the detection of incipient failures in these engines.

As a result of work subsequently performed by the ROICC-Pacific and various agencies and consultants under his direction, a very successful nondestructive testing technique was established. This technique utilized commercial ultrasonic instrumentation of the pulse-echo type. The procedure, as finalized, will unfailingly detect cracks in the major webs of the diesel engine pistons under consideration, and requires only the removal of the cylinder head for access to the piston top.

The only major constraints in the application of this technique are the requirements that (1) the piston material be homogeneous, (2) detailed information relating to piston configuration be available, and (3) the diagnosis be made by technical personnel experienced in ultrasonic interpretation.

N-1131
The Development of a Three-Dimensional Stress Cell for Granular Soils -Preliminary Evaluation, Oct 1970, T. K. Lew, AD714837

This study presents the results of preliminary tests on a three-dimensional soil stress cell. The results indicate that: (1) the hydrostatic response is linear for stresses up to 3,000 psi; (2) the cell requires no calibration, (3) its response is insensitive to variations in soil stiffness; (4) its dynamic response closely follows the decay of the over-pressure pulse; and (5) with a few exceptions, the measured stresses computed from the stress cell data and corresponding stresses in the soil are within 10% absolute. More extensive testing and evaluation is required before the stress cell developed can be used with complete confidence.

N-1132
AN/FO Test of a Model Silo (U), May 1971, R. J. Odello, SECRET

N-1133
Specialized Anchors for the Deep Sea - Progress Summary, Nov 1970, J. E. Smith, R. M. Beard, R. J. Taylor, AD716408

Five anchor design concepts have been explored in conjunction with the program to develop an improved deep sea mooring capability. The knowledge gained from study of these anchor concepts - free-fall, pulse-jet, explosive, padlock, and vibratory - are summarized in this report.

The vibratory anchor is currently the center of the deep sea anchoring development effort. A first generation design has demonstrated the concept is feasible. Tests have shown that improvements are required for the vibratory anchor. An analytical study has been performed to assist in optimizing a second generation design. Improvements incorporated in the second generation design will be based on information from tests of the first design and the analytical study. The improved design will be tested in a range of seafloor sediment types and water depths to rate its capabilities and establish its reliability.

N-1134
The Spherical Acrylic Pressure Hull for Hydrospace Application - Part IV -Cyclic Fatigue of NEMO Capsule No. 3, Oct 1970, J. D. Stachiw, AD715345

The 66-in. OD 2.5-in.-thick NEMO model 600 spherical hull no. 3 has been hydrostatically pressure-cycled till fatigue cracks appeared in the acrylic plastic and the top hatch plastically buckled. The plastic buckling of the hatch, fabricated from annealed 4130 alloy steel, took place during simulated repeated dives in the 2,080 to 2,250-ft-depth range. The cracks in the acrylic plastic hull were located in the beveled surface in contact with the metallic polar closures. The first crack was observed only after the hull had been subjected to 993 consecutive pressure cycles, of which 815 cycles were to 1,200 ft followed immediately by 178 cycles to 1,540 ft. An additional 257 pressure cycles to 2,080-ft depth did not implode the pressure hull but only caused the cracks to extend further into the hull. The duration of sustained pressure loading in each pressure cycle was approximately 45 min followed by 15-min relaxation period.

The cyclic tests conclusively prove that (1) an adequate cyclic fatigue safety factor exists for NEMO hulls performing, routinely, extended manned dives to 600-ft depth, and that (2) manned proof test dives of 1 hr duration to 1,200-ft depth can be performed providing the total number of proof test dives does not exceed 100. To prevent plastic buckling of the polar steel closures prior to general implosion of the capsule it is necessary to specify heat-treated 4130 steel alloy for the polar penetration closures.

N-1135
Naval In-Place Seafloor Soil Test Equipment, a Performance Evaluation, Oct 1970, R. J. Taylor, K. R. Demars, AD716754

NCEL developed a vane shear and cone penetrometer apparatus capable of obtaining the in-place undrained shear strength of sediments to a depth of 10 ft in the seafloor. The device is a subsystem of the Deep Ocean Test In-Place and Observation System (DOTIPOS). Information obtained with this equipment will enhance the Navy's ability to design foundations more economically and reliably for seafloor

installations. The results of tests performed at 100- and 600-ft deep sites and the evaluation of DOTIPOS and the vane shear and cone penetrometer apparatus are presented.

N-1136
Air Cushion Heavy Lift Pontoon, Nov 1970, C. I. Skaalen, AD877462

An air cushion mobile heavy lift platform concept has been proposed to augment existing Naval heavy lift capabilities. This concept was studied in view of current air cushion vehicle technology. Capabilities, missions and logistics have been defined in terms of a pontoon air list (PAL) system. The system would consist of a skirt system, power system and pontoon platform. The system was found to be feasible and could be synthesized using off-the-shelf material.

N-1137
Silicone Alkyd Paints, Nov 1970, J. B. Crilly, AD878488L

Two test paints based on silicone alkyd vehicles have been compared with specification paints after 45 mo exposure at Kwajalein, Marshall Islands; Kaneohe, Hawaii; and Port Hueneme, Calif. One silicone alkyd paint is performing significantly better than the comparison standards while the other is about the same as the standards.

N-1138
Airfield Pavement Condition Survey, USNS Adak, Alaska, Jan 1971, D. J. Lambiotte, R. B. Brownie, AD719889

The results of a condition survey of the airfield pavements at the U.S. Naval Station, Adak, Alaska, are presented. The survey established statistically based condition numbers (weighted defect densities) which were direct indicators of the condition of the individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts.

N-1139
Sea Testing of Divers Air Hose and Comparison to Analytical Results, Apr 1971, T. L. Culbertson, AD726159

Data from sea tests performed on 1/2-in. and 3/8-in.-ID divers hose were compared to and found agreeable with the results of an analytical model of air flow in a divers hose. Assured of the validity of the analytical model, peak air flow rates were analyzed in 3/8-in.-ID hose and found not near choked flow conditions. It was concluded that 3/8-in.-ID air hose could supply enough air to support a hard working diver at a 300-ft depth. However, with increasing depths, there is a requirement for increased input air pressure.

N-1140
Second Annual Report of In Situ Test and Evaluation on a Reinforced Plastic Float and Brow - Fleet Landing, San Diego, Jan 1971, J. A. Drelicharz, AD880274L

After 2 years of in situ test and evaluation, a prototype fiberglass landing float constructed of glass-wrapped foam planks and its companion brow are operating in satisfactory condition. The float has been modified with the installation of an inexpensive venting system and its companion brow adapted as a test platform for the test and evaluation of five commercially available non-skid deck coatings suited for application on fiberglass materials.

N-1141
Comparative Solutions for the Response of Restrained, Rigid-Body Underwater Structures to Acoustic Shock, Jan 1971, J. G. Hammer, N. S. Zwibel, AD718328

This study seeks better understanding of the general problem of predicting the response of fixed underwater structures to a shock wave propagating through the water. Two idealized structures are considered - an elastically restrained rigid sphere and an elastically restrained rigid cylinder. The shock is assumed to be an exponentially decaying pressure pulse in an acoustic fluid. Solutions to the exact equations are obtained analytically for the spherical structure and by Bellmans numerical inversion procedure for both structures. Previously obtained solutions for the restrained cylindrical structure, simplified by Mindlin-Bleich approximation, are found to be in agreement. Response curves are given for both structural types over a range of parameters. The effects of drag are discussed.

N-1142
The Shock and Vibration Hardness of a Water Well Jet Pump, Jan 1971, D. Pal, H. A. Saberon, R. S. Chapler, AD881184L

NCEL is evaluating methods of measuring and cataloging the ssential shock and vibration hardness of routinely installed Naval shore-based equipment. This is the first report on actual hardness and as such contains considerable detail and discussion on hardness measurement and in particular of the tests selected to measure the hardness of a Barnes model 84-27363 water well jet pump. It is to be emphasized that the detail of this report is not typical of the planned cataloging that is to be a final outcome of the program. That final cataloging will not be attempted until several items have been tested and refined presentation procedures have been developed. In this report the shock hardness is recorded as a Fourier transform of input shock accelerations that have caused failure. The vibration hardness is given as vibration velocity spectra plotted on four-coordinate paper. Thus if a shock or vibration environmental severity at a proposed equipment location exceeds the levels here reported, the equipment cannot survive that environment and must be isolated from it.

N-1143
Use of X-Ray Diffraction and Infrared Spectroscopy in Paint Analysis, Mar 1971, R. W. Drisko, J. B. Crilly, AD721696

A method was developed for distinguishing among the exterior oil paints TT-P-102, Class A, TT-P-102, Class B, TT-P-103, TT-P-104, and TT-P-105 by X-ray diffraction. Methods utilizing X-ray diffraction were also developed for quantitative analyses of (1) zinc and zinc oxide in mixtures of these two pigments and (2) asbestos in a paint pigment. Infrared spectra of 40 weathered exterior paints were prepared using potassium bromide disks without separation of the paint pigment and vehicle. Many different generic types of paint were found to have characteristic absorption bands that permit their identification.

N-1144
Mobile Ocean Basing Systems - A Concrete Concept, Jan 1971, J. J. Hromadik, D. A. Davis, D. F. Griffin, W. R. Lorman, M. J. Wolfe, N. S. Zwibel, AD881182L

Large floating ocean platforms are envisioned as satisfying basing requirements of the Navy in the mid-80s. The floating platforms would consist of structural components mass-produced, constructed into modules ashore, launched, towed to the site and assembled into platforms. This investigation studied various configurations using concrete as the construction material. The scope of effort included synthesis of concepts, concrete production, construction methodology and cost, and an RDT&E plan. It is concluded that concrete is a feasible and practical construction material for large ocean platforms.

N-1145
Underwater Work Functions Required in Salvage, Feb 1971, G. L. Liffick, AD721353

Sixteen past salvage operations have been reviewed and two experienced salvors interviewed to determine the work functions required in underwater salvage. The results indicate seven work functions are compatible with hydraulic systems. These work functions are - rigging and load handling, bolting, mechanical cutting, tunneling/excavating, grappling, drilling and tapping.

N-1146
Mark I Deep Dive System - Experimental Stress Analysis, Feb 1971, S. B. Nosseir, S. K. Takahashi, AD722315

This investigation is concerned with the structural safety of the mating flange assembly and the turnbuckle tie-downs of the Mark I Deep Dive System. Various parts of the system were instrumented to measure the strains induced by the ship motion. Test results lead to the following conclusions: (a) the clamp screw, which controls the movement of the mating flange, needs to be redesigned, and (b) a procedure be established for the evaluation of the stresses due to the original tightening of the turnbuckle tie-downs.

N-1147
Airfield Pavement Condition Survey, USNAS Quonset Point, Rhode Island, Feb 1971, D. J. Lambiotte, L. J. Woloszynski, AD720691

The results of a condition survey of the airfield pavements at the U.S. Naval Air Station, Quonset Point, R.I., are presented. The survey established statistically based condition numbers (weighted defect densities) which were direct indicators of the condition of the individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts.

N-1148
Airfield Pavement Condition Survey, USNAS Point Mugu, California, Feb 1971, D. J. Lambiotte, R. B. Brownie, AD720319

The results of a condition survey of the airfield pavements at the U.S. Naval Air Station, Point Mugu, Calif., are presented. The survey established statistically based condition numbers (weighted defect densities) which were direct indicators of the condition of the individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts.

N-1149
Design, Construction and Installation of the Rich Ships Fendering System at Naval Installations, Feb 1971, J. A. Drelichars, AD881940L

A promising new ship fendering system has been designed by John Rich Enterprises, Inc., Sacramento, Calif. The system has been built and installed at three Naval facilities: Naval Construction Battalion Center, Port Hueneme, Naval Supply Center, Oakland, and Naval Station, Treasure Island. The system consists of clusters of vinyl, cylindrical cells sandwiched between timber frames. The cells have an opening at one end which is submerged. On impact, the water-charged cells discharge at a controlled rate, thereby attenuating the impact force. The resiliency of the vinyl recharges the cell for further impact. The fender system is undergoing evaluation.

N-1150
A Fluidic System for Mixing Two Fluids - Development Study, Feb 1971, D. Pal, AD722316

Results of a study on the use of proportional fluid amplifiers for the mixing of two fluids are presented. The system proposed is considered capable of mixing fluids in varying mixture ratios. For this application, the fluidic device promises to be superior to conventional mechanical flow modulating devices. The fluidic mixing system being tested uses a double leg elbow amplifier and is designed for mixing hot and cold water.

N-1151
Investigation of Thermal Insulating Materials for Deep Ocean Habitat Environment, Feb 1971, S. C. Garg, AD882354L

For missions requiring saturation dives at depths exceeding 300 ft, a warm and comfortable environment of a habitat is necessary from which divers can make many excursions of limited duration in time. Effective thermal insulation of such a habitat is necessary to reduce the heating power requirements. A survey of available thermal insulation materials was carried out to determine those materials which could be used for habitat insulation in a high pressure environment of humid helium.

N-1152
Airfield Pavement Condition Survey, USNALF Charlestown, Rhode Island, Feb 1971, D. J. Lambiotte, L. J. Woloszynski, AD721323

The results of a condition survey of the airfield pavements at the USNALF Charlestown, R.I., are presented. The survey established statistically based condition numbers (weighted defect densities) which were direct indicators of the condition of the individual asphaltic concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts.

N-1153
Airfield Pavement Condition Survey, USNAS Willow Grove, Pennsylvania, Feb 1971, D. J. Lambiotte, L. J. Woloszynski, AD721324

The results of a condition survey of the airfield pavements at the U.S. Naval Air Station, Willow Grove, Pa., are presented. The survey established statistically based condition numbers (weighted defect densities) which were direct indicators of the condition of individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station pavements, compilation of data on current aircraft traffic and aircraft types using the station, and a study of the requirements for future pavement evaluation efforts.

N-1154
Test and Evaluation of a Tensiometer for Measurement of Tension in Guying Systems at Naval LF Communications Stations, Mar 1971, H. A. Lasitter, AD884424L

A vibra-tension meter for measuring tension in antenna tower guy lines was tested and evaluated. This device provides guy tension readings by measurement of the natural vibrational frequency of a stretched guy line - combined with the length and weight of the line. The application of this instrument in determining the stress in fiberglass and metallic guys used with Wellen-Weber antenna systems is also discussed. Field tests made at antenna sites indicated that tension measurements on guy lines whose length was greater than 40 ft would have to be artificially shortened (or bridged) in order to obtain accurate readings. This is because the meter is designed to measure guy lengths of 40 ft or less.

N-1155
Airfield Pavement Condition Survey, USNAS Cecil Field, Florida, Mar 1971, D. J. Lambiotte, R. B. Brownie, AD721325

The results of a condition survey of the airfield pavements at the U.S. Naval Air Station, Cecil Field, Florida, are presented. The survey established statistically based condition numbers (weighted defect densities) which were direct indicators of the condition of the individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts.

N-1156
Wave Energy Extraction by Crescent Shaped Columns for Station Keeping of Floating Ocean Platforms - Hydraulic Model and Feasibility Study, Mar 1971, C. L. Liu, R. H. Fashbaugh, AD724673

Fixed or floating column-supported platforms in the ocean experience direct and reverse wave drag caused by the oscillating water particle velocity. The drag coefficient for the direct flow can be different from that for the reverse flow if the cross-sectional area of the supporting column is not symmetric about the column axis. Therefore, a net wave drag force theoretically can be produced. The purpose of this study was to determine whether this concept can be utilized to reduce the power requirements for positioning large floating platforms such as the proposed mobile ocean basing system (MOBS). The results of the tests show that there is a net wave force opposite to the direction of wave travel on the column with the crescent cross section. However, an analytical study based on the test data shows the rate of energy extraction from waves by crescent shaped columns for sea state 5 to be about 6% of the energy required for station keeping of a large floating platform. Hence, the concept does not seem applicable to large floating ocean platforms.

N-1157
Ocean Engineering Significance of Marine Seismic Reflection Profiling Technology, May 1971, E. F. Pawlowicz, AD724674

It is proposed that a self-powered, deep-towed subbottom profiler be designed and fabricated which will produce high resolution records of at least the first 100 ft of soil in water depths to 6,000 ft.

N-1158
Underwater Manipulative Construction Systems (UMCS), May 1971, P. K. Rockwell, AD885920

The principles of manipulation are discussed and an underwater manipulative construction systems (UMCS) is defined. A UMCS is a remote handling system which is intended to perform useful construction operations in the submarine environment, providing means by which man can meet underwater construction requirements while being protected from the environment. A UMCS consists of seven interrelated elements. A manipulator arm, tools or terminal devices, a control system, a feedback loop, power, a working platform, and the work object. Each element of the UMCS is discussed in detail, and existing manipulator systems for underwater work are described.

N-1159
Experimental Piping and Conduit Installations on the Navy Fuel Department Pier, Point Molate, California, Apr 1971, T. Roe, AD885578

Non-specification piping and conduit have been installed on the fuel pier at Point Molate, California. The materials, their installation, their end use requirements, and their condition as of September 1970 are described.

N-1160
Protection of DSRV Sea Seat Surfaces Exposed to Cyclic Pressure in Seawater, Jun 1971, J. F. Jenkins, F. M. Reinhart, AD731356

The efficacy of two coating systems in preventing corrosion of seal seats similar to those used for the through-hull electrical penetrators on the deep submergence rescue vehicle (DSRV) was evaluated under simulated DSRV operating conditions. A very thin (0.0002 to 0.0003 in.) wash primer reduced corrosion of the seal seats for a short period and a thicker (0.0023 to 0.0025 in.) coating system prevented seal seat corrosion for 183 simulated service cycles in pressurized seawater.

N-1161
Economical Power Quality Monitors, Jun 1971, H. H. Kajihara, AD885921

To achieve compatibility between the quality of power supplied to electronic loads and the power quality required by these loads, it is necessary to know the transients that occur in electrical power systems and the transient susceptibility of electronic equipment. To fill this need, NCEL has developed a power transient monitor for quantitative recording of the transients in power systems. Since only one monitor was developed, the transient characterizations of only one power system at a time is possible. A more time effective scheduling and usage of the one available monitor would result if prior knowledge was available on whether a specific power system was experiencing frequent transients. This prior knowledge could be obtained by employing a simpler and less expensive monitor. A specification has been developed for an economic monitor which would count the number of transients of a specific type. This report reviews the results of the survey made to determine the commercial availability of instruments that meet this specification, and makes recommendations on in-house development of a suitable monitor.

N-1162
Electromagnetic Interference (EMI) Study of Six Typical Army Portable 3-kW Engine-Generator Sets, J. L. Brooks, AD885922

The DOD Project Manager, Mobile Electric Power, United States Army Materiel Command, sponsored a study program to investigate the electromagnetic interference (EMI) associated with six typical, portable 3-kW engine-generator sets. The investigation program required that each of the six engine-generator sets be subjected to an EMI test in accordance with MIL-STD-462, EMI Test Procedures. Once the EMI had been measured, suppression techniques were developed and the unit remeasured to verify conformance to MIL-STD-461, EMI Specification Limits. The test data, test techniques, test equipment, specification requirements and necessary suppression procedures are detailed in this report.

N-1163
An Energy Injection Circuit for AC Power Continuity Device, Jun 1971, K. T. Huang, AD727581

NCEL previously investigated the use of an L-C tank circuit as a redundant power source for supplying continuous power during momentary interruptions of the primary power source, lasting 100 msec or less. Results of this investigation showed that the tank circuit has an inherently high power loss. Further, the amount of energy that can be stored in the tank circuit is limited by the physical size of the tank circuit components. In an effort to reduce the size of the tank circuit components, an energy injection circuit was investigated. An experimental, 1-kW, 100-V, 60-Hz model of the circuit was developed and evaluated by NCEL. It was concluded that the energy injection circuit can only be considered as a low level power continuity device for loads of less than 50 kVA.

N-1164
Evaluation of Equipment for an Elevated Causeway, May 1971, B. R. Karrh, AD885579

Evaluation tests of three pieces of equipment for use with an elevated causeway are reported. Each test is presented and discussed separately. The equipment evaluated includes two systems for lifting pontoons on piles - a hydraulic jacking system and a block and tackle hoist system with griphoist hand jacks - and explosive pile cutters. In general, the findings are: (1) the particular hydraulic lift system evaluated proved to be too complex and unreliable for field use; (2) the block and tackle gear with griphoist jacks is marginally safe equipment for lift a 60-ton Ammi pontoon on piles and is time-consuming; (3) of the three types of explosive pile cutters tested - inside rigid cutter, outside cutter, and inside inflatable cutter - the inside inflatable cutter satisfies more of the operational requirements for retrieval of an elevated pier than does either of the other two.

N-1165
Technical Data on Sorbents for Navy Oil Spills, Jun 1971, J. A. O'Brien, AD886388

The behavior of seven representative sorbent materials was determined with various liquids and liquid combinations - clean water, contaminated water, four Navy fuel oils, oil-in-water emulsions, and floating oils on water. Information was obtained on sorption rates and ratios, pressure-time requirements for squeezing oil from a sorbent, sorbent oil retention and natural oil drainage, reusability, chemical response to Navy fuel oils, flammability and sorbent buoyancy under a variety of conditions.

N-1166
Airfield Pavement Condition Survey, USNAS New Orleans, Louisiana, Apr 1971, D. J. Lambiotte, R. B. Brownie, AD724286

The results of a condition survey of the airfield pavements at the U.S. Naval Air Station, New Orleans, Louisiana, are presented. The survey established statistically based condition numbers (weighted defect densities) which were direct indicators of the condition of the individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts.

N-1167
Airfield Pavement Condition Survey, USNAS Cubi Point, Philippines, Apr 1971, H. Tomita, R. B. Brownie, AD724675

The results of a condition survey of the airfield pavements at the U.S. Naval Air Station, Cubi Point, Philippines, are presented. The survey established statistically based condition numbers (weighted defect densities) which were direct indicators of the condition of the individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, and a study of the requirements for future pavement evaluation efforts.

N-1168
Airfield Pavement Condition Survey, USNAS Chase Field, Texas, Apr 1971, D. J. Lambiotte, R. B. Brownie, AD724676

The results of a condition survey of the airfield pavements at the U.S. Naval Air Station, Chase Field, Texas, are presented. The survey established statistically based condition numbers (weighted defect densities) which were direct indicators of the condition of the individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts.

N-1169
Backflow Prevention Devices for Potable Water Systems at Naval Shore Facilities, Investigation Through January 1971, May 1971, R. N. Bibbens, AD886389

Backflow prevention devices are required where a potable water system is connected to a source of contamination. The device must prevent any reversal of flow that could cause contamination of the potable water system. This report describes an investigation of the testing and certification of reduced pressure principle and double check valve backflow prevention devices.

N-1170
High Explosive Field Test of Hardened Electrical Generators, May 1971, R. S. Chapler, J. M. Stephenson, AD886568

Emergency electrical power for hardened Naval installations is often provided by diesel engine driven generator sets. In a continuing effort to determine the degree of protection required to provide continuous electrical power in an air blast environment, NCEL participated in Event DIAL PACK, the detonation of a 500-ton, surface-tangent spherical charge of TNT at the Canadian Defence Research Establishment, Suffield, Alberta, Canada, in July 1970. Two 10-kW diesel generator sets were preferentially hardened, placed in grate-covered pits and subjected to a 100-psi overpressure environment. Minor damage to grate pit covers and generator accessory equipment was incurred, but both generator sets continued to produce electrical power during and after the blast. The test showed that minimal hardening of sensitive generator components will enable them to operate successfully in a 100-psi environment.

N-1171
Structural Investigation of Davisville Ammi Lift Dock Test Model, May 1971, S. K. Takahashi, S. B. Nosseir, R. R. Karrh

An Ammi lift pontoon, a component of the lift dock, was analyzed by both the finite element computer method and the conventional beam theory. The general results from both approaches were found to be in close agreement.

N-1172
Corrosion of Materials in Hydrospace - Part VI - Stainless Steels, Sep 1971, F. M. Reinhart, AD732365

A total of 1,750 specimens of 57 different stainless steels were exposed in seawater at the surface and at depths of 2,500 and 6,000 ft in the Pacific Ocean for periods of time varying from 123 to 1,064 days in order to determine the effects of the seawater environments at different depths on their corrosion resistance. Corrosion rates, type of corrosion, pit depths and stress corrosion cracking resistance are presented.

N-1173
Evaluation of Eight Epoxy Adhesives for Bonding Concrete and Micro-Concrete Structural Components Exposed to Room and to Hydrostatic Pressure Conditions, Jul 1971, T. Roe, A. F. Curry, P. C. Zubiate, AD888505L

Eight epoxy adhesives were evaluated for bonding concrete and micro-concrete blocks. Shear strength was determined in bonded blocks which had been stored at room conditions and which had been subjected to seawater at 500 psi for 14 days. Three of the adhesives were found to be equally acceptable and significantly stronger than the other five adhesives.

N-1174
Submersible Diver Tool Power Sources, Electro-Hydraulic and Cryogenic Pneumatic, Aug 1971, S. A. Black, AD731358

Two self-contained and completely submersible power supplies for powering diver-operated hand held tools are discussed. One power supply operates pneumatic tools while the other operates closed cycle oil hydraulic tools. Operational evaluations performed with Navy qualified divers using hand-held tools powered by the modules proved both concepts to be effective submersible power sources. Refinements necessary are delineated.

N-1175
Evaluation of Pneumatically Sealed Doors for Use in RFI Shielded Enclosures, Oct 1971, H. A. Lasitter, AD733657

A standard swinging door with fingerstock and pressure bladder recessed into the door periphery has been designed and developed at NCEL. This door may be used as a "kit" and can be installed at any communications center where the shielding effectiveness is degraded by the door. Sliding doors which are sealed by means of an internal pressure bladder were available for evaluation along with the NCEL design. Shielded enclosures at three military installations were visited and examined for operational performance. Each of the enclosures had at least one pneumatically sealed door installed as part of the shielded enclosure. Each enclosure exhibited a shielding effectiveness value of greater than 100 db; in one case, the values were greater than 120 db for frequencies greater than 200 kHz. The shielding effectiveness of the NCEL door was greater than 110 db at MIL-STD-285 test frequencies.

N-1176
Investigations Directed Toward Development of a Direct Reading Thickness Gage for Paint Films on Wood, Oct 1971, F. W. Brown, R. L. Alumbaugh, AD732936

This is the final report of studies directed toward the development of a direct reading paint film thickness gage for wood using backscattered beta radiation from a SR-Y-90 source. The results of research reported here show the following: (1) the rugged portable field model of the paint film thickness gage that was developed can be used to measure thicknesses of three commonly used exterior specification paint systems for wood. Calibration curves are given indicating that the gage can measure thicknesses from 0.5 to 30 mils and has an accuracy of about 5%. Additional data show that the gage readings are unaffected by the presence of absorbed moisture. (2) Work directed toward development of a direct reading gage and a smaller diameter probe was discontinued when it was found that the gage could not be used to determine thicknesses of three additional specification paint systems for wood, i.e., TT-P-19, TT-P-105, and MIL-P-52324, all applied over TT-P-25 primer. The topcoats of these exterior paint systems appear to be transparent to beta radiation and backscattering occurs only from the primer.

N-1177
Strength Properties of Some Pacific and Indian Oceans Sediments, Aug 1971, D. G. Anderson, AD732366

Sediment engineering properties, including vane shear strength data and classification test results, are summarized for core samples from 18 locations in the southwest Pacific and eastern Indian Oceans. This summary presents information on the engineering properties of soils from the areas of investigation. Attempts were made to correlate the measured strength data with index properties of the sediments (Atterberg Limits) that can be determined from disturbed or remolded samples. For the relatively shallow sediments considered in this study, no useful relationships were observed.

N-1178
Seafloor Penetration Tests - Presentation and Analysis of Results, Aug 1971, H. J. Migliore, H. J. Lee, AD732367

A series of 11 in-situ penetration tests was conducted by NCEL at two seafloor sites. The objectives of these tests were to illustrate the capabilities of existing penetration evaluation equipment and to acquire data for use in evaluating a series of proposed penetration prediction techniques. The tests consisted of allowing two types of objects to free-fall into the seafloor with the accelerations experienced by the objects during penetration being recorded mechanically. The resulting data were subjected to a regression analysis which yielded information about the penetration mechanism but no practical results. This was followed by a physical analysis based on static soil mechanics relations. The latter analysis was shown to yield predictions of penetration depth which were within 50% of the measured values. A suggested prediction technique based on this analysis is presented.

N-1179
Measuring Water Permeability of Masonry Walls, Aug 1971, H. Hochman, AD731553

The Dunwell procedure for determining the water permeability of masonry walls was modified so that it improved reproducibility, decreased the testing time from 3 to 4 days to less than 1 hour, and did not mar the painted surface. These improvements resulted from the elimination of the possiblity of air entrapment in the reservoir and finding a sealant that produces a leak-free system immediately and could be washed off with common solvents.

N-1180
High Explosive Field Test of BUSHIPS Blast Valve, Oct 1971, J. Norbutas, R. Chapler, D. Pal, AD889703L

Antiblast closure valves are intended to prevent destructive air blast waves from entering protected shelter areas through ventilation openings. To determine the effectiveness of one particular blast valve, NCEL participated in Event Dial Pack, the detonation of an above ground, surface tangent, spherical shaped, 500-ton TNT charge, held at the Defence Research Establishment, Suffield, Alberta, Canada, in Jul 1970. Three identical valves were tested at the predicted 50-psi level, one each oriented face-on, side-on, and back-on to the direction of the blast. The test installation included electronic instrumentation for automatic recording of the blast loading and valve performance. The electronically recorded data showed an incident free field air blast pulse with a shock front peak overpressure of 44 psi at the valve test site. Valve leakage pulses with incident shock front peak overpressures of 12, 10, and 8 psi, and valve closure times of less than 2 msec. The valve installation oriented back-on to the blast allowed the largest leakage pulse. Subsequent shock tube tests demonstrated less leakage for lower level incident shock waves applied face-on. The valve is recommended for use in ventilation openings in shelters housing fairly rugged equipment.

N-1181
High Explosive Field Test of a Hardened Air Entrainment System, Oct 1971, D. E. Williams, R. H. Fashbaugh, AD890483L

Tests were conducted on a hardened air entrainment system as part of the U.S. program of the 500-ton blast and shock experiment Event Dial Pack to obtain data for purposes of validating analytical studies and establishing improved design criteria. The test was divided into a blast valve test, an operational test of an air entrainment system, and a debris ingestion study. The blast valve test structure was located at a range corresponding to a 175-psi incident pressure level and the air entrainment system test structure and debris ingestion test tubes were located at the 600-psi incident pressure range. The test results showed the air entrainment system to be adequate in air blast wave attenuation and to be structurally sound. The NCEL air blast attenuator was effective in attenuating the air blast wave and a conical debris deflector proved to be effective in limiting the amount of debris ingested into an air inlet.

N-1182
Seafloor Pile Foundations - State-of-the-Art, and Deep-Ocean Emplacement Concepts, Oct 1971, D. A. Raeche, M. J. Migliore, AD889087

A review of the state-of-the-art of the emplacement and design of seafloor pile foundations/anchorages was conducted. Several concepts for emplacement mechanisms suitable for use in water depths to 6,000 ft were considered, and a preliminary effectiveness evaluation of the mechanisms was conducted to reduce the number of systems for further investigation. The state-of-the-art review indicates that marine drilling techniques and equipment could be readily adapted for deep-ocean pile emplacement for a very near-term requirement. However, the use of such a method would be quite costly. Other pile emplacement systems are presently limited to depths of about 1,000 ft by the need for relatively large amounts of power.

Development of a 6,000-ft pile foundation/anchorage emplacement capability is not limited by any need to develop novel mechanical equipment. Existing equipment can be adapted, or new equipment can be designed on the basis of proven principles. The most promising emplacement mechanisms for Navy development are vibrators based on eccentric-weight or linear-oscillator devices, jack-in mechanisms and screw-in systems. Selection of a single concept for further development can be accomplished in the near future. A moderate effort is required to more completely define the operating characteristics of the various types of emplacement mechanisms.

N-1183
The Relative Motion Between Ships in Random Head Seas, Sep 1971, D. A. Davis, N. S. Zwibel, AD731360

As part of the Navy's program to develop mobile port facilities, an analytical model has been developed which can be used to compute the relative motion between vessels in regular and random head seas. The model, based on strip theory, is suitable for analyzing all single hull, linearly moored slender vessels. Since symmetry of moorings (if present) is assumed throughout, the motion is restricted to heave, surge, and pitch. Deep-water added mass and damping coefficients are used in the equations of motion, and the resulting model predictions are considered valid provided that the draft-to-mean depth ratio does not greatly exceed 0.50. Typical results from the analysis are presented.

N-1184
Comminution of Rock With Controlled Stress Waves, Oct 1971, R. N. Murtha, R. J. Odello, J. R. Allgood, AD733661

This study was initiated to prove a principle upon which to base the design of hard rock tunneling machines. The technique of interest involves trepanning a core and subsequent comminution of the core by controlled stress waves.

To achieve the objective, exploratory explosive tests were performed in the laboratory on cylindrical specimens cast from hydrostone. Instrumentation was installed on some of the specimens to record the dynamic radial strain resulting from the explosive detonation.

Both visual and strain gage data showed that the specimens could be fractured in the desired manner. The thickness of the spalling was found to be directly related to the radial stress wave characteristics. Thus, the spall size should be controllable by changing the duration and magnitude of the wave.

N-1185
High Explosive Field Test of Hardened Cooling Equipment, Dec 1971, J. A. Norbutas, AD890939L

Cooling for hardened shelters can be obtained from water wells and evaporative water coolers. In an effort to determine the blast resistance of these cooling system components in the high overpressure region, NCEL participated in Event Dial Pack, the detonation of a 500-ton surface-tangent spherical charge of TNT at the Canadian Defence Research Establishment, Suffield, Alberta, Canada, in Jul 1970. A water well and evaporative water cooler of special design were subjected to a 600-psi overpressure environment. This report describes the test setup and the results obtained.

N-1186
Explosive Anchor for Salvage Operations - Progress and Status, Oct 1971, J. E. Smith, AD735104

An explosive anchor for salvage operations was designed, fabricated, and tested. The primary objective was to alleviate the critical problem of anchoring in coral seafloors, but it also was desired to incorporate as broad a range of salvage anchoring capabilities into the new anchor as possible. The prototype is 12 ft high, has a 10-ft circular base, and weighs about 6 tons. It functioned in coral and developed a holding capacity greater than 150,000 lb. It also demonstrated potential for service in other seafloors and over a wider range of operational conditions. Further development is proceeding to reduce anchor size and weight and to simplify and make the ordnance system more reliable so that it will meet acceptable operational standards.

N-1186A
Explosive Anchor for Salvage Operations - Progress and Status, Jan 1972, J. E. Smith

N-1187
Motion of Freely Suspended Loads Due to Horizontal Ship Motion in Random Head Seas, Oct 1971, N. S. Zwibel, AD732368

The theory is developed for the swinging motion induced in a wire suspended load due to the horizontal motion of a ship. An explicit formula is obtained for the significant amplitude of horizontal load motion when the ship is exposed to random head seas. Numerical results are presented for two typical cargo ships in a sea state three. It is found that very large motions are suffered by the load. For critical line lengths, resonance effects magnify the ship motion by several orders of magnitude. These results will be used to assist in the development of on-loading and off-loading devices for cargo vessels in open beach operations.

N-1188
Preliminary Investigation of Structural Damage, San Fernando, California Earthquake of February 9, 1971, Oct 1971, S. K. Takahashi, S. B. Nosseir, AD733658

This report contains information and photographs obtained during a preliminary investigation of structural damage caused by the San Fernando Valley, Calif. earthquake of 9 Feb 1971. Since the damage was quite widespread, the failures of only a few residential homes, commercial buildings and freeway bridges were inspected. Larger structures visited were a hydraulic fill dam which almost failed completely, two large Veterans Administration Hospital buildings that collapsed, and the Los Angeles County Olive View Medical Center. The photographs presented in this report were all taken within 9 days after the earthquake struck and depict the various modes of failure incurred by the structures. The failure patterns at the Olive View Medical Center clearly showed the superiority of the spirally reinforced concrete columns over the tied columns. This and other significant structural failures may call for a critical review of the current building codes.

N-1189
Airfield Pavement Condition Survey, USNAS Agana, Guam, Mariana Islands, Sep 1971, H. Tomita, M. C. Chapman, AD733660

The results of a condition survey of the airfield pavements at the U.S. Naval Air Station, Agana, Guam, Mariana Islands are presented. The survey established statistically based indicators of the condition of the individual asphaltic concrete and portland cement concrete

pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts.

N-1190
Airfield Pavement Condition Survey, USNAS Imperial Beach, California, Sep 1971, H. Tomita, L. J. Wolonzynski, AD733656

The results of a condition survey of the airfield pavements at the U.S. Naval Air Station, Imperial Beach, Cal if. are presented. The survey established statistically based condition numbers (weighted defect densities) which were direct indicators of the condition of the individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts.

N-1191
Development of a Portable Smoke and Gas Removal Unit for Personnel Shelters, Oct 1971, S. C. Garg, R. S. Chapler, AD8914691

A feasibility study was carried out earlier to determine if a portable unit is a practical approach to the problem of removing smoke and gases produced by small fires in personnel shelters. To determine the usefulness of the concept, a prototype unit was designed, developed, and tested in the laboratory to remove smoke and gases generated to simulate a small fire in a 7,500-cu ft room. The prototype portable smoke and gas removal unit was found to successfully reduce the smoke and gases to habitable levels in about 5-1/2 hr. Recommendations are made to improve the construction and performance of the unit for service-wide applications.

N-1192
Analysis of the Condition of the Snap 7-E Acoustic Beacon Installation After 64 Months at 2,650 Fathoms, Feb 1972, J. F. Jenkins, AD8937231

An isotopic generator powered acoustic beacon installation was recovered after 64 mo of exposure to the seawater and bottom sediments at 2,650 fathoms of depth in the Atlantic Ocean south of Bermuda. An analysis of the deterioration of the components of the installation showed that the basic steel support structure and the isotopic generator housing suffered only minimal attack. The lifetimes of these elements are projected to exceed 10 yr at this site. Stainless steel components of the installation were severly corroded and the use of stainless steel is not recommended. The bottom environment in this location was found to be atypical and similar installations at other would have significantly shorter lifetimes.

N-1193
Feasibility of Computer Models for Military Soil Stabilization Research, Nov 1971, J. R. Forrest, AD735446

This report considers the feasibility of using computer models for developing expedient soil stabilization techniques. Of major importance is the increase in soil strength necessary to provide specified degrees of vehicle mobility and dust or erosion control. The merits of pursuing this task at the molecular level are considered, and it is decided that application of electrochemical theory is not warranted at this time. A mechanistic approach, based upon finite element technology, is suggested.

N-1194
Analysis of Off-Loading Cargo at the Beach, Oct 1971, J. G. Kirby, AD736599

This report documents an experimental examination of the attainable cargo flowrate for two types of future landing craft, air cushion and planing. Both forklift and crane off-loading were considered, and the performance using 96 in. x 108 in. large pallets was compared with that using 40 in. x 48 in. pallets. It was found that the large pallet concept can increase the productivity of the forklift by more than 300% and the crane by approximately 200% over what is possible with the standard pallet.

N-1195
The Biodegradation of Oil in Seawater for Naval Pollution Control, Jan 1972, T. R. O'Neill, AD740757

Natural oil seeps and accidental spills are common to the coast of Southern California. Field observations and laboratory tests support the view that marine microorganisms have the capacity to oxidize and thus degrade oil and derivatives of oil. This report describes the sampling of beach sand, sediment water, and tar deposits from 15 different sites of Southern California, where oil spills are chronic. The laboratory techniques of isolating and culturing hydrocarbon-oxidizing microorganisms are also described, as are cell density studies, where Navy fuels are used as the sole source of energy for microbes in the collected samples. To date, 62 hydrocarbon-oxidizing species, 48 bacteria, 10 fungi, and 4 yeasts have been isolated.

N-1196
Mooring System Concepts for Expeditionary Logistics Facility Operations, Oct 1971, R. C. Towne, W. G. Hatch, AD745750

The objective of this study was to develop an engineering/operational methodology to assess the feasibility of, and to design as a preliminary concept, the total mooring systems for cargo ships and associated unloading platforms operating in open and sheltered coastal waters. The methodology was to be capable of examining the mooring systems in terms of performance, logistic burden, installation, and operational modes in the context of the expeditionary logistics facility. Mooring concepts are proposed and alternatives identified in terms of the state-of-the-art and advanced technical solutions. Cost-effectiveness comparisons are made of the proposed mooring concepts using the methodology developed in the study. Technical barriers and trade-offs are identified, RDT&E developments are recommended.

N-1197
Development of an Elevated Causeway - Surf Tests, Nov 1971, R. R. Karrh, AD735447

Tests were performed to determine the feasibility of erecting an elevated pontoon causeway in the surf zone of an open beach. Ammi pontoons, measuring 90x28x5 ft, served as test vehicles. Techniques for installing an elevated causeway in a surf environment were evaluated, functions requiring refinement and/or further development were identified. Two independent tests were performed - one at the beach interface and one in 20 ft of water approximately 300 ft from shore. Estimates of time, manpower, and equipment required to erect an elevated causeway were derived from the experiment. The tests demonstrated that the operations required to install an elevated causeway are feasible in surf up to 8 ft. Higher surf is likely to seriously degrade the effectiveness of operations.

N-1198
Airfield Pavement Condition Survey, USNAS Barbers Point, Hawaii, Oct 1971, H. Tomita, L. J. Wolonzynski, AD735105

The results of a condition survey of the airfield pavements at the U.S. Naval Air Station, Barbers Point, Hawaii are presented. The survey established statistically

based condition numbers (weighted defect densities) which were direct indicators of the condition of the individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts.

N-1199
Reduction of Stresses in Buried Structures, Dec 1971, S. K. Takahashi, R. N. Murtha, AD736601

Tests were performed in Event Dial Pack on 1- and 3-ft diameter steel cylinders with hemispherical end caps to obtain information on the dynamic behavior of structures containing fluid (a) internally pressurized and (b) with backpacking. The four test structures were oriented with their longitudinal axes parallel to the surface and normal to a radius through ground zero. The data were used to compare the variation of the parameters of internal pressurization and backpacking and to check the results of a two-dimensional, nonlinear, large deformation computer code developed for this task. The 3-ft diam models were designed according to the recently developed optimization equations by NCEL. The 3-ft diam, 0.134-in. models were not damaged when subjected to a peak surface overpressure of 680 psi. The 1-ft diameter model buckled in several locations because of its shallow depth of burial. However, all the tanks were still operational after the blast. Strains, deflections, and accelerations were less for the internally pressurized capsule with backpacking than for the other two capsules with no backpacking. Peak interface pressure measured for the model with no backpacking and with internal pressure was about 44% of the peak surface overpressure. Finite element computer data gave conservative estimates. The NCEL optimization equations can be used, with proper discretion, to design a buried fuel container to survive blast loading.

N-1200
Sulfur Concrete for Polar Construction, Jan 1972, J. R. Keeton, AD892647L

Experimental studies on sulfur concrete in the laboratory and at McMurdo Station, Antarctica are described. Sulfur concrete mixtures containing 12-1/2% and 15% sulfur by weight of aggregate showed high tensile, flexural, and compressive strengths as well as high Young's Modulus in the laboratory. With the equipment utilized in Antarctica, adequate temperatures were not obtained to produce satisfactory sulfur concrete.

N-1201
Airfield Pavement Condition Survey, USNAS Whidbey Island and USNOLF Coupeville, Washington, Nov 1971, D. J. Lambiotte, L. J. Woloszynski, AD735860

The results of condition surveys of the airfield pavements at the U.S. Naval Air Station, Whidbey Island and U.S. Naval Outlying Field, Coupeville are presented. The surveys established statistically based condition numbers (weighted defect densities) which were direct indicators of the conditions of the individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts at NAS Whidbey Island included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts. The additional evaluation efforts except for the skid resistance tests were also performed at NOLF Coupeville.

N-1202
Airfield Pavement Condition Survey, USMCAS Kaneohe, Hawaii, Nov 1971, M. Tomita, J. A. Garcia, AD735861

The results of a condition survey of the airfield pavements at the U.S. Marine Corps Air Station, Kaneohe, Hawaii, are presented. The survey established statistically based condition numbers (weighted defect densities) which were direct indicators of the condition of the individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station, compilation of the data on current aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts.

N-1203
Airfield Pavement Condition Survey, USNAF China Lake, California, Nov 1971, M. Tomita, R. B. Brownie, AD735862

The results of a condition survey of the airfield pavements at the U.S. Naval Air Facility, China Lake, Calif. are presented. The survey established statistically based condition numbers (weighted defect densities) which were direct indicators of the condition of the individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts.

N-1204
Airfield Pavement Condition Survey, USNAS Alameda, California, Nov 1971, M. Tomita, L. J. Woloszynski, AD735863

The results of a condition survey of the airfield pavements at the USNAS Alameda, Calif., are presented. The survey established statistically based condition numbers (weighted defect densities) which were direct indicators of the condition of the individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts.

N-1205
Shock Wave Propagation Through Air Entrainment Systems - Phase I, Feb 1972, R. H. Fashbaugh, A. Widawsky, AD893045L

An analytical study was undertaken with the objective of developing the capability of predicting shock wave propagation through air entrainment systems of hardened facilities. Only one-dimensional solutions are considered in this report, the first phase of the study. Two finite-difference schemes for approximating the hyperbolic partial differential equations of fluid dynamics are used, the pseudo-viscosity scheme and a modified form of the Lax-Wendroff two-step scheme. Shock wave attenuation due to viscous losses at ducting walls is included. A comparison of the results of the analysis with shock tube experimental data shows that the pseudo-viscosity scheme adequately predicts shock wave attenuation when a constant value of friction coefficient is used, except for very long ducts. The two step method results agree with the shock attenuation trend of the experimental data but this method predicts high values for the shock peak overpressure because of an overshoot caused by the occurrence of oscillations in the numerical solution.

N-1206
Development of Facilities Accounting and Airfield Operations Computer Programs for Project WIRE, Apr 1972, C. J. Crowell, AD900217L

The purpose of Project WIRE (western installations requirements evaluation) is to evaluate consolidation plans for DOD installations for operational and/or economic advantages. Under Project WIRE sponsorship, NCEL developed two computer programs to be used in those evaluations: (a) a management accounting program which calculates for a given date the adequacy, requirement, and cost of facilities at DOD installations, and (b) a management simulation tool which predicts operational characteristics of DOD airfields as a function of ground and air traffic. This is the final report on development of those programs.

The management accounting program contains 368 category codes of facilities and may be easily expanded. The program can be used for automated analysis of the BFRL of a single installation or to analyze the facilities impact of base consolidations.

N-1207
Investigation of Heat Pipe Technology for Naval Applications, Feb 1972, S. C. Garg, AD892644L

A survey of heat pipe theory, applications and developments has been carried out with particular reference to long heat pipes. Applications in Naval operations where the heat pipe technology could be profitably employed are pointed out. Recommendations are made to design and test a long heat pipe in the laboratory with a view to applying the technology in improving equipment operation and reliability, reducing maintenance or component replacement, reducing cost of operation, or permitting designs which otherwise might not be feasible.

N-1208
Airfield Pavement Condition Survey, USNOLF San Nicolas Island, California, Dec 1971, H. Tomita, R. B. Brownie, AD738824

The results of a condition survey of the airfield pavements at the U.S Naval Outlying Field, San Nicolas Island, Calif., are presented. The survey established statistically based condition numbers (weighted defect densities) which were direct indicators of the condition of the individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, and a study of the requirements for future pavement evaluation efforts.

N-1209
Studies in Saturated Pool Boiling of Water, Jan 1972, S. C. Garg, AD738825

A photographic study of saturated nucleate pool boiling of water on horizontally mounted wires and tubes was carried out. The effects of the diameter of the heating surface, system pressure and heat flux upon the bubble diameter at departure from the heating surface were investigated. Five platinum wires of diameter between 0.001 and 0.026 in. and two platinum tubes of diameter 0.05 and 0.10 in. were used at pressures between 1.0 and 14.7 psia. Departure diameter of more than 1,800 discrete bubbles was measured at heat fluxes up to 125,000 Btu/hr-ft^2 by a frame-by-frame analysis of 6,100 ft of 16 mm film taken at 3,000 and 5,000 frames/sec.

The bubble diameter data were compared with analytical expressions by Owens, Ivey and Morris and Garg. An empirical expression is proposed which successfully correlates the bubble diameters in saturated nucleate pool boiling of water at all pressures. Recommendations are made to systematically investigate the effects of surface roughness and the degree of subcooling upon the bubble diameters at departure in nucleate pool boiling.

N-1210
Ten Year Field Exposure of Concrete and Masonry Paints, Apr 1972, C. V. Brouillette, AD743871

Four specification coatings for masonry surfaces were applied in Aug 1961 to two concrete buildings in the NCEL complex. Their condition was examined at about yearly intervals for 10 yr. Three exterior emulsion paints, acrylic (TT-P-0019A), polyvinyl acetate (TT-P-0055A) and styrene-butadiene (TT-P-0099A), were found to perform well. The cement-water base coating (TT-P-0021A) presented an unsightly appearance within 2 yr, particularly just after a rain. Because of greater alkali resistance and lower cost, exterior acrylic emulsion paint is recommended for general use on masonry surfaces.

N-1211
Antifouling Concrete - Preliminary Report, Jan 1972, J. S. Muraoka, AD738826

Concrete test panels containing expanded shale aggregates saturated with various antifouling chemicals were placed in tropical waters, in Port Hueneme Harbor, at depths of 120 ft, 600 ft, and on the surface to evaluate antifouling properties of the chemicals. Panels with mixtures of antifouling chemicals were more resistant to fouling than panels with a single chemical compound. The study is continuing.

N-1212
Marginal Terrain Platforms, Jun 1972, A. Widawsky, AD901987L

From a detailed study of 10 types of terrain and requirements for 6 types of artillery missions, an analytical evaluation of existing and conceptual platforms was made. It was found that a foam fiberglass platform would be most effective over the terrain-mission spectrum. A model of such a platform was built and successfully tested as an artillery platform on a surface of extremely low bearing strength. A need for a specially designed VTOL platform was identified. Of currently existing platforms, those most effective over the entire terrain-mission spectrum are AM-3, Airmobile Firing Platform (Rock Island Arsenal), MO-MAT, XM18E1, and XM20.

N-1213
Corrosion of Materials in Surface Seawater After 12 and 18 Months of Exposure, Jan 1972, F. M. Reinhart, J. F. Jenkins, AD743872

A total of 1,150 specimens of 189 different alloys were completely immersed in surface seawater for 12 and 18 mo to obtain data for comparison with deep ocean corrosion data. Corrosion rates, types of corrosion and pit depths were determined.

N-1214
Airfield Pavement Condition Survey, USNALF San Clemente Island, California, Jan 1972, H. Tomita, L. J. Woloszynski, AD738827

The results of a condition survey of the airfield pavements at the U.S. Naval Auxiliary Landing Field, San Clemente Island, Calif., are presented. The survey established statistically based indicators of the condition of the individual portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts.

N-1215
Airfield Pavement Condition Survey, USMCAS (H) Santa Ana and USMCAS (MOLF) Mile Square, California, Jan 1972, H. Tomita, J. A. Garcia, AD738828

The results of a condition survey of the airfield pavements at the U.S. Marine Corps Air Station (Helicopter)

Santa Ana and U.S. Marine Corps Air Station (Helicopter Outlying Landing Field) Mile Square, Calif., are presented. The surveys established statistically based condition numbers (weighted defect densities) which were direct indicators of the condition of the individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts at MCAS (H) Santa Ana included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts. The additional evaluation efforts except for the compilation of the aircraft data were also performed at MCAS (MOLF) Mile Square.

N-1216
Marine Corps Cargo Transfer in Combat Operations, Feb 1972, M. J. Wolfe, AD892645L

The objective of the study was to determine what hardware is required to improve the supply system of the Marine Corps in combat. The scope of the study included the materials handling equipment needed to move cargo from the manufacturer or supplier through to the using unit in the field. A qualitative approach was used to investigate the routine materials handling requirements at all echelons in the combat zone. Specific recommendations are given for a family of equipment suitable for handling standard pallets as well as newer forms of palletized and containerized cargo.

N-1217
Airfield Pavement Condition Survey, USNALF Monterey, California, Jan 1972, H. Tomita, L. J. Wolosznyski, AD739314

The results of a condition survey of the airfield pavements at the USNALF, Monterey, Calif., are presented. The survey established statistically based condition numbers (weighted defect densities) which were direct indicators of the condition of the individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts.

N-1218
Airfield Pavement Condition Survey, USMCAS Yuma, Arizona, Feb 1972, H. Tomita, L. J. Wolosznyski, AD739317

The results of a condition survey of the airfield pavements at the U.S. Marine Corps Air Station, Yuma, Ariz. are presented. The survey established statistically based condition numbers (weighted defect densities) which were direct indicators of the condition of the individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts.

N-1219
Airfield Pavement Condition Survey, USNALF Crows Landing, California, Feb 1972, H. Tomita, L. J. Wolosznyski, AD739316

The results of a condition survey of the airfield pavements at the USNALF, Crows Landing, Calif., are presented. The survey established statistically based condition numbers (weighted defect densities) which were direct indicators of the condition of the individual portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts.

N-1220
Classified Materials Incineration - The Problems and Current Approaches to Their Solution, Apr 1972, W. W. Watson, AD900215L

The Naval shore establishment has found it increasingly difficult to effectively and economically destroy the never-ending accumulation of classified materials generated by modern government. This difficulty has, in addition, been magnified in recent years by the necessity for compliance with increasingly stringent air pollution control regulations.

At the request of NAVFAC, a continuing investigation into improved methods for classified materials destruction, with special emphasis on incineration processes, has been conducted by NCEL. As a result of this program, it has been determined that the "starved air" incinerator is currently a relatively inexpensive and potentially effective unit. For major installations, and for the destruction of large quantities of densely packed or bound material, the "rotating combustion chamber" incinerator appears promising.

N-1221
Underwater Surveying at Diver Depth for Naval Installations - Nearshore, Apr 1972, J. B. Ciani, R. L. Brackett, R. G. Luthy, AD743873

Special methods and novel equipment for diver survey in the nearshore zone were designed, tested, and used to conduct a seafloor construction survey at a site off Anacapa Island, Calif. Sea surface positions were determined and transferred to the seafloor where two permanent benchmarks were placed. The geodetic coordinates of these two benchmarks were determined and closed back to the island in this work to +0.1 sec of latitude and longitude (+10 ft) and +0.4 ft of depth (+1%). Seafloor traverse and layout were performed with the measurement of angles, distances, and relative elevations. Angles measured with a bearing circle and read to 30 sec were determined on land to have a standard error of closure of +4.5 min around a mean of +2 min. Seafloor traverse disclosed an average angular closure error of -11.5 min. Distances measured by surveyor's tape and read to 0.01 ft were repeated over the same course three times to 1,160. Relative elevations measured with a differential pressure gage on the seafloor were virtually identical to measurements based on level readings to a level rod spar buoy. By this work it was demonstrated that surveying could be approached at diver depth on the seafloor in the nearshore zone. Although an interim capability is now available, its accuracy and utility do not match that of third order land survey. Therefore, it is recommended that this development be continued.

N-1222
In-Place Maintenance Painting of Steel Piling, Apr 1972, C. V. Brouillette, R. W. Drisko, AD900212L

Several materials and application procedures have been investigated for use in the in-place maintenance painting of steel piling. Coatings designed for application to dry sandblasted piling above the waterline have performed well for 2 yr. Coatings designed for application between tides, so that they are wetted with seawater almost immediately after application, or for application underwater, have performed well for 1 yr.

Application above water was accomplished by conventional spraying. Part of the application between tides and a few feet below mean low water was accomplished by a special cofferdam designed for use on steel sheet piling. The best was accomplished by brushing coatings specially formulated for underwater application. Surface preparation for the latter application was generally by underwater sandblasting, but cleaning with a pneumatic needle gun was also investigated. Laboratory testing indicated that needle gun cleaning was a promising technique. It was also used to screen candidate underwater-applied coatings.

While the performances of some test coatings are quite promising to date, their further exposure and investigation of new materials and application procedures will continue in order to make them more practical and economical.

N-1223
Urethane Foam Floats for Dredge Pipe, Apr 1972, R. W. Drisko, J. A. Drelicharz, AD743874

The feasibility of using urethane foam floats as replacements for conventional steel dredge pipe floats was investigated. Material and design requirements were determined, and two 1/8-scale models were fabricated. It was concluded that a full-scale model of a float of this design could be fabricated by personnel at a remote location with limited knowledge of materials and equipment for foaming operations but that only in-service testing of a prototype model fabricated in the field would indicate whether it would be able to satisfactorily withstand the severe conditions encountered in actual use.

N-1224
Corrosion of Alloys in Hydrospace - 189 Days at 5,900 Feet, Apr 1972, F. M. Reinhart, J. F. Jenkins, AD743875

A total of 525 specimens of 60 different alloys were exposed at a depth of 5,900 ft in the Pacific Ocean for 189 days in order to determine the effects of the deep ocean environments on their corrosion resistance. Corrosion rates, types of corrosion, pit depths, and stress corrosion cracking resistance are presented.

N-1225 - Cancelled

N-1226
Tests of Bonded Woven Roving, Ballistic Nylon, and Sand Against 81mm, 105mm, and 155mm Projectiles, Jun 1972, W. A. Keenan, AD903485L

In Apr 1971, NCEL tested the effectiveness of three materials to stop fragments from 81mm, 105mm, and 155mm projectiles at Camp Pendleton, Calif. The materials included ballistic nylon, bonded woven roving, and sand. Eight projectiles were detonated at ranges from 5 to 20 ft from 12 shields, each 2 by 3 ft. Shield thicknesses ranged from 3/8 to 1-1/8 in. of woven roving, 20 to 60 plies of ballistic nylon, and 2 to 8 in. of sand (contained between two sheets of woven roving). It is estimated from extrapolation of test data that all fragments from the 81mm projectile are stopped by about 30 plies of ballistic nylon, 11/16 in. of woven roving, or 2-1/2 in. of sand. Fragments from the 155mm projectile are stopped by about 80 plies, 1-5/8 in., or 8 in., respectively. In terms of least weight protection, ballistic nylon is better than woven roving which is better than sand. In general, theoretical predictions underestimated the measured number of fragments hitting and the number perforating the shields.

N-1227
Evaluation of Bottom Breakout Reduction Methods, Apr 1972, K. D. Vaudrey, AD743880

Breakout forces present problems in making retrieval lifts by increasing the lift force requirement, creating a dynamic snap-load in the lifting line, and causing control difficulty during ascent. Three breakout reduction methods are tested using small submersible sized objects. These methods are: (1) mud suction tubes, (2) water flooding, and (3) air jetting. The results showed that all methods were effective at reducing the breakout force to less than 10% of the wet weight of the object. Diver handling techniques are evaluated and described. Also, a review of three methods which calculate breakout forces is presented.

N-1228 - Cancelled

N-1229
Hydraulic Tools and Equipment for Underwater Salvage, Jul 1972, G. L. Liffick, F. B. Barrett, AD748585

Extending the U.S. Navy's underwater salvage capability will require improved diver-operated tools and equipment. NCEL is conducting a program to develop hydraulic hardware for future underwater salvage operations. Commercially available hydraulic pumps, rigging, load handling and cutting equipment have been evaluated at NCEL to determine characteristic diver performance and mechanical suitability for underwater operation. Manually operated hydraulic pumps were modified and pumped against a load cell to determine reasonable levels of diver exertion. Tests have shown that divers can be utilized as prime movers for small jobs and that some conventional surface hydraulic equipment can be used underwater for reasonable periods of time with a minimum of additional maintenance. Surface hydraulic equipment suitable for underwater operation includes manual pumps, rams, cylinders and several cutters. However, innovative new equipment is urgently required for underwater salvage particularly for load handling.

N-1230
Concrete Polymer Composite for Military Undersea Facilities, Apr 1972, J. R. Keeton, R. L. Alumbaugh, P. J. Hearst

Precast portland cement concrete specimens were impregnated with monomeric and resinous materials by the brush-on, soak, and vacuum-soak methods. The impregnants were polymerized by the promoted-catalytic or thermal-catalytic methods or with curing agents. Impregnations of specimens with certain epoxies by the vacuum-soak method resulted in reductions in water absorption of over 99%. Impregnations of specimens with methyl methacrylate by the vacuum-soak method, polymerized thermalcatalytically, resulted in compressive strengths as high as 23,750 psi.

N-1231
Field Study of Fencing Materials in a Marine-Atmospheric Environment - Results of Up to Three Years of Atmospheric Exposure and Corrosion Rate Determination, Jun 1972, E. S. Matsui, AD746842

Fifteen different corrosion-resistant chain-link fencing systems were installed at NCEL, Port Hueneme to evaluate their performance in a marine-atmospheric environment. These included metallic, plastic-coated, and alloy wire fencing. The test fences were inspected and evaluated periodically for their performance, and the corrosion rates were determined during and up to 3 yr of their exposure. A salt-spray test was also run on some of the samples. As of this date, the evaluation indicates that the vinyl-clad galvanized chain-link fence and accessories are performing better than other corrosion-resistance chain-link fence being investigated. Although cost of the vinyl-clad fencing was slightly more (11%) than the galvanized chain-link fence, the extra cost of the vinyl-clad fencing appears economically well justified because of its outstanding corrosion resistance, longer service life, and other benefits provided by the vinyl coating.

N-1232
Buoyant Concrete for Ocean Construction and Flotation, Jun 1972, H. H. Kusano, AD744922

Buoyant concrete material has been envisioned for ocean construction systems. This report summarizes an investigation of buoyant concretes containing lightweight, nonabsorbent glass nodules as the major aggregate constituent. Specimens (3 x 6 in. cylinders) from 35 different batches of concrete were tested for workability, strength, density, and absorption. The glass nodules were tested to implosion. Mix design curves and cost estimates were determined. The results indicate that this concrete can be used as a low-cost ($0.10 to 0.20 per pound of buoyancy) buoyant filler material for ocean applications in which low-strength (150 psi) is permissible.

N-1233
Calibration of Winsor Probe Test System for Strength Evaluation of Concrete in Naval Structures, J. R. Keeton, V. Hernandes, AD902599L

Tests are described in which the concrete probe tester (Winsor Probe Test System) was calibrated in concrete slabs containing river aggregate having a Mohs scratch hardness of 6 and in concrete slabs containing limestone aggregate having a Mohs hardness of 3.5. NCEL recommends the probe tester, the testing procedures, and calibration curves given herein for evaluation of in-situ compressive strength of concrete in existing structures of the Naval establishment.

N-1234
Near-Surface Facility Optimization Investigation for the Survivable Sanguine Systems Study, Apr 1972, J. R. Allgood, T. K. Lew, R. T. Odello, A. V. Widawsky, Secret

N-1235
Conductive Flooring for Ordnance Activities and Hospitals, Jun 1972, P. J. Hearst, AD902600

Various military and commercial ordnance facilities and various military, public, and private hospitals were visited or contacted to obtain information about the performance of their conductive flooring. Many of the newer flooring materials gave satisfactory service, but the information obtained was not adequate to rate or rank the different flooring materials. Manufacturers of conductive flooring were also contacted. Many conductive flooring materials are currently available, and the advantages and disadvantages of these materials are discussed.

N-1236
Paints for Wood, Oct 1972, J. B. Crilly, AD752781

Twenty-one paint systems, mostly latex, were exposed on southern yellow pine and on douglas fir plywood at Port Hueneme, Calif., and Kwajalein Atoll, Marshall Islands, for 15 and 27 mo. Two primers, one oil and one latex, were used, and a few systems were self-primed. White and one blue tint, Federal Standard 595 color number 35526, were exposed. A brief review of the pertinent literature through 1961 is included in the introduction.

N-1237
Piston Plate Blast Valve Development, Oct 1972, J. A. Norbutas

This note describes the status of a project to develop an antiblast valve for use in ventilation systems in hardened shelters. The valve is to provide protection against the destructive blast waves that might propagate through ventilation openings as a result of the detonation of nuclear weapons in the atmosphere. Performance criteria for this passive type valve, include 1,000 psi reflected overpressure at the valve inlet and 3,333 cfm air flow. A description is given of the completed preliminary design of the valve, based on a patented concept, that does not require an external relay duct. Shock tube tests on a model of the valve demonstrated the valve's ability to provide protection from blast waves with reflected overpressures as high as 1,600 psi. Steady state ventilation flow tests on the model valve revealed a pressure drop of 0.65 in. water gage at its rated capacity of 500 cfm. This is well within the criteria. Plans for future work to complete the development of a full size prototype valve are outlined.

N-1238
Salvage Equipment Pool - SUPSALV/NCEL, Jul 1972, J. J. Bayles, AD903688L

This report has been prepared to assist divers and support personnel with aspects of safety, handling and operation of hydrazine fueled salvage lift assist devices. The devices (and fuel for them) are located at NCEL, Port Hueneme, Calif., where Navy divers receive periodic training in their operation and maintenance. This pool, augmented by other miscellaneous salvage equipments, and the trained personnel provide the Navy with a ready salvage capability for emergency incidents. The devices range in lift capability up to a nominal 8.4 long tons.

N-1239
Study of Electrical Power Distribution System Transients Caused by Lightning at NAVRADSTA (T), Isabela, Puerto Rico, Jun 1972, J. L. Brooks, K. Huang, AD903384L

One of the objectives of work unit YF38.534.005.01.001, "High Quality Electric Power for Sensitive Electronic Equipment at Naval Shore Stations," is to characterize those transients occurring on the power distribution system of Navy shore stations which can be directly correlated with observed lightning phenomena. NAVRADSTA (T), Isabela, Puerto Rico, was chosen as the transient monitoring site because of the high incidence of lightning during the months of Aug and Sep each year. Accordingly, this monitoring trip was scheduled and completed between 16 Aug and 27 Sep 1971. This report describes, in detail, the electrical distribution system of the two test sites and presents a thorough analysis of the recorded and observed events. The recorded transients are time-correlated with observed lightning activity in such a manner as to provide an in-depth characterization of the numerous types encountered. A theoretical treatment of the distribution system response to a typical transient is presented based on the recorded transients and nameplate data taken from the various components of the distribution system.

N-1240
Three-Phase Power Disturbance Monitor, Jun 1972, M. N. Smith, AD746169

This report describes a newly developed three-phase power disturbance monitor which consists of an overvoltage sensor counter, undervoltage sensor counter, low threshold pulse transient sensor counter, high threshold sensor counter and an over-under frequency sensor counter. The monitor will simultaneously monitor voltage or frequency variations and pulse transients of either positive or negative polarity on all phases of a 120/208, three phase, 50-60 Hz power distribution circuit.

N-1241
Tests for Fabric Characteristics - 8.4-ton Lift Capability Collapsible Salvage Pontoon, Jul 1972, J. J. Bayles, AD749024

Tests conducted revealed that the 8.4-ton collapsible salvage pontoon purchased under contract NOBS 94517 would not be sufficiently reliable to permit its use under certain deep ocean salvage conditions.

It is recommended that these pontoons be limited to salvage operations of less than 350 ft depth.

N-1242
Tropical Exposure of Paint, Jul 1972, C. V. Brouillette, AD748185

Replicate specimens of coated steel test panels were exposed in Kwajalein, Marshall Islands (8 deg 44 ft N lat); Kaneohe, Hawaii (21 deg 21 ft N lat); and Port Hueneme, Calif. (34 deg 7 ft N lat). Two test sites were within the tropical zone (23 deg 27 ft N lat) and one was about 10 deg north of this zone. Coating performance was correlated with the variations in weather conditions at these test sites. A rule of thumb was postulated for classifying coatings as poor, acceptable or excellent relative to their concurrent performance at Kwajalein and Kaneohe. A paint that does not fail at either Kwajalein or Kaneohe after 3 yr of exposure is considered good to excellent, depending on any evidence of serious deterioration along the scribe as well as the condition of the unscribed specimen. If a paint fails at Kwajalein but has not failed at Kaneohe during 3 yr it is acceptable.

N-1243
Marine Corps Fuel Systems (1975-1985), Dec 1972, R. C. Winfrey, A. Jokubaitis, P. J. Daly, M. E. Hollin, H. J. Norton, C. K. Smith, W. W. Watson, AD907009L

This report documents an analysis of Marine Corps bulk fuel requirements between 1975 and 1985. The current Marine Corps Amphibious Assault Fuel System (AAFS) and Tactical Airfield Fuel Dispensing System (TAFDS) were investigated to determine their capability to meet future fuel requirements. A survey of related military and commercial fuel storage and handling equipment was conducted. Future fuel quantity requirements were determined for various operating modes and mixes of combat equipment, along with a description of fuel developments which may create quality control problems in the field. Recommendations are made to develop a modular forward area fuel supply container system and a POL quality control monitoring system.

N-1244
Airfield Pavement Evaluation, Royal Thai Navy Station, Ban U-Tapao Airfield, Thailand, Jun 1972, D. J. Lambiotte, AD903328L

The re-evaluation of the pavement at the Royal Thai Navy Station, Ban U-Tapao Airfield, Thailand, is presented with the allowable gross load capacities of all airfield pavements for various aircraft gear configurations. Included are results of a pavement condition survey with a defect summary, results of pavement and soil tests conducted during the survey, supplementary photographs, and estimates of remaining runway pavement life.

N-1244 Add
Airfield Pavement Evaluation, Royal Thai Navy Station, Ban U-Tapao Airfield, Thailand, Jun 1972, D. J. Lambiotte

Table 5, p. 61, "Summary of Allowable Gross Aircraft Loadings," does not include allowable loads for C-5A aircraft. This is because at present there are no published evaluation/gross-load charts for C-5A aircraft on rigid pavements. It is possible, however, to estimate allowable C-5A gross loads on U-Tapao pavements by utilizing presently available design curves for the aircraft. This procedure yields allowable gross C-5A loadings of at least 900,000 lb on all of the airfield facilities listed in Table 5.

N-1245
Direct Embedment Anchor Holding Capacity, Dec 1972, R. J. Taylor, H. J. Lee, AD754745

Techniques for predicting the maximum uplift forces which may be applied to direct embedment anchors without causing the anchor to pull out are provided. This holding capacity problem is subdivided into three categories, immediate breakout, long-term static load, and long-term repeated load. Holding capacities under long-term repeated and long-term static loading conditions are poorly understood at present. It was therefore necessary to combine work from other areas with a small amount of directly applicable work to yield approximate immediate use results. For each manner of loading considered, two general types of seafloors are considered, cohesionless and cohesive soil. Rock is not considered in this report.

To simplify the holding capacity prediction process, the suggested procedure is outlined without rationale in a block diagram with each item of the diagram being briefly discussed. A sample problem is also presented.

N-1246
Foundations for Small Seafloor Installations, Sep 1972, H. G. Herrmann, AD750259

This report presents a procedure for the design of foundations for small non-manrated and non-strategic seafloor installations. These procedures are applicable only to installations with dimensions less than 15 ft and submerged weight less than 4,000 lb. They do not require a detailed analysis of the prospective site and are applicable to all seafloor sites, except those located on slopes greater than 10 deg and those in areas of rapid sediment accumulation, such as off mouths of large rivers. The report includes analyses of vertical and lateral loading and load resistance, tiedowns, use of materials, and foundation emplacement. Several typical foundation types and special features are described. Two example design problems are included to illustrate the design procedures.

N-1247
Erection Instruction for Unheated Storage Shelter and Equipment Repair Ship in Polar Regions, Nov 1972, F. W. Brier, AD906065L

An investigation of available commercial building systems showed the fold-a-way building was inexpensive and easily erected and could function as a heavy-equipment repair and maintenance shop or an unheated storage shelter when used in conjunction with building accessories developed by NCEL. These accessories are a timber foundation and entrance ramp, anchoring system, mobile foundation and floor system, heating system, electrical system, an equipment door cover, and a field erection boom. Erection procedures and instructions for the fold-a-way building and the accessories are presented in this Technical Note.

N-1248
Building Foundation Study at McMurdo Station, Antarctica, Sep 1972, R. A. Paige

NCEL investigated problems concerning subsurface temperatures, snow accumulation, and potential frost heaving beneath buildings at McMurdo Station, Antarctica. Two buildings were selected for a comparative study of their effects upon earth-fill foundation and underlying permafrost. One building has an open blow space beneath it for air circulation and the other is completely enclosed.

Snow drifting and accumulation beneath buildings with an open blow space is detrimental because it engulfs utility pipes and renders them inaccessible for maintenance. It is also a source of melt water which could cause fill erosion or frost heaving. It is concluded that any building can be enclosed as necessary because: (1) permafrost consists predominantly of solid rock, there are no zones of high-ice-content silty soils typical of the Arctic, (2) the buildings protect the frozen ground from solar and atmospheric heat and tend to prevent thawing, and (3) the enclosed building has shown no detrimental foundation effects since its completion in 1964. The earth-fill pad is frozen solid and the area beneath the building is clean and dry.

N-1249
Snowdrift and Foundation Studies for the New South Pole Station, Nov 1972, F. W. Brier, R. A. Paige, AD753192

A two part study was conducted to determine the snowdrift characteristics of the New South Pole Station and properties of snow foundations at the South Pole. Snowdrift characteristics were studied using 1.150 scale models in a wind duct and 1.10 scale models in the field. From the scale model tests, areas of high and low snow accumulation rates were determined for a static undisturbed state in the vicinity of the station. The physical properties of natural and compacted snow were determined for the South pole and three load settlement tests were conducted on different foundation materials. The load settlement tests showed that the settlement rate of footings on natural snow is several times greater than footings on compacted snow.

N-1250
Investigation of Chemical Crosslinking or Complexing of Water-Soluble Materials to Yield Water-Insoluble Materials, Dec 1972, T. Roe, Jr., AD753193

In an effort to produce resinous compounds for use in preventing passage of water through porous construction materials such as concrete, a series of crosslinking or complexing reactions were carried out to produce water-insoluble materials from water-soluble materials. None of the materials produced had mechanical and chemical properties equal or superior to those of polyvinyl alcohol precipitated by sodium sulfate.

CONTRACT REPORTS

NOY-12561
Gravitational Waves in a Shallow Compressible Liquid, Report N-64, May 1949, California Institute of Technology, L. I. Schiff

This paper develops the theory of the propagation of waves through a horizontally stratified compressible liquid under the influence of gravity, with two simplifying assumptions: (1) the wave amplitudes are small, so that a linear or first-order theory suffices, (2) the liquid is assumed to be shallow so that the lengths of all waves are large in comparison with the liquid depth.

Air Bubble Breakwater, Report N-64.1, Jun 1949, California Institute of Technology, L. I. Schiff, AD80217

This paper considers one aspect of the effectiveness of a single or repeated air bubble screen as a breakwater for gravitational waves in shallow water. The aspect considered arises from the change in density and compressibility of the bubbly water as compared with normal water outside the screen. The effects of currents produced by the mass of rising bubbles will be discussed elsewhere. Use is made here of the notation and some results from another paper entitled Gravitational Waves in a Shallow Compressible Liquid; equations from that paper are denoted by primes. The properties of bubbly water are considered first, then the transmission of waves through a single bubble screen, and finally the transmission through a series of equally spaced screens.

Model Studies of Apra Harbor, Guam, M.I., Report N-63, Jun 1949, California Institute of Technology

This report presents the results of model studies of the water motions induced by waves and currents in and adjacent to Apra Harbor, Guam, M.I. The objectives of the studies were to evaluate designs for protective structures proposed by the Bureau of Yards and Docks, to recommend changes in these designs, if necessary, to obtain the desired protection from water surface disturbances and to determine the circulation within the harbor and its effect on the pollution problem.

Harbor Development Study, Model Studies for Harbor Developments, Progress Report for Jun 1 to Dec 31, 1949, California Institute of Technology, J. H. Carr

The general objective of the harbor development study is the investigation of the wave energy distribution in simple harbor areas, with the specific objective of determining design principles which will permit the prediction of harbor performance. The progress accomplished to date has consisted of the analysis of the problem in terms of applicable physical principles, the review of present knowledge of these principles, the formulation of a general laboratory program, and the construction of the laboratory facilities required for the first phase of the program.

Harbor Development Study, General Harbor Study: Progress Report for Jan 1 to Jun 30, 1950, California Institute of Technology, J. H. Carr

Investigation of the theoretical aspects of water-wave diffraction through an opening in a breakwater has progressed in two principal directions. First, the work of Penney and Price, in adapting Summerfelds solution of the optical diffraction problem to the case of water-wave diffraction, has been studied with a view toward generalizing it to suit any angle of wave incidence. In the second place, pursuing the method of a group at the Massachusetts Institute of Technology, an application of Mathieu functions to the case of water-wave diffraction has been made, to achieve an exact solution of the problem.

This second phase of the investigation seems to be especially fruitful in that the total amount of energy entering a harbor, and the distribution of energy within the harbor, can be numerically computed. Tables of constants involved in this computation are being published by the National Bureau of Standards, and will be generally available soon.

Harbor Development Study, General Harbor Study: Theoretical Studies, Jun 1950, California Institute of Technology, M. E. Stelzriede

Harbor Development Study, General Harbor Study: Progress Report, Jul 1950, Reflection and Transmission of Water Waves by Floating and Fixed Rigid Surfaces Barriers, California Institute of Technology, J. H. Carr

Harbor Development Study: Progress Report for Aug 1 to Oct 31, 1950, California Institute of Technology, J. H. Carr, M. Meisels, M. C. Walker

Harbor Development Study: Interim Report, Dec 1951, California Institute of Technology, J. G. Elliott, J. C. Hulft, M. Meisels

Harbor Development Study: Model Study of U.S. Naval Station, Mayport, Florida, Dec 1951, California Institute of Technology, M. Meisels, J. H. Carr

Harbor Development Study: Interim Report, Jan - Jul 1952, California Institute of Technology, J. H. Carr, J. G. Elliott, M. Meisels, M. E. Stelzriede

Harbor Development Studies: A Preliminary Investigation of the Stability of Caisson-Type Breakwaters, Progress Report, Nov 1952, California Institute of Technology, J. G. Elliott

This report describes the result of experiments conducted by the hydrodynamics laboratory with models of caisson-type breakwaters. The problem, equipment and techniques were introduced and described in part V of the January - July 1952 interim report of this laboratory. Briefly, the problem was to investigate the stability of portable, gravity-type wave barriers (caissons). As an initial approach, tests were conducted with models of the Phoenix barrier, since some prototpye data are available for comparison. This preliminary study was qualitative in nature, however, the results indicate the relative importance of the parameters involved, and it is hoped that these results will be useful in planning future investigations of a more quantitative nature.

Mobile Breakwater Studies, Report N-64.2, Dec 1950, California Institute of Technology, J. H. Carr, ATI208959

This report presents the results of studies of the problems and possibilities of mobile breakwaters. The field of study was divided into two main parts, general investigation of the hydromechanical laws pertaining to the problem of wave height attenuation, and the laboratory investigation of some specific devices which offered some promise of meeting minimum operational requirements.

Mobile Breakwater Study, Interim Report, Oct 1951, California Institute of Technology, M. E. Stelzriede

This report presents a survey of the surface barrier studies which had been conducted by the hydraulic structures laboratory up to that date. The performance curves of a number of types of mobile breakwaters were examined, and the decision reached that the most satisfactory one, all factors considered, was the three-bulkhead structure. After investigating the effect of such parameters as freeboard height, bottom clearance, and bulkhead spacing on the overall behavior of the barrier, a scale model of a hypothetical prototype pontoon assembly was constructed which incorporated what appeared to be the most effective values of these parameters. Performance data of this so-called optimum breakwater is given.

Mobile Breakwater Study, Interim Report, Dec 1951, California Institute of Technology, M. E. Stelzriede, J. H. Carr

The present report continues where the previous one left off, with a more intensive consideration of certain features of barrier performance which have been but vaguely understood. Specifically, the values of the coefficient of transmission, defined as the ratio of transmitted wave height to incident wave height, were determined under various controlled wave conditions for the following bodies: (1) fixed single bulkheads of different bottom clearances, (2) fixed three-bulkhead barrier, (3) floating three-bulkhead barrier with fixed baffle extending upward from the bottom, (4) floating barrier with weighted mooring lines,

(5) floating barrier with increased virtual mass on the end bulkheads, (6) floating barrier with hydrofoil added forward of first bulkhead.

Wave Protection Aspects of Harbor Design, Report E-11, Aug 1952, California Institute of Technology, J. H. Carr

The purpose of this manual is to present practical procedures and techniques which make possible the rational design of artificial harbors on a wave-protection basis. The over-all philosophy of design which has been adopted is one of successive approximation or refinement. Such a system has the outstanding advantage that the number of complicating variables can be greatly reduced in the case of the first-order solution, thus eliminating much ambiguity at the outset. When the relatively straightforward first-order solution has been obtained, it can be further refined to a degree consistent with the accuracy of the field data available and the importance of the problem. In particular, the first-order solution is obtained by applying the principles of wave diffraction to determine a breakwater orientation which provides an acceptable degree of wave protection, without considering the effect of wave reflections within the harbor. Successive refinements of this solution are obtained by considering the effect of multiple reflections within the harbor on the net wave disturbance at particular, strategic areas within the harbor. In addition to specific information relating to the determination of wave disturbances for well defined situations, certain general relationships between wave disturbances and harbor geometry are discussed. These relationships may be valuable qualitative guides for the approximate solution of field problems where a lack of time or other factors preclude the making of a complete analysis.

Interim Report (on Wave Forces on Plane Barriers), Dec 1952-Mar 1953, California Institute of Technology, M. Meisels, M. E. Stelzriede

Interim Report (on Wave Forces on Barriers), Jul 1953, California Institute of Technology, J. G. Elliott

Wave Forces on Plane Barriers, Report E-11.1, Oct 1953, California Institute of Technology, J. H. Carr

This report summarizes the analytical work and experimental investigations of plane barriers. Novel and practically useful results are reported in two principal categories, (1) the demonstration of a high degree of inaccuracy in the Sainflou theory for waves of length to depth ratio less than 3 or 4, and (2) the demonstration of a simple relationship between the force and moment acting on a vertical plane barrier and that acting on plane barriers inclined up to 10 deg seaward and 30 deg shoreward from the vertical.

Interim Report (on Wave Forces on Barriers), Nov 1953, California Institute of Technology, J. G. Elliott, M. Meisels, M. E. Stelzriede

Wave Forces on Curved and Stepped Barriers, Report E-11.2, Jun 1954, California Institute of Technology, J. H. Carr

The final phase of change 0 to contract NOY-12561 was the investigation of nonbreaking wave forces on a curved barrier and a family of three stepped-face barriers. This work was completed during the last part of change 0 and the first part of the current change Q. The results of these measurements are presented and compared with the previously completed analytical and experimental results for plane barriers. The experimental work performed includes both pressure-distribution measurements for one value of wave height to determine the nature of the forces in as much detail as possible, and direct force measurements which extend the results over a wide range of wave heights.

The principal conclusion reached from these studies is that the influence of breakwater shape on the magnitude and distribution of the forces acting due to wave attack is largely determined by the degree to which the shape tends to promote wave breaking against the structure. In other words, the vertical pressure distribution for pure wave reflection is essentially independent of barrier shape, and the departure from this pressure distribution is in proportion to the degree of departure from the situation of pure reflection.

For the stepped barriers studied, the departure from the analytical values of force and center of pressure for a vertical plane barrier are sufficiently small that the simple theory, or a slight modification of that theory, appears to be still useful as a design procedure.

Breaking Wave Forces on Plane Barriers, Report E-11.3, Nov 1954, California Institute of Technology, J. H. Carr, AD77861

This phase of the investigation approached the problem by determining the force-time history during the entire wave cycle to permit the evaluation of other aspects of the force function than the singular one of initial impulse. The results promise to provide useful data for a wide range of design problems.

Results include (1) determination of wave steepness and water depth parameters which result in wave breaking for various plane barrier and foreshore geometries. (2) Correlation of measured breaking wave impulse with computed wave momentum derived from solitary wave theory. (3) Experimental determinations of the relationship between wave parameters and the magnitude and location of a maximum effective force believed valid for design purposes, expressed in terms of the computed wave momentum.

Final Report on Contract NOY-12561, Report E-11.4, Nov 1954, California Institute of Technology, J. H. Carr, AD77862

Contract NOY-12561 was initiated 28 June 1945 for the purpose of conducting hydraulic model experiments to guide the extensive harbor improvements then in process and planned for, at Apra Harbor, Guam, M.I. The contract was continued through change orders and finally terminated on 30 November 1954. The Apra Harbor investigation was completed at the end of 1948, and during the following contract period activity was directed along the lines of basic investigations of wave phenomena as they affect harbors and harbor structures.

In the following sections of this report, the aim and procedure of the several investigations are outlined and the principal results summarized.

NOY-22271

Vibration-Compaction of Sand, Design, Testing and Evaluation of a Six-Ton Vibrator and Correlations With a Rational Analysis of Vibrator-Soil Systems, Jan 1952, California Institute of Technology, F. C. Converse, AD84579

There is a growing need in the field of civil engineering for a relatively light-weight and efficient vibration-compaction machine to supplement the heavy rolling equipment now generally used for the compaction of soil. Such a machine has particular advantages under conditions where the transportation of heavy equipment is difficult, and the time required for compaction is of primary importance. To date, attempts to design vibration-compaction equipment for use in highway and airport runway construction have met with only limited success. This appears to be due largely to a lack of knowledge of the basic laws involved in the compaction of soils by vibration. The engineers for the armed forces are keenly aware of the need for basic vibration studies, and it is through their initiative that the investigations described below were undertaken.

Vibration Compaction of Cohesive Soils, a Study of the Basic Laws Governing Compaction of Soil by Oscillating Surface Loads, Dec 1954, California Institute of Technology, F. C. Converse, AD78592

Preliminary field tests with a large vibrator resulted in the conclusion that the laws developed for sand did not apply to cohesive soil. A new theoretical approach to the determination of resonance of the vibrator soil system for cohesive soil was developed, but even though the vibrator was operated at resonance in a manner similar to that used for compacting sand, the degree of compaction of the cohesive soil was not satisfactory to these early tests.

A program of basic studies on a small scale was therefore undertaken. The general behavior of the soil was first studied by vibrating small quantities in a 4-in.-diam cylinder with dead weights acting on the surface of the soil. Later larger quantities were used and more extensive tests carried on in a larger pit.

Preliminary field studies indicated that rather large forces were required to cause compaction of the cohesive soil. Studies were made of the possibilities of reducing the force required by the introduction of chemicals to help break down the surface tension of the soil moisture and reduce the electrostatic bonds between the soil particles. Results to date appear to indicate that the vibrator compactor may eventually become a more useful tool for compacting soil than it has been in the past.

Further Studies on Vibration Compaction of Cohesive Soils, a Continuation of the Research Into the Basic Laws Governing Compaction of Soil by Oscillating Surface Loads, Sep 1955, California Institute of Technology, F. C. Converse, AD78419

Previous reports on the project work have been issued under the dates of March 1950, An Investigation of the Compaction of Soil by Vibration; January 1952, Vibration Compaction of Sand; and December 1954, Vibration Compaction of Cohesive Soils. The investigations since the publication of the last report have consisted mainly of field tests with a small oscillator on prepared soil, and a small amount of laboratory work to determine the physical characteristics of the soil--its shearing strength and its modulus of rigidity under varying density and moisture conditions.

NOY-22272

Radio Interference Elimination, Progress Report 1, Jan 1951, Stanford Research Institute, D. L. Benedict, AD222178

Radio Interference Elimination, Progress Report 2, Mar 1951, Stanford Research Institute, D. L. Benedict, ATI197346

Principles Governing the Construction of Shielded Rooms, Interim Report, Technical Report 1, Apr 1951, Stanford Research Institute, E. M. T. Jones

This report presents an analysis of the mechanism of shielding electromagnetic energy in one region from another, and specific recommendations for the construction of a shielded room to offer 120 db attenuation to all signals from 15 kc - 24,000 Mc.

The shielding problem is set forth in terms of transmission line theory since this seems to be the easiest method to understand as well as the most powerful analytic method of attack. A brief discussion of power line filters is included.

The conclusion is reached that a room constructed of a single thickness iron wall offers a more universally acceptable shield than solid copper or copper mesh walls.

Electrical Interference Problems Interim Report, Technical Report 2, May 1951, Stanford Research Institute, D. K. Weaver, ATI199121

This report is a qualitative discussion covering the subject of electrical interference and noise problems. The discussion includes typical interference sources, means of coupling resulting noise energy into a signal channel and general methods of eliminating or reducing interference. Several specific problems are covered.

Radio Interference Elimination, Progress Report 3, Jun 1951, Stanford Research Institute, D. L. Benedict, AD222177

Radio Interference Elimination, Progress Report 4, Sep 1951, Stanford Research Institute, D. L. Benedict, AD222175

Radio Interference Elimination, Progress Report 5, Dec 1951, Stanford Research Institute, D. L. Benedict, AD222176

Design of Interference Suppression Filters, Interim Report, Technical Report 3, Dec 1951, Stanford Research Institute, D. K. Weaver, AT1196750

This report describes the design of low-pass filters providing a controlled minimum attenuation in the stop band. Filters resulting from the design procedures given here use their elements in an efficient manner. Both M-derived and insertion loss methods of design are presented. A table is given of normalized filters which can be scaled to any cutoff frequency and to any impedance level.

Problems in the Measurement of Radio Noise Interference, Interim Report, Technical Report 4, May 1952, Stanford Research Institute, J. Goldberg, AD10862

The difficult problem of measuring power level and the time and frequency characteristics of an interference is encountered in all work on radio interference. Some of the standard difficulties which occur in calibrating measuring equipment and interpreting the results are discussed in this report. Elementary concepts of communications noise measurement are introduced, with information on the characteristics and origins of common radio noise and interference. Responses to noise and interference of key components of noise measurement instruments are described. Supplementary descriptions of artificial noise sources and standard noise ratings of receiving systems are given. The problem of errors in measurement is discussed with respect to errors of interpretation, errors in the use of equipment, and effects in the equipment. Recommendations are made as to desirable calibration procedures.

Elimination of Radio Interference by Shielding and Design of Shielded Rooms, Final Report, Aug 1952, Stanford Research Institute, D. L. Benedict, ATI197345

In many areas where radio interference is very strong, sensitive receivers and measuring equipment must be housed in electro-magnetically shielded rooms in order to achieve their full effectiveness. This report, the last of a series of five reports on shielding, filtering, and noise measuring, reviews work conducted by the Stanford Research Institute for the U.S. Navy Bureau of Yards and Docks on the use of solid sheet iron as a shielding material for attenuations of 120 db or greater over the frequency range of 15 kcps to 10,000 Mcps. Iron was selected as a result of an earlier study and report reviewing the theory of shielding and the merits of various conducting materials and construction procedures.

An experimental room made of 0.635 mm silicon transformer iron was constructed and shown to provide 46 db attenuation at 15 kcps. The attenuation was proportional to the square root of the frequency and became greater than 160 db in the 1 to 10 Mcps frequency range. Flush, rubber cushioned, pressure contacts around the door were tested and shown to provide equivalent attenuation when equipped with bronze contact strips. Contact between iron and iron surfaces was not adequate. These results are in agreement with theoretical predictions.

Associated facility requirements including power line filters, ventilation, and illumination are discussed. A 100-db power line filter was designed and constructed in accordance with recommendations contained in a report on filter networks. Testing procedures are described and applied to the filter in order to demonstrate by example how the variation of frequency with component impedance values can be handled.

NOY-22273

Pressurization of Buildings, Quarterly Report 1, Oct 1950, University of Minnesota, C. E. Lund, R. M. Granum, R. D. Turnacliff

Pressurization of Buildings, Quarterly Report 2, Jan 1951, University of Minnesota, C. E. Lund, R. M. Granum, R. D. Turnacliff

Pressurization of Buildings, Quarterly Report 3, Apr 1951, University of Minnesota, C. E. Lund, R. M. Granum, W. T. Peterson, R. D. Turnacliff, T. F. Irvine

Pressurization of Buildings, Summary Report 1, Oct 1952, University of Minnesota, C. E. Lund, W. T. Peterson, T. F. Irvine

Pressurization of Buildings, Supplementary Report 1, Jun 1952, University of Minnesota, C. E. Lund, W. T. Peterson, AD67251

Pressurization of Buildings, Supplementary Report 2, Jul 1952, University of Minnesota, C. E. Lund, R. E. Paul, W. T. Peterson, AD93371

Pressurization of Buildings, Supplementary Report 3, Aug 1952, University of Minnesota, C. E. Lund, W. T. Peterson, AD93373

Pressurization of Buildings, Final Report, Nov 1952, University of Minnesota, C. E. Lund, R. E. Paul, AD78694

The main purpose of this report is to summarize the results of this investigation and provide recommendations for sealing buildings at pressures not exceeding 1 in. of water. The data contained herein has been corrected for different conditions as determined by the studies on the small test house and presented in previous reports. The information is presented under following general headings, classification of leakage sources, general recommendations, recommended sealing materials, recommended application procedures.

NOY-24742

Prestressed Concrete Frames, Quarterly Report 1, Nov 1952, Illinois Institute of Technology, K. P. Milbradt

Prestressed Concrete Frames, Quarterly Report 2, Jan 1953, Illinois Institute of Technology, K. P. Milbradt

Prestressed Concrete Frames, Quarterly Report 3, Mar 1953, Illinois Institute of Technology, K. P. Milbradt

Prestressed Concrete Frames, Final Report, Jun 1953, Illinois Institute of Technology, K. P. Milbradt, AD34983

Project NOY-24742, Investigation of Continuous Prestressed Concrete Frames, developed a number of noteworthy contributions to the field of prestressed concrete. These developments have taken place during the 2-1/2 yr of the project activity. This final report surveys the results of the complete project, while making available detailed data in the appendices.

The general investigations made by the project include studies of prestressing steel and end anchorages, and analytical studies for development of an effective design procedure for indeterminate prestressed concrete frames. The investigations culminated in the design, construction and test of a beam, a prestressed monolithic frame and a prestressed component frame. The data from these tests afforded evidence substantiating the design assumptions, material behavior and structural action of these structures.

This final report covers the entire project from February 1951 to June 15, 1953.

NOY-27476

Study of Wave Forces on a Vertical Test Pile in Shallow Water, Progress Report for Quarter, Jan 1952, Agricultural and Mechanical College of Texas, C. L. Bretschneider

Study of Wave Forces on Hinged Piling in Shallow Water, Interim Quarterly Report, Jun 1952, Agricultural and Mechanical College of Texas, R. O. Reid, C. L. Bretschneider

Study of Wave Forces on Hinged Piling in Shallow Water, Interim Quarterly Report, Aug 1952, Agricultural and Mechanical College of Texas, R. O. Reid, C. L. Bretschneider

Study of Wave Forces on Hinged Piling in Shallow Water, Annual Report, Nov 1952, Agricultural and Mechanical College of Texas, R. O. Reid, C. L. Bretschneider, AD79134

Surface Waves and Offshore Structures, the Design Wave in Deep or Shallow Water, Storm Tide, and Forces on Vertical Piling and Large Submerged Objects, Oct 1953, Agricultural and Mechanical College of Texas, R. O. Reid, C. L. Bretschneider, AD19097

It has been attempted to bring together here much of the pertinent information which is necessary in estimating the forces exerted by waves on marine structures. Some practical methods are presented for estimating, (1) the design wave parameters H and T, particularly for relatively shallow water regions such as on the gulf shelf, (2) the water depth taking storm tide into account, (3) the crest elevation of any wave and the wave profile of the maximum waves, (4) the total wave forces on piles, and (5) the force on a submerged barge. With respect to the wave theory, it has been attempted to take into account the effect of wave steepness as well as relative depth and arrive at a consistent picture of the various wave and wave force parameters through graphical representation.

Wave Force Experiments in the Gulf of Mexico, October 1952-December 1954, Ref. 55-7A, Jan 1955, Agricultural and Mechanical College of Texas, B. W. Wilson, AD79550

Wave Force Experiments at Atchafalaya Bay, La., Technical Report 38-1, Feb 1954, Agricultural and Mechanical College of Texas, R. O. Reid, AD84611

The following report describes the instrumentation, procedure, and results of wave force experiments carried out at an oil platform belonging to the Pure Oil Company and located at latitude 29° 18.44' N, longitude 91° 32.11' W (Atchafalaya Bay area, Louisiana). The primary purpose of the investigation, which is at present being continued at a new location on the Texas coast, is that of correlating the total wave force on a vertical pile of circular cross section with the significant wave characteristics (height and period) for total submergence of the pile.

Effects of Vibrations on the Measurement of Wave Forces, Technical Report 38-2, Ref. 55-41T, Dec 1955, Agricultural and Mechanical College of Texas, B. W. Wilson, R. O. Reid, AD88693

This report presents a study of the nature of the natural (free) vibrations of a marine oil platform used as a base of attachment for a wave force measuring assembly and the vibrations of the measuring system itself. The objective of this inquiry was to determine to what extent and in what modal form these vibrations might enter into the recordings of wave force as obtained from the test pile. Various analytical techniques have been applied to the problem and show good concurrence of results, in general, too, the findings of theory are substantiated by the identification of frequencies in the wave force traces. In the fundamental mode the supporting platform at the Caplen (near Galveston) test site is found to have a period of about 1.2 sec. This vibration is sufficiently remote in value from that of the test pile, which has a natural period in water of about 0.50 sec, for an independence of action between the two vibrating systems under normal conditions.

The conclusion reached is that no very serious repercussions of the vibrations on the wave force measurements need be expected, what there are can be adequately filtered out of the records by IBM analysis procedures.

Laboratory Study of Impact of Cylindrical Objects on a Fluid Surface, Technical Report 38-3, Ref. 56-1T, Jan 1956, Agricultural and Mechanical College of Texas, R. P. Savage, AD104645

In the present study laboratory experiments have been made to evaluate the impulse imparted to a relatively large volume of fluid when struck by a small cylinder with its axis parallel to the free surface of the fluid. The measured impulse is compared with that predicted from theory. This report forms a part of the author's (R. P. Savage) thesis for his masters degree.

Analysis of Wave Force Experiments at Caplen, Texas, Final Report, Technical Report 38-4, Ref. 156-2F, Jan 1956, Agricultural and Mechanical College of Texas, R. O. Reid, AD94632

This is the final report of a series of four technical reports describing an investigation of wave forces exerted on piles.

The present report presents the results of wave force experiments carried out at the Sun Oil Company pier near Caplen, Texas. The method of analysis presented in this final report is considered to supersede that given in Report 38-1. The data consists of waves ranging from <1 up to nearly 7 ft in height and of a significant period of about 4 sec.

The main objective of the analysis was to evaluate the drag and inertia coefficients applicable to the present tests and show to what degree of approximation the actual wave force records can be reproduced by using these coefficients together with the wave theory. The biggest problem in the analysis is that of dealing with the very complicated time sequences of the measured forces and waves. No reliable method of measurement of orbital currents associated with waves exists for us in the field.

NOY-27475

Study of Quonset Walls for Determination of Thermal Conductivity Factors, Quarterly Report 1, Apr 1952, University of Minnesota, C. E. Lund, R. M. Lander, R. E. Paul

Study of Quonset Walls for Determination of Thermal Conductivity Factors, Quarterly Report 1, May 1952, University of Minnesota, C. E. Lund, R. M. Lander, R. E. Paul, AD222140

Study of Quonset Walls for Determination of Thermal Conductivity Factors, Final Report, Sep 1952, University of Minnesota, C. E. Lund, R. M. Lander, R. E. Paul, AD94716

In Nov 1951, a cooperative research program between the Engineering Experiment Station of the University of Minnesota Institute of Technology and the U.S. Naval Civil Engineering Research and Evaluation Laboratory was initiated to study the factors affecting the thermal conductivity of quonset walls. A summary of the original program is shown in Appendix I.

A quarterly report, submitted in May 1952, described the program and the progress of the investigation and presented the test results which were available at that time.

The purpose of this program was to study heat transmission through standard naval type quonset walls and to investigate the effect of different insulation applications on the thermal resistance of quonset structures.

NOY-27477

Prototype Experimental Cargo Sled, Type Mark IV, Stress Analysis, 1953, Zeigler-Harris and Company

The stress values calculated for each analysis are those existing under the critical conditions of loading imposed. Only those parts and assemblies which are stressed relatively high have been included in this report.

Operation Maintenance and Assembly Manual for Prototype Experimental Cargo Sled, Type Mark IV, 1953, Zeigler-Harris and Company

Instructions, assembly list, and drawings for operation, maintenance and assembly are included.

NOY-27480

Engineering Development Study of Sanitary Facilities in Arid Regions, Quarterly Progress Report 1, Apr 1952, Hostrup, Lyons and Associates, AD222142

Engineering Development Study of Sanitary Facilities in Arid Regions, Quarterly Progress Report 2, Jul 1952, Hostrup, Lyons and Associates, AD221946

Engineering Development Study of Sanitary Facilities in Arid Regions, Quarterly Progress Report, Oct 1952, Hostrup, Lyons and Associates, AD222143

Engineering Development Study of Sanitary Facilities in Arid Regions, Final Report, Jan 1953, Hostrup, Lyons and Associates, AD17671

This report, while cognizant of the generalized problems related to sanitation in arid regions, is concerned particularly with the development of facilities for three major personnel classifications, namely, large complements of men, permanently or temporarily attached; small groups, permanently or temporarily attached; and very small mobile groups.

For the purposes of this study, large complements are understood to mean 1,000 men or more, stationed in Naval, military and Marine installations and for which the provision of sanitary facilities entails treatment and disposal on a plant scale consistent with all the ramifications stemming from the systematized pattern of military life. Small groups, in either permanent or mobilization establishments, represent a maximum of 250 men, for which treatment facilities again tend to follow standardized lines but compatible with the environment and influences of a regimented existence. Very small mobile groups signify not more than 50 men, presumably on bivouac and sufficiently transitory to demand either portable waste treatment facilities or adequate temporary means, capable of rapid erection and removal.

Each of the three classifications is considered individually in a separate section of this report, findings and recommendations are consolidated and summarized under appropriate headings, detailed recommendations, basic design data, drawings, charts, tabulations and a comprehensive bibliography are presented.

NOY-27481

Engineering Development Study of Water Sources, Supply, and Facilities in Arid Regions, Quarterly Progress Report 1, Apr 1952, Hostrup, Lyons and Associates

Engineering Development Study of Water Sources, Supply and Facilities in Arid Regions, Quarterly Progress Report 2, Jul 1952, Hostrup, Lyons and Associates

Engineering Development Study of Water Sources, Supply, and Facilities in Arid Regions, Quarterly Progress Report 3, Oct 1952, Hostrup, Lyons and Associates

Engineering Development Study of Water Sources, Supply, and Facilities in Arid Regions, Final Report, Jan 1953, Hostrup, Lyons and Associates, AD18291

The purpose of this investigation and report is the study of water sources and engineering development of supply and facilities with particular reference to projects in arid regions. With this general objective in mind, a review of current methods, processes, design criteria, research activities and other pertinent factors has been carried on. As will be noted in a following scope, consideration has been given groups of various types and sizes from very small groups to large permanent establishments. Engineering development for projects of the latter classification has followed substantially modern water works practice employed in municipalities, while for very small groups methods have been much less standardized. Studies were also conducted to determine if possible new procedures for solutions to problems encountered in water engineering activities. Problems were encountered during World War II which required solution to avoid critical consequences. Some of these problems were general, while others were related to a specific locality. The report presents a discussion of those problems which generally occur in water supply development in arid regions and recommendations based upon extensive water works engineering experience, both as concerned with municipal and military water supply systems.

NOY-27482

Investigation of Ship Mooring Forces, Quarterly Reports 1 and 2, Jul 1952, Carr, McGraw and Shapiro, AD221955

Investigation of Ship Mooring Forces, Quarterly Report 3, Oct 1952, Carr, McGraw and Shapiro

Investigation of Ship Mooring Forces, Final Report, Apr 1953, Carr, McGraw and Shapiro, AD80461

A feasible approach to the rational design of a mooring structure is a program of experimental measurements of a sufficiently large range of conditions to permit eventual generalizations. The experimental measurements of the mooring forces should be correlated wherever possible with the coexisting environmental factors - wind, wave and current conditions, type of vessel, and mooring configurations. The process of obtaining a body of statistically reliable information will be expedited in direct ratio to the degree of correlation obtained between forces and environment. It must be appreciated, however, that a certain minimum number of observations are necessary to establish correlation.

This report covers the contract period of 1 yr and describes the development of equipment to measure and record mooring forces together with the subsequent force measuring program. Mooring line force measurements were made at berths 86 and 39 at the Navy Supply Depot at San Pedro during the contract period and are discussed together with environmental factors such as wind and water motion.

NOY-27485
A Study of the Characteristics of Prestressed Concrete Columns, Interim Report 1, Jun 1952, University of Southern California R. A. Breckenridge

A Study of the Characteristics of Prestressed Concrete Columns, USCEC Report 18-6, Final Report, Apr 1953, University of Southern California, R. A. Breckenridge, AD44811

A literature survey was conducted to determine the information available on prestressed concrete columns. Theoretical analyses and pilot tests were made on axially prestressed slender concrete columns to determine their characteristics under axial concentric and eccentric loads.

The literature survey showed that there is only a small amount of theoretical or experimental information on prestressed columns, but that there have been six or more structures constructed using such columns.

The theoretical analyses and pilot tests indicate that axial prestressing has no effect on the primary stability of slender columns. The results of the tests also indicate that the equations derived to calculate the stresses in eccentrically loaded and axially prestressed concrete columns are correct.

NOY-27486
The Snyder Surcon Impact Dynamometer, Final Report, 1954, Snyder Research Inc., R. K. Snyder, AD221954

The first portion of this report appertaining to the driving of piles, pile drivers, and similar subjects, is in no sense authoritative. The remarks are merely the result of the authors preliminary study of the subject prerequisite to the development of the impact dynamometer.

The authors personal experience in hydraulics, pneumatics, and mechanical engineering contributes a certain background from which the basic concept of the impact dynamometer was drawn. This report includes the theoretical and the mathematical calculations appertaining to the subject impact dynamometer as more specifically shown in the blueprints, the specifications, and the mathematical analysis of the subject device. Such a device, to the authors knowledge, has not been built before and as a result, the device is, in some respects, experimental. However, the operability of all of the units, including the hydropneumatic absorbers, the oil cooler, the valves, flanges, piping, packing, etc., are well known and their combination in the dynamometer raises mainly the questions of interdependent operation and control. Herein lies the unknown area. In any event, the data drawn from the actual operation of the dynamometer will speak for itself, and will give a better basis for further work on that part of the subject which today may be largely speculative.

NOY-27487
Study and Survey of Portable Water-Tube and Fire-Tube Boilers, Quarterly Progress Report 1, Aug 1952, Lawrence B. Freed, AD78648

Study and Survey of Portable Water-Tube and Fire-Tube Boilers, Quarterly Progress Report 2, Dec 1952, Lawrence B. Freed, AD22065

Study and Survey of Portable Water-Tube and Fire-Tube Boilers, Quarterly Progress Report 3, Jan 1953, Lawrence B. Freed, AD222066

Report on Survey and Study of Packaged Fire-Tube and Water-Tube Boilers, Final Report, 1953, Lawrence B. Freed, AD102768

The objectives of this report are to reveal, summarize and evaluate the results of extensive investigations of and pertaining to packaged type water-tube and fire-tube boilers operating in various areas of North America under varying conditions of operation and climate, to provide suggested specifications for the types of boilers falling within the scope of the survey, and to provide suggested standards for operation and maintenance for this type of boiler. The report includes packaged boilers with operating pressure ranges up to and including 125 psig, and up to and including 175 hp rated output which are presently available from commercial sources and in current operation.

NOY-27488
Investigation of Glass Fibers as Reinforcement for Prestressed Concrete, Progress Report, Apr 1953, Princeton University, W. M. Angas, N. J. Sollenberger

Investigation of the Effects of Repetitive Loading on Fiber Glass Rods in Prestressed Concrete Construction, Jun 1954, Princeton University, J. M. Weis

The Development of Fiber Glass Reinforced Plastic Rods, Jun 1955, Princeton University, A. Surko

Investigation of Glass Fibers as Reinforcement for Prestressing Concrete, Final Report, Sep 1955, Princeton University, AD94804

Various samples of commercially obtainable fiber glass products that could be used for prestressing concrete were investigated and tested. These samples included fiber glass cordage, tape and rods. Fiber glass rods proved to be most promising and further investigations were confined to testing fiber glass rods.

The lack of ductility of these fiber glass rods necessitated research to find or develop a satisfactory end connection with which they could be tested in tension. The most satisfactory end connection capable of developing the ultimate strength of the fiber glass rod was an ordinary drop-forged open socket for 1/4-in. wire rope in which the split and splayed end of the rod was embedded in a suitable plastic.

Further research was instituted to determine the strength properties of fiber glass rods. The strength properties investigated were ultimate tensile strength, modulus of elasticity, static fatigue and endurance fatigue limits. The ultimate strength of commercially available fiber glass rods varied between 94,000 psi and 140,000 psi. The modulus of elasticity varied between 4,900,000 psi and 7,000,000 psi. Both the static fatigue and endurance fatigue limits were found to be about 50% of the ultimate strength of the fiber glass rod.

A number of small experimental prestressed beams were prestressed with fiber glass rods made by the Columbia Products Company of Columbia, S.C. The beams were prestressed by the pretensioning method. The beams performed satisfactorily when tested and showed that sufficient bond could be developed between fiber glass rods and concrete to permit the use of such rods for prestressing by the pretensioning method.

NOY-27489
Study of Water Recovery Methods and Equipment, Report 1, Review of Literature, Aug 1952, University of Minnesota, E. A. Baillif, R. J. Howe, E. N. Kemler, M. H. Lajoy, A. J. Madden, AT1206005

Study of Water Recovery Methods and Equipment, Report 2, Review of Patent Literature, Sep 1952, University of Minnesota, E. A. Baillif, R. J. Howe, E. N. Kemler, M. H. Lajoy, A. J. Madden, AD281

Study of Water Recovery Methods and Equipment, Report 3, Theoretical Possibilities for Water Recovery Systems, Apr 1953, University of Minnesota, E. A. Baillif, R. J. Howe, E. N. Kemler, M. H. Lajoy, A. J. Madden, AD41826

Study of Water Recovery Methods and Equipment, Report 4, Manufacturers and Users Information on Water Recovery Systems, May 1953, University of Minnesota, E. A. Baillif, R. J. Howe, E. N. Kemler, M. H. Lajoy, A. J. Madden, AD41827

Study of Water Recovery Methods and Equipment, Report 5, Summary and Recommendations, May 1953, University of Minnesota, E. A. Baillif, R. J. Howe, E. N. Kemler, M. H. Lajoy, A. J. Madden, AD41828

This report gives in summary form the results of the various studies made on the various water recovery processes as reported in previous reports. Of the processes studied, those concerned with direct distillation and compression distillation have been carried to the point where they can be considered as fully developed. Direct distillation equipment is largely one designed for a particular condition (generally shipboard use) and, therefore, is not and probably will never be a standardized type of equipment. Compression distillation is adaptable to smaller scale operations and can, therefore, in some degree be standardized. Additional work will be necessary on this type of equipment, not on the basic principle, but rather on the development of necessary techniques to improve operations in the field. This will vary with the type of water source and also with the water which is being distilled.

NOY-27490
Prefabricated Stressed-Skin Panel Wanigan Type Hut, Apr 1952, Transa-Housing, Inc., W. G. Lutzi

The basis for the general characteristics and size of this wanigan was to develop a rugged, light-weight, low-shipping cube, easily erected wanigan, suitable for multiple uses such as barracks, galleys, mess halls, hospitals, offices, shops or service units.

NOY-27491
Study of the Mechanical Engineering Features of Polar Water Supply, Quarterly Progress Report 1, Jul 1952, Hostrup, Lyons and Associates, AD255492

Study of the Mechanical Engineering Features of Polar Water Supply, Quarterly Progress Report 2, Oct 1952, Hostrup, Lyons and Associates, AD255493

Study of the Mechanical Engineering Features of Polar Water Supply, Quarterly Progress Report 3, Jan 1953, Hostrup, Lyons and Associates, AD255494

Study of the Mechanical Engineering Features of Polar Water Supply, Final Report, Aug 1953, Hostrup, Lyons and Associates, AD34069

The general purpose of this investigation and report is the study of the mechanical features of polar water development, including investigations, studies, surveys, designs and calculations aimed toward the development of location procedures, treatment methods, equipment and techniques for natural water source supply and reclamation, the establishment of design criteria and standards therefore, for special application to requirements of small military personnel groups.

NOY-27492
Investigation of Indirect Evaporative Air Cooling, Jul 1952, University of Texas

Investigation of Indirect Evaporative Air Cooling, Quarterly Progress Report 2, Jul-Oct 1952, University of Texas, J. R. Watt, AD222161

Investigation of Indirect Evaporative Air Cooling, Quarterly Progress Report 3, Oct 1952-Feb 1953, University of Texas, J. R. Watt, AD222075

Investigation of Indirect Evaporative Air Cooling, Quarterly Progress Report 4, Feb-Jun 1953, University of Texas, J. R. Watt

Investigation of Evaporative Air Cooling, Final Report, Apr 1952-Dec 1953, University of Texas, J. R. Watt, AD42451

This report deals with comfort air cooling by evaporation of water. Two methods are examined.

A. Indirect evaporative cooling in which the air is cooled without humidifying it.

Indirect evaporative coolers using plate-type heat exchangers offer significant economies over refrigerated air conditioning. Equipment and power costs can be further reduced by simplified water spray system, dual use of single fan for cooled and tower air, and elimination of almost all moving parts, as outlined herein.

Such coolers promise economical comfort cooling in a variety of climates. For relatively humid areas, two-stage designs are recommended, for relatively dry areas single stage units should suffice. However, for intermediate zones, combination units are proposed, one stage of indirect cooling plus one of direct evaporative cooling, the latter governed by a humidistat in the conditioned space.

Test results and design data are given.

B. Direct ordinary evaporative cooling in which the air is cooled by humidifying it.

Direct evaporative cooling is recommended for areas ranging from moderately dry to arid, especially where large volumes of air are needed. Humidistat control is advisable where humid days occur.

A bibliography of 102 items relating to evaporative cooling is given.

NOY-28143
Investigation of Minimum Spacing of Bars in Precast Elements, Photographs, Oct 1951, University of Texas, Civil Engineering Research Laboratory, AD222216.

Minimum Spacing of Bars in Precast Elements, Interim Report, Apr 1952, University of Texas, Civil Engineering Research Laboratory, AD79132

Minimum Spacing of Bars in Precast Elements, Part I, Jul 1952, University of Texas, Civil Engineering Research Laboratory, K. D. Turpin, H. Matlock, F. M. Ferguson, J. N. Thompson, AD222165

Precast concrete members often utilize thin sections in which it is difficult to maintain the usual bar spacings. Hence studies of the effect of bar spacing upon bond resistance were deemed necessary.

Section I reports pullout tests made on pairs of plain bars under conditions such as to emphasize adhesion strength. These tests used cold rolled steel bars at varying spacing. The very smooth bars gave very low bond strength. High strength concrete (7,000 psi) gave no higher bond strength than moderate strength concrete (4,000 psi).

Section II reports pilot tests made on pairs of deformed bars under conditions intended to simulate actual beam conditions. A special rig and an eccentric form of test specimen were developed for these tests. The results point up the seriousness of splitting stresses caused by the wedging action of the bar lugs. All these specimens failed by splitting and only 6 out of 39 specimens gave ultimate strengths as high as standard working stresses. Bond resistance was sensitive to bar spacing. Bond strength wa

noticeably increased by the presence of web reinforcement. High strength concrete did increase bond resistance with these bars, by as much as one third.

Minimum Spacing of Bars in Precast Elements, Quarterly Report 1, Oct 1952, University of Texas, Civil Engineering Research Laboratory, AD221956

Minimum Spacing of Bars in Precast Elements, Quarterly Report 2, Jan 1953, University of Texas, Civil Engineering Research Laboratory, AD221957

Minimum Spacing of Bars in Precast Elements, Quarterly Report 3, Apr 1953, University of Texas, Civil Engineering Research Laboratory, AD79977

Minimum Spacing of Bars in Precast Elements, Special Interim Report, May 1953, University of Texas, Civil Engineering Research Laboratory, AD31981

Minimum Spacing of Bars in Precast Elements, Part 2, Aug 1953, University of Texas, Civil Engineering Research Laboratory, R. D. Turpin, P. M. Ferguson, J. N. Thompson, AD222164

The minimum spacing of deformed bars in reinforced concrete members as limited by bond strength was investigated by an extensive test program.

A special testing rig and an eccentric form of pullout tests provided the bulk of the data reported, but a number of beam tests were made to verify the result obtained. The effect of concrete mix, age, curing, and stirrups were investigated with two-bar and one-bar eccentric pullout tests. All specimens were made of small aggregate, 1/4-in. maximum size. Deformed bars meeting A.S.T.M. specification A305 were used.

All these tests showed low bond strengths due to splitting, not only at close spacings, but also at wide spacings such as those used in slabs. The splitting stresses produced by bond would not be serious in mass concrete or at the support of simple beams but could be important almost anywhere else. Where splitting is not externally prevented, there are very few cases (and only extreme cases) where the data justify the A.C.I. building code allowable bond stress of 350 psi, if a factor of safety of 2.5 is desired. The allowable bond stress should generally be limited to values from 90 to 300 psi depending upon bar spacing, concrete strength, and stirrups, but depending primarily upon the bar spacing.

It is pointed out that the present A.C.I. minimum clear spacing of 1 in. or 1-bar-diam is not a critical dimension, nor is an allowable bond stress of 350 psi with F'_c equal 4,000 psi justified for this spacing under the conditions investigated.

Minimum Bar Spacing as a Function of Bond and Shear Strength, Sep 1953, University of Texas, Civil Engineering Research Laboratory, P. M. Ferguson, R. D. Turpin, J. N. Thompson, AD31982

The minimum spacing of bars in reinforced concrete members subject to bending must satisfy two distinct conditions. First, the spacing and cover must be adequate to transmit the bond and shear stresses necessary for beam action. Second, the spacing and cover must be adequate to pass the maximum size of aggregate. This paper is not concerned with the second requirement. It deals entirely with splitting due to bond stress, a critical aspect of the stress condition which has received little attention, and it points out situations where this should govern design. It reports an experimental investigation carried out for the U.S. Navy Department, Bureau of Yards and Docks. The results indicate conservatism in the A.C.I. building code on the matter of minimum bar spacing under some conditions, accompanied by inadequate protection against failure in bond under other circumstances. All the experimental work has used new type deformed bars meeting ASTM specification A-305, and the conclusions relate entirely to construction using this type of bar.

Minimum Spacing of Bars in Precast Elements, Quarterly Report 4, Nov 1953, University of Texas, Civil Engineering Research Laboratory

Minimum Spacing of Bars in Precast Elements, Part 3, Splices, Mar 1954, University of Texas, Civil Engineering Research Laboratory, J. Chinn, P. M. Ferguson, J. N. Thompson

The strength of lapped splices was investigated by an exploratory series of 37 beams in each of which all the tension steel was spliced in a constant moment section.

Variables considered were: (1) length of lap, (2) concrete strength, (3) thickness of cover under or over the bars, (4) strength of spaced compared to contact splices, (5) effect of beam width per splice, (6) effect of casting bars in top of beam, (7) effect of bar size, (8) effect of stirrups.

All splices failed by splitting of the concrete, generally at strengths considerably below those necessary to give a factor of safety of 2.5 on splices designed by the A.C.I. building code Splice strength was sensitive to the width of beam and to the cover. There was less effect than expected from casting the bars in the top of the beam. Stirrups enclosing the splice increased the strength very greatly.

Most of the tests were run with number 6 bars. However, tests with number 3 and number 11 bars indicated that strength decreased somewhat with increasing bar size, even when all dimensions (in terms of bar diameters) were comparable.

NOY-28144
Study of Damage to Concrete Due to Welding or Reinforcing Steel in Field Splices of Precast Units, Photographs, Oct 1951, University of Texas, Civil Engineering Research Laboratory

Damage Due to Welding Between Precast Concrete Units, Jan 1952, University of Texas, Civil Engineering Research Laboratory, H. Mallock, P. M. Ferguson, J. N. Thompson, AD7715

Cracking around welded connections and splices between precast concrete units led to this exploratory investigation.

One phase of the study dealt with a typical panel section and its steel plate connection to adjacent panels. Welding around these plates caused expansion both of the embedded steel plate and the concrete beneath it, sufficient to cause cracks in the adjacent concrete of the panel. These cracks were prominent during or shortly after welding, but closed up as the materials cooled and not considered of serious consequence structurally.

Temperature measurements in the steel plates and reinforcing bars and on the surface of the concrete indicated a very localized zone of high temperature. Concrete dehydration due to heat was evident only where direct contact was made with the plate and there only as a surface phenomenon.

Another phase dealt with the welded splicing of bars where continuity of action across a field joint was desired. Welding equivalent to butt splicing always produced cracks over and parallel to the bar and extending back several inches into the concrete mass. Temperature measurements and physical inspection again showed negligible dehydration of concrete. Modulus of rupture tests on the concrete in direct contact with the bars verified that physical damage was limited to the area where visible cracks formed.

It was concluded than any significant structural damage to panels on actual installations would probably be due to restraints against normal contraction after welding. A study of these restraints is recommended.

NOY-28145
Engineering Development and Fabrication of a Suppressed Ignition System, Apr 1953, Hallett Manufacturing Co., A. Cramp, AD102847

This report describes research and development work done in the performance of Yards and Docks contract NOY-28145 on a shielded, unitized, universal ignition system and a unitized, universal shield for generators and regulators.

The problem consists of the necessary research, development and fabrication of a unitized, suppressed ignition and electrical system. The igniter will combine as a single shielded unit the coil, condenser, and the distributor. The shielding of the generator and voltage regulator is also to be considered as a single unit design. The specified engines to be considered are, Ford V-8 passenger unit, Chevrolet 6 cylinder passenger unit and the Continental F-162 engine that is used in the towmotor lift truck. The use of ferrous stampings will be emphasized. The igniters, through basically a 6-V unit, are to be designed for 12- and 24-V operation. All design is to be from a standpoint of low cost production.

NOY-28146
Development of Arctic Fire Extinguishers, Progress Report, Jun-Sep 1951, Bjorksten Research Laboratory, Inc., AD221949

Development of Arctic Fire Extinguishers, Progress Report, Sep-Dec 1951, Bjorksten Research Laboratory, Inc., AD221950

Development of Arctic Fire Extinguishers, Progress Report, Dec 1951-Mar 1952, Bjorksten Research Laboratory, Inc., L. A. Roe, AD222069

Development of Arctic Fire Extinguishers, Final Report, Jun 1952, Bjorksten Research Laboratory, Inc., L. A. Roe, AD78672

Initial efforts were devoted to the testing and evaluation of dry chemical extinguishers. These were found to be ineffective under Arctic conditions on all except very small class B fires.

Subsequently, we were instructed to direct primary efforts towards the development of an extinguisher for class A fires. This meant that all presently available dry chemicals could not be considered as they are ineffective on class A fires at any temperature. Some efforts were directed towards the development of a powder which would be effective on class A fires.

Tests with new fluorinated hydrocarbon liquid agents showed that these agents were effective on all types of fires under Arctic conditions.

No new type of extinguisher was developed under this contract. However, work progressed to a point where recommendations can be made for the adaptation and improvement of existing air-pressurized vaporizing-liquid type extinguishers, for use at -65F.

Our final recommendation which sums up the work under the contract is that air-pressurized vaporizing-liquid type extinguishers loaded with dibromotetrafluoroethane (Halon 1202) or dibromodifluoromethane (Halon 1202) should be adopted as standard equipment for Arctic use.

NOY-28147
Design and Development of a Heating System for the Douglas Arctic Pre-Fabricated Buildings, May 1952, George W. Meek and Associates, AD86460

The general purpose of this contract was to furnish all engineering services required for the conduct of an engineering development study including investigations, studies, designs and calculations culminating in a design of a heating system for the Douglas arctic pre-fabricated building. While the Douglas building is specifically referred to, it was understood that the broader objective was to develop a heating system suitable for any structure of the same dimensions, shape and thermal characteristics regardless of the exact details or materials of construction.

NOY-28148
Study of Radiant Heating for Arctic Buildings, Sep 1951, University of Minnesota, Department of Mechanical Engineering, A. B. Algren, E. N. Kemler, M. H. Lajoy, G. R. Whitnah, AD78693

The results obtained from this preliminary investigation indicate that radiant heating systems for use in Arctic regions possess considerable merit. It is believed that greater overall comfort can be obtained at lower inside air temperatures and with less stratification, provided the relationship between the heating system and treatment of interior surfaces with proper reflective materials can be established. The results of the experimental studies carried out in connection with this investigation indicate that fuel savings of the order of 25% can be obtained by proper wall surface treatment. It is possible that the overall fuel savings by properly designed radiant heating systems in wanigans might exceed this.

Radiant heating systems are very flexible and can be adapted to meet a wide variety of conditions. Where low floor temperatures are permissible, radiant ceiling panels alone might be satisfactory. Where high floor temperatures are desired, a floor type panel heating or perimeter heating system might be adapted. The general flexibility of radiant heating systems permits meeting a wide variety of requirements.

NOY-28149
A Photoelastic Study of Dynamic Stresses in Structures, Final Report, Phase 1, Jun 1952, Illinois Institute of Technology, Department of Mechanics, M. M. Frocht, P. D. Flynn, AT1206815

Results of a literature survey on dynamic photoelasticity are given. The survey shows that two facts stand out, (1) no effective technique has yet been developed for the study of dynamic stresses even in two dimensions, to say nothing of three-dimensions, and (2) the validity of the stress optic law for dynamic conditions has been assumed but not proved or verified.

Report further deals with developments in high speed photography from point of view of selecting or designing suitable equipment for dynamic photoelastic investigations. A study of the dynamic stresses in longitudinal impact would seem to provide a more suitable starting point for developing an experimental technique and for verifying the stress optic law.

A Photoelastic Study of Dynamic Stresses in Structures, Quarterly Report, Jul-Sep 1952, Illinois Institute of Technology, Department of Mechanics, M. M. Frocht, AD222144

A Photoelastic Study of Dynamic Stresses in Structures, Quarterly Report, Oct-Dec 1952, Illinois Institute of Technology, Department of Mechanics, M. M. Frocht

A Photoelastic Study of Dynamic Stresses in Structures, Quarterly Report, Jan-Mar 1953, Illinois Institute of Technology, Department of Mechanics, M. M. Frocht, AD34435

A Photoelastic Study of Dynamic Stresses in Structures, Yearly Report, Jul 1952-Jun 1953, Illinois Institute of Technology, Department of Mechanics, M. M. Frocht, P. D. Flynn, D. Landsberg, AD221952

A Photoelastic Study of Dynamic Stresses in Structures, Quarterly Report, Jul-Sep 1953, Illinois Institute of Technology, Department of Mechanics, M. M. Frocht, AD221953

A Photoelastic Study of Dynamic Stresses in Structures, Quarterly Report, Oct-Dec 1953, Illinois Institute of Technology, Department of Mechanics, M. M. Frocht

A Photoelastic Study of Dynamic Stresses in Structures, Quarterly Report, Jan-Mar 1954, Illinois Institute of Technology, Department of Mechanics, M. M. Frocht

A Photoelastic Study of Dynamic Stresses in Structures, Final Report, Nov 1954, Illinois Institute of Technology, Department of Mechanics, M. M. Frocht, P. D. Flynn, D. Landsberg, AD84714

The present report deals primarily with the further development of equipment and techniques for obtaining dynamic stress patterns showing fundamental aspects of stress wave propagation, and with a study of the dynamic stress-optic law which is essential to the proper interpretation of such patterns. It also describes studies of stress wave

propagation in a compression bar, the use of the Fastax camera, experiments with concentrated loads, stress concentrations, and beams under central impact.

NOY-28150
Deep Soil Stabilization, Phase 2, In-Place Mixing of Intrusion Grout With Soft Soils, Final Report for period Jun 24 to Dec 21, 1951, Apr 1952, Intrusion-Prepakt, Inc., AD79312

Results of laboratory scale applications of our deep-soil stabilization process conducted at the U.S. Naval Civil Engineering Research and Evaluation Laboratory at Port Hueneme, California during the months of Apr, May, and Jun 1951, revealed that full scale demonstrations of the process and apparatus were justified.

A site for testing was selected at the San Francisco Naval Shipyard because previous investigation showed that soft mud might be expected to a depth of at least 40 ft. Using various mixing heads, a number of elements were grouted to depths of 30 to 40 ft. The elements were later subjected to load and pull tests. Various results are discussed in the report.

NOY-28151
A Study of the Passive Defense of Shore Installations, V. 1: The Characteristics of Aerial Guidance Most Likely to Be Used Against Shore Targets (U), May 1953, University of Colorado, Secret

A Study of the Passive Defense of Shore Installations, V. 2: Existing and Proposed Means of Passive Defense for Use With Shore Targets (U), May 1953, University of Colorado, Secret

NOY-73218
Study of Moisture Migration Through Concrete Floors, Quarterly Report 1, Oct 1952, University of Minnesota, C. E. Lund, R. E. Paul, AD222139

Theoretical Analysis of Vapor and Moisture Migration Through Concrete Slabs and Soils, Jul 1954, University of Minnesota, C. E. Lund, J. T. Yen, AD93372

The methods of moisture migration through concrete slabs laid over different types of soils involves the analysis of many complex factors in order to determine quantitatively the rate such moisture is transmitted through the concrete. Although this investigation is primarily for the purpose of determining quantitatively the rate of moisture dispersion through concrete slabs within the Navy warehouses used for storage of materials, it is also of considerable importance to the building industry.

Investigation of Moisture Migration and Vapor Permeability of Concrete Warehouse Floors, Quarterly Progress Report, Sep 1954, University of Minnesota, C. E. Lund, AD77680

Moisture Migration and Vapor Permeability of Concrete Storehouse Floors, Summary Report, Jun 1955, University of Minnesota, C. E. Lund, AD78478

A report covering the theoretical analysis of vapor and moisture migration through concrete slabs and soils was submitted on July 28, 1954. This report covered a detailed analysis of the factors affecting moisture migration through concrete and the effect of soils upon such migration.

This report summarizes previous work and covers preparation of specimens, description of test equipment, instrumentation and a progress report on the data obtained. It also supplements the literature survey in earlier reports.

NOY-73219
The Development and Standardization of Thermal-Compression Sea-Water Distillation Units, Progress Report 1, June 1953, Battelle Memorial Institute, J. A. Eibling, J. M. Allen

The Development and Standardization of Thermal-Compression Sea-Water Distillation Units, Progress Report 2, Sep 1953, Battelle Memorial Institute, J. A. Eibling, J. M. Allen

NOY-73221
Development, Design and Prototype Fabrication of Arctic Type Sewage Disposal System, Assembly Instructions, Cost Breakdown, Service Manual, and Outline of Test Program, (On Cover: Service Manual, Nottingham Model 100X, Sewage Disposal Unit), Jan 1953, M. C. Nottingham Co., AD86437

The Nottingham Model 100X provides for sewage disposal by bacterial action, much the same as provided for in a septic tank. In the report various problems in connection with its development are discussed.

NOY-73222
Screen Room Radio Interference Filter Development, Sep 1952, Hopkins Engineering Co., AD102846

This report covers the development and design work done under this contract during the period 12 May 1952 to 30 Aug 1952.

This report contains information pertinent to the development and design of a power line radio interference filter suitable for screen room application.

In this report, consideration is given to a suggested circuit for such a filter and experimental test results on this suggested filter. The presstype filter, type 109, was developed from the suggested filter circuit. The test results on type 109 are included in this report.

Test results and filter characteristics for the four (4) final filters fabricated under the requirements of the contract are all presented in this report.

Appendix: Layout Drawings and Photographs of the Hopkins 109 Power Line Filter, Sep 1952, Hopkins Engineering Co., AD102846

NOY-73223
Report on Soil Truss Developed by U.S. Naval Civil Engineering Laboratory, Port Hueneme, California, Mar 1953, California Institute of Technology, Frederick J. Converse, AD84580

The objects of this investigation were (1) to check the results of the shearing strength of soil as determined by the soil truss with shear tests on the same material using standard triaxial and direct shear methods. (2) To study the tress in order to determine its range of usefulness in soil engineering problems. Six different sets of tests were run, each set consisting of three series of soil truss tests each at four values of the truss angle θ, three series of triaxial tests, each at five values of σ_3 (3, 6, 10, 15, and 20 psi), two series of direct shear tests each at five values of normal load (σ = 6, 10, 15, 20, and 25 psi).

NOY-73227
Damage Due to Welding Between Precast Concrete Units, First Phase Report, Dec 1952, University of Texas

Development of Criteria for the Control of Damage Due to Welding of Reinforcing Steel Splices Between Precast Concrete Units, Quarterly Progress 4, Jul 1953, University of Texas, J. N. Thompson

Evaluation of Damage Due to Welding Between Precast Concrete Units, Oct 1953, University of Texas, H. Matlock, A. A. Toprac, J. N. Thompson, AD79133

A previous investigation served to establish that the damage to welded splices between unrestrained precast concrete units consisted primarily of cracking due to differential thermal expansions. The present study was intended to establish the effects of the controlling variables and to evaluate the damage.

Specimens consisted of pairs of concrete blocks cast with a deformed reinforcing bar projecting from the end of each block. The bars were connected with 60-deg V-butt welds, performed at a reasonably rapid rate.

Temperatures were measured with thermocouples along the steel bars. The output voltages of the thermocouples were repeatedly scanned in sequence and recorded with a cathode-

The Development and Standardization of Thermal-Compression Sea-Water Distillation Units, Progress Report 3, Dec 1953, Battelle Memorial Institute, J. A. Eibling, J. M. Allen

The Development and Standardization of Thermal-Compression Sea-Water Distillation Units, Progress Report 4, Mar 1954, Battelle Memorial Institute, J. A. Eibling, J. M. Allen

The Development and Standardization of Thermal-Compression Sea-Water Distillation Units, Progress Report 5, Jun 1954, Battelle Memorial Institute, J. A. Eibling, J. M. Allen

The Development of Thermal-Compression Sea-Water Distillation Units, Progress Report 6, Feb 1955, Battelle Memorial Institute, J. A. Eibling, J. M. Allen, R. W. Baker, AD222141

The Development of Thermal-Compression Sea-Water Distillation Units, Progress Report 7, May 1955, Battelle Memorial Institute, J. A. Eibling, J. M. Allen, AD786674

The Development of Thermal-Compression Sea-Water Distillation Units, Progress Report 8, Aug 1955, Battelle Memorial Institute, J. M. Allen, W. A. Spraker, AD115900

The Development of Advance-Base Thermo-Compression Sea-Water Stills, Summary Report, Nov 1955, Battelle Memorial Institute, J. A. Eibling, J. M. Allen, AD94743

This report presents a summary of the results of a research program on the study and development of thermo-compression sea-water stills for use at advance Naval bases. The material from which this summary was prepared is contained in eight quarterly progress reports which were written during the course of the project. The project began in April 1953. Data pertaining to experimental work are recorded in Battelle laboratory record books no. 9387 and 8160, which are on permanent file at Battelle.

Initially the research program had for its objective the development of 85-and 200-gph distillation units. Later the scope of the project was amended to permit concentration of effort on one size of still in range of 85 to 100 gph. The main treatment in this report pertains to the development of the smaller still. In particular, a size of 90 gph was selected for design purposes. In some instances, data are presented on the larger still and reference is occasionally made to standardization and interchangeability.

The Development of Advance-Base Thermo-Compression Sea-Water Stills, Quarterly Progress Report 9, May 1956, Battelle Memorial Institute, D. L. Hyatt, J. A. Eibling, AD115898

The Development of Advance-Base Thermo-Compression Sea-Water Stills, Quarterly Progress Report 10, Aug 1956, Battelle Memorial Institute, D. L. Hyatt, J. A. Eibling, AD115899

The Development of Advance-Base Thermo-Compression Sea-Water Stills, Quarterly Progress Report 11, Nov 1956, Battelle Memorial Institute, D. L. Hyatt, J. A. Eibling, AD255271

The Development of Advance-Base Thermo-Compression Sea-Water Stills, Quarterly Progress Report 12, Feb 1957, Battelle Memorial Institute, D. L. Hyatt, F. W. Fink, J. A. Eibling, AD255270

The Development of Evaporators for Advance-Base Thermo-compression Sea-Water Stills, Summary Report, Mar 1957, Battelle Memorial Institute, D. L. Hyatt, J. A. Eibling, AD255272

This report presents a summary of the work performed from Nov 15, 1955, to Mar 15, 1957, on the development of advance-base thermocompression sea-water stills. During this period the research effort was directed solely toward the improvement of evaporators for thermocompression stills. The work was carried out on an extension of a previous research program which began in Apr 1953 and which covered evaluations of all of the components of thermocompression stills. The results of the previous research program are contained in a summary report dated Nov 1955.

ray oscilloscope and camera. Power was recorded continuously and the instant of cracking was determined by the parting of a carbon element on the specimen surface. The lengths of cracks were measured immediately after welding. Electrode consumption was noted.

Bond tests performed without friction at the bearing face emphasized the low splitting resistance of thin precast members. Bond values were considerably less than even the allowable value of the A.C.I. design code. Pull-out tests made with friction showed that strengths were increased about three-fold by providing frictional resistance against the opening of cracks.

The bond tests did not show that any significant decrease in strength was due to the cracks formed by welding. Apparently, with the specimens and procedures used, it made little difference whether the initial crack was formed during welding or later by initial loading in the pull-out test.

NOY-73229

Development and Design of a Disaster Shelter, Final Report, May 1953, Harold P. King, AD102962

The structural engineers preliminary report dated 28 August 1952 and copies of the preliminary drawings are included as the first section of this final report for the purpose of presenting a complete record of the development of the disaster shelter.

NOY-73231

Plastic Beams Project, Quarterly Report 1, Report P52-21, Sep 1952, University of California at Los Angeles, J. M. English, W. T. Thomson, J. A. Cheney, AD12758

Plastic Beams Project, Quarterly Report 2, Report P52-218, Dec 1952, University of California at Los Angeles, J. M. English, W. T. Thomson, J. A. Cheney, AD12759

Plastic Beams Project, Quarterly Report 3, Report P53-8, Mar 1953, University of California at Los Angeles, W. T. Thomson, J. A. Cheney, AD12744

Dynamic Response of Beams in and Beyond the Elastic Range, Report 53-19, Aug 1953, University of California at Los Angeles, W. T. Thomson, J. M. English, J. A. Cheney, AD21405

The problem of the response of beams in the elastic range can be solved by means of superposition of normal modes of vibration. This method has been utilized here with simplifying assumptions to obtain the response of beams beyond the elastic range. Yield hinges are assumed to form in the beam which alter the constraint conditions of the elastic portions of the beam. The analysis is essentially the study of the dynamic behavior of the elastic portions of beams between such yield hinges and constraints.

In order to carry the theory into actual application, dynamical beam properties must be determined. These must include the effects of dynamic loading of material properties as well as the characteristic number and functions.

An electronic analog computer has been employed to reduce the labor of numerical solutions. Several such solutions in the elastic range and one in the inelastic range are shown.

Plastic Behavior of Beams Under Long Duration Impulsive Loads, Report 54-92, Oct 1954, University of California at Los Angeles, W. T. Thomson, AD52844

The elastic behavior of structures subjected to impulsive loads is well understood. Even for the more complex structures it is only necessary to know its normal modes in order to determine its transient behavior. For complex impulsive loads the dynamic load factor for each mode can be generated by an analog computer and the contributions of the various modes can be summed to represent deflection, slope, moment, or shear.

Very little is known regarding the plastic behavior of structures subjected to impulsive load. For the more simple structures, step-by-step computing procedures are available which become hopelessly complicated when damping is taken

into account. Aside from the computational difficulties, not enough is known regarding the dynamic resistance of structures which is dependent on many factors such as load, deflection, time, and configuration.

Under these circumstances, it is highly desirable to study first the simplest structural element, involving a single yield hinge, the simply supported beam. This report represents such a study aided by an analog computing scheme and correlated with experimental data. The experimental beams, tested by the Civil Engineering Research and Evaluation Laboratory at Port Hueneme, were concrete with over-reinforcing tension and compression steel. Due to the over-reinforcing of steel the concrete serves only to add mass and hold the reinforcing bars in place, and has negligible influence on the strength of the beam.

Dynamic Response of Single Span Beams in the Plastic Region, Report 52-53 (55-52 rev.), Jun 1957, University of California at Los Angeles, W. T. Thomson, AD139139

Very little is known regarding the dynamic behavior of structures in the plastic region. The concept of normal modes as used in the elastic analysis is difficult to apply since varying regions of yielding continually alter the original structure. In addition, knowledge is lacking regarding the dynamic behavior of structural materials for conditions under which they are used.

In spite of these difficulties, progress has been made in the analysis of basic structural elements such as the beam under various end conditions and loading. These methods require the making of many simplifying assumptions which are justified only on the basis of the success of the procedure in arriving at results which are in agreement with measured test results. Sweeping statements of the applicability of these methods to other structures of differing configuration of material should, however, be viewed with reservation.

NOY-73232

Beach Trafficability Survey, First Quarterly Status Report, Oct 1952, University of California, Institute of Engineering Research, AD17118

Review and Evaluation of Research Related to Trafficability of Beaches, Series 59, Issue 1, Jul 1953, University of California, Institute of Engineering Research, R. Horonjeff, H. B. Seed, C. J. Vantil, R. L. Wiegel, P. D. Trask

The purpose of this investigation was to survey, summarize, and analyze existing data related to beach trafficability and to indicate what research is needed for the development of techniques which will permit appraisal of beach trafficability with greater precision than is now possible.

The main objectives of the research in trafficability have been (1) to improve the trafficability characteristics of military vehicles and (2) to develop techniques for predicting the performance of soils for the movement of given vehicles. But since the relationship of vehicle and soil is involved in both, the two types of investigations often become concerned with similar problems.

NOY-73233

A Preliminary Report on Methods Proposed to Be Improved or Developed for Accurately Determining the In Situ Densities of Cohesionless Beach Soils, USCEC Report 19-2, Aug 1952, University of Southern California, D. F. Griffin, J. R. Keeton

A Study to Develop or Improve a Method for Accurately Determining the In Situ Densities of Cohesionless Beach Soils, Monthly Status Report 1, Aug 1952, University of Southern California, D. F. Griffin

A Study to Develop or Improve a Method for Accurately Determining the In Situ Densities of Cohesionless Beach Soils, USCEC Report 19-3, Monthly Status Report, Sep 1952, University of Southern California, D. F. Griffin

A Study to Develop or Improve a Method for Accurately Determining the In Situ Densities of Cohesionless Beach Soils, USCEC Report 19-4, Quarterly Status Report, Oct 1952, University of California, D. F. Griffin

A Study to Develop or Improve a Method for Accurately Determining the In Situ Densities of Cohesionless Beach Soils, USCEC Report 19-5, Monthly Progress Report, Oct 1952, University of Southern California, D. L. Griffin

A Study to Develop or Improve a Method for Accurately Determining the In Situ Densities of Cohesionless Beach Soils, USCEC Report 19-6, Monthly Progress Report, Nov 1952, University of Southern California, D. F. Griffin

A Study to Develop or Improve a Method for Accurately Determining the In Situ Densities of Cohesionless Beach Soils, USCEC Report 19-7, Quarterly Status Report, Dec 1952, University of Southern California, D. F. Griffin

A Study to Develop or Improve a Method for Accurately Determining the In Situ Densities of Cohesionless Beach Soils, USCEC report 19-8, Montaly Status Report, Jan 1953, University of Southern California, D. F. Griffin

A Study to Develop or Improve a Method for Accurately Determining the In Situ Densities of Cohesionless Beach Soils, USCEC Report 19-10, Quarterly Status Report, Mar 1953, University of Southern California, D. F. Griffin

A Study to Develop or Improve a Method for Accurately Determining the In Situ Densities of Cohesionless Beach Soils, USCEC Report 19-12, Monthly Status Report, May 1953, University of Southern California, D. F. Griffin

A Study to Develop or Improve a Method for Accurately Determining the In Situ Densities of Cohesionless Beach Soils, USCEC Report 19-13, Monthly Status Report, Jun 1953, University of Southern California, D. F. Griffin

Study and Development of Methods for Determining In-Place Densities of Soils, USCEC report 19-14, Final Report, Sep 1953, University of Southern California, D. F. Griffin, AD79282

In order to compare various methods that might be used to measure in situ densities it seemed desirable to select a testing medium that would be as uniform as possible and one that would vary as little as possible with use. Ottawa 20-30 sand (A.S.T.M. designation, C-190) seemed to meet these requirements. Most of the laboratory work was performed using this sand. In addition, some experiments were made using graded Ottawa sand (A.S.T.M. designation, C-190). Field studies were included and experiments were performed both on the beach at Santa Monica and on the beach at Point Mugu. Also, a literature survey of irradiation methods for determining in situ densities was made. Work was officially started on this project July 1, 1952 and experimentations were completed June 30, 1953.

Following a literature survey and some preliminary experiments in the laboratory a statement was composed entitled A Preliminary Report on Methods Proposed to Be Improved or Developed for Accurately Determining the In Situ Densities of Cohesionless Beach Soils. On Aug 8, 1952, the above report was reviewed and discussed with representatives of U.S. Naval Civil Engineering Research and Evaluation Laboratory. At this meeting it was mutually agreed that the following methods would be investigated under the contract: fluid injection method, wedge method, tube method, sand funnel method, large sand funnel-tube method, small sand funnel-tube method, and the rubber balloon-tube method. It was decided that the cone-penetrometer method would not be investigated.

Study and Development of Methods for Determining In-Place Densities of Cohesionless Soils, Apr 1954, University of Southern California, D. F. Griffin

Methods investigated included fluid injection, wedge, tube, sand funnel, and rubber balloon. Ottawa 20-30 sand (ASTM designation C-190) and graded Ottawa sand (ASTM

designation C-109) were used as the testing media in the laboratory. Some field studies were also conducted on the beach at Point Mugu, California.

Each method investigated involved shearing action on the soil. This action had the usual effect of causing loose sands to contract and tight sands to expand. For each method a plot of control densities versus percent deviation of test densities from control densities showed a straight line relationship. Certain methods are more reliable than others and each method has a different straight line relationship for each different sand.

At the moment we are far from having developed a method for measuring in-place densities of cohesionless soils with consistently high accuracy. This is especially true for methods involving shearing action on the soil.

NOY-73237
Refabricated Straight Side 20-ft x 48-ft Building, Steel Frame and Steel Exterior and Wood Frame and Wood Exterior, 1953, Modular Structures, Inc., AD106931

The design for a 20-ft by 48-ft building, as designed under the terms of NOY-73237 has now been completed. It is the purpose of this report, as a supplement to the working drawings, to summarize the development of the design, discuss its characteristics, explain the choice of structural sections and indicate alternate possibilities.

NOY-73242
Studies Leading to the Development of an Electromagnetic Darkroom, Quarterly Progress Report, Aug 1953, Southern Methodist University, AD141926

Studies Leading to the Development of an Electromagnetic Darkroom, Progress Report, Dec 1953, Southern Methodist University

Studies Leading to the Development of an Electromagnetic Darkroom, Progress Report, Mar 1954, Southern Methodist University

Studies Leading to the Development of an Electromagnetic Darkroom, Progress Report, Jul 1954, Southern Methodist University

Studies Leading to the Development of an Electromagnetic Darkroom, Progress Report, Oct 1954, Southern Methodist University

Studies Leading to the Development of an Electromagnetic Darkroom, Progress Report, Apr 1955, Southern Methodist University

Studies Leading to the Development of an Electromagnetic Darkroom, Progress Report, Aug 1955, Southern Methodist University, K. W. Heizer, W. W. Koepsel, AD222076

Studies Leading to the Development of an Electromagnetic Darkroom, Progress Report, Nov 1955, Southern Methodist University, W. W. Koepsel, C. M. Schwalm

Studies Leading to the Development of an Electromagnetic Darkroom, Progress Report, Oct 1956, Southern Methodist University, K. W. Heizer, AD222138

Studies Leading to the Development of an Electromagnetic Darkroom, Final Report, May 1958, Southern Methodist University, K. W. Heizer, W. W. Koepsel

At the request of the Civil Engineering Research and Evaluation Laboratory, Port Hueneme, Calif., the School of Engineering, Southern Methodist University, undertook an investigation leading to the development of an electromagnetic darkroom. The darkroom should function as a free space chamber and allow interference-free quantitative electromagnetic radiation measurements to be made. It was the purpose of the study to conduct an investigation that would lead to the construction of a single or a series of rooms having walls with a very low reflection factor over a very wide frequency spectrum (15 kcps to 10 kMcps). In order for the room to be effective, it was required that the reflection factor of the walls be no greater than 10% and that the transmission factor through the walls be 0. The study was begun on May 9, 1953, and an experimental laminated section absorber was successfully tested in Oct 1954.

The original absorber was designed to use only lossless dielectrics. Since that time, methods have been developed that allow loss in the dielectrics. Synthesis techniques require materials that proved difficult to obtain. Lengthy computations were necessary to make use of certain preselected materials. Therefore, an electric simulator was developed to solve the problem.

An absorber using lossy elements was constructed and the results compared to the calculated values.

NOY-73243
A Study into the Feasibility of Assembling Complete KD-T6B and T7A Pontoons at Advance Bases as Outlined in the Anderson-Nichols Report, Production Planning Analysis for NL Pontoons at Advance Bases, and Anderson-Nichols Drawings no. 676-D, 1 to 6, 15, 20 to 28; E-707, 22 to 24; 60E-701, 1 to 21, 1953, Modular Structures, Inc., F. J. Bageman, AD222068

The end use of the individually fabricated pontoon requires, in most cases, assembly in strings together with other pontoons possibly made by more than one advance base depot or supplied by various manufacturers from rear areas. The writer has had many discussions with Navy personnel pertaining to the difficulties encountered during string assembly and has personally observed many of these operations. These difficulties can be minimized by maintaining rigid control over dimensions and tolerances of the corner straps on the finished pontoon.

It is the writer's opinion that this exact relationship of corner straps, controlled by definite tolerances is the prime required characteristic of the finished pontoon, watertightness being second, and the third, preservation and painting.

Bureau Yards and Docks drawings 146-507 and 146-508 are not sufficiently complete in dimensions and tolerances to accomplish the above objective.

A pontoon with corner straps conforming to drawings and specifications, which clearly show dimensions and tolerances shown is of first order importance and consequently will exert influence and control over the nature and type of jigs and fixtures used for the assembly. It is with this in mind that the writer's comments are made.

NOY-73244
Survey and Analysis of the Vapor Transmission Properties of Building Materials, Quarterly Progress Report 1, Aug 1953, University of Colorado, H. M. Whippo, B. T. Arnberg

Survey and Analysis of the Vapor Transmission Properties of Building Materials, Quarterly Progress Report 2, Nov 1953, University of Colorado, H. M. Whippo, B. T. Arnberg

Evaluation of Dehumidification Requirements of Dehumidified Storehouses at the U.S. Naval Advanced Base Supply Depot, Gulfport, Mississippi, Dec 1953, University of Colorado, H. M. Whippo, B. T. Arnberg, AD102888

The subject warehouses were visited during the period of October 24-26, 1953, and tests were made to determine the water vapor transmission. The results of these tests showed that the buildings were drying out and that normal water transmission patterns had not been established.

An analysis was made to determine the normal and transient dehumidification loads to be expected in operation of the subject warehouses and to determine if additional vapor sealing of the exterior walls would be required to reduce the vapor load. The results of this analysis showed that less than 10% of the normal dehumidification load could be eliminated through the use of a vapor seal applied to the exterior walls, and, therefore, such a vapor seal was not recommended.

The major part of the normal dehumidification load was found to be due to leakage of air into the warehouses through cracks around doors, etc. It was recommended that these be reduced to a minimum by regular maintenance procedures.

The amount of water transmitted through the floor was found to be indeterminable and further experimental investigation to establish this amount was recommended.

The time required for initial establishment of the interior relative humidity at 40% was determined to be approximately a year after loading the building with stores. This was primarily due to the large amount of wood used in packaging. A recommendation for an investigation into the possibility of reducing the amount of wood used was made.

Survey and Analysis of the Vapor Transmission Properties of Building Materials, Quarterly Progress Report 3, Feb 1954, University of Colorado, H. M. Whippo, B. T. Arnberg, AD221951

Survey and Analysis of the Vapor Transmission Properties of Building Materials, Final Report no. 1, Jan 1955, University of Colorado, H. M. Whippo, B. T. Arnberg, AD102889

In order to provide useful engineering information for engineers concerned with the control of humidity in buildings, this investigation was undertaken to determine the basic criteria which govern the transmission of water vapor through building materials and to correlate currently available data related to the permeability of such materials to the passage of water vapor in a manner most useful to the engineer.

The available data on the permeability of a wide variety of building materials is presented and the average relative humidity of the test conditions at which it was determined to enable the engineer to make some estimate as to its applicability.

Survey and Analysis of the Vapor Transmission Properties of Building Materials, Progress Report, Jun 1955, University of Colorado, H. M. Whippo, F. O. Woodsome, AD78418

NOY-73246

Test and Evaluation of a Portable Topping Unit, Jan 1954, Ralph M. Parsons Co., AD102777

The work required to be carried out in the performance of contract NOY-73246 entailed an analysis of process data secured during test operation of the topping unit which, when combined with the results of observations of the plant in operation, would lead to the preparation of a report setting forth whether or not the unit, as designed and operated, was capable of producing products as called for in the design. However, at the request of the project officer acting for the United States Naval Civil Engineering Research and Evaluation Laboratory, observations have been included in this report on mechanical deficiencies or points of potential mechanical improvement applicable to the unit as installed at Shelby, Mont. These may not reflect exclusively on the process adequacy of this unit as a prototype, but should be incorporated with others in the final design of a unit suitable for advanced base operations.

NOY-73248

Investigation of Freezing as a Means of Obtaining Fresh Water From Salt Water, Report 1: Summary of Patent Information, May 1954, University of Minnesota, E. N. Kemler, AD102961

Investigation of Freezing as a Means of Obtaining Fresh Water From Salt Water, Progress Report 1, Jul 1954, University of Minnesota, E. N. Kemler, M. H. Lajoy, J. L. Threlkeld, E. W. Rosencrants, R. R. Johnson, R. P. Tendyke, K. Ludescher

Investigation of Freezing as a Means of Obtaining Fresh Water From Salt Water, Progress Report 2, Sep 1954, University of Minnesota, E. N. Kemler, M. H. Lajoy, J. L. Threlkeld, E. W. Rosencrants, R. R. Johnson, R. P. Tendyke, K. Ludescher

Investigation of Freezing as a Means of Obtaining Fresh Water From Salt Water, Final Report, Jan 1955, University of Minnesota, E. N. Kemler, M. H. Lajoy, J. L. Threlkeld, E. W. Rosencrants, R. P. Tendyke, K. Ludescher, AD78695

This report summarizes the experimental results of tests made on methods for desalting ice made of brine having an initial salinity of 35,000 ppm. The freezing and some draining tests were covered in detail in Progress Reports I and II. A summary of the information from the patent literature was covered in detail in Report I and will not be discussed further in this final report.

NOY-73251

Air Blast Simulator, Progress Report 1, Jun 1954, W. W. Boynton and Associates

Air Blast Simulator, Progress Report 2, Jul 1954, W. W. Boynton and Associates

Air Blast Simulator, Progress Report 3, Aug 1954, W. W. Boynton and Associates

Air Blast Simulator, Progress Report 4, Sep 1954, W. W. Boynton and Associates

Air Blast Simulator, Progress Report 5, Oct 1954, W. W. Boynton and Associates

A Study and Evaluation for the Design of an Experimental Blast Simulator, Final Report, Jan 1955, W. Boynton and Associates, AD62366

Tests were performed in test chambers of approximately 0.1 cu ft and 1.0 cu ft volume. Both black powder and primacord were used as energy sources.

It was determined that primacord was suitable for producing the pressure-rise times required. If longer rise times are desired, the use of black powder is indicated.

Experiments concerned with the control of pressure decay showed that the desired curve could be approached with reasonable accuracy by opening valves in a predetermined sequence. For closer control a servo-system is indicated.

Appendix A of the report contains the data obtained from the tests performed.

NOY-73260

A Preliminary Study of Forces in Ship Moorings Due to Wave Action, Series 91 and 92, Issue 1, Jul 1955, University of California, Berkeley, K. E. Beebe, AD74611

A series of experiments was performed to determine the forces induced in weightless cables mooring a rectangular block which was subjected to wave action, for a particular set of mooring cable conditions. The purposes of this study were to extend the experimental work of a previous study to a wider range of wave conditions, and to attempt to predict changes in mooring cable forces qualitatively for a large range of wave dimensions. The results are summarized in graphical form, with the forces exerted on the mooring system presented as a function of wave length and height.

Ship Mooring Literature Survey, Series 91 and 92, Issue 2, Aug 1955 ,University of California, Berkeley, R. L. Wiegel, AD74530

Presented herein are summaries of over 50 papers on various phases of the general problem of mooring a ship subject to wave or surge action.

Model Study of Ship Mooring Forces, Progress Report, Series 92, Issue 3, Nov 1955, University of California, Berkeley, R. W. Clough, AD81123

Model Study of Ship Mooring Forces, AFDL-1, Series 92, Issue 4, Mar 1956, University of California, Berkeley, R. L. Wiegel, R. W. Clough, R. A. Dilley, S. F. Whisenand, J. B. Williams, A. L. Arnold, AD90732

Model Study of Ship Mooring Forces, ARD-12, Series 92, Issue 5, Jul 1956, University of California, Berkeley, R. A. Dilley, R. L. Wiegel, J. B. Williams, AD107061

Model Study of Ship Mooring Forces, CVE-78, Series 92, Issue 6, Aug 1956, University of California, Berkeley, R. A. Dilley, J. B. Williams, R. L. Wiegel, AD111563

Model Study of Ship Mooring Forces, ARG-11, Series 92, Issue 7, Aug 1956, University of California, Berkeley, R. A. Dilley, J. B. Williams, R. L. Wiegel, AD113449

Model Study of Ship Mooring Forces, Final Report, Series 92, Issue 8, Aug 1956, University of California, Berkeley, R. L. Wiegel, R. A. Dilley, R. W. Clough, J. B. Williams, AD114763

Presented herein is a discussion of the problem of wave-induced forces on ships moorings, together with the details of a study of four ship models, each with a different mooring system. The resulting mooring line and mooring fender forces are given. In addition, the correlations between prototype and model natural periods of surge and sway for an AFDL (floating drydock) are given.

NOY-73262

Preliminary Design for an Air Blast Simulator, Final Report, Aug 1955, W. W. Boynton and Associates, AD103060

This report contains the results of the work performed under BUDOCKS contract NOY-73262 for engineering and preparation of preliminary plans, cutline specifications, and cost estimate for an air blast simulator.

The report briefly reviews the design criteria for the air blast simulator which were developed under BUDOCKS contract NOY-73251 and outlines the basic considerations involved in the proposed design.

Preliminary stress calculations and a cost estimate for budget purposes are included in the report.

ix drawings, which are described in this report, are attached.

NOY-73267

Engineering Study of Meyerstein 125-ton Floating Crane, Luffing Screw System, Apr 1953, Zeigler-Harris and Co., AD79135

The following report covers an engineering study of the Meyerstein 125-ton floating crane, luffing screw system. The work involved investigations, surveys, studies, calculations and designs, all aimed toward the development of an improved design of the luffing screw system to correct present inherent weaknesses and malfunctions.

NOY-73519

Investigation of Further Usefulness of the Soil Truss, Interim Report, Jan 1953, University of Pennsylvania, D. T. Harroun

Investigation of Further Usefulness of Mark II Soil Truss, Final Report, May 1953, University of Pennsylvania, D. T. Harroun, AD78702

This memorandum presents the final results of the evaluation of the Mark II soil truss, contract NOY-73519, in the general field of civil engineering, other that that of trafficability for which the apparatus was developed.

The purpose of this memorandum is to demonstrate the correlation between field soil truss results and standard laboratory tests.

It is obvious that the soil truss, in common with the current types of cone and vane field shear devices, will measure quick, unconsolidated shear values. For this reason correlation in this investigation will be with standard laboratory controlled strain direct shear apparatus using quick unconsolidated tests.

Investigation of Further Usefulness of Mark II Soil Truss, With Controlled Rate of Shear, Part B, Dec 1954, University of Pennsylvania, D. T. Harroun, AD78703

The intent of the investigation is to adapt soil truss test results to the general field of Civil Engineering, other than trafficability for which the instrument was originally developed by the Naval Civil Engineering Research Laboratory. Specifically, it is to provide a technique for obtaining the standard soil characteristics of frictional resistance O and cohesion C directly in the field by means of the Mark II soil truss without recourse to the expensive and time consuming methods of undisturbed soil sampling, transporting and laboratory testing.

Investigation of Further Usefulness of Mark II Soil Truss, With the Port Hueneme Hydraulic Loading Device, Part C, Sep 1955, University of Pennsylvania, D. T. Harroun

The purpose of the present phase of this investigation of the possibilities of the soil truss is to evaluate the Navcerek Hydraulic Loading Device as a means to the end of obtaining usable results from field soil truss tests.

Investigation procedure paralleled closely the evaluation of the pacing dial rate controller in reference no. 4, the laboratory investigation involved the evaluation of the characteristics of the hydraulic mechanism itself, and the field investigation consisted of actual field tests on typical soils which were subsequently compared with laboratory tests on undisturbed samples.

NOY-76655

Electronics Interference Survey at the U.S. Naval Ammunition Depot, Crane, Indiana, 1953, Hopkins Engineering Co., W. B. Underwood, D. H. Obryhim, AD108227

The purpose of this report is to set forth the results of a comprehensive investigation of the interference conditions existing at the U.S. Naval Ammunition Depot, Crane, Ind., at the time of this survey, and to offer recommendations for correcting these conditions which exist.

Electronics Interference Survey at the U.S. Naval Air Station, Quonset Point, R. I., Nov 1953, International Electronics Engineering, Inc., W. B. Underwood, D. H. Obryhim, AD108658

In accordance with the provisions of contract NOY-76655 and with the scheduled program as outlined in BUDOCKS letter C-347/FMM, dated 24 Aug 1953, an electronics interference survey was conducted at the U.S. Naval Air Station, Quonset Point, R.I. During this survey, the majority of the engineers time was devoted to the investigation of interference produced by mobile equipment at that location.

Electronics Interference Survey at the U.S. Naval Civil Engineering Research and Evaluation Laboratory, Port Hueneme, Calif., Mar 1954, International Electronics Engineering, Inc., W. B. Underwood, D. H. Obryhim, AD108761

The purpose of this report is to set forth the results of tests performed on a shielded enclosure to determine its effectiveness in suppressing the interference produced by an operating arc welder.

Electronics Interference Survey at the U.S. Naval Air Missile Test Center, Point Mugu, Calif., Report 2-514-11-54, Mar 1954, International Electronics Engineering, Inc., W. B. Underwood, D. H. Obryhim, AD108227

In accordance with the provisions of contract NOY-76655, an electronics interference survey was conducted at the Naval establishments at Point Mugu and Port Hueneme, Calif. Most of the work done at Port Hueneme is reported in Report no. 1-514-11-54, which describes tests performed on an arc welder operating in a shielded enclosure. Other work done at Port Hueneme, not directly related to the welder tests, is covered in this report.

All data gathered during this survey are listed at the end of the report, and graphs are provided where the interference information can best be presented in this manner.

NOY-90920

Study to Develop a Liquid Binder for Soil, Progress Report, Sep-Oct 1955, Frederick Hafnor

A Study to Develop a Liquid Binder for Soil, Progress Report, Oct-Nov 1955, Frederick Hafnor

Study Directed Toward the Development of Some Form of a Liquid Binder for Soil, Final Report, Dec 1955, Frederick Hafnor, AD102942

A study directed toward the development of some form of a liquid binder, which will penetrate soil and cause this to harden sufficiently to permit its removal from the surrounding soil mass and subsequent measurement of its volume by immersion in water.

The liquid binder shall penetrate the soil to a depth of 6 in. when poured onto the surface of any soil.

The liquid binder should further be usable over an environmental temperature range of 40F to 100F, be suitable for field use, and the diameter of the hardened sample should be about 4 in.

This study should be limited entirely to the development of a liquid binder and the method of pouring onto the soil without any type of mechanical appurtenance.

NOY-90922
Rapid Loading Tests on Three Grades of Reinforcing Steel, May 1956, David S. Wood

This report presents the results of rapid loading tests on three grades of reinforcing steel. The work has been carried out in accordance with contract NOY-90922, negotiated between the U.S. Naval Civil Engineering Research and Evaluation Laboratory, Port Hueneme, Calif., and the author.

The object of the tests is to determine the values of the (upper) yield point stress of three grades of reinforcing steel as a function of strain rate for strain rates in the range from 0.02 in./in./ sec to 0.6 in./in./sec.

P.O. 112/64
Field Intensity Measurements at Salt Lake City, Utah, Dec 1963, Stoddard Aircraft Radio Co., Inc.

This report contains field intensity measurements performed at Great Salk Lake, Utah.

The site for the measurement was located near Grantsville, Utah approximately 50 miles from Salt Lake City.

The purpose of these measurements was to investigate the correlation between the theoretical transmitted field intensity at prescribed distances from the transmitting monopole and the measured field intensity.

P.O. 118/64
Survey of the State of the Art in Static Inversion and Conversion to 400-cps Electrical Power, Aug 1964, Electronic Specialty Co., G. L. Hoyt

It is the purpose of this paper to report on the state of the art in static conversion and inversion of 60 cycle and DC power sources to 400 cycle power, and to discuss the economic and practical feasibility of the application of the most recent developments in this field to any functions that may be performed more proficiently by 400 cycle power.

Special emphasis is placed on economic and practical considerations of uninterruptible power such as the storage of rectified public utility power in batteries for the purpose of driving inverters, which would then continue to furnish power for essential services in the event of the failure of public utility power.

P.O. 123/64
Practical Handbook for Location and Prevention of Radio Interference From Overhead Power Lines, Westinghouse Report 64-9F4-565-R1, Aug 1964, Westinghouse Electric Corp., Pittsburgh, Pa., AD612190

This handbook is intended as a practical aid to the location, reduction and prevention of radio interference from overhead lines up to 69 kV.

The theoretical aspects are not included. Many years of experience by utilities have shown that the location of the source of interference and its elimination does not require exact determination of field strengths but rather a technique founded on experience and a knowledge of the past radio interference characteristics of apparatus and pole top line construction.

P.O. 127/64
Propellant Actuated, Embedment Anchor System, Jun 1964, Aerojet-General Corp., R. A. Thomason

The objective of this report is to present the fundamental aspects of, and review the technical problems associated with propellant actuated embedment anchor mooring systems. Included is a description of the physical mechanisms and design concepts of cartridge actuated embedment anchors as they exist today and a prospective look into the future.

The progress made in the field has been rather slow since 1960. As a result, a number of basic principles and technical features have not been fully crystallized, as yet, nor are they even understood to any extent. It becomes very difficult, therefore, to describe some of the problems clearly. However, it is hoped that this paper will help to clarify the thinking of the interested reader, and stimulate his interest in further investigations.

P.O. 129/66
Test Procedure for Field Evaluation of Acoustical Attenuation of Partitions and Enclosures, Jun 1966, Bolt Beranek and Newman Inc., AD487815L

The report presents general procedures and measurement techniques applicable for accurate field evaluation of acoustical enclosures. The distinction between noise reduction measurements and transmission loss measurements are carefully made. The difficulties and inaccuracies normally encountered in making these measurements in the field under non-laboratory conditions are discussed in detail. In addition, the important factors that control and determine the ultimate degree of sound privacy that an acoustical enclosure will be able to provide are considered.

Informal Contract 2/58
Technical Review of an Automatically Controlled Cathodic Protection System, Jun 1958, Allen B. Rosenstein

Informal Contract 1/62
Survey of All Available Information on Commercially Obtainable Donductive and/or Radio Frequency Absorbing or Attenuating Materials, Dec 1961, Interference Consultants, Inc., AD633690

This survey was made because of research contemplated on new materials, new adhesives, new methods of construction and the preparation of manuals for the maintenance of shielded enclosures of all kinds. It includes an extensive bibliography of material on shielding.

SYM-ABWSS
Report of the Symposium on Advanced Base Water Supply and Sanitation, Oct 1953, AD222064, ATI210027

SYM-APJA
Proceedings of the Symposium on Airfield Pavements for Jet Aircraft, Apr 1952, ATI208851

SYM-EAO
Proceedings of the Conference on Equipment for Amphibious Operations, Oct 1955, Confidential, AD105802

SYM-FERE
Proceedings of the Symposium on Fire Extinguishment Research and Engineering, Nov 1954, AD222168, AD103101

SYM-MBC
Report of the Marine Borer Conference, May 1951, AD222167, AD210028

SYM-MEME
Report of the Symposium on Military Earth Moving Equipment, Dec 1952, AD21329

SYM-PMR
Symposium on Preservation for Mobilization Requirements, Oct 1956, AD125226

NBY-3101
In-Place Density Tests of Montalvo Base Coarse Material Under Controlled Conditions, Final Report, Jun 1956, University of Southern California, D. F. Griffin, USCEC Report 52-101, AD107423

In order to evaluate the effectiveness of any type of compaction equipment, it appears desirable to investigate the accuracy with which in-place densities of base course materials can be measured. The works of Griffin and Keeton dealt primarily with cohesionless sands. The pattern of behavior of graded material containing large stones was unknown at the beginning of this project, and it was to satisfy a growing need for enlightenment about the limitations of accuracy with which in-place density measurements of such soils as base course materials could be made, that this research was undertaken.

The sand jug and cone apparatus was used to determine volumes of cavities from which base coarse material was excavated. The accuracy of the sand cone apparatus per se was evaluated and found to be consistently of a high order, even in rough cavities. In-place density tests were made in a box of known volume with the material placed at various densities and at various water contents.

NBY-3103
Acceptance Tests on the Prototype Model of the Brushless Generator Per Specification MIL-R-2729A, Mar 1957, Leach Corporation

This report covers the results of tests which were taken to determine if the brushless generator performance complied with the requirements set forth in Military Specification MIL-R-2729A.

Additional tests, not specified by MIL-R-2729A, were performed and recorded to give a more complete demonstration of the equipment's performance.

Supplementary Tests and Information on the Prototype Model of the Brushless Generator Per Specification MIL-R-2729A, Apr 1957, Leach Corporation

This is a supplementary report to the original report entitled, Acceptance Test on the Prototype Model of the Brushless Generator. It contains a schematic of the electrical system, wiring drawings, a drawing of the generator, parts list of added components, parts location diagrams and test results which were requested by A. M. Brown of the U.S. Naval Civil Engineering Research and Evaluation Laboratory.

NBY-3127
History of the Development, Design, Fabrication and Proof Testing of the Atomic Blast Simulator, Jul 1958, W. W. Boynton and Associates

For many years the need for a dynamic load generator capable of subjecting large structural shapes to shock loads similar to those created by a nuclear explosion, but without radiation effects, has been indicated. Boynton and Associates was authorized by the Naval Civil Engineering Laboratory at Port Hueneme, Calif., to investigate the practicability of, and design for, such a generator. Fabrication, construction and proof testing followed, and the generator is now in operation.

This atomic blast simulator is the only dynamic load generator of its type and size in existence. Application of the principles developed here show great possibility in three dimensional dynamic loading of large structures and explosive forming of metals.

Atomic Blast Simulator, Final Report, Sep 1958, W. W. Boynton and Associates

This final report on contract NBY-3127 is broken up into the following phases: (1) engineering supervision, including consulation with bidders, awarding of contracts, concrete construction, steel fabrication, machining, hydrostatic testing and erection; (2) simulator operation; (3) proof testing; and (4) the source of energy and its effects, a summary of the analysis of the proof testing.

The first three appendices are on work performed under the engineering supervision phase while Appendix IV is a thorough discussion of the analysis of the proof testing.

Design for Supplemental Equipment for Atomic Blast Simulator, Final Report, Sep 1958, W. W. Boynton and Associates

This report, the final design drawings, and specifications, are the results of the work performed under BUDOCKS contract NBY-3152 for the Engineering and Preparation of Final Design Drawings, Specifications and Cost Estimate for Supplemental Equipment for the Atomic Blast Simulator (designed under BUDOCKS contract NBY-3105).

This report discusses the design, specifications, and a cost estimate for the fabrication of the suplemental equipment as outlined in exhibit A, sections 1 through 5, of said contract. Pertinent design calculations are appended.

Operation Manual of Atomic Blast Simulator, Sep 1958, W. W. Boynton and Associates

This operation manual describes the operation of the atomic blast simulator developed, designed, and proof-tested by Boynton and Associates for the U.S. Naval Civil Engineering Laboratory. The test is divided into introduction, test elements, and test cycle.

Illustrative figures and graphs are appended.

NBY-3128
Airfield Vacuum Cleaner Decontamination, Engineering Status Report, Mar 1958, J. T. Barnett, R. Schmidt, E. H. Birdsall, Coleman Engineering Co., Inc.

This report summarizes the results of programs conducted to determine performance of selected procedures and equipment in dislodgement, pick-up and retention of fall-out particles as specified in exhibit A, section 1, paragraph 3(8) of the subject contract.

Airfield Vacuum Cleaner Decontamination, Final Engineering Report, Jun 1959, J. T. Barnett, R. Schmidt, E. H. Birdsall, Coleman Engineering Co., Inc.

This report summarizes the result of study and testing conducted to determine performance of selected procedures and equipment in dislodgement, pick-up and retention of fall-out particles as specified in exhibit A, of Contract NBY-3128.

Appendices and an Addendum are included which present in detail a discussion of study areas, apparatus surveyed and tested, and results of tests and the report of a consultant retained by Coleman Engineering Company Inc.

NBY-3139
Rigid Vertical Thin Barrier, Series 140, Issue 1, Jun 1959, R. L. Wiegel, University of California, Berkeley, AD259130

A theory is presented for the transmission of waves past a rigid vertical thin barrier extending from the water surface to some distance below the surface. This theory is based upon consideration of wave power transmission. Laboratory data are presented to show that this theory is useful from the engineering design standpoint, but that improvements are desirable.

Floating Breakwater Survey to Aug 1959, Series 140, Issue 2, Aug 1959, R. L. Wiegel, University of California, Berkeley, AD254902

In this report will be presented the information and thoughts on floating breakwaters resulting from the work performed since the start of the contract.

First, a review of the literature was made, primarily to see whether any conflicts existed, either between sets of experiments, or between theory and observations. In addition, discussions were held with various persons on the subject.

At the end of the first six months of work there appeared to be at least three fruitful avenues of study; (1) the effect of a very thin flexible, almost zero buoyancy, plastic membrane on the water surface; (2) the effect of a chemical additive that increases the viscosity of water by a factor of the order of 13,000 to 50,000; (3) the effect of a very thin rigid vertical curtain which extends from some distance above the water surface through the trough of the wave.

Since the original ideas were presented, an additional possibility was discovered during the course of some routine laboratory tests in connection with no. 2. This method is comprised of: (4) a flexible plastic (or other similar material) bag filled with seawater. The advantage of such a system is that the bag can be transported to the desired location in its collapsed state and then filled with seawater on the spot.

A fifth method has been tested briefly in connection with the problem of wave abatement in the well of an LSD: (5) a false bottom filled with holes with some packing material similar to spanish moss between the false bottom and the real bottom.

Floating Breakwater Survey, 15 Aug 1959 to 30 Jun 1960, Series 140, Issue 3, Jun 1960, R. L. Wiegel, H. W. Shen, O. C. Wright, University of California, AD254901

The tests reported herein are a continuation of the tests reported in Floating Breakwater Survey to 15 August 1959, University of California, Institute of Engineering Research, Technical Report no. 140-2. These tests were on the water-filled bag (hovering break-water).

A large number of tests were conducted for the purpose of obtaining forces in the mooring lines. These tests were made in the 50 by 150 by 2-1/2-ft deep model basin, tests being made with both types of bags.

In order to obtain information on the effect of natural, and larger, waves on the water-filled bags, it will be necessary to fabricate large bags and test them in San Francisco Bay. Because of this, the necessary procedures were developed, a trial installation made, and analyses of the results undertaken in order to plan for the larger installation.

Floating Breakwater Survey, summer and fall 1960, Series 140, Issue 4, Jun 1961, H. W. Shen, University of California, AD265095

As reported in Technical Reports no. 140-2 and 140-3, frequently there was considerable slack in the mooring lines of the floating breakwater. The previous experimental results also indicated that the bow mooring lines carried by far the largest forces and that the force readings in each mooring line were rather scattered. It was decided to determine the force patterns if no initial slack was permitted in the mooring lines. The orientation of the bag could also be controlled better if the lines were taut. Then it might be possible to determine whether or not the scattering of force readings was due to the different orientations of the bag.

Hovering Breakwater, Final Report, Series 140, Issue 5, Jun 1961, R. L. Wiegel, H. W. Shen, J. D. Cumming, University of California, AD265097

A bag filled with water that hovered with its top just afloat was tested in both the laboratory and in San Francisco Bay. It appeared to be a more effective breakwater for wind waves which were at their limit of stability (whitecaps) encountered in the bay than for swell-type waves of the laboratory. The mechanism, or mechanisms, by which the breakwater attenuated the waves was not determined, although it behaved in part as a nonlinear mechanism.

Closely Spaced Piles as a Breakwater, Series 140, Issue 6, May 1961, R. L. Wiegel, University of California, AD265096

One possible solution to the problem of creating an area sheltered from wave action is the use of closely spaced piles. This possibility is usually considered when a pile-supported pier is needed, and it is desired to obtain double use from the structure. Theory and laboratory studies show that this is not a practical solution.

NBY-3143

An Exploration Investigation of Mobile Breakwaters, Project Report 60, Jun 1959, H. D. Frederiksen, J. M. Wetzel, University of Minnesota, St. Anthony Falls Hydraulic Lab., AD255724

Contract NBY-3143 was established to devise and investigate new schemes suitable for the development of mobile breakwaters. Mobile breakwaters are to be capable of attenuating various ocean waves sufficiently to provide a calm area for cargo-handling facilities. The devices investigated under this contract consisted of floating-plate absorbers, floating membranes, viscous blankets, and pneumatic wave mattresses. Results of tests on floating plate absorbers and membranes are not encouraging, whereas the viscous blanket and pneumatic wave mattress seem promising. The viscous blanket gave satisfactory attenuation for wave lengths up to about twice the blanket length. The performance of the pneumatic wave mattress was slightly below that of the viscous blanket in this range, but exceeded the viscous blanket for wave lengths greater than twice the absorber length. Both units operated satisfactorily for a considerable range of wave lengths. It is felt that the preliminary results warrant further tests on both devices. A test program is recommended that would study effects of a variation of the various dimensional configuration of each of these two devices. Larger scale tests are also recommended especially on the viscous blanket, in order to determine the significance of scale effects.

An Experimental Study of Flexible Floating Breakwaters, Technical Paper 31, Series B, Oct 1960, J. F. Ripken, University of Minnesota, St. Anthony Falls Hydraulic Lab., AD419826

Earlier studies had indicated that moored flexible bags positioned slightly below the water surface and with a liquid or a gas could attenuate the height of gravity water waves. The studies reported herein describe large and small scale laboratory tests evaluating the attenuation effects and mooring forces for various bag configurations. A breakwater composed of a moored row of clean, floating cylindrical bags filled with water provided excellent wave attenuation with moderate mooring forces. This type of breakwater appeared suitable for practical development of temporary wave protection works. Submerged bags filled with air also provide good attenuation action but involved a substantial structural system for mooring.

NBY-3145

Outline of Test Program for the Dynamic Testing of Various Structural Connections in the Atomic Blast Simulator, Oct 1958, B. G. Johnstone, University of Michigan

Auxiliary loading devices are described and complete design details of both connections and auxiliary apparatus are presented in Appendix B. Recommended instrumentation, test procedures, and suggestions regarding the interpretation of test results are included in this report. The possibility of direct tests in tension, and/or shear are also discussed and schematic drawings indicated.

Although the proposed program is essentially of a pilot and exploratory nature a number of valuable findings should result and the adaptability of the blast simulator to different types of connection tests will be demonstrated.

NBY-3146
Study to Determine the Optimum Section of Reinforced Concrete Beams Subjected to Blast Loads, Final Report, Feb 1959, University of Nebraska, G. R. Swihart, AD636184

This study was performed to determine the combination of parameters which will provide the optimum resistance for reinforced concrete beams subjected to blast loadings. The ultimate goal of the study was to enable selection of beams from design charts.

Calculations were performed on an electronic digital computer making it possible to include a wide range of variables. The results are summarized in twelve design charts. Recommendations are offered for extending and improving the program. A numerical example illustrating the use of the charts is included in an Appendix.

NBY-3150
Feasibility Study Concerning the Utilization of Plastics for Underground Personnel Shelters, Sep 1959, Massachusetts Institute of Technology, D. A. Blackett, AD223706

Certain aspects of underground load-response phenomena are investigated and it is found that there are many areas of ignorance and uncertainty. Some of these uncertainties have considerable effect upon the relative desirability of steel, reinforced concrete and fiberglass reinforced plastic as underground structural materials.

Design procedures are developed for various structural types and cost data obtained.

Keeping in mind the various uncertainties concerning plastics and the plastics industry, and underground load response theory, the following conclusions are drawn concerning the feasibility and practicability of underground plastic shelters:

1. Underground plastic shelters can be built to the same size and with the same resistance as shelters made of conventional materials.

2. Underground shelters of reinforced fiberglass plastic are practical if all or some of the following conditions are met: (a) the overpressures and spans considered are such that the thickness of the wall does not exceed 0.6 of an inch. For a 40-foot hemispherical dome this would mean an overpressure of approximately 100 psi. (b) The necessity of shipping components by air is foreseen. (c) Wartime scarcity of steel and other normal building materials is felt to be a serious problem.

Brief recommendations concerning future research and development are presented.

NBY-3152
See NBY-3127, third report

NBY-3153
Mobile Self-Elevating Platform With Breakwater Used to Form a Multi-Purpose Harbor Unit, Feasibility Study, Nov 1959, Delong Corporation, AD254905

The purpose of this study is to provide information showing the feasibility of installing an effective type breakwater on a floating self-elevating platform with extensible legs to form a multi-purpose harbor unit, which, when used with others like it, forms a breakwater, pier and sheltered harbor.

The results of this investigation and laboratory tank tests of various type breakwater models indicates that solid wall type breakwaters mounted on multiple platform units, offer the best effective wave protection to form a sheltered harbor.

This study shows that multiple mobile harbor units with extensible legs can be utilized to support a breakwater and simultaneously be used as a pier or may be used as a pier only without the breakwater panels installed.

NBY-3157
Mobile Marine Platform Housing a 20,000 kW Nuclear Electric Power Facility, Conceptional Study, V. 1, Specifications, Apr 1959, Delong Corporation, AD419839

This report presents a conceptional design of a floating, mobile, and self-elevating support platform housing a 20,000 kW nuclear electric power plant. The purpose of this study is to provide information permitting a comparison between this mobile power plant and stationary installation of the same capacity at an overseas location.

The results of this investigation clearly show that it is feasible to house and operate nuclear power plant on a mobile offshore elevated platform.

This study shows that this type platform is an efficient approach to power plant mobility for use anywhere in the world.

Mobile Marine Platform Housing a 20,000 kW Nuclear Electric Power Facility, Conceptional Study, V.2. Design Drawings, Apr 1959, Delong Corporation

NBY-3160
Feasibility Study of Experimental Investigation of Neutron and Gamma Ray Attenuation in Various Soils and Materials, Final Report, Jan 1959, W. W. Boynton and Associates

Considerable information exists regarding gamma rays both as to theory and experimentation, as well as theory on neutron penetration, while little or no work has been done on experimentation on the higher energy neutrons (14 mev). Sources of adequate intensity are available for producing both neutrons and gamma rays. Detection and measurement techniques and instrumentation are much more highly developed and available for picking up and recording gamma rays and the lower energy neutrons than for the higher energy neutrons.

NBY-3161
Study of Multi-Fuel Heaters for Arctic Application, Semiannual Report, Mar 1959, University of Wisconsin, S. T. Hsu, D. W. Treadwell, J. C. Wendte, S. M. Wu, AD419747

Study of Multi-Fuel Heaters for Arctic Application, Semiannual Report, Mar 1960, University of Wisconsin

Study of Multi-Fuel Heaters for Arctic Application, Final Report, Mar 1962, University of Wisconsin, AD419838

Results of investigation,

A. A prototype multi-fuel coolant heater with a capacity of 25,000 Btu/hr has been designed, developed and tested at the engineering experiment station of the University of Wisconsin. Powered with 24-V storage batteries, the heater may be operated at a temperature as low as -65F by using aviation gasoline, JP4, or Arctic diesel oil.

B. The length of starting period increases with decreasing ambient temperature. It varies from instant to a few seconds at room temperature of 72F and from 2 to 3 min at -65F.

C. Overall efficiency of about 75% was achieved at room and low temperatures.

D. At Arctic temperatures, fuel preheating was definitely required for easy starting and satisfactory operation but air preheating was not necessary.

E. The construction of the heater is strong enough to withstand vibrations and shocks in ground, sea or air transportation.

NBY-3163
Design of Entrance Systems for Personnel Protective Shelters (U), Dec 1959, Armour Research Foundation, Secret, AD374024

NBY-3165
Wave Research Project, 10 Reports, 1959. The California Company, (1) Pressure tabulation, 1-ft-diam pile. (2) Pressure tabulation, 1-ft-diam pile. (3) Pressure tabulation, 2-ft-diam pile. (4) Pressure tabulation, 3-ft-diam

pile. (5) Pressure tabulation, 4-ft-diam pile. (6) Energy and moment energy tabulation, 1-ft-diam pile. (7) Energy and moment energy tabulation, 2-ft-diam pile. (8) Energy and moment energy tabulation, 3-ft-diam pile. (9) Energy and moment energy tabulation, 4-ft-diam pile. (10) Force and moment tabulation, 1-, 2-, 3-, and 4-ft-diam piles.

NBY-3167
Inflatable Causeway Research and Development Project, Design Contract, Feb 1959, Marco Engineering Co., no report

NBY-3169
Outline of a Shielding Manual for Protective Construction, Dec 1958, Associated Nucleonics, Inc., A. G. Duncer, M. J. Kelly, L. R. Mendelsohn

This report covers preliminary work necessary for the development of a radiation shielding manual for protective construction, where the manual is to provide adequate information to allow for the ready design of bomb shelters by personnel not trained primarily in the nuclear field.

Based on information derived from an extensive literature survey, an outline for such a manual has been developed and is presented. Much theoretical and experimental shielding work has already been performed and reported in the literature. A summary of the available pertinent information is presented, along with recommendations for experimental and theoretical investigations in those areas where information is lacking.

NBY-3170
Resume of Feasibility Studies for Extended Use of Standard and Special Panels Developed for the Prefabricated Panelized 16 ft x 28 ft Arctic Building, Feb 1961, King, Bentoff and Associates, AD254951

The adaptation of the insulated panels designed for the standard and high module Arctic building is unlimited in themselves, but their use may be limited by economic or transportation problems. The use of such panels for floors, walls and roof for larger buildings will facilitate the enclosing of them rapidly after the frame is in place. The panels can be so arranged to provide ample doors and windows.

Erection Manual, Prefabricated Panelized 16 ft x 28 ft Arctic Building, Feb 1961, King, Bentoff and Associates

Specifications, Prefabricated Panelized 16 ft x 28 ft Arctic Building, Feb 1961, King, Bentoff and Associates, AD254950

NBY-3171
Examination and Study of Certain Structures in the Pacific Ocean Area, Preliminary Report, undated (Jun 1959), C. H. Scholer

Examination and Study of Certain Structures in the Pacific Ocean Area, Final Report, Oct 1959, C. H. Scholer

Portland cement concrete has been used extensively since 1940 in many structures built by the Navy on the islands in the Pacific. In most of these structures, coral aggregates have been used, and, in many instances, either brackish water or seawater was used as the mixing water. This study was to determine the present condition of these structures and their service record to date.

NBY-3174
Proposal for the Fabrication of Hose Reels, Diesel Powered, for 4-in. and 6-in. Hose Systems, Report no. 525, Apr 1960, Townsend Engineering Products

Presented herein is a technical proposal to the U.S. Naval Civil Engineering Laboratory for the fabrication of a 4-in. diesel-powered hose reel and for the design and fabrication of a 6-in. diesel-powered hose reel.

NBY-3175
A Survey and Recommendations for Radioisotope Applications Pertinent to the U.S. Naval Civil Engineering Laboratory Operations, TLW-1055 Jun 1959, revised Aug 1959, Tracerlab, Inc., L. J. Beaufait, J. Kohl

On May 11-12, 1959, Messrs. L. J. Beaufait, Jr., and J. Kohl of Tracerlab, visited the U.S. Naval Civil Engineering Laboratory located at Port Hueneme, Calif. The purpose of the visit was to survey the various projects being or projected to be carried out at NCEL with an eye toward recommending any pertinent radioisotope applications which could materially contribute to these operations and to then follow up the visit with a report.

Section II of this report provides descriptive materials, isotopes, equipment, personnel, and licensing requirements, and recommendations for promising and representative applications.

Section III presents recommendations resulting from the visit to NCEL and the preparation of this report.

Appendices 1 thru 7 cover NCEL personnel contacted, available radioisotope application training programs, equipment and facilities for a radioisotope lab, pertinent regulations, sources of radioactive materials, irradiation facilities, and a nuclear reference list.

A Survey and Recommendations for Radioisotope Applications Pertinent to the U.S. Naval Civil Engineering Laboratory Operations, Supplementary Report, TLW-1055A, Aug 1959, Tracerlab, Inc., L. J. Beaufait, J. Kohl

NBY-3177
Feasibility Study of System for Off-Loading Cargo by Ship-to-Shore Highline, Aug 1959, Marco Engineering Co.

This report describes a feasibility study of off-loading cargo by ship-to-shore highline systems consisting of a mono-cable (single) highline system referred to as case I and Bi-cable (continuous) highline system referred to as case II. Case I includes two single highlines and case II includes two continuous highlines. Marco Engineering Co. was awarded contract NBY-3177 by the U.S. Naval Civil Engineering Laboratory, Port Hueneme, Calif., to perform this study.

The basic requirements are: after an LST 1156 class is beached, 4,000-lb palletized loads be off-loaded at the beach by highlines at the rate of approximately 120 tons/hr.

Both case I and case II are feasible methods for quickly off-loading deck cargo from ship-to-shore. But with relatively comparable costs and operational manpower for both cases, the compactness, simplified traffic pattern, and approximately four items greater discharge capacity of case II leads the report to recommend case II as the system to be further developed. With case I extrapolated to include port and starboard towers, case II still has an unloading rate advantage of about two to one.

NBY-3185
Radiation Streaming in Shelter Entranceways, Report no. 1158-12, Oct 1960, Armour Research Foundation, C. W. Terrell, A. J. Jerri, R. O. Lyday, D. Sperber, AD258385

The basic objective of the work reported herein is to study, describe and measure the transport of nuclear radiation through air ducts having walls of different materials. Particular emphasis is placed on full-scale concrete ducts which are intended for use as underground shelter entranceways and contain a right angle bend.

It is shown that a modified Albedo theory will rather accurately describe the transmission of both gammas and neutrons in lead and concrete ducts. Theory is compared with experimental measurements of gamma dose and neutron flux attenuation factors. Neutron number Albedo measurements are made and reported.

Work by various theorists and experimenters are included for completeness and comparison. This program rather clearly points out direction future programs should take and the areas in which major emphasis is needed.

Radiation Streaming in Shelter Entranceways, Report no. 1158A01-5, Jul 1961, Armour Research Foundation, C. W. Terrell, A. J. Jerri, AD262211

The objective of this program is an inalytical and experimental investigation of the streaming of gamma and neutrons through ducts and personnel shelter entranceways. During the period covered by this report the attentuation of gamma rays in co: :ete walled ducts having two right angle bends was measured. Both Z and U shapes were studied experimentally.

The addition of a second right angle bend results in a large increase in the attenuation for gamma rays and the energy dependence of the attenuation is considerably reduced. For smaller ducts of cross section 1 by 1 ft, the attenuation of the second bend is far greater than for the larger cross section entranceway. The next phase of the work should cover the measurement of neutron dose attenuation for the same duc s.

Radiation Streaming in Ducts and Shelter Entranceways, Report no. 1158A02-7, Apr 1962, Armour Research Foundation, C. W. Terrell, A. J. Jerri, R. O. Lyday, AD437860

In the program just completed the energy dependence of duct attenuation was extended for gamma rays. Further duct geometry dependence was also measured. Thermal neutron attenuation was determined for a non-point source and the neutron attenuation was found to be extremely small.

Use of Albedo theory to successfully describe the radiation streaming of gamma rays was further strengthened and a computer code was prepared to describe the streaming in a straight duct. The code will represent a tremendous labor saving device for future calculations. An analytical analysis of a straight duct, using Albedo theory, is included in the appendix along with an outline of future research needs.

NBY-3186
Program on the Dynamic Testing of Structural Frames and Arches, May 1960, University of Michigan, B. G. Johnstone, AD624107

A test program involving welded portal frames, with either hinged or fixed column bases, together with two hinged arches, is described. The tests are scaled to adapt them to the atomic blast simulator of the U.S. Naval Civil Engineering Laboratory at Port Hueneme, Calif.

Recommendations are made as to test assembly, instrumentation, and procedure. Auxiliary equipment is described. Alternate test set-ups with or without dynamo-meters are designed and relative advantages and disadvantages discussed. Appendix A covers design calculations for the test frames and arches. Appendix B gives design calculations for auxiliary equipment. Appendix C (not bound in this report) consists of five large tracings giving complete design details.

NBY-3187
Operating Manual, RYD-552 Meter, 1962, Interference Testing and Research Laboratory, Inc.

This report describes and gives operating instructions for a special meter designed for measurement of radio frequency interference and field strengths.

NBY-3188
Guidebook for the Planning of Intergrated Atomic Defense Shelters in Selected Military Building Types, Feb 1961, Pennsylvania State University, R. O. Enge, G. H. Albright, A. F. Dill, AD263051

This study was designed to provide a guidebook which presented, in terms understood by architects and planners, information to enable such professionals to effectively plan integrated shelter as a part of the design of selected military building types.

This guidebook illustrates the point that integrated convertible shelters can be incorporated within conventional spaces of buildings without decreasing the efficiency of performing the normal functions or creating a windowless monstrosity and at little or no increase in cost. The military building types selected to illustrate the planning analyses and concepts are, enlisted men's barracks, training school, administration building, 100 bed hospital, subsistence building, and a communications building.

NBY-3189
Improved Line Impedance Stabilization Method, Final Report, Oct 1960, Stoddard Aircraft Radio Co., Inc., J. W. Shaw, E. R. Byerley, AD419512

This final report contains a detailed description of tests performed in accordance with the requirements of contract NBY-3189, Naval Civil Engineering Laboratory, Port Hueneme, Calif. The purpose of this contract is to develop improved or new techniques of measuring RF conducted interference at frequencies ranging from 14 kc to 100 Mc. To accomplish this, measurements were performed using new and improved line impedance stabilization methods and conducted interference testing techniques.

Part I of this report contains the general and detailed factual data resulting from these tests. Also included are studies and comments upon the various aspects of line impedance stabilization network methods both from present and future possibilities.

Part II contains recommendations for improvement in existing line impedance stabilization network methods based upon the experience gained in performance of the test described in part I.

NBY-3190
Feasibility Study of the Outfitting of Existing U.S. Navy Vessels for Deep Ocean Bottom Drilling to 1000-ft Water Depths, Apr 1960, Global Marine Exploration Co., AD636214

This report investigates the feasibility of outfitting existing U.S. Naval vessels with portable drilling equipment to provide them with limited drilling capability.

The feasibility of this undertaking is demonstrated and as a result, the Navy can with a minimum of vessel alterations and the addition of portable equipment, avail themselves of an extremely versatile tool in the field of underwater construction.

To achieve the results herein indicated as both practical and conveniently available, we recommend that detail engineering and outfitting of a vessel should proceed without interruption if the advantages of this capability are to be realized.

NBY-3191
The Field Solidification and Desalination of Sea Ice, Summary Report, Nov 1960, Artic Institute of North America, W. D. Kingery, C. M. Adams, W. R. Campbell, R. J. Dulsky, D. N. French, AD254935

Variables have been studied which affect the rate of ice formation, its structure, and its salinity when formed from ponds, by rapid or slow solidification from rapidly moving streams, and from sprays. Experimental measurements were carried out at Barrow, Alaska, and at Eglin Air Force Base, Florida. These measurements show that the rate of formation, salinity, and product characteristics can be predicted.

Solidification and pressure processes are not practical for field desalination. Brine migration processes are found to be more important than commonly recognized and offer the best approach to development of field desalination techniques.

The conditions required for effective spray solidification have been determined, and it has been shown that very high rates of ice building can be achieved by this process. Necessary spray characteristics are defined.

NBY-3192
Electromagnetic Interference Measurement System, Study Phase Report, Aug 1960, Panoramic Radio Products

The purpose of this project is to develop a method for the measurement of low amplitude electromagnetic signals in the frequency range 14 kc to 10,000 Mc/sec. The project is

to result in the development, testing and delivery of experimental models (breadboard type) to demonstrate feasibility and performance of the system. This report covers the study phase which consisted of literature search, consultations, overall system analysis preliminary studies and experimentation to determine a system design. The results of this work indicate that the system requirements can be met by use of a low-noise radio-frequency input circuit and a panoramic spectrum display of the measured signal. This report includes the block diagram and performance characteristics of the proposed system, which is scheduled to be built during the second phase of the project.

Electromagnetic Interference Measurement System, Final Report, Jul 1961, Panoramic Electronics, Inc, M. Weiss,

The purpose of this project is to develop a method for the measurement of low amplitude electromagnetic signals in the frequency range 14 kc to 10,000 Mc/sec. The project resulted in the development, testing and delivery of experimental models (breadboard type) to demonstrate feasibility and performance of the system. This report covers phase II which consisted of the development, construction and testing of the system design which was determined in phase I to be the most suitable. The system consists basically of a low-noise radio-frequency input circuit and a panoramic spectrum display of the measured signal. This report includes the block diagram, circuit schematics and performance characteristics of the system. Further areas of investigation and development are also suggested.

NRV-3193

Report on the Engineering and Design of Fixed Navigational Towers in 200 ft Water Depths, Mar 1960, Global Marine Exploration Company

The report presents the engineering and design work covering fixed navigational towers for installation in the open sea in a water depth of 200 ft. The site for the initial installation is in the vicinity of Port Hueneme, Calif., but the basic design and erection procedures allow the use of this tower in similar water depths where environmental conditions may vary considerably.

NRV-3195

Unit Model no. 85 and 200 gph, Final Report, undated (1961), Aqua-Chem, Inc.

The general intent of the contract was threefold: (1) A study, of the present 85-gph and 200-gph water distillation units with a view to recommending changes that would (a) increase the output of each unit; (b) Maintain increased capacity for longer operation periods; (c) Remove operating hazards promoted by manual operation. (2) Based upon the results of the study (item 1) to prepare drawings necessary to modify the units as recommended in the study. (3) To test the results of the design practice on both the DVC 8 and DVC 20 after approval by the U.S. Naval Civil Engineering Laboratory as to the design changes and the method of operation.

Unit Model no. 85 and 200 gph, Report on Phase 1, Feb 1961, Cleaver-Brooks Special Products, Inc.

After reviewing the vapor compression cycles as applied to the DVC 8 and DVC 20 units, it was determined that the limiting factor regarding distillate output was the compressor. Since distillate quantity is dependent upon the capacity of the compressor, the manufacturer of the compressor was contacted to see by what amount the compressors, as used on the DVC 8 and DVC 20, could be increased in capacity while still maintaining safe operation. Much correspondence took place before it was decided that the compressor on the DVC 20 could be increased in speed sufficiently to make improvement worthwhile.

After much deliberation, the manufacturer, Sutorbilt, informed Cleaver Brooks Company the following regarding compressors:

1. The compressor on the DVC 8 could be increased in speed to a maximum speed of 1,400 rpm providing that certain modifications were made.

2. The compressor on the DVC 20 could be increased in speed to a maximum speed of 1,500 rpm providing that certain modifications were made.

Since the compressors are the limiting factor for increased production of distillate, it was decided to test the units as received when operating the compressors, at the increased speeds recommended, and to ascertain whether other equipment on the unit was adequate for the increased speed. This was the procedure adopted in the tests as described above.

Unit Model no. 85 and 200 gph, Supplementary Report, Phase 1, Apr 1961, Cleaver-Brooks Special Products, Inc.

This supplementary report clarifies certain points raised after the submission of the initial report of February 1961. There are comments on the modifications and speeds of the compressors and additional data on regulating feed and blow down.

Unit Model no. 85 and 200 gph, Supplementary Report, Phase 1, Jul 1961, Aqua-Chem, Inc.

This report is a follow-up and covers the following items, (1) method of controlling feed water to the DVC 8 and 20 units, (2) method of injecting acid into the units, (3) method of controlling blow down from the units, and (4) suggestions for installation of demisters in the DVC 8 and 20 in lieu of the present mechanical separators.

NRV-3196

Loading on Cylindrical Pilings Due to the Action of Ocean Waves, V. 1. Correlation With Experimental Results, Nov 1960, National Engineering Science Co., L. Skjelbreia, J. A. Hendrickson, W. Gragg, L. M. Webb, AD251471I

The primary purpose of the work presented in this report has been to process experimental data obtained at the Bay Marchand installation, Gulf of Mexico, and to evaluate drag and mass coefficients needed to calculate the wave forces on cylindrical piles by use of theory. Experimental data in the form of wave forces were incorporated with the fifth order theory for gravity waves to determine the two experimental coefficients.

In order to avoid the tedious and time consuming computations encountered in determining the wave profile, dynamic pressure, total force and overturning moment, volumes II, III, and IV have been prepared. The information included in these three volumes is based on normalized values for drag and mass coefficients and may be easily used together with more refined values for drag and mass coefficients obtained in the future.

The experimental coefficients obtained as a result of this work is probably the most refined and realistic values available to date. It should be pointed out, however, that the experimental data are restricted to shallow water and relatively small wave heights. The extrapolation of these data to deep water should be verified by additional experimental data obtained in deep water.

Loading on Cylindrical Pilings Due to the Action of Ocean Waves, V. 2-4, Theoretical Results, Nov 1960, National Engineering Science Co., L. Skjelbreia, J. A. Hendrickson, W. Gragg, L. M. Webb, AD251472, AD251473, AD251474

NRV-3198

Study of Corrosion Problems in Naval Reinforced Concrete Structures Subject to Salt Water Exposure, Final Report, Jun 1962, C. H. Scholer

It is the contractor's judgment that current concrete technology has nothing to offer in the way of alleviating the problem of corrosion of reinforcement in concrete structures exposed to salt spray and mist. It is also his judgment that under severe exposure to seawater spray, splash and mist that our best reinforced concrete will have some horrible examples of deterioration. The record to date is not bad, but wherever concrete becomes loaded with salt due to splash, spray and mist some serious cases of corrosion will develop.

Recommendations are made for some additional studies in the Naval Civil Engineering Laboratory which may improve our concrete technology.

NBY-3200
Methods of Improved Measurement for Electromagnetic Field Components, Interim Report, Moore School Report 61-09, Nov 1960, University of Pennsylvania, R. A. Bartfeld, F. Haber, R. A. Leavenworth, P. P. Lombardini, R. M. Showers, P. B. Swarup

A bibliography on effects in solid state materials which are potentially useful for improving the methods of measuring electromagnetic fields from VVLF to 10 KMC/S is reported here. In addition, the effects considered are described and discussed in relation to the bibliography. A large part of the bibliography was obtained by a systematic review of the ASTIA reports and abstracts and references published in the Proceedings of IRE, both for the years 1959-1960. Recommendations for further work are given.

Methods of Improved Measurement for Electromagnetic Field Components, Interim Report 2, Moore School Report 62-02, Jun 1961, University of Pennsylvania, R. A. Bartfeld, R. J. Doviak, P. B. Swarup

A bibliography on effects in solid state materials which are potentially useful for improving the methods of measuring electromagnetic fields from VVLF to 10 KMC/S is continued in this report. In addition, the problem of interaction between electric and magnetic dipoles is discussed. Recommendations concerning further theoretical studies and practical applications of promising phenomena are given.

Study of Methods of Improved Measurement for Electromagnetic Field Components, Final Report, Moore School Report 62-19, Jul 1962, University of Pennsylvania, R. A. Bartfeld, R. Doviak, R. Mulholland, P. Swarup, AD278692

The near field measurement problem is described and analyzed in three stages. The inherent suitability of loops and dipoles for near field measurements is investigated first. It is found that small loops and dipoles can be used as acceptable field indicators in many, but not necessarily all, near-field situations.

The restrictions imposed on the use of loops and dipoles are derived. In particular, the interaction error is analyzed and computed for various cases of practical interest.

Instruments utilizing loops and dipoles, applicable to near field measurements, are examined. Investigated in particular are the advantages and requirements of power density measurements in the near field. It is found that the measurement of the complex poynting vector offers certain advantages compared to other power measurements in the near field. The effect of instrument errors is considered.

NBY-13028
Dose Attenuation by Soils and Concrete for Broad, Parallel Beam Neutron Sources, AN-108, May 1958, Associated Nucleonics, Inc., D. Spielberg, A. Duneer

This report presents the theory and results of certain neutron shielding studies performed to supply information primarily for underground bomb shelter design. Specifically, for neutron source energies of 0.025 mev, 0.5 mev, 2.5 mev, 7.5 mev, 10 mev, and 14 mev, and various angles of incidence upon the ground, results are presented that show the total neutron plus secondary gamma dose rates which would be received by individuals located in shelters at various distances below ground. To cover the entire range of possibilities, four basically different soil types were analyzed with water contents ranging from zero to saturation. This range also includes concrete. Also, dose rates were calculated for depths ranging from 30 to 1,000 grams/cm sq.

NBY-32189
Elasto-Plastic Response of Two Rigid Frames to a Distributed Dynamic Load, Mar 1961, Southwest Research Institute

In this section the elasto-plastic response of a two-hinged frame subjected to a linearly decaying distributed dynamic load acting on one of its columns is determined.

The elastic and elasto-plastic normal modes for the structures are determined and utilized in the computation of the response of the frame to the applied load.

NBY-32190
Monte Carlo Calculations on the Reflection and Transmission of Scattered Gamma Radiations, Final Report, TO-B 61-39, revised, May 1962 (originally published Jul 1961), Technical Operations, Inc., D. J. Raso, AD262362. Appendix B, Method for Processing the Characteristics, also issued separately as AD419844

During the course of work at NCEL in months following July 1961 in which the Monte Carlo output was reduced to a set of analytical approximations, it was noted that some of the results seemed to be at variance with earlier data published by Berger and Raso and by Davisson. After some months of investigation an error was found in the computer program caused originally by a typographical error in a previous study. This revised version presents the recalculated Monte Carlo output in a somewhat different format to conserve space and produce more readable tables.

Monte Carlo calculations were performed to determine the backscattering and the transmission of gamma rays having energies between 0.02 mev and 10.0 mev from concrete. The radiation was assumed to be incident on a semi-infinite medium and on various slab thicknesses of 0.5, 1.0, 2.0, and 4.0 mfp at angles of cos θ_0 = 1.0, 0.75, 0.50, 0.25, and 0.10. The case histories of 5,000 photons were followed on the IBM 704 digital computer. The information obtained included, (1) the characteristics of emergent photons, which were stored on magnetic tape, (2) a routine that processes these characteristics to give polar and azimuthal angular dose distribution, (3) detailed results from the application of the processing routine to the parameters investigated. The computer program, the processing routine, and the results are appended.

NBY-32192
Review of Data From Lateral Thrust Loadings on Piles, Final Report, May 1962, University of Texas, L. C. Reese, H. Matlock, R. L. Tucker, R. E. Smith, W. B. Ingram, AD419820

The deflections and stresses in a laterally loaded foundation pile are a consequence of complex interaction among the structure, the pile, and the supporting soil. Correlations are needed to enable reliable prediction of force-deformation characteristics (P-Y curves) from the results of soil tests.

Data furnished by the U.S. Naval Civil Engineering Laboratory have been organized on which to base the needed correlations. Pertinent data from instrumented pile tests have been evaluated for accuracy and validity and, in some cases, attempts have been made to apply reasonable corrections or estimates. Final evaluation of resulting P-Y curves was limited by the need for soil-test data representative of the condition of the soil at the time of the tests.

Lateral-plate-bearing tests produce results which appear to be reasonably valid. Further tests and correlations are needed.

A continued program of investigation is strongly recommended.

NBY-32195
Development of Soil Pressure Gages, Jun 1963, Rensselaer Polytechnic Institute, E. C. W. A. Geuze, R. Y. K. Cheng, AD422037

An evaluation of the factors involved showed that the design of a gage entity could not be attempted before the effects of the environmental conditions on an inclusion inside the medium had been sufficiently analyzed.

On the basis of a theoretical study of the inclusion effect a spherical shape of the gage proved to be a unique solution.

A prototype of a gage was used to prove the occurrence of stress concentrations and to test its performance under given environmental conditions.

Further development of the measurement system for various soil conditions was needed to prevent the stress concentration on the gage to occur within the soil medium. A solution of this problem could be obtained which also satisfied certain requirements for the placement of the gage at a point of the medium.

NBY-32196
Navy Lightered (N.L.) Equipment, P-Series, Dec 1961, Cannon and Sullivan

The P-series Navy lightered (N.L.) equipment represents a pontoon system of improved design comparable structurally and operationally to previous systems. After an exhaustive study of manufacturing problems, fabrication cost, and testing of components, the P-series equipment was developed. The P-series equipment is less costly, easier to fabricate, requires fewer parts, and is more quickly assembled than similar equipment of earlier design.

Part I of this report defines and describes the parts and assemblies included in the P-series equipment, methods of constructing pontoon assemblies, detailed construction and operation of causeways, barges, and warping tug, limitations on the use of pontoon structures, and field maintenance and repair of pontoon structures and accessories.

Appendices to part I list the parts and assemblies included in the P-series equipment by part number and plate number, and the series of motion pictures available on pontoon assembly and operation.

Part II of the report describes and provides detailed construction and operation of currently active pontoon structures not assigned to the amphibious construction battalions.

The appendices to part II list parts and assemblies by part number and plate number, as applicable to the pontoon structures included in part II. The background of the development of the P-series equipment and a brief description of items under development for possible inclusion in the system is also presented.

NBY-32197
Material Specifications and Fabrication Procedures for a Moored Underwater Container, May 1962, Western Gear Corp.

The specifications and manufacturing procedures are logically divided into two sections, one section applying to the outer cylinder which is manufactured from fiberglass and the other section for the inner cylinder which is manufactured from aluminum.

In each section the materials, applicable specifications, and vendors are indicated as well as the general manufacturing procedures.

Applicable drawings for each section are listed.

Government specifications that apply for material procurement and processing are included. Additional manufacturing information has been included as general notes on the drawings which have been forwarded under separate cover.

NBY-32198
Static and Dynamic Response of Granular Soils, Technical Report No. 1, Feb 1963, Columbia University, D. M. Burmister, R. D. Stoll, AD420157

Part I of this research deals with two types of triaxial tests where consolidation or prestress loading is applied, (1) while maintaining a constant ratio of principal stresses or (2) while maintaining zero radial strain. A set of fundamental static triaxial stress-strain and shear strength performance ratings are developed based on the controlling influences of soil identification, relative density, and triaxial prestress and load history.

Dynamic Response of Granular Soils, Technical Report No. 2, May 1964, Columbia University, R. D. Stoll, I. A. Ebeido

Part II covers development of apparatus for studies of wave propagation in a confined sand column with the input supplied by an air pulse from a pneumatic shock tube. A special specimen container was constructed to provide restricted radial strains while allowing unimpeded axial motion, thus approximating plane wave conditions. Stress gauges were designed and placed to record passage of a single wave front.

Investigations of the Quasi-Static and Dynamic Response of Granular Soils, Mar 1966, R. D. Stoll, I. A. Ebeido, M. S. Mese, AD638009

This report describes experimental studies of shock-induced sustained-amplitude stress waves in soil. A general analysis is made of wave propagation in a cylindrical bar. The mathematical model includes stress relaxation and radial inertia factors. Also included is analytical interpretation of unloading wave propagation. Unloading waves were generated experimentally by suddenly unloading a previously loaded cylindrical specimen. The analysis results in a theory which accounts for longitudinal, axial, and radial shear modes. Preliminary results are presented of experiments involving earth shock with spherical symmetry. Quasi-static isotropic compression tests and their associated problems are discussed.

NBY-32199
The Influence of Mechanical Shielding on the Response of a Buried Cylinder, Feb 1962, University of Arizona, D. A. Dadeppo, J. F. Werner, AD277436

This report is concerned with a study of the response of a buried cylinder in isolated and unisolated configurations. The main objectives of the study were: (1) to determine, by an analytical investigation, the potential effectiveness of mechanical shields for underground structures, and (2) to formulate a test program to provide experimental verification of the theory.

A description of the structural system, a brief discussion of some shock isolating materials, and the method of analysis are presented. This is followed by a presentation of the results of the response studies and a description of an experimental test program.

NBY-32200
An Accepted Auto Ignition Alarm Unit, Final Report, Oct 1962, Panoramic Electronics, Inc.

Specifications and drawings, no report.

NBY-32203
Damping Characteristics of Prestressed Concrete, Series 100, Issue 15, Jan 1962, University of California, Berkeley, J. Penzien, AD271886

The investigation was undertaken to specifically study the damping characteristics of concrete under different types and intensities of prestress. Some conclusions have been deduced: (1) under steady state conditions, internal damping in prestressed concrete members may be less than one percent of critical if the initial prestress is sufficient to prevent tension cracks from developing. (2) Under transient conditions, the amount of internal damping present in prestressed concrete members depends to a great extent on the past history of loading and on the amplitude of displacements produced. For those cases where members have been dynamically loaded only a few times to a given stress level which produces considerable cracking, damping can be expected anywhere in the range of 3-6% of critical. (3) Magnitude and type of prestress in concrete members have an indirect influence on internal damping only because these parameters control the amount of cracking which can take place.

NBY-32205
Sanitary Waste Disposal for Navy Camps in Polar Regions, a Study of Existing Practices With Recommendations for Research on Improved Methods for Littoral and Ice Installations, Final Report, May 1962, Clark and Groff Engineers, AD282520

In the development of adequate systems many factors must be considered. Among these are the effects of the polar environment, character of the military operations, economical use of power, manpower and water, and the necessary aesthetic and sanitary criteria. Prior to recommending design and research, field visits were made to arctic installations and related research organizations.

All possible waste collection, treatment and disposal concepts were enumerated and evaluated. These included conventional as well as new and speculative concepts. Based upon a comparative evaluation of these concepts in their application to the polar environment, the most feasible methods were selected.

For complete solution of the polar waste collection and disposal problem, it was concluded that the regeneration of potable water from the sanitary wastes would solve the water supply and waste disposal problems simultaneously and entirely within the encapsulated environment of the polar camp. The proposed system consists of minimum flush toilets, combination of all wastes and regeneration by a high temperature oxidation (HTO) unit or by vacuum distillation with catalysis. In the event that water supply is not a problem, wastes can be collected as stated, disinfected by waste heat, steam or electricity, and discharged to snow or ice sump or marine outfall. For isolated areas and small groups of men, a recirculating synthetic flushing fluid unit would give adequate solution to the human waste problem with optimum water conservation.

NBY-32206
Motions of a Moored Construction-Type Barge in Irregular Waves and Their Influence on Construction Operation, Aug 1962, Marine Advisers, Inc., P. Kaplan, R. R. Putz

Results and methods are given for a theoretical study of the behavior of a moored construction-type barge and that of a load, lowered by means of a line from the barge, in irregular seas in deep water. Load-lowering through the hull as well as by means of a boom having variable azimuth angle is considered. Equations of motion of the system for sinusoidal waves are formulated for 6 deg of freedom, including both hydrostatic and hydrodynamic effects. Sinusoidal solutions of these equations are obtained for each of the six barge motions (surging, heaving, pitching, swaying, rolling, and yawing), as well as for the components of the load displacement vector, the vertical component of the load acceleration and the added dynamic tension in the lowering line.

NBY-32207
Description of the Wave Project II Data Reduction Processing Program, Research Report 766, Aug 1962, California Research Corp., R. G. Dean

This report describes wave force data reduction procedures and calculations, plus the resulting output formats for data obtained from wave project II.

Operation of Wave Project II, Progress Report no. 3, Research Report 769, Aug 1962, California Research Corp., V. Schoettle

Report covers the period from September 1, 1960 to September 30, 1961, describes operation and maintenance, contains drawings of dynamometer positions in winter and summer configuration, lists calibration constants and normalization corrections, and presents characteristics of wave recordings obtained during eight minor storms and, in more detail, hurricane Carla.

Operation of Wave Project II, Progress Report no. 4, Research Report 796, Mar 1963, California Research Corp., V. Schoettle

Report covers the period from October 1, 1961 to October 31, 1962, describes operation and maintenance, contains drawings of dynamometer positions in winter and summer configuration, lists calibration constants and normalization corrections, and presents characteristics of wave recordings obtained during seventeen minor winter storms. No hurricane-generated waves occurred at the instrument site during the report period.

Final Report on the Operation of Wave Project II, Research Report 829, Apr 1964, California Research Corp., V. Schoettle

This report covers the period from November 1, 1962 to November 12, 1963. It describes operation and maintenance, contains dynamometer and wave staff mounting dimensions, lists calibration constants and normalization corrections, and presents characteristics of wave recordings obtained during seven minor storms. No major storms occurred at the instrument site during the report period.

NBY-32209
The Dynamic Behavior of Reinforced Concrete Columns, Part 3, DASA-133, Oct 1962, Massachusetts Institute of Technology, C. Y. Yang, K. F. Reinschmidt, AD298721

This research covers the theoretical and experimental investigation of the dynamic behavior of reinforced concrete columns.

Two reports of the same title, parts I and II, were published in September 1960 and March 1962 respectively, concerning primarily the ultimate strength and buckling of concentrically loaded columns. Experiments were performed on 185 columns of 5 by 5-in. square section, of different lengths and of different eccentricities of the load.

The present report covers primarily the theoretical investigation of eccentrically loaded columns. A minor experimental program of 20 columns was carried out. Also included in the report is a summary of results of the first 2 yr.

Comparisons between experimental results and theoretical predictions are made and explanations for their discrepancies are given.

Design charts for dynamically loaded columns, both concentrically and eccentrically, were prepared. A chart for checking long columns for dynamic buckling is also presented.

NBY-32210
Development of Insulating Aqueous Foams for Protection of Ice Surfaces, Final Report, Nov 1962, Onodaga Associates, Inc., F. C. Shibel, C. S. Grove, A. R. Aidun, AD419986

The objective was to find a means of protecting ice runways in the Arctic regions during the summer months when melting or thawing can occur causing soft spots or pot holes. Many insulating materials are available, but the difficulties of application and/or transportation and the resultant increased cost preclude their use. A proprietary concept utilizing aqueous foam insulation was suggested by Onodaga Associates, Inc. The use of aqueous foam has many advantages including ease of application and no need for removal. The stability, insulating and generation properties of the foam were studied in detail in both small and large scale laboratory tests. Actual arctic field testing substantiated these findings and proved the use of aqueous foam to be both feasible and promising.

NBY-32214
Operating Manual, BYD-552 Meter, 1963, Interference Testing and Research Laboratory, Inc.

This report updates the report on contract NBY-3187.

NBY-32215
Study of Natural Forces Acting on Floating Ice Fields, Final Report, Sep 1962, National Engineering Science Co., J. A. Hendrickson, L. M. Webb, R. J. Quigley, AD419827

The response of finite ice floes to water waves is analyzed for relatively deep water. The deformation and peak outer fiber stress are studied for various floe dimensions and elastic properties over a range of incident wave lengths. It is found that for long incident wave lengths the flow duplicates the incident wave characteristics and the response is thus independent of floe thickness. For shorter incident wave lengths the response is strongly dependent upon floe thickness, and the amount of incident wave energy transmitted beneath the floe.

For longer incident wave lengths the probability of floe fracture is quite low because the transmitted energy is absorbed in rigid body motion. For shorter incident wave lengths, however, the stresses in the floe can be very high and thus, regardless of floe dimensions, the probability of fracture is high provided that the incident wave amplitude is large.

A study of the pertinent properties of sea ice is included in order to establish the values used in the numerical work.

NBY-32219
Feasibility Studies of Poynting Vector Measurements, Moore School Report 63-23, Jul 1963, University of Pennsylvania, R. A. Bartfeld, R. G. Mulholland, P. B. Swarup, AD415157

Feasibility studies of poynting vector measurements were undertaken as a result of previous studies concerning methods of improved measurements in the near field of radiating sources. In previous reports it was indicated that a new type of near field measurement, the poynting vector measurement, has some distinct advantages over presently used methods. The present study concerns itself with the feasibility of those measurements and a demonstration of the principle involved.

Study of Methods of Implementing Poynting Vector Measurement, Moore School Report No. 65-16, Dec 1964, University of Pennsylvania, W. W. Cowles, N. Farhat, K. S. Foo, AD458560

The basic concept of development of the poynting vector sensor arose in the course of an investigation of new methods of detecting electromagnetic fields. During this work it was recognized that a source could not be fully characterized by a single measurement. For example, measurements of both the electric and magnetic components provided additional information over the measurement of only one, which might be useful for various purposes.

Accordingly, the purpose of this report is to provide the following, 1) an analysis of the properties of a poynting sensor, 2) a discussion of methods of implementing such a sensor for practical use and to report on experimental work that has been accomplished to demonstrate the principles involved, 3) to indicate possible application of poynting sensor devices along with practical limitations on their design and use.

Implementation of Poynting Vector Measurements, Moore School Report No. 67-05, Aug 1966, University of Pennsylvania, W. W. Cowles, AD640990

This report covers the design, construction, and field testing of an experimental device capable of measuring the magnitude of the poynting vector associated with an electromagnetic field. With mechanical manipulation, it can determine the direction of the poynting vector. It is based upon theory which has been described previously.

Tests of the final device demonstrate that it is capable of measuring this quantity with reasonable accuracy. The major limitations on its use result from the necessity for obtaining an accurate phase calibration of the two separate channels used for amplifying the signals received, respectively, on the rod and the loop antenna. Interaction between the rod and the loop does not seem to be a significant problem.

The device has unique characteristics and a number of applications for it are indicated. Recommendations on improvements in the device which are desirable for general field use are included.

NBY-32220
Proposed Specifications for Electromagnetic Shielding of Enclosures and Buildings, Final Report, Phase I, ES 2115-4220(1), Sep 1962, Genistron, Inc., J. F. Fischer, H. H. Ohta, L. G. Jakubec, AD419845

This document represents the final report on Phase I 500F Genistron Project 2115-4220. This program, under the U.S. Naval Civil Engineering Laboratory contract NBY-32220, is intended to result in definitive specifications and architectural plans for the fabrication and installation of large radio frequency shielded rooms and buildings. The shielding effectiveness of various materials, and fabrication methods for on-site construction from basic materials shall be determined by literature research and laboratory investigation as required. Methods of electrical bonding between sheets shall be studied for initial shielding effectiveness and deterioration with aging. The relative merits of butt versus overlapping joints shall also be determined. The end product shall be definite drawings and specifications which will provide an optimum shielding effectiveness for such buildings in practice, considering plane wave fields 2 - 10,000 Mcps, and electromagnetic fields 10 kcps to 2 Mcps.

Proposed Specifications for Electromagnetic Shielding of Enclosures and Buildings, ES 2115-4220(2), Oct 1962, Genistron, Inc., J. F. Fischer, L. G. Jakubec, H. H. Ohta

Proposed Specifications for Electromagnetic Shielding of Enclosures and Buildings, ES 2115-4220(3), Nov 1962, Genistron, Inc., J. F. Fischer, L. G. Jakubec, H. H. Ohta

Proposed Specifications for Electromagnetic Shielding of Enclosures and Buildings, ES 2115-4220(4), Dec 1962, Genistron, Inc., J. F. Fischer, L. G. Jakubec, H. H. Ohta

Proposed Specifications for Electromagnetic Shielding of Enclosures and Buildings, ES 2115-4220(5), Final Phase Report II, Jan 1963, Genistron, Inc., J. F. Fischer, L. G. Jakubec, H. H. Ohta

Phase I basically consisted of a study of the state-of-the-art in shielding effectiveness. An extensive survey of the literature was made, resulting in the abstracting of some 144 documents and papers. Phase II has primarily consisted of testing to clarify doubtful areas encountered during the literature survey. This includes, but is not limited to, testing to substantiate predicted shielding efficiency calculations, measurement of leakage introduced by various seam configurations, determination of door requirements, etc. Phase III will be directed toward utilization of the information gained in earlier phases in order to formulate architectural drawings and specifications for the subject shielded enclosures.

Proposed Specification for Electromagnetic Shielding of Enclosures and Buildings, Final Project Report, Jul 1963, Genistron, Inc., L. G. Jakubec, H. H. Ohta, AD417699

Phase I has primarily consisted of a study of the state of the art in shielding effectiveness. This study included an extensive survey of the literature, formulation of a bibliography, the separation of data considered to be valid from that which was questionable, and the presentation of conclusions reached. The material also delineated areas which warrant further analysis and investigation during phase II. The phase II program primarily consisted of testing to clarify doubtful areas encountered during the literature survey. Phase III was directed toward utilizing information gained in earlier phases in order to formulate architectural drawings and procedure specifications for the aforementioned enclosures and/or buildings.

NBY-32222
The Influence of Normal Pressure on Bond Between Concrete and Reinforcing Steel in Pull-Out Tests, Jun 1964, Iowa State University, R. E. Untrauer, R. L. Henry, J. F. Harris, AD454767

The objective was accomplished by conducting pull-out bond tests. The main variables were magnitude of normal pressure, concrete strength, size of bar, length of embedment to bar diameter, and orientation of the plane of the bar seam with respect to the normal pressure.

Bond strength was found to increase with normal pressure. This increase was expressed by an empirical equation relating average bond stress, normal pressure and concrete strength. Bar size had no effect on bond for a constant embedment length to bar diameter. Also, orientation of plane of bar seam with respect to plane of normal pressure had no significant effect. The smaller embedment-length to bar-diameter ratio of the two used gave higher average bond stresses. In general, the higher normal pressures resulted in higher loaded-end slip at ultimate load.

Bond-slip curves were obtained for an embedment length of two lugs at either the loaded or unloaded end of the specimen. These curves were used in a numerical procedure to predict the behavior of full length embedment specimens. The results indicated that with further testing to obtain the variation of the bond-slip relationship along the bar a numerical procedure may be used to describe the behavior of the pull-out bond specimen.

NBY-32223
Modifications to Philo Logistics Model, Vol. 1, Problem Statement, Dec 1963, Operations Research, Inc., H. Grossman, J. H. Hamilton, D. E. Mandell, M. W. Pulscak, A. Reiff

Operations Research Incorporated was asked to modify logistic systems study (philo) to provide improved methods and techniques for efficient distribution of men and supplies involved in expeditionary operations.

The modular design of the computer program will facilitate modification for purposes of maintenance and expansion.

Volume I (Statement of problem) contains a discussion of the problem and the revised model specifications.

Modifications to Philo Logistics Model, Vol. 2, Computer Program Design, Dec 1963, Operations Research, Inc., H. Grossman, J. H. Hamilton, D. E. Mandell, M. W. Pulscak, A. Reiff

Volume II (Computer program design) contains a detailed explanation of the computer program (e.g., organization, description, flow charts, input-output formats and operating instructions).

NBY-32225
Theoretical Investigation of Semi-Infinite Ice Floes in Water of Infinite Depth, Jun 1963, National Engineering Science Company, J. A. Hendrickson, L. M. Webb, AD414532

The response of semi-infinite ice floes to water waves is analyzed for relatively deep water. If the floe submergence is neglected, it is found that a progressive wave is transmitted. The stress produced by this transmitted wave is determined for various floe thicknesses and incident wave lengths. When the submergence is not neglected, it is necessary to use a finite difference approach to the solution. Such a solution is attempted and the results and accompanying numerical problems are considered in detail.

NBY-32226
High Voltage Surge Measurements on Stranded Copper Conductor and on Magnetic Tape Wrapped Stranded Copper Conductor, Research Report 63-928-565-R1, Aug 1963, Westinghouse Electric Corp., W. E. Pakala, H. M. Smith, AD417379

It has been found that SiFe magnetic tape contiguously wrapped around a copper conductor increases, to a marked extent, the attenuation of radio frequencies and radio interference pulses traveling along power lines. The purpose of the surge tests reported herein was to find out if a magnetic tape wrapped conductor will attenuate high voltage surges, such as produced by lightning.

It was found that the positive polarity crest surge voltage was reduced at end of test line by the plain copper line from 81 to 88% of its sending end value depending on the surge voltage magnitude. With the magnetic tape wrapped conductor the positive polarity crest surge voltage was reduced at end of test line from 70 to 73% of its sending end value depending on the magnitude of the surge voltage. Negative polarity surges were reduced to a lesser extent. These results indicate that the overall attenuation constant is approximately two times as great, at high surge voltages, for the magnetic tape wrapped conductor as it is for the plain copper conductor. This is not greatly significant with respect to reduction of the surge crest voltage. Higher attentuation at the low frequencies is desirable since these affect the surge crest voltage to a greater extent than high frequency. The greatest reduction at high surge voltages was at the lowest surge test voltage. With 500-V surges from a low voltage pulse generator the reduction was to 60% of its sending end value with the magnetic tape wrapped conductor. With respect to time in microseconds to crest voltage it was higher for positive polarity surges and there was no large difference found in time to crest between the two types of conductors.

NBY-32227
Nonlinear Dynamic Response of Reinforced Concrete Circular Arches, Jan 1964, Massachusetts Institute of Technology, I. K. Shah, AD602045

A set of differential equations and boundary conditions governing the behavior of reinforced concrete arches under dynamic loading is formulated. These equations are derived by considering the arch element in its deformed state. The force-strain relations are formulated by assuming a nonlinear stress-strain curve for concrete and a bilinear stress-strain curve for steel. The governing differential equations are converted into difference equations which, together with the force-strain relations, are solved by a step by step method of numerical integration. A program for the IBM 7094 computer is prepared to handle extensive computations involved in the method and also to facilitate the investigation of the effects of various parameters on the response and the load carrying capacity of the arch.

The influence of a few parameters on the response and the load carrying capacity of a particular arch is studied.

NBY-32228
Techniques and Materials in the Modeling of Reinforced Concrete Structures Under Dynamic Loads, Dec 1963, Massachusetts Institute of Technology, N. G. Harris, P. C. Schwindt, I. Taher, S. Werner, AD602034

A study is made of the technological problems involved in the materials choice, fabricating techniques and loading requirements of models of reinforced structures subjected to dynamic loading effects.

The overall problem of reinforced microconcrete models is examined from the point of view of clarifying the basis of model scale, aggregate gradation, size of test specimen and fabricating techniques used in the M.I.T. laboratory for structural models. A study of the effect of scale on the unconfined compressive strength of small cylinders and beams revealed an increase in strength with decrease in size of specimen with marked increases for the smallest samples.

The fabrication techniques used in the making of the reinforcement for microconcrete models is described with various examples given. A new method of welding the reinforcement is examined from the point of view of the alteration of its mechanical properties.

The use of various filler epoxy systems to model concrete was investigated.

A dynamic loading system suitable for model studies was investigated. A gas system with fast loading behavior is described and details of its construction given.

NBY-32229
Underwater Observation System, Operating and Maintenance Instructions, Nov 1963, Research Manufacturing Corporation

This report contains the description, characteristics and operating instructions of an underwater observation system.

NBY-32233
Wave Forces on Piling, Institute of Engineering Research, Report No. HPS-64-1, Jun 1964, University of California, Berkeley, A. D. K. Laird, AD606502

The object of the research program was to gather a representative body of data on various groups of cylinders subjected to simulated wave action with a view to providing information relative to the behavior of docks, dolphins or other marine and harbor structures of similar configuration in waves of various heights and periods.

Principal emphasis was to be placed on the five-pile dolphin group and the three-row dock configuration. Auxiliary arrangements for comparison or special studies, such as single piles and single rows of piles, were of subordinate interest.

NBY-32235
Winds, Waves, Tides and Wave Run-Up at Ventnor, New Jersey, During the Storm of March 5-8, 1962, NESCO No. SN-138, Jul 1963, National Engineering Science Company, C. L. Bretschneider, J. I. Collins

This report presents the results of hindcasts for winds, waves, tides and wave run-up at Ventnor, New Jersey, during the east coast storm of early March 1962. The hindcasts are compared with available observations and good agreement was obtained. Recommendations for further studies to improve existing methods and applications of hindcasting techniques are given.

NBY-32236
Long Waves on a Sloping Beach and Wave Forces on a Pier Deck, Sep 1964, North Carolina State University, M. Amein, AD451244

This report presents the results of an investigation on the motion of long-period waves on a sloping beach and on the determination of wave forces on a pier deck. Oscillatory waves with periods of 30, 120, and 200 sec, and beach slopes of 0.05, 0.075, and 0.10 are considered.

The wave propagation is determined by the first-order linear small amplitude theory away from the shore and by the first-order nonlinear shallow-water theory near the shore. Calculations by the linear theory are made by using Friedrichs second asymptotic representation, which is suitable for the small beach slopes. Calculations by the nonlinear theory are made on a digital computer by a finite difference scheme based on the method of characteristics. In the numerical method, the bore equations are coupled to the equations of the nonlinear theory, and a procedure for the calculation of the wave run-up on the dry sloping beach bed is also given. Instantaneous wave profiles as functions of the distance from the shore are presented for each combination of wave period and beach slope.

Wave pressures on the pier deck are computed by the application of the Froude-Krylov hypothesis to the flow around the pier. For each combination of wave period and beach slope, instantaneous pressure diagrams on the pier deck are given, from which the wave forces can be calculated by integration.

NBY-32237
Monte Carlo Computation of 100,000 1-mev Gamma Rays Scattered by Concrete Slabs, TO-B 64-31, Mar 1964, Technical Operations, Inc., D. J. Raso, AD438908

Monte Carlo calculations were performed to determine the back-scattering of 1.0 mev gamma rays from concrete and their transmission through slabs of this medium. The radiation was assumed to be incident at various angles θ_0 ($\cos\theta_0$ = 1.0, 0.75, 0.50, 0.25 and 0.10) on a semi-infinite medium and on slabs with thicknesses of 0.55, 1.1, 2.2, and 4.4 mfp. Case histories of 100,000 photons were followed in groups of 20,000 on an IBM 7094 digital computer for each of the six incident angles. Differential dose and number distributions as a function of azimuthal and polar angles are reported.

NBY-32239
Engineering Study of Integrated Fuel Transport System for Inland Waterways, Jun 1963, National Steel and Shipbuilding Company, K. Evans, P. J. Iovin

There were four concepts considered in the development of the barge: self-propelled aluminum, self-propelled steel, barge with towboat, and inflatable rubber tanks with towboat.

The summary and conclusions section contains a comparison and analysis of all four concepts in summary form.

In the technical discussion section the aluminum and steel versions are reviewed in detail. The towed barge concept and the towed rubber tank concept are reviewed only in sufficient detail to show the reason for rejection.

The general description section contains outline specifications for both aluminum and steel barges including weight, draft, methods of construction, methods of module connection, materials, power requirements, steering mechanisms and appurtenances.

The three subsections of the appendix contains two outline drawings, one each for the aluminum and steel barges, curves of form, and calculations for forces on joints.

NBY-32240
Development of Soil Pressure Gages, Mar 1965, Rensselaer Polytechnic Institute, E. C. W. A. Geuze, R. Y. K. Cheng, AD466091

Much of the same material presented in the earlier report on contract NBY-32195 is repeated with the addition of a section on the placement method.

NBY-32242
Design Information for Protection Against Initial Radiation (U), May 1964, Holmes and Narver, Inc., Secret, AD361613

NBY-32243
Effect of Membrane Action on Slab Behavior, Report R65-25, Aug 1965, Massachusetts Institute of Technology, J. F. Brotchie, A. Jacobson, S. Okubo, AD470747

This report is concerned with the increase in load capacity and change in behavior which occur when transversely loaded reinforced and unreinforced concrete slabs are restrained against lateral displacement at the edges. The experimental phase of the study is restricted to square slabs, either unreinforced, or reinforced near the bottom only with steel wires uniformly and equally distributed in each direction. All slabs span 15 in. each way and are statically loaded through a membrane by hydraulic pressure of uniform intensity. The form parameters varied in the tests are span-to-depth ratio (20, 10, 5) and reinforcement ratio (0.0, 0.5%, 1%, 2%, 3%).

The tests are primarily concerned with compressive membrane or arching action resulting from restraint to elongation, but in the clamped slabs the effect of tensile action caused by restraint to inwards movement of the edge is also studied.

In the theoretical phase, simplified expressions for predicting the behavior above are developed, and are compared with the test results.

NBY-32246
Monitoring and Decontamination of Toxic Agents in Water, Final Report, (U), R-6376, Dec 1965, Rocketdyne, Confidential, I. Lysyj, et al., AD374899

NBY-32248
Model Tests of Fishhook Barge, Letter Report 1024, May 1964, Davidson Laboratory, Stevens Institute of Technology, N. M. Maniar

Data on model tests of the barge.

NBY-32251
Feasibility Analysis of a Prototype Shielded Enclosure, Report No. 2115-6462, Dec 1964, Genistron, Inc., D. R. Harrell, AD458240

This document constitutes the final report on the engineering testing efforts accomplished under U.S.N.C.E.L. Port Hueneme Contract NBY-32251. It contains descriptions of these efforts and the results of testing, along with applicable conclusions and recommendations.

The subject program was initiated to evaluate the procedures, processes and specifications developed under Contract NBY-32220 when applied to construction of a shielded facility, and to measure the shielding efficiency of the constructed facility to determine its resultant attenuation characteristics.

NBY-32253
Evaluation of Urethane Foams for Protecting Ice and Snow Surfaces, GERA-961, Nov 1964, Goodyear Aerospace Corp., AD453723

A review of the pertinent characteristics of the urethane foam compounds was made and the most promising candidates were selected. A testing program was planned, test equipment was designed and constructed, and extensive tests were conducted in the U.S. Naval Civil Engineering Laboratory (NCEL) at Port Hueneme, Calif.

NBY-32254
Inelastic Buckling of an Elastically Supported Buried Cylinder, Research Institute of Science and Engineering Project 462, Apr 1965, University of Detroit, D. A. Dadeppo, AD465618

Experiments on buried cylinders show that such structures may be expected to fail by buckling. When the depth of cover is very small the buckling may appear in the form of roof caving which is characterized by the development of large (finite) relative displacements of the upper portions of the cylinder. At greater depths of cover (depth on the order of the radius of the cylinder), failure appears to be initiated by local buckling in the lower portions of the cylinder. Beginning with the initial buckle, which may occur with elastic or inelastic deformation, the strength of the cylinder deteriorates rapidly and total collapse follows.

NBY-32256
Experimental Investigation of Ice Floe Under Wave Action, Jan 1965, National Engineering Science Co., AD456969

Ice floes in the arctic have occasionally been split by catastrophic fissures. These fissures are often miles long and traverse both thick and thin ice without deviation from a straight path. They are called long wave cracks to distinguish them from peripheral cracks due to the jamming action of adjacent floes.

The mechanism of cracking postulated and dealt with under this contract would be brittle failure under excessive bending induced by pressure loading variations generated under the ice floe by incident gravity waves.

The purpose of the model tests carried out under the present contract was to obtain experimental results on the interaction behavior of floating ice sheets with gravity waves. Specifically, it was desired to test the mathematical model set forth in the report, Study of Natural Forces Acting on Floating Ice Fields.

This mathematical model can, of course, be applied to any floating elastic material. However, in order to extend the test results to cover equivalent prototype results for floating ice sheets, the test model must satisfy the laws of similitude.

NBY-32257
Development of Basis for Allocating Maintenance Resources, Apr 1964, Battelle Memorial Institute, AD602802

This study was undertaken to develop new and reliable methods for annual public works resource allocations to U.S. Naval shore activities for maintenance of Class 11 real property facilities. Existing data from 134 activities located in the eastern United States were selected for analysis, economic, geographic, climatic, organizational, and operational factors and measurements were considered and evaluations made to estimate their influence on maintenance fund and manpower requirements. Regression equations, based on data from a selected number of building types and the 134 activities, are given for estimating requirements. Applications of the equations for sample estimates are encouraging, but results indicate need for further refinement and extension of the analysis. Recommendations are made for temporary use of pertinent equations with judicious consideration of their inherent limitations. As such, these methods should be useful as a management tool for resource allocations at field engineering offices and for planning at the Bureau of Yards and Docks.

Development of Basis for Allocating Maintenance Resources (Public Works personnel), Jul 1964, Battelle Memorial Institute, AD602803

The Bureau of Yards and Docks must justify and subsequently, allocate resources for public works at various shore activities in the Navy. Of particular concern are personnel resources. The purpose of this project was to perform a research study to examine the possibility of using equations arising from regression analyses of activity data as a logical basis for determining PW personnel requirements for a representative group of Naval shore activities. To be useful, the derived basis for determining requirements must be applicable throughout the Navy.

Personnel requirements for a particular activity could be expected to depend upon work requirements to provide adequate maintenance for real property. The amount of maintenance to be performed, in turn, could be expected to depend on size of facilities, use, age, replacement value, and other definable and measurable factors. In fact, such dependence is apparent from plots of maintenance cost versus building areas, versus replacement value, etc. Such plots indicate the statistical nature of the data and suggest that the work requirement is dependent upon several variables at one time.

NBY-32258
Management of the Distribution of Maintenance Resources, Jul 1964, Stanford Research Institute, B. Lefkowitz, T. R. Cockerline, D. A. Desopo, AD443384

The principal features of the procedure developed in this study for allocating maintenance funds are summarized below. (1) Facility needs for budget preparation purposes are stated in terms of two kinds of essential maintenance, emergency, and other essential. (2) These quantities are separately estimated for each facility class. (3) The BUDOCKS appropriation is allocated to facilities so as to cover emergency needs of all facilities and to distribute the remaining money to facilities depending on essentiality, condition, and cost of the facility.

NBY-32259
Preliminary Study of Forecasting the Escalation of Construction Costs, Aug 1964, Arthur D. Little, Inc., AD446740

The objectives of this study are twofold: (1) The first is to examine the state-of-the-art of forecasting escalation of construction costs, to determine the extent to which construction costs have escalated historically, to examine factors which escalate construction costs. (2) The second objective is to detail a program of work on developing a method of forecasting the escalation of construction costs up to, say, 5 yr in advance, with an estimate of the accuracy of forecast.

NBY-32260
Feasibility Study of Improved Lightning Protection Systems, G.E. Report No. 64PT146, Aug 1964, General Electric Company, AD451034

The process by which thunderclouds are charged is not completely understood. This is also true of the process by which the lightning stroke is initiated and propagated to ground or to another cloud. However, several hypotheses have been promulgated which are generally accepted.

On the basis of these hypotheses there are, at least theoretically, numerous ways of influencing lightning strokes to ground. The purpose of this investigation was to probe among these ways to determine the feasibility of achieving an improved lightning protection system.

Because of the broad scope of the subject, the study was confined largely to approaches based on the use of ionized media. In addition to a review of General Electric Company investigations, a thorough search of published technical literature was made, with particular emphasis on recent activities and modern technologies.

NBY-32261
The Planning and Development of Expedient Shelter Facilities, Mar 1965, Pennsylvania State University, A. W. Knott, G. H. Albright, M. W. Isenberg, R. E. Kummer, AD465123

The planning and construction of expedient fallout radiation shelters for Navy shore-based installations are presented in detail in this report. The document contains expedient shelter planning and design criteria, recommended construction procedures, and expedient shelter solutions. The shelter solutions are first developed conceptually, then detailed plans are presented for six representative alternatives.

NBY-32262
Transient Synthesizer Feasibility Study (Phase I), Sep 1964, General Electric Company, AD607327

This report, strictly speaking, is neither a feasibility study nor a preliminary engineering investigation, even though it contains information pertinent to both. It is not a feasibility study because there has been no question of the fact that the synthesizer is within the state of the art. On the other hand, it is not a preliminary investigation because in this case there were no trusted and confirmed synthesizer operating requirements upon which to base an engineering study. This is, in fact, the purpose of the synthesizer itself.

Because of these unusual factors, it was necessary to study and evaluate the following items simultaneously, operating requirements, over-all design criteria, detailed design approach, cost.

Findings in one area reflected on decisions made in the others. Although a serious attempt was made to obtain a balance between operating features and cost, final selection of the SCR approach was largely based on present trends in the utilities and electronic industries. As a result, the feasibility study was expanded to the extent of being as definitive as possible, insofar as final design, packaging, and ultimate cost for a prototype are concerned. This, admittedly, was done with some trepidation and feeling of risk, in view of the development work required.

NBY-32263
Mobile Drydock Launch Facilities Study - Volume I - Saturn V Launch System, Dec 1964, Martin Company, AD456367

A feasible, economical facility for offshore launch of Saturn V space vehicles at the Pacific Missile Range (PMR) has been identified.

Confidence in the feasibility and economy of the Saturn V MDLF is based on analysis of drydock modifications by the naval architect and marine engineering firm that originally designed the vessels, on conceptual design and cost analysis by Martin, and on model basin tests.

Model basin testing has shown that the Saturn V, on its launch platform, can be safely towed and grounded in the seas off PMR during more than 300 days of the year.

Such a launch facility can be designed, constructed, and activated for the first flight in about 3 years. The next steps, if a go-ahead is ordered, are exact subsoil and hydrographic surveys, preliminary design preparation, and refined cost estimates.

Mobile Drydock Launch Facilities Study - Volume II - Titan IIIC Launch System, Dec 1964, Martin Company, AD456368

An economical Titan III launching system can be provided at PMR using auxiliary floating drydock-big (AFDB) cruiser drydock sections as a launch platform. This mobile drydock launch system (MDLS) will be located offshore from Pt Arguello.

The MDLS consists of a mobile launch facility on two drydock sections, an assembly facility on three drydock sections, permanent ground facilities, and support vessels.

This MDLS, with a single launch facility and launch site is capable of at least 10 launches per year, the same as a single land-based pad, using onpad assembly techniques. The launch rate can be easily increased by the addition of launch facilities.

Mobile Drydock Launch Facilities Study - Volume III - Floating Tracking and Communication Station, Dec 1964, Martin Company, AD456369

This study was performed for two major purposes, to determine the feasibility of implementing and operating floating tracking and communications stations (FTCS) built on modified AFDB cruiser drydock sections, and to evaluate the potential need, utility, and advantage of these stations.

The FTCS is a suitable type of transportable tracking station. Major advantages are lower acquisition and operation costs, as well as greatly simplified site planning and relocation.

The FTCS characteristics are compatible with the static, dynamic, environmental, and space accommodation requirements of an integrated tracking and communication station.

The baseline system is similar in concept to the advance range instrumentation ship (ARIS) stations. The model was optimized and defined to show feasibility and suitability for the application. Alternative models were also examined to determine what flexibility could be achieved in an FTCS.

Mobile Drydock Launch Facilities Study - Volume IV - Drydock Modifications for Space Mission Support, Including Model Studies, Jan 1965, Martin Company, AD456370

The maximum loads imposed on the flight vehicles, towers, and drydocks by wind, towing, lowering, and launch require: (1) no major modification to the drydock structure for Titan III, (2) no appreciable structural modifications to the Titan III vehicle, (3) some modification of the drydocks and launcher umbilical tower (L-UT) for Saturn V (only about 200 tons of steel), and (4) support for Saturn V between the third stage and umbilical tower only while towing.

Neither the Saturn V nor Titan III receive damaging loads while ballasting down onto the underwater launch foundation. Model tests and theory indicate that the flight vehicles may be submerged in 12-to 15-ft waves without being structurally damaged; however, the practical seamanship problems associated with the lowering procedure will most probably govern the wave heights to be allowed.

NBY-32267
Dynamic Tests of Model Steel Structures, Report No. 65-32, Nov 1965, Massachusetts Institute of Technology, W. L. Stewart, P. E. Rowe, P. J. Pahl, AD628063

The objective of this research project is the development of modeling techniques for steel structures and an investigation of the effect of strain rate on the resistance function of structural elements. The work proceeded in four phases. A dynamic loading machine was developed, dynamic material properties were determined in a series of tensile tests, 16 static and dynamic tests were performed on simply supported beams loaded at the third points, and a series of

16 static and dynamic tests were performed on fixed ended portal frames subjected to a lateral load at the level of the girder.

The dynamic loading machine is capable of rise times of 3 ms or more and maximum loads of 2,000 lb. It can also be used as a static loading machine.

Generally, it is concluded that model studies of steel structures provide an excellent experimental tool. Very sensitive tests for the investigation of strain rate effects have been developed. The necessary apparatus and techniques have been refined and initial difficulties eliminated so that a large number of additional tests on models with a variety of geometric configurations and material properties could be performed rapidly and reliably. These tests might significantly extend our understanding of the dynamic behavior of steel structures.

NBY-32268
Scheduling Maintenance Activities of Public Works Centers With the Aid of Automatic Data Processing Equipment, Jan 1965, Stanford Research Institute, J. Brenner, H. Barnett, H. Beenhakker, P. Butterfield, M. Sobel, AD458252

In the course of the study it was determined that the methods of scheduling generally used at a large public works center involve such complicated constraints and currently yield schedules of such efficiency that a full study, not to speak of a marginal improvement of such procedures, would not be feasible under the present limited contract. Instead, the point of view was taken that marginal improvements might be attainable by alternation of queuing disciplines, or alternatively, in the incorporation of new ideas in the procedure for choosing jobs to work on in a shop, from the list of jobs that present themselves every Monday morning, and in the partial automation of information needed for scheduling. A recommendation was also developed for effecting the use of machine scheduling systems for planning manpower requirements at new activities.

NBY-32271
Calculation of Static and Dynamic Response of Circular Arches, Aug 1965, University of Virginia, R. T. Eppink, AD474271

The purpose of this investigation is to perform theoretical calculations of the behavior of two-hinged circular arches deflecting in their own plane and subjected to loads distributed uniformly over a portion of the arch and applied both statically and dynamically. The objective is to provide analytical support for experimental results obtained from structural steel arches tested in the atomic blast simulator of the U.S. Naval Civil Engineering Laboratories.

NBY-32272
Observations on Two Management Aids and a Cost Model for Deferred Maintenance, Part I, Technical Report, Part II, Summary Report, PRC R-649, Oct 1965, Planning Research Corporation, AD472942L

This report describes a study directed toward examining some of the critical aspects of managing public works maintenance at Naval shore activities. Two major tasks are included within the scope of the study.

The first task is comprised of two separate subtasks. One subtask shows that installation of engineered performance standards has increased productivity of maintenance personnel between 35 and 40%. The other subtask confirms the validity of the maintenance analysis effectiveness rating procedure for the evaluation of the performance of the individual activities against established criteria and the identification of weak areas of management control. The study findings also show that the weights assigned to the constituent rating elements are not reflected in total score variance so that comparative evaluations among activities based on total scores may not be valid.

The second task develops a methodology to determine the total annual cost of deferring maintenance. Two major sources contributing to this cost are identified. (1) Those costs attributable to a shortened useful life of the facility, and (2) those costs attributable to decreased effectiveness in performing the mission of the facility. The methodology is exemplified by application to three specific deferred maintenance actions associated with roads, housing, and waterfront operational facilities.

Other related findings are discussed in the report and specific recommendations are made for improvements.

NBY-32273
Research and Development Study for Deep Ocean Reactor Placement, May 1965, Bechtel Corporation, AD466696

This study presents a survey of the various means by which an object weighing over a hundred tons can be lowered to the ocean floor (20,000 ft), monitored, and retrieved. Two basic systems, their major subsystems, and alternate modes of operation are discussed, analyzed, and evaluated. The all-surface system accomplishes the required tasks from the surface of the sea. The vehicle-assisted system utilizes submersible work vehicles. The approximate costs of these two systems are compared and a composite system is recommended which is considered the best from the standpoints of flexibility and practicality.

The appendixes include studies on nuclear considerations, a discussion of long lines including rods, pipes, ropes, and chains, a parametric study of deep diving vehicles, and an analysis of the variation in sea water density and load volumes as applied in this study.

NBY-32274
Study of Heat Transfer and Fouling of Heat Transfer Surfaces in the Deep Ocean, Nov 1965, C. F. Braun and Company, AD626185

The aim of this study is to furnish enough information to adequately design natural convection heat rejection surfaces in medium to deep ocean environments (300 to 20,000 ft). We developed information on heat transfer, biological fouling, and corrosion under the given conditions.

Several corrosion and marine fouling tests on heated metal surfaces were performed in the ocean. These experiments consisted of a 120-day shallow ocean test and two 5-day deeper ocean tests at depths of 300 and 4,500 ft in southern California waters. Four cylindrical elements, each containing three different metals electrically isolated from one another, comprised the test unit.

Test results revealed that marine fouling did not occur on heated metal surfaces above 100F. Corrosion scale formation was not greatly affected by temperature over the range 100 to 140F. However, corrosion scale lowered overall heat transfer coefficients of some of the metal elements.

A conceptual design study was conducted for an undersea convector section of a 500-kW (E) fuel cell. We constructed a prototype unit and tested it for 54 hr in Port Hueneme Harbor. Experimental data confirmed the laboratory test data and the design approach.

The design criteria developed from this investigation are presented in a single chapter. We included step-by-step procedures for designing an undersea finned heat rejection surface and for estimating the flow and penetration of a turbulent plume above an underwater heat source.

NBY-32275
The Development, Fabrication, and Evaluation of a Device for the Measurement of Thermal Properties of Soil, Jan 1966, Virginia Polytechnic Institute, S. T. Hsu, H. S. Kao, AD632080

Statement of the problem---(1) to design, develop, fabricate and evaluate a probe device embodying the line heat source concept for the in-situ measurement of the thermal conductivities of soils. (2) To develop and evaluate the technique, using the probe device, for measuring the thermal conductivities of soils in-situ. (3) To design, develop, fabricate, and evaluate a heated disk device based upon the contact principle for the in-situ determination of the thermal diffusivities of soils. (4) To develop and evaluate the technique, using the heated disk, for measuring the thermal diffusivities of soils in-situ.

Device for the Measurement of Thermal Properties of Soil, Operation and Maintenance Manual, Jan 1966, Virginia Polytechnic Institute, S. T. Hsu

A probe device was designed and fabricated especially for the in-situ determination of the thermal conductivity of soils. The complete system consists of a battery, a probe and tool box and an instrument box. The report contains operating and maintenance instruments. There are diagrams and illustrations.

NBY-32279
Attachments and Connections to Buried Structures, Oct 1965, University of Illinois, Dept. of Civil Engineering, J. D. Haltiwanger, C. C. Tung, G. C. Feng, W. C. Schnobrich, AD475427

In the past extensive theoretical and experimental studies have been made of the problems associated with the structural design of isolated structures or elements thereof to resist the forces and motions imparted to them in an underground environment by the effects of nuclear explosions. However, there has been rather little attention given to the design of connections between such buried structures and attachments to them. It is obvious that most buried structures cannot perform fully the functions for which they were intended unless they are connected physically by means of pipes, conduits, shafts, etc. to other supporting underground and/or aboveground facilities. The studies reported herein are directed toward the problems associated with the design of connections between buried structures and attachments to them.

NBY-32281
Procedures for Evaluating Rheological Properties of Asphalts Pertinent to an Investigation of the Viscous and Elastic Properties of Bituminous Pavements, Project 389, May 1965, Texas A and M University, R. N. Traxler, AD466265

Eight procedures that are at present available for measuring the flow properties of asphalts at low temperatures are described briefly.

Elasticity Theory Applied to Flexible Pavement Design, Project 389, 1965, Texas A and M University, F. H. Scrivner, AD466264

If granular materials do not possess a modulus of elasticity in the sense that the term is used in theory, then the theory of elastic layered systems does not apply to flexible pavements. It appears to us, therefore, that new research in this field should seek to (1) develop a deformation law for granular materials similar to Hookes Law for metals. (2) From the deformation law develop a theory of stress distribution for flexible pavements similar to the theory of elastic layered systems. (3) Determine the accuracy of the new theory by full-scale field tests.

Suggestions for Phase II of Research on the Elastic Properties of Asphaltic Concrete, B. M. Gallaway, and Elastic Properties of Asphaltic Concrete, R. A. Jimenez, Project 389, 1965, Texas A and M University, (Two papers bound in one report) AD466266

An ever increasing amount of data is accumulating to cast a shadow on the idea that soil and asphalt aggregate systems act only in an elastic manner. In order to approach the present research in an honest fashion with the hope that at least a part of the true nature of such materials may be revealed, at least two avenues of research should be considered. The purpose of these tests would be to measure the effects of a limited number of variables on the values of the different K-S in the proposed equations.

The comments and statements presented herein are concerned with factors that influence the deformation characteristics of asphaltic concrete pavement surfacings. Of particular concern are the modulus of elasticity, E, and Poissons ratio, μ.

NBY-32282
Theoretical Study of an Arctic Environment Simulator, Report no. 3039, Aug 1965, Aerojet General Corporation, AD472186

This report contains the results of a theoretical investigation to determine the feasibility of simulating the Arctic Ocean environment in a laboratory.

Ranges of individual parameters for the atmosphere and hydrosphere have been established. For most of these parameters, the information is presented only in simple graphic or tabular form. For solar and terrestrial radiation, however, recourse is made to analytical expressions as well.

Scaled simulation was considered first from an all-conclusive point of view and then narrowed to a manageable domain - that portion of the total Arctic region which is close to the interface between the atmosphere and the hydrosphere.

It is concluded that many scaled simulations are completely feasible. Consideration of the means of achieving such simulation indicates that the required laboratory facility also is practicable.

NBY-32286
Continued Study in Development of Basis for Allocating Maintenance Resources, Feb 1965, Battelle Memorial Institute, AD461112

This report contains the results of work performed under Contract no. NBY-32286 in continuing the work initiated under Contract no. NBY-32257. Presented are regression equations derived from relating historical (FY1963) data on maintenance resource expenditures (manpower and funds) to measures of inventory of class II real property and personnel loading with due consideration given to the effects of geographic, climatic, economic, contracting practices, management, functional and other factors. The principal results given are based upon consideration of 144 public works departments and offices within the continental limits of the United States. Also presented are specific equations and worksheets recommended for use as a management tool in allocating maintenance resources.

Continued Study in Development of Basis for Allocating Maintenance Resources (Public Works Personnel), Feb 1965, Battelle Memorial Institute

This report contains the results of a portion of the work performed under Contract no. NBY-32286 in continuing the work initiated under Contract no. NBY-32257. Presented are regression equations derived from relating historical (FY1963) data on public works maintenance resource utilization (manpower) to measures of inventory of class II real property and personnel loading with due consideration given to the effects of geographic, climatic, economic, contracting practices, management, functional and other factors. The principal results given are based upon consideration of 144 public works departments and offices within the continental limits of the United States. Also presented are specific equations and worksheets recommended for use as a management tool in allocating personnel resources.

NBY-32287
Packaged, Self-Contained, Fire Suppression System for Use in Remote Areas Where a Normal Water Supply Is Not Available for Structural Fire Fighting, Factor Mutual Report No. 15974, May 1965, Factory Mutual Research Corp., J. B. Smith, E. W. Cousins, J. S. Slicer, M. J. Miller, R. L. Pote, AD466694

Five packaged, self-contained fire suppression systems were devised after a comprehensive review of pertinent material. Eighty-one references are attached. The two most promising concepts, as recommended by FMRC and approved by the Navy, are a multi-cycle, total flooding system using bromotrifluoromethane and an automated sprinkler system using water.

NBY-62158
Search Operations to Locate and Recover a Submersible Test Unit Designated STU 1-1, (NA65H-213), Mar 1965, North American Aviation, Inc., Columbus Division, C. H. Holm, W. Christiansen, AD838406L

This letter report describes methods that were devised for ship search operations designed to locate and recover a submersible test unit designated STU 1-1, implanted in a deep ocean environment. Although most of the experiences described were accomplished by wire sweep and grappling techniques, the principles and the methods are of general application. Pertinent information regarding oceanographic environment, and the reconnaissance and positioning methods used will be provided by the U.S. Naval Civil Engineering Laboratory.

NBY-62161
A Study to Determine the Optimum Urethane Foam Coating for Protecting Ice and Snow Surfaces, Goodyear Report no. GERA 979, Jul 1965, Goodyear Aerospace Corp., AD469935

The effort performed under Contract NBY-32253 disclosed two problem areas. These areas were trafficability and wind resistance. Contract NBY-62161, covered by this final report, dealt with these two areas as well as with the equally important problems of transportation, storage, foam generation, application, and maintenance associated with the task of providing a protective foam cover for ice and snow surfaces.

The investigation of protective covers resulted in two final concepts which provide adequate resistance to traffic and wind and are worthy of full-scale development. The two concepts are the regenerating foam-granule/snow cover technique, utilizing a frozen mixture of granules and snow, and the rapid-airstrip blanket technique, utilizing a layer of insulating granules covered by a flexible fiberglass laminate cover.

Standard procedures for polar operations may be followed. Most equipment required for preparing and maintaining these protective covers is that normally used on polar runways. No major problems were found in the areas of transportation, storage, generation and application of the protective foam.

NBY-62163
Research Study to Develop Workload Indicators for Bureau Field Divisions, Oct 1965, Management Technology Inc., AD472566L

Results to date have been gratifying in their quality and utility. This project to develop a system of workload indicators is management research, exploring an area of technology which has not been chartered prior to this current effort. The very nature of research carries no guarantee of positive or agreeable conclusions. In view of this, the present study has been conducted in cooperation with the Operations Research Division of the Navy Civil Engineering Laboratory. Promising results are summarized in Exhibit II-A, Summary of results - quality of estimating equations, which categorizes the results within each of the assigned management programs as either good or fair. Unlike the earlier findings reported in the two preliminary draft reports, no poor results remain to be shown. This testifies to the reality of the workload indicator concept, the soundness of the research approach undertaken, and the continued effort to improve all of the results above the threshold of fair.

NBY-62164
Evaluation of Practical Methods for the Construction of EMI Shielded Enclosures, Dec 1965, Genistron, Inc., J. C. Shifman, AD478473

The report presents information concerning the construction and test of a large continuously-soldered-seam shielded room. The design of this shielded room utilized criteria developed under BUDOCKS Contract NBY-32220, modified by subsequent experience gained in the construction and test of a small prototype room at the U.S. Naval Civil Engineering Laboratory, Port Hueneme. Construction problems and test results are described. The method of examining seams magnetically for leaks during construction is described in detail. Results of an ambient conducted noise survey on certain power conductors are given. The isolation effectiveness of a power line transformer was measured and results given. Methods of preparing pipe penetrations are described. Problems in construction which effected shielded effectiveness are discussed. A proposed improved seam design is presented.

NBY-62165
Technical Manual for Aqua-Chem Spray-Film Vapor Compression Evaporator, 1966, Aqua-Chem, Inc.

This manual is furnished to provide guidance on operation and general maintenance of the Aqua-Chem Spray film vapor compression distilling plant.

A background of information relating design and principles of operation is also provided so that the operating personnel can more easily become acquainted with the distilling process.

The manual should be placed in the hands of personnel responsible for the operation and maintenance of the distilling plant.

NBY-62167
Fire Tests of Two Remote Area Fire Suppression System Concepts, FMRC No. 15974.1, Nov 1965, Factory Mutual Research Corp., AD475343

Two packaged, self-contained fire suppression systems were fire tested to determine which would best meet the remote area fire protection needs. Results of 31 tests indicate that the multi-cycle, total flooding system using bromotrifluoromethane is superior to the automated sprinkler system using water.

NBY-62169
Study of an Automatic Control System for a Multistage Evaporator With Varying Heat Input Rate for Desalination of Seawater, Jun 1965, Jacobs Engineering Co., J. Houseman, J. R. Canter, J. Doshi, AD469084

A study of an automatic control system for a multistage flash evaporator operating with a varying heat input rate has been carried out. The semi-portable evaporator will utilize waste heat from a diesel engine to produce potable water from seawater.

An analysis of the problem indicated that the best way to compensate for the varying heat input rate is to vary the seawater feed rate to maintain a constant brine temperature at the heater outlet.

A study of various types of control systems was made to determine the types of controls that will fulfill the requirements. Particular consideration was given to self-actuated devices.

NBY-62174
Test of Existing Open and Closed Type Guy Insulators and a Feasibility Study of Improved Designs for High Strength Alumoweld Cables, Feb 1966, General Electric Company

Results of testing strings of open and closed type fail-safe guy insulators show a linear relationship between peak-wet flashover rating and number of units in a string. The effect of grading rings and spacing of insulator units is demonstrated.

NBY-62176
Test of Charcoal-Filled Gas Filter for Fire Retardancy, FMRC No. 16286, Feb 1966, Factory Mutual Research Corporation, R. M. Newman

A government-furnished charcoal-filled gas filter was submitted to the Factory Mutual Research Corporation for a fire retardancy test. The test consisted of exposing the filter to flames from two gas burners. The filter and burners were installed in a sheet metal duct and air, at a

velocity of approximately 200 fpm, was blown past the burners and through the filter. Visual observations were made both upstream and downstream of the filter, flue gas samples were taken and analyzed, and smoke densities were determined. The test was conducted for a total time of 5-1/2 min, with burners on for the first 3 min. The filter burned vigorously and charcoal was destroyed. Flue gas analysis indicated approximately 10% carbon monoxide by volume, maximum. Smoke obscuration was moderate to dense over the greater portion of the test.

NBY-62177
Survey of Foamglas Insulated Buried Hot Pipelines, Phase I, Jul 1965, Harco Corp., R. L. Deskins, AD474998

This report comprises phase I of a three phase comprehensive survey which is to determine the suitability of foamglas for possible Navy use in underground heat distribution systems. A list of installations containing foamglas insulated hot pipelines buried directly in the ground was compiled by contacting likely foamglas users. Information relating to soil corrosiveness, ground water conditions, and maintenance problems on the existing installations is presented.

Information reported by owners and engineers indicates that maintenance problems had occurred in 53% of installations more than 5 yr old, and in 15% of installations less than 5 yr old. However, some of those maintenance problems did not appear to be connected with insulation failure. Careful workmanship in the foamglas coating is considered to be extremely important for a successful installation, particularly in moist environments. No failures were reported in well drained soil. Detailed investigations of certain foamglas installations will be made during phases II and III of this survey.

Survey of Foamglass Insulated Buried Hot Pipelines, Phase II, Sep 1965, Harco Corp., R. L. Deskins, AD475027

Phase II consisted of site visits to six installations selected from the phase I report and from a separate list prepared by the Navy. Information relating to the installation, operation, and maintenance of the six buried hot pipelines is presented in this report. Four of the pipelines were installed in wet soil and three of these had had extensive maintenance problems relating to moisture penetration. A more detailed investigation of three of those will be made during phase III of this survey.

Survey of Foamglass Insulated Buried Hot Pipeline, Phase III, Nov 1965, Harco Corp., R. L. Deskins, AD475098

Phase III consisted of surveys and excavations at three sites selected from phase II. The investigations included inspection of pipelines and foamglas along with soil corrosion tests.

The pipelines selected for investigation were 7 to 8 yr old and installed in wet soil. Two of the pipelines were hot water systems (approx. 200F) and the third one was a steam system. One hot water system had been successful, and the other had extensive pipe corrosion problems. The steam system had exhibited high heat loss and had just been replaced with a conduit system.

NBY-62201
Foundation Investigation for Proposed Nuclear Blast Shock Simulator Facility, Port Hueneme, California, for the U.S. Naval Civil Engineering Laboratory, July 1966, R. T. Frankian and Associates

This report presents the results of our investigation of the site of the proposed nuclear blast shock simulator located on the base of the Naval Civil Engineering Laboratory at Port Hueneme. The purpose of the investigation was to determine the nature of the subsurface soils and to prepare recommendations pertinent to the design of the foundation for the simulator.

A Discussion of the Relationship Between Equipment Characteristics and Shock Test Methods, RMP TR3833-1/3, Aug 1967, The Ralph M. Parsons Company, H. R. Saffell, R. C. Yang

Testing methods currently employed to verify the ability of equipment housed in protective structures to survive the strong shocks generated by nuclear explosions involve assumptions not only as to the nature of the environment but also regarding the dynamic characteristics of the equipment. Unless, in each specific case, the assumptions can be justified by a critical evaluation of the dynamic phenomena, the validity of the test as a criterion of survival remains open to serious question. The need for many of the assumptions would be less critical if a test machine were available which was capable of reproducing all parameters of the environment as accurately as they can be predicted to occur, that is, if the limitations on simulation imposed by the test machine itself were minimized.

In this report, the assumptions implicit in many of the current testing methods as applied to several specific classes of hardware are reviewed qualitatively. It is concluded that, in many important cases, the characteristics of the equipment are such that tests on existing machines fail to demonstrate survivability with the desired confidence.

CR-65.001
Study of Ground Motions for Simulation by Shock Testing Machine, L. S. Jacobsen, J. Karagozian, J. A. Malthan, Los Angeles, Calif., Aghabian-Jacobsen Associates, Nov 1965, Contract NBY-62198, AD628765

This study was performed in order to obtain criteria for the design of a testing machine that will simulate ground shock. Approximate methods were used in defining the motions encountered during ground shock in representative soil profiles, and the effect of various structures interposed between the free-field and equipment was estimated. Shock spectra were then obtained for typical equipment located in various types of structures placed in the assumed soil conditions. In this manner, a range of values was obtained that defined approximately the shock input and the shock response of equipment, which, it is believed, bounds the shock conditions for specified environments given in the work statement.

CR-65.002
Task-Analytic Methods Applied to Staffing Criteria for Construction Inspectors, Canoga Park, Calif., Robert B. McClellan, Dec 1965, Contract NBY-62172, AD627599

This is the final report of an operations research study undertaken to use a task-analytic approach to establish criteria for the Bureau of Yards and Docks personnel staffing, required for the inspection of Naval shore establishment construction projects.

Staffing criteria based on dollars work in place by construction type are presented with supporting documentation.

Leveled inspection hours per thousand dollars work in place are presented for use in all Naval districts. Allowed inspection hours are presented for the 11th Naval District.

CR-65.003
Task-Analytic Methods Applied to Staffing Criteria for Construction Inspectors, Appendix, Canoga Park, Calif., Robert B. McClellan, Dec 1965, Contract NBY-62172, AD627340

Part A. Leveled inspection hours per dollar work in place supporting data. (Forms 1, 2, 3, 4, 5)

Part B. Contribution by division by type of construction (Form 6)

Part C. Basic work measurement data

CR-65.004
Cost Reduction Achieved Through Utilization of Engineered Performance Standards in Navy Public Works, Development and Demonstration of a Methodology, Presentation Summary, Los Angeles, Calif., Planning Research Corporation, Dec 1965, Contract NBY-62168

CR-65.005
Cost Reduction Achieved Through Utilization of Engineered Performance Standards in Navy Public Works Maintenance, Development and Demonstration of a Methodology, R. E. Bean, H. M. Dye, G. K. Tallmadge, Los Angeles, Calif., Planning Research Corporation, Dec 1965, Contract NBY-62168, AD479678L

Four major tasks are included within the study.

Two of the tasks are methodology developments - (1) the procedures to be used in calculating a Navy-wide cost reduction associated with engineered performance standards under Department of Defense cost reduction directives, and (2) the recommended data collection procedures to be employed during an EPS installation. The methodology developed produces net savings - that is, both achieved savings and implementation costs of EPS are considered.

A third task is the calculation of the EPS-associated cost reduction for Fiscal Year 1965 using the derived methodology. Based on a sample of 56 of the total 108 activities currently utilizing EPS, the Navy-wide cost reduction for Fiscal Year 1965 is $1.5 million. The study shows that cost reductions are achieved because of the increased productivity of maintenance personnel in the years immediately following an EPS installation. Based on the analysis performed for the fourth task of this study, the Navy-wide estimate of this increased productivity currently being achieved at activities where EPS is utilized is approximately 23%. This, however, is only two-thirds of the potential savings.

CR-65.006
Study of Standby Fuel Cell Power Systems, 30 June to 30 September 1965, R. F. Wolf, et al., Milwaukee, Wis., Allis-Chalmers, Space and Defense Sciences Dept., Dec 1965, Contract NBY-62178, AD477113

The program was initiated by soliciting up-to-date fuel cell information from known manufacturers and research organizations through questionnaires. Similarly, since the need for a transitional source of energy was anticipated, a questionnaire covering secondary batteries was also formulated. The survey information received was integrated with existing knowledge from which the system selections were made.

Along with fuel cell and battery research, a study was made of the potential fuels and oxidants available for standby power systems. A screening of these available reactants resulted in the detailed consideration of 11 fuels and 3 oxidants. The characteristics of these were tabulated for final consideration.

Final fuel cell system selection was made on the basis of cost effectiveness studies. Hydrazine-air fuel cells were selected as the best choice for all power levels on this basis. An alternate system using dissociated ammonia-air was recommended because of the projective nature of hydrazine costs. Cost effectiveness also determined the choice for the dissociated ammonia-air system.

For all systems at all power levels, lead calcium batteries were selected as the best choice for transitional energy reservoirs based on their particular suitability for long-term standby service.

CR-65.007
Development of a Condition of Maintenance Rating Scale and Sampling Procedures for Buildings of the Naval Shore Establishment, Columbus, Ohio, Battelle Memorial Institute, Dec 1965, Contract NBY-62175, AD656584

Presented in this report are the results of a partial study conducted by Battelle Memorial Institute (BMI) for the development of a condition of maintenance rating scale and sampling procedures for buildings of the Naval shore establishment. The study was reoriented before its completion date at the request of BUDOCKS after it was mutually agreed by the maintenance division and Battelle that the need for economic evaluation was more urgent than a maintenance rating scale. Several models for rating individual buildings were being investigated by BMI at the time, and a discussion of these models is included. Also included are considerations for the development of a sampling procedure to arrive at an activity rating.

CR-66.001
Development of Water Permeameter for Asphalt Concrete Cores, Vol. 1, F. N. Finn, K. G. Hicks, and J. Wilson, Oakland, Calif., Woodward, Clyde, Sherard and Associates, Jan 1966, Contract NBY-62183, AD479177I

This report covers the development of a water permeameter to measure the coefficient of permeability of asphalt concrete cores. The report includes, (1) an evaluation of permeability measuring concepts, (2) results of investigation of techniques for the falling head permeameter, (3) a description of the falling head permeameter, (4) a summary of the test results, and (5) a bibliography compiled during the literature search.

CR-66.002
Test Procedures for the Determination of the Coefficient of Permeability of Asphalt Concrete Cores, Vol. 2, F. N. Finn, K. G. Hicks, J. Wilson, Oakland, Calif., Woodward, Clyde, Sherard and Associates, Jan 1966, Contract NBY-62183, AD479178I

Volume II covers test procedures for the determination of the coefficient of permeability of asphalt concrete cores.

CR-66.003
Engineering Study on the Economics of Boat Floats (Los Angeles and San Diego Areas), D. R. Garbaccio, G. Zwier, R. W. Wilson, San Marino, Calif., Science Engineering Associates, Feb 1966, Contract NBY-62190, AD631464

A variety of types of boat floats, used as floating platforms for embarking or disembarking personnel from launches and other small landing craft, have come into use over the years at ports and marinas for both military and civilian purposes. These floats utilized materials such as timber, steel, concrete, plywood, ceramic and plastic. In their environments these floats have shown different responses in regard to life, initial costs and maintenance expense.

The problem posed in this report is that of determining which type or types of floats are economically most suitable for the areas of Los Angeles and Long Beach harbors and for the port of San Diego.

CR-66.004
Hydra 5 Model Tests, Response Due to Wave Action, D. N. Garbaccio, San Marino, Calif., Science Engineering Associates, Mar 1966, Contract NBY-62199, AD633948

Details are reported on the design for 1/20 linear scale model of an approximately 15,000-lb 40-ft-long missile (Hydra) now operated by the Naval Missile Center, Pt. Mugu, from a vertically floating position on the open ocean as a scientific space probe. Natural periods of model oscillation of 1.9 sec in heave and 3.0 sec in pitch are predicted. The model has been built and proof tested. It is desired to improve missile stability in a seaway. Hence, there is included a program for the measurement in the wave tank at the Naval Civil Engineering Laboratory (100 x 2 x 3 ft high) of the response of the model freely floating in water 2.5 ft deep to regular waves of varying height up to 5.0 in. with period and length of respectively 0.90 sec and 4.1 ft to 3.5 sec and 38.8 ft. These measurements, besides steering missile modification where required, should assist in the prediction of missile response to seas up to state 4.

CR-66.005
Interaction Theory for a Floating Elastic Sheet of Finite Length With Gravity Waves in Water of Finite Depth (Including a Comparison With Experimental Data), J. A. Hendrickson, San Marino, Calif., Science Engineering Associates, Apr 1966, Contract NBY-62185, AD635581

In the present study a theory is developed for the dynamic interaction of a floating elastic plate with incident gravity waves. The theory is two-dimensional and assumes finite dimensions for the plate and a finite depth for the water. The depth of submersion of the plate, however, is neglected. This investigation extends the work of previous investigations by considering the two-dimensional, finite depth aspect of the fluid flow.

The theory is adapted to a numerical means of analysis and a computer program is developed to calculate the response parameters of the elastic sheet for given input parameters. Numerical results are obtained for a particular plate and water depth for four different input waves. These conditions were chosen to be the same as those for which model tests were performed under a different study. The experimental results and the theory are then compared and shown to be in reasonable agreement.

Suggestions for future work are made. It is advised that the presently developed theory be extended to include the effect of plate submersion. Further, since the goal of these studies is to understand the naturally occurring stresses in ice floes, it is suggested that a program be developed for field investigations.

CR-66.006
Development and Evaluation of 60 Cycle and 400 Cycle Transformer-Filters, W. K. Grossmann, Los Angeles, Calif., Genistron, Inc., May 1966, Contract NBY-62194, AD635487

This report contains final design and performance data of the Genistron BP-814 and BP-815 transformer-filters. The report also compares theoretical findings with the measured performance of the filters by means of graphical presentation of essential parameters. A discussion of these results permits selection of an optimum trade-off between parameters for future designs. Finally, a qualitative assessment of features, with regard to anticipated usage, is formulated as a general description and compared with established devices of similar performance.

CR-66.007
Acquisition of Data on Vehicle Usage by Selected Elements of Naval Shore Stations, F. M. Fulton, Santa Paula, Calif., Applied Science Corporation, Jun 1966, Contract GS-09S-17338, AD485565L

The Naval Civil Engineering Laboratory, Port Hueneme, Calif. is conducting an operations research study of transportation equipment allowances for all types of Naval shore activities in an effort to develop practical transportation allowance formulae. As a part of this study the Applied Science Corp. was given the task of acquiring and analyzing functional transportation data from seven West Coast stations. This seven station sample consisted of five Naval air activities, one Naval supply center and a Naval shipyard.

This report provides a structured, comprehensive summary of the transportation-related data obtained for the seven stations. This data is analyzed for cross-correlation of transportation needs between common-denominator organizational elements present at each of the stations. The analysis found that six of the seven stations fitted a common vehicle usage pattern, and derived a simple linear equation that was capable of predicting basic station vehicle needs within an accuracy of 5%.

Key parameters in the derived relationship were found to be three activity-factors which determined by each station's operational environment, particularly - station location, size and housing ratios. Correlation of the three factors with these station environmental parameters is demonstrated, however, the derivation of explicit relationships for these activity-factors is a part of the basic study task that is beyond the scope of the present data acquisition and analysis task.

CR-66.008
An Engineering and Economic Evaluation of Floating Fender Concepts, B. J. Thorn, San Marino, Calif., Science Engineering Associates, Jun 1966, Contract NBY-62205, AD640979

This report contains an engineering and economic evaluation of eight different concepts of floating fenders to be considered for Navy docks.

The engineering aspects involve discussion of different design criteria, such as vessel approach velocities, acceptable lateral dock loads, hull loads and stresses in structural timber. A description of the dynamics of a berthing ship is given, including a discussion of the various energy correction coefficients to be used. The hydrodynamic mass coefficient is especially emphasized. The results obtained on this coefficient by many different investigators are summarized, showing that large unexplained discrepancies exist.

The economic criteria employed are stated and summarized. A short discussion on deterioration of camel materials is also included. Due to inadequate data on maintenance costs, these calculations had to rely mostly on engineering judgement and intuition. Fairly detailed engineering descriptions and calculations as well as economic evaluation of every concept is included.

Conclusion and recommendations based on the study are given as well as a preliminary final design.

CR-67.001
The Impact of Large Installations on Nearby Areas, G. Breese and others, Princeton, N.J., Princeton University, Aug 1965, Contract NBY-32250, AD641925

The establishment of a large industrial or military installation involves enormous changes in the nearby areas land use, population, government, and economy, as revealed by the five case studies in this report. The case studies illustrate different sizes and types of use (integrated steel mill, Atomic Energy Commission plant, Naval training camp, Air Force Base, and aircraft manufacturing plant), geographic areas, focal study areas, and varying kinds of sponsorship. In virtually every case, the new installations effect on the host area involved a change from a predominantly rural or semi-urban type of living and development to an urban type. Common problems included financial burden on

local areas for provision of expanded facilities, lag in provision of commercial facilities and private housing, relocation of displaced persons and businesses, disruption in the local society and economy due to exceptional demands, inflation in land values, and ineffective development controls, particularly evident in the case of urban planning and subdivision regulations.

Characteristics of impact patterns and the devices for anticipating related events and issues are identified. Procedures are suggested for dealing effectively with the impact situation during its various stages of development to help preclude the replication of errors of the past in such circumstances. One of the recommendations is that in each new impact situation an impact task force be established by the military or industrial installation to work with the local government. The duties of its members--professional in training and experience--would include advance research and planning required to resolve impact problems. There should also be made available reserve pools of financial resources, equipment resources, and professional staff resources for emergency conditions.

CR-67.002
Incorporated in CR-68.007

CR-67.003
Passive Devices for Providing Continuity of Electric Power, J. L. Radnik, P. K. Kawecki, J. N. Van Scoyoc, Chicago, Ill., Illinois Institute of Technology Research Institute, Jul 1966, Contract NBY-62200, AD637849

In an engineering and experimental analysis of passive devices for providing continuity of electric power, a parallel resonant circuit used in conjuction with a step-up transformer and connected in shunt with the critical load was shown to be feasible. An experimental load of 1 kW was adequately supplied during interruptions of 1/2 cycle. In addition, an isolation circuit was developed, which can be used to isolate the critical load and resonant circuit from other loads and the source in case of source failure.

CR-67.004
Monitoring and Control of Sea Water Composition, H. C. Edgington, Azusa, Calif., Aerojet-General Corporation, Feb 1967, Contract NBY-62182, AD647129

This report describes the work carried out in the study and preliminary design of a sea water simulator. The purpose of the device is to approximate for various locales and depths, the sea water chemistry represented by eight chemical parameters -- salinity, alkalinity, carbon dioxide, pH, oxygen, hydrogen sulfide, phosphate, and E_h.

A literature search was conducted to elucidate this chemistry and to obtain data quantitatively interrelating these chemical systems and their physical states. A survey was made to compare the characteristics of commercially available control instrumentation and transducers. Based upon the information gathered, a system was then designed. The envisioned system incorporates computer control of both closed-loop and open-loop chemistries. Predicted accuracies for output composition control are reconciled with suggested USNCEL performance specifications.

CR-67.005
Conceptual Study of a Lightweight Causeway, D. M. Hodges, Terminal Island, Calif., Marco Engineering Company, Oct 1966, Contract NBY-62207, AD801668L

New materials, fabrication methods and systems configuration can be applied to the existing system of pontoon units that couple into an amphibious causeway (to provide a roadway from an LST to the beach) with the prime objective of weight reduction for these portable units. Such a conceptual study is presented in this report.

Each causeway unit of steel construction had a weight of approximately 70 tons. A subsequent causeway system utilizing inflatable bags for pontoons attained a unit weight of about 44 tons. It is now desirable to have a causeway system that would have a unit weight near 30 tons.

The analysis of this report indicates that through the use of new materials and methods a causeway unit can be built within the weight goal of 30 tons.

CR-67.006
Conceptual Study of a Lightweight Causeway, R. M. Drawsky, Oakland, Calif., Kaiser Aluminum and Chemical Corporation, Sep 1966, Contract NBY-62208, AD801904L

A lightweight causeway concept, employing lightweight corrosion resistant aluminum in combination with urethane foam, is described in this report. The lightweight causeway sections are composed of a structural framing and an external skin of aluminum. The entire cavity of the causeway section is filled with a rigid, poured-in-place urethane foam which provides buoyancy and additional stiffness.

In addition to offering a significant reduction in weight, the lightweight causeway system provides several unique advantages over existing causeway systems. These advantages, as well as other aspects of the proposed design concept, are discussed in detail in the body of the report.

CR-67.007
Preliminary Design of a Nuclear Blast Ground Shock Simulator, H. R. Saffell, R. C. Yang, J. Seehuus, Los Angeles, Calif., Ralph M. Parsons Company, Aug 1966, Contract NBY-62201, AD800383L

This report presents the preliminary design of a shock test machine capable of producing motions typical of those predicted to occur in buried or partially buried structures exposed to nuclear ground shock. The machine is intended as a tool for investigating damage mechanisms, shock testing criteria, and shock isolation methods as well as for shock-qualifying small items of equipment.

Significant features of the machine include a capability for generating a wide variety of waveforms of the types generally associated with the response of elastic structures to airblast-induced and outrunning ground motions, and for producing simultaneously or phased vertical and horizontal motions of different strengths and waveforms.

CR-67.008
The Development of an Economic Method to Determine Whether an Existing Naval Facility Should Be Replaced or Continued in Use by Modernization, R. N. Pesut and others, Columbus, Ohio, Battelle Memorial Institute, Sep 1966, Contract NBY-62175, AD800875L

An economic model was developed to aid the analyst in calculating the ultimate cost of making a decision either to replace an existing facility with a new facility or continue the existing facility in use by modernization. This model deals explicitly with the risks associated with the survival and future need of the facility. The basic model developed in this report is designed for comparing costs of alternatives. Comparision of benefits generally requires exercise of management judgment. A discussion of methods by which costs and benefits can be jointly considered is included. Also a discussion of methods of estimating the cost factors involved in the economic evaluation is presented.

CR-67.009
Static Electric Power Inversion Using Semiconductor Devices, H. G. Hamre, O. M. Kuritza, Chicago, Ill., Illinois Institute of Technology Research Institute, Sep 1966, Contract NBY-62189, AD640968

Results of a study of static electric power inversion techniques using semiconductor devices are given, including recommendations that bridge-type inverters, employing impulse commutation, sinusoidal wave form synthesis using stepped-wave techniques, and output voltage control within the inverter by use of pulse-width methods, are most suitable for use in the design of a family of inverters in the power range from 10 kW to 600 kW. Additional requirements of transient stability, frequency control, reliability, electromagnetic compatibility, and system costs are considered. Comparative analysis of various solid state devices

and inverter techniques, and their advantages and disadvantages are discussed. Present trends in the development of static power inverter equipment are considered and future trends are anticipated, where possible. Recommendations are given to indicate areas where additional investigation is needed.

CR-67.010
Extended Data File on Vehicle Usage by Selected Naval Shore Stations, N. Hitchman, F. M. Fulton, Santa Paula, Calif., Applied Science Corporation, Nov 1966, Contract GS-09S-17338, AD802113L

This study was done in two parts. Part I was published in Jun 1966, and contained a structured comprehensive summary of transportation-related data for seven west coast stations. Also it contained the development of a linear equation for use in predicting vehicles of "common denominator" organizational elements. This initial effort showed sufficient promise to warrant further investigation and Part II of the study was initiated in Aug 1966, to broaden the station sample to 14 stations located across the continental United States, and to refine and test the allocation formula for its practical use in planning. This Part II study also contains a comprehensive summary of transportation-related data for the additional eight station sample. It also provides a data summary for the 14 stations studied and contains methods for establishing environmental factors (K, M, and N). Highlights of the overall findings are that prediction factors derived in the study show satisfactory results for predicting 71% of the cases examined, in 57% of the stations studied the data-predicted vehicle allocations were within 7% of the actual on-station allocations. Predictions for all stations were within 22% of the actual allocations.

CR-67.011
Response of Drydock Gates to Blast Loading, J. J. Brooks, San Marino, Calif., MacNeal-Schwendler Corporation, Oct 1966, Contract NBY-62196, AD643853

Relatively simple methods of predicting the response of the primary structure of drydock closures for damage assessment purposes have been developed in this study. It has been found that the lowest natural mode is the principal contributor to deflections and stresses as long as the dynamic loads are applied simultaneously to all parts of the gate.

Static analyses were made for uniform and hydrostatic loads, and transient analyses were made for simple blast pulses and uniform step-function loads. Two modal analyses were also made. It was found that the static deflection shapes are very similar to the first natural mode shape, and can be used as such for the accuracy required for damage assessment.

Only the virtual mass of the water, the concrete ballast, and the water ballast are important for determining the appropriate mass parameter for a drydock gate.

It was found that the peak stresses due to a suddenly applied uniform pressure of the same magnitude as the hydrostatic pressure at the bottom of the gate are about six times higher than those due to the hydrostatic pressure for which the gate presumably has been designed.

It is apparent that additional study is needed to define the nuclear environment for drydock gates, since it is not clear as to which phenomenon is the principal threat.

CR-67.012
Water-Jet Feasibility Study--A Propulsion System for Barges, Tugs, and Other Pontoon-Based Floating Structures, N. B. Johnson, San Jose, Calif., FMC Corporation, Jan 1967, Contract NBY-62217, AD645425

The study was undertaken to determine the feasibility of replacing the presently used 06DH and 9D-200 outboard propeller drive units with a waterjet propulsion system. "Best Choice" waterjet system is presented and declared feasible for use with pontoon-based floating structures.

The possible methods of waterjet propulsion for the low speed, high load application are presented. The basic parameters and theory are defined, and a technique of component selection is developed. The topics of pump, engine, water intake, and jet control are considered in detail. Cost and performance comparisons between the outboard propeller drive units and the proposed waterjet system are included.

CR-67.013
Development of a Current Injection Probe (CIP) for High Power Level Filter Analysis, R. B. Cowdell, W. K. Grossman, Los Angeles, Calif., Genisco Technology Corporation, Genistron Division, Nov 1966, Contract NBY-62222, AD646050

This report describes the successful development of a radio frequency current injection probe capable of injecting amperes of RF current over the frequency range 100 Hz to 1 MHz into power circuits carrying as much as 200 A of 60 Hz or 400 Hz power.

The purpose of this development was for the evaluation of power filters with greater than 100 db of attenuation under full rated power load conditions.

The significance of 0.10 ohm source and load impedances upon power filter performance is described. Impedance of a typical power source from 16 kHz through 25 MHz is presented.

CR-67.014
Development of a Long Range Plan for Engineering Research on Flexible Pavements, B. M. Gallaway, C. R. Foster, Bryan, Tex., Consulting and Research Services, Inc., Nov 1966, Contract NBY-62210, AD645519

A recommended research program is given which will provide the Navy with necessary information to prepare a rational method of flexible pavement design, to make rapid and efficient evaluations of load carrying capacities and will give objective information on scheduling needed maintenance that will extend pavement life and improve skid resistance and smoothness. The research program will also add to and improve the currently available information on asphalt and asphalt mixes and will provide improved procedures for maintaining existing pavements.

CR-67.015
Summary of Plan for Development of a Nondestructive Method for Determination of Load-Carrying Capacity of Airfield Pavements, F. N. Finn, B. F. McCullough, Oakland, Calif., Materials Research and Development, Inc., Nov 1966, Contract NBY-62223, AD807395L

This report gives a summary of the plan which is presented in detail in the final report, CR-67.016.

CR-67.016
Plan for Development of a Nondestructive Method for Determination of Load-Carrying Capacity of Airfield Pavements, F. N. Finn, B. F. McCullough, Oakland, Calif., Materials Research and Development, Inc., Nov 1966, Contract NBY-62223, AD807371L

The U.S. Navy Civil Engineering Laboratory desires a non-destructive method of pavement evaluation which would give improved areal coverage and be sufficiently economical and fast to allow seasonal and annual evaluations. This report provides a plan which encompasses the experiment design, some of the required instrumentation, and the estimated cost for developing a non-destructive method. The background information for the development plan was assimilated from an extensive literature review, correspondence with authorities in the field, and from staff experience. The information for deflection-radius of curvature and vibratory testing is presented as detailed resumes in the report and as annotated bibliographies in the appendices. Two phases for development are proposed. The first is a correlative phase where deflection and radius of curvature measurements are used to replace the plate load test in the

current method. The second is a commutative phase, wherein the present procedure is replaced by the proposed evaluation procedure.

Seventy-two test sections of prescribed combinations are necessary for performing the required experiment. These test sections will be selected from in-service airfield pavements at 8 to 12 Naval Air Stations.

A limited cost study using a representative 10,000 ft flexible pavement runway indicates that the proposed method would be considerably more economical than the present as well as providing a greater amount of data for making a rating of load carrying capacity.

CR-67.017
Concept Design for a Manned Underwater Station, Baltimore, Md., Westinghouse Electric Corporation, Mar 1967

The results of a 15 man-month conceptual design study for a manned underwater station are presented, conforming to the requirement of a 30-day mission for men at 6,000 ft. The station is self-supporting when emplaced by using an isotope heat source with turbo-electric power generation, and a lift support system to provide comfortable one-atmosphere environment. The pressure hull is toroidal in shape, 40 ft in overall diameter with a 10-ft tube diameter. HY-140 steel is recommended for construction of the internally ring-stiffened hull. The concept provides a stable platform with maximum viewing of the bottom in the limited visibility in the deep ocean. For bottom locations with sufficient bearing strength, the hemispherical foundation and toroidal hull act as a ball-and socket joint with unique leveling capability. Where extremely low bearing strength materials are encountered, modifications are made to distribute the load on the bottom. Additional toroidal modules, mating in a vertical stack, permit expanding the station for larger operational missions.

Emergency power and lift support provisions are included for a 50-day period beyond the 30-day mission requirement. However, with the recommended power system and the electro-mechanical lift support equipment there is no reason why the mission time cannot be extended to 90 days when personnel interchange is undertaken. Crews may be exchanged by using small submersibles which have a mating capability with bottomed submarines.

CR-67.018
Water Waves Generated by Shallow Water Explosions, R. W. Whalin, D. J. Divoky, Pasadena, Calif., National Engineering Science Company, Sep 1966, Contract NBY-62206, AD809328L

This report presents results of a study of the applicability of linear theory to the generation of explosion waves in shallow water. The mathematical model developed for deep water wave generation is applied in the shallow water case using several different initial water craters exposing the bottom. The initial disturbance may be either stationary or time-dependent with an initial velocity field. The resulting wave trains are shown in a series of figures as a function of time at a fixed location.

In addition, available data for waves generated by shallow water explosions is analyzed in an attempt to establish the limits of validity of the linear theory. It is concluded that at this time the available data is inadequate for this purpose. The possibility of simulating shallow water explosion waves in a wave tank by use of a plunger is discussed in light of the previous analytical and empirical considerations.

CR-67.019
Conceptual Study of a Manned Underwater Station, K. Lawrence, Groton, Conn., General Dynamics Corp., Apr 1967, Contract N62399-67-C-0004, AD653075

The report covers the conceptual development of a manned underwater station, capable of operating in depths down to 6,000 ft, providing adequate lift support facilities for 5 men for periods of up to 30 days. The placement of the station uses the concept of free descent without the use of power by using negative buoyancy as the motivating force. Bottom approach is accomplished by winching against an anchor weight which initially provided a portion of the negative buoyancy. The station itself is designed to be positively buoyant at all times. Ascent is accomplished by release of anchor weight and using the positive buoyancy of the station to freely ascend.

The report further studies power plants suitable for the station load of 22 kWE and recommends three types of sources, one surface oriented, the remaining in situ that could be applied to the station. The report also outlines potential missions that could be applied to the station.

CR-67.019-1
Conceptual Study of a Manned Underwater Station, Addendum I, Radioisotope Power Equipment, Groton, Conn., General Dynamics Corporation, Mar 1967, Contract N62399-67-C-0004, AD815358L

This addendum describes an electrical power supply which could be developed for use in conjunction with underwater stations.

The radioisotope power equipment described herein is a self-contained integrated system of components capable of transforming the decay energy of radioisotopes into electrical energy. It provides a continuous long-term source of power for use in an underwater environment over a wide range of operating depths limited only by pressure hull considerations.

Three energy flow systems are employed in this concept. A lead-bismuth eutectic primary coolant circulating by natural convection transfers thermal energy from the fuel elements, and that due to conversion of photon radiation absorption within the coolant, to a steam generator and to a standby cooling system. A steam system converts thermal energy to electrical through a turbine generator set. The standby cooling system regulates the lead-bismuth temperature by removing excess thermal energy.

CR-67.019-2
Conceptual Study of a Manned Underwater Station, Addendum II, TOPS Nuclear Reactor Power System, San Diego, Calif., General Dynamics Corporation, Mar 1967, Contract N62399-67-C-0004, AD815368L

The information in this addendum contains certain proprietary data which has been deleted from the main body of the text of the report "Conceptual Study of a Manned Underwater Station U," Report No. CR-67.019, so as to facilitate wide distribution of the main report. This addendum contains the detailed discussion of the nuclear power plant as well as the appropriate cost and schedule information.

CR-67.020
Environmental Effects on Engineering Properties of Deep Ocean Sediments, E. Vey, R. D. Nelson, Chicago, Ill., Illinois Institute of Technology Research Institute, Dec 1966, Contract NBY-62159, AD647744

The environmental effects of the deep ocean were investigated in consolidation, direct shear, and vane shear tests on four ocean bottom sediments Tests were performed in sea water environment within pressure chambers to create hydrostatic environmental pressures up to 10,000 psi. The pressure chambers were also refrigerated to provide the required 1C to 3C environmental temperature.

The direct shear tests indicated that there was a decrease in shear strength with increased environmental pressures for fine grained soils at high void ratios. The vane shear tests showed an increase in shear strength with an increase in environmental pressure for the more plastic soil and a decrease in strength with an increase in environmental pressure for the less plastic soil. The consolidation tests showed no effects that could be attributed to the environmental conditions. However, the apparatus was not sensitive enough to measure effects on loose sediments under small loads. Such effects might be expected to occur based on the shear test results.

CR-67.021
Power System Synthesizer, H. W. Middlecoff, Gardena, Calif., Inet Power, Company of Teledyne, Jan 1967, Contract NBY-62159, AD647743

The power synthesizer is capable of simulating power line faults and includes the means of generating, programming and recording a family of output voltage, frequency and other transient power conditions. The transient output from the power system synthesizer can be applied to critical electronic equipment.

CR-67.022
Concept for a Manned Underwater Station, R. C. Dehart, O. O. Benson, N. I. Turner, San Antonio, Tex., Southwest Research Institute, Feb 1967, Contract NBY-62203, AD653730

A concept for a manned underwater station capable of descending to a depth of 6,000 ft is described. The station is attached to an anchor resting on the bottom of the ocean and is winched to the desired depth. Living and working space for a five-man crew is provided in the station.

CR-67.023
Passive Electrical Power Continuity Device, R. H. Lee, R. E. Tupack, Gardena, Calif., Teledyne, Inc., Inet Power Division, Sep 1967, Contract NBY-62226, AD849600L

A passive power supply utilizing a parallel resonant circuit to provide output continuity during input faults was developed and successfully tested. A fault generator was also developed to provide the power interruptions of up to 1/2 cycle to demonstrate the passive power supply. A critical load of 5 kVA was adequately supplied during input interruptions of 1/2 cycle. The resonant circuit and critical load were automatically isolated from the input and other non-critical loads during the input interruption period.

CR-67.024
Silt-Stabilizing Agents and Application Equipment for Salvage Operations, M. M. Epstein, J. M. Harris, B. R. Lower, Columbus, Ohio, Battelle Memorial Institute, Jul 1967, Contract N62399-67-C-0001, AD819946L

The program described in this report is the first phase in the development of a polymer-based silt-stabilizing system, including application equipment, for use in underwater salvage operations. The purpose of the stabilizer is to bind together or overlay the silt particles and, thus, prevent or greatly attenuate the loss of visibility due to silt clouding.

The first portion of the program consisted of a literature survey and beakerscale laboratory experiments on a wide range of candidate stabilizing materials. Comparative performance of the agents was evaluated with the aid of a turbidity meter and stirring apparatus as well as by direct observation and photographic records. The beaker tests resulted in the recommendation of seven agents for further study. Five of these were gel-forming polymer solutions activated by a mild acidification of the surrounding medium. One was a partially cross-linked hydrogel requiring application as a dry powder, and one was a flocculating agent. The selected agents were given follow up tests in a 10-sq-ft pool using trial application apparatus designed to reveal the necessary parameters for larger scale equipment. Such factors as viscous effects, gelling time, flow rate, polymer-solution concentration, and covering ability were investigated.

On the basis of the pool tests, recommendations for further investigation and incorporation into full-scale equipment were made for two classes of stabilizer - the algin and polyvinyl acetate copolymer resins. Some further study of hydrogels was also recommended.

CR-67.025
Creep of Floating Ice Sheet, D. H. Garbaccio, San Marino, Calif., Science Engineering Associates, Apr 1967, Contract N62399-66-C-0032, AD654742

Theory was developed for a finite length line load on an elastic plate on elastic foundation. When the solution for a finite thickness plate failed to give convergent expressions for the bending moments under load, the solution was reduced to the case of a thin plate for which a convergent solution was obtained. The correspondence principle was applied to obtain the linear visco-elastic problem. An approximate method of Laplace transform inversion was used to obtain the time dependent behavior of the creeping plate. Numerical results are presented.

Theory was developed using the Hankel and Laplace transforms for a plate of finite thickness with circular symmetrical loading which was later reduced to a uniform load over a circular area. The solution is presented in a form where numerical calculations can easily be made with a digital computer.

Owing to the complexity of the problem the nonlinear creep behavior of floating ice sheets was limited to a thin plate with circular symmetry deforming with a power creep law. No numerical results were obtained but a suggested method of solution is outlined.

CR-67.026
Acquisition and Analysis of Transportation Data for Naval Air Stations, F. M. Fulton, Santa Paula, Calif., Applied Science Corporation, Jun 1967, Contract N62583-67-D-4790, Confidential, AD500552L

CR-67.027
Optimization of a Reverse Osmosis Sea Water Desalination System, S. Manjikian, Del Mar Calif., Universal Water Corporation, Oct 1966, Contract NBY-62214, AD657855

Work has been directed toward improvement of semipermeable membranes for use in reverse osmosis desalination systems. Inclusion of pyridine as a constituent in the membrane casting solution has resulted in appreciable increased membrane strength.

Design criteria for various systems for desalting sea water, based on present technology, were evaluated. It is proposed to use a two pass system with sea water initially passed through membranes at 1,200 psi to produce an intermediate water of about 5,000 ppm. This intermediate water is stored as produced and, in a predetermined time cycle, is used as feed for the same membrane units on a time shared basis, to produce product water of less than 500 ppm TDS.

CR-68.001
Computer Simulation Model for Consolidation Analysis of Public Works Organizations, Part One, Main Report, J. D. Toellner, Los Angeles, Calif., J. Toellner and Associates, Jul 1967, Contract N62399-67-C-0010 (NBY-62233), AD825093L

Significant benefits may be possible from the consolidation of public works functions at adjacent Naval facilities. To test the effects of various types of consolidations a simulator is recommended. This simulator is prepared for analysis on an IBM 7094 computer. Data for the area to be investigated is collected and prepared for input to the computer with the simulator. Details of various organizations are selected and tested, the computer printing out such details as personnel required, costs and effect of variation of shop locations.

CR-68.002
Computer Simulation Model for Consolidation Analysis of Public Works Organizations, Part Two--User Manual, J. D. Toellner, Los Angeles, Calif., J. Toellner and Associates, Jul 1967, Contract N62399-67-C-0010 (NBY-62233), AD825994L

This manual gives details for data collection and preparation for use with the public works consolidation simulator.

CR-68.003
Computer Simulation Model for Consolidation Analysis of Public Works Organizations, Part Three--Technical Appendices, J. D. Toellner, Los Angeles, Calif., J. Toellner and Associates, Jul 1967, Contract N62399-67-C-0010 (NBY-62233), AD825018L

This volume contains technical details of the construction and use of the public works consolidation simulator. It contains definitions, model uses, control parameters, decision tables and details of the pre-processor program and data listings.

CR-68.004
Conceptual Study of Electrical Power Transmission Systems to Deep Ocean Installations, I. M. Waitsman, Groton, Conn., General Dynamics, Electric Boat Division, Aug 1967, Contract N62399-67-C-0015 (NBY-62244), AD662037

The study considered the technical feasibility and limits of transmitting electrical power to deep ocean installations and to provide comparisons of various power sources applicable to underwater power transmission systems.

The most serious limitation associated with obtaining usable power at deep ocean depths is the present limitation of watertight cable connectors. There are mechanical and electrical problem areas associated with underwater electrical connectors and hull penetrations used to transmit power to submerged loads encapsulated in a pressure hull.

For in situ power locations, the reactor power plant systems are the most cost effective for power ranges of 30 kW and larger. Within the present state-of-the-art in situ power plants can be deployed to supply 30 kW to 300 kW load requirements at depths from 600 ft to 20,000 ft. Load levels of 1000 kW and 3000 kW are currently depth limited to 2000 ft by hull and heat removal system technology.

CR-68.005
Study to Formulate Methods and Procedures to Determine Navy Family Housing Construction Requirements, Columbus, Ohio, Battelle Memorial Institute, Sep 1967, Contract NBY-62173, AD825019L

This study describes a method for determining the expected deficit in Navy family housing 3 to 5 years in the future. The expected housing requirements are determined from base staffing projections and from information concerning the expected proportions of personnel at the base in each rank category requiring family housing. Bedroom requirements are determined by reference to total Navy proportions for each rank category. Expected housing assets are made up of military-controlled assets, occupied community assets, and vacant community assets. Military-controlled assets are determined in the same manner currently used by the military. Occupied community assets at a base are determined by a sample survey at the base. Various methods for determination of expected vacant community assets were examined and a selected method field tested. The method now recommended is basically the method currently used by the military. The recommended method for determining housing requirements provides results which are as accurate as the current DOD method and at an estimated cost saving for the Navy of more than $300,000 annually. Approximately $75,000 of this savings can be realized in reduced expenditure. The remainder is due to savings of time for personnel filling out questionnaires. The reduced costs are realized by sampling methods while the accuracy is maintained by using total Navy proportions for each rank category to estimate bedroom requirements.

CR-68.006
Effects of Air Blast Loading on a Pier, Y. C. Kim, T. Karlsson, W. L. Ko, San Marino, Calif., Science Engineering Associates, Sep 1967, Contract N62399-67-C-0049, AD663706

An experimental program designed to study the effects of air blast loading on a pier is described. A pier model was tested in a 6-ft-diam horizontal shock tube under four different test situations simulating pier on a beach with water, pier on a dry beach in a Mach reflection region, pier in deep water, and a pier on a dry beach in a region of regular reflection. The model was subjected to various shock overpressures in each of the four test situations.

Transient pressure distributions on the pier are investigated and it is found that a pier on a dry beach in a region of Mach reflection results in the most severe uplift pressure loads due to the air blast. A two-dimensional analysis based on Whitham's diffraction theory predicts higher uplift loads at low to moderate pressures and lower loads at higher pressures than were observed. Discrepancies between theory and experiments are attributed to three-dimensional effects and other geometric complications which are not accounted for in the theoretical analysis.

The presence of water apparently results in waves splashing on the underside of the pier. It is possible that this can result in uplift forces exceeding those induced by the air shock. This effect needs further study.

CR-68.007
Shock-Resistant Wells, R. W. Anderson, K. Hove, Los Angeles, Calif., Aghabian-Jacobsen Associates, Aug 1967, Contract N62399-67-C-0017 (NBY-62212), AD667846

A study is presented of water wells for shelter facilities, which will functionally survive the critical effects associated with the detonation of nuclear weapons. Overpressure, weapon yield, well depth, and soil properties are varied in order to determine siting and hardness limitations of the well concepts studied.

Two basic well casing environments are investigated: (1) direct encasement in soil (integral concept), and (2) encasement in a gel medium for shock isolation (gel-isolated concept). Well depths of 50 to 1,600 ft, overpressures up to 300 psi, and weapon yields up to 20 Mt are used in the study. The dynamic behavior of the well casing, the discharge pipe, and the pump unit is investigated for the different well concepts and weapon effects.

The integral well concept is analyzed as an equivalent static problem by using propagating wave fronts. Shock spectra analysis and the normal mode method are used to analyze the gel-isolated concepts.

CR-68.008
Investigation of Embedding an Anchor by the Pulse-Jet Principle, J. C. Lair, Torrance, Calif., Sea-Space Systems, Inc., Oct 1967, Contract NBY-62225, AD663899

To develop an embedment anchor to hold at 200 times its own weight of 25 lb extends the art of deep anchorings at small cost if a ballistic anchor containing a reciprocating mechanism can be materialized. Three general concepts are merged in one device: (1) About half the ultra high pressure energy released from a powder charge is used for ballistic penetration of the sea bottom. (2) A fraction of the balance of this energy is trapped at high working pressure and deepens the penetration by driving a simple, short-lived reciprocating machine which executes less than 1000 cycles. (3) Depletion of the trapped high pressure is finally downward at low pressure from the nose of the anchor so as to transport away bottom material which has been loosened by the action of the machine.

All main components are identified and dimensions are chosen to make these concepts compatible, and lead to a metal weight slightly in excess of the 25-lb goal. Performance of the embedment depends on details of the interaction between the anchor and local sea bottom and must be development tested. The mechanism with a very short-service life stroke should be inexpensive, but high temperature, high pressure seals for the brief duty are difficult and not known to be feasible.

CR-68.009
Naval Air Station Utilities Consumption Study, Los Angeles, Calif., Peat, Marwick, Livingston and Co., Apr 1968, Contract N62399-67-C-0028, AD836908L

The basic goal of this study was to determine the feasibility of developing a method or technique for predicting the utilities consumption at Naval Air Stations. This

study has demonstrated that it is not currently feasible to develop a model for predicting utilities consumption at the three sample Naval Air Stations. However, results indicate that if the proper data were available, a valid and accurate electrical utilities model could be constructed.

CR-68.010
Design of Cylindrical Reinforced Concrete Tunnel Liners to Resist Air Overpressures, A. J. Hendron, Urbana, Ill., N. M. Newmark Consulting Engineering Services, Jun 1968, Contract NBY-62218, AD837422L

This report presents a procedure for the design of cylindrical reinforced concrete shelters that are buried with their axes parallel to the ground surface. The method is based on a study of combinations of thrust and bending moment which must be resisted by a reinforced concrete tunnel section when the section and surrounding soil are subjected to blast loading. On the basis of this study, it has been possible to define a design thrust, as a function of depth of burial, and a design bending moment, as a function of the cylinder stiffness, for a cylinder buried in a granular material.

CR-68.011
Triga Oceanographic Power Supply for a Manned Underwater Station Volume I, Reference Design, J. B. Dee, San Diego, Calif., Gulf General Atomic, Inc., Jun 1968, Contract N62399-67-C-0046, AD836066

The Triga oceanographic power supply (TOPS) is designed to provide 100 kW of electrical power for a manned underwater station (MUS). The design is based on utilization of existing technology both in the reactor and energy conversion unit.

The nuclear steam supply module is based on the widely used Triga research reactor. It contains the entire pressurized water primary coolant circuit and the steam generator. The U-ZRH-fueled, water-cooled core is characterized by unique features of inherent safety with load-following capability. The result is a simple system requiring a minimum of attendance by an operator.

The active mechanisms of the steam-rankine cycle power conversion system utilize only commercially available components. The entire power plant except for the control console is contained in a one-atmosphere environment at a depth of 6,000 ft by a pressure hull which is adapted to function also as condenser surface for the thermodynamic cycle.

Design emphasis throughout the study has been placed on reliability, minimum risk, and utilization of off-the-shelf equipment, with plant efficiency taking a subordinate position. The basic TOPS nuclear steam supply module is designed to support alternative power conversion systems for producing up to 500-kW-net electrical power.

CR-68.012-1
Concept Development of Manned Underwater Station; Vol. I, Test Sections I Through XVII, D. W. Carreau, Groton, Conn., General Dynamics Corporation, Electric Boat Division, Jul 1968, Contract N62399-67-C-0044, AD865211L

This report describes the development of a manned underwater station concept capable of supporting five men for 30 days at depths up to 6,000 ft in a one-atmosphere shirt-sleeve environment. Functional requirements for the various subsystems and the overall configuration are established. The rationale for selection of particular systems is presented and the integration of these systems into the station is carried out.

The station permits direct observation at depth from within the one atmosphere environment. Indirect observation is also possible with closed circuit TV. The station has the ability to recover samples with a manipulator and bring them into the pressure envelope at depth through the lock-in/lock-out system.

Volume I contains text, sections I through XVII and references to the total report. Volume II contains appendices A through E. Reference is made to Supplement 1, a color movie of the model test program. See Report CR.013 for the program plan and cost data.

CR-68.012-2
Concept Development of Manned Underwater Station, Vol. II, D. W. Carreau, Groton, Conn., General Dynamics Corporation, Electric Boat Division, Jul 1968, Contract N62399-67-C-0044, AD841350L

This volume contains appendices A through E to the text and references given in volume I.

CR-68.012 Suppl
Supplement 1 is a color movie of the model test program.

CR-68.013
Concept Development of Manned Underwater Station, Supplement no. 2, D. W. Carreau, Groton, Conn., General Dynamics Corporation, Electric Boat Division, Jul 1968, Contract N62399-67-C-0044, AD841300L

This supplement contains the program plan and cost data. Basic report text is in CR-68.012-1 and CR-68.012-2.

CR-68.014
Environmental Effects on Engineering Properties of Deep Ocean Sediments - Phase II, E. Vey, R. D. Nelson, Chicago, Ill., Illinois Institute of Technology Research Institute, Jun 1968, Contract N62399-67-C-0021, AD848950L

The effect of the environmental pressure on the consolidation and shear strength characteristics of deep ocean soils was investigated. Consolidation, direct shear and vane shear tests were performed on remolded specimens of soils dredged from the ocean bottom. These tests were conducted in sea water within pressure chambers at hydrostatic environmental pressures up to 10,000 psi and at temperatures of 1C to 3C, the temperature of the deep ocean.

The environmental pressure caused no appreciable effect on the direct shear strength nor the vane shear strength for either the silt soil and clay soil.

The environmental pressure caused no appreciable effects on the consolidation characteristics of the silt soil. For the clay soil the time period to reach 100% primary consolidation was increased by the environmental pressure with the amounts of primary and secondary consolidation not appreciably affected.

These tests were conducted on completely remolded deep ocean specimens which had a soil structure different from the in situ structure. Therefore, the results obtained may differ for the same soils in the natural state.

CR-69.001
Toxic Agent Monitoring System, B. W. Liebel, R. M. Roberts, El Monte, Calif., Aerojet-General Corporation, Jul 1968, Contract NBY-62211, (Confidential)

CR-69.002
Analysis of Rectangular Shallow Shells, C. V. Chelapati, Culver City, Calif., Jul 1968, Contract N62399-67-C-0040, AD854939L

The analysis of rectangular shallow shells with arbitrary boundary conditions and shapes is formulated using the method of modified finite difference and frame-work analogy. The analysis and the digital computer program is developed with the object of using the large scale digital computers efficiently to solve a wide variety of elastic problems in the class of shallow rectangular shells. The boundary conditions at the edges can arbitrarily be specified as free, simply supported (roller), fixed, or can be supported by edge beams. The thickness of the shell, the distance from an arbitrary plane to the panel points and the loading can be specified as desired.

The analysis of linear elastic shells is developed using a displacement method of approach. Equations of equilibrium, strain-displacement relationships and strain-stress resultant relationships are developed independently in series of matrix equations. The stiffness matrix is developed in the form of series of submatrices. The elements of the portion of the stiffness matrix and the load

vector at any level N is automatically generated and modified by eliminating appropriate rows and columns, depending upon the forced boundary conditions. The generation of the nonzero submatrices and the solution of linear equations start from one edge, N = 1, and progresses to the opposite edge where N = N. The matrix need not be symmetric. Solution for the set of linear equations results in finding the unknown displacement components of the shell under a given loading. The strains at the panel points and stress resultants are calculated using the appropriate matrix equations.

CR-69.003
Functional Design of an Ingress-Egress System for an Ocean Bottom Station, R. M. Sapp, Annapolis, Md., Westinghouse Electric Corp., Ocean Research and Engineering Center, Oct 1968, Contract N62399-68-C-0020, AD841554L

The design provides means to resupply a manned underwater station on the ocean bottom. Environmental and logistics constraints are defined and alternatives to the baseline system are suggested. An outline specification for equipment is included.

The baseline system utilizes a deep submergence rescue vehicle (DSRV) suitably modified for station resupply. The operation is thus performed only once in 30 days for a five man station. If, when the station is actually deployed, a DSRV is not available, other methods utilizing diving bell type structures may be employed.

Of the three candidate site areas examined, San Clemente, Hawaii and Kauai Islands, Hawaii is most advantageous based on environmental and bathymetric considerations.

Under the constraints of the study a single 9-ft-diam sphere has been chosen for an access chamber. Other configurations have advantages, especially that of utilizing the upper portion of the reactor cylinder for main access.

CR-69.004
An Evaluation of High-Expansion Foam Systems for Protection of Naval Shore Facilities, M. J. Miller, E. W. J. Troup, Norwood, Mass., Factory Mutual Research Corporation, Aug 1968, Contract N62399-68-C-0021, AD844054L

The usefulness of high-expansion foam systems in Naval shore installations is evaluated on the basis of, (1) a literature survey, (2) evaluation of three representative foam systems, (3) tests on one selected system to determine whether detriment to system performance results from combustion products, if the foam generator is housed within the protected buildings, and (4) a cost effectiveness comparison between qualified foam systems and water sprinkler systems. Based on the evaluation, recommendations are made relative to the use of high-expansion foam and alternative systems in Naval shore facilities.

CR-69.005
Systems Analysis of Pontoons, M. F. Karchnak, C. L. Hayen, Rockville, Md., Challenger Research Inc., Oct 1968, Contract N62399-68-C-0017, AD851829L

A description is given of nine pontoon systems including current Navy pontoon systems and commercial systems. These systems are evaluated against 14 amphibious assault type missions such as causeways, lighters, crane platforms, and fuel barges. The parametric characteristics of pontoon systems are thus developed. An effectiveness model is developed to provide an analytical method of evaluating the pontoon systems relative to the missions. The model is exercised for the nine systems across the 14 missions and the most effective system identified for various weighting assumptions. Finally, an optimum pontoon system is defined based upon the model exercise.

CR-69.006
Study of Service Shelters for Polar Facilities on Ice and Snow, Sherman Oaks, Calif., King-Benioff-Steinmann-King, Oct 1968, Contract N62399-68-C-0007, AD854938L

Service shelters are required for airfields, harbors, and similar logistical support facilities at polar stations. Williams Field at McMurdo Station, Antarctica, is such a support facility. Although it is the principal U.S. airfield in the Antarctic, it is located on a deep snowfield and its principal facilities consist of skiways on snow and runways on ice.

Requirements, criteria, and design approaches are developed in this study for mobile service equipment and shelters to provide flight-line support, service and supply centers, public-works shops, and unheated storage shelters for such facilities. These include mobile equipment for aircraft maintenance, standard-use structures for control centers and light industrial shops, special use structures for heavy industrial shops where heavy floor loads are involved, and unheated storage structures for ready-access and long-term storage of critical materials and equipment. The study concluded that slightly modified commercial equipment and structures meet the requirements for mobile equipment and standard-use structures, but special designs are required to fill the requirements for special-use and unheated storage structures.

CR-69.007
A Study of Response of Port Hueneme Harbor and Offshore Regions to Incident Waves, L. Hwang, D. Divoky, Pasadena, Calif., Tetra Tech, Inc., Dec 1968, Contract N62399-68-C-0036, AD845147L

A study was performed to determine response of the harbor of Port Hueneme to incident periodic and dispersive (explosion) waves. A newly developed analytical method capable of treating harbors of arbitrary shape is utilized and the corresponding computer program is included in an appendix. Response to waves generated by three hypothetical nuclear explosions of 1, 5 and 10 Mt in the Santa Cruz basin is calculated as is the resulting run-up along adjacent shorelines.

CR-69.008-1
Ferro Cement Panels, Vol. 1, Experimental Evaluation and Protective Potential, R. Adams, Van Nuys, Calif., T. Y. Lin and Associates, Nov 1968, Contract N62399-68-C-0040, AD850630L

A series of practical experiments was conducted in order to judge the effectiveness of ferro cement panels in building revetments, bunkers, "concrete sky" aircraft cover and fenders around bridge piers for protection against underwater demolition charges. Ferro cement consists of sand-cement mortar filled with closely woven steel mesh reinforcing.

Panels of varied design were exposed to rifle and pistol fire. Two-inch panels were exposed to surface and underwater demolition charges up to 20 lb of TNT, the latter in different arrangements and stand off distances from a simulated bridge pier under 11 to 16 ft of water. One-inch panels were exposed to the M26 hand grenade, M79 cartridge grenade, M16 rifle, 81mm and 4.2 in. mortar shells, 105mm Howitzer shell and to 66mm and 3.5 in. rockets, heat.

CR-69.008-2
Ferro Cement Panels, Vol. 2, Military Uses and Installation, R. Adams, Van Nuys, Calif., T. Y. Lin and Associates, Nov 1968, Contract N62399-68-C-0040, AD850631L

Military uses and installation of ferro cement panels are presented, based on conclusions reported in volume I.

Tilt-up construction of revetments is recommended, with sections 3 ft wide and a multiple of 3 ft in height, of two layers of 3 ft x 3 ft x 1-in. panels secured at their vertical edges to wood 2 x 8's. Support is provided by posts at 9 ft centers and a rail to which tops of sections are secured.

Revetment sections are recommended for the walls and roof of bunkers in prepared defensive positions. In hasty defense resulting from a meeting engagement, single 1-in. panels about 4 sq ft in area will reinforce hastily dug-in protection. Their availability in a meeting engagement is problematical.

For "concrete sky", blanketing layers of 3 ft x 3 ft x 1-in. panels fabricated in place over an arched supporting structure is recommended, with multiple layers separated 6 in. by timber spacers secured to the layer beneath them.

For pier fenders, it is recommended that pre-fabricated sections of two 4 ft x 4 ft x 2-in. panels secured to wood 4 x 6's, filled with urethane or polystyrene foam, be suspended from the bridge superstructure by means of steel wire strands.

CR-69.009
Vibratory Embedment Anchor System, J. A. Mardesich, L. R. Harmonson, Long Beach, Calif., Ocean Science and Engineering, Inc., Feb 1969, Contract N62399-68-C-0008, AD848920L

A requirement existed for an anchor especially suited for deep ocean work. Conventional anchors are designed for placement by dragging and have low efficiency in resistance to uplift forces which makes these anchors impractical for use in ocean depths greater than 500 ft. An anchor that can penetrate vertically into the ocean bottom and develop a high capacity to resist uplift and horizontal loads relative to its own weight is required for active and contemplated ocean tasks. The aim of this project was to meet this requirement by developing and testing a vibratory type of anchor similar in principle to commercial vibratory pile hammers and vibrating core samplers now in use. It has been our intention to develop an anchor of this type that would offer advantages in weight control, versatility, and safety over an anchor embedded with a single phase burst of energy and also in placement, performance and economy of material over a conventional anchor.

CR-69.010
(Number reassigned.)

CR-69.011
Polymer-Based Silt-Stabilization System and Application Equipment for Salvage Operations, M. U. Widman, M. M. Epstein, D. W. Frink, Columbus, Ohio, Battelle Memorial Institute, Dec 1968, Contract N62399-68-C-0028, AD847380L

The program described in this report is the second phase in the development of a polymer-based silt-stabilization system. During this program several algin resins gelling agents, and filler materials were evaluated in laboratory beaker experiments. The most promising of these were then evaluated in a test tank. Test-tank experiments were made with especially designed equipment. An important aspect of the work was the development of a method and equipment capable of dispensing and gelling the polymer so that a continuous and coherent film could be obtained. The experimental equipment designed for test-tank evaluation was capable of laying a film about 1 ft wide. After a number of experimental runs were made in the test tank, a basic material system was selected. Simplified application equipment for field experiments was then designed. This application equipment consisted of (1) a 3-ft-wide nozzle, (2) 50-ft hoses, (3) a gasoline-engine-powered polymer and gelling-agent pumping and storage system. These equipments were successfully operated in the test tank. Based on the results of this development work, recommendations were made for further detail investigation of the required operational qualities of the material system, field tests of the application equipment, development of field-application techniques, and development of a larger scale application system.

CR-69.012
Nemp Hardening of Protective Shelters, Technical Data, F. A. Fisher and others, Pittsfield, Mass., General Electric Co., Feb 1969, Contract N62399-68-C-0031

CR-69.013
Nemp Hardening of Protective Shelters, Technical Data Supplement to CR-69.012, F. A. Fisher, D. W. Caverly, Pittsfield, Mass., General Electric Co., Feb 1969, Contract N62399-68-C-0031, (Secret-RD)

CR-69.014
Creep of Floating Ice Sheets Computer Calculations, D. H. Garbaccio, San Marino, Calif., Science Engineering Associates, Dec 1968, Contract N62399-68-C-0023

Using a digital computer calculations were made of the deformations and bending moments in a floating ice sheet. The ice behavior was described by a linear viscoelastic model consisting of a Maxwell and a Voigt element in series. Loading with circular symmetry uniformly distributed was applied to a plate of finite thickness described by Reissner theory. The effect of superposed loads describing aircraft landing gear was considered. Calculations were also made for a linearized approximation to the problem of a thin sheet described by a power creep law. The method was only partially successful because the time span of applicability was short.

CR-69.015
Vulnerability of Buried Cables to Nuclear Detonations, John Karagozian, Consulting Engineer, Los Angeles, Calif., Mar 1969, Contract N62399-69-C-0021

This report presents the vulnerability, design, test, and installation requirements associated with cables buried near the surface in the high-overpressure regions resulting from nuclear weapons. Relative displacement in a non-uniform media is predicted as the critical environment. The study cable is assumed to be a solid ductile metal core with polyethylene insulation. Vulnerability is given as a function of overpressure range, weapon yield, and media characteristics. Laboratory tests are recommended to determine cable fragility levels as a function of the interaction with soils (and rock inclusions) under pressure and rigid body motions. Plowing and trenching techniques and costs are discussed with examples of installed systems involving over 6000 miles of cable.

CR-69.016
Feasibility Study of Deep-Fracture Electrical Grounds, R. L. Richardson, Petroleum Engineer, Ventura, R. D. Hitchcock, Physicist, NCEL, Port Hueneme, Calif., Jun 1969, Contract N62399-69-C-0026

This report presents the results of a study of the technical feasibility and costs of vertical grounds. The proposed grounds are constructed by drilling a vertical hole to depths of up to 10,000 ft and subsequently producing a horizontal or vertical fracture, filled with electrolyte, that has a surface area and thickness as large as practicable.

Resistances to ground as low as 2 ohms cannot be achieved with a center-fed horizontal fracture, unless the fracture radius is greater than 1,200 ft, the fracture thickness is 10 times the predicted thickness, and the bore-hole radius is increased locally to 3 ft.

CR-69.017
Parametric Study of Air Entrainment Subsystems, T. N. Gardner, Los Angeles, Calif., Mechanics Research Inc., Aug 1969, Contract N62399-69-C-0020, AD864016L

This report is a cost-effectiveness evaluation of current approaches to the design of air entrainment subsystems. It contains no new gas dynamics or other technology. Numerous different solutions to the design problem are considered and relative merits of each are established on a

cost basis. Considerable design and cost data are presented. A probabilistic effectiveness model is constructed. Recommendations for further research and development are made.

CR-69.018
Measurements of Shock Wave Attenuation in Ducts With Large Length-to-Diameter Ratios, C. E. Wooldridge, R. J. Kier, Menlo Park, Calif., Stanford Research Institute, Nov 1969, Contract N62399-69-C-0037, AD864288L

An investigation has been conducted to determine the magnitude of viscous attenuation of the shock front in smooth-walled tubes with a length-to-diameter (L/D) ratio of 600. The tests were carried out in a hydrogen driven shock tube of 0.485-in. inside diameter, with air and sulfur hexafluoride as the driven gases. The pressure in the driven section was held at 1 atmosphere for the tests ranging up to a Mach number of 8.9. It was reduced below 1 atmosphere at higher Mach numbers in order to avoid heating. The incident shock produced a square pressure pulse. The initial shock Mach numbers were varied from about 3.5 to 15.7. The corresponding initial shock overpressure ratios varied from about 15 to 250.

CR-69.019
Dynamic Response Analysis of Two-Dimensional Structures With Initial Stresses and Non-homogeneous Damping, Berkeley, Calif., University of California, Department of Civil Engineering, Nov 1969, Contract N62399-69-C-00169, AD874628L

A method of analysis for the evaluation of the dynamic response of two-dimensional solids is presented. A Fortran IV listing of the computer programs is included.

CR-69.020
Sanguine Facility System Study, W. Wingenbach, F. Nodosy, Santa Barbara, Calif., American Machine and Foundry Company, Dec 1969, Contract N62399-69-C-0019, (Secret)

CR-69.020A
Supplementary Report, Sanguine Facility System Study, Appendices D and E, W. Wingenbach, Santa Barbara, Calif., American Machine and Foundry Company, Aug 1970, Contract N62399-69-C-0019, (Secret)

CR-69.021
Investigation of Blast Resistant Water Well Concepts, D. P. Abildskov, T. N. Gardner, Los Angeles, Calif., Mechanics Research, Inc., Jan 1970, Contract N62399-69-C-0033, AD875931

Elements of a hardened water well were defined and sized to withstand weapon threats up to 5 Mt, 3,000 psi in seven different subgrade profiles. Within the objective of achieving cost-effectiveness of the well designs, an attempt was made toward uniformity and simplicity of approach across the range of threat and geological profiles. A test program was carried out to determine the susceptibility of pumps to shock and hydrodynamic pulse. Element costs and total well costs were determined for selected configurations in the different geological profiles. Considerable design and cost data are presented. Recommendations for further research and development are made.

CR-69.022
Feasibility Study and Design of Hardened Evaporative Coolers, W. B. Koerner, W. A. Renner, Los Angeles, Calif., Agbabian-Jacobsen Associates, Feb 1970, Contract N62399-69-C-0004, AD875930L

A study is presented on the feasibility of designing and constructing, for test purposes, an evaporative type cooling system located within an underground shelter hardened to withstand an airblast overpressure of 600 psi. The study includes the analysis of two government-furnished basic evaporative cooling concepts resulting in presentation of conclusions, recommendations and cost comparison of these systems and the preparation of the design calculations, specifications and construction drawings of the selected system.

CR-69.023
A Computer Program to Display the Dynamic Stress Analysis of Structures, M. J. Kaitz, S. M. Shallon, Culver City, Calif., Visual Computing Corp., Apr 1970, Contract N62399-69-C-0022, AD871627L

A finite element simulation program for dynamic stress analysis of underground structures is modified to permit generation of a display data file. The data file may be processed by the display program to generate pictorial displays on an SC 4020 film recording system.

The displays graphically represent the physical environment of the structure and provide a means of visually analyzing its static or dynamic behavior. Dynamic changes in displacement and stress are represented as equivalent motion in a series of sequential displays.

The display method is applicable to any structural analysis program which determines sequential values of stress and displacement. Program documentation is included in this report.

CR-69.024
Design of Pressurized Fuel Storage Tanks to Resist Air Overpressures, W. E. Gates, Van Nuys, Calif., T. Y. Lin Associates, May 1970, Contract N62399-69-C-0017, AD874828

This report presents a design procedure and cost optimization curves for cylindrical steel tanks with spherical end caps that are buried with their axis parallel to the ground surface. The fuel storage tanks are designed to resist high overpressures associated with nuclear air blast. Internal pressurization has been utilized to minimize material and fabrication costs and increase the buckling capacity of the tanks.

The design procedure is believed to be valid for overpressures ranging from 10 to 3,000 psi. The overall reasonableness of the design procedure has been confirmed by experimental model tests on buried steel cylinders and pressurized tanks in granular materials.

CR-69.025
Evaluation of High-Pressure Airblast Attenuation Effectiveness of Air Entrainment Subsystems, S. P. Gill, et al., San Leandro, Calif., Physics International Co., Apr 1970, Contract N62399-70-C-0003, AD875425L

This report describes the results of a test in which four air entrainment subsystem (AES) conceptual models were exposed to a simulated nuclear airblast at 3,000-psi overpressure. The Boss explosively driven blast simulator was used to generate a blast wave pressure-time profile closely matching 1/9 scale of a 1-Mt nuclear burst in a 7 x 28-in. rectangular blast duct 100-ft long.

AES models were welded to the blast duct and instrumented with piezoelectric pressure gauges. Results include pressure-time histories at blast valve locations and accumulator stations, and observations of model component failure modes. This test represents the first time that subscale air entrainment subsystems have ever been exposed to blast waves in air at high overpressure levels, and the results indicate substantial differences between predicted and measured pressures.

CR-69.026
Propellant-Actuated Embedment Anchor, R. A. Thomason, F. J. Bucella, E. I. Lindberg, Downey, Calif., Aerojet-General Corporation, Ordnance Division, Nov 1968, Contract N62399-68-C-0002, AD850896

This report contains a review of the results of an engineering, development, and manufacturing program for the development of a propellant-actuated embedment anchor. The objective of the program was to provide a prototype anchor system suitable for marine salvage operations. Calculations

and engineering discussions are presented to support the design concept and certain specific components contained in the system. Test results are reviewed to define the demonstrated performance capability of the anchor in a variety of sea-floor compositions. Numerous photographs and drawings are included to illustrate the various anchor system components and to document the development test operations. Several appendixes are included to define specific test procedures, some of which are applicable to a general, future proof-test and evaluation program.

CR-69.027
Earthquake Occurrence and Effects in Ocean Areas, B. W. Wilson, Consulting Oceanographic Engineer, Pasadena, Calif., Mar 1969, Contract N62399-69-C-0042, AD859931L

Present-day concepts of the major seismic zones around the world are discussed in relation to observed features of earthquake occurrence. There is mounting evidence that vertical cellular convection of earths mantle material is responsible for sea floor spreading about the mid-ocean ridges and for under-thrusting of oceanic crustal blocks beneath adjacent continental crusts. Earthquake activity is largely confined to the boundaries of these crustal blocks where thrust faulting along island arcs and shear along transform or transcurrent faults are proceeding. Seismicities of different oceanic regions are presented in terms of available statistics on earthquake occurrence relative to earthquake magnitude. Characteristic features of terrestrial earthquakes are reviewed, as well as known features of large submarine earthquakes, both as to tectonic movements and sea disturbances. From measurements of accelerographs and general statistical information, accelerations and velocities of ground motion are assessed in relation to earthquake magnitude. Other parameters such as fault length, duration time of shaking, maximum tectonic displacement are related statistically to earthquake magnitude Tsunami generation is also reviewed and approximate statistical relationships given for wave height, period and source dimensions in terms of earthquake magnitude. The vulnerability of ocean bottom structures to effects from earthquakes is then dealt with from the viewpoints of seismic risk, foundation failure, structure dynamics and tsunamis. \ number of suggestions are made for needed research in areas of deficient knowledge.

CR-69.028
Underwater Laser Surveying System, D. R. Borchardt, Redondo Beach, Calif., TRW Systems Group, Mar 1969, Contract N62399-69-C-0010, AD859968L

This report describes the development of an underwater laser surveying system (ULSS) usable by two divers for plot layout, bottom contour mapping and other underwater surveying missions. The TRW portable cold-cathode argon laser is the central element to the system. The supporting test program demonstrated the feasibility of the system for plot layouts to 6-in. accuracy and contour elevation to 1.2-in. accuracy over ranges of up to 100 ft.

Operating procedures and maintenance instructions for the system are also included in the report.

CR-69.029
Bolted Joint Connections for Deep Ocean Applications, D. W. Carreau, Groton, Conn., General Dynamics Corp., Electric Boat Division, Jun 1969, Contract N62399-67-C-0044-P001, AD855178L

This report identifies the criteria, rationale, and design analysis for pressure-hull bolted joints for use in the construction of non-combatant deep ocean habitats such as the manned underwater station (MUS). Bolted joints are a necessity to provide versatility in construction utilizing standardized modules. Modular construction permits a variety of configurations to meet the requirements of specific missions. Safety is provided by the utilization of previously certified modules. System growth can be accommodated by adding modules to an existing basic system.

The bolted joint design is based on criteria established by the MUS. A bolted joint is utilized for the pressure-hull (power plant) module to permit interchangeability of experimental power plants. This joint is approximately 12-1/2 ft in diameter. In addition, a smaller bolted joint is used to attach work modules to the observation sphere at the bottom of the station. Both joints are developed in this report and detailed engineering drawings are provided. A detail design of a 1/4-scale stress model is presented for test verification and certification of the design.

This report covers phase 1 (prototype reference design) of a four-phase program in the development of pressure-hull bolted joints. The total program is oriented toward certification of the prototype hardware design to the requirements of NAVSHIP 0900-28-2010. This program provides a balance between analytical effort and model tests to obtain design certification prior to fabrication of a full-scale prototype joint.

CR-69.030
Penetration of Objects Into the Ocean Bottom (the State of the Art), W. E. Schmid, Consulting Engineer, Princeton, N.J., Mar 1969, Contract N62399-68-C-0044, AD695434

The state of the art of predicting as well as achieving the penetration of objects into the sediments of the ocean floor is presented. Both free-fall as well as driven penetration is reviewed. The information known about ocean bottom soils is briefly summarized.

For free-fall penetration the impact velocity, attitude and direction are most important and methods for calculating these parameters are demonstrated.

Impact penetration relations are then discussed based on theoretical as well as empirical relations.

The theoretical considerations valid for driving objects into the bottom sediments are reviewed and the equipment and machinery available at present (1969) for achieving penetration or for driving piles into the ocean bottom are presented. Recommendations for immediate use and for continuing research are made.

CR-69.031
Breakout Resistance of Objects Embedded in Ocean Bottom, A. S. Vesic, Duke University, Durham, N.C., May 1969, Contract N62399-68-C-0043, AD699525

A study of factors affecting the magnitude of break out resistance of objects embedded in ocean bottom. Following a literature review most discussions deal with the basic problem of centrally loaded object pulled by vertical force from a sediment with level surface. Considerations of effects of eccentric and inclined loading and slope of the ocean bottom are added. It is found that failure patterns depend on relative depth of the object, as well as on soil type. Theoretical analyses show better agreement in soft and loose soils than in stiff and dense soils. Suggestions for analysis of suction force and effects of soil liquidity are given. Recommendations for future research include our problem areas. (1) Effects of soil liquidity and compressibility on failure patterns, (2) adhesion between soil and buried objects, (3) nature and magnitude of suction force, (4) rheological properties of soils in breakout.

CR-69.032
Theoretical Analysis of the High Voltage Buried Cable, J. P. Wesley, Rolla, Mo., University of Missouri, Department of Physics, Nov 1968, Contract N62399-68-C-0047, AD853972L

A theoretical analysis is presented of an insulated high-voltage buried cable which is center fed and connected to the earth at each end. Differential equations are set up in terms of the Hertz polarization potential and solved by integration of the solution for the dipole case. Electric and magnetic fields are computed through operations on the Hertz potential. Solutions are obtained for the range of distances from the cable greater than an earth wavelength and less than an air wavelength. Also solutions are obtained for the field inside the cable insulation and the

near region of the earth. The radial field in the insulation is many orders of magnitude greater than the longitudinal field and is the only one to consider as a cause of internal dielectric breakdown. The radial field is independent of earth parameters provided the earth is homogeneous.

The report also examines the feasibility of winding iron wire around the cable to shield it from high local fields due to earth inhomogeneities.

CR-69.033
Stress Concentrations in Hull Shapes From Surface Discontinuities, P. M. Hoyt, B. Chang, Laramie, Wy., University of Wyoming, Natural Resources Research Institute, Apr 1969, Contract N62399-68-C-0005, AD608303

Stresses in a sphere-cone-cylinder model of a manned underwater station were studied in this investigation. Data were obtained from a photoelastic model and from a finite element computer program to compare the stress concentration at the change in geometries and at the stiffener locations.

A small-scale photoelastic plastic model was loaded under an internal pressure of 1 psi at a critical temperature of 270F and the stresses were frozen by slowly cooling the model. The cylinder diameter-to-thickness ratio was 95. The cone was made tangent to the partial sphere at the point of intersection. However, the cone-cylinder intersection or change of surface continuity was rather sharp. Rectangular shaped internal radial stiffeners which had the same stiffness as the scaled-down T-shaped stiffeners were used. After stress freezing, the model was sliced longitudinally and transversely, and the meridional and circumferential stresses were determined with a 10-in.-diam collimated light polariscope.

The highest stress occurred at the inner surface of the intersection of the conical section with the main cylinder Recommendations are made to reduce the high stress concentrations, and general guidelines in the design of similar structures are presented.

The results of the three-dimensionsl photoelastic investigation agreed quite well with those of the finite element analysis.

CR-69.034
A Wet and Dry Deep Submergence Electrical Power Transmission System, R. K. Swanson, et al., San Antonio, Tex., Southwest Research Institute, Jul 1969, Contract N62399-69-C-0001, AD862148L

This report describes the preliminary design of a 4,160 V, 3-phase, 50-A/phase conventional dry connector and a connector that can be connected and disconnected underwater which is designated as a wet connector. The state-of-the-art in connector design and fabrication is discussed in detail. Underwater transmission cable state-of-the-art is presented and finally a bibliography containing pertinent information on cables, connectors and components is given.

CR-70.001
Study of Equipment and Methods for Removing Oil From Harbor Waters, P. C. Walkup, et al., Richland, Wash., Pacific Northwest Laboratories, Battelle Memorial Institute, Aug 1969, Contract N62399-69-C-0028, AD696980

A cost effectiveness analysis was performed for equipment, materials, and techniques for the removal of spilled petroleum products from the surfaces of ports and harbor waters used by U.S. Naval craft. Effectiveness criteria, formulated for presently practiced methods and available equipment and materials, included speed, completeness, ease of operation, effect on marine life, and availability. Parameters for the effectiveness study were based on the petroleum products now in use or planned for future use and a detailed review of the geographic, hydrographic, physical, and environmental characteristics of ports used by the U.S. Navy. It was found that the two most cost effective systems for broad application were mechanical recovery of spilled material by surface suction devices supplemented by mechanical containment and the application of chemical dispersants by pier or vessel mounted high pressure spray equipment. Recommendations included, the development of additional technology pertinent to petroleum product spills of concern to Naval installations, additional management planning and preparation for coping with spill incidents, installation of equipment at Naval facilities to protect sensitive areas, and support of innovative development activities for improved equipment and methods for coping with petroleum spills.

CR-70.002
Manned Underwater Station Resistance in Still Water and in Waves, O. J. Sibul, Berkeley, Calif., University of California, Berkeley, Jul 1969, Contract N62399-68-C-0045, AD713458

Two models of manned underwater stations were towed in still water as well as in waves. The resistances were measured and the optimum towing configurations recommended. The response curves for added resistance were derived from uniform wave tests. Then the added resistances were calculated for sea states 3 and 5 and compared with model tests. Dynamic forces in towing cable (caused by wave action) were measured.

Some measurements were made to estimate overturning as well as oscillatory moments produced by bottom currents while the station is sitting on the bottom.

CR-70.003
Automatic Fire Protection System for Manned Hyperbaric Chambers, Phase I, System Development, I. A. Eggleston, W. R. Herrera, G. E. Commerford, San Antonio, Tex., Southwest Research Institute, Aug 1970, Contract N62399-68-C-0022, AD712848

The problems of fire detection and suppression in dense atmospheres typical of diving chamber service are analyzed, with special attention to nitrogen-oxygen up to 8 atm and helium-oxygen up to 45 atm. Spectral comparisons indicate either infrared (IR) or ultraviolet (UV) flame detectors may be used. The current IR equipment is the better choice. There is a need for a combustion products detector and an acceptable model is available. Although it is sensitive to changes in atmospheric density, automatic compensation is feasible. Dense atmospheres affect the performance of water spray nozzles. Complete data are given for a typical line of commercial nozzles (Viking) for four sizes and five nozzle angles, at flow pressures of 60 psig and chamber pressures up to 500 psig. A water rate for suppression is estimated at 2-3 gpm/sq ft, and supported by fire test data. The flash-off of dissolved gases can be a serious problem in system design. A closed water loop balanced to chamber pressure and pump driven when needed is preferred to any system which exposes water to gas pressures above the chamber operating level for periods long enough to permit saturation.

CR-70.004
A Study of Automatic Fire Protection Systems for Advanced Bases, L. A. Eggleston, San Antonio, Tex., Southwest Research Institute, Jul 1969, Contract N62399-69-C-0027, AD859950L

Advanced bases store material of high mission support value, but site limitations make conventional fire protection systems impractical. The AB fire threat is analyzed and criteria developed which a system must meet to be useful. For a typical 40 x 100-ft AB undivided warehouse, the concept is developed of establishing a number of fire zones, each with highly responsive fast acting detector package and an adequate gas pressurized extinguisher package. Dry chemical, Freon 1301, or high expansion foam would be used to suit the climate. A control package using computer logic would actuate as many extinguishers as necessary to put out the fire. Cost, weight, and volume data are included. Prototype development is recommended.

CR-70.005
Large Displacement Analysis of Axisymmetric Shells, E. Wilson, L. Jones, T. Hsueh, Berkeley, Calif., University of California, Department of Civil Engineering, Mar 1969, Contract N62399-68-C-0035, AD866841

A method of analysis for the evaluation of the large displacement behavior of axisymmetric shells is presented. A Fortran IV listing of the computer program is included.

CR-70.006
Stability Analysis of Axisymmetric Shells, T. Hsueh, E. Wilson, Berkeley, Calif., University of California, Department of Civil Engineering, Sep 1969, Contract N62399-68-C-0035, AD866839

The finite element method is applied to the stability analysis of axisymmetric thin shells subjected to axisymmetric load conditions. The conical shell element is used in the formulation. Several examples are presented to illustrate the application of the method. The use of the program and a listing of the Fortran IV program are given in the appendices.

CR-70.007
Study of Slope Instability in the Ocean Floor, R. F. Scott, K. A. Zuckerman, Pasadena, Calif., Division of Engineering and Applied Science, California Institute of Technology, Mar 1970, Contract N62399-69-C-0005, AD707451

There are three sections to the report, (a) ocean floor soil types and characteristics, (b) stability analysis of submarine slopes, and (c) discussion of problems with conclusions and recommendations. In the first section the physical and mechanical properties of the soils encountered in various types of ocean-floor terrain are described and summarized in tables and diagrams. The application of conventional subaerial slope stability analyses to ocean-floor soils and their environment is examined in the second section. Some aspects of the stability of underconsolidated soils forming in areas of rapid deposition are given particular attention. Following a summary of the conclusions reached in the study, some detailed recommendations regarding future studies and experimental work are given in the final section of the report.

CR-70.008
A Literature Review on Erosion and Deposition of Sediment Near Structures in the Ocean, H. A. Einstein, R. L. Wiegel, Berkeley, Calif., University of California, Hydraulic Engineering Laboratory, Feb 1970, Contract N62399-69-C-0007, AD707056

This survey presents the results of a study of a characteristic flocculated sample of deep-sea sediment. In main, it consists of a literature review on, deep-sea sediments and flows, on scour and deposition of cohesive sediments, and on sediment transport by wave action.

CR-70.009
Study of Entanglement Probability Among Long Vertical Lines in Ocean, T. Zsutty, San Jose, Calif., Department of Civil Engineering and Applied Mechanics, San Jose State College, Apr 1970, Contract N62399-69-C-0014, AD708034

This study provides reliability information related to the problem of line entanglement in vertical, multiline, weight raising systems in a turbulent ocean. Turbulence is modeled as a vertical field of stationary normal random processes with a given cross-spectral density function matrix. The vertical line is modeled as a linear, lumped-parameter system. Engineering values may be assigned to the constant parameters in both the turbulence spectral density matrix and the system response function matrix. Frequency domain analysis provides the horizontal displacement spectral density function matrix, and a discrete representation of spectral density allows a closed form summation expression for the expected rate of zero displacement crossings. The Poisson distribution is assumed for the calculation of the probability of crossing a given displacement limit during a given time interval. Results are tabulated for the evaluation of safe spacing distances for given high, medium, and low turbulence conditions and line system properties. A deterministic analysis is made for the effect of vertical surface wave motion on horizontal displacement. A preliminary development deals with the numerical simulation of the vertical turbulence field.

CR-70.010
Environmental Analysis Relative to Portable Port Operations, M. M Bascom, T. W. Baseler, et al., Washington, D.C., Ocean Science and Engineering, Inc., Oct 1969, Contract N62399-69-C-0052, AD863216L

A study of the oceanographic environment at 11 remote semi-tropical coastal areas and the effects of these environments on the deployment and operation of the portable port systems defined in proposed technical approaches - 41 Element no. 63712N, Project no. Y41BC prepared by the Naval Facilities Engineering Command, Feb 1, 1969.

Consideration is given to the requirements for and the effectiveness of a breakwater system on improving and extending the operation of the port facilities when deployed along an exposed coastline. Alternate methods of mooring the piership are discussed and recommendations are made for methods of improving cargo transfer equipment to permit port operation without the benefit of a breakwater.

CR-70.011
Analysis of Wastewater Treatment and Disposal Systems for Advanced Bases, N. L. Drobny, S. R. Qasim, Columbus, Ohio, Battelle Memorial Institute, Columbus Laboratories, Oct 1969, Contract N62399-69-C-0036, AD863790L

Recent military experience has demonstrated that safe and efficient waste-disposal systems for advanced bases are desirable in the interest of overall combat effectiveness. An investigation has been conducted to determine the most cost-effective wastewater treatment and disposal system that can be obtained commercially or that will become available in the near future for 500-man and 1000-man military camps. Suggestions are also provided which indicate possible modifications of the existing state of the art to achieve significant improvements tailored to the specific requirements of advanced bases.

Technical requirements for wastewater treatment and disposal systems for advanced bases were established and these requirements were treated as minimum performance criteria. A comprehensive survey of 19 manufacturers was then conducted to obtain technical and economic data on commercially available equipment and systems. A total of 21 separate systems were found to satisfy the technical requirements established.

Those systems which satisfied the technical requirements were then subjected to a rigorous cost-effectiveness analysis. Unit costs (cents per thousand gallons treated-capital plus operating) were developed using manufacturers data. System effectiveness was determined using a decision weighting model based on pairwise comparisons. A total of eight measures of effectiveness were employed in the weighting model. They are as follows: (1) simplicity of operation, (2) simplicity of installation, (3) operational flexibility and reliability, (4) environmental quality control, (5) manpower requirements, (6) space requirements, (7) power requirements, and (8) relocatability.

Results indicate that conventional stabilization ponds are the least costly of all systems available, but that other systems may be more suitable from a cost-effectiveness viewpoint. Guidelines were developed that can be used to select commercially available systems for incorporation in the Navy's advanced base functional components system.

It was also established that major improvements in overall effectiveness probably can be achieved at modest expense by incorporating selected components of several existing systems into a single unit tailored to the specific requirements of advanced bases. Three such possibilities were identified.

It is recommended that the Navy pursue a continuing research and development program designed to develop improved wastewater treatment and disposal systems and to develop integrated systems for the complete waste- and water-management functions at advanced bases. Recommended elements of such a program are outlined.

CR-70.012
A Computer Program for the Analysis of Thin Shells, C. P. Johnson, P. G. Smith, Berkeley, Calif., University of California, Department of Civil Engineering, Jan 1969, Contract N62399-68-C-0035, AD701896

The finite element method is used for the analysis of thin shells of arbitrary geometry. The shell surface is idealized by an assemblage of flat triangular elements, and the stiffness properties of each element are evaluated. The stiffness of the complete assemblage is obtained by the direct stiffness procedure.

The computer program is suitable for the static analysis of linear shells subjected to arbitrary surface pressure loadings and concentrated nodal forces. Displacement boundary conditions can also be specified.

The use of the program and a listing of the Fortran IV program for the CDC 6400 are given in the report. Also, a discussion of the analysis of a toroidal shell with meridional stiffeners is included as an example.

CR-70.013
Dynamic Testing of Load Handling Wire Rope and Synthetic Rope, E. A. Capadona, Cleveland, Ohio, Preformed Line Products Company, Jan 1970, Contract N62399-69-C-0013, AD712486

A testing program was initiated to conduct dynamic tests on torque balanced wire and synthetic rope. The scope of the work was to provide data so that a basis can be established to select the best type of line for load-handling purposes in the deep ocean environment. The tests consisted of tension vs elongation, rotation and kink formation, and longitudinal dynamic response.

The tension elongation tests yielded data typical to stranded line construction. The rotation-kink tests revealed that negligible rotations resulted in the test cables when under load and that no kinks were formed when the load was suddenly released. The dynamic response tests showed that the measured dynamic stresses were dependent upon the exciting frequency. The natural frequency for the synthetic rope sample was 0.3 and 0.6 cps for the wire rope. The tests indicated that the highest values of combined static and dynamic stresses occur at resonance which could cause failure of the cable at points of high stress concentration.

It is recommended that some hydraulic parameters and random excitation be introduced in the future testing of this type. Stress relieving fittings should be investigated for use on load handling lines in the ocean environment.

CR-70.014
Study for Allocation of Maintenance Funds, Navy Family Housing, B. B. Gordon, et al., Columbus, Ohio, Battelle Memorial Institute, Jan 1970, Contract N62399-69-C-0043, AD869112L

This report contains the results of work performed under Contract no. N62399-69-C-0043. Presented are the results of regression equations derived from relating historical data on Navy family housing maintenance resource expenditures and operation resource expenditures (funds) to measures which can be used to predict these expenditures. The results are based upon consideration of approximately 98% of the total dwelling units for which the Navy has direct responsibility for maintenance and operation. Results of specific regression equations are presented in the form of worksheets for use as a management tool in allocating maintenance and operation resources.

CR-70.016
Design and Calibration of a Deep Ocean Nuclear Probe for Sediment Water Content, J. C. Ringle, J. R. Bell, J. L. Hurley, Corvallis, Ore., Oregon State University, May 1970, Contract N62399-69-C-0009, AD721095

A laboratory model of a nuclear moisture meter was constructed and calibrated. The meter, which is composed of an AMBE neutron source and a CD-covered LiI detector, measures epithermal neutrons. Samples of varying composition and moisture content were assembled and used to determine the accuracy of the meter.

The atom-percent-water in any sample was found to vary linearly with epithermal count rate, a result expected and predicted theoretically. These measurements were sediment-independent. The moisture content was determined from the atom-percent-water by using porosity. The moisture content was sediment-dependent, as expected.

The moisture content can be determined over a range of about 20 to 350%. If no information is known about the sediment, the maximum error in moisture content is about 32%, the average error is about 16%. If information is available concerning the sediment (as from a core sample of a gamma density probe), the maximum error in moisture content is about 23%, the average error is about 9%.

CR-70.017
Test and Analysis of the Equipment Chassis Test Track, C. J. Nuttall, Chestertown, Md., WNRE Incorporated, Mar 1970, Contract N62399-69-C-0046, AD712503

A small, self-propelled, single-tracked test chassis, designed for use in an upcoming experimental program of traction tests on submerged soils (depths to 20 ft), is described. Some relevant, simple state-of-the-art procedures for calculating traction performance are offered. The results of preliminary trials, intended primarily to demonstrate mechanical operation of the rig in the underwater environment, are presented and commented on.

CR-70.018
Turbidity Currents on the Ocean Bottom, M. Ewing, W. B. F. Ryan, H. D. Needham, B. C. Schreiber, Palisades, N.Y., Lamont-Doherty Geological Observatory of Columbia University, Nov 1970, Contract N62399-69-C-0006

The ocean bottom turbidity currents flow downslope, under the influence of gravity and by virtue of the fact that the density of their entrained turbulent suspension is greater than that of water. Turbidity currents originate in upslope sedimentary reservoirs. Initiated by some trigger mechanism, the sediment fails and starts to slump. As all or parts of the slump are transformed into a suspension of higher density than the surrounding water, a resulting turbidity current flows downslope with increasing velocity (often through channels) until it reaches lower gradients, where it further spreads out and decreases in velocity. The current can pick up new material from the sea bed in the path of motion if the velocity and turbulence are sufficient to retard the settling of entrained particles. Turbidity currents can flow for several thousand kilometers, moving out to the extremes of a sedimentary depression. As the current slackens, suspended sediment is deposited vertically and laterally in graded beds known as turbidites. Depending upon the properties of the initial suspension, the grain size of the entrained particles, and the steepness of the downhill slope, the velocities of turbidity currents range about 10 cm/sec to over 50 knots (2,500 cm/sec). The basal portion of the average turbidite bed may be deposited on the basin floor in a few hours. The thickness of individual beds ranges from a few millimeters to several meters.

Turbidity currents are potentially dangerous to ocean floor structures.

CR-71.001
Study of Equipment and Methods for Removing or Dispersing Oil From Open Waters, C. H. Henager, P. C. Walkup, J. R. Blackshaw, J. D. Smith, L. M. Polenta, M. J. Schneider, J. J. Dorgan, Richland, Wash., Pacific Northwest Laboratories Division of Battelle Memorial Institute, Aug 1970, Contract N62399-70-C-0008

A cost effectiveness analysis was performed for equipment, materials and techniques applicable to removal or dispersal of spilled oil from U.S. Navy AO and AOG vessels on open waters. Effectiveness parameters included oil product types (JP-5, distillate fuel, Navy special and bunker C), a range of spill locations (3 and 12 miles from shore) and varying spill sizes (2,700, 270,000, and 6,750,000 gal). Criteria for evaluation of systems under the above parameter situations, formulated for presently available equipment and materials, included completeness of oil removal, rate of removal, hazard and pollution, use in limited access areas, sensitivity to expected environmental factors, sensitivity to temperature extremes, toxicity to marine life and system availability. Cost effectiveness was determined using the three spill sizes and checked for spill frequency sensitivity. The three most cost effective systems for the range of spill sizes were found to be burning, dispersing and mechanical skimming. Considering system applicability to various products and the requirements of rate of removal for massive spills, the most practical universal system with a favorable cost effectiveness ratio was found to be dispersing. This is followed by dispersing plus a containment boom. Burning agents applied directly to the spill were judged to be the third best system based on its favorable cost effectiveness but limited applicability to oil types and permissible burning circumstances.

CR-71.002 - Not available

CR-71.003
The Seafloor Excavator, C. P. Buckely, F. S. Coxe, O. Shev, Anaheim, Calif., Northrop Corporation, Electro-Mechanical Division, Dec 1970, Contract N62399-70-C-0006

The system definition and analysis process through a deep-ocean seafloor excavator is developed and described. Eight concepts are initially formulated and studied, with the three most practical being further developed. A comprehensive system and cost analysis of the three selected concepts is performed to determine the single, most effective concept. The preliminary design and the design specifications for this concept are developed. The resulting design is of a wide-tracked, remotely operated submersible vehicle equipped with a revolving, extendable (jacknife) dredging arm capable of performing earthmoving, excavating dredging tasks in waters as deep as 6,000 ft.

This report is comprised of four volumes. Volume I contains the summary, volume II contains the preliminary design and specifications, volume III contains the concept definition and system analysis studies conducted to establish the preliminary design requirements, and volume IV contains supporting and supplemental data developed during the course of this program.

CR-71.004
Sanguine System Feasibility Study, G. A. Young, R. J. Brandt, C. F. Bagge, D. A. Bond, Agbabian-Jacobsen Associates, Aug 1970, Contract N62399-70-C-0019, (Secret)

CR-71.005 - Not available

CR-71.006
Automatic Fire Protection System for Manned Hyperbaric Chambers, Phase II - Prototype Design, Fabrication and Test, Vol. A - System Design and Test, Vol. B - Operators Manual, (2 vols.), L. A. Eggleston, W. R. Herrera, San Antonio, Tex., Southwest Research Institute, Feb 1971, Contract N62399-69-C-0045, AD731680, AD731681

Based upon the phase I results, a prototype automatic fire protection system was constructed and tested at SWRI using compressed air and helium air mixtures up to 8 atm. Many problems were encountered before rapid, and reliable infrared (IR) detection could be assured. Other difficulties were encountered with an ionized particle (IP) detector for combustion products, which although not yet completely satisfactory shows an attractive potential for detecting serious overheat situations. Considerable fundamental work was done of this unit in diving atmospheres. A total of 264 tests were conducted.

Extinguishment was satisfactory. The overall measured system responses from visible flame to the start of water discharge from the nozzles ranged from 1.3 to 2.4 sec. With the system in optimum condition, the average response was 1.9 sec.

CR-71.007
The Design and Fabrication of One (1) Prototype Portable Smoke and Gas Removal Unit, N. L. Carroll, M. J. McGoff, D. L. Thiebaud, J. C. King, L. W. Goehring, Evans City, Penn., MSA Research Corporation, Oct 1970, Contract N62399-69-C-0038, AD882714L

A prototype portable smoke and gas removal unit was developed to clear the atmosphere of a sealed room after a fire.

The unit utilizes a series of filters and chemical beds to remove particulate matter, carbon dioxide and carbon monoxide within 3 hr to such a level that a man may work safely and comfortably.

The unit is self-contained, with its own electric motor, blower, filters and chemical beds, all mounted on a portable platform truck with floor lock.

CR-71.008
Study of Modernization and Replacement, Navy Family Housing, B. B. Gordon, D. N. Molnar, N. H. Fischer, R. B. Guy, Columbus, Ohio, Battelle Memorial Institute, May 1971, Contract N62399-69-C-0048, AD723233

During the first phase of this contract, a mathematical model was developed to determine at what point in the life cycle of a family housing unit is it economical to modernize, to continue routine maintenance, or to replace. Existing models in use within the government or the private sector did not satisfy the requirements. The economic decision model, developed using the concepts of dynamic programming, determines the optimum investment strategies throughout the housing units life. Computer programs were developed on the CDC 6400 computing system. During the second phase, the model was field tested in Norfolk, Va. Data were collected for three Navy family housing projects in the Norfolk area. Much of the required input data had to be estimated on the basis of expert judgment. Plans for modernization and replacement were developed for the three housing projects. Although many difficulties arose in developing the required input data, the model provides valuable guidelines for Navy family housing.

CR-71.009
A Method for Evaluation and Selection of Deep Ocean Load Handling Systems, Volume I - Final Report, R. J. Knight, J. E. Curry, V. E. Bolding, J. C. Mitchell, H. P. Weldon, Seal Beach, Calif., North American Rockwell, May 1971, Contract N62399-70-C-0024, AD730036

This study for the development of a method for the evaluation and selection of deep ocean load handling systems was conducted to assist the U.S. Navy in performing seafloor construction projects through consideration of operations involving equipment and transport of materials for load

implantment. The study has accomplished four primary tasks: (1) the assemblage and organization of data, (2) the development of a mathematical model which is descriptive of a generalized total deep ocean implantment mission, (3) translation of the data and model into a computerized method to enhance utilization, and (4) validation of the method through application of selected case examples. The method provides the capability to evaluate any selected deep ocean load handling system on the basis of critical mission parameters. The evaluation may be conducted to: (1) compare candidate systems with respect to a specific or general mission on the basis of cost, time, and confidence, (2) develop a "best" system for the conduct of a specific mission, (3) establish the sensitivities of a selected system for a given mission, and (4) define the requirements for a "best" system applied to a selected mission. Documentation of this study is presented in two volumes and a computer source deck.

Volume I contains a synopsis of the study scope of the deep ocean load handling mission, analysis which was performed, and significant findings and general results of the study effort. A technical discussion is provided of the mathematical model inclusive of mechanization logic and evaluation factors. Formulation of the computer model defining format and utility subroutines is presented. Validation results of the method for selected candidate systems and missions have been included.

Volume II is a user's manual descriptive of the formulated computer program. It describes the theory associated with development of the model and depicts nomenclature and significant features of the model operation. A general description of the program containing deck setup, job control and devices, subroutines, and logic diagrams is also included. An appendix presents the data developed for model access during any mission scenario.

CR-71.010
A Method for Evaluation and Selection of Deep Ocean Load Handling Systems, Volume II - Users Manual, R. J. Knight, J. E. Curry, V. E. Bolding, J. C. Mitchell, H. P. Weldon, Seal Beach, Calif., North American Rockwell, May 1971, Contract N62399-70-C0024, AD730037

This study for the development of a method for the evaluation and selection of deep ocean load handling systems was conducted to assist the U.S. Navy in performing seafloor construction projects through consideration of operations involving equipment and transport of materials for load implantment. The study has accomplished four primary tasks: (1) the assemblage and organization of data, (2) the development of a mathematical model which is descriptive of a generalized total deep ocean implantment mission, (3) translation of the data and model into a computerized method to enhance utilization, and (4) validation of the method through application of selected case examples. The method provides the capability to evaluate any selected deep ocean load handling system on the basis of critical mission parameters. The evaluation may be conducted to: (1) compare candidate systems with respect to a specific or general mission on the basis of cost, time, and confidence, (2) develop a "best" system for the conduct of a specific mission, (3) establish the sensitivities of a selected system for a given mission, and (4) define the requirements for a "best" system applied to a selected mission. Documentation of this study is presented in two volumes and a computer source deck.

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CR-72.001
Closed-Cycle Power Systems for Undersea Military Facilities and Equipment, P. T. Fukunaga, R. O. Pearson, Redondo Beach, Calif., TRW Systems Group, Sep 1971, Contract N62399-71-C-0027, AD888288L

This report summarizes TRW's experience with some 30 power sources which have been previously considered for underground application and extrapolates this information through a screening process to determine which of these 30 power sources may be of interest for deep ocean application. The report further describes the methodologies used to select power sources for underground applications. The report does not include all power sources which could be considered for underwater application--only the 30 previously considered for underground application.

The report recommends that an undersea power source handbook be prepared which would organize all available power source information in a manner which would allow designers of deep ocean systems to rapidly select power sources for specific undersea applications.

CR-72.002
Study of Construction Methods for Large Undersea Concrete Structures, Engineering Division, San Francisco, Calif., Santa Fe-Pomeroy, Inc., Sep 1971, Contract N62399-71-C-0015, AD732794

The report on a study of construction methods for large undersea concrete structures was undertaken to annotate up-to-date capability of the construction industry to emplace those structures on the seabed. In equating this capability to the requirement, several methods and combinations of systems were evident, predicated on the final site selection for the emplacement. Each offshore site has a different set of geographical conditions that should be evaluated prior to designing and selecting any one method for construction. The report considers these variables in water depths up to 1,000 ft deep.

In evaluating design and construction methods for even larger objects and at depths up to 3,000 ft, additional unknowns were indicated by the research. From this research and analysis several future study areas were suggested.

Concepts involving underwater mixing and placing of concrete were reviewed along with various justifications for such developments.

Recommendations and items for future research are also included in the report.

CR-72.003
Expeditionary Logistic Facility, a Conceptual Design of Materials Handling System for Naval Advanced Base Ports, C. P. Hanley, New York, N.Y., J. J. Henry Co., Inc., Sep 1971, Contract N62399-71-C-0011, AD735442

This report presents a unique concept for off-loading nonself-sustaining container ships at Naval advanced bases. The concept is described with graphic representations, narrative discussions, performance estimates and cost data. System operations and performance are discussed. All auxiliary operations such as delivery, maneuvering, erection, positioning and repositioning are covered. The design analyses for the concept are also included. A program for the development through prototype is outlined.

CR-72.004
Ship-Indexing Approach to Container Offloading at a Naval Advanced Base, S. Berger, J. Weis, F. Pitts, J. Lechus, R. Montes de Oca, Arlington, Va., Control Systems Research, Inc., Sep 1970, Contract N62399-71-C-0012, AD735443

This report presents an innovative concept for offloading containers from non-selfsustaining containerships at Naval advanced bases. The concept is described by means of extensive graphic representations which are accompanied by narrative discussions and performance and cost data. System operations over a sustained period of time, and performance levels for average and extreme sea conditions are covered. All of the ancillary operations such as maneuvering, repositioning, alignment, transport and erection are covered. The main design analyses performed in formulating the concept are included. Finally, a program for continuing development through the prototype phase is outlined.

The concept is designated the ship-indexing approach. The essential feature of this concept is the engagement of the working rig to the containership during cargo transfer. This enables the rig crane work to expeditiously align with deck-stowed containers and cell guides, and also facilitates longitudinal alignment during successive repositioning operations as containers are offloaded. However, the greatest benefit occurs as sea conditions worsen, since relative motions between the crane platform and the containership are eliminated.

CR-72.005
Probabilistic Formulation for Analytical Modeling of Concrete Structures, M. Shinozuka, Ridgewood, N.J., Nov 1971, Contract N62399-71-C-0022, AD735444

Specifically, a probabilistic model of spatial variation of concrete strength is considered and the corresponding statistical size effect is discussed. This interpretation of the size effect together with the recently developed method of digital simulation of random function makes it possible to demonstrate the statistical size effect in terms of a numerical example. The same interpretation is also used in a failure analysis (1) to illustrate the fact that the location of crack initiation and the (minimum) load associated with it are statistically different from specimen to specimen and (2) to reproduce, again with the aid of the digital simulation technique, these locations and minimum loads. Finally, a method of digital simulation of multivariate-multidimensional random functions is described with a numerical example.

CR-72.006
A "Wet" and "Dry" Deep Submergence Electrical Power Transmission System, Phase I and Phase II, Volume I and Volume II, E. Briggs, et al., San Antonio, Tex., Southwest Research Institute, Nov 1971, Contract N62399-69-C-0001, AD892356L, AD892357L

The design, construction and testing of a dry, conventional electrical connector and cable system and a wet (mated underwater) electrical connector system rated at 4,160 V, 3 phases, 50 A/phase is described. The system was designed for operation to depths of 6,000 ft with a safety factor of 1.5. In phase I, the state-of-the-art in connector design and fabrication is reviewed including a bibliography containing information on cables, connectors, and components. Emphasis was placed on a single design with components easily obtainable and having an expected life time of operation of 3 to 5 years. The results of tests of the connector indicate that the connector will perform satisfactorily if the precautions described in the report are followed.

The connector system was designed so that it can be readily expanded without change in the basic concept for operation at 15,000 V and 1,000 kW.

CR-72.007
The Vertical Holding Capacity of Marine Anchors in Sand and Clay Subjected to Static and Cyclic Loading, S. M. Bemben, M. Kupferman, E. M. Kalajian, Amherst, Mass., Department of Civil Engineering, University of Massachusetts, Nov 1971, Contract N62399-70-C-0025, AD735950

The purpose of this investigation was to experimentally measure and then to evaluate the influence, if any, of different loading conditions on the vertical holding capacity of marine anchors embedded in sand and in clay.

Small and medium scale indoor laboratory tests and outdoor field tests in a specially constructed tank facility were conducted. In addition, small scale semi-spacial laboratory tests on half-sectioned anchors against a plexiglass viewing face were conducted.

The predictions for the holding capacity for anchors in clay and in sand in the shallow mechanism of failure and also for anchors in clay in the deep mechanism, when subjected to static loadings, are found to be in good agreement with cited previous formulas. However, the prediction for the holding capacity for anchors in sand, subjected to static loadings, in the deep mechanism are not in good agreement with any previous formulas.

The effect of a cyclic loading pattern as compared to a static loading pattern was observed and the detrimental effect of a continuous cyclic creep behavior on the useful life of an anchor is noted.

CR-72.008
Development of Materials Handling Concept for Naval Advanced Base Ports, J. McDougall, New York, N.Y., George G. Sharp, Inc., Dec 1971, Contract N62399-71-C-0013, AD736236

This report describes and illustrates a material handling concept for Naval advanced base ports.

It includes basically plans, descriptions and back-up calculation for a concept capable of movement to an advanced base where it can be erected and used for off-loading containers from a supply ship to lighters or other craft. The concept consists of a container crane mounted on a barge which can be jacked out of the water at the advanced site to form a stable platform.

A summary of the various propulsion methods are outlined in the text and attached plans. Speed and power requirements as well as estimated costs are presented for each propulsion case.

Ships motion and its effect on cargo handling rates is discussed.

A prototype development program outlining the main factors affecting the development of the concept as well as an estimate of cost to accomplish this development is given.

Appendices A and B forming part of this report contains body and line plans, midship section, weight estimates and stability calculations for this concept.

CR-72.009
Modification of the General Structural Analysis Program (SAP) for Dynamic Loads, Berkeley, Calif., Department of Civil Engineering, University of California, Dec 1971, Contract N62399-71-C-0003, AD736237

A general structural analysis program (SAP) was modified to permit analysis for dynamic loads by direct step-by-step integration. The theory for the development of the step-by-step method is summarized in this report. Also, a description of the use of the program and its limitation is given.

CR-72.010
Materials Handling Concept for Off-Loading Container Ships in Forward or Remote Areas, E. Simonson, R. A. Crea, Battelle-Northwest, P. O. Box 999, Richland, Wash., Jan 1972, Contract N62399-71-C-0018, AD739382

This report describes a concept for unloading conventional containerships at remote or advanced areas which lack conventional container gantry cranes. The concept employs a support ship which has a novel form of gantry crane. One end of the crane runway is supported on the deck of the

containership by a movable support leg, while the other end is secured to the support vessel. The containers beside the support leg are removed from the containership and deposited on the deck of the support vessel beside the point where the runway is secured to the support vessel. The support ship has provisions for unloading to landing craft or lighter barges by means of a wet well included inside the support ship. Provisions are also made for unloading the container to either a fixed pier or floating causeway.

This report is a feasibility study and contains data on unloading rates, structural concepts, geometric configurations and mooring problems.

CR-72.011 - Cancelled

CR-72.012
Prototype Quick Camp System Final Report, R. Bredhold, Tulsa, Ok., North American Rockwell Corp., Mar 1972, Contract N62399-71-C-0002, AD742451

This report summarizes the major facets of the design and fabrication effort accomplished by the North American Rockwell Corp. in the development of a prototype Quick Camp System.

The development effort consisted generally of preliminary studies, preliminary design, final design, and fabrication of selected components of the system for test and evaluation.

The Quick Camp System provides minimum facilities for rapid deployment of small Seabee groups. The facilities are deployable to a forward and/or remote area (from an advanced base) by helicopter or truck and provide a completely intermodal transportation capability for movement to the advanced base. The system consists of various combinations of seven basic modules and three special packages to provide for camps of from 13-104 men in size. The modules utilize an 8 x 8 x 20 ft ISO (International Standards Organization) container as the basic structure and each is completely equipped to fulfill its specific function.

Cost estimates for implementation and maintenance/repair are included along with an evaluation of the attainment of cost goals.

CR-72.013
Analysis of Layered Systems Subjected to Wheel Loads, Berkeley, Calif., University of California, Department of Civil Engineering, Jan 1972, Contract N62399-71-C-0004, AD742147

This final report presents a procedure which combines infinite field solutions with the finite element method to represent the domain of interest in semi-infinite problems. This approach reduces computer time required and increases the accuracy of solution for such problems. The method involves approximating the displacements of the system by global displacement functions which may extend to infinity, and correcting these functions by finite element displacements within regions of the structure where discontinuities in materials and geometry occur. An operating computer program has been developed for the two-dimensional analysis of solids. The program has general capabilities, however, it can be used for the analysis of layered systems subjected to wheel loads.

CR-72.014
Power System Analog, R. Parente, Santa Monica, Calif., System Development Corp., Apr 1972, Contract N62399-72-C-0001, AD744244

This document is the final report on a program of investigation and design carried out by the System Development Corporation (SDC), Santa Monica, Calif., under contract to the Naval Civil Engineering Laboratory (NCEL), Port Hueneme, Calif. The topic of this program was the propagation of electrical disturbances in the power distribution facilities of Navy shore stations.

Part One of this report covers the analysis of the shore stations power systems. Part Two gives the design for a special purpose analog computer which will be used to simulate those power systems in order to determine corrective upgrades. Part Three is an executive summary of the program.

CR-72.015
System Study, Vacuum Sewage Collection, R. Waller, C. Mallory, Columbia, Md., Mittman Associates, Inc., Dec 1972, Contract N62399-71-C-0008, AD744339

An effectiveness/cost comparison was made between gravity sewer systems and vacuum sewer systems for use in Navy advanced bases. The vacuum systems considered were (a) single pipe system where vacuum toilets are connected directly to a vacuum sewer while the remaining wastes drain by gravity to a building vacuum valve which interconnects to the vacuum sewer, (b) dual pipe system in which the wastes from vacuum toilets are conveyed in a separate vacuum sewer from the other wastes, and (c) combined system where conventional fixtures are used and all wastes drain to a building vacuum valve and then are transported in a vacuum sewer. Estimates of the daily and peak wastewater flows were developed for a 500-man base for both vacuum toilets and for low flush water toilets. Due to the unique utilization of facilities at an advanced base, peak flows were estimated to be 11.7 to 12.7 times the average flow. A vacuum system using low flush water toilets and vacuum transport of the combined wastes was the system selected for further evaluation.

Design and layouts were prepared for both gravity and vacuum sewer systems for the same base configurations and other design conditions. The effectiveness of the two systems were evaluated based on (a) system reliability, (b) operational requirements, (c) routine maintenance requirements, (d) installation requirements, (e) ease of repair, (f) terrain considerations, (g) susceptibility to attack, (h) size and weight, and (i) space requirements. Cost estimates were prepared for both systems for (a) reference design conditions, (b) optimal slope, (c) rock, (d) high water table, (e) frost, and combinations of the various site conditions. Effectiveness cost ratios were determined for each of the conditions.

For the reference design conditions, the total annual costs were estimated at $17,800 for the vacuum system compared to $25,600 for the gravity system. The effectiveness/cost ratios for the two systems were 3.37 and 1.56, respectively. Of the 18 conditions evaluated, the effectiveness/cost ratio was higher for the vacuum system in 12 cases, higher for the gravity system in 5 cases, and equal in 1 case. The gravity system was higher in those cases where optimal slope conditions were present.

The principal conclusion of this study was that vacuum sewer systems offer improved design flexibility under adverse site and construction conditions. A demonstration installation to verify design assumptions, generate design criteria, and to evaluate the performance of vacuum system components was recommended.

CR-72.016
Dynamic Behavior and Resistance of Prestressed Split Beams, N. H. Burns, E. A. Ripperger, C. Veeraiah, Austin, Tex., The University of Texas at Austin, May 1972, Contract N62399-71-C-0014, AD748650

Prestressed concrete beams concreted in two stages, having their interface at the level of the centroidal axis, are called prestressed split beams. Only the bottom portion of this split beam is prestressed. This report deals with an experimental study of the dynamic behavior and resistance of this type of prestressed beam.

Nine simply supported prestressed split beams were tested under dynamic loading and three beams were tested under static loading. The variables studied in this investigation were the interface roughness and the reinforcement parameter RF(Y) (R and F(Y) are the percent and yield point of the web reinforcement across the interface.) Two of the nine dynamic test beams had smooth composite interface while

all the remaining tests were constructed with rough interface surfaces. These surface conditions were actually not greatly different and the comparisons among companion specimens did not support any specific conclusions with regard to the difference in dynamic load capacity with rough or smooth surface.

The dynamic horizontal shear strength of the split beams was found to be less than the corresponding static strength. The dynamic flexural strength was found to be more than the corresponding static strength. Among the beams tested under dynamic loading, beams with RF(Y) of 670 failed in flexure. Among the beams with RF(Y) of 176, those having web reinforcement widely spaced (because of greater F(Y)) failed in horizontal shear, while those having closely spaced web reinforcement (because of lesser F(Y)) failed in shear compression. This may suggest that spacing of web reinforcement may be another parameter to be considered in future studies.

A satisfactory prestressed split beam may be designed to carry applied dynamic loading provided RF(Y) is sufficiently large and the web reinforcement is closely spaced. Beams designed following the ACI Code 318-71 should be safe for dyanmic loading with respect to horizontal shear failure.

CR-72.017
Development of End-Closure Systems for Undersea Concrete Pressure Resistant Cylindrical Hulls, R. G. Leonard, P. G. Norken, San Francisco, Calif., Bechtel Corporation, May 1972, Contract N62399-71-C-0017, AD746180

The purpose of this study was to develop end-closure systems for undersea concrete pressure resistant hulls. These end-closures must seal and lock concrete cylinders ranging from 20 to 60 ft in diameter. They must be removable, permitting full access when the cylinders are located on the ocean floor in 1000 ft of water and when the cylinders are located on land.

The study considers end-closure configuration including geometry and material, actuation of handling methods and sealing and locking alternates.

Areas requiring additional research and development are identified.

CR-72.018
Development and Shock Tube Test Analysis of Piston Plate Airblast Valve, R. O. Clark, Albuquerque, N.M., The Clark Valve Company, Apr 1972, Contract N62399-70-C-0009, AD747657

An airblast valve utilizing the piston plate principle is conceptually designed for use in a blast hardened air entrainment system. Primary features of this valve are the elimination of the extensive delay path external to the valve housing, the elimination of the debris pit and auxiliary power to help close the valve, insensitivity to ground shock even if some distortion of the valve housing occurs, and several less significant features.

One dimension of the valve is independent of scaling properties. This dimension was reduced about 1/6 to design a sectional test valve that would adapt to a high pressure shock tube without changing any performance characteristics associated with normal ventilation flow or shock interaction.

The sectional test valve is stress analyzed for static pressure up to 1,500 psi and dynamic interacting high pressure shock on the closure mechanism.

The sectional test valve was constructed according to the included shop drawings for tests in a high pressure shock tube. The first series of tests showed three problem areas or performance faults and indicated likely methods of solution. The second test series validated these methods of solution. Finally, repeated shock waves were applied up to the incident pressure of 250 psi (1,640 psi reflected pressure) successfully.

The normal ventilation pressure head loss through the valve was found to be exceptionally low at 0.73 inches of water for 500 cfm.

The resulting recommended modification applied to the prototype is expected to more than satisfy government specifications and requirements of the blast valve.

CR-72.019
A Finite Element Computer Program for the Prediction of the Behavior of Reinforced and Prestressed Concrete Structures Subject to Cracking, M. A. Taylor, K. M. Romstad, L. R. Herrmann, M. R. Ramey, Davis, Calif., University of California, Jun 1972, Contract N62399-70-C-0021, AD749998

The report describes the theory, development, and application of the finite element technique to a computer analysis of reinforced concrete structural members. The analysis is applicable to both axisymmetric and planar structures and represents a significant improvement over previous analyses. The analysis accounts for the nonlinear behavior of (a) concrete (in bi-axial stress states), (b) concrete-steel bond, and (c) steel (i.e., elastic-plastic response). The program predicts the states of stress and strain for the concrete, reinforcement and the bond existing between the two. Furthermore the program predicts the initiation and propagation of cracks in the concrete. In addition structures and members analyzed may contain preassigned cracks (such as caused by shrinkage) and/or initial tractions (such as prestressing).

CR-73.001
Study of Electromechanical Cable Testing and Test Specifications, J. C. Minor, Columbus, Ohio, Battelle Memorial Institute, Jul 1972, Contract N62399-72-C-0013, AD903747

The purpose of the program was to analyze present electromechanical (E/M) cable testing and test specifications for cables used in the deep ocean and to recommend research programs to correct and improve deficient areas. The work included a survey of the literature and contacts with the major E/M-cable manufacturers, users, and testing agencies. E/M-cable types were identified by application as bottom-laid, suspended-array, or ship-stored cables. Major problem areas, such as corrosion, fish-bite, and kinking, were discussed. Presently used testing methods and test applications were summarized. Four research programs were recommended for developing standard test methodologies to be applied to E/M-cable testing:

(1) Breaking strength, tension/elongation, tension/rotation, and tension/rotation tests using a tensile test machine
(2) Tension/rotation and susceptibility-to-kinking tests using a suspended cable with attached weights
(3) Bend-over-sheave tests
(4) Hydrostatic pressure tests

CR-73.002
Methods of Analysis for Very Thick Walled Cylindrical Shells, J. R. Vinson, Mar 1972, Contract N62399-71-C-0005, AD747963

Inclusive analytical methods are developed for determining stresses and deformations in very thick walled finite length cylindrical shells of isotropic materials subjected to lateral and in-plane axially symmetric loads, for all boundary conditions. Although the methods developed are accurate for thin classical shells, their unique utility lies in analyzing very thick walled shells with ratios of wall thickness to mean radius (H/R) up to 1/2.

The solution employs no shell theory assumptions. The methods involve expanding all dependent variables in series of legendre polynomials, or closely related functions, in the thickness coordinate. An n-th order theory is defined.

The theory shows that a bending boundary layer does exist at each end, but the rate of decay varies from that of classical shell theory. One can integrate various stress quantities across the thickness to define resultants and couples identical to those of classical shell theory.

When the present theory is used for the lame plane strain problem, stresses and deformation differ from the lame theory at most in the third significant figure.

Also, when the present theory is used to analyze thin classical shells, the results merge with those of classical theory. However, for thicker shells, classical theory can underestimate some stresses as much as 52% for thick shells considered.

CR-73.003 - Cancelled

CR-73.004
Concept Definition of the Navy Environmental Protection Data Base (NEPDB) System, D. N. Berg, Menlo Park, Calif., Stanford Research Institute, Aug 1972, Contract N62399-72-C-0006, AD904496L

This concept definition of the Navy Environmental Protection Data Base (NEPDB) system analyzes the user requirements for environmental data and develops characterizations of data base components. Preliminary concepts for data base organization and indexing are discussed extensively, and a number of required data files are identified. The functions that the system must perform are discussed and shown in flowcharts and more detailed signal flow diagrams.

Major alternative system operations discussed are centralized/ decentralized operations, manual/automatic operations, and index and storage media. Trade-off analyses of these alternatives are made and evaluated according to specific criteria. The results of these evaluations are then used to synthesize a set of final NEPDB system options. These options are discussed and the preferred option is recommended. Assumptions made during the course of this study are listed and recommended for further study. A phasing of the growth of the NEPDB system is discussed with subsequent recommendations.

Finally, a plan for the NEPDB Phase II effort is developed, estimates of initial system implementation costs are given, and manpower costs for initial system operation are provided.

CR-73.005
Concept Definition of the Navy Environmental Protection Data Base System, H. B. Collins, Jr., Philadelphia, Penn., General Electric Company, Jun 1972, Contract N62399-72-C-0007, AD904945L

The plan consists of: Section 1.0 - Management plan, covering personnel, organization, and management control systems, reporting and schedules. Section 2.0 - Technical plan, covering the approach to the study, the study outputs, the task definitions, and related corporate experience. Section 3.0 - Plans for ADP software and services specifications per Mil Spec 5230.1

The plan reflects and extends the Phase I effort to provide the necessary framework to accomplish the tasks outlined in paragraph 1.2.1 of RFP, N62399-72-R-006 Rev. 1 of 9 Mar 1972. The study will be accomplished by the same strong interdisciplinary team of professionals assembled during Phase I, modified as appropriate to assure the proper skills to accomplish the technical and cost tradeoffs, and test and evaluation plans as well as the preliminary design effort required for the preparation of the ADP software and services specifications.

The proposed approach during Phase II will continue to be from a total systems viewpoint with emphasis on the needs and value of the system to potential users and a cost effective balance of manual and automated processes.

CR-73.006
Naval Environmental Protection Data Base (NEPDB) System, C. V. Beckers, R. C. Joseph, R. S. Tiefeld, Portsmouth, R.I., Raytheon Company, Jun 1972, Contract N62399-72-C-0008, AD904946

The two part report presents Raytheons concept (Part I) of the Navy Environmental Protection Data Base (NEPDB) system and Raytheons plan (Part II) for Phase II of the NEPDB system development. The NEPDB system is under development as part of the NEPDB program. The objective of the program is to establish a program to gather data pertaining to air, water, land, noise and oily waste to show the extent to which the environment is affected by Naval ships, aircraft, and shore installations. The NEPDB system will be a data handling system which supplies user-required information and when developed and implemented will serve the following user-required purposes: (1) insure Navy compliance with Federal, State, and local standards and regulations, (2) demonstrate and justify the need for corrective actions to improve the environment, and (3) demonstrate the degree of improvement resulting from investments.

The conceptual system is described in terms of functional flow diagrams and information flow diagrams. Six top-level functions of the system are identified and detailed in lower-level diagrams. The development of the concept is founded on an analysis of typical user requirements as reflected in typical user questions and in Navy instructions on environmental matters. The system concept makes maximum use of existing Navy systems to provide the required capability. It is a mix of human and computerized data handling capabilities, providing for flexibility and growth. A centralized data storage and retrieval operation complements decentralized data acquisition and application functions. Use of existing computer capability is recommended.

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AD446327 - R-323

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