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SUMMARY OF RESEARCH ACTIVITIES ACADEMIC DEPARTMENTS 1980-1981.(U)
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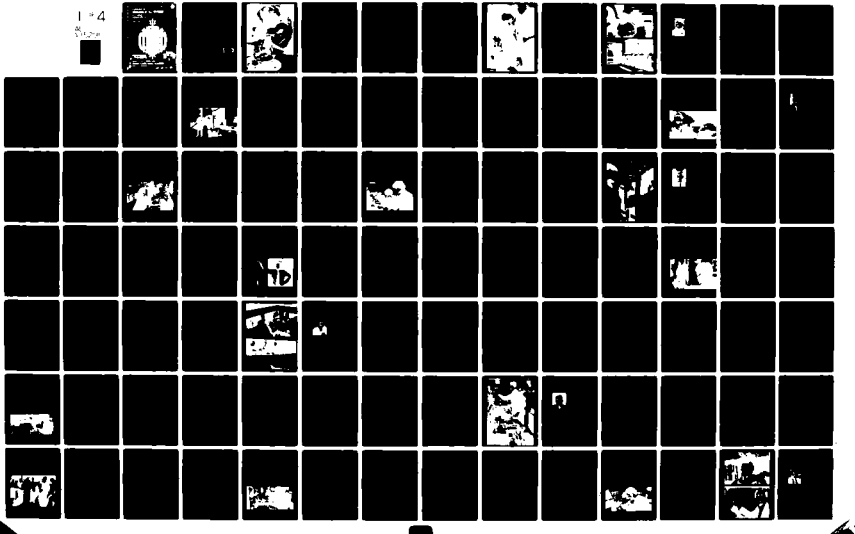

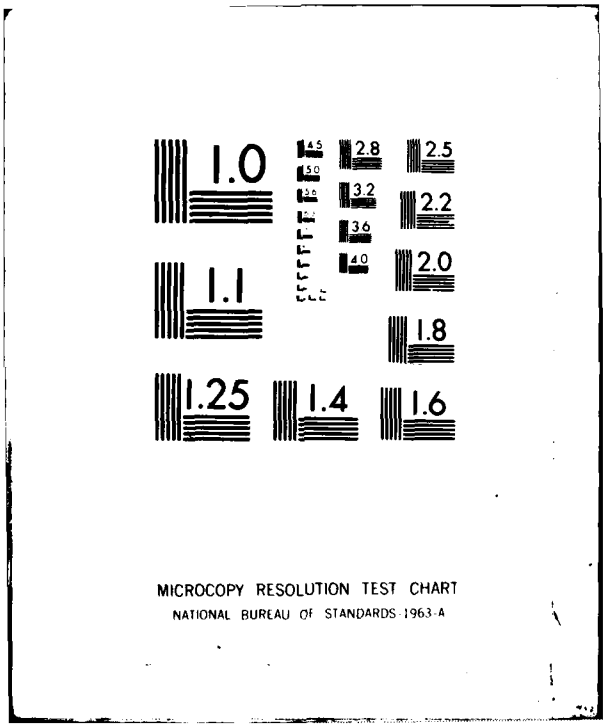
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SUMMARY
OF
RESEARCH ACTIVITIES
1980 - 1981

COMPILED AND EDITED

BY

PROFESSOR WILSON L. HEFLIN

ENGLISH DEPARTMENT

OCTOBER 1981

UNITED STATES NAVAL ACADEMY
ANNAPOLIS, MARYLAND
21402

FOREWORD

The academic excellence of an educational institution is measured by the achievements of its faculty in teaching, research, and related scholarly endeavors. It is the policy of the Naval Academy to provide and maintain an environment in which research activities that contribute to the professional growth of the faculty and outstanding midshipmen may flourish.

The research activities of the faculty range from very applied cooperative studies with the Navy research and development community to very fundamental investigations concerned with extending the frontiers of knowledge. The broad scope of research described in this annual report reflects the interests and expertise of the participating faculty and midshipmen, as well as the availability of laboratory, library and computer facilities.

This publication was compiled to acquaint the reader with faculty and midshipmen research efforts being done behind the classroom scene. Research results are published in manuscripts, reports, and prestigious journals as well as presented at important professional meetings and conferences. In addition to their teaching and research, the faculty contribute to their profession through participation in professional societies and consulting activities. This publication contains summaries of completed and on-going faculty projects, midshipmen research course projects including the Trident Scholar Program, and lists of presentations and publications. The work reported on was conducted during the period July 1980 through June 1981.

External support continues to increase significantly. This is undoubtedly due to the additional opportunities provided by new laboratories in the Engineering Studies Complex and the initiative of the well-qualified civilian and military members of the faculty. It is important to acknowledge the strong and continuous support provided by the Chief of Naval Research, Director of Navy Laboratories and the numerous activities of the Naval Material Command, without which such progress could not be possible.

Comments and suggestions related to the research efforts will be gratefully received and sincerely appreciated.

BRUCE M. DAVIDSON
Academic Dean

RICHARD D. MATHIEU
Director of Research/
Associate Dean

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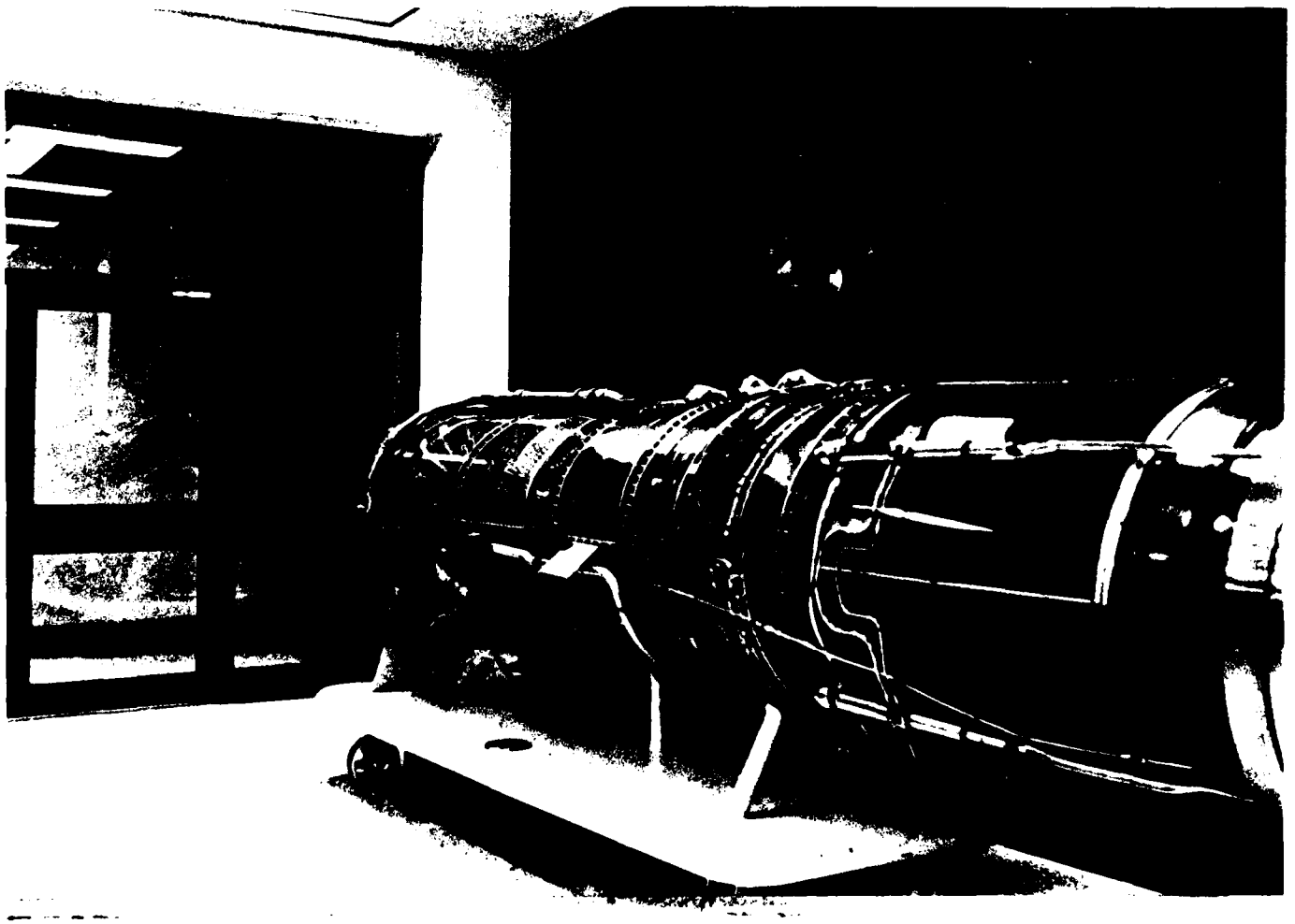

AEROSPACE ENGINEERING DEPARTMENT

Commander Paul B. Schlein, USN, Chairman

It is the objective of the Aerospace Engineering Department to continually develop its educational process. This report of the research performed in this period is a very important part of that development. The projects span engineering and depart widely from the stricture of well-trodden curricula. Midshipmen are more heavily involved than before. The researchers are required not merely to fill the gaps in the body of knowledge, but also to expand their grasp.

Measurement of the effectiveness of the educational process is always difficult. However, this year, at the American Institute of Aeronautics and Astronautics Mid-Atlantic Regional Student Conference, five of sixteen papers accepted were authored by midshipmen. Further, Midshipman Jett won first place and Midshipman Johnson, second place. These tangible indications of midshipman academic acumen are very good measures of the educational process at the Naval Academy.

Not reported herein, but important to note, was the support provided to Sir Frank Whittle in boundary-layer control, to Dr. Joseph Foa of George Washington University in cryptosteady thrust augmentation, and to the Office of Naval Research in flow-field measurements in the lee of inclined cones and cylinders utilizing state of the art laser-doppler velocimetry.

Research was a large and continuing effort in the Aerospace Engineering Department.

* * * * * *

VORTEX FLOW CONTROL APPLIED TO A RADIAL DIFFUSER

Researcher: Assistant Professor John E. Allen

Sponsor: Naval Academy Research Council

Because of the geometric limitations of certain internal flow systems, the use of a conical or rectangular diffuser for the recovery of kinetic energy as static pressure is often impractical. In these situations it becomes necessary to use a device which turns the flow from the axial to radial direction and affects the desired pressure recovery. If this turning and diffusion is to be accomplished as efficiently as possible, large distances in the radial direction with relatively narrow channel widths become necessary. The main problem with this arrangement is that as the channel widths are increased, an area of separated flow forms near entry to the radial channel and increases until the flow fails to reattach, forming a radial-wall jet. Any improvement in the pressure recovery or reduction in the length of the radial channel must be focused on this separation problem at the inlet corner. One technique which has been proven to be very effective when applied to rectangular and conical diffusers is that of Vortex Flow Control. This principle applied to a radial diffuser replaces the inlet corner by a torroidal vortex which rotates in the direction of the turning flow. The vortex aids in the turning of the flow and energizes the boundary layer to prevent separation. Many internal flow systems could make use of such a diffuser if it can be shown to be efficient and compact. One particularly attractive application is that of an exhaust diffuser for certain turbo-shaft engines.

This research was to construct, instrument and test a cold air flow model employing an annular entry to a radically diffusing channel. Parametric studies may then be conducted to optimize the performance for various flow conditions.

The test apparatus was constructed from plexiglas tubing and sheet and instrumented with pressure taps to measure mainstream flow rate, overall pressure recovery of the device, and pressure distributions along the radial channel. Preliminary results indicate that the improvements in diffuser performance suggested by flow visualization studies can be achieved. In particular, the installation of a "Coanda surface" downstream of the vortex corner resulted in a 20% increase in pressure recovery at a previously optimized configuration.

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MEASUREMENT OF SUPERSONIC SKIN FRICTION

Researcher: Professor Bernard H. Carson

Sponsor: Defense Nuclear Agency

For the past three summers, work has been conducted in the U. S. Naval Academy 6" x 6" blowdown supersonic wind tunnel under sponsorship by the Defense Nuclear Agency, in the area of high speed turbulent boundary layers. The primary goals of this work have been:

a. To modify and develop this facility into a form compatible with the measurement of turbulent skin friction.

b. To conduct a series of prototype experiments aimed at the determination of turbulent skin friction on sand-grain roughened specimens, to serve as a baseline to establish the equivalence between sand-grain roughness and other types of surface roughness in the production of aerodynamic drag due to skin friction.

During the summer of 1978, work was exclusively devoted to the complete redesign of a skin friction balance system supplied by DNA. Numerous unforeseen difficulties were encountered with this balance, including lack of sensitivity, vibrational problems, the incompatibility of the original sensing elements with the tunnel operating pressure, and so forth. These problems were for the most part resolved. At the same time, ancillary data-acquisition instrumentation was developed.

During the summer of 1979, development work continued on the balance system, and smooth surface skin-friction coefficients were measured over the range of Mach numbers of about 2 to 3.5. These results were in good qualitative agreement with previous work, and also with computed predictions supplied by Science Applications, Inc. However, results of comparable experiments using roughened surface elements were widely scattered and considerably at variance with anticipated results. It was believed that this was attributed to the lack of upstream "conditioning" of the flow to the roughness elements, and that the measurements were strongly influenced by transitory effects as the boundary layer, having been developed over a smooth surface upstream of the element, suddenly encountered the roughened element.

Accordingly, extensive modifications were made in the spring of 1980 to the balance system to permit interchangeable surfaces upstream of the test specimen. Techniques were developed to attach various types of roughness to these surfaces, so as to provide the necessary flow conditioning. A boundary layer survey-probe was

developed during the past summer to determine the velocity profiles, giving results that were in good agreement with those anticipated for the smooth plate. Four grades of sand-roughened plates were also tested. Presently, the results of these tests are still under study. Preliminary indications are that the profiles developed over the roughened elements deviate considerably from the classical profiles measured in incompressible flow, and consideration is now being given as to the rationale involved in explaining these differences.

Parallel to these efforts, a comprehensive computerized data reduction program was developed.

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AERODYNAMIC ANALYSIS METHODS

Researcher: Research Professor Arthur R. Maddox

Sponsor: Naval Air Systems Command

The main objective is to develop a computer code for the new aerodynamic analysis techniques, principally the paneling technique, which will be suitable for coupling with existing computer graphics systems to provide a capability for courses in airplane/missile design. The approach has been to use an existing large scale code representation of these techniques and scale it down in size and scope while retaining as many features as possible and still fit machine limitations. At this time, a full-scale code has been modified and made operational on the Naval Academy computer system as well as an approximately ½-scale limited version. The limited version is still slightly too large to couple interactively with the graphics system, and some more simplifications must be made. An introductory pre-program to assist in setting up a problem with this code is also being designed.

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NAHBE PROJECT

Researcher: Professor Andrew A. Pouring

Sponsor: Office of Naval Research

Now that a reasonable technical base has been established for spark ignition (S.I.) behavior of an engine operating on the heat-balanced cycle with pressure exchange, the primary objective is to gain theoretical and experimental understanding of compression ignition behavior, both carbureted and injected.

1. Parametric Variations, CFR Engine (S.I.). The previous research report on this topic was revised and extended to one additional variation. The additional variation is the use of Naval Academy Heat-Balanced Engine (NAHBE) manifold in standard S.I. piston operation. It gains in output, with better emissions, with better fuel economy than standard S.I. operations, but has a large increase in exhaust gas temperature (~200°F) and loses multi-fuel ability.

2. Heat Transfer. A simple electrical analog was developed to plot flux lines and isotherms for any piston geometry. A great deal of understanding was gained in piston heat-flows, and preliminary temperature data was obtained for several piston geometries and materials using "Temp Plug" inserts for acquiring the temperatures. These results led immediately to composite piston designs which are now under evaluation.

3. Materials Analysis. Current materials for composite pistons include grey cast iron, ductile iron, NIRESIST 1 through 5 (as is plus ductile types) and titanium. A ceramic coating was tried on aluminum with poor results. Results for NIRESIST 5 look very promising.

4. Theoretical Cycle Analysis. Since the air standard and fuel-air cycles had been examined, attention was turned to a regenerative heat-balanced cycle; this additional feature is a necessity in understanding better the limits to be expected with both S.I. and C.I. operation. An extension of the classic and quasi-equilibrium thermodynamic heat-balanced cycle to include regeneration has been made. Calculations show that recuperation of a portion of the heat rejection can produce further performance improvements beyond those of the Otto or Diesel cycles. Results of this work suggest that internal heat transfer effects in an actual heat-balanced engine are as critical as the non-steady gas dynamics in achieving optimum design and operation.

5. Non-Steady Gas Dynamic Analysis. Results of theoretical studies, experimental Fastex Schlieren and experimental holographic interferograms have been combined into one report. The simplified wave analysis using Helmholtz resonator theory is yielding extremely promising results in Midshipman William Johnson's Trident Scholar research and will ultimately lead to optimized engine-scaling parameters (from one engine to the next).

6. Parametric Testing of the CFR Engine - C.I. Mode. To facilitate this study, a second CFR engine was modified to a C.I.-NAHBE with fuel injection while the original engine remains carbureted. Long delays in acquiring parts and modifying existing ones has delayed the direct injected program. The carbureted engine has been run in the C.I. mode with several fuels, a new full range (of compression ratios) of frictional horsepower data-curves developed, and tests are currently underway on the transitional behavior from S.I. to C.I. operation. The direct injected engine is now complete except for some modification of the injector head itself.

7. Combustion Kinetics. The feasibility of extension of the kinetic cluster theory is being documented by Dr. E.R. Buckle of Sheffield University with the help of Dr. E. L. Keating, USNA. After spending several weeks at Sheffield during the summer of 1980, the thermal model proposed by Dr. A. Pouring was singled out for further investigation and is now being "reactivated" on the USNA computer.

8. Two Stroke NAHBE Application. Student projects have examined the feasibility of 2-stroke operation on a single cylinder engine. Full evaluation is not possible with the current lowspeed dynamometer, but the limited results show improvement in fuel consumption, reduced emissions, lower idle (400 RPM), and multifuel capability. The engine has started cold with JP5 fuel.

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DESIGNING A COMPUTER-AIDED DESIGN AND MODEL TESTING SYSTEM

Researcher: Professor David F. Rogers

Sponsor: U. S. Coast Guard

The researcher continues development of a Computer Aided Design/Computer Aided Manufacturing capability for ship hulls and towing tank models.

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PROPULSION EFFECT ON VSTOL PERFORMANCE IN GROUND PROXIMITY

Researcher: Professor Maido Saarlas

Sponsor: Naval Air Systems Command

One of the significant VSTOL aircraft problems is the propulsion-induced suckdown effect on the aircraft in the proximity of the ground. The suckdown (negative lift) effect is caused by the spanwise flow of the propulsion gases away from the engines. This study attempted to assess the influence of the engine doors on controlling the hot gas flow along the span. A scale model (1/30) was build and tested with cold flow at varying nozzle pressure ratios and heights from the ground. The results showed that the doors, by their deflection angle, can be used to decrease the negative lift.

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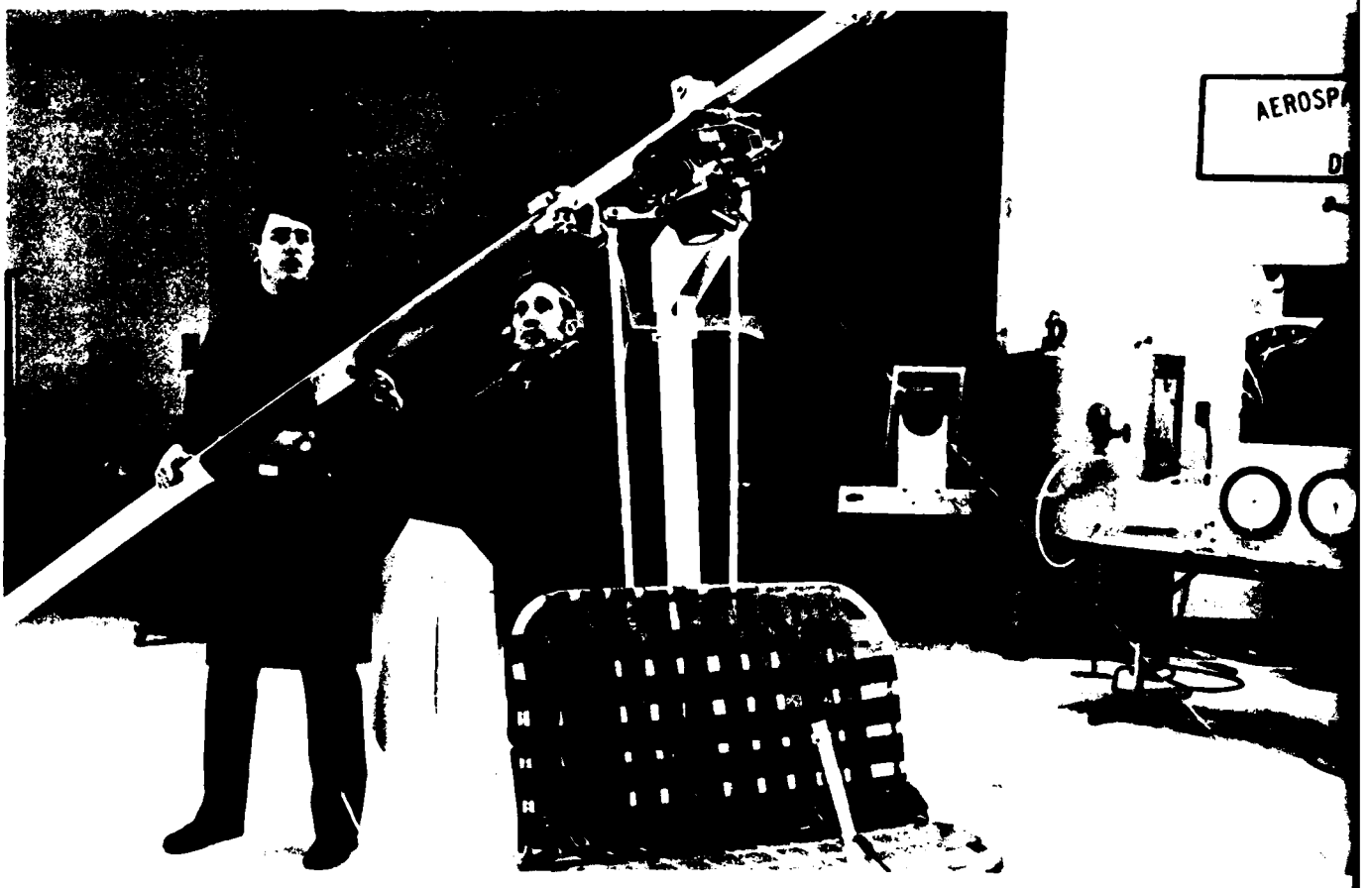

HANG GLIDER DESIGN

Researchers: Midshipmen 1/C Henry P. Aszklar, Jr. and Joseph A. Manchor

Adviser: Associate Professor Vadym V. Utgoff

The objective of the project will be to design a hang glider from conception to a complete solution. The criteria for design will be maximum performance with ease of construction. The glider will be of the single wing and tail configuration.

******

RECIPROCATING ENGINE IMPROVEMENT

Researcher: Midshipman 1/C Stuart D. Bailey

Adviser: Commander Paul B. Schlein, USN

The objectives of this study were to investigate the feasibility and effect of quench (or squish) clearance reduction on detonation, the durability of ceramic (plasma sprayed z_rO_2) on the piston tops, and the effect of selective valve shutdown for specific fuel consumption (sfc) improvement of a representative automotive reciprocating engine.

The investigation began with assembly of the modified engine and the modification of the "Go-Power" dynometer and associated instrumentation for the required testing. Early testing was performed that resulted in further modification of extant instrumentation and purchase of additional test equipment to ensure safety during high power tests. Further, initial runs demonstrated the need for corrective modifications to the power plant due to buildup of tolerances during assembly.

With completion of reassembly of the engine and instrumentation and apparatus, full evaluation of detonation limit with reduced clearance, larger duration operation for coating durability, and valve train alteration tests will be conducted.

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DETERMINATION OF THE DRAG POLAR OF THE BENSEN GYROCOPTER

Researcher: Midshipman 1/C Richard H. Fanney

Adviser: Associate Professor Vadym V. Utgoff

The drag polar of the Bensen Gyrocopter will be determined by measuring the tension in the towlime and the angle of the line with respect to horizontal datum. The component lift and drag can then be determined and the coefficients of lift and drag. This will be done at varying line angles to obtain the drag polar.

******

FEASIBILITY STUDY OF THE USE OF LIGHTER-THAN-AIR VEHICLES FOR MARTIAN SCIENTIFIC EXPLORATION

Researcher: Midshipman 1/C Thomas W. Hartline

Adviser: Professor Bernard H. Carson

Following the success of the Viking lander series on Mars, the National Aeronautics and Space Administration has been examining alternate means of extending the capability of information-gathering systems through the use of "roving" vehicles. The obvious drawback with this approach is that such vehicles can easily be frustrated by anticipated but unpredictably distributed terrain features of the Martian landscape.

This inherent disadvantage has motivated serious study of yet another alternative, which consists of an unmanned aircraft which would be transported in a collapsed form to the Martian surface, then erected and activated to fly a flight plan that would allow scientific information to be gathered over a distance of 3600 miles. This aircraft is proposed to have an endurance of 17.8 hours, and a payload of 100 kilograms. At termination, the aircraft is allowed to crash, and no provisions are made to reactivate its systems.

This study examines the feasibility of using a Lighter than "Air" (i.e., a buoyant) vehicle to perform essentially the same mission, but with the advantage that, through solar collectors, the airship could be used on a repeatable basis. The study considers size, materials, and energy requirements.

The general conclusion reached in this preliminary study is that such a scheme is feasible for the problem of supplying the

lifting gas (hydrogen) for the vehicle. Various schemes are discussed; the most promising of these is the alkali-hybrid, water method of gas generation, which would be launched in sufficient quantity by the Space Shuttle.

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OPTIMUM PISTON DESIGN FOR HEAT-BALANCED INTERNAL COMBUSTION ENGINE

Researcher: Midshipman 1/C William H. Johnson

Advisers: Professor Andrew A. Pouring and Assistant Professor John E. Allen

The Naval Academy Heat-Balanced Engine (NAHBE) has been studied extensively for the last five years. Efforts to understand and predict the complex process occurring in the engine are difficult to verify experimentally. Optimization of the output of the engine, though possible, is laborious. A possible solution to the problem of predicting the time-dependent reactions occurring in the engine and a design tool for optimization is to model the NAHBE piston cap through the application of Helmholtz Resonator Theory. This theory generalizes the time-dependent reaction of a volume of fluid in a chamber by an acoustic analog to the mechanical system of a forced oscillator. The theory enables one to predict or design the acoustic impedance of a cavity and its natural frequency by modifying the cavity and inlet geometry. This study gives a solution applying the Helmholtz Theory to predict the fluid mass displacement. The solution of the NAHBE cap reaction by the Helmholtz Theory is substantiated in this study through a high-speed Schlieren film analysis of the actual combustion process in a NAHBE.

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THE FEASIBILITY OF TURNBACK FROM A LOW ALTITUDE ENGINE FAILURE DURING THE TAKEOFF CLIMB-OUT PHASE

Researcher: Midshipman 1/C Brent W. Jett, Jr.

Advisers: Professors David F. Rogers and Bernard H. Carson

The purpose of this research is to develop the necessary computerized data acquisition and analysis capability for use with the flight simulator, and to investigate a new emergency procedure for loss of engine immediately after takeoff.

******

GYROCOPTER FLOAT RESEARCH PROJECT

Researchers: Midshipmen 1/C Richard Manski and Charles E. Odom

Adviser: Associate Professor William J. Bagaria

The purpose of this project is to design and draw the final blueprints for solid form, fiberglass covered pontoons for the department's Bensen Gyrocopter. At the completion of the project, there will be detailed shop drawings including hull lines for computer-aided cutting and shaping, thickness of fiberglass covering, placements of mounting bolts and plates, and any other information which may be found through research which would be pertinent to construction.

******

NON-STEADY FLOW ANALYSIS IN THE NAHBE BALANCING CHAMBER

Researcher: Midshipman 2/C Thomas L. Mascolo

Adviser: Professor Andrew A. Pouring

In R. P. Pandalai's original model for interface motion under the NAHBE balancing cap, he depicted a circular interface which moved from the outer wall of the combustion chamber to the stem of the cap. The area seen by the interface would be continuously decreasing as it moved towards the cap stem. This model necessitates that the shock wave make a 90-degree turn as it passes through the clearance gap.

An alternate model would be to allow the shock wave to pass straight through the gap and continue in the same direction as in the combustion zone. In this model, the flow would see an increasing area as it traveled towards the power piston. The area change can be thought as a series of finite area changes beginning with an initial decrease in area to account for passage through the clearance gap, and then increasingly larger area ratios. Using the known dimensions of the pressure exchange cap, exact ratios can be determined. These ratios can then be used to find the shock Mach numbers at various locations under the cap.

The result of these calculations shows that the original model is valid but that the shock wave strength emitted from the balancing chamber is increased by the present treatment.

******

THE PROPULSIVE TAIL

Researcher: Midshipman 1/C Laurence M. Myers

Adviser: Commander Paul B. Schlein, USN

It was the objective of the study to determine the feasibility of integrating the vertical and horizontal stabilizing surfaces of an aircraft into an aft-mounted propeller-propulsion system. The investigation was begun by deriving a computer program for the calculation of minimum induced loss propellers. That was accomplished following Larrabee of M.I.T. and modifications for Reynolds effects. Following that, a propeller sideforce computer code was derived based on the work of Rebner and modified for the effect of Mach number. Finally, the two codes were placed together in an interactive routine that would calculate the efficiency and side force for a given propeller and operating condition. The results of such calculations can be reduced to equivalent horizontal and vertical tail size and the resulting thrust horsepower increment or decrement determined.

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UTILIZATION OF ROTOR-STORED ENERGY FOR HURDLING TERRAIN OBSTACLES

Researchers: Midshipmen 1/C C. Robert Perry and David M. Sperling

Adviser: Associate Professor Vadym V. Utgoff

The objective of this project is to design, build, and test a model of a simple strap-on autogyro which will utilize rotor-stored energy to enable a marine to hurdle combat zone obstacles such as rivers, swamps, deep canyons, and the like.

Even the most simple one-man helicopter is an extremely complicated device. It is, therefore, costly, expensive, and difficult to maintain and does not lend itself to mass production. A helicopter requires either dual counterrotating rotors, or an anti-torque tail-rotor, to function. It also requires a swash-plate consisting of large bearings and an array of push rods for control.

By contrast, an autogyro, needing no anti-torque devices, can be controlled through a simple universal joint. For short flights, the necessary energy can be stored in the rotor itself in the form of kinetic energy of rotation. The rotor blades must be put into flat pitch and the rotor must be brought to the highest possible

rotational speed by utilizing a small engine. On takeoff, the blades are given positive pitch to produce lift. During the ensuing climb, rotor speed will decay, and when it falls to its operating minimum, blade pitch must be reduced to maintain this value during the balance of the flight.

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FABRIC ROTOR

Researcher: Midshipman 1/C Michael J. Rounds

Adviser: Associate Professor Vadym V. Utgoff

The maximum speed of rotary wing aircraft is limited by stall on the retreating blade and the drag divergence Mach number of the advancing blade. It has been proposed that rotary wing airspeeds can be increased by using a wing for lift at high speeds and by retracting or removing the rotor. One such means involves the use of highly flexible rotor blades which can be retracted in the manner of an automobile seat belt.

It is proposed to investigate the feasibility of designing a fabric rotor blade on the principle of a parawing. In the latter, shape is maintained by ram pressure; in the former, by centrifugal pumping.

A fabric rotor blade will be made and tested in the rotor laboratory. An analysis will be made to support the feasibility of the concept.

******

VORTEX FLOW CONTROL DIFFUSER TESTS

Researcher: Midshipman 1/C Robert A. Shafer

Adviser: Assistant Professor John E. Allen

Goals of this project, a continuation of the adviser's NARC sponsored summer project, include 1) re-instrument test apparatus and complete parametric analysis to determine the influence of certain geometric variables and flow conditions on the performance of the diffuser; 2) modification of the computer-control programs for efficient data taking; 3) development of a more efficient data analysis program which will allow results to be processed on the time-sharing facilities during the data-taking operations; and 4) optimization of diffuser performance and obtaining results for various configurations.

******

CARSON, Bernard H., Professor, "Wing in Ground Effect - Vehicle of the Future?" , AIAA Advanced Marine Vehicles Newsletter, (Summer 1980), 1-2.

Since aircraft are normally designed with enough power to climb to an efficient cruising altitude, ground effect has not, until recently, played an important role in vehicular performance.

This article surveys developments of utilization of "ground effect," the most significant being the X-112 aircraft designed in the 1960's by the late Dr. Alexander Lippisch. Probably the most important contribution resulting from this effort was the demonstration that it is possible to design a craft which is stable both in and out of ground effect. Hitherto, this had been one of the major obstacles, since the center of pressure on an airfoil changes dramatically with ground effect, giving rise to large changes in pitching moments. Concurrently, and possibly as a result of Lippisch's success, the Soviets began serious work on developing their versions of ram wing vehicles, a number of which have flown successfully. To date, all such craft have been built in small experimental sizes, corresponding in gross weights to small personal aircraft, the exception being one Soviet craft of about 7 tons. Interest in these craft has also evolved in Great Britain and France.

During the past five years, considerable U. S. interest has developed in the "Power Augmented Ram" wing (PAR) concept, in which the thrusters are located so that a portion of the high-pressure exhaust gas is blown under the wing, enhancing or augmenting the ram wing effect, which is particularly beneficial at low speeds.

******

MADDOX, Arthur R.,Research Professor, "Correlations of Store Separation Trajectories with General Techniques of Analysis," AIAA Journal of Aircraft, (November 1980).

A series of store drops was made at moderate to high subsonic speeds with the same configuration on the center position of a triple-ejector rack (TER) on an F-4 inboard pylon. The data were compared wind tunnel and mathematical simulations. Both estimation techniques predicted the general nature of the motion, especially at low speeds, but failed to predict a minor collision observed at high speed.

******

POURING, Andrew A., Professor, and RANKIN, Bruce H., Professor, "Time Dependent Analytical and Optical Studies of Heat Balanced Internal Combustion Engine Flow Fields," EW Report 13-80.

Comparison is made of the non-steady combustion and flow processes predicted by the method of characteristics for time dependent compressible flow in a heat-balanced engine with photographic records of combustion flow fields observed by high speed Fastex Schlieren and Holographic interferometry. Pressure exchange and the accompanying mass transport are demonstrated analytically and observed optically. Qualitative agreement between the initial top dead center calculation and photographic evidence is seen. Schlieren and interferometer records give typical combustion flow field interactions through all strokes of an operating four stroke glass walled two dimensional engine. At least four modes of time dependent combustion are identified over the entire power stroke and the influence of geometry on the control of combustion chamber pressure and temperature is discussed.

******

GILLERLAIN, Joseph D., Jr., Associate Professor (Mechanical Engineering) and POURING, Andrew A., Professor (Aerospace Engineering), "Experiments on Condensation of Water Vapor by Heterogeneous Nucleation," 12th International Symposium on Rarefied Gas Dynamics, Charlottesville, Virginia, 7-11 July 1980.

******

POURING, Andrew A., Professor (with others), "Parametric Variations of a Heat Balanced Engine," ASME Fluids Engineering/Applied Mechanics Conference, Boulder, Colorado, June 1981.

******

ROGERS, David F., Professor, and SATTERFIELD, Steven G., Jr., "B-spline Surfaces for Ship Hull Design," Computer Graphics 80, Brighton, England, 13-15 August 1980 and at SIGGRAPH 80, Seattle, Washington, 14-18 July 1980.

******

ROGERS, David F., Professor, co-author, "Interactive Graphics and the DNC Production of Complex Three Dimensional Shapes," National Computer Graphic Association Conference, Baltimore, Maryland, 14-18 June 1980.

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ELECTRICAL ENGINEERING DEPARTMENT

Professor Francis Joseph Eberhardt, Chairman

Research in the Department of Electrical Engineering serves three purposes: it supports continuing development of the faculty; it provides an important element of applied engineering for midshipmen who participate in projects; and it contributes new knowledge to the disciplines. The second of these purposes is the most important at the Naval Academy. Research must provide the basis for a strong undergraduate program. Therefore, in addition to advancing the frontiers of their research areas, faculty members are committed to maintaining dynamic and challenging projects for midshipmen who choose to specialize in electrical engineering. Participating midshipmen have the opportunity to engage, with faculty members, in unstructured scientific effort of a wide variety. Thus, they are exposed to some of the techniques applied to the solution of practical engineering problems. Research activity provides midshipmen the opportunity to learn how the engineering community responds to the ever-expanding needs of the service.

The Department of Electrical Engineering has continued to expand its capabilities for research and development in both the software and hardware of microprocessor systems. Support is now being received from the Naval Ship Research and Development Center (NSRDC), Naval Research Laboratory (NRL), and the Naval Surface Weapons Center (NSWC). This support involves not only some hardware costs and intersessional faculty salaries but the engineers at these Navy research and development centers are actively cooperating in finding areas in which small projects related to "real-world" problems can be effectively engineered by midshipmen in EE49X (Research Studies) courses and by Trident Scholars. This is a valuable experience for an undergraduate in any case. For the Navy and the prospective naval officer, it provides the benefits of producing junior officers who have not only had practical engineering experience but have an insight into the complex relationship between the Navy's own research and development community and the operating forces.

******

RADIATION TESTING OF SPECIALLY-PROCESSED SEMICONDUCTOR TEST-UNITS

Researcher: Associate Professor Richard L. Martin

Sponsor: Naval Research Laboratory

Radiation hard semiconductor devices are required by the U.S. Navy. To maintain or increase the radiation hardness levels of the next generation of integrated circuits, several variations or additions to the existing processing steps have been proposed. The resulting matrix of variations in design and processing is too extensive to have the individual elements prototyped. Radiation testing and evaluation of special test units incorporating both design and processing variations are used to help direct semiconductor manufacturers through the matrix, leading to optimum radiation hardening techniques.

******

RADIATION CHARACTERIZATION OF CERTAIN 2107-TYPE DYNAMIC RANDOM ACCESS MEMORIES

Researcher: Associate Professor Richard L. Martin

Sponsor: Naval Research Laboratory

A group of early version 2107A, recent 2107C and one specially processed 2107-type dynamic random access memories were studied to determine their tolerance to ionizing radiation. Each device studied was exercised and measured both in-source and out-of source. Characterization and comparisons were made covering total dose-failure levels, retention time degradation, and failure mode.

*****

A DEVELOPMENT SYSTEM TO SUPPORT THE CREATION OF SPECIAL PURPOSE MICROPROCESSOR CONTROLLERS

Researcher: Professor Ralph P. Santoro

Sponsor: Influence Mechanisms Branch, Naval Surface Weapons Center, White Oak

The requirement for special purpose controllers to support the mission of Section U-12 of the Influence Mechanisms Branch established their need for an in-house development system that would make the creation of these controllers more efficient.

During the development system specification phase, it became clear that the typical controller to be developed would be an excellent engineering design project for a midshipman, First Class. The potential benefits to all from midshipman involvement in these controller designs, motivated the creation of twin development systems, one at the NSWC and one at the USNA. With this arrangement, a midshipman could start the project at USNA and move to NSWC upon graduation.

The first midshipman controller project (a memory-box analyzer) was begun in January 1981 and our experience thus far has been very satisfactory.

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MISSILE DATA-ACQUISITION SYSTEM USING 24K OF CMOS 12-BIT RAM

Researchers: Associate Professors Antal A. Sarkady and Herbert M. Neustadt

Sponsor: Naval Surface Weapons Center, White Oak

A high-speed internal data-acquisition and CMOS RAM data-storage system was designed to measure and record the dynamic behavior of missiles and torpedos during the air-water interface. The system is internal to the missile and, on recovery, the stored data is preprocessed by a microcomputer-based ground support system. A prototype was built and tested during the summer of 1980 and was delivered during the fall with two models of the ground-support system.

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DESIGN OF AN ULTRASONIC IMAGING SYSTEM TO DETECT CORROSION PITS IN BOILER PIPES

Researcher: Associate Professor Antal A. Sarkady

Sponsor: Naval Ship Research and Development Center

Design of an ultrasonic detector and positioning system was completed during the academic year 1980-1981. The detector is part of a portable instrument to be used aboard ship for assessing corrosion pits in boiler pipes.

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DEVELOPMENT OF SIGNAL PROCESSING PROGRAMS FOR LEAKAGE MEASUREMENTS IN HYDRAULIC RAMS AND SEALS

Researcher: Associate Professor Antal A. Sarkady

Sponsor: Naval Ship Research and Development Center, Annapolis

An interactive command scanner program was written in TI9900 assembly language for the SP16 signal processor. The program greatly facilitates usage of the SP16 algorithms. The program was completed and delivered to NSRDC during the summer of 1981 where it was applied in the measurement of leakage rates in hydraulic rams and seals.

*****

UNIVERSAL MOTOR CONTROLLER IGNORES LINE RESISTANCE

Researcher: Professor Stephen H. Burns

The purpose of this motor control circuit is to keep the motor voltage independent of a varying resistance in the ac line while allowing, nevertheless, the ac source voltage to exercise control over the motor's speed.

The goal was to develop an inexpensive and compact solution of what appeared to be a previously neglected electronics or controls problem. While the immediate vehicle was a toy train, the resulting ideas are applicable to a much wider range of systems.

The plan was conceived in block-diagram form in December 1979. The first block would take advantage of Thevenin's theorem to deduce the open-circuit source voltage when negligible current was drawn. The second and final block would power the motor with (or see that the motor speed was proportional to) a voltage that was a predetermined function of the deduced, open-circuit, line voltage. The investigations consisted of devising and testing promising realizations of these blocks.

In summary, problems suggested by the following topics were encountered and overcome: dependence of the voltage-sensing circuit on temperature, dependence of the voltage-sensing circuit on the back electromotance of the controlled motor, wide dynamic range of input and output voltages, and conversion of reciprocal time to voltage.

The controller is reasonably well-engineered, and its status is considered "completed." A remarkably simple and linear reciprocal-time-to-voltage converter was found. It deserves a literature survey and, if not already published, a few measurements and a short writeup of its own.

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SINGLE-CHIP MICROCOMPUTER APPLICATIONS

Researcher: Associate Professor Tian S. Lim

Recent advances in NMOS technology have made it possible for the integrated circuit industry for the first time to place enough capability on a single silicon die to create a true single-chip microcomputer containing all the functions required in a digital processing system. Intel's 8748 is a 40-pin single-chip microcomputer consisting of: (a) a central processing unit, (b) program memory, (c) data memory, and (d) input/output ports. In this project various applications of 8748 were investigated.

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DESIGN OF A HIGH-SPEED SOLID STATE MICROCOMPUTER TO VCO INTERFACE

Researcher: Midshipman 1/C Michael Kennedy

Adviser: Associate Professor Richard L. Martin

An interface between an 8080A central processor board and an integrated circuit voltage-controlled oscillator was designed using all electronic switching to obtain range-stepping. Preliminary calculations were performed to optimize the transitions between ranges. A printed circuit board was designed and implemented, and basic operational checks were made.

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DESIGN AND DEVELOPMENT OF A MEMORY BOX ANALYZER

Researchers: Midshipmen 1/C Ronald B. Hawkins, Robert McDowell, and Michael Shields

Adviser: Professor Ralph P. Santoro

The memory box is an apparatus that is placed in the ocean to record seismic and acoustic events for durations of up to 45 days. Information retrieval was accomplished manually and was time-consuming and error-prone. The memory box analyzer is a device which automates the information retrieval process and provides for automatic test and evaluation of the memory box as well.

The work during the spring semester included the design of the microprocessor-based analyzer and the construction of a prototype. Each student contributed a portion that included both hardware and software components. Testing of the prototype has been done and the design has been finalized.

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A DIGITAL DELAY LINE

Researcher: Midshipman 1/C Peter A. Polcari

Adviser: Associate Professor Antal A. Sarkady

A high-speed, dual-channel digital delay line was designed and developed intended for sonar signal-processing. The system uses 12-bit analog-to-digital and digital-to-analog converters for

data acquisition and display and a T.I. TMS9911 direct memory access controller for data storage. The maximum analog sampling rate is 100 kHz, and the maximum delay time is approximately 4 msec. The system is configured on a TM990/512 board, and it is pin compatible with TM990/101M microcomputer bus structure.

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A HIGH-SPEED ULTRASONIC DATA ACQUISITION SYSTEM

Researcher: Midshipman 1/C A. D. Scott

Adviser: Associate Professor Antal A. Sarkady

A high-speed, programmable data acquisition and random-access storage system was designed and developed to digitize "echo" returns obtained from a 10 MHz ultrasonic transducer. The analog echo signal is digitized by an 8-bit "flash" converter with a maximum rate of 30 MHz and up to 1K byte of data can be buffered in the bipolar solid state random access memory. The system is configured on a TM990/512 board and it is pin compatible with the TM990/101M microcomputer bus structure.

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DEVELOPMENT OF A DIGITAL PLOTTING PROGRAM FOR THE TM990/101M MICROCOMPUTER

Researcher: Midshipman 1/C Michael Shields

Adviser: Associate Professor Antal A. Sarkady

A T.I. 9900 assembly language program was developed to produce high speed and high resolution labeled plots on the Integral Data System, Inc. model 460 "Paper Tiger" impact printer. The program employs auto scaling and generates dark vector between data points using an "orange" buffer. The printer/plotter uses standard 8-inch-wide impact paper and the resolution for both the X and Y axis is 82 points per inch.

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DESIGN AND DEVELOPMENT OF A 16-BIT MICROCOMPUTER SYSTEM FOR ULTRASONIC APPLICATIONS

Researcher: Midshipman 1/C C. B. Vagts

Adviser: Associate Professor Antal A. Sarkady

A 16-bit microcomputer and positioning system was designed and developed to scan ultrasonic targets. The positioning system uses DC servo-motors and position transducers in a closed loop mode to provide three degrees of freedom. A TM990/101M microcomputer controls the ultrasonic scanning sequence and initiates the "pinging". The resolution of the positioning system is approximately .01 inches and the maximum "pinging" rate is approximately 1 KHz.

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BURNS, Stephen H., Professor, "Train Speed Controller Ignores Track Resistance," Electronics, 53(September 1980), 135-137.

The purpose of this motor-control circuit is to keep the motor voltage independent of a varying resistance in the ac line while allowing, nevertheless, the ac source voltage to exercise control over the motor's speed. Near the zero crossings of the source, the circuit disconnects the motor and measures the time during which the open-circuit source voltage is within some reference voltage of zero. This time is inversely proportional to the slope (and hence amplitude) of the source voltage. The inverse-time-to-voltage converter develops a control voltage that is directly proportional to the source voltage. The power stage develops an average output voltage across the motor that is directly proportional to the control voltage. Because the power stage operates efficiently in a switching mode and because the remaining active functions are fulfilled by only two signal transistors and an LM3900 IC, the circuit will fit in the tender of a typical model locomotive.

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LIM, Tian S., Associate Professor, co-author, "Single-Chip Microcomputer Application in High Altitude Balloon Orientation System," IEEE Circuits and Systems Magazine, 2(December 1980), 1-7.

This paper describes the application of a single-chip microcomputer in a high-altitude balloon instrumentation system. The system, consisting of a magnetometer, a stepping motor, a microcomputer and a gray code shaft-encoder, is used to provide an orientation reference to point a scientific instrument at an object in space. The single-chip microcomputer, Intel's 8748, consisting of a CPU, program memory, data memory and I/O ports, is used to control the orientation of the system.

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LIM, Tian S., Associate Professor, co-author, "Application of Microprocessors in an Upper Atmosphere Instrument Package," Proceedings of IEEE Southeast Conference 1981, (April 1981), 832-836.

Some scientific instruments to be flown in the upper atmosphere for the purpose of studying gamma-ray phenomena have to be pointed at a celestial object. A common practice at NASA is to fly the instrument package on a balloon to a height of about 20 to 30 miles and keep it at that altitude for a specified length of

time to gather information. In order to point the instrument at the target object, one must determine a geocentric reference system and calculate a set of pointing directions with respect to that system. This paper describes a servo-driven magnetometer table which measures offset from magnetic north. This measurement, along with local vertical, GMT (Greenwich mean time) and target declination and right ascension, is used to calculate payload azimuth required to point at the celestial target.

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MARTIN, Richard L., Associate Professor, "Radiation Testing of Recent Vintage 8080A Microprocessors From Several Manufacturers," IEEE Transactions on Nuclear Science, NS-27 (August 1980), 1332-1333.

A novel radiation experiment was performed using recent vintage 8080A-microprocessors from several manufacturers. Functional self-tests were continuously monitored during irradiation. Total dose-failure levels as well as implications of dose-rate dependency and mode of failure are noted.

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SARKADY, Antal A., Associate Professor, "An Interactive and Recursive Signal Processor 16-bit Microcomputers," Proceedings of the Society of Photo-Optical Instrumentation Engineers on Real-Time Signal Processing, (July 1980), 279-285.

An interactive and recursive signal-processing system was designed using a top-down approach. The system design is flexible and readily adapts to many types of signals. This is obtained by defining a set of signal processing procedures which permits a rich set of algorithm branches and domains. Recursion paths in the system allow signal enhancement and waterfall displays of intermediate results. Four re-entry points into the system provide for interactive or continuous processing. The system has been implemented with the 16-bit TI9900 microcomputer and used extensively for both research and instructional purpose. Commonly-used signal processing algorithms have been timed and results are presented.

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ALLEY, Reuben E., Jr., Professor, "Windmills," Winter Meeting of the American Association of Physics Teachers, New York City, January 1981.

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ALLEY, Reuben E., Jr., Professor, "Sixteenth Century Machines: Ramelli's Le Diuerse et Artificiose Machine," Summer Meeting of American Association of Physics Teachers, Stevens Point, Wisconsin, June 1981.

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LIM, Tian S., Associate Professor, "Applications of Microprocessors in an Upper Atmosphere Instrument Package," IEEE Region 3 Conference, Huntsville, Alabama, 8 April 1981.

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MARTIN, Richard L., Associate Professor, "Closed Loop Motor Speed and Oscillator Frequency Control Using a Microprocessor," ASME Annual Winter Meeting, Chicago, Illinois, November 1980.

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MARTIN, Richard L., Associate Professor, "Microprocessor Applications Seminar," ASEE Annual Conference, University of Massachusetts, Amherst, June 1980.

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SANTORO, Ralph P., Professor, "Microcomputer Applications to Education," Association of Independent Maryland Schools Annual Fall Conference, Baltimore, 17 November 1980.

*****

SARKADY, Antal A., Associate Professor, co-author, "An Interactive and Recursive Signal Processor for 16-bit Microcomputers," Society of Photo-Optical Instrumentation Engineers, San Diego, California, July 1980.

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SARKADY, Antal A., Associate Professor, "Measurement of Probability Density Functions Using a 16-bit Microcomputer," The American Society of Mechanical Engineers, Chicago, Illinois, November 1980.

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MECHANICAL ENGINEERING DEPARTMENT

Professor Thomas W. Butler, Chairman

Faculty and midshipmen research in the Mechanical Engineering Department covers many of the areas of specialization in mechanical engineering. These include research in direct energy conversion, fluid mechanics, heat transfer, solid mechanics, acoustics, dynamic effects, stress corrosion cracking, fracture mechanics, composite materials, welding, design, and computer-aided graphics.

Research is supported through funds from six different government agencies with the David W. Taylor Naval Ship Research and Development Center, Annapolis Laboratory, providing opportunities for several faculty members to work on projects during the intersessional period. Additionally, some faculty members have undertaken independent research in their areas of expertise. Including all levels of research, 13 civilian and two military faculty members have been active in the research of the Department this year.

An important part of the Department's research effort each year is the involvement of midshipmen in independent research, design, and development projects. Current midshipmen interests include the Naval Academy Heat Balanced Engine, computer graphics, corrosion, impact, mechanical testing, and many aspects of fluid mechanics.

Supporting the research effort in mechanical engineering are the extensive laboratory facilities located in Rickover Hall. The Department maintains facilities for performing experimental research in several areas: fluid mechanics, solid mechanics, materials science, experimental-stress analysis, control systems, mechanical vibrations, heat transfer, and thermodynamics.

The primary driving force behind the Department's research is the need for the faculty to stay abreast of developments in many diversified areas of mechanical engineering, thereby enabling them to be more effective classroom teachers.

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LIGHT WEIGHT ARMOR MATERIALS TESTING

Researcher: Professor Thomas W. Butler

Sponsor: Naval Surface Weapons Center, White Oak Laboratory

This project involves developing testing techniques and performing mechanical tests (quasi-static) on candidate light-weight armor materials. Testing is underway.

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OPTIMUM REQUIREMENTS FOR A SHAFT SEAL RESEARCH AND DEVELOPMENT FACILITY

Researcher: Associate Professor Elliott E. Dodson

Sponsor: David W. Taylor Naval Ship Research and Development Center, Annapolis Laboratory

Summer work for DTNSRDC, Annapolis, was spent developing plans and specifications for a Seals R&D facility.

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ANALYSIS OF DATA FOR PROJECT LINEAR CHAIR

Researcher: Professor John O. Geremia

Sponsor: David W. Taylor Naval Ship Research and Development Center, Annapolis Laboratory

A second set of data has been evaluated for NSRDC, Annapolis. This project is classified.

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DESIGN OF EXPERIMENTS FOR CORROSION TESTS

Researcher: Professor John O. Geremia

Sponsor: David W. Taylor Naval Ship Research and Development Center, Annapolis Laboratory

Turbine components are subject to severe corrosion effects in a sea environment. These components will corrode because of temperature level, fuel/sulfur content, salt water content and other causes. The general approach to solving this problem has been to coat the components, especially blades, with a protective

surface. Various modes of corrosion take place at different combinations of variables. The test plan takes this into account and is designed to separate the various individual and interaction effects of the variables. The test plan is aimed at determining which combination of variables gives the most severe/least severe effect and which coatings should be used over the range of conditions.

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MODEL DEVELOPMENT FOR UNDERWATER EXPLOSIONS

Researcher: Professor John O. Geremia

Sponsor: Naval Surface Weapons Center, White Oak Laboratory

This is a long term, ongoing project. Its objective is to develop a mathematical model for underwater explosions that is more descriptive of the actual phenomenon than the present model. The development of the model requires a mathematical procedure and a measurement procedure, to disentagle various spurious effects from the explosive signal; these include, bottom reflections, gage effects, and cable effects.

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TEST PLANS FOR EVALUATING BURNING CHARACTERISTICS OF ELECTRICAL CABLES

Researcher: Professor John O. Geremia

Sponsor: David W. Taylor Naval Ship Research and Development Center, Annapolis Laboratory

Electrical cables are believed to be a prime source of spreading fire from one compartment to another on ships. Presently, their burning characteristics are determined by a "Ladder Test," which has proven inadequate because of the way the tests are run. A new test has recently been developed called the Ohio State University (OSU) test. The objectives of this research were to (1) construct a test plan to obtain useful data from ladder tests on burning characteristics; (2) construct a test plan for the OSU apparatus; (3) design each test plan so that the two types of tests may be compared and correlated; and (4) make recommendations on instrumentation.

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INVESTIGATION OF VORTEX-CONTROL FIN INTERACTIONS

Researcher: Associate Professor Joseph D. Gillerlain, Jr.

Sponsor: Naval Surface Weapons Center, White Oak Laboratory, Naval Air Systems Command

The objective of this investigation is to develop predictive methods for the aerodynamic behavior of missiles and aircraft experiencing vortex impingement on control surfaces. Detailed knowledge of the three-dimensional viscous flow field, as determined from wind-tunnel experiments, is required in order to model the vortex-fin interaction and to develop predictive methods.

The experimental measurements will be made in the U. S. Naval Academy Aerodynamics Laboratory subsonic Aerolab windtunnel. A pressure distribution model consisting of a rectangular fin with a cylindrical leading edge has been built. The fin is adjustable for angle-of-attack.

Non-intrusive flow measurement and flow visualization techniques will be used, to include three-dimensional laser Doppler velocimetry (LDV) and the fluorescent mini-tuft method, respectively. The pressure distribution data will be integrated to obtain aerodynamic forces, which will be compared with force balance data. Results of various conventional methods of wing/fin analysis will be compared to the measured aerodynamic loads.

Force moment and pressure distribution data have been obtained for one free-stream velocity and one vortex strength for ten vortex generator upstream positions and five fin angles of attack. In addition, three dimensional flowfield laser-Doppler velocimeter (LDV) measurements have been completed for two upstream positions of the generated vortex and for three fin angles of attack. LDV measurements were obtained upstream of the fin and in planes at three chordwise stations on the fin on both the windward and leeward sides. Data reduction and analysis is in progress.

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TOWED SUBMERSIBLE VEHICLES

Researcher: Professor Robert A. Granger

Sponsor: Naval Coastal Systems Center, Panama City, Florida

This is an experimental study of the stability characteristics of a slender body being towed at arbitrary lengths of flexible cable, variable depths, and speeds at various excitation frequencies and amplitudes in the vertical and longitudinal sides. The facility being used is the USNA Tow Tank, where large towing apparatus have had to be designed and manufactured. The project is nine months behind schedule because of the ordering of material, availability of technical help, and use of the tow tank for academic research.

Lieutenant Commander J. Shoemaker is using this research as part of his Masters thesis at the University of Maryland.

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3-D LASER DOPPLER VELOCIMETRY ON SLENDER BODIES

Researcher: Professor Robert A. Granger

Sponsor: Naval Coastal Systems Center, Panama City, Florida

The first phase of this research is to investigate an experimental procedure for measuring the three-dimensional unsteady velocity field around a slender body at arbitrary large angles-of-attack in water using LDV. Since 3-D laser doppler velocimetry is in the pioneering stage, this work will be a definition study on use of backward or forward scatter, optical to mechanical set-ups of the laser in a large depth of field in water. Matching of index of infraction will be of prime importance.

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VERTICAL POSITION, GMAW-PULSED CURRENT WELDING OF 4-INCH-THICK Ti-6Al-2Cb-1Ta-0.8Mo ALLOY

Researcher: Associate Professor Dennis F. Hasson

Sponsor: David W. Taylor Naval Ship Research and Development Center, Bethesda, Maryland

A 4-in-thick Ti-6Al-2Cb-1Ta-0.8Mo alloy weldment was fabricated using gas metal arc pulsed current welding in the vertical

position to evaluate out-of-position welding techniques. Chemical composition, tensile strength, compressive strength, Charpy V-notch energy, and dynamic tear energy met specification requirements. Elastic-plastic J_{Ic} fracture toughness of the weld metal was also measured. A variation with respect to weld direction in the tensile yield and ultimate strengths was observed with the longitudinal direction being the stronger. The 0.2-percent offset yield and ultimate tensile strengths were slightly less, and fracture toughness values were higher than those reported previously for a 4-inch-thick gas metal arc spray flat position weldment. There was a definite dependence of Charpy V-notch energy value on temperature. The Charpy V-notch energy values for the weld metal exceeded those of 4-inch-thick beta processed plate. Welding of 4-inch-thick plate in the vertical position by the gas metal arc welding-pulsed current process produces satisfactory welds.

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DYNAMIC KEY CURVE TESTING METHOD DEVELOPMENT

Researcher: Associate Professor James A. Joyce

Sponsor: David W. Taylor Naval Ship Research and Development Center, Annapolis Laboratory

The purposes of this research are (1) to develop a Key Curve Analysis method to determine the J-R curve and J_{Ic} for elastic-plastic materials loaded at 100 in/sec.; (2) evaluate the effect of loading rate on the Key Curve function for a single material and explore the separability of strain rate effects and crack length effects, and (3) develop and test a computerized tearing instability test and demonstrate its comparability to the compliant test machine approach using compact specimens and a pipe of 4" diameter.

A test method will be developed, to utilize ½ T scale bend bars loaded statically and at 100 in/sec to develop a key curve function to analyze load displacement records of 1T scale bend bars to obtain J-R curves and J_{Ic} at static loading rates and 100 in/sec load point rate. The two key curve functions will then be compared to evaluate the degree of coupling present between crack length dependence and strain rate dependence of the key curve function. Utilizing a PDP 11 computer controlled servo-hydraulic machine, the researcher will simulate a compliant test machine to attempt to produce instability behavior in compact specimens of HY130 and in 6061-T6 pipe of 4" OD and 0.25 in. wall thickness. These results will be compared with results obtained in a spring compliant displacement controlled test machine.

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J-R curves have been obtained from compact specimens of A533B steel loaded at static loading rates and at 10 in/sec load point velocities. These results have shown an increase in J_{I_c} but little or no effect on the material tearing modulus. Tearing instabilities have been obtained on compact specimens using the compliant displacement controlled test machine. Accurate simulation of structural loading, though, would more inexpensively be generated if a computer could be used to apply the applied tearing force rather than building a structural model, and for this reason a computer-controlled machine simulating a compliant structure would be of great value.

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FATIGUE CHARACTERIZATION OF ASEM WELDMENTS

Researcher: Associate Professor James A. Joyce

Sponsor: David W. Taylor Naval Ship Research and Development Center, Bethesda, Maryland

The researcher proposed to characterize the fatigue life under fully reversed ASEM spectrum loading conditions of A15456 fillet welds and evaluate three joint geometries including butt welds, cruciform and tee. He determined elastic-plastic fracture properties of plate and weldments and possible correlations between weld quality and fatigue life for each geometry studied.

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INSTABILITY TESTING OF NUCLEAR GRADE PIPE

Researcher: Associate Professor James A. Joyce

Sponsor: Nuclear Regulatory Commission
David W. Taylor Naval Ship Research and Development Center, Annapolis Laboratory

The researcher developed a test procedure to evaluate experimentally the tearing instability conditions for circumferentially cracked 8" diameter A106 pipe at room temperature loaded in 4 point bending in a compliant test machine. Presently fixtures are being prepared in David W. Taylor Naval Ship Research and Development Center shop to accomplish this task. Pipe has been purchased and characterized using small specimens. The test machine was upgraded for fatigue and test under computer control.

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FATIGUE TESTS FOR ASEM JOINTS

Researcher: Major John D. Pavlovsky, USA

Sponsor: David W. Taylor Naval Ship Research and Development Center, Annapolis Laboratory

The materials branch, DTNSRDC, Annapolis, has employed USNA to conduct a laboratory study as part of the "Fatigue and Fracture of Welded Aluminum for Light Weight Ship Structures" program of the Surface Ships Materials Technology Block program.

The program has a subtask of fatigue testing related to joints in the ASEM (Aluminum Ship Evaluation Model) under spectrum loading. The purpose of the subtask is to provide data to evaluate joint designs, enhance predictive capabilities,and aid in spectrum loading development.

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UNSTEADY TRANSONIC AERODYNAMICS ON ELASTIC AIRCRAFT

Researcher: Professor Robert A. Granger

An unsolicited research proposal was submitted to NSF for possible funding dealing with the unsteady transonic aerodynamic forces on oscillating aircraft wings. The method is based as a theory developed by the researcher and is to be extended to thick wings with attached shocks for a complete range of reduced frequencies. Professor Granger is the principal investigator, and Drs. Davis and D'Archangelo of the Mathematics Department are co-investigators. The method involves Mathieu functions, and thus high speed digital computation is required. The study is solely theoretical.

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HYDROGEN PRODUCTION FROM NUCLEAR FISSION PRODUCT WASTE HEAT AND USE IN GAS TURBINES

Researcher: Associate Professor Eugene L. Keating

An analysis has been made on the feasibility of producing hydrogen using fission product waste heat and its subsequent combustion in gas turbines. The work has been performed in three distinct phases.

In the first phase, a system using heat generated from radioactive wastes has been designed which produces saturated steam. This steam is sent through a turbogenerator to produce electricity. The electrical power output of this system has been calculated as a function of fission product decay time, solidified form of fission products, as well as numerous other parameters.

In the second phase, the electrical energy produced is used to electrolyze water, which in turn produces hydrogen. The amount of hydrogen produced (lb/h) has been calculated for varying electrical inputs, electrolyzer efficiencies, and feedwater temperatures. This hydrogen is then assumed to be liquified and stored. Finally, the third phase considers the burning of this hydrogen in a standard marine gas turbine.

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TEMPERATURE DISTRIBUTION AND MICROSTRUCTURE TIN WELDS

Researcher: Midshipman 1/C Jerry L. Carson

Adviser: Associate Professor Dennis F. Hasson

The project undertook to determine a correlation between temperature distribution in a weld in a sample of naval steel during the welding process, and the resulting microstructure and properties of the weld after cooling.

Microstructure and metal properties can be examined by utilizing equipment already available in the metallurgy labs. Temperature distribution can be determined using indicator paints or thermocouples.

The principal difficulty is determining temperature distribution right on the border of the pool where indicators or thermocouples might come into contact with the puddle.

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CALIBRATION AND TESTING AT USNA SHOCK TUBE FACILITY

Researcher: Midshipman 1/C Michael J. Connolly

Adviser: Associate Professor Eugene L. Keating

The calibration and operation of a newly installed chemical shock tube facility has been completed. Experimental measurements at gas dynamic conditions around both incident and reflected shock waves were obtained using the facilities located in Rickover Hall. Fifteen different test conditions were taken and compared with results obtained from theoretical calculations. In addition an appropriate laboratory exercise was developed for use in the Mechanical and Aerospace Engineering curriculum.

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INDUSTRIAL FURNACE RECUPERATION

Researcher: Midshipman 1/C Robert Filler

Adviser: Lieutenant Commander Richard H. Funke, USN

A literature search of information relating to improvement of high temperature industrial furnace fuel economy through recuperation of combustion air was made. Development was completed of macroscopic mathematical performance model of currently installed recuperator in General Electric glass furnace, Erie, Pennsylvania.

Fuel consumption with other types of recuperators in same application was predicted. Non-quantitative analysis was made of reliability and maintainability of alternate recuperator designs.

This research project was intended as a blend of thermodynamics, heat transfer, combustion theory, and fluid mechanics.

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DESIGN AND PROTOTYPE CONSTRUCTION OF A SAILBOAT WINDMAST/ POWER-KEEL

Researcher: Midshipmen 1/C Thomas S. Fricke and Matthew McCroary

Adviser: Associate Professor William M. Lee

Much effort is being made today to utilize solar power and WECS (Wind Energy Conversion Systems) in order to conserve fossil fuels. There is a way to utilize the natural attributes of a sailboat to good advantage to generate and store energy. First, most sailboats sit pier-side or at a mooring most of the time, with the masthead at advantageous height for a windmill. Secondly, a large mass of inert lead or iron is used for ballast in the keel. These two attributes lend themselves to use as a WECS as described below.

A small windmill, perhaps of the vertical axis, self-starting variety, is placed atop the sailboat mast with a flexible driveshaft going down the hollow mast to a generator located within the hull. Alternatively, a light generator could be designed as an integral unit with the windmill and located on top of the mast. The keel would be designed to house large lead-acid batteries similar to those used in forklift trucks. Proper ventilation would be designed to vent the hydrogen generated during charging unless sealed batteries could be obtained.

This stored energy would be used by an electric drive motor instead of a gasoline or diesel engine to get the sailboat in and out of port. An electrical control panel would be designed to regulate the charge from the windmill, shore power, or dragging the propulsion screw while underway on sail. Perhaps a provision for the latter addition of photovoltaic charging could be made.

The proposed method of investigation involves most of the departments within the Division of Engineering and Weapons. Midshipmen and professors in the 490 series of design courses could assist in the trade-off in their area of expertise to achieve the compromises so necessary to fit a propulsion system to a hull. The naval architects would design a keel to accommodate the batteries, vent hydrogen, present the best hydrodynamic shape, and calculate the stability with the additional masthead weight. The marine engineers would deal with the propulsion motor and screw. Mechanical engineers would design the light flexible shaft, gears, and bearings, and perhaps the windmill. Electrical engineers would design the electrical, electronic, metering, regulation, and control of the generator, batteries, and propulsion motor. Finally, the aeronautical engineers might get involved in the windmill blade design and testing in a wind tunnel.

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TEMPERATURE MEASUREMENTS OF NAHBE PISTON CAPS

Researcher: Ensign Richard C. Locke

Adviser: Associate Professor Eugene L. Keating

This research work consisted of placing templugs, temperature measurement plugs, at three locations in NAHBE piston caps to find the internal temperature variations in each type of cap material tested. As of this time, temperature measurements were done only in a cast iron cap specimen. Other materials that were to be tested included aluminum, several other types of cast iron (with varying nickel content), and titanium.

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KINEMATIC SIMULATION USING A TEKTRONIX 4054 COMPUTER

Researcher: Midshipmen 1/C James R. Nault and Brian S. Coval

Adviser: Professor J. Alan Adams

The USNA has recently obtained two Tektronix terminals using a new programming language slightly different from NATS BASIC. The 4054 has 64K storage capability, refresh capability to display dynamic motion in real time, and is slated to be used in conjunction with a large screen which has great advantages for teaching purposes.

A number of programs currently being used in conjunction with NATS BASIC will be rewritten for use with 4054 BASIC. These programs concern 4-bar linkages, quick-return mechanisms, and other simple mechanisms. Besides rewriting existing programs from NATS BASIC to 4054 BASIC, new mechanisms and configurations will be programmed for graphic display of kinematic behavior.

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SOLAR-STIRLING POWER SYSTEM

Researcher: Midshipman 1/C David T. Norris

Adviser: Professor Chih Wu

Solar energy collecting systems and Stirling engine are theoretically and experimentally studied. A computer-aided design in solar-Stirling power system is made. The computer program has a thermodynamic solar analysis and a kinematic analysis. The input parameters are location, climate conditions, Stirling cycle regenerator efficiency, and Stirling engine phase angle between the piston and displacer. The output of the program includes tilt angle, engine displacement, velocity, acceleration versus crank angle, heat cap temperature, output power, etc. The influences of each design variable is examined. A feel for the kinematics of the Stirling engine and energy flow of the power system is obtained.

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DEVELOPMENT OF MOIRE MODELS FOR EM431

Researcher: Midshipman 1/C Peter J. Riester

Adviser: Associate Professor Jack H. Smith

Several models for Moire strain analysis were produced. These will be used in the course EM431.

Photographic coatings were made from a Van Dyke solution and applied to polyurethane models. The coatings were exposed to produce line gratings of 300 lines per inch using a master grating and ultra-violet light. Models for uniaxial stress and also for biaxial stress were made.

Additionally models for uniaxial and biaxial stress were made from plexiglass using stripping film and gratings of 1000 lines per inch.

Several tests were run to verify that the models were suitable for use in midshipmen laboratory exercises.

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SOLAR AIR CONDITIONING

Researcher: Midshipman 1/C William H. Wakeley

Adviser: Professor Chih Wu

Solar air conditioning theory and its engineering analysis are studied. Existing types of solar air conditioning are surveyed. Economics and feasibility are surveyed. A computer model is developed for solar air conditioning design.

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TESTING AND MEASUREMENT OF VARIOUS PHOTOVOLTAIC CELLS

Researcher: Midshipman 1/C Bradley E. Ward

Adviser: Professor Chih Wu

Two types of solar cells, concentrator and microgenerator, are studied. Solar incident energy, cell voltage and current are measured by a radiometer and a digital multimeter. The laboratory solar incident energy is supplied by a filament lamp which is specially filtered to approximate the frequency spectrum emitted by the sun. The laboratory tests are validated by performing some of the tests in sunlight with normal atmospheric conditions. Testing differences are noted and discussed. Performance characteristics of various solar cells including efficiency, maximum output power, and fill-factor are determined.

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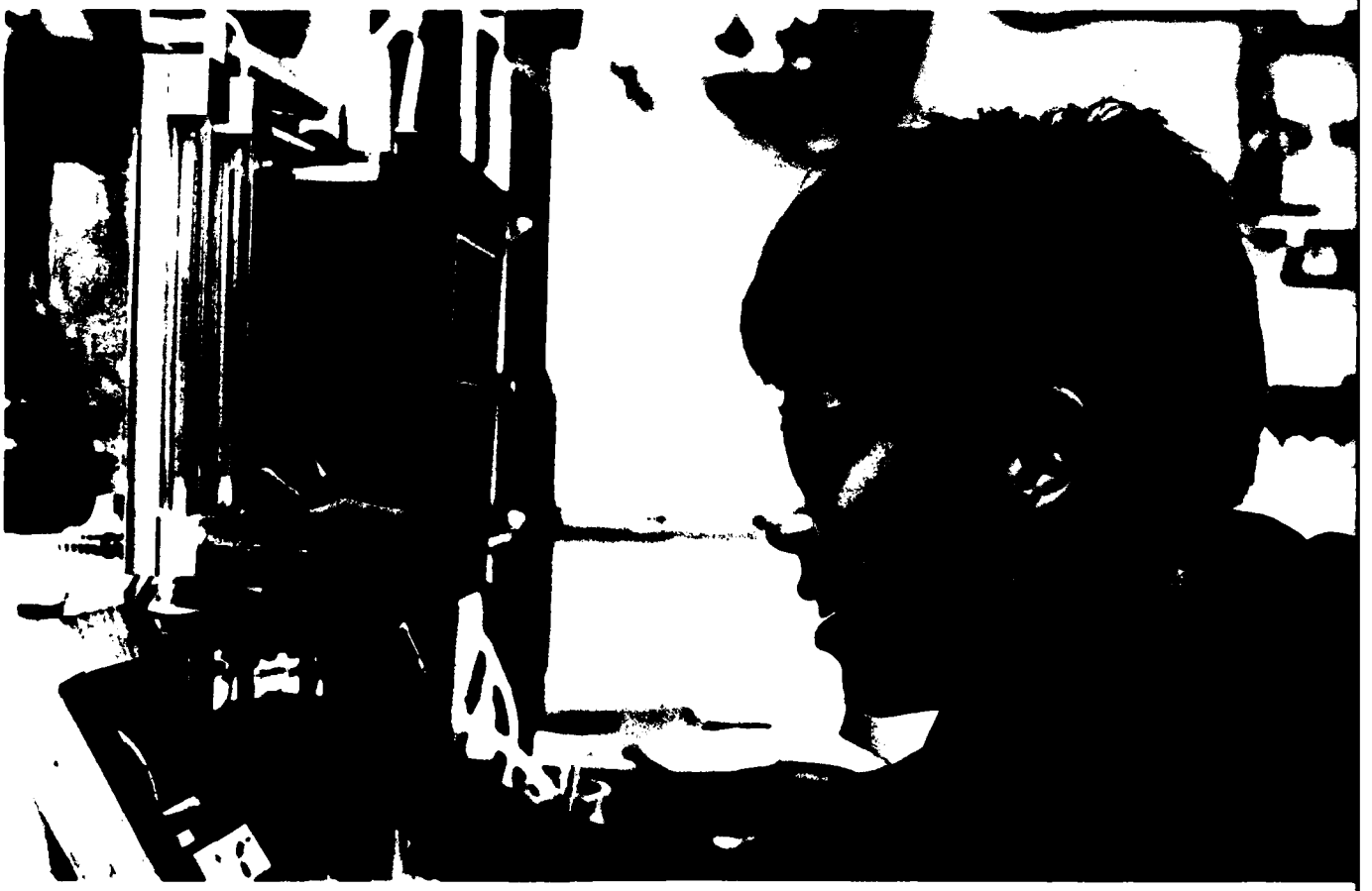

ADAMS, James A., Professor, "Kinematics with Computer Simulation," Frontiers in Education 10th Annual Conference, ASEE, (October 1980), 225-229.

This paper discusses a method for using computer graphics and a motion simulation technique to obtain dynamic displays of both kinematic motion curves and the geometric behavior of planar mechanisms. Mathematical theory from both kinematics and computer graphics is used to create the desired results on a storage tube display terminal. The resulting simulations offer insight and new pedagogical potential in the field of kinematics.

The approach is suitable for use with beginning college students in engineering or science. Samples of simulation results in the form of either 8-mm film or video tape are available and will be shown during the paper presentation. Various approaches for usage in the classroom are suggested.

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GILLERLAIN, Joseph D. Jr., Associate Professor, "Experiments on Vortex Impingement on Control Fins," co-author, in Proceedings of the 5th U.S.-German Data Exchange Agreement meeting on Viscous and Interacting Flow Field Effects, AFWAL-TR-80-3088, (June 1980),393-400

Accurate prediction of the aerodynamic behavior of missiles and aircraft experiencing vortex impingement on control surfaces becomes more essential as high angle-of-attack maneuvering requirements increase. Detailed knowledge of the three-dimensional viscous flow field, as determined from wind tunnel experiments, is required in order to develop predictive methods based on the vortex-fin interaction. Tests were conducted in the U. S. Naval Academy Aerodynamics Laboratory subsonic wind tunnel using a pressure distribution model and a flow visualization model. Both consisted of a rectangular fin with cylindrical leading and trailing edges, and both were adjustable for angle-of-attack. The impinging vortex was generated upstream of the fin at the juncture of two adjacent airfoils set at equal but opposite angles-of-attack. The vortex velocity field was surveyed using a laser Doppler velocimeter. The flow visualization tests utilized the fluorescent mini-tuft technique. Surface pressure distribution data were obtained along with force balance data. Results from preliminary tests are presented, and future work is outlined.

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HASSON, Dennis F., Associate Professor, "Corrosion Fatigue of Anodized Aluminum 7075-T73 in Salt Ladened Humid Air," Engineering and Weapons Division Report EW-1-81.

Corrosion fatigue of A17075-T73 anodized by various methods has been measured in salt laden moist air. Principal results are: (1) Anodization caused a reduction in fatigue life irrespective of the thickness or type of anodization; (2) a correlation of alumina density with fatigue life was not found; (3) reduction of fatigue life in the environment is attributed to crack growth of microcracks both present and/or initiated in the anodized coating. Details of fatigue environmental chamber and statistical analysis of the data are given in appendices.

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HASSON, Dennis F., Associate Professor, and James A. JOYCE, Associate Professor, "Characterization of Transition Temperature Behavior of HY130 Steel by the J_{I_C} Fracture Toughness Parameter," Engineering Fracture Mechanics, 13 (1980), 417-430.

The objectives of this study were to determine whether the J-R curve approach could be used to evaluate the ductile-to-brittle temperature performance of a high yield strength structural steel (HY130) and to demonstrate that the single specimen unloading compliance method is applicable to evaluate J_{I_C} values and J-R curves for compact specimens tested at temperatures from 192° to 150° C. The major conclusions of this work are that J_{I_C} and the complete J-R curve can be obtained using the single specimen method over the above-temperature range and that J_{I_C} does define a ductile to brittle transition temperature for HY130 steel which should be more valuable for structural design than that found from Charpy V or dynamic tear specimens because it is based on a fracture toughness parameter. The comparison of the J_{I_C} transition temperature and that from Charpy V specimens shows that the Charpy V transition temperature is more conservative for the HY130 steel tested. In transitional J_I specimens which demonstrated a ductile crack tearing followed by a brittle failure, scanning microscope stero pair fractography showed that the transition from ductile to brittle behavior was very gradual in comparison to the distinct crack tips obtained on ductile specimens broken in a brittle fashion at a cryogenic temperature.

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JOYCE, James A., Associate Professor and Dennis F. HASSON, Associate Professor, co-authors, "The Effect of a Higher Loading Rate on the J_{I_C} Fracture Toughness Transition Temperature of HY Steels," Journal of Engineering Materials and Technology, 103 (April 1981) 133-141.

The objectives of the study were to extend the J_{I_C} transition temperature analysis of earlier work for HY130 to HY 80 steel and also to determine the effect of a higher strain rate on the J_{I_C} fracture toughness of both HY80 and HY130 steels. The fracture parameter J_{I_C} in both low and high strain rate tests demonstrated a ductile-to-brittle transition in HY80 and HY130 steels analogous to Charpy V notch transition behavior. The J_{I_C} transition temperature from slow rate tests was less conservative than that from fast rate tests. The J_{I_C} transition temperatures from slow and fast rate tests gave less conservative transition temperatures than those from Charpy tests. SEM stereo pair fractography showed that the transition from ductile to brittle behavior was not as gradual for the fast rate testing as previously reported for slow rate tests.

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JOYCE, James A., Associate Professor, co-author, "Direct Evaluation of J-Resistance Curves from Load Displacement Records," Fracture Mechanics: Twelfth Conference, ASTM STP 700, 1981, pp. 222-236.

The objective of this work was to experimentally develop a key curve for compact specimens of HY130 steel and to use this load displacement records alone using the analysis of Ernst et al. Eight 1/2T compact tension specimens with crack lengths from a/W = 0.59 to 0.94 were used to generate a series of load displacement records, which were assembled in a computer file as the key curve for geometrically similar compact specimens of this steel. Using this file, J-resistance curves (J-R curves) for 1T compact specimens were then obtained directly from the load displacement records and compared with unloading compliance J-R curves obtained for the same specimens. The critical J-values were found to be identical, but the new analysis gives much lower J-R curve slopes beyond the critical J for nonside-grooved specimens. For side-grooved specimens in which the crack does not tunnel, however, the J-R curves for the two methods were nearly identical. The J-R curves evaluated using the key curve method showed much less dependence on crack length than those obtained by the unloading compliance method. Agreement between the predicted and measured final crack length was excellent using the key curve method.

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JOYCE, James A., Associate Professor, and Dennis F. HASSON, Associate Professor, co-authors, "Computer Data Acquisition Monitoring of the Stress Corrosion Cracking of Depleted Uranium Cantilever Beam Specimens," Journal of Testing and Evaluation, 8 (1980), 293-300.

The objective of this work was to develop and demonstrate a computer data acquisition system to monitor the stress corrosion cracking of laboratory cantilever specimens. Present methods using optical techniques require long times to establish the crack growth rate when low crack growth rates are present. These methods also give very limited data and do not show clearly the dependence of the crack growth rate on stress and atmospheric variables. These methods also are incapable of resolving irregularities in the crack growth rate that would exist if oxide-forming and cracking mechanisms were applicable in the material test atmosphere system. The major conclusion of this work is that a computer data acquisition system can be used to evaluate low crack growth rates in relatively short times as well as to evaluate the magnitude of variations in crack growth rate about a mean value. Other advantages are that the specimen can be completely enclosed to better control the test atmosphere. Other variables like temperature and corrosion potentials can be easily monitored, and a permanent magnetic tape record can be produced for later reanalysis.

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JOYCE, James A., Associate Professor and Dennis F. HASSON, Associate Professor, co-authors, "Stress Corrosion Cracking of Depleted Uranium Alloys in Moist Salt Ladened Air," National Association of Corrosion Engineers, 37 (February 1981), 81-88.

Stress corrosion cracking (SCC) in selected depleted uranium alloys in salt ladened moist air environments has been studied by cantilever beam testing. Crack growth kinetics were monitored during the test using a computer data acquisition system. Continuous measurements of crack growth with time showed discontinuous crack growth with increasing K_I. Threshold stress intensity values for stress corrosion cracking K_{ISCC}, were found to be 24.4 MPa - $m^{\frac{1}{2}}$ and 15.6 MPa - $m^{\frac{1}{2}}$ for U-3/4 Ti and DU-3/4 Quint alloys, respectively. Values for U-2 Mo in two heat treated conditions were slightly less than the U-3/4 Ti threshold. Data is presented in a "safe zone" plot of flaw size vs. applied stress. Fractographic investigation by scanning electron microscopy revealed mixed fracture modes with both transgranular and intergranular fracture occurring.

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ADAMS, J. A., "Computer Graphics and Engineering Education," Duke University Faculty/Student Seminar, Durham, North Carolina, 16 February 1981.

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GILLERLAIN, J. D., Jr., Associate Professor, "Vortex-Fin Interaction Flow Field Measurements," AIAA 13th Fluid and Plasma Dynamics Conference, July 1980; AIAA Paper No. 80-1332.

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GILLERLAIN, J.D., Jr., Associate Professor, "Experiments on Condensation of Water Vapor by Heterogeneous Nucleation," 12th International Symposium on Rarefied Gas Dynamics, July 1980.

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JOYCE, James A., Associate Professor, "Key Curve Dynamic J-R Curve Testing," NRC VIRG meeting, Silver Spring, Maryland, 17 July 1980. (Updated version to ONR Fracture Symposium, DTNSRDC, Annapolis, Maryland, 17 February 1981.)

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JOYCE, James A., Associate Professor, "Minicomputers Applications in the Fracture Mechanics Laboratory," ASME Century 2 Conference, San Francisco, California, 11 August 1980.

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JOYCE, James A., Associate Professor, "Ductile Fracture Tearing Instability," Monthly seminar, University of Illinois, Champaign, 12 November 1980.

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KEATING, Eugene L., Associate Professor, "Parametric Variations of A Heat Balanced Engine," Symposium on the Fluid Mechanics of Combustion Systems ASME Fluids Engineering/Applied Mechanics Conference, Boulder, Colorado, 22-24 June 1981.

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LOPARDO, V. J., Professor, "Second Law Analysis of Thermal Systems," Five seminars, the Catholic University of America, Washington, D.C., 4, 18 February, 4, 18 March, and 8 April 1981.

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READ, Kenneth F., Assistant Professor, "Power System Development Program Overview," 7th Ocean Energy Conference, Washington, D.C. 3 June 1980.

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READ, Kenneth F., Assistant Professor, "Ocean Thermal Energy," Invited paper, Case Institute of Technology Centennial Celebration, Cleveland, 15 July 1980.

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READ, Kenneth F., Assistant Professor, Panel discussion on Ocean Energy, 1981 Annual Meeting and Product Exposition of the American Section of the International Solar Energy Society, 29 May 1981.

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WU, Chih, Professor, "Review and Assessment of Recent Liquid Magnet Hydro-Dynamics Soviet Literature:, NSRDC Classified Research Report, September 1980.

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WU, Chih, Professor, "Effect of a Computer Information Management System on Shipboard Facilities Maintenance and Manpower Utilizations", International Congress on Applied Systems Research and Cybernetics, Acapulco, Mexico, 12-16 December 1980.

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WU, Chih, Professor, "A Computer Method for Mixed Lubrication," 1981 ACM Computer Science Conference, St. Louis, Missouri, 24-26 February 1981.

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WU, Chih, Professor, "Teaching Solar Energy Stirling Machine Cycle and Their Combinations by Computer", 1981 Maryland Association for the Educational Uses of the Computer Conference, Towson, 20 March 1980.

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WU, Chih, Professor, "Teaching Solar Stirling Engine Design Through Computer Interactive Programming," 1981 ASEE Annual Conference, Los Angeles, California 21-25 June 1981.

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NAVAL SYSTEMS ENGINEERING DEPARTMENT

Captain Sidney E. Veazey, USN, Chairman

Research in the Naval Systems Engineering Department plays a vital role in the professional enrichment of both midshipmen and faculty. During Academic Year 1980-1981, faculty members and midshipmen participated in numerous and varied projects in the fields of marine engineering, ocean engineering, and naval architecture.

A variety of projects were undertaken, both funded and unfunded. These include faculty research in the areas of scoring alternative ship's general arrangement plans against desired ship performance, shallow water ship-resistance, testing the USNA YP replacement model, irregular wave generation, surface ship non-linear response, seafloor dynamics, electrical resistivity techniques for measuring liquefaction of sand, methodology for use by the public utility industry for improving power plant availability, and faculty sponsored midshipman projects in the areas of computer aided structural design, ship propeller design, electrolytic drag reduction, measurement of sail forces and moments, design and fabrication of an instrumented fall cone, surface wave and bottom sediment interaction, wave forces on an inclined pile, wave-energy-conversion, and calibration and tests of the Naval Academy heat-balanced diesel engine.

Support for research was found in many sources, from departmental operating funds to contracts and grants from such diverse organizations as the Naval Academy Research Council, the Naval Sea Systems Command, the Naval Civil Engineering Laboratory, the U. S. Coast Guard, the David W. Taylor Naval Ship Research and Development Center, the Office of Naval Research, and the Department of Energy.

Research and design projects, as in the past, have continued to display the originality and variety typical of the Naval Systems Engineering Department faculty and undergraduate majors. The Department will continue to pursue an aggressive commitment for research for the midshipmen and faculty that provides the needed scholarly activity to maintain an outstanding undergraduate program. Many of the faculty members of the Department are internationally known for contributions in their respective fields.

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U. S. NAVAL ACADEMY YP REPLACEMENT MODEL TEST PROGRAM

Researcher: Associate Professor Roger H. Compton

Sponsor: Naval Sea Systems Command

This is an extensive experimental program to quantify the still water performance, beam sea-rolling performance, and head/following sea seakeeping performance of six variations of hull-form being considered by the U. S. Navy to replace the present YP fleet at USNA. Semiplaning hulls of soft and hard chine designs are being studied by the testing of (nominally) five-foot models. For each hull, variations of displacement, center of gravity, and weight distribution are varied over a range prescribed by the sponsor.

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SEA FLOOR DYNAMICS

Researcher: Associate Professor Thomas H. Dawson

Sponsor: Office of Naval Research

The objective of this research is to determine the degree to which an elastic model can describe sea-floor response to overhead water surface waves. The work is continuing under ONR sponsorship and involves collaboration with personnel of the Coastal Studies Institute of Louisiana State University.

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SCOUR AROUND MULTIPLE PILE GROUPS SUBJECTED TO UNIDIRECTIONAL AND WAVE-INDUCED OSCILLATORY CURRENTS

Researcher: Assistant Professor Ronald C. Gularte and Commander Ronald A. Erchul, USN

Sponsor: Civil Engineering Laboratory, Port Hueneme, California

The research was concerned with a laboratory study of local and general scour around multiple circular piles subjected to both unidirectional and oscillatory (wave induced) currents. Pile diameters of 1.88, 2.88, and 3.75 inches were tested and pile spacings, in a square grouping, were varied from 2 to 6 diameters. The results indicate that the mode of scour changes in the 5 to 7 pile diameter range. With respect to the range of variables considered, wave heights of 2 to 4 inches were used with wave periods ranging from 2 to 4 seconds. The mean water depth over the test bed was 12.5 inches. Unidirectional velocities of 0.8 and 1 feet per second were used.

The bed materials were fine beach sand (median diameter 0.22 mm) and median river sand with a median diameter of 0.35 mm. A total of 62 runs (28 with the river sand and 34 with the fine beach sand) were completed. The following aspects were considered: 1) the relative influence of longshore and wave induced currents on scour; 2) the effect of pile diameter and spacing on the mode of scour; and 3) determination of those parameters important in scour around pile groups subjected to combined oscillatory and unidirectional currents.

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IRREGULAR WAVE GENERATION

Researcher: Professor Bruce Johnson, co-researcher

Sponsor: Naval Sea Systems Command

Working with contractor personnel, the researchers developed the "periodic irregular encountered wave technique." The experimental verification of this technique was undertaken as a series of midshipman research projects during 1978-1979 and 1979-1980. Although the midshipmen developed several computer programs to predict the required wave frequencies and amplitudes needed to generate a desired encountered wave spectrum, a mathematical difficulty was encountered which was beyond the capabilities of the midshipmen to solve. It involves the use of a non-linear "Jacobian of Transformation" to convert spectral densities based on equally-spaced frequency intervals in the encounter frequency domain to the equivalent spectral densities based on non-equally spaced frequency intervals in the wavemaker frequency domain.

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SURFACE SHIP NONLINEAR SEAKEEPING RESPONSE

Researcher: Research Professor David D. Moran

Sponsor: Naval Sea Systems Command

The ongoing project is designed to explore the nonlinear responses to large amplitude and controlled frequency (distribution) waves. Seakeeping response is examined in three degrees of freedom. Specific phase-controlled wave spectra are used as excitation.

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A METHOD FOR SCORING ALTERNATIVE GENERAL ARRANGEMENT PLANS AGAINST DESIRED SHIP PERFORMANCE

Researcher: Assistant Professor Bruce C. Nehrling

Sponsor: Naval Sea Systems Command

A method for systematically evaluating the impact of alternative general arrangement plans on a ship's overall performance is postulated. This proposed approach uses the theory of fuzzy sets in an attempt to provide the naval architect with an analytic procedure for making arrangement decisions. The use of fuzzy set theory provides a means for circumventing many of the ill-defined requirements and/or criteria typically associated with general arrangement design. Fuzzy set theory is explained. Its potential use in evaluating general arrangement designs in terms of performance objectives is shown by means of an example.

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SHALLOW WATER RESISTANCE TESTS FOR U. S. COAST GUARD RIVER BUOY TENDER

Researcher: Assistant Professor Bruce Nehrling

Sponsor: U. S. Coast Guard

The primary purpose of this study is to determine the shallow water resistance of a river buoy tender. This study will also help to prove or disprove the validity of small model tank tests for shallow water studies. A 5' model of the ship will be made using the CADIG, CAMILL, and NC shop facilities. A false bottom will be designed and built for the 120' tank. Numerous tests and comparisons with existing data and theory will be made. A final report will be issued.

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ANALYSIS OF THE KAIMEI WAVE ENERGY CONVERSION DATA

Researcher: Professor Michael E. McCormick

Sponsor: Solar Energy Research Institute

Data from the International Energy Agency (IEA) Wave Energy Project in the Sea of Japan was analyzed using averaging techniques, spectral density, and cross-correlation methods. The results of the analysis showed strong correlation between pitching motions of the test platform, Kaimei and power output.

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THE LIGHT-WATER BREEDER REACTOR

Researcher: Midshipman 1/C Patrick M. Blake

Adviser: Associate Professor Martin E. Nelson

Most news on breeder reactors in recent years has been concentrated on the liquid metal fast breeder reactor (LMFBR), particularly the Clinch River site where construction has been halted. Very little has been written about its counterpart, the light-water breeder reactor.

The light-water breeder reactor shows distinct advantages over LMFBR. It makes use of the abundant thorium-U-233 fuel cycle instead of U-235 fuel; it should be possible to alter existing commercial plants to accept a light-water breeder core; and it significantly reduces the production of dangerous transuranic elements as byproduct wastes, among them plutonium.

An unusual core geometry makes this reactor suitable for breeding. Criticality is controlled by moving fuel, not control rods. A thorium blanket sponges up excess neutrons but makes fuel in the process, something control rods did not do.

The light-water breeder reactor shows many advantages over the liquid metal fast breeder. Although this reactor will not solve problems of nuclear waste or recycling of spent fuel, it does promise to greatly extend fuel supplies and use a potentially safer fuel cycle.

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ARTIFICIAL ISLANDS IN AN ARCTIC ENVIRONMENT

Researcher: Midshipman 1/C Michael A. Giorgione

Adviser: Assistant Professor Ronald C. Gularte

In the design of artificial islands for use in the Arctic environment it is common practice to use material locally available for fill because of problems associated with transport. The problem is that as these islands are placed in deeper water the ice forces will be greater, requiring that the perimeter of these islands be strengthened. Possibilities include sheet piling, inplace grouting and the use of geotechtiles. This research is to be a combined analytical and model study (at low temperatures) of currently available and new concepts to strengthen artificial islands and to determine experimentally the applicability of these concepts.

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REVIEW OF RECENT ADVANCES IN U. S. FUSION RESEARCH

Researcher: Midshipman 1/C William E. Higgins

Adviser: Associate Professor Martin E. Nelson

This project involved studying the latest technological advancements in U. S. Nuclear Fusion Research. The programs reviewed by the project includes the magnetic Torus and the Tokamah models being developed at Princeton; the tandem mirror design; the research on laser induced implosion fusion reactors being studied by Sandia labs; and the proposed "Star Fire" fusion reactor under development by the Argonne National Laboratory.

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DRAG AND INERTIAL COEFFICIENTS FOR CYLINDERS IN VISCO-ELASTIC MEDIUMS

Researcher: Midshipman 1/C James Rowland Huss

Adviser: Assistant Professor Ronald C. Gularte

This research is to determine the drag and inertial coefficients for cylinders in cohesive clays near the liquid limit and to predict the total force on cylinders in the field subjected to mud slides or mud waves.

The coefficients will be determined by towing and oscillating cylinders of various sizes in a small "mud" towing tank.

The results are anticipated to yield the necessary coefficients as well as suggested analytical expressions for predicting drag on cylinders moving through visco-elastic material.

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WAVE ENERGY CONVERSION SPAR BUOY/LINEAR-INDUCTANCE SYSTEM

Researcher: Midshipman 1/C Douglas G. Johnson

Adviser: Professor Michael E. McCormick

A purely-heaving, circular, cylindrical spar buoy was studied in the 120- foot wave tank for its wave energy conversion ability. The buoy was equipped with a linear-inductance electro-mechanical energy conversion device. Of particular interest was optimization of the power output using impedance-matching. This was accomplished by varying the back-voltage of the system, and an optimal power output was obtained.

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STUDY OF HYDROFOIL ASSISTED PLANING CRAFT

Researcher: Midshipmen 1/C David N. Judy and Lewis R. Grigg

Adviser: Associate Professor Roger H. Compton

As a lower cost solution to the high speed, small patrol craft problem than the U.S. Navy's PHM, this study concentrates on surface-piercing hydrofoils as a lift mechanism. While beginning as only partial support to augment the planing bottom lift, the project became a study of a surface piercing hydrofoil variant of a PHM-sized ship. A model was designed and built using the CAMIL system.

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WAVE-INDUCED FORCES ON INCLINED PILES

Researcher: Midshipman 1/C Donald J. Marrin

Adviser: Professor Michael E. McCormick

Piles of various diameters were subjected to waves in the 120-foot wave tank. These piles were inclined at 30°and 45° to the vertical. The information obtained gives an indication of the applicability of the Morison, et al, equation on inclined piles.

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INSTRUMENTED FALL CONE

Researcher: Midshipman 1/C Michael McLaughlin

Adviser: Assistant Professor Ronald C. Gularte

The research consisted of the design, fabrication, and testing of an instrumented fall-cone device. The device is normally used in geotechniques to determine the undrained shear strength of cohesive materials, but in this instance a displacement transducer was used in conjunction with the computer to determine velocity and acceleration. The time history of the cones penetrated was used to determine the viscoelastic properties of the material being tested.

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DAMAGE STABILITY

Researcher: Midshipman 1/C J. W. Osborne

Adviser: Professor Rameswar Bhattacharyya

Because of the importance of survivable fire power in time of war, stability and reserve buoyancy are considered of basic importance in U. S. Naval ships. Present regulations for damage stability criteria are not complete and computer applications in ship design make it possible to investigate this aspect more extensively than before.

The purpose of this project is to develop a realistic method of calculating the stability of a ship when damaged, even in a seaway. The second part of the project will include further calculation and develop criteria based on the calculations.

This project should be completed at the end of the present academic year. On the basis of this investigation a computer program should be developed by midshipmen at a future date.

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FULL SCALE MEASUREMENT OF SAIL FORCES ON A USNA YAWL

Researchers: Midshipmen 1/C Mark D. Pallin and William Beydler

Adviser: Associate Professor Roger H. Compton

The USNA 44-foot yawls are rated for racing under the MHS rule. Although the boats are supposedly identical, their ratings vary considerably. A study was undertaken to quantify some of the factors used in the rating procedure--especially the propulsive characteristics of a yawl's sail plan. The original plan of side-by-side sailing trials with two yawls--one with the full yawl working sails and the other sailed as a sloop was discarded after careful consideration of the quantitative results likely. Rather, an apparatus permitting the measurement of full-scale sail forces and moments was designed and fabricated.

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ELECTROLYTIC DRAG REDUCTION

Researcher: Midshipman 1/C Eric H. Randall

Adviser: Professor Michael E. McCormick

Ruthenium electrodes were placed in salt water solutions having salinity values up to 35%--the average ocean value. Rates of gas volume production were determined for each salinity value, while varying the current through the electrode system. The information is needed to determine the effectiveness of electrolytic drag reduction in waters of various salinity values.

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DESIGN TO IMPROVE THE USNA BF_3 PROBE VERTICAL TRANSFER MECHANISM

Researcher: Midshipman 1/C Russell J. Vranicar

Adviser: Associate Professor Martin E. Nelson

This project involved analyzing and designing a vertical probe transfer mechanism for the BF_3 or the neutron detection probes used at the USNA. These probes are used in measurements on the USNA subcritical reactor (SCR) in experiments conducted in the laboratory of Reactor Physics II (EN 463).

The present transfer mechanism is very slow, causing delays in the completion of certain experiments. The present probe movement is controlled by a series of reduction gears, whose gear ratio would have to be changed to increase the vertical speed of the probe. This project developed an engineering design which when implemented would result in a faster moving neutron probe.

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WINDMAST/POWER KEEL

Researchers: Midshipmen 1/C Russell J. Vranicar, Matthew A. Carr, Michael J. Gallet, Project Manager, and M. J. Giancaterino

Advisers: Captain Sidney E. Veazey, USN, and Associate Professor William M. Lee

Much effort is being made today to utilize solar power and WECS (Wind Energy Conversion Systems) in order to conserve fossil fuels. There is a way to utilize the natural attributes of a sailboat to good advantage to generate and store energy. First, most sailboats sit pier-side or at a mooring most of the time, with the masthead at an advantageous height for a windmill. Secondly, a large mass of inert lead or iron is used for ballast in the keel. These two attributes lend themselves to use as a WECS.

Midshipmen are performing trade-off studies and are completing conceptual design. A number of manufacturers have been contacted. A PERT chart is being developed to assist in program management. The C&D Battery Company may donate the batteries for the project. Also, GSA and Navy sources have been contacted regarding a suitable confiscated or donated sailboat. Two ensigns will work part time on the project during the summer.

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BHATTACHARYYA, Rameswar, Professor, "Ship Mooring Dynamics," Proceedings "Ship Mooring Dynamics", NCEL, California, 1980.

The usefulness of the strip-theory approach, expecially for longitudinal motions and associated predictions, has surpassed the imagination of many theorists and engineers. Predictions for the transverse motions and the associated predictions, however, are not as good because of the difficulty in determining the motion coefficients of the lateral motions.

The present paper enumerates the inherent assumptions in the present theory and attempts to establish how far the transverse motions can be estimated, if not improved, by determining the coefficients more accurately after incorporating the appendage as well as hull circulation effects.

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COMPTON, Roger H., Associate Professor, co-author, "USNA YP Replacement Model Test Program: Zero Speed Beam Sea Rolling Tests," USNA Engineering & Weapons Division Report EW-3-81, 20 March 1981.

Two alternative hull forms for the replacement USNA YP were ballasted to specific values of displacement, vertical position of the center of gravity, and longitudinal position of the center of gravity. They were then subjected to an experimental test program to determine their zero speed rolling characteristics in long crested, regular beam seas.

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DAWSON, Thomas H., Associate Professor, co-author, "Correlation of Field Measurements with Elastic Theory of Seafloor Response to Surface Waves," Offshore Technology Conference Proceedings, Houston, 1981.

Field measurements of the time-variation of water pressure and bottom horizontal and vertical accelerations caused by water surface waves are shown to be in excellent agreement with predictions from an elastic theory of sea-floor response. The theory reveals the existence of both Airy-type water waves and Rayleigh-type soil waves and both are shown to be important in correlating the measured water pressure and bottom response with the theory over individual wave cycles. The field measurements are associated with surface-wave heights ranging up to about 5 feet and bottom vertical deflections ranging up to about 0.25 inches. The elastic shear modulus needed for correlation is found to depend on the frequency of the wave cycle and to decrease from about 27 to

13 kips/ft^2 as the frequency increased from about 0.79 to 1.21 rad/sec. The ratio of the height of the Rayleigh-type wave to that of the Airy-type is also found to decrease from about 0.019 to 0.004 over this same frequency range. These variations are attributed to a tendency of the soil response to shift away from that of a solid and toward that of a fluid as the wave frequency increases.

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DAWSON, Thomas H., Associate Professor, "Simplified Analysis of Offshore Piles Under Cyclic Lateral Loads," Ocean Engineering,7, (1980), 553-562.

A simple theory for predicting the response to cyclic lateral loading of piles deeply driven in either soft clay or sand is presented and formulas given for calculating, among other things, deflection and internal bending moment along the pile. The theory assumes the soil resistance to deflection to be characterized by an initial elastic reaction up to a critical deflection level, followed by a yield reaction independent of further deflection. Soil parameters are estimated, and the theory is shown to provide good correlation with existing field data.

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GULARTE, Ronald C., Assistant Professor, co-author, "Erosion of Cohesive Sediments as a Rate Process," Ocean Engineering, 7 (1980), 539-551.

The problems associated with the erosion of cohesive sediment in the marine environment are well recognized. However, the mechanisms of controlling erosion are not well understood. The research presented was directed at characterizing the erosion resistance of cohesive sediment through the application of rate process and double layer theories. Additionally, relationships between erodability and temperature, salinity, pore water content and erosional shear stress were studied.

A total of 50 tests were conducted in a refrigerated water tunnel. These included tests in which temperature was incremented at constant erosional shear stress and tests within which the erosional stress was varied at constant temperature.

The material tested was a remoulded illitic-silt (Grundite). Tests were performed at constant pH and at five different water contents ranging from 40% to 80%. For each water content, samples were tested at five different salinities varying from 0 to 10% NaCl.

Results are as follows: (1) The erosional response of cohesive sediments can be described with rate process and double layer theories; (2) the magnitude of experimental activation energies suggest solid-to-solid bonding and are essentially independent of salinity and water content; and (3) experimental flow volumes were essentially invariant with water content, but decreased with salinity in accordance with the double layer theory, which suggest that the dominant interparticle forces in surface cohesive erosion are physico-chemical rather than mechanical.

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JOHNSON, Bruce, Professor, co-author, "Single Pass Seakeeping Tests Using the Periodic Irregular Encountered Wave Technique," Proceedings of the 19th American Towing Tank Conference, Ann Arbor, Michigan, July 1980.

The tedious and time-consuming nature of seaworthiness tests on ship models in a towing tank using regular waves has long been known. Complete test results consist of data for a series of different wave lengths, each carried out at a series of different model velocities. A single run down the tank obtains results for one wave length at one velocity. Consequently, a complete test requires a large number of individual runs.

A new technique for measuring model response amplitude operators in a single run for each Froude Number has been developed. It requires computer control of the wave generator and special software. It utilizes equally spaced harmonic components in the encountered wave domain to obtain a periodic irregular encountered wave. Some additional work is needed to improve on the repeatability of the response amplitude operators and to compare the results with the equivalent regular wave tests. Work on these aspects is underway.

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McCORMICK, Michael E., Professor, "Sea of Japan Wave Energy Conversion Data Analysis," Solar Energy Research Institute, Report No. EW-12-80, August 1980.

The methods of analyses of the data resulting from the wave energy conversion tests in the Sea of Japan are outlined. The tests, sponsored by the International Energy Agency and performed on the floating platform called the "Kaimei," resulted in fifty magnetic tapes on which are recorded data from eighty sensors. The data on the tapes are in voltages and must, therefore, be

converted to dimensional data. Furthermore, the data are in digital form. Algorithms must be written to reduce the data and analyze the results. The analyses include (a) averaging each sensor output every twenty minutes over a twenty-four hour period, (b) the cross-correlation of sensor outputs to determine the relative dependence of one variable on the other, and (c) the calculation of the spectral densities of specific sensor outputs to determine the various energies of the variables. Data from these analyses are presented in graphical form.

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McCORMICK, Michael E., Professor, and Professor Rameswar BHATTACHARYYA, co-authors, "A Surveillance Aspect of Ship Wave Measurements," Naval Engineers Journal, (February 1981), 85-88.

It is shown that "at-sea" measurements of the transverse waves generated by a deep-draught ship can be used to determine the course and speed of the ship and its distance from the point required along with telemetering equipment and a spectral analyzer. By continuously monitoring the wave spectra at three points, the transverse waves in the ship's wake are detected as spikes in each of the spectra. A narrow band about the transverse wave period can then be monitored to obtain the necessary information.

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McCORMICK, Michael E., Professor, Ocean Wave Energy Conversion, New York: Wiley-Interscience, 1981.

This book is devoted to both basic wave energy conversion and the most recent technological advances in the field. The book includes a historical review, basics of wave mechanics, wave alteration, wave energy conversion, electromechanical energy conversion, energy transfer, moorings and environmental aspects. Also included are a bibliography and summaries of 14 wave energy conversion patents.

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NEHRLING, Bruce C., Assistant Professor, "A Method for Scoring Alternative General Arrangement Plans Against Desired Ship Performance," Report prepared for NAVSEA, March 1981.

A method for systematically evaluating the impact of alternative general arrangement plans on a ship's overall performance is postulated. This proposed approach uses the theory of fuzzy sets in an attempt to provide the naval architect with an analytic procedure for making arrangement decisions. The use of fuzzy set theory provides a means for circumventing many of the ill-defined requirements and/or criteria typically associated with general arrangement design. Fuzzy set theory is explained. Its potential use in evaluating general arrangement designs in terms of performance objectives is shown by means of an example.

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NELSON, Martin E., Associate Professor, "Hydrogen Production from Nuclear Fission Product Waste Heat and Use in Gas Turbines," International Journal of Hydrogen Energy, 5(1980), 383-399.

An analysis has been made on the feasibility of producing hydrogen using fission product waste heat and its subsequent combustion in gas turbines. The work has been performed in three distinct phases.

In the first phase, a system using heat generated from radioactive wastes has been designed which produces saturated steam. This steam is sent through a turbogenerator to produce electricity. The electrical power output of this system has been calculated as a function of fission product decay time, solidified form of fission products, as well as numerous other parameters.

In the second phase, the electrical energy produced is used to electrolyze water, which in turn produces hydrogen. The amount of hydrogen produced (lb/h) has been calculated for varying electrical inputs, electrolyzer efficiencies, and feedwater temperatures. This hydrogen is then assumed to be liquified and stored. Finally, the third phase considers the burning of this hydrogen in a standard marine gas turbine.

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NELSON, Martin E., Associate Professor, and Clyde C. RICHARD, Associate Professor, "An Application of a Reliability Analysis Method to Actual Unit Failure Data," ASME Century 2 Potpourri Conference, San Francisco, 13-15, Aug 1980.

Several models exist for calculating the increase in power plant availability by adding redundant systems and/or increasing the reliability of components within critical systems. One such model uses accumulated system operating data to predict future plant availability. Based on actual plant data, this model determines the improvement in unit equivalent availability for improvement projects that increase the reliability of already installed components. For projects that add redundant components to critical systems, the model also allows for the determination of the change in equivalent availability. This paper presents calculations of the expected improvement in the equivalent availability of a coal-fired unit for two cases: 1) an increase in the reliability of the pulverizer components, and 2) installation of an additional pulverizer. Based on actual plant outage data accumulated at the component level over a five-year period, a calculation is performed to show the change in unit equivalent availability for increases in the meantime-to-outage of the pulverizer feeders, exhausters, and mills. Additionally, an analysis of the increase in equivalent availability for the addition of a spare pulverizer is made. This calculation shows that a 2.4 percent increase in plant equivalent availability is realized by adding a spare pulverizer to this unit.

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ERCHUL, Ronald A., Commander, USN, and Ronald C. GULARTE, Assi - ant Professor, "Electrical Properties of Calcareous Sediments," Symposium on Performance and Behavior of Calcareous Soils, American Society for Testing and Materials, Fort Lauderdale, Florida, January 1981.

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GULARTE, Ronald C., Assistant Professor, co-author, "Erosion Resistance and Shear Strength of Weak Cohesive Sediments," Fall Meeting of the American Geophysical Union, San Francisco, California, Fall 1980.

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GULARTE, Ronald C., Assistant Professor, "The Physico-Chemical Aspects of Cohesive Erosion," invited guest lecture, Yale University, February 1981.

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INCE, John F., Professor, "MARAD T-AO Commercial Fleet Oiler," Local Section of SNAME, October 1980.

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INCE, John F., Professor, "Finite Source Queues with Heterogeneous Populations," Journal of the Operations Research Society of America, 1981.

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NELSON, Martin E., Associate Professor and Clyde C. RICHARD, Associate Professor, "An Application of a Reliability Analysis Method to Actual Unit Failure Data," ASME Century 2 Potpourri Conference, San Francisco, 13-15 August 1980.

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RICHARD, Clyde C., Assistant Professor, "An Application of EEI Outage Data for Predicting the Availability of a Compressed Air Energy Storage Power Plant," ASME Winter Annual Meeting, Chicago, 16-21 November 1980.

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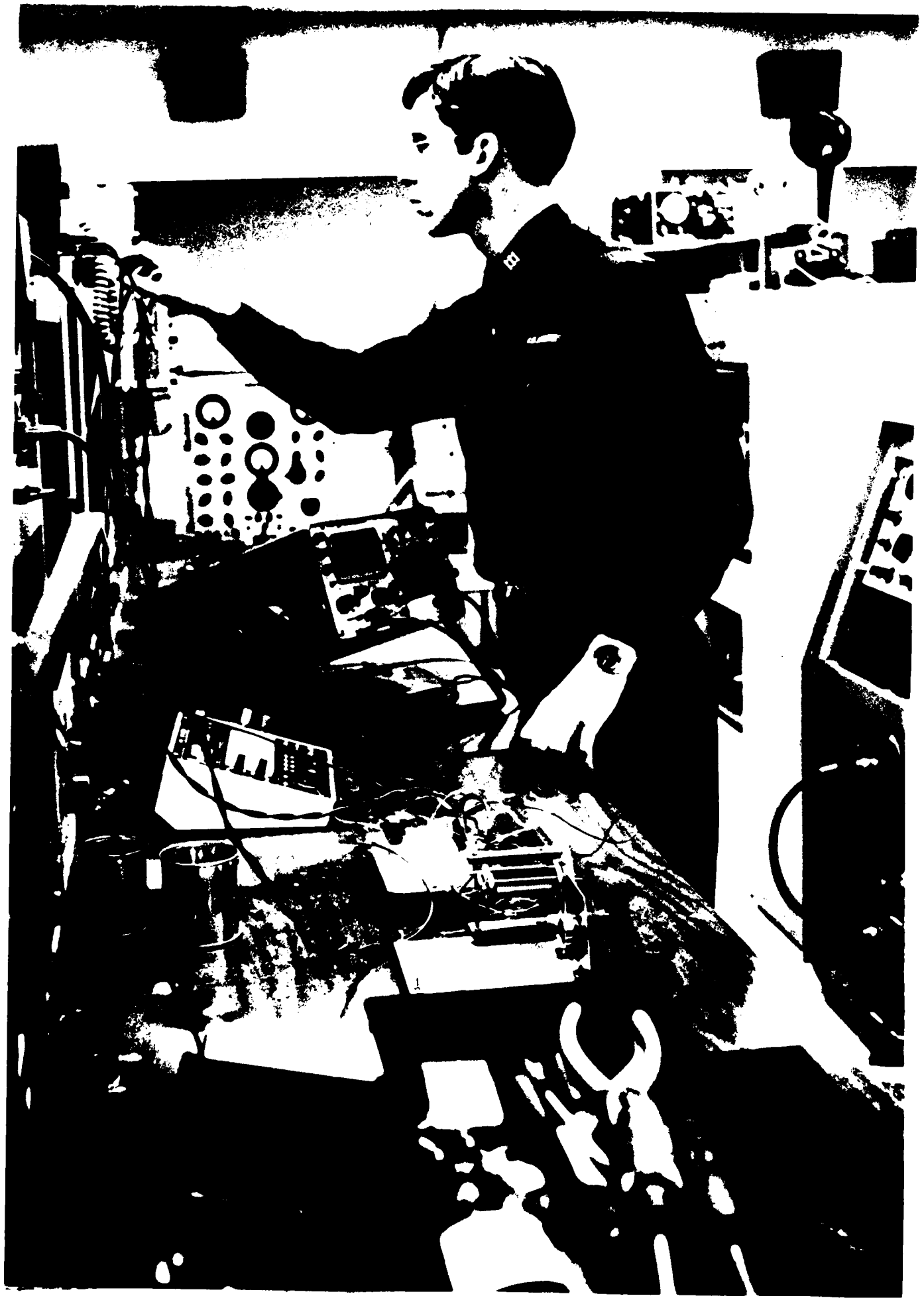

WEAPONS AND SYSTEMS ENGINEERING DEPARTMENT

Professor Charles F. Olsen, Chairman

The Weapons and Systems Engineering Department provides and maintains an environment in which research activities contributing to the professional growth of the faculty and outstanding midshipmen flourish. Such research, in addition to keeping both faculty and midshipmen abreast of today's rapidly advancing technology, ultimately improves the academic environment by providing examples of, and solutions to, existing problems. Where research is based on problems posed by the U.S. Navy, the association causes the academic environment to be more relevant to the professional development of midshipmen.

Faculty research is regularly undertaken by nearly all civilian members of the Weapons and Systems Engineering Department and on occasion by some military members as well. Funding for research activities is available from several sources, including grants or contracts from various federal agencies as well as funding support from within the Naval Academy. Current contracts have been made by faculty members with both the Naval Surface Weapons Center, the Naval Air Development Center, and the Naval Research Laboratory. Excellent faculty and midshipmen research relations have additionally been established with the David W. Taylor Naval Ship Research and Development Center, Annapolis Laboratory.

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STUDY OF GAS DYNAMIC EFFECTS IN NON-UNIFORM HIGH PRESSURE ELECTRICAL DISCHARGES

Researcher: Lieutenant Commander Jonney L. Barto, USN

Sponsor: Chief of Naval Research/U.S. Naval Postgraduate School

The purpose of the research was to investigate and model the stabilizing effects of high speed convection and turbulence on a high pressure (atmospheric) electric discharge for enhanced energy coupling in a continuous wave electric discharge laser. The primary objectives of stability enhancement and development of a physical model accounting for the coupling of the flow field parameters to the atomic level processes inherent in the discharge were accomplished.

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LASER-TRIGGERED SWITCH MODIFICATION TO VEBA

Researcher: Lieutenant Colonel Jerry R. Bettis, USAF

Sponsor: Naval Research Laboratory

A high current, relativistic electron-accelerator, designed and constructed at NRL several years ago has been modified to permit command output switching. As originally designed, the generator pulse forming network had an unbalanced water Blumein with the output switching provided by a self-closing water switch. The switch region of the Blumein was redesigned to replace the self-closing water switch with a laser-triggered gas switch. The switch conversion not only provides a command triggered output capability but also results in significant improvements in the output waveform. Substantial improvement in the voltage fluctuation during the constant portion of the output waveform and in the shot-to-shot reproducibility of the output voltage were necessitated by the requirements of the free electron laser experimentation.

Switching was accomplished by a Q-switched ruby laser-pulse introduced into the spark gap along a radius. Portions of the beam were diverted by partial reflection along two additional radial paths, from the center outward, in order to provide up to three simultaneous switch channels. The radial introduction provides a fail-safe, single channel irradiation along the opposite radius regardless of optical component alignment. A successful modification to the laser-triggered switch was made. Two-channel operation lowered risetime by approximately 50%. The flat portion of the output voltage pulse was increased from

30 to 50 nano-seconds. These characteristics allowed successful demonstration of an intense-beam, free-electron-laser at NRL. The output power from the device far exceeded predictions because of the reproducible nature of the voltage switching.

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RESOURCE SHARING FOR MICROCOMPUTERS

Researcher: Associate Professor C. George Brockus

Sponsor: Naval Academy Research Council

Several microcomputer systems are available for use in the Department. These systems are available to users with a wide variety of backgrounds for application in many diverse project areas. It is not economically feasible to provide mass storage or sophisticated peripherals for each simple system. Conversely, in order for the systems to be used easily by the novice, there must be access to mass storage for program development and for access to the existing library of utility software routines.

The solution is to connect the simple systems in a common communications network with a master system, the latter having the required mass storage, sophisticated peripherals and sophisticated operating system software. The overall design philosophy will be to connect the master system to several communications nodes via serial asynchronous links, and to establish a parallel communications bus at each node interconnecting several simple systems. The ES495 project, Investigations in Serial Communications Networks, has established much of the software to support those serial links.

Hardware development is underway for the parallel bus. The IEEE 488 bus is being used,and both master and slave cards are being prepared for the S100-bus systems of the Department.

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APPLICATION OF MICROPROCESSORS TO CONTROL SYSTEMS

Researcher: Assistant Professor Robert DeMoyer, Jr.

Sponsor: Naval Academy Research Council

A digital controller algorithm has been developed which incorporates state variable feedback and a state observer. The

controller can be applied to various plants and be made to produce various responses by re-computing constants used within the algorithm rather than making hardware changes.

Controller performance has been predicted over a wide range of conditions by use of an all-digital simulation. Design curves produced by the simulation aid in the choice of controller parameters, including sampling rate and micro-computer word lengths.

The simulated results have been verified by an INTEL 8080 based controller applied to physical plants simulated on the EAI 681 analog computer.

Although the major goals of the project have been achieved, some aspects of the problem are continuing to be examined.

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COMPUTATIONAL METHODS FOR THE OPTIMAL CONTROL OF STOCHASTIC PROCESSES

Researcher: Assistant Professor Richard V. Houska

Sponsor: Naval Academy Research Council

The objectives of this research are, 1) to develop theoretical methods for finding the optimal control of a stochastic process that are intuitive from an application standpoint; 2) to develop efficient computational procedures for finding the optimal controls identified by the theory in the first research objective; and 3) to investigate the application of the computational methods described in the second research objective to control and information systems of potential interest to the U. S. Navy.

For a typical control problem, modeling a system means finding a differential equation, usually linear and autonomous, that approximately describes the observed system response. After a suitable differential equation is found, a controller is designed by introducing a control function that modifies the differential equation to give a desired or controlled response. So long as the forces and related aspects of system response can be analyzed in a classical sense (i.e. by application of Newton's Laws) this approach to control system analysis and design works very well. However, when control systems become more complex and systems response cannot be described by simple differential equations, more

sophisticated models of system dynamics must be considered. Most of these alternative models are statistical in nature, and are called stochastic processes. Control problems involving stochastic processes are called stochastic control problems.

Obtaining a numerical solution for many stochastic control problems entails a nontrivial exercise in digital computer programming. Large amounts of data, operations involving high order matrices, and convergent matrix sequences are usually part of any computer program which calculates an optimal control. Further complicating matters from an engineering standpoint is the fact that an understanding of abstract stochastic control theory requires a level of mathematical sophistication not possessed by the typical engineer, even with an advanced degree. Although potentially programmable procedures do exist for many stochastic control models, they are often imbedded in abstract theory, and thus are not likely to be exposed to and tested by the engineering community. One way of closing this gap between theory and practice is to develop the theory in mathematical terms already understood by those who would apply it.

The first results of this research are of a theoretical nature and include several theorems about the existence and form of optimal controls.

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CONTROLLABLE PITCH SCHEDULING ON DD-963 CLASS SHIPS

Researcher: Assistant Professor Jerry W. Watts

Sponsor: David W. Taylor Naval Ship Research and Development Center, Annapolis Laboratory

The intricate propulsion-pitch control systems of gas turbine driven DD-963 class ships were investigated so as to alter the control to provide an automatic trail shaft mode at reduced pitch. Three problem areas were identified. These were the 140 rpm limiter, the PLA-pitch limiter, and the pitch schedule. The proper identification of these problems greatly enhanced the success of the sea trials which followed. Litton is in the process of building a prototype control system for installation on a trial ship.

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REGENERATED GAS TURBINE ENGINES

Researcher: Assistant Professor Jerry W. Watts

Sponsor: David W. Taylor Naval Ship Research and Development Center, Annapolis Laboratory

Waste heat recovery using recuperation on marine propulsion gas turbine engines is being investigated. Performance data of selected engines is being obtained by modifying computer models of those engines. Dynamic engine response under recuperation will be investigated. Most important is the heat soak effect during drop load, which will be examined for possible engine overspeed.

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MICROCOMPUTER-MANAGED CLIMATE CONTROL SYSTEM STUDY

Researcher: Midshipman 2/C Richard A. DeLong

Adviser: Associate Professor Kenneth A. Knowles

This project involving the design and construction of a microcomputer managed climate control system for a model house. Various control strategies were investigated in order to devise an optimal control system.

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VOICE CONTROLLED TABLE-TOP ROBOT

Researchers: Midshipmen 1/C Robert J. Fisher and C. J. Willy

Adviser: Associate Professor Kenneth A. Knowles

This project involved modifying a pneumatic/hydraulic table-top robot; interfacing the electrohydraulic solenoid control valves to an 8080-based microcomputer; and incorporating a commercial speech recognition device to import voice control of the robot. Digital coded disc position feedback was installed but not incorporated into the control loop.

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PNEUMATIC-POWERED MICROCOMPUTER-CONTROLLED REFRESHMENT DISPENSER

Researcher: Midshipman 1/C R. B. Garlinghouse

Adviser: Associate Professor Kenneth A. Knowles

This project involved the design and construction of a pneumatic-powered multiple location pick-and-place device; interface of the electropneumatic control valves with an 8080-based microcomputer; and the development and implementation of the computer control algorithms.

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ALL-ELECTRIC TABLE-TOP MANIPULATOR

Researcher: Midshipman 2/C Kurt S. Harms

Adviser: Associate Professor Kenneth A. Knowles

This project involved the design and construction of a five-axis all-electric table-top manipulator. Counter weights and parallel-motion linkages permitted the installation of the motors on the rotating base plate rather than on the driven linkages themselves.

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MINIATURE ELECTRIC MANIPULATOR

Researcher: Midshipman 1/C Richard S. Kopp

Adviser: Associate Professor Kenneth A. Knowles

This project involved the design and construction of a small, lightweight electric manipulator. Parallelogram linkages permitted mounting the drive motors on the base. The control of this manipulator was chosen for ease of future interfacing with a microcomputer.

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MICROCOMPUTER-CONTROLLED HYDRAULIC MANIPULATOR

Researchers: Midshipmen 1/C J. Kent Mills and Kevin C. Warnke

Advisers: Assistant Professor Richard V. Houska and
Associate Professor Kenneth A. Knowles

The problems investigated in this project include: 1) using a microcomputer to control the position of a "pick-and-place" type of robot arm; 2) using direct digital readout sensors (angular encoders) to provide position information for the robot arm; 3) redesigning and strengthening the mechanical joints of the robot arm; and 4) using pneumatic valves to control hydraulic system.

An 8080 microcomputer was connected to an existing pick-and-place hydraulic robot arm to investigate the capabilities of computer control. A novel automatic positioning system was also developed. It provides for storing a sequence of positions and commands in a learning mode that the robot later uses to complete

a task such as moving an object from one arbitrary position to another. This work is part of an overall program to develop a fundamental robotic system capability in the Department of Weapons and Systems Engineering.

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MODEL RAILROAD SOUND SIMULATION

Researcher: Midshipman 1/C Mark L. Mervine

Advisers: Assistant Professor Richard V. Houska and
Associate Professor Olaf N. Rask

The problem of developing a low cost system for transmitting audio information through model railroad tracks is investigated in this project. The approach used is to frequency modulate a phase locked loop with the desired audio information, send the FM signal through the tracks, and then through the wheels of a railroad car in which a phased locked loop demodulator circuit is installed. The receiver circuit locks on to the FM carrier and extracts the audio information which is then amplified and broadcast through a small speaker mounted in the car. The researcher succeeded in getting the basic system to work; however, more than a desirable level of distortion is present in the demodulated audio signal, and further work in this area is indicated.

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INVESTIGATIONS IN SERIAL COMMUNICATIONS NETWORKS

Researchers: Midshipmen 1/C Mark L. Mervine, Kevin C. Warnke, and C. J. Willy

Adviser: Associate Professor C. George Brockus

Investigations were conducted in methods of serial communications. Communications were conducted among three microcomputer systems at various band rates. Software was prepared for the initialization of the UARTS, for the primitive port handlers for input and output, and for several different communications scenarios.

Communications were conducted with one master and two slaves, with any station capable of initiating the communications. Each station reverted to a polling mode when inactive. The master station was able to initiate a "double-talk" mode in which communications were directed to both slaves simultaneously.

Investigations were conducted into the use of Residue Number systems for the purpose of error detection in communications. Simple communications protocols were established including the use of ASCII headers, EOT symbols, and data transparency techniques useful for the transmission of binary data.

Transmission and receiving programs from this project were incorporated in the Keyboard Monitor used in ES486 in order to permit program transfer between machines in that course.

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MICROCOMPUTER CONTROLLED PNEUMATIC MANIPULATOR

Researcher: Midshipman 1/C David L. Ricks

Adviser: Associate Professor Kenneth A. Knowles

This project involved interfacing an open loop positioner with a microcomputer. A.C. solenoid control valve interfaces were developed.

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BARTO, Jonney L., Lieutenant Commander, USN, co-author, "Study of Gas Dynamic Effects in Non-Uniform High Pressure Electrical Discharge." Naval Postgraduate School Research Report for the Chief of Naval Research, August 1980.

A study of current (Ib) and voltage (Vb) at breakdown for a high pressure corona discharge with a subsonic stabilizing flow is reported. Gas dynamic interactions change breakdown properties in a highly stressed anode with a grounded plate cathode. The current direction is parallel or anti-parallel to the flow. Both Ib and Vb have been found to increase and decrease, not necessarily in phase, nor by the same amounts, as a function of flow speed and turbulence intensity in a complicated fashion. An "anode extension" model has been developed which describes most of the characteristic variations in the breakdown properties. This model is more sophisticated than previous ones in that it reflects dominant processes through a wide range of velocities and turbulence intensities for both flow orientations.

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BETTIS, Jerry R., Lieutenant Colonel, USAF, "Laser-Triggered Switch Modification to VEBA." IEEE Transactions of 1981 Particle Accelerator Conference, 1981.

The VEBA high current, relativistic electron accelerator has been modified for free electron laser experiments by replacing a self-closing water output switch with a laser-triggered gas switch. Reliable switch operation has been achieved in single and two-channel discharges with output waveforms closely matching computer simulation.

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BROCKUS, C. George, Associate Professor, "Magnitude and Time Scaling for State-Space Descriptions of Systems," Computers in Education Division of ASEE Transactions, 12(October 1980), 99-104.

This paper presents a new method for estimating scale factors for systems given in terms of state equations.

The machine variables (scaled state variables) are related to the state variables by a linear transformation. The ratios of scale factors are seen to determine the magnitude scaling for

off-diagonal elements of the system matrix. The size of the scale factors are subsequently selected by consideration of the initial conditions and inputs to the equations.

Ideal ratios are selected in accordance with the goal of obtaining "nice" numerical coefficients for the scaled equations. The actual ratios are determined by satisfying equations of dependence among those ratios while minimizing the error between the desired and actual ratios.

Time scaling is seen to be required by certain conditions in the system matrix.

The method is applied through examples to second order and third order systems, the preponderance of systems to be dealt with in undergraduate engineering laboratories.

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BROCKUS, C. George, Associate Professor, "Conversions From/To Decimal," CoED, (January-February 1981), 9-11.

The current proliferation of microprocessor applications gives rise to a need for many engineers and educators to convert numbers back and forth between decimal representations and those of other bases. The need particularly exists when the alternative bases are powers of two, as in octal (base 8) and hexadecimal (base 16).

Calculators are available which will perform conversions automatically between decimal and some alternative base, but not everyone with a need for conversions has access to them. However, given access to a programmable calculator, that conversion capability can be programmed easily on that calculator. Furthermore, the conversion process will be perfectly general and can be used for conversions between decimal and any desired alternative base.

Two programs are derived for use on the HP-25 to accomplish those conversions. Each program consists of two algorithms, one for the integer portion of a real number and the other for the fractional portion. The first program will convert numbers from decimal to the desired base. The second program will convert numbers from the alternative base to decimal. The arithmetic for all four algorithms is performed in decimal.

The programs are given, together with examples and instructions for program execution. While the programs are perfectly general, they were developed for use with octal and hexadecimal numbers. In those applications they will find their greatest use.

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HOUSKA, Richard V., Assistant Professor, "Problems in Selecting a Digital Controller/Computer for an Automated UNREP System," Report, David Taylor NSRDC, Annapolis, October 1980.

The sensors branch (Code 2732) is currently developing a prototype automatic control system to maintain constant separation distance between ships during UNREP. Several important problems need to be solved in radar to develop a reliable system that will meet expected performance levels. These include selecting computer hardware, and developing appropriate software for real-time command, display and control processing.

This report identifies trade-offs associated with various solutions to these problems and offers recommendations for selecting various approaches.

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KNOWLES, Kenneth A., Associate Professor, "An Algorithm to Detect Inadvertent Motion," Proprietary Technical Report to U.S. Navy, May 1981.

This report develops a software algorithm which, when used in conjunction with a specified hardware circuit, can detect and originate corrective action when simulation trainer motion platforms malfunction. Simplified state space models of the motion platforms are developed, along with a strategy for detecting and neutralizing inadvertent motions caused by both hardware and software malfunctions. Specific algorithms are developed for the TRIDENT Ship Control Operator Trainer Device 21C10.

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KNOWLES, Kenneth A., Associate Professor, "Comments on Rate Versus Position Control for Planes/Rudder Emergency Control," Proprietary ORI, Inc. Technical Memorandum to U.S. Navy, January 1981.

This report investigates hardware, control theory, and human factors aspects of controlling a submarine in near surface configurations when the planes and rudder are in the emergency (backup) mode of control. Current control configurations typically shift from the normal position control mode to an emergency rate control mode. Advantages and disadvantages of each system are presented along with recommendations.

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KNOWLES, Kenneth A., Associate Professor, "TRIDENT Ship Control Operator Trainer (TSCOT) Inadvertent Motion Investigation," Proprietary ORI, Inc. Report to U.S. Navy, July 1980.

A ship control motion simulation trainer had experienced several cases of apparently inadvertent platform motion. Because of the severity of these motions, a potential safety hazard was deemed to exist. The cause of the inadvertent motion and numerous other potential causes were eventually determined. This report delineates the results of the inadvertent motion investigation and presents extensive recommendations for short and long term resolution of the problem.

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MITCHELL, E. Eugene, Associate Professor, "Introduction of Microprocessors into the Systems Engineering Majors at the United States Naval Academy." IEEE Catalog Number TH0083-6, IEEE Computer Society Publication Number 360, 1980.

An attempt is made to describe, in some detail, the process and evolution of the introduction of microprocessors into the Weapons and Systems Engineering Department at the U.S. Naval Academy. The Systems Engineering Department is now a heavy user of microprocessors, but has a non-electrical curriculum. Several planning decisions are discussed, which were found to be extremely valuable. Some of the uses of microprocessors in the Department are mentioned and the impact on the major and curriculum is considered.

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BARTO, Jonney L., Lieutenant Commander, USN, "Gas Dynamic Interactions in a Non-Uniform High Pressure Electric Discharge." 33rd Annual Gaseous Electronics Conference, University of Oklahoma, Norman, Oklahoma, October 1980.

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BETTIS, Jerry R., Lieutenant Colonel, USAF, "Laser-Triggered Switch Modification to VEBA." National Bureau of Standards Conference on Laser Damage in Optical Components, Denver, Colorado, September 1980.

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BROCKUS, C. George, Associate Professor, "Scaling Systems in State Space Form." Pittsburgh Modeling and Simulation Conference, Pittsburgh, April 1981.

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DEMOYER, Robert Jr., Assistant Professor, and E. Eugene MITCHELL, Associate Professor, "A Microcomputer Controller Incorporating a State Observer and State Variable Feedback." Fall Mid-Atlantic ASEE Conference, Lafayette College, Easton, Pennsylvania, October 1980.

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DEMOYER, Robert Jr., Assistant Professor, and E. Eugene MITCHELL, Associate Professor, "A Microcomputer Controller Incorporating a State Observer and State Variable Feedback," ASME Winter Annual Conference, Chicago, November 1980.

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HOUSKA, Richard V., Assistant Professor, "A Simple Matrix Approach to Finding the Optimal Control for a Stochastic Process," Pittsburgh Modeling and Simulation Conference, Pittsburgh, April 1981.

******

KNOWLES, Kenneth A., Associate Professor, "Applications of Single Board Microcomputers as Measurement and Control Devices." ASME Winter Annual Conference, Chicago, November 1980.

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MITCHELL, E. Eugene, Associate Professor, "Introduction of Microprocessors into the Systems Engineering Major at the United States Naval Academy." Workshop on Microprocessors and Education sponsored by IEEE Computer Society and DISEM Project. Presented at Colorado State University, Fort Collins, Colorado, November 1980.

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MITCHELL, E. Eugene, Associate Professor, et. al. "Workshop on Basic Interfacing of Microprocessors." ASEE Annual Conference Amherst, Massachusetts, 1980.

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DIVISION OF
ENGLISH AND HISTORY

ENGLISH DEPARTMENT

Associate Professor Fred M. Fetrow, Chairman

For faculty members of the English Department, Academic Year 1980-1981 was a most active and productive time for literary research and scholarly publication. Six sponsored projects, with support from the Naval Academy Research Council, were underway: a study of the female warrior in the epic tradition; analysis of Shakespeare's influence on a novel by James Joyce; a concordance of the poetry of Alfred, Lord Tennyson; a biography of Lucy Hay, Countess of Carlisle; a study of E. M. Forster's prose style; and a study of the relationship of John Milton to violence and Renaissance culture. Under a grant from the Instructional Development Program, two English Department faculty members were at work on computer packages in literary methodology. Two assistant professors studied in major universities under summer grants from the National Endowment for the Arts. Independent (non-funded) research, with 18 projects in progress, included critical and biographical studies of American and British authors.

One book by a member of the English faculty was published: an analysis of five major and representative examples of recent sports fiction. Two articles appeard in collected volumes of critical essays, and 10 articles were published in literary journals. Seven faculty members made 13 presentations at meetings of professional organizations.

Research, critical investigation, and creative writing by members of the English faculty enhance the quality and vitality of instruction in the classroom as well as the scholarly reputations of those involved and the Naval Academy they represent.

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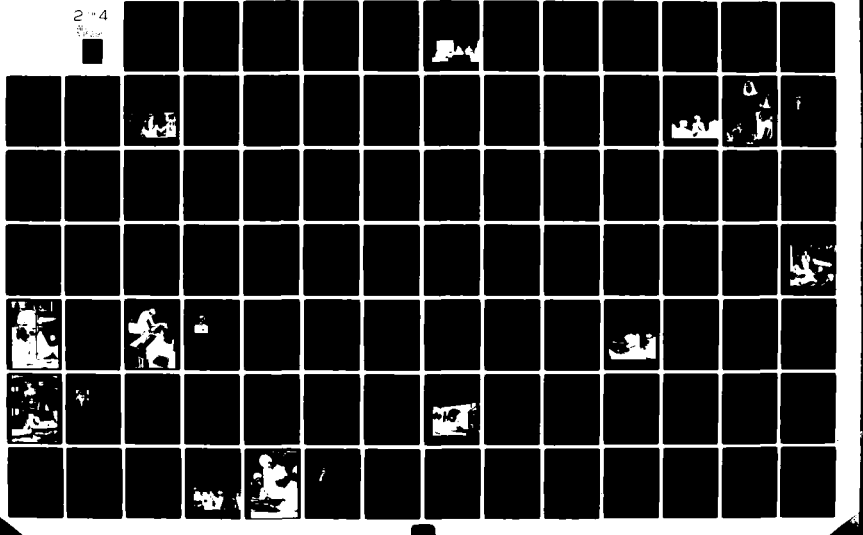

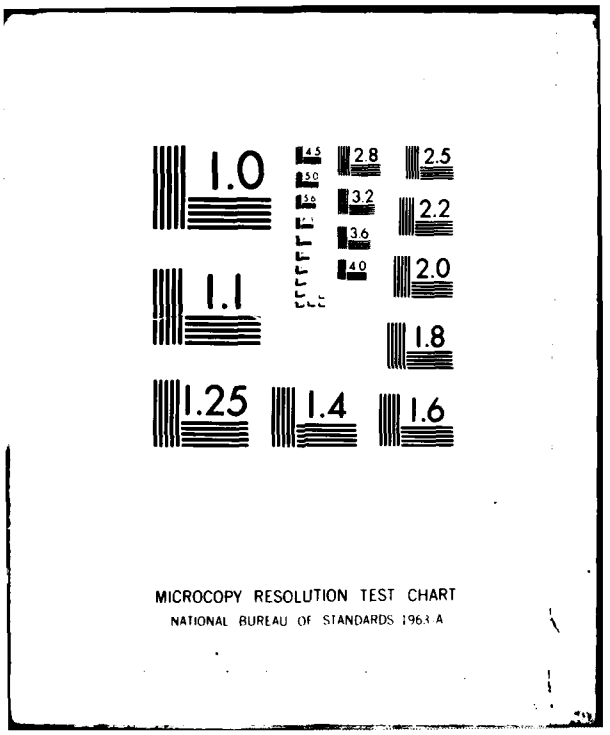
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PENTHESILEIA TO BRITOMART: THE FEMALE WARRIOR IN THE EPIC TRADITION

Researcher: Assistant Professor Mallory Young Clifford

Sponsor: Naval Academy Research Council

Since the appearance of the Amazon queen Penthesileia in a lost epic relating to the end of the Trojan War, the woman warrior has been a significant character in almost every major Western battle epic, Classical and Christian. She appears in Virgil's Aeneid, in Boiardo's, Ariosto's, and Tasso's Italian epics, and in Spenser's Faerie Queene. With Milton's Paradise Lost, she disappears from the battleground, but not forever. Tolkien's contemporary fantasy epic resurrects her as Eowyn, the female destroyer of the Nazgul Lord whom "no living man may hinder."

What is the function, purpose, and role of the epic warrior heroine? Why does she become a significant--almost a necessary--element of epic battle literature? A close study of a number of the most important and interesting warrior women--Penthesileia herself, Virgil's Camilla, Ariosto's Marfisa and Bradamante, Tasso's Clorinda, and Spenser's Britomart--should help answer those questions.

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JOYCE'S USE OF SHAKESPEARE IN FINNEGANS WAKE

Researcher: Lieutenant Commander John Harty, USNR

Sponsor: Naval Academy Research Council

This project, which may result in a doctoral dissertation, is a study of the influence of Shakespeare on James Joyce's Finnegans Wake. Allusions to Shakespeare's life and works have been noted, and the search continues for verbal echoes, either in direct quotations or paraphrases. A literature search reveals that a 1979 Stanford University dissertation addresses this topic. The dissertation has been ordered and will be carefully studied.

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A CONCORDANCE OF TENNYSON'S POETRY

Researcher: Major Laurence W. Mazzeno, USA

Sponsor: Naval Academy Research Council

Concordances, alphabetical word lists showing the location of specific words used by an author within the canon of his works, have long been of value for scholars engaged in literary research. For years such works were produced manually; but in recent years, software technology has been applied to the problem of concordance generation, and computer-generated concordances have become more available. Since the current manually-produced concordance of the works of poet-laureate Alfred, Lord Tennyson is no longer adequate in light of recent scholarship regarding the poet's works, a new concordance will be a most welcome addition to the library of Tennyson scholars. The new concordance will be based on the Longman/Norton edition of Tennyson's works, edited by Christopher Ricks, a work now recognized as the standard text of Tennyson. The Waterloo Concordance Generator Program, modified by personnel at the USNA Computing Center, is being used to produce the concordance.

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A BIOGRAPHY OF LUCY HAY, COUNTESS OF CARLISLE

Researcher: Assistant Professor Michael P. Parker

Sponsor: Naval Academy Research Council

Although recognized as one of the most influential women in seventeenth-century England, Lucy Hay, the Countess of Carlisle, has never been the subject of sustained critical investigation. This researcher has undertaken the initial research for a biography of Lady Carlisle. The Countess was the foremost aristocratic patron of English poetry during the 1620s and 1630s. But Lady Carlisle did not confine her interests to literature. Her role in arranging the royal match between Charles I and Henrietta Maria earned her the intimate friendship of the new queen and an influence upon affairs of state equaled by few women in any age. During the political crisis of 1641, however, Lady Carlisle abruptly transferred her allegiance to Parliament; it was only her timely warning that enabled the opposition leaders in the Commons to escape arrest by Charles I. The motives behind the Countess's political conversion have never

been adequately explained; her private life and literary endeavors lend themselves to equally contradictory interpretations. While contemporary histories, memoirs, and letter collections contain a wealth of references to and assessments of Lady Carlisle, these notices have never been collated and subjected to detailed scrutiny. Through a study of these primary sources, contained in libraries in Britain and America, the researcher hopes to attain an understanding of this complex, puzzling, and undeniably important woman of the seventeenth century.

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RECENT DEVELOPMENTS IN NARRATIVE THEORY

Researcher: Associate Professor Stephen M. Ross

Sponsor: National Endowment for the Humanities

This project included participation in an NEH Summer Seminar for College Teachers at Yale University during July-August 1981.

The seminar was conducted by Professor J. Hillis Miller of Yale, for two decades one of America's leading scholars of British and American fiction. The Seminar concentrated on contemporary theories of narrative and on ways in which recent critics have moved toward more thorough examination of language as it is special to story-telling and prose fiction. In particular the Seminar studied "Deconstruction," a method of reading in which the critic seeks not what the novel's author intended to say but what the author could not say because of limits inherent in language.

Participation in the Seminar has resulted in an article, "The Evocation of Voice in Absalom, Absalom"!" The article studies how the intensely vivid narrative voice in Falkner's novel fails to constitute a reality sufficient for the moral implications of the novel's themes. Faulkner's novel creates excessive voice in an effort to have characters say more than can possibly be said or comprehended.

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E. M. FORSTER'S PROSE STYLE

Researcher: Assistant Professor Molly B. Tinsley

Sponsor: Naval Academy Research Council

This study of E. M. Forster's prose style has been advanced in the following directions: (1) research in the psychology of creativity has given new basis and direction to its stylish methodology by emphasizing the importance of unconscious choice; and (2) the tabulation of syntactic features in a selection of Forster's short stories and in two non-fiction works, The Hill of Devi and Abinger Harvest, is complete. It will be necessary to retabulate, or verify, stylistic features in Howards End and Maurice, a pursuit which has led to an essay on the style of the latter novel.

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INSTRUCTIONAL PACKAGES IN LITERARY METHODOLOGY

Researchers: Associate Professor David O. Tomlinson and Assistant Professor Stephen M. Ross

Sponsor: United States Naval Academy (Instructional Development Program)

Utilizing the CAVE format, two packages are being created initially--one on Literary Creation and Intention" and one on "Literary Biography." The packages will present material to students which cannot normally be brought into the classroom. (For example, manuscripts and documents are not usually moved from the libraries where they are housed.) They will help students master the techniques of dealing with and accounting for such materials through computer questioning.

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SPENSER AND THE EPIC ROMANCE

Researcher: Assistant Professor John Wooten

Sponsor: National Endowment for the Humanities

Professor Thomas P. Roche, Jr. of Princeton University conducted an NEH Seminar during the summer of 1980: "Spenser and the Epic Romance." The seminar focused on three sixteenth-century attempts to renew and rewrite Virgil's Aeneid. The three poets involved wished to create a vernacular epic. Each in his own way--Ariosto, Tasso, Spenser--was attempting to establish a city better than the Rome of Aeneas: the Ferrara of the D'Este, Jerusalem, and Cleopolis. Each succeeding poet uses, imitates, refines the work of his predecessors in much the same way Virgil used Homer.

The methodology used in the seminar was historical criticism: how was each poem read during the Renaissance and how do those readings help us to reconstruct the intentions of the individual authors. The numerous commentaries on Virgil, including the thirteenth book of the Aeneid added by Mapheus Vegius, give a clear picture of how the sixteenth century read Virgil, and these (primarily allegorical) ways of reading are related closely to the commentaries on Ariosto and Tasso. These poems and commentaries establish a context for reading The Faerie Queene, for which no such elaborate commentary exists.

As a result of work in this seminar, the researcher presented two papers to professional meetings.

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"BY VIOLENT STROKE": MILTON, VIOLENCE, AND RENAISSANCE CULTURE

Researcher: Assistant Professor John Wooten

Sponsor: Naval Academy Research Council

This project is the result of the researcher's dissatisfaction with various scholarly and critical efforts to account for or even to characterize John Milton's political and personal development before, during, and after the English Civil War. Milton, major seventeenth-century poet and political revolutionary, moved in the course of his adult life from a passionately actively political idealism to a seemingly pacifistic state of world-weary resignation. Milton, in the 1640's and 1650's, ardently defended the beheading of King Charles I and forcefully celebrated the martial victories of Oliver Cromwell. By 1667,

however, Milton had modified his views. In his last work, Paradise Regained, we have a severely restrained and passionless dismissal of all the Satanic temptations to martial glory, political power, and even humanistic learning. This research project is intended to widen the area of discussion about this development in Milton's attitudes in the belief that a fuller examination of violence in Renaissance English culture will shed new light on Milton's growing disenchantment with physical force as an acceptable weapon for social order.

Successful completion of this project means that very large questions about Milton and his age must be asked and answered. For example, what impression does one get from sixteenth and seventeenth-century accounts of English life about the level of violence in the society at large? What was the contemporary reaction to the various public floggings, mutilations, and executions? Just how frequent were such events, and were many voices raised in objection to what seems to us today a multitude of cruel and unusual punishments? What were Englishmen told by the Church about these matters and about the "glory of welfare"? Was there such a thing as a pacifist in the seventeenth century?

An extended study of contemporary accounts, related secondary materials, Milton criticism, and sociological and psychological theory will start this summer.

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CONRAD'S SEAMANSHIP IN "TYPHOON"

Researcher: Associate Professor James A. Arnold

Conrad's statement in his Author's Note to "Typhoon" that "the particular typhoon of the tale was not a typhoon of my actual experience" is equivocal; it leaves open the possibility that there was no typhoon of his experience. However, he has been quoted as saying later that "I experienced another one in the Indian Ocean, and used my impression of that . . ." Indeed, the weather and sea conditions as described in the story give an accurate impression of such storms as now known and as described in late 19th Century books on weather and cyclonic storms available to Conrad. (It may be possible to find a book on seamanship of Conrad's seagoing period with a chapter on cyclonic storms such as the one Captain MacWhirr consulted.) On the other hand, some of Conrad's data on ship course, direction of swell and wind direction are inaccurate or contradictory. For example, it is impossible to determine whether the Nan-Shan's course, direction of swell and wind determine whether the Nan-Shan's course is north or northeast, though the latter is more likely. However, in that case, the "cross swell from the direction of Formosa Channel" that the ship encounters should be coming from dead ahead rather than broad on the bow and would not cause the severe roll that the first mate wants to moderate by heading "to the eastward." In fact, Captain MacWhirr, a keen observer of detail, says to his first mate that the swell comes from northeast. Apparently Conrad cared little about accuracy of technical detail in his description so long as its general impression was correct and effective.

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CONRAD'S USE OF NAMES

Researcher: Associate Professor James A. Arnold

This study is an attempt to discern a pattern in Conrad's use of real and fictitious names and changes of names of persons, places, and ships in Conrad's fiction. Much data has been collected, but the study is still in an amorphous state. When data are complete, it might lend itself to computer analysis.

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THE GEOGRAPHY OF CONRAD'S EASTERN TALES

Researcher: Associate Professor James A. Arnold

This research project is a complete survey of the setting of Conrad's eastern tales with particular emphasis on Lord Jim. It will be partly based on the published work of Conrad scholars. However, the location of Patusan in Lord Jim has not yet been correctly identified, nor has Samburan in Victory. On the basis of data in the novels themselves and a study of detailed maps in atlasses of the general areas concerned, it should be possible to locate these places.

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THE SIGNIFICANCE OF THE YOUNG RUSSIAN'S BOOK IN CONRAD'S "HEART OF DARKNESS"

Researcher: Associate Professor James A. Arnold

This is a sequel to an article entitled "The Young Russian's Book in Conrad's 'Heart of Darkness.'" The first article identified the book as Nicholas Tinmouth's An Inquiry Relative to Various Points of Seamanship, Considered as a Branch of Practical Science. The sequel will attempt to explain the strong appeal of the book to the young Russian and Marlow, the narrator and protagonist of the story. Such an explanation will require a careful examination of their characters with a view to determining what Conrad really wanted his readers to think of their feelings and attitudes, not only about the book but also about other characters in the story. It will also require a study of contemporary newspaper and magazine articles to define British public opinion about European operations in the Congo.

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LITERARY CONTENTS OF NEW YORK CITY NEWSPAPERS

Co-researcher: Assistant Professor Harriet Bergmann

Work continues on the project previously supported by the Naval Academy Research Council, "An Index to the Literary Contents of New York City Newspapers, 1833-1860." A computer program for filing the data has been written, and well over 3,000 entries are in already. Researchers are entering data from the New York Tribune presently, and hope to publish this part soon. In addition, work is progressing on several articles demonstrating the method of investigation and the uses to which the computer can be put in the humanities.

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THE SPINSTER IN AMERICAN LITERATURE

Researcher: Assistant Professor Harriet Bergmann

Study is in progress on a project designed to discover the role of the spinster as she appears in American literature. Toward the end of the nineteenth century the "new Woman" became a popular figure for such novelists as James, Howells and Wharton. In almost every one of their novels the anti-marriage figure of the spinster appears, making an attempt (usually vain) to dissuade the young woman from believing that marriage is her sole option. Reading in feminist literary theory as well as in a variety of American novels is presently underway.

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MISCHIEVOUS GAMES: PLAYFUL ARTISTRY IN CONTEMPORARY FICTION

Researcher: Assistant Professor Neil Berman

Work continues on this project, originally begun with Naval Academy Research Council support. Although the emphasis began with recent American fiction, the focus has now expanded to include Latin American novelists such as Garcia Marquez, Cortazor, and Infante. The researcher has also found that the French novelists Robbe-Grillet is important for the focus chosen. Along with American writers such as Delillo, Kosinski, Barth, and Pynchon, these writers often weave a game structure directly into the narrative techniques of their fictions. At other times the subject matter suggests a strong nexus between technique and theme.

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THE HERALDRY OF SATAN'S BATTLE STANDARD IN BOOK I OF MILTON'S PARADISE LOST

Researcher: Associate Professor John P. Boatman

All commentators on Milton's carefully crafted description of Satan's battle standard (lines 531-539) have ignored its heraldic import and focus instead on the name and function of Satan's standard-bearer or on the uncertain involvement of the passage in the larger metaphoric structures of the epic as a whole. The investigator believes, however, that reading Milton's description as a heraldic "blazon" yields a greater significance than has as yet been suspected.

Milton's passage presents immediate problems of interpretation. First of all, technical heraldic terminology and its popular associations in biblical history and legend must be recognized. Satan's standard is the heraldic banner of his "house," displaying his heraldic devices and tinctures: diamonds (="gems") in a field of gold (a parody of "celestial armory":V, 553-554); the unfurled ensign streaming like a meteor in the wind both indicates a royal standard (9 yards in length) and parodies the sword of Christ that blazes like a comet (XII, 632-634)--an ironic portent of divine retribution to come. But most significant of all is the combination of "gems," "gold," and "rich emblaz'd" in a single expression. The terms are all heraldic. "Rich emblaz'd" (short for "full riche emblazed") implies a fixed heraldic pattern of the tincture "sable" (black) on the metal "gold." But "sable" is the heraldic designation of "diamond" (which like the "carbuncle" glows in deepest dark), which in turn correlates with the planet "Saturne," popularly known as "Satan's planet," since both share the same evil qualities of disaster, disease, death, and corrupting power.

Furthermore, these same tinctures and charges--diamonds or adamant and gold--appear in the historic battle flags of two of Milton's favorite apostates from virtue: King Harold at Hastings and the Emperor Constantine at the Malvern Bridge--a view that Milton bitterly expresses in his History of Britain (Chapter 6) and elsewhere. Both had failed their divine missions in some way.

Above all, Milton's "blazon" accomplishes three important purposes for him: it reveals the celestial-demonic nature of Satan as the Anti-Christ (in one sense, a parody of the God-Man Christ); it symbolizes the divine paradox in which evil serves the purpose of "eternal providence"; and it integrates the symbolic schemes of light and dark, of ascent and descent, of moral loss and spiritual redemption into one poetic pattern that the poet hopes will "justify the ways of God to man." In short, the "blazon" of Satan's standard announces the central artistic concerns of the poet in the whole epic.

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THE STORYTELLERS OF PARADISE LOST

Researcher: Assistant Professor Mallory Young Clifford

Milton's Paradise Lost relates the events of one week--and all of history. The events of the "present" week are narrated directly by Milton's persona; the past and the future are presented in accounts delivered to Adam by Raphael and Michael. The two angels together narrate nearly half of the entire epic. Narrator and characters alike repeatedly refer to Raphael's tales of war in Heaven and the creation of the world as "relations,"

a possible indication of their weightiness and significance. Adam is the only storyteller in the epic to refer to his tales as stories. Nonetheless, the intensity, liveliness, and richness of Raphael's accounts provide pleasure, one that proves to be a perfectly respectable form of Edenic enjoyment. Michael's long, unembellished account of history presents a sharp contrast; this does not indicate, however, that Milton was aiming towards an ideal "transparent" style. Rather the style of Michael's account corresponds to the literal and symbolic conditions of his narration: Michael is the only narrator in the epic who is entirely impartial.

Milton himself, a partial narrator like the affable Raphael, refers to his own narrative as neither relation nor story, but as song. He thus links himself to both the Classical and Biblical traditions of inspiration and protects himself from the dangerous charge of the hubris of invention.

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AMERICAN LITERATURE OF THE SEA

Researcher: Professor Wilson L. Heflin

The researcher has been preparing a new section on American literature of the sea, to be added in a revised edition of Bibliography of the literature of the United States. About 40 titles will be included: bibliographies, general studies, historical background, and studies of individual authors. Special attention will be given to the life and works of James Fenimore Cooper, Richard Henry Dana, Jr., Edgar Allan Poe, Herman Melville, and Jack London.

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TRUTH AND FEELING IN THE CANTERBURY TALES

Researcher: Assistant Professor John M. Hill

This project, formerly supported by a Naval Academy Research Council grant, has developed into a book-length study. In five chapters, each devoted to two tales or a tale and a prologue, the following parts of Chaucer's Canterbury Tales are examined: the Canon Yeoman's Tale and the Manciple's Tale; the Squire's Tale and the Franklin's Tale; the Shipman's Tale and the Prologue to the Prioress' Tale; Sir Thopas and Melibee; and the Monk's Tale and Nun's Priest's Tale.

This study addresses Chaucer's philosophical concerns in The Canterbury Tales, a crucial matter for understanding the Tales as what they are: a series of brilliant explorations into the truths of human experience and passion, on one level, and the adequacy of various approximations of order on all levels (e.g. marital, ethical, societal and cosmic). The key word is "exploratory"; Chaucer maintains a troublesome relationship vis-a-vis his work and his readers. He puts us in his place: we must struggle, as he has, with all of the perspectives on love and will, justice and order, intent and effect, high seriousness and playfulness that appear in the Tales. What perplexes him, he leaves for us--resolving nothing. A failure to recognize as much, along with little research in Chaucer's philosophical vocabulary and his philosophical use of rhetorical concepts, has led to a scholarly impasse in Chaucer studies devoted to The Canterbury Tales.

Each tale brings with it a tradition of scholarly commentary, which must be accounted for, and may raise scholarly questions that demand investigation on their own. But the way in which Chaucer's philosophical poetics works in each tale is the researcher's main concern. Also, just how each tale illuminates and suggests the main issues of that poetics is studied.

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INTERSUBJECTIVITY AS A MODE OF BEING: AN EXAMINATION OF MARCELIAN CONCEPTS IN WALKER PERCY'S NOVELS

Researcher: Instructor Mary D. Howland

The purpose of this project is to explore Gabriel Marcel's major philosophical ideas and demonstrate their importance in Walker Percy's novels. In addition, study will be made of the related philosophical ideas of Martin Heidegger and Jean Paul Sartre.

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FRESHMAN ENGLISH AGAINST ITSELF

Researcher: Assistant Professor Charles J. Nolan, Jr.

Though the teaching of writing has at last become a legitimate enterprise, its emergence has led in many colleges to the elimination of literature from the freshman course. The reasons for this colossal blunder are several: a misinterpretation of the English department's service function, the pressures of vocationalism, and the writing teacher's new-found prestige. The effects of removing literature, however, are none too good. One of the more misguided results has been the focus on mere skill acquisition; another has been a change in attitude toward both the course and

the students. But most damaging has been the failure to develop literacy in the larger sense. Though the need to cultivate this larger literacy is a principal reason for reintroducing literature, there are others. Since students, as research shows, continue to read books after they graduate, English teachers should aid them in forming some sense of how to judge literature while they are in school. Another reason involves helping students make connections between past and present. Most important, however, the study of literature is essential if students are to become more civilized citizens.

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PLAIN LANGUAGE LEGISLATION

Researcher: Assistant Professor Stephen M. Ross

A number of states have passed legislation requiring "plain language" in certain kinds of legal documents, such as consumer contracts, loan agreements, etc. The legislation presents certain problems in defining "plain language," and in assessing how best to achieve clarity and coherence in documents understandable by average readers. The research involves applying certain linguistic theories to plain language legislation, to determine which descriptions of language and of writing might best accomplish the goals of such legislation.

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THEORY OF NARRATIVE VOICE

Researcher: Assistant Professor Stephen M. Ross

The term "voice" as applied to works of literature has become an important concept in recent American and English criticism. "Voice" seems to offer a conceptual bridge between contemporary critical concerns, with their increased emphasis on abstract analysis, and more traditional concerns with biography and literary history.

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A BIBLIOGRAPHIC STUDY OF AMERICAN SEA POETRY

Researcher: Major Eric Steinbaugh, USMC

This study focuses on American poetry that uses the sea as its predominant subject or major metaphor, including the following:

(1) Poems describing the sea; (2) poems exploring the relationship between man and the sea; (3) narrative legends and and fantasies of the sea; (4) historical and commemorative poems; (5) humorous sea poems and limericks; and (6) poems which use the sea as metaphor.

The initial goal of the project is to compile a checklist of major American sea poetry gleaned from bibliographies, anthologies of sea poetry, and the works of individual American poets. The eventual objectives include a bibliographic essay surveying American sea poetry from 1600 through the present, and an annotated bibliography of American sea poetry.

To date, the checklist includes the works of over one hundred American poets and continues to grow; work continues with an anticipated acceleration during the summer break.

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NOT INDEED FINE: SYNTAX IN E. M. FORSTER'S MAURICE

Researcher: Assistant Professor Molly B. Tinsley

In this study, the researcher argues for a literary, as opposed to linguistic, approach to prose style: style is a resource which the artist can shape and manipulate according to the demands of his narrative. The body of the study illustrates this approach through an analysis of two stylistic patterns in Forster's Maurice--broken parallelism and multiple predicate sentences. The incidence of both patterns is found to be significantly higher in Maurice than in Forster's other "Cambridge novel," The Longest Journey. Both patterns are shown to recur in association with particular concerns of character and theme.

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THE GOLDEN ECHO: LINGUISTIC PATTERNINGS IN HOPKINS' POETRY

Researcher: Assistant Professor Nancy Wicker

Gerard Manly Hopkins was one of the few nineteenth century writers who developed an explicit system that explored the linguistic structures of poetry. His theories of rhythm have been discussed frequently, but his notions of phonic and semantic patternings have received little critical attention. Applying Hopkins' theories to his poems will reveal comprehensive readings of poems and intricate language matrixes as well as provide a richer understanding of the mechanics of poetry in general. Hopkins himself sees rhyme as essential to verse, and he regards rhyme as phonic as well as structural. From these concerns he derives his theories of repeating figures of speech and parallelism of thought. Beginning with Roman Jakobson in 1960, current linguists are just beginning to examine Hopkins' theories. This study will illustrate that the linguistic patternings that Hopkins explores in theory do in practice generate meaning in his poetry. And as Hopkins divides his figures into those of speech and those of grammar, this study as well will consider first phonic and second syntactic patternings as it explores various of Hopkins' poems and ideas.

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BERMAN, Neil, Assistant Professor, Playful Fictions and Fictional Players: Game, Sport and Survival in Contemporary American Fiction. New York: Kennikat Press, 1981.

This book-length study analyzes five major and representative examples of recent sports fiction in terms of the relationship between play and sport. While each writer in this study suggests a dualism between play and a repressive society, none accepts the fact that play is opposed to seriousness, work, or reality. Contemporary American sports fiction denies the validity of such dualisms, attacks them as being naive, and collapses them to show how play is work, sport is reality, and sport and play are serious.

As the metaphors of sport become compellingly literal interpretations of contemporary life, it also becomes increasingly important for the critic to note that sports fiction treats play as reality and suggests that an unplayful world is in fact unreal. Play, often specifically manifested as sport, offers the possibility, real or apparent, of achieving some liberation, and hence self-definition, however minimal, in a reductive world. The player seeks escape from an environment he finds insignificant at best, intolerable at worst. Play is never opposed to reality or seriousness, but all recent sports novels do suggest a dualism between play and the modern world; a repressive, technological society is constantly challenging the more liberating values of play.

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BERMAN, Neil, Assistant Professor, "Characterization in Walden: Thoreau's Portrait of True and False Ego," Thoreau Journal Quarterly, 12 (October 1980), 17-26.

Thoreau's Walden is a "portrait of the artist" in which an ideal protagonist is sketched through both implicit and explicit judgments about the various visitors to the woods society. Man should ideally involve himself in both a higher, spiritual/intellectual nature as well as his physical, more primitive nature. Only through some balance of these two can man properly balance his ego. While positive characteristics may be seen in the woodchopper's physically excellent skills or the pauper's humility, Thoreau's portrait is most fully and ideally described in the character of Bronson Alcott, the philosopher of optimism and faith, who is sympathetic to all men, consistent in his attitudes, and Free because he is pledged to no institution.

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BERMAN, Neil, Assistant Professor, "Coover's Universal Baseball Association: Play as Personalized Myth," reprinted in Contemporary Literary Criticism, Volume 15. Edited by Sharon R. Gunton and Laurie L. Harris. Detroit: Gale Research Company, 1980, pp. 143-144.

Coover's novel stands as the most far-reaching example of a completely internalized play-world which transcends the limitations of the mundane world. J. Henry Waugh (Yahweh) has created a game-world so completely internalized that it creates its own course and meaning, establishes its own myths and rituals, entirely cut off from such venerable mythic traditions as are employed in Malamud's The Natural or Roth's The Great American Novel. Coover thus challenges many of the reader's typical preconceptions about play: although the play-sphere is the product of schizophrenia, it is vastly more interesting, complex, and compelling than the mimetic world of so-called "reality."

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BERMAN, Neil, Assistant Professor, "Zen and the Art of Basketball in Lawrence Shainberg's One on One," Critique, 22 (August 1980), 5-20.

The metaphorical texture and significance of sport are rendered with as much sensitivity and accuracy in Lawrence Shainberg's One on One (1970) as in any recent American novel. This novel marks a sharp break from the muscular, naturalistic tradition in American sports fiction of Hemingway's generation and ranks as one of the best introspective sports novels of our time. Basketball is shown to be an aesthetic experience which makes available to the player the instinctiveness, joy, creative freedom, and magic of sport as sacred play. The liberation of the game is constantly posed as an alternative to many reductive influences of the modern world such as a debased language, narrow stereotyping, and the "futurism" of goal-oriented commercialism. Playful values are not only recovered in this novel, but they also make possible transcendence of a rigid and deadening environment.

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HEFLIN, Wilson L., Professor, "More Researching in New Bedford," Melville Society Extracts, No. 43 (September 1980), 11-14.

Using recently prepared indexes and catalogues at the New Bedford Free Public Library, the researcher concentrated on Herman Melville's first voyage in the ship Acushnet of Fairhaven.

Several important discoveries resulted. First, it was found that Frederick Raymond, first mate of Acushnet, had sailed during a brief, nearly disastrous whaling voyage as second mate of the Winslow, commanded by famous Captain Owen Chase. Chase had been first mate of the Essex in 1820 and had written the sea classic which influenced the conclusion of Moby-Dick--Narrative of the Most Extraordinary and Distressing Shipwreck of the Whale-ship Essex.

Other discoveries included findings about the later whaling career of George W. Galvan, third mate of the Acushnet, and about the earlier whaling careers of two boatsteerers (harpooners), Wilson Barnet and Alexander Barron. Three crew lists from the National Archives are reproduced in this article.

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MAZZENO, Laurence W., Major, USA, "Major Richard Delafield and the US Military Mission to the Crimean War," Joint Perspectives, 1 (Winter 1981), 72-83.

The U.S. Military Mission to the Crimean War appointed by Secretary of War Jefferson Davis in the Spring of 1855 spent almost a year touring Europe and inspecting the battlefield in the Crimean peninsula. Its members, Major Richard Delafield, Major Alfred Mordecai, and Captain George McClellan, each composed extensive reports on the state of the military art in Europe. Yet the Mission's members failed to carry out several important tasks assigned them by Secretary Davis in his published instructions. This article examines the causes for that failure, tracing the journey of the Mission across the continent and into the Crimea. Though ostensibly on a non-political tour, the Mission's itinerary took them to all the major political capitals of Europe; and the backgrounds of two members, Delafield and McClelland, made these men particularly good candidates for a mission whose unstated purpose may have been to assess the capability of European nations to transfer the scene of hostilities from the Baltic and Black Sea regions to the American coast. The fact that the members were delayed by some of the governments they visited, and were not given special treatment as normally accorded representatives of a neutral country, suggests that the European nations were quite skeptical about the intentions of these military representatives from the western hemisphere.

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MAZZENO, Laurence W., Major, USA, "Tennyson and Henry James," Tennyson Research Bulletin, 3 (November 1979 [published 1980]), 111-116.

Critics who have written previously about the influence of Tennyson on Henry James have usually emphasized the author's disenchantment with the poet's works. This essay presents a more balanced view of James's attitude toward Tennyson, demonstrating through a comparison of texts not hitherto considered, that James, despite his occasional disparaging comments, felt a genuine admiration for Tennyson and his works. The subtle way in which James's work displays this Tennysonian influence is demonstrated by analysis of a key passage in one of James's later novels, The Golden Bowl.

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NOLAN, Charles J., Jr., Assistant Professor, "Hemingway: The Writer as Researcher," Review, 2 (1980), 351-359.

When Hemingway published A Farewell to Arms in 1929, he asked Scribner's to downplay the autobiographical element. Early reviewers and later critics, however, insisted upon making the connection between Frederic Henry's experience and Hemingway's life. Now Michael Reynolds has shown that Hemingway drew as much from books as he did from life. Reynolds suggests that Hemingway used a variety of sources; he also ferrets out biographical material that informed Farewell and provides other valuable information as well. Reviewers have had mixed reaction to Reynolds' work, all praising him for his diligent research but some raising questions about his critical judgments and omissions. The present writer agrees with Jeffrey Meyers that "Reynolds' scholarship is superior to his criticism" and provides full support for that judgment, while still recognizing Reynolds' research as a needed corrective to past Hemingway scholarship.

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NOLAN, Charles J., Jr., Assistant Professor, Contributions to the Annual Bibliography of English Language and Literature, Volume 52, eds. Michael Smith, James B. Misenheimer, Jr., and Mary Jean DeMarr. Leeds: Modern Humanities Research Association, 1980.

Contributions to the Annual Bibliography come from a careful review of the many issues of fourteen journals ranging from Anthropological Linguistics to the International Philosophical Quarterly. The contributor examines and notes any article,

edition, book, or thesis, published in any language, that has an important link to English or American language or literature and any ancillary work that bears significantly on those fields. Using a specialized format, he then prepares bibliography cards for such items and forwards them to the American editor, who in turn sends the American contribution to Leeds, England, where the Annual Bibliography is published. The result each year is one of the two major bibliographies in English studies.

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NOLAN, Charles J., Jr., Assistant Professor, "That Hideous Strength: Antidote to Modernism," Bulletin of the New York C. S. Lewis Society, 11 (1980), 5-6.

Rejecting the modernist viewpoint, depicted and also decried by Georg Lukacs in "The Ideology of Modernism," C. S. Lewis affirms in That Hideous Strength that Aristotelian position that man is a social animal. Most obvious is his portrayal of the "menagerie" at St. Anne's as having a strong sense of community, but Lewis' social conception also involves depicting man's place in a hierarchical chain of being and portraying marriage as the focal point of his communal nature. Lewis also rejects the modernist view that human origins and goals are impossible to determine, because he believes that man is created by God. In dismissing various aspects of modernism, That Hideous Strength is his vigorous antidote to modernism.

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PARKER, Michael P., Assistant Professor, "A Source for Thomas Carew's 'Epilogue to a Play presented before the King and Queene,'" Notes and Queries, NS 28 (April 1981), 173-174.

Rhodes Dunlap, Carew's most recent editor, remarks that the "Epilogue to a Play" echoes "the Platonic doctrine of the alternation of opposites developed in the Phaedo." The immediate source for the theory of pleasure expounded in the piece, however, is the opening dialogue of Giordano Bruno's Spaccio de la bestia trionfante. While the epilogue has long been ascribed to Carew on stylistic grounds, the indebtedness to Bruno strengthens the attribution, since Carew made extensive use of the Spaccio in his masque Coelum Britannicum, first performed in February, 1634. More noteworthy than the mere fact of the borrowing is Carew's careful editing of his source to suit the tastes of his royal audience. Bruno's frank references to sexual pleasure are deleted, perhaps in deference to the super-

sensual theories of love espoused by Henrietta Maria and the Caroline court. The borrowing from Bruno in the "Epilogue to a Play" testifies to the range of Carew's intellectual interests, as well as to his ability to employ the fruits of his philosophical reading in a courtly, predominantly lyric, poetic mode.

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SOLLEY, George C., Captain, USMC, "Leadership and the American Character," United States Naval Institute Proceedings, 106 (November 1980), 74-75.

The teaching and practice of military leadership since World War II has increasingly ignored the basic nature of leadership, the imposition of the leader's will toward the fulfillment of a goal, causing excessive reliance on rewards as means of motivation, acceptance of mediocre performance, lack of respect for enlisted men, and reluctance on the part of officers to exert will. Recognition of certain aspects of the American character--individualism, respect for efficiency and success, competitiveness, desire for respect, skepticism toward authority--and the willingness to use the power of will in order to promote excellence can in large part remedy these problems.

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STEINBAUGH, Eric, Major, USMC, "The Critical Reception of Winston Churchill's Historical Romances," Dartmouth College Library Bulletin, 21 (November 1980), 2-12.

Winston Churchill (1871-1947) was the most popular American novelist during the first quarter of this century, judging by the number of books sold. His literary career can be divided into three periods: the historical romances, the political novels, and the socio-religious novels. His historical novels brought him before the public, secured his reputation, and were some of the best-selling books he wrote. A sampling of contemporary criticism reveals that the books were valued for their historical accuracy and life-like sketches of famous people, but were felt to be lacking in literary merit because of melodrama, unconvincing fictional characters, and excessive length.

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TOMLINSON, David O., Associate Professor, "John Pendleton Kennedy: An Essay in Bibliography," Resources for American Literary Study, 9 (Fall 1979; published 1981), 140-170.

There has been no previous bibliographic essay evaluating John Pendleton Kennedy's literary career, his relation to major writers, and his government service, including his tour of duty as Secretary of the Navy. This essay accounts for materials published about Kennedy during his lifetime and up through 1980.

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WICKER, Nancy, Assistant Professor, "Numbers Count: From Generalization to Detail in Freshman Composition," Louisiana English Journal, 19 (Spring 1980), 40-43 (published 1981).

Average freshman writers are handy at loading their compositions with generalizations, and the instructor is often faced with training the students to pay attention to detail. Exploring prewriting skills with a class is essential, but simply encouraging these techniques is often insufficient. If the instructor quantifies the number of items accrued by, for example, brainstorming, and stipulates that they be incorporated into the finished essay, the resulting papers are more vivid, more concrete, and more sound. A simple assignment is to construct a travel brochure and an expose for the same city including at least two dozen items (positive in the first case, negative in the second) generated by the prewriting experiments. Or more complexly, the instructor can conduct an experiment by asking the students to write a paper on a common topic, like the cause of crime, and then demonstrate the value of research for the students by assigning a research paper on the same topic. The instructor now specifies how many documented facts the student must include in the research paper, the number of elements in the thesis, and the types of sources consulted. The students begin to appreciate not only research but also the effectiveness of detail, and the instructor learns the magical power of numbers.

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BOATMAN, John P., Associate Professor, four presentations to the Robert Burns Society, Annapolis, Maryland:

"The Symbolic Society of Ideal Brotherhood in Burns' 'Love and Liberty--A Cantata," 30 September 1980.

"Trick or Treat, or Burns' 'John Barlycorn' and the Ancient Rituals of Fertility," 25 October 1980.

"Burns' 'Underground Poetry' (I)," 24 February 1981.

"Burns' 'Underground Poetry' (II)," 24 March 1981.

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HEFLIN, Wilson L., Professor, "Melville and Nantucket," principal address, Golden Anniversary Celebration of the Whaling Museum, Nantucket, Massachusetts, 12 August 1980.

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NOLAN, Charles J., Jr., Assistant Professor, "Aaron Burr and American Fears," Annual Convention of the Popular Culture Association in the South, Winston-Salem, North Carolina, 17 October 1980.

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NOLAN, Charles J., Jr., Assistant Professor, "Freshman English Against Itself," Conference on College Composition and Communication, 26 March 1981.

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PARKER, Michael P., Assistant Professor, "'To my friend G.N. from Wrest': Carew's Secular Masque," Fourth Biennial Renaissance Conference, University of Michigan-Dearborn, 18 October 1980.

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PARKER, Michael P., Assistant Professor, "The Broken Harp: Davenatus Virbius and the Myth of Orpheus," Southeastern Renaissance Conference, Atlanta, 4 April 1981.

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ROSS, Stephen M., Assistant Professor, "Recent Critical Approaches to Absalom, Absalom!," Modern Language Association, Houston, 27 December 1980.

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TINSLEY, Molly B., Assistant Professor, "Back to Basics: the Five Senses," McKendree College Writers' Conference, Lebanon, Illinois, 1-2 May 1981.

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TINSLEY, Molly B., Assistant Professor, "Fiction Reading," Takoma Park Public Library, Takoma Park, Maryland, 7 May 1981.

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WOOTEN, John, Assistant Professor, "From Purgatory to the Paradise of Fools: Dante, Ariosto, and Milton," Sixteenth Annual Medieval Congress, Kalamazoo, Michigan, 9 May 1981.

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HISTORY DEPARTMENT

Professor Philip W. Warken, Chairman

For the History Department, 1980-1981 was an outstanding year in publication and research. Seven books were published and others revised. All were in the field of naval history. Included among the new publications were the Proceedings of the third and fourth Naval History Symposia sponsored by the History Department. The faculty also published seventeen articles, papers and encyclopedia entries.

Throughout the year, the History Department continued to participate actively in professional conferences across the country. At thirteen of these, faculty members presented papers. Other presentations were made to military and civic audiences.

The results of the History Department's deep involvement in research are reflected in the ongoing enrichment of the classroom experience offered the midshipmen as well as in the production of scholarly publications and papers.

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SEAPLANES: PAST PROBLEMS AND FUTURE PROSPECTS

Researcher: Assistant Professor P. R. Artigiani

Sponsor: Advanced Concepts Division, NavAir Systems Command

Given the remarkable effectiveness of off-the-water flying from the earliest days of aviation history through World War II, explaining the sudden disappearance of seaplanes from Western arsenals is difficult. This essay explores a variety of contingent and systematic factors leading to a general decline in the perceived utility of seaplanes. Recognizing the importance of most of these factors, the study nevertheless finds that seaplane technology continued to develop during the period 1945-1980. Recent changes in environmental factors affecting the desirability of seaplanes to planners may take advantage of technological developments in the past. If that is the case, the study concludes, the technology exists to make seaplanes effective instruments in a large variety of missions.

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THE COMMANDANCY OF GEORGE BARNETT, 1914-1920.

Researcher: Lieutenant Colonel Merrill L. Bartlett, USMC

Sponsor: Naval Academy Research Council

Military and naval historians generally agree that the most far-reaching institutional changes in Marine Corps history occurred during World War I. The Corps grew from fewer than 10,000 men to more than 75,000. More importantly, the role of the Marine Corps in the age of the battleship Navy was fixed, while detached service with the Army proved successful. The man largely responsible was Major General Commandant George Barnett (1859-1930), USNA 1881. Even so, he was abruptly "sacked" in 1920 by Secretary of the Navy Josephus Daniels.

While Barnett's efforts to expand the size of the Corps have received study, his overall impact on the office of the Commandant of the Marine Corps has seen little scholarly inquiry. When Barnett assumed the post in 1914 (largely as a result of political patronage), his staff consisted of three principal staff officers--Adjutant and Inspector, Paymaster, and Quartermaster--plus their assistants and a few harried and overworked clerks. Six years later and with a Corps that had increased almost eight fold, Barnett's office brimmed with bright young Marine officers and Headquarters Marine Corps had become

transformed into a modern and efficient administrative organization. To many, it appeared that the the office of the Commandant was on a par, albeit socially and politically, with that of the Chief of Naval Operations.

Throughout his commandancy, Barnett was opposed by two powerful factions. His day-to-day antagonist was the Secretary of the Navy. An egalitarian moralizer, the progressive Daniels interpreted every act by Barnett as being motivated by self-serving aggrandizement. No matter that Barnett pleaded that it was for the good of the Corps. Daniels was supported in his criticism by the powerful Chairman of the House Naval Affairs Committee, Congressman Thomas S. Butler, a fiery Quaker whose son, Smedley, was one of the Corps' most colorful officers.

How Barnett was able to shape the Marine Corps to his own perspective rather than bend to the forces opposing him is the keynote of this study on his commandancy. Marked by bureaucratic efficiency at home, expeditionary duty successfully accomplished in a variety of inhospitable places, and a splendid reputation earned in combat in France, the period under study served to foreshadow similar expansion and successes in World War Two.

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THE PAPERS OF JOHN PAUL JONES

Researcher: Assistant Professor James C. Bradford

Sponsor: Naval Academy Research Council and the National Historical Publications and Records Commission

This project will produce a complete, scholarly edition of the papers of John Paul Jones. The first phase of the project involves the collection of all materials. To date copies have been obtained from 65 repositories. Over 2000 items have been accessioned and filed, targets have been prepared for future photographing, and transcribing of documents has begun. This phase of the project should be completed by June 1981. Documents will then be selected for the letter-press edition, all documents prepared for publication; a subject index and finding guide will be prepared. The entire project should be completed by August 1983.

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WOODROW WILSON - TRANSITION OF THOUGHT FROM CONGRESSIONAL GOVERNMENT TO CONSTITUTIONAL GOVERNMENT IN THE UNITED STATES

Researcher: Lieutenant Constance Carte, USN

Sponsor: Naval Academy Research Council

The political views of Woodrow Wilson change drastically from the publication of Congressional Government to the publication of Constitutional Government in the United States. The proposed study will reflect a clear advantage over the classic Link interpretation which explains the evolution of Congressional Government as an occurrence singly inspired by Wilson's admiration of the English constitutional system. Link offers his assessment that Wilson's perspective was shaped by Bagehot's English Constitution and Gamaliel Bradford's writings. The problem with this interpretation lies in the fact, recognized by Link, that "it is inconceivable that Wilson did not read all or most of these editorials and articles, yet there is no mention of any of them in his writings." While Wilson does state in a letter to Ellen Anxson that Bagehot's study did influence his own study, this factor still fails to adequately explain why the study was undertaken; it merely provides an insight into a manner of approach. Moreover, the Link study does not trace Wilson's political growth of thought from 1884 to 1908.

The proposed study will set forth the impact of political changes occurring between 1884 and 1908 that are responsible for his shift in political philosophy. The study will, in comparing and contrasting the philosophies of each of Wilson's works, show the transition of this thought from the early to latter stage. Consideration will also be given to evidence of Wilson's personal development, which may also lay claim as cause for any change in political perspective. The importance of exploring this area becomes clear as one considers that this man who writes of the inconsequential nature of the presidency in 1884 has completely altered his perspective by 1908 and subsequently runs for that very office. Wilson, prior to 1884, fashions himself as one day becoming a senator and believes that the real power in the nation lies in Congress; yet he never runs for Congress. So little is clear to explain why these changes came to be, but one fact is certain: a closer look is needed at this time during which the foundations of Wilson's political thought shift; for we may have herein another key to understanding his presidency.

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DYNAMIC MILITARY ENGAGEMENTS THROUGH COMPUTER GRAPHICS

Researcher: Associate Professor William M. Darden

Sponsor: Naval Academy (Academic Dean)

The object of this project is to present a classroom demonstration by means of computer graphics of the background, development, and results of selected battles. Complete statistics of the opposing forces, as well as pictures of important commanders, the battlefield terrain, and weapons used, are made available.

The Battle of Gettysburg was put on line this year.

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HISTORY OF MARINE AMPHIBIOUS OPERATIONS IN WORLD WAR TWO

Researcher: Associate Professor William M. Darden

Sponsor: Naval Academy (Academic Dean)

In contrast to the preceding project, the decision was made to put amphibious operations on videotape rather than the computer. A 25-minute documentary of the Northern and Central Solomons Campaign views the course and assesses the significance of the struggle. It is hoped that this project will help show the history and development of Marine amphibious operations in World War Two.

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"BABUSHKA" OF THE RUSSIAN REVOLUTION: THE LIFE OF EKATERINA K. BRESHKO-BRESHKOVSKAIA, 1844-1934

Researcher: Assistant Professor Jane E. Good

Sponsor: Naval Academy Research Council

Ekaterina Konstantinovna Breshko-Breshkovskaia (1844-1934) was a prominent naroknik (populist) and leader of the Russian Socialist Revolutionary Party. Her devotion to the revolutionary cause, her generosity to her fellow Siberian exiles, and her solicitude for the poor earned her the nickname Babushka--"Little Grandmother" of the Russian Revolution. The project is to research and write a book-length biography of Breshkovskaia.

Breshkovskaia's life deserves study for several reasons: Breshkovskaia lived ninety years; she was born during the reign

of Nicholas I and died as Stalin tightened the reins of his communist dictatorship. Therefore, her life spanned three distinct periods of Russian revolutionary activity: the revolutionary underground (1860-1917); the Revolutions of 1917; and the revolutionaries in European exile. Usually these periods are studied separately, largely because few of the narodniki survived tsarist persecution to witness the revolution when it finally occurred. A careful study of her activities is thus a chronicle of the fate of the entire revolutionary movement in Russia.

Breshkovskaia was a narodnik, a Socialist Revolutionary, and not a Marxist. She began debating Marxists in the 1890s, when the writings of Karl Marx first began to attract the attention of revolutionaries disillusioned by the failure of the populists to overthrow the autocratic regime. She remained an implacable foe of the Bolsheviks until her death.

The biography of Breshkovskaia will be based on the type of primary source material that historical research demands: archival and manuscript collections letters; diaries; reminiscenses; interviews; and newspaper accounts. Indeed, Breshkovskaia is a good subject for study because all of this vital material is located outside the Soviet Union. (Since she is a "non-person" in the Soviet Union today, it would be impossible to gain permission to go there to work on her biography). In particular, the biography will address such questions as why Breshkovskaia turned from reform to revolution; why she committed herself to the theories of Russian populism; why she was able to emerge from Siberian exile still eager to continue to fight autocracy when so many of her fellow exiles gave up the struggle; and why she was so hostile to Marxism in general and Lenin in particular.

Breshkovskaia's impressions will be analyzed within the framework of Russian populism, but the entire movement will not be reduced to her thinking. Also, it is difficult to answer motivational questions without resorting to some psychological analysis. Thus, although the study will not be a pure psychobiography, insights from the field of psychology will be used when appropriate.

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RESTRICTIONS ON ACCESS TO GUAM, 1898-1962

Researcher: Associate Professor Frederick S. Harrod

Sponsor: Department of Justice

Based upon records of the Department of the Navy, this study examines the limitation the Navy placed upon civilian travel to Guam. From the time of the acquisition of Guam in the Spanish American War, the Navy recognized the strategic value of the island. Because of Guam's isolation, restrictions were not burdensome before 1942. In the rebuilding period after 1945, the Navy assumed even greater control of the island. With Guam's transfer to the Interior Department, continued Navy restrictions became increasingly controversial and the Navy eventually rescinded such control.

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APRA AND THE PERUVIAN MILITARY, 1948-1968

Researcher: Assistant Professor Daniel M. Masterson

Sponsor: Naval Academy Research Council

This study, in its present form, traces the impact of a powerful independent political party on the armed forces and focuses on the competition for political power. In the decades following 1930, sizeable numbers of junior and non-commissioned officers conspired with APRA for a variety of social, political, and personal motives. Understandably, loyal officers, reacting to the breakdown of military discipline resulting from APRA's revolutionary activism, sought the party's destruction. These efforts, however, were met with stiff APRA resistance which was frequently supported by military dissidents who actively opposed the policies of their anti-Aprista superiors. After 1948, when APRA turned away from revolutionary politics, the intensity of this rivalry subsided. But nearly twenty years of plotting, rebellion, and intrigue were manifested in the actions of the officer corps during the 1960s. This study will concentrate on the military's successful efforts to thwart the presidential ambitions of APRA chief, Haya de le Torre, in 1962. It will also examine the link between past APRA-military conflicts and the strong anti-civilian bias expressed by the officers who seized power in 1968.

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MEMBER COUNTRY INFLUENCING OF ORGANIZATIONAL DECISION-MAKING: THE CASE OF THE WORLD BANK GROUP

Researcher: Lieutenant Commander Robert W. Stuart, USN

Sponsor: Arleigh Burke Scholarship

This study was intended to meet the final outstanding requirement for the degree of Ph.D. (International Economics) which was conferred by the Fletcher School of Law and Diplomacy, Tufts University in May 1981.

The completed study met three research objectives. First, a review of functional, structural, and behavioral literature was conducted to identify the key elements to be included in a comprehensive decision-making model equally applicable at the three levels of analysis. Second, this decision-making model was constructed and functional, structural, and behavioral overviews of the model developed. Then finally, the model was tested considering one particular international development organization, the World Bank Group.

The in-depth analysis of the decision-making processes of the World Bank Group uncovered the existence of precise influence avenues or "influence pressure points" by which or along which a member country can exert significant influence and subsequently direct the nature of organizational output.

In short, the study became a prescription for developmental organization member countries to maximize the return from their organizational investment.

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TECHNOLOGY AND HUMAN VALUES

Researcher: Assistant Professor P. Robert Artigiani

Surveying the literary responses to technological change, a pattern of hostile criticism is established in which technology is described as "dehumanizing." Upon analysis these criticisms are shown to be fairly typical of human responses to eras of transition and not legitimate critiques of technology. It is then argued that technology required cultural developments which seem more likely to expand the concept of humanism and that writers like Saint-Exupery have clearly demonstrated the potential benefits arising from appropriate responses.

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SOLDIER AND SAILOR TOO: THE AUTOBIOGRAPHY AND PAPERS OF MAJOR GENERAL COMMANDANT GEORGE BARNETT (1859-1930)

Researcher: Lieutenant Colonel Merrill L. Bartlett, USMC

Major General Commandant Barnett was the first USNA graduate to become Commandant of the Marine Corps (1914-1920). His papers and autobiography provide a valuable insight into the life of a promising Marine Corps officer in the late nineteenth and early twentieth centuries. Barnett's recollections of midshipman life and motivation to be a Marine are also interesting. Barnett's contribution to the development of the Advance Base Force and employment of Marines in World War One deserves inquiry and analysis. The subject has been accepted as a topic for a doctoral dissertation at the University of Maryland.

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GEORGE BARNETT, 1859-1930: A REGISTER OF HIS PERSONAL PAPERS

Researcher: Lieutenant Colonel Merrill L. Bartlett, USMC

As Major General Commandant, 1914-1920, George Barnett headed the Marine Corps at an important, transitional stage of its history. This register of his papers, covering the entire span of his career, 1881-1923, should be a valuable tool for students of the naval service. It has been accepted for publication by the Marine Corps Historical Center.

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A HISTORY OF THE PUGET SOUND NAVY YARD, BREMERTON, WASHINGTON

Researcher: Professor William M. Belote

The purpose of this project is to present an objective, concise, scholarly history of the Puget Sound Navy Yard located at Bremerton, Washington. This study will comprise an approximately 5,500-word chapter in a book on American naval bases to be assembled and edited by Professor Paolo E. Coletta. The author will gather source materials for the chapter on the Bremerton Yard this summer, using his summer home nearby as a convenient research base. Professor Coletta has already written to the Public Information Office at the Yard concerning the availability of research materials. Local newspapers, including files of the Bremerton Sun, are also available. A Yard Museum located at the ferry dock in Bremerton may supply materials also.

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THE 'SHELL-SHOCK' CRISIS OF WORLD WAR I: THE ENGLISH CASE

Researcher: Assistant Professor Theodore Bogacz

This study will deal with the revolutionary impact of the hundreds of thousands of "shell-shock" casualties in 1914-1918 on the Army's, the Government's and the English public's attitudes toward psychology and mental illness.

The author begins by briefly describing the terrifying conditions on the Western Front which drove so many soldiers into nervous collapse and then discusses how the massive incidence of shell-shock in World War I affected the British Army from battalion medical officers to the General Staff. He will try to demonstrate that shell-shock, regarded in 1914-1915 as an excuse for cowardice (when recognized at all), by the end of the war was being treated with a surprising degree of sophistication by Army authorities. Turning to civilian responses to the shell-shock phenomenon, he stresses the ignorance and hostility which in 1914 characterized the educated public's attitudes toward psychology and mental illness. By 1918, the English national press reflected a vast shift of attitudes: the Times, for example, was advancing complex psychological theories to explain shell-shock and was now casually employing the once-recondite language of Freudian analysis in its columns. The author will conclude with an examination of the British Government's post-war investigation of the shell-shock crisis which demonstrates how far attitudes toward mental illness and its treatment had altered in little less than a decade as a result of the shell-shock crisis of World War I.

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BONDING AND BREAKDOWN: MORALE IN THE ROYAL WELSH FUSILIERS IN THE GREAT WAR

Researcher: Assistant Professor Theodore Bogacz

This study will examine the morale of a single battalion which fought on the Western Front from 1914-1918; the 1st Battalion, Royal Welsh Fusiliers. Through unpublished letters and diaries and interviews with survivors, the author will attempt to reconstruct the daily life of this British Army line battalion and to explain why the morale of this unit never broke in spite of its horrendous losses at Ypres, the Somme, and Passchendaele.

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GENERAL CLIFTON CATES, USMC

Researcher: Professor Paolo E. Coletta

A biographical essay is being prepared for Commandants of the Marine Corps, edited by Assistant Professor Robert W. Love, Jr., and Lieutenant Colonel Merrill L. Bartlett, USMC.

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U. S. NAVAL BASES

Researcher: Professor Paolo E. Coletta

The task is to acquire authors to write essays on United States naval bases. This is a 250,000-word project.

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CURATORES VIARUM: HIGHWAY MAINTENANCE IN ITALY IN THE ROMAN EMPIRE

Researcher: Assistant Professor Phyllis Culham

This study examines the history of the organization of attempts to build and maintain Italian highways under the Roman Empire. It provides a detailed examination of the imperial bureau devoted to highway maintenance. All personnel known to have been attached to the bureau are discussed in an effort to compare it to other bureaus and to gain new insights into Roman Social history. The work has been provisionally accepted for publication, pending revision.

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THE NORSE IMPACT UPON MILITARY STRATEGY IN WEST FRANCIA, 862-869

Researcher: Assistant Professor Carroll M. Gillmor

Until the Northmen first attacked the seacoasts and later directed their raids from inland waterways, the strategy of Carolingian monarchs (Charlemagne and his successors) had been directed towards problems of offensive wars of conquest on land. With the coming of the Norse invasions, control of the waterways emerged as the major strategic objective for the first time in the military history of western Europe. The purpose of this study is to demonstrate that Charles the Bald, a grandson of Charlemagne, devised an effective strategy to deal with these sea raiders, and in so doing, brought about a shift from offensive to defensive warfare. By examining the response of a land-oriented military force to invasion by sea raiders, this work will make a significant contribution to the early history of European seapower. Moreover, in addition to overturning some commonly held assumptions about the warfare of this period, analysis of these military events will help to explain the dismemberment of the Carolingian Empire, a development which was of the utmost importance for the territorial formation of modern European nations.

Through the application of textual analysis and the interdisciplinary methodology of archaeology and iconography, this study will explain the dynamics of change from an offensive to a defensive strategy. Moreover, the incorporation of comparative data on Norse cavalry operations in England, as well as fortification building both in England and Germany, will place the strategic shift in West Francia in the broader context of Ninth Century European military history.

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WAR ON THE RIVERS: THE FRANKISH MILITARY RESPONSE TO THE VIKINGS

Researcher: Assistant Professor Carrcll M. Gillmor

This study will cover the following basic areas: Carolingian defense strategy to c. 840: a background chapter on the fortifications, garrisons, and coastal defense measures of Charlemagne and Louis the Pious; the Viking military threat, primarily devoted to the logistics of the Norse raids, especially the speed of navigation on the rivers as determined by the ship and its equipment as well as by tidal and river currents; riverine defense on the Seine - discusses the entire bridge-building process - royal supervision of the project, selection of a site, description of the physical structures, logistics - the mobilization of workers

and construction materials, maintenance of garrisons, impact of bridge-building on the existing military organization; emergence of a defense strategy in the Loire Basin - documents the change from the offensive warfare of Charles the Bald's field commander, Robert the Strong, to the defensive strategy which combined fortified bridges and garrisons.

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THE BATTLE OF FONTENOY, 841: A RECONSIDERATION

Researcher: Assistant Professor Carroll M. Gillmor

Fontenoy was one of the major set battles of the Carolingian period. The analysis of this battle requires the recognition of linkages and the resolution of contradictions in the accounts of four eyewitnesses. After reconstructing the battle from fragmentary evidence, the study will then make some observations about the performance of Carolingian armies in the field.

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SOLZHENITSYN'S PRECURSOR: V. G. KOROLENKO'S VISIT TO THE UNITED STATES, 1893

Researcher: Assistant Professor Jane E. Good

This study compares the written impressions of America by the nineteenth century Russian radical author V. G. Korolenko with Alexander Solzhenitsyn's recent critique of the United States. It concludes that certain features of their criticisms are remarkably similar. Both find Americans to be excessively materialistic and caught up in transitory problems. They also regard the press as irresponsible. Both believe that America has great potential, but that, as yet, it has been unfulfilled. The article has been accepted for publication in The Historian in 1981.

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VLADIMIR KOROLENKO

Researcher: Assistant Professor Jane E. Good

The career of the Russian radical, populist, and writer Korolenko (1853-1921) is traced in a 2,000-word study. It has been accepted for publication in the Modern Encyclopedia of Russian and Soviet History. Because of a mix-up, it was deleted from

the volume for which it was originally scheduled, but will appear in a supplement.

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THE RELUCTANT PARTNER: THE UNITED STATES AND THE CREATION AND EXTENSION OF THE CONVOY SYSTEM 1917-1918

Researcher: Senior Lecturer Eric Grove

The thesis developed is that the United States played a vital role in convoy in World War I, but this was despite considerable hostility both to the strategy itself and the idea of defending Allied (expecially British) shipping. Research is being carried out using National Archives; Operational Archives and Naval Library at Washington Navy Yard; and the Library of Congress.

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NATIVISM, ETHNICITY, AND THE ENLISTED FORCE OF THE NAVY AND MARINE CORPS, 1870-1910

Researcher: Associate Professor Frederick S. Harrod

During the late nineteenth century, growing nativist sentiment throughout the nation had its counterpart in efforts to "Americanize" the enlisted force. Although the Navy had traditionally accepted large numbers of foreigners, it became increasingly displeased with what Secretary Benjamin Tracy characterized as its "mongrel crews." In Manning the New Navy, the author has considered some aspects of this subject. Yet many important avenues of research relating to the attitudes of Navy officials and civilians toward foreigners in the service remain to be explored. In addition, the Marine Corps is completely unstudied.

The project is continuing along three main lines of research. One avenue is additional searching for writings by nativists on the Navy and Marine Corps and writings by officers expressing nativist sentiments to establish personal and ideological links between the two groups. The second area of concentration is further archival research into Navy and Marine policies regarding aliens. The third major line of study concerns the enlisted force of the Marine Corps. There is a need to investigate all aspects of Marine enlisted policy as well as particular questions relating to non-citizens in the force. In this way it will be possible to understand the specific policies of the Marines and to compare these policies to those of the Navy.

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COLONEL CHARLES G. McCAWLEY, COMMANDANT OF THE U. S. MARINE CORPS, 1876-1891

Researcher: Associate Professor Frederick S. Harrod

A biographical essay which will be a chapter in a collection of essays on the Commandants of the Marine Corps, edited by Associate Professor Robert W. Love, Jr., and Lieutenant Colonel Merrill L. Bartlett, USMC, of the Naval Academy.

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THE AMBIGUOUS REFORMATION IN THE TERRITORIAL CITIES OF UPPER AUSTRIA, 1520-1576: ENNS, FREISTADT, GMUNDEN, LINZ, STEYER, VOCKLABRUCK, AND WELS

Researcher: Assistant Professor Corina M. Herrera

This study explores the responses to the Protestant Reformation of the sixteenth century in a selected group of small cities. While much of the previous and current literature in this field has concentrated on major urban centers in which the Reformation gained early and formal acceptance, this study analyzed a region in which incremental change provided the key to religious conviction. Because the critical obstacle to a formal Reformation was the lack of strong and consistent leadership, this research surveyed the role of local elites, including the clergy, lay students and later magistrates, and the school teachers.

The dissertation has been accepted by the graduate faculty at Yale University and the Ph.D. was conferred in May 1980.

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INTELLIGENCE AND VALUES

Researcher: Professor David E. Johnson

The purpose of this project is to assess the implications in the evolution of our concept of human intelligence for changes in our value concepts. The author's objectives are: (1) to clarify for himself one significant shift in our conceptual framework; (2) to write about the conclusions of his research so that he and others can understand what is written; (3) to publish some of these writings. The author plans to read several books and articles dealing with artificial intelligence as an adequate model for human intelligence, comparing them with more traditional notions of the nature of man. Then he will analyze the implications of these changes in our culture's view of man for our values. This project is in preliminary stages.

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FROM PEARL HARBOR TO TOKYO BAY: ERNEST J. KING AND THE AMERICAN NAVY IN THE SECOND WORLD WAR

Researcher: Associate Professor Robert W. Love, Jr.

This project is a major study of American naval policy and strategy under the leadership of Fleet Admiral King during the Second World War. Research on the first portion of the study, which concerns the period from the Japanese attack on Pearl Harbor to the victory on Guadalcanal, has been completed and the manuscript is being readied for publication. The major theme of the study is the significance of individual leadership in the formulation of national policies, as exemplified by the activities of Admiral King during the first year of the global war. Additionally, the study attempts to explain the close connections between theater strategies, arms transfer, institutional imperatives, military construction, and perceptions by leaders of national interests.

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POLITICS AND MILITARY PROFESSIONALISM IN PERU, 1939-1963

Researcher: Assistant Professor Daniel M. Masterson

The process of military professional development in Peru in the mid-twentieth century is reviewed in the context of civil-military relations, including political affairs, and of the evolution of institutional ideology within the armed forces themselves. Special attention is paid to the reformist orientation (structural, economic, and agrarian) of the Peruvian military. Field research, including extensive personal interviews, has been conducted in Peru, as well as in relevant American archives.

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THE ABOLITION OF PURCHASE IN THE BRITISH ARMY

Researcher: Captain Brendan P. Ryan, USMC

This research was conducted as part of course work in a seminar in British history in the 19th century. It is an examination of the criticism raised against the system whereby a potential officer in the British Army made a cash payment to the government for the commission, and later paid additional sums to other officers for promotion. This system was criticized as the source of incompetence and unprofessional attitudes toward

service. Purchase was abolished in 1871 by the Secretary of State at War, Edward T. Cardwell. The Cardwell Reforms are considered the foundation of the modern British Army. However, the facts and circumstances of the abolition of purchase are often clouded by future value judgments that did not play upon the decisions of Cardwell and his contemporaries. Additionally, many of the justifications for the abolition of purchase were window-dressings that were neither realistic nor proven after the system ended. This paper reviews the incidents and arguments leading up to Cardwell's reform bill and reassesses the actual results of the reform. It is based primarily on secondary works but does incorporate some material from the Parliamentary Sessional Papers, Hansard's Debates, and the Reports of various Royal Commissions.

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THE DEVELOPMENT OF CHRISTOPHER HILL'S HISTORIOGRAPHY

Researcher: Captain Brendan P. Ryan, USMC

Christopher Hill is one of the most significant historians of Stuart England and the English Revolution,1641. He has for 30 years produced tremendously challenging and insightful works on this period, questioning the accepted interpretations of all phases of that remarkable century. Hill himself has gone through considerable change as a historian, from what has been described as a "vulgar Marxist" to an extremely erudite, warm-hearted, eclectic interpreter of history. This evolution has had significant impact on the study of British history. This project, produced as part of the course requirements for a seminar in Tudor-Stuart England, will examine that development from Hill's own prolific work (over 3,000 pages in print) and the criticisms of his contemporaries.

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WILLIAM WARD BURROWS: FIRST COMMANDANT OF THE UNITED STATES MARINES

Researcher: Captain Brendan P. Ryan, USMC

This project will be a chapter in a collection of essays on the Commandants of the Marine Corps, edited by Associate Professor Robert W. Love, Jr., and Lieutenant Colonel Merrill L. Bartlett, USMC, of the Naval Academy. Burrows was the first Commandant of the U. S. Marines, re-established by Congress in 1798 after the demobilization of the Continental Marines of the Revolution. As the first Commandant, Burrows had a variety of influences on the Corps, including the transfer of Marine Headquarters to Washington from Philadelphia. An accomplished politician himself and staunch

Federalist, Burrows effectively operated within the circles of power to secure the future of the Corps. This project will be based on the holdings of the National Archives and especially the USMC Historical Center.

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THE CZECH LEGION IN ITALY

Researcher: Associate Professor Rowan A. Williams

There is no known publication in English that treats the history of the Czech prisoners of war in Italy in World War One. Thanks to the political activities of Czech nationalists in the allied nations, the prisoners were mustered into the 6th Division of the Czechoslovak National Army. The division was committed against the Austrians at the Battle of the Piave in June 1918, held a crucial sector of the Alpine front in August, and participated in the Final Vittorio-Veneto Offensive. The legionnaires then accompanied Thomas Masaryk to Czechoslovakia, where they occupied the province of Slovakia in defiance of the Hungarian Communist Goverment. A preliminary study of the legion has been completed and is scheduled for publication.

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MARK HANNA AND THE ELECTION OF 1897

Researcher: Professor Philip W. Warken

An article-length analysis of the Ohio Senate Election of 1897 traces events from the appointment of Senator John Sherman as Secretary of State, which opened a seat in the Senate, to the final vote by the state legislature which elected Hanna to the Senate.

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BARTLETT, Lieutenant Colonel Merrill L., USMC, "Ouster of a Commandant," U.S. Naval Institute Proceedings, 106 (November 1980), 60-65.

The reason for the dramatic and unexpected relief of Major General George Barnett as Commandant of the U.S. Marine Corps in 1920, following his extremely effective conduct of that office during World War One, has never been satisfactorily explained. This article, based upon extensive archival research, provides the first complete account of the incident.

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BARTLETT, Lieutenant Colonel Merrill L., USMC, "Commodore James Biddle in the First American Naval Mission to Japan, 1846," American Neptune, 41 (January 1981), 25-35.

This article based on extensive archival research provides a detailed account of Commodore James Biddle's mission to Japan prior to Matthew C. Perry's more historical "opening" of Japan.

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BELOTE, William M., Professor, Corregidor the Stirring Saga of a Mighty Fortress, Chicago: Playboy Press, Inc., 1980. Co-author Professor James H. Belote, Principia College.

This book is a paperback edition, retitled and revised, of the authors' previous book published originally by Harper and Row, Publishers Inc., of New York.

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COLETTA, Paolo E., Professor, French Ensor Chadwick: Scholarly Warrior. Washington: University Press of America, 1981.

The first midshipman from the new state of West Virginia, Chadwick attended the USNA while it was at Newport during the Civil War. After serving on various ships he was the first naval attache, in London, 1882-1889, and contributed greatly to the building of the New Navy. He subsequently served as Chief of the Bureau of Equipment, Chief Intelligence Office, Captain of the heavy cruiser New York and also chief-of-staff to Admiral William S. Thomas during the Spanish-American War, President of the Naval War College, and ended his active duty as Commander, South Atlantic Squadron. Upon retiring in 1906 he turned to history and wrote a number of books on naval and diplomatic topics.

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COLETTA, Paolo E., Professor, A Bibliography of American Naval History. Annapolis, Md.: Naval Institute Press, 1981.

This guide provides access to almost 6,000 books, documents, doctoral dissertations, periodicals, essays, transcriptions of oral interviews and fiction vital to the advanced study of Americal naval history. The bibliography covers naval scholarship from the galley to the newest nuclear-powered aircraft carriers and their influence on seapower in the 1980s.

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COLETTA, Paolo E., Professor, The U.S. Navy and Defense Unification, 1947-1953. Newark: University of Delaware Press, 1981.

The National Security Act of 1947 provided for a Secretary of Defense and a National Military Establishment to contain three services, now including the Air Force, that were to be separately administered. However, roles and missions were not spelled out clearly. The bulk of the study deals with smoothing relations with an Army and Air Force that wished to reduce the Navy to a mere ASW and transport force. The cancellation by Secretary of Defense Johnson of a super carrier precluded the test and evaluation of a weapons system needed if the Navy were to keep abreast of the newest technological developments. In the end, the granting of additional authority to the Secretary of Defense and deleting the service secretaries from the National Security Council caused the secretaries to assume the role of single service managers.

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COLETTA, Paolo E., Professor, Contributing editor, with Robert G. Albion and K. Jack Bauer, American Secretaries of the Navy, 2 vols. Annapolis Md.: Naval Institute Press, 1980.

Essays on 57 secretaries of the Navy.

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COLETTA, Paolo E., Professor, "The Court-Martial of Bowman Hendry McCalla," American Neptune 40 (April 1980), 127-134.

Of the Academy Class of 1865, McCalla served in various ships as a junior officer until he was sent to the Academy as an instructor and then as second in command of the Bureau of Navigation, 1881-1887. In that billet he helped institute reforms needed to man the New Navy that sat badly with conservatives. In 1887, during his first command, he struck an unruly crewman with his sword. The article deals with his court-martial in 1890, in which he admitted that he had erred yet was punished with a sentence of three years on half pay and no promotion. A man of violent temper, he was charged with having disgraced the service. However, friends were able to have his sentence reduced. He subsequently served well during the Spanish-American War, Filipino Insurrection, and the Boxer Rebellion.

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COLETTA, Paolo E., Professor, "The Diplomacy of Theodore Roosevelt and William Howard Taft," Gerald K. Haines and J. Samuel Walker, eds., American Foreign Relations: A Historiographical Review. Westport, Connecticut: Greenwood Press, 1981, pp. 91-113.

This is a narrative of the debate over the foreign policies of these two presidents in the writings of consensus, realist, and new left historians, with an evaluation of their writings.

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COLETTA, Paolo E., Professor, "Louis E. Denfeld," in Robert W. Love, Jr., ed., The Chiefs of Naval Operations. Annapolis, Maryland: Naval Institute Press, 1980, pp. 193-208.

Of the Naval Academy Class of 1912, Denfeld served on destroyers during World War I and then alternated between sea commands and personnel work in Washington. As Chief of Naval Operations, he was instrumental in creating a naval framework for NATO and in defending the Navy during the battles over defense unification that occurred from 1947 to 1949. For defending his service with honest testimony before a congressional committee, his tour was cut short. Thereafter, until his death in 1972, he made no further public comments about national security.

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GILLMOR, Carroll M., Assistant Professor, "The Introduction of the Traction Trebuchet into the Latin West," Viator, 12 (June 1981).

This study analyzes the westward diffusion of rotating beam siege engines.

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GOOD, Jane E., Assistant Professor, "Sergei M. Kravchinsky," Modern Encyclopedia of Russian and Soviet History, 18 (1980), 54-56.

This article of approximately 2000 words details the life of Russian radical S. M. Kravchinsky (1851-1895), who is perhaps better known in the United States by his pseudonym Stepniak. The article is based on research in primary sources and includes a bibliography of works in both English and Russian. The Modern Encyclopedia of Russian and Soviet History will eventually run about 30 volumes. All articles are signed by the authors.

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HARROD, Frederick S., Associate Professor, "Americanization of the United States Navy Enlisted Force," in Seamen in Society, Paris: International Commission of Maritime History, 1980, pp. 187-206.

During the late nineteenth century, growing nativist sentiment throughout the nation had its counterpart in efforts to "Americanize" the enlisted force. Although the Navy had traditionally accepted large numbers of foreigners, it became increasingly displeased with what Secretary Benjamin Tracy characterized as its "mongrel crews". During the 1890's position to foreigners increased within the service, and new recruiting practices after the Spanish-American War allowed the Navy to ban first enlistments of non-citizens after 1907.

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LOVE, Robert W., Jr., Associate Professor, Editor and co-author, Chiefs of Naval Operations. Annapolis: Naval Institute Press, 1980.

This is a collection of nineteen biographical essays, one dealing with each Chief of Naval Operations from Admiral Benson to Admiral Zumwalt. Each essay briefly treats an admiral's career before his becoming CNO, describes why he was selected, and then spends the better part of the chapter explaining and analyzing his policies.

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LOVE, Robert W., Jr., Associate Professor, Editor, Changing Interpretations and New Sources in Naval History, New York: Garland Press, 1980.

This is a collection of papers delivered at the Third Naval History Symposium sponsored by the History Department of the U. S. Naval Academy in October 1977. The topics covered in the book include naval sociology, radio intelligence, tactics in the age of sail, naval administration in the 15th and 19th centuries, combined operations in the age of oar, and naval strategy in the Vietnam War.

Twelve other department members who participated in the project included Assistant Professor P. R. Artigiani, Lieutenant Colonel M. L. Bartlett, USMC, Professor W. M. Belote, Assistant Professor J. C. Bradford, Assistant Professor C. M. Gillmor, Associate Professor K. J. Hagan, Associate Professor F. S. Harrod, Assistant Professor J. Sweetman, Associate Professor C. L. Symonds, Associate Professor J. P. Thomas, Jr., Professor L. V. Thompson, and Professor P. W. Warken.

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MASTERSON, Daniel M., Assistant Professor, "Field Research on the Modern Peruvian Military: A Selective Guide," Field Research Guide: Ecuador, Peru, Bolivia, and Chile. Durham, North Carolina: Duke University Press, 1981.

This article reviews available archival materials in the United States and Peru which can be used to analyze modern civil-military relations. It provides the location, conditions of availability, and relative utility of these materials. Particular emphasis is given to records housed in the Centro de Historico-Militaies in Lima.

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SWEETMAN, Jack, Assistant Professor, Battleship Bismarck: A Survivor's Story. Translated from the German of Baron Burkard von Mullenheim-Rechberg. Annapolis: Naval Institute Press, 1980.

This book, written by the senior-ranking survivor of the German super battleship Bismarck, provides the most complete account to date of the mighty ship's career. The author was assigned to the Bismarck while she was still under construction and served on her until her destruction by overwhelming British forces in May 1941. In this history-cum-memoir, he interweaves his personal recollections with the findings of postwar research to address the crucial questions, strategic and tactical, concerning the Bismarck's ill-fated sortie. His work represents a significant contribution to the naval history of World War Two. A German edition, entitled Schlachtschiff Bismarck 1940/41: Der Bericht eines Oberlebenden, was published by Ullstein Verlag shortly subsequent to the appearance of the American edition.

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SWEETMAN, Jack, Assistant Professor, with Admiral James L. Holloway, Jr., USN (Ret.). "A Gentlemen's Agreement." United States Naval Institute Proceedings, 106 (Setember 1980), 71-77.

In 1945, it became evident that the U. S. Naval Academy, as traditionally constituted, could not possibly provide the annual input of junior officers needed by the postwar navy. A board headed by Admiral Holloway was convened to address the question of officer education and procurement. Its recommendation, which became known as the Holloway Plan, was to supplement the Academy's output by a regular, paid Naval Reserve Officers Training Corps. This program was successfully adopted. In the article, Admiral Holloway furnishes an informal, inside account of the board's activities.

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SWEETMAN, Jack, Assistant Professor, "The Civilian Faculty, 1845-1960." Part I: Shipmate, 44(January-February 1981), 29-31; Part II: Shipmate, 44 (March 1981), 33-35.

The civilian faculty has played a vital part in the operation of the U.S. Naval Academy since its foundation in 1845. This article traces the changing role of the civilian faculty as it evolved over the decades and profiles a number of its most celebrated members. Especial attention is paid to the contributions made by the History Department to the growth of American naval history. The information presented, much of it the result of new research

complements that contained in the author's The U. S. Naval Academy: An Illustrated History.

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SYMONDS, Craig L., Associate Professor, "General Robertson's Nickajack Campaign." Journal of the Order of the Indian Wars (Winter, 1980-81), 27-34.

This article describes the military campaign of General James Robertson's militia forces against the Indians of Tennessee in 1794. It was an important campaign not only in the history of the Indian wars, but in terms of the relationship between the local governments which supported the raid, and the national government which opposed it.

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SYMONDS, Craig L., Associate Professor, "Notable Naval Books of 1980". U. S. Naval Institute Proceedings 107 (January 1981), 88-91.

This article is an annual summary and annotation of the top two dozen or so naval books published in the previous twelve months.

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SYMONDS, Craig L., Associate Professor, New Aspects of Naval History. Selected Papers from the Fourth Naval History Symposium. Annapolis: Naval Institute Press, 1981.

Co-editors of this volume were Lieutenant Colonel M. L. Bartlett, USMC, Assistant Professor Jane Good, Assistant Professor James Bradford, Assistant Professor Daniel Masterson, Assistant Professor Carroll Gillmor, Associate Professor Robert W. Love, Jr., and Associate Professor Frederick Harrod.

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ARTIGIANI, P. Robert, Assistant Professor, "Rousseau and Emerson: An Analysis of the Concept of Freedom in Europe and America." Invited paper, Tenth Annual Meeting of the International Society for the Comparative Study of Civilizations, Bloomington, Indiana, 28-31 May, 1981.

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ARTIGIANI, P. Robert, Assistant Professor, "Modern and Scientific Values," Seminar on Values in Higher Education, Sixth International Conference on Improving University Teaching, Lausanne, Switzerland, 9-12 July, 1980.

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BELOTE, William M., Professor, "Evolution of Carrier Task Forces During the 1930s," The Military History Round Table, Inc., Seventh Regiment Armory, Baltimore, 16 April 1981.

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BRADFORD, James C., Assistant Professor, "Rural Entrepreneurship in the Early Republic: Henry Lee's Matildaville," Society for Historians of the Early American Republic, Urbana, Illinois, 18 July 1980.

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BRADFORD, James C., Assistant Professor, "Forts of the Chesapeake," Maritime Heritage of the Chesapeake Series, St. Johns College, Annapolis, March 1980.

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BRADFORD, James C., Assistant Professor, "The Papers of John Paul Jones," Manuscript Society of Washington, Washington, D.C., March 1980.

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BRADFORD, James C., Assistant Professor, "John Paul Jones," New York City Revolutionary Roundtable, New York City, October 1980.

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CALDERHEAD, William L., Professor, "The Interstate Slave Trade in Virginia: The Old View Versus the New," SHEAR Conference, University of Illinois, July 1980.

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CALDERHEAD, William L., Professor, "Thomas Carney: Forgotten Black Soldier of the American Revolution," Maryland Commission of Afro-American History, Annapolis, 1981.

******

CULHAM, Phyllis, Assistant Professor, "Diversity in Early Christianity." Glen Burnie Rotary Club, Glen Burnie, Maryland, April 1981.

******

GILLMOR, Carroll M., Assistant Professor, "Riverine Operations in West Francia, 845-862, and the Emergence of Tactical Doctrine," 16th International Congress of Medieval Studies, Western Michigan University, Kalamazoo, May 1981.

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GOOD, Jane E., Assistant Professor, "Babushka, America, and the Russian Revolution," 19th Annual Southern Conference of Slavic Studies Meeting, 18 September 1980.

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GOOD, Jane E., Assistant Professor, "America and the Russian Revolutionary Movement," 14th Annual Duquesne History Forum, Pittsburgh, 29 October 1980.

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GROVE, Eric J., Senior Lecturer, "Post War Royal Navy," Baltimore Military Circle, Baltimore, 19 March 1981.

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GROVE, Eric J., Senior Lecturer, "Post War Royal Navy," Navy Leage Annapolis, 22 May 1981. "Post War Royal Navy," USNA Reserve Officers, 10 February 1981.

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GROVE, Eric J., Senior Lecturer, "World War II Tanks," Potomac Arms Collectors Association, Washington, D.C., 20 March 1981.

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JOHNSON, David E., Professor, "Personal Autonomy in Moral Education," Sixth International Conference on Improving University Teaching, Lausanne, Switzerland, 10 July 1980.

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LOVE, Robert W., Jr., Associate Professor, "U. S. Strategy in World War II," Air University, Maxwell Air Force Base, Alabama, September 1980.

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MASTERSON, Daniel M., Assistant Professor, "Caudillismo and Institutional Change: Manuel Odria and the Peruvian Armed Forces, 1948-1956," Fourth Annual Conference on Latin America, Western Illinois University, December 1980.

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MASTERSON, Daniel M., Assistant Professor, "APRA and the World War: The Changing Focus of Anti-Imperialism," Duquesne History Forum, Pittsburgh, October 1980.

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RYAN, Brendan P., Captain, USMC, "Development of Amphibious Warfare," Modern Military History Class, University of Alabama, in Birmingham, 16 April 1981.

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SWEETMAN, Jack, Assistant Professor, "The Landing at Veracruz, 1914," Baltimore Roundtable of American Military History, Baltimore, September 1980.

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SWEETMAN, Jack, Assistant Professor, "Battleship Bismarck," Kiwanis Club of South Orlando, Orlando, Florida, December 1980.

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SYMONDS, Craig L., Associate Professor, "Thomas Jefferson's Naval Policy," Annual meeting of the American Historical Association (Pacific Coast Branch), University of Southern California, August 1980.

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SYMONDS, Craig L., Associate Professor, "The Yankee Mariner, 17th to the 20th Centuries," Inaugural Address at the Conference on the "Yankee Mariner, Past, Present, and Future" hosted by the Center for the Study of the American Experience, Annenberg School of Communications, University of Southern California, March 1981.

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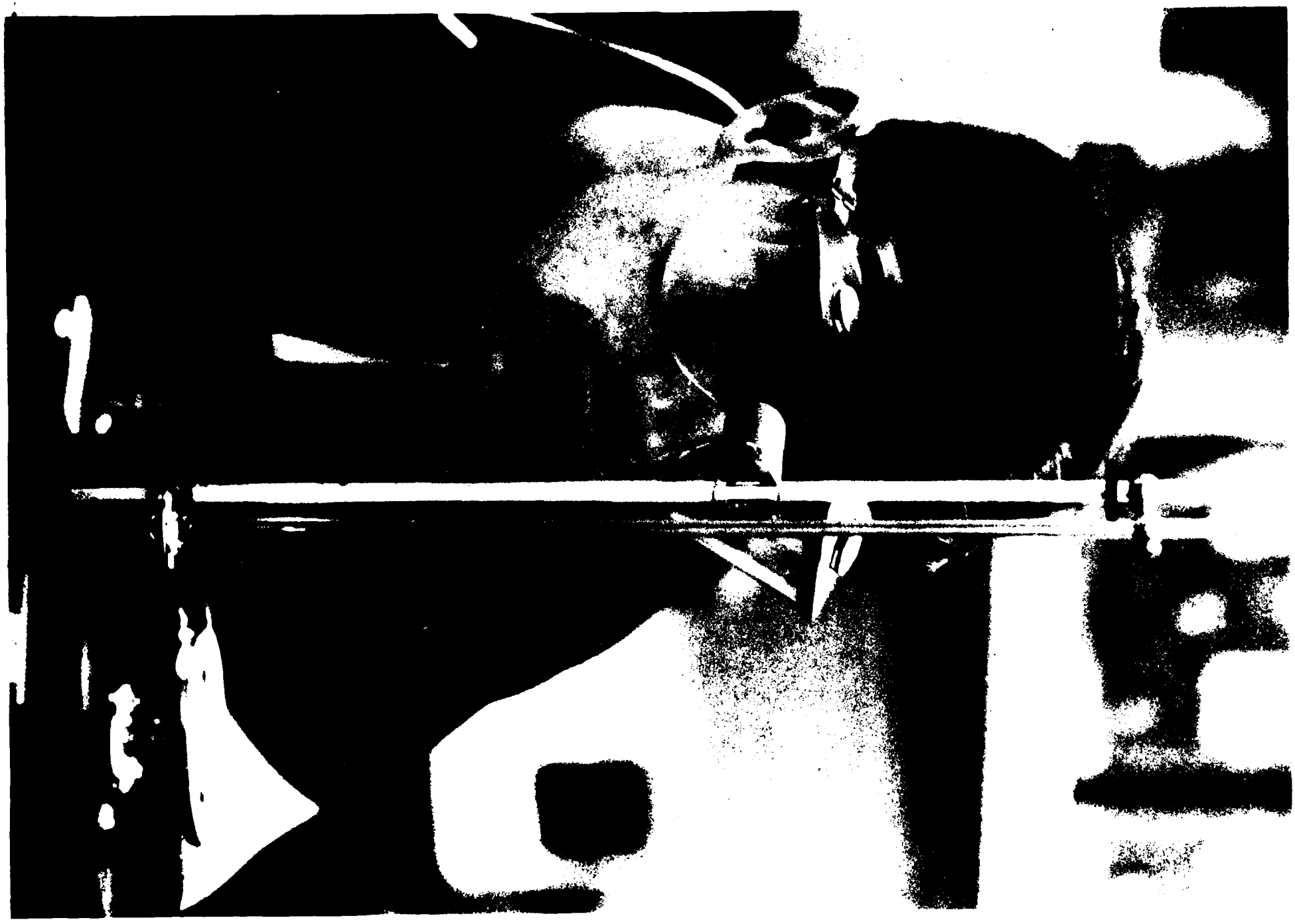

DIVISION OF
MATHEMATICS AND SCIENCE

APPLIED SCIENCE DEPARTMENT

Commander Neil L. Kozłowski, USN, Chairman

The research being performed by the Applied Science Department, as illustrated in the following pages, emphasizes both the high level of activity within its three disciplines and the fine quality of its output. Interest and dedication on the part of faculty members and midshipmen alike culminated in Academic Year 1980-1981 in scholarly projects that addressed timely, real world needs. While pure research remains valuable in advancing knowledge, it is beneficial and necessary to have the added dimension of practical applicability to illustrate and reinforce the meaningfulness of the effort to the student.

Pursuit of new and different projects in the areas of operations analysis, management, or computer science is an ongoing endeavor to continue to provide challenging and fulfilling educational experiences.

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GRADUATE PERFORMANCE EVALUATION SYSTEM (GRAPES)

Researcher: Lieutenant Commander Kevin T. Moore, USN

Sponsor: U. S. Naval Academy (Division of Professional Development)

The GRAPES survey was designed to provide a systematic method of soliciting appraisals from Naval Academy graduates on how well the institution was performing its mission. Grapes is one of many such evaluations that are used by the school's adminstration to determine the need for change and the subsequent appraisal of changes that are made. This annual GRAPES survey focused on the USNA graduates of the Classes of 1967, 1972, and 1976.

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ALTERNATE ENERGY PROJECT U. S. NAVAL ACADEMY DAIRY FARM

Researcher: Commander James M. Petrovich, USN

Sponsor: U. S. Naval Academy Supply Officer

The researcher conducted research into alternate energy uses and applications for the U. S. Naval Academy Dairy Farm. Areas include alcohol production and applications as motor fuel and heating fuel; methane gas production from dairy manure using an anerobic, plug flow digester; employment of heat exchanges; and other technological applications to improve energy efficiency.

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A COMPARISON OF THREE MEASURES OF TURBIDITY

Researchers: Assistant Professor Frederick A. Skove and Professor Jerome Williams (Oceanography)

Sponsor: Environmental Protection Agency

During the summer of 1979, a relatively large number of coincidental turbidity measurements were made at a single location. Readings were taken with a 10cm path length transmissometer and a white Secchi Disc, while at the same time water samples were collected for determination of suspended solids. These data were analyzed and it appears that the Secchi Disc reading is the most precise of the three methods. Suggestions are made as to the possible reason for this result.

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MAGNETIC FIELDS OF A HORIZONTAL ELECTRIC DIPOLE IN A SEMI-INFINITE MEDIUM

Researchers: Assistant Professor F. A. Skove, Assistant Professor L. K. Chi, et al.

Sponsor: David W. Taylor Naval Ship Research and Development Center

Various formulae for magnetic fields of horizontal electric dipoles in a semi-infinite medium have been derived. In the interest of providing the ability to evaluate the magnetic field strength interactively at one-site field locations, reduced expressions (which are valid in the quasi-static range) for the magnetic field were used in developing computer generated plots.

Existing expressions were used to plot the field strength for AC and point DC dipoles with the receiver either in the medium or above the medium. In order to plot the special case of a finite length DC dipole with the receiver above the medium, the reduced expression had to be derived. These new expressions, in addition to agreeing with Kraichman's point dipole expressions which are valid at a distance, also are valid with the receiver directly above the source.

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A COMPARATIVE STATISTICAL ANALYSIS OF NAPS AND NON-NAPS CLASS OF 1980 MIDSHIPMEN

Researchers: Midshipmen 1/C George J. Basil and Joseph D. Dauplaise

Adviser: Associate Professor Randall K. Spoeri

Sponsor: Chief of Naval Operations (OP-95)

The Naval Academy Preparatory School (NAPS) in Newport, Rhode Island, provides college preparatory work for enlisted personnel and high school graduates who are either academically deficient or do not obtain a primary nomination to the Naval Academy. There has been little previous research done (supported by statistical tests) to indicate the effectiveness of NAPS in preparing new midshipmen. This project analyzes and compares the performance of NAPS and non-NAPS USNA midshipmen for their freshman year. It is concluded, as a result of the analyses, that NAPS was effective in preparing midshipmen candidates for the rigorous academic curriculum at USNA.

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OPTIMUM ASSIGNMENT OF CARRIER-BASED AIRBORNE REFUELING ASSETS

Researchers: Midshipmen 1/C Jeffrey D. Brandt and Richard J. Racine

Sponsor: Chief of Naval Operations (OP-95)

The object of the project was an analysis of the optimum employment of fighter CAP in a pre-positioned screen and the associated task force.

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MARINE CORPS AVIATOR RETENTION SURVEY ANALYSIS

Researcher: Midshipman 1/C Robert M. Dixon

Adviser: Major Robert L. Spooner, USMC

Sponsor: Headquarters, U. S. Marine Corps

The declining retention of aviators and flight officers is presently one of the major concerns of Headquarters, U. S. Marine Corps. This study analyzes survey responses from approximately 4000 active and recently separated Marine Corps pilots and NFO's concerning retention and job satisfaction.

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COMPUTER ASSISTED OPTIMAL MINEFIELD DESIGN

Researchers: Midshipmen 1/C Jay Grafton and Robert Kennington

Adviser: Lieutenant Commander Robert L. Peck, USN

Sponsor: Chief of Naval Operations (OP-95)

This study reports the development of an inter-active computer program written in the BASIC language which accepts a wide variety of inputs and which establishes an "optimal" minefield based on these inputs.

The research was undertaken to assist a carrier-based mine warfare officer tasked with mining a particular region of the world. At present, when operationally tasked with mining an area, the mine warfare officer utilizes information provided in a minefield planning folder. This folder specifies the coordinates of the region, depths of water, and appropriate types of mines to be used. In addition, the mine warfare officer must make best

use of his available assets (aircraft, aircrews, and ordnance). He then plots a limited number of possible fields and selects the one which appears to be best.

The computer program simulates 1000 different minefields, each based on the minefield coordinates, navigational reference points, number of aircraft, and number of mines carried by each plane, and ordnance parameters. For each, a probability of kill, P_k, (probability that a transiting vessel detonates at least one mine) is determined. The minefield with the highest probability of kill is presented to the mine warfare officer. Output includes heading of each aircraft, and latitude and longitude of each mine in the minefield, plus the associated P_k.

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OPERATIONAL AVAILABILITY: ITS DEFINITIONAL AND LOGISTICAL USES

Researchers: Midshipmen 1/C James D. Heffernan and Gregory L. Point

Advisers: Associate Professor Randall K. Spoeri and Lieutenant Commander Ted R. Maynard USN

Sponsor: Chief of Naval Operations (OP-95)

The Operational Availability (O.A.) of a system with a given number of components is determined using the failure rate and repair rate of each component. With components arranged in various series and parallel configurations, computer simulation is used to empirically determine what O.A. the system actually experienced. Computations are performed using the failure and repair rates to compute the expected O.A. of the system as well as the mean and variance of the number of spare parts required by the system per day.

The simulation showed that the distribution of these spare parts is normal. From this, upper bounds for the expected number of spares needed by the system per day were computed for several confidence levels.

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ESTIMATING THE PROBABILITY OF TARGET ILLUMINATION IN OVER-THE-HORIZON HARPOON MISSILE ENGAGEMENTS

Researchers: Midshipmen 1/C Mark W. Krause and Donald Densford

Adviser: Lieutenant Commander Robert L. Peck, USN

Sponsor: Chief of Naval Operations (OP-95)

At present, documentation of the Harpoon anti-ship missile reveals a high target illumination probability. Questions have arisen as to the magnitude of illumination probability and whether or not the published probability adequately accounts for all of the targeting errors inherent in a combat situation. This study presents a computer simulation that approximates the accuracy with which a Harpoon missile can illuminate a target and takes into account the combined effects of a variety of possible errors. The results of this research will assist in the future formulation of Harpoon tactics so that the missile may be better employed against long range targets.

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STREAMLINING THE DISTRICT OF COLUMBIA'S PERMITTING PROCESS

Researchers: Midshipmen 1/C Thomas J. Moore and J. D. Messinger

Adviser: Associate Professor Randall K. Spoeri

Sponsor: District of Columbia Office of Planning and Development

In an effort to streamline the permitting process for the District of Columbia, this project was initiated to: (1) identify and categorize the array of problems that result in delays in the permitting process, and (2) to suggest specific operations analysis techniques that might be used to study and alleviate the problems identified. This project is the first part of a broad study and provides the conceptual framework for future studies.

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THE DEVELOPMENT AND USE OF SEAHUNT: A SIMULATION USED FOR DETERMINING THE OPTIMAL USE OF MINEHUNTING EQUIPMENT

Researchers: Midshipmen 1/C Patrick Smith and Peter J. Karcz

Adviser: Associate Professor W. Charles Mylander

Sponsor: Chief of Naval Operations (OP-95)

A manual game and a computer simulation were developed for use in analyzing the merits of different tactics employed by present U. S. naval minehunting platforms. Statistical analyses supports the hypothesis that the two simulations are the same model.

The simulation model represents the deployment of two different minehunting systems which vary in degree of effectiveness in clearing a minefield. The tactical problem is made complex by the presence of a mixture of "Proud" mines, which are moored floating mines, and "Hidden" mines, which lie on the ocean floor. The choice of equipment used to clear a minefield depends on the mix of mine types in the field.

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AN ANALYSIS OF THE USNA ADMISSIONS PROCESS

Researchers: Midshipmen 1/C Dennis Sokup and Scott Whitfield

Adviser: Associate Professor W. Charles Mylander

Sponsor: U. S. Naval Academy (Dean of Admissions)

Two areas of operations of the Naval Academy's Admissions Office were examined. The admissions process was diagrammed to display the flow of paper and identify bottlenecks and sources of delay in the processing of candidates applying to the Naval Academy. No bottlenecks subject to Naval Academy control were identified.

The second area of operations examined was the programs used to attract applicants to the Naval Academy. The effectiveness of four programs in use was studied. Only one of the four programs, the Engineering-Science Seminar can be shown to be effective. No determination could be made of the other three programs (Operations Information, the Blue and Gold Program, and the Educator Visits) because of the lack of useful data. Data collection programs to correct this situation were devised, and it is recommended they be implemented.

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BRAIN WAVE ANALYSIS

Researcher: Associate Professor Karel Montor

During the y c, a variety of subjects were tested to determine relationships between left/right hemisphere dominance and performance/physiological problems. Results indicate clearly that the U. S. Naval Academy has the ability to identify "not normal" EEG's. Fatal accidents have been related to neurological disfunctioning.

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CLASS OF 1980 DATA BASE

Researcher: Associate Professor Karel Montor

The files of the Class of 1980 were organized and completed containing therein 191 different statistics. Reports will be issued over the next several years detailing this four-year study.

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MYLANDER, W. Charles, Associate Professor, Summary and Chapter 1 of the Energy Information Administration's Annual Report to Congress 1979 - Vol 3: Projects, July 1980.

The Summary, in four and one-half pages, presents a consistent overview of the Energy Information Administration's energy projection for the period 1980 to 2020. Important insights provided in the volume are highlighted in the Summary.

The first chapter, "Energy Projection: The Purposes and Methods," provides the reader with a statement of the purposes and goals of the energy forecasts presented. It warns the reader of institutional constraints affecting the forecasts and discusses the limitations of the forecasts and the sources of uncertainty.

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NORCIO, Anthony F., Assistant Professor, "Human Memory Processes for Comprehending Computer Programs," Proceedings of the IEEE International Conference on Cybernetics and Society, Boston, 1980.

While programmer behavior research has supported the importance of logic segments in the human memory organization of computer programs, no direct attempt has related comprehending computer programs to logic segment organizations. The purpose of this study was to examine experimentally logic-segment chunking and program comprehension. Using the Cloze procedure which requires subjects to supply missing statements, the results suggest that it is easier to supply correct statements within a logic segment than at the beginning. The results also suggest that internal program documentation and statement indentation tend to enhance the memory/comprehension processes. It is concluded that highlighting logic segments may improve these processes.

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SPOERI, Randall, Associate Professor, co-author, "A Local Area Application of Methodologies for Estimating and Projecting Socioeconomic Data Items," in Small-Area Population Estimates-Methods and Their Accuracy and New Metropolitan Area Definitions and Their Impact on the Private and Public Sectors, Small-Area Statistics Papers, Series GE 41, Number 7, Bureau of the Census, U. S. Department of Commerce, May 1981.

This paper describes research conducted at the Bureau of the Census in investigating the feasibility of applying nonsurvey statistical methods to the estimation and projecting of socioeconomic data items for the city of Denver, Colorado. The methods fall into three general categories: synthetic estimation,

categorical data analysis, and time-series analysis. The data used as input to these methods have been obtained from Federal, State, and local sources. The research was conducted as part of the Commerce/Cities program, a Department of Commerce initiative, with the objective of demonstrating how cities can use existing Departmental resources to better deal with specific problems.

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CHI, L. K. Assistant Professor, "Magnetic Fields of a Horizontal Electric Dipole in a Semi-infinite Medium," Applied Science Department Publication AS-1-80.

Various formulae for magnetic fields of horizontal electric dipoles in a semi-infinite medium have been derived. In the interest of providing the ability to evaluate the magnetic field strength interactively at on-site field locations, reduced expressions (which are valid in the quasi-static range) for the magnetic field were used in developing computer generated plots.

Existing expressions were used to plot the field strength for AC and point DC dipoles with the receiver either in the medium or above the medium. In order to plot the special case of a finite length DC dipole with the receiver above the medium, the reduced expression had to be derived. These new expressions, in addition to agreeing with Kraichman's point dipole expressions which are valid at a distance, also are valid with the receiver directly above the source.

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CHI, L. K., Assistant Professor, "A Computer Method for Mixed Lubrication," 1981 ACM Computer Science Conference, St. Louis, Missouri, 24-26 February 1981.

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MONTOR, Karel, Associate Professor, "Video Tapes in Education," 1981 Maryland Association for the Educational Uses of the Computer Conference, Columbia Maryland, 20 March 1981.

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NORCIO, A. F., Assistant Professor, "Comprehension Aids for Computer Programs," Annual Meeting of the American Psychological Association, Montreal, Canada, 1980.

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NORCIO, A. F., Assistant Professor, "Chunking and Understanding Computer Programs," Human Machine Systems Symposium, Boston, Massachusetts, 1980.

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SPOERI, Randall K., Associate Professor, co-author, "A Local Area Application of Methodologies for Estimating and Projecting Socioeconomic Data Items," 140th Annual Meeting of the American Statistical Association, Houston, Texas, 11-14 August 1980.

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SPOERI, Randall K., Associate Professor, Jonathan D. MESSINGER, Ensign, USN, Kevin T. MOORE, Lieutenant Commander, USN, W. Charles MYLANDER , Associate Professor, Robert L. PECK, Lieutenant Commander, USN, and Robert L. SPOONER, Major, USMC, "Recent Applied Statistical and Related Quantitative Research at the United States Naval Academy," Meeting of the Washington Statistical Society, Washington, D.C., 16 June 1981.

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CHEMISTRY DEPARTMENT

Professor Samuel P. Massie, Chairman

Research continues to be an integral part of midshipman education and faculty professional development in the Chemistry Department.

Efforts in support of Navy needs occupy a fair percentage of the work undertaken by the faculty of the Department , but, with the addition of several vigorous young faculty members, activity on the broader scientific front is increasing.

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HYDROGEN EVOLUTION FOR (1.1) FERROCENOPHANES AND RELATED DIMETAL COMPOUNDS

Researcher: Lieutenant Commander Thomas E. Bitterwolf, USNR

Sponsor: Naval Academy Research Council

Ferrocene is known to protonate at the metal in very strong acid to yield a long-lived species. In contrast, (1.1) ferrocenophane, in which two ferrocenes are held side by side, immediately undergoes oxidation and hydrogen liberation under identical conditions. The hydrogen liberation reaction is presently being studied by several other groups as a possible surface agent for photoelectrodes that may be used to split water for a fuel source.

Our recent studies of the hydrogen evolution reaction involving (1.1) ferrocenophane has shown that hydrogen exchange at the rings accompanies hydrogen loss and that an average of eight exchanges occurs on the molecule before hydrogen evolution occurs to oxidize the metals and stop the exchange reaction. This evidence suggests that hydrogen evolution requires the coincidental protonation of both irons on the (1.1) ferrocenophane, further suggesting that the rate of hydrogen evolution will follow a dependence on the square of the hydrogen ion concentration.

In a second series of experiments it was found that there is no light dependence of the hydrogen liberation reaction. Reactions conducted in the dark appear to be complete in the same time as those observed in the light. Since these reactions are very fast, it is still possible that a light dependence will be observed at lower temperature or lower acid concentration, a question which is being explored by a collaborator.

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MECHANISM OF FERROCENE ELECTROPHIC SUBSTITUTION REACTIONS

Researcher: Lieutenant Commander Thomas E. Bitterwolf, USNR

Sponsor: Naval Academy Research Council

The mechanism of ferrocene electrophilic substitution reactions involving hydrogen as an incoming electrophile has been studied for many years, but no definitive study has emerged to describe the course of the reaction. At issue has been the extent of involvement of the elctron-rich metal as a potential center for electrophilic attach from an acidic solution. Research performed at the Naval Academy has developed an extensive body of information on the

conformational behavior of a long-lived, metal-protonated species which is known to exist in very strongly acidic media. This information has now been applied to the mechanistic question. Using deuterated acids, it has been possible to utilize NMR to measure the rate of exchange of deuterium for hydrogen both on the rings and on the metal. It has been learned that bridges between the rings alter the rate of exchange, and that the rings and the metal can serve as initial centers of proton attack in acids. Tilting the rings back, thereby exposing the metal, increases the likelihood that the metal will serve as the initial center of reaction. In compounds where the metal is extensively protonated, the ring positions adjacent to the metal-hydrogen bond are strongly favored for exchange relative to those ring positions away from the iron-hydrogen. Blocking the metal with several bridges forces the reaction to occur almost exclusively on the rings.

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INTRINSIC DEFECTS IN POLYACETYLENE

Researcher: Assistant Professor Mark L. Elert

Sponsor: Naval Research Laboratory

Intense interest in the study of polyacetylene has been generated by the discovery that its conductivity can be varied over an enormous range by appropriate doping with foreign chemical species. The researcher has performed calculations to investigate the effects of intrinsic defects (including cross-linked chains, imbedded rings, strained carbon-carbon bonds, and chain terminations) on the electronic properties of polyacetylene. In particular, we have focused on the question of whether such defects could produce trap states in the semiconducting gap in this material. Results were obtained using a Green's function approach, based on a Slater-Koster parameterization which was developed for trans-polyacetylene. This parameterization preserves $1/d^2$ scaling, and produces a density of states which correlates well with ab initio band structure calculations and with UPS data.

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DETERMINATION OF MOLECULAR ORBITAL COUPLING AND ANALYSIS OF ELECTRON TRANSITION RATES

Researcher: Captain William J. Lademan, USMC

Sponsor: Naval Academy Research Council

A radiationless transition is a process involving the transfer of an electron from a vibrational level in an excited electronic state to a vibrational level of comparable energy existing in the ground electronic state. It becomes necessary to study the rate of radiationless transitions in order to understand the manner in which this decay affects the fluorescence of the molecule.

First-order perturbation theory is sufficient in dealing with a radiationless transition as long as the Born-Oppenheimer approximation of no change in nuclear coordinates is adhered to. However, nuclear displacement may cause the ground and excited electronic states to shift thus affecting the coupling constants which exist between vibrational levels in these elctronic states. It is then found that first order perturbation theory is unable to depict the physical reality of what occurs because it can no longer adequately portray transitions between vibrational levels.

It has been the intent of this research to calculate the amount of vibronic coupling between ground and excited electronic states using the Hertzberg-Teller expansion. This coupling will allow accurate prediction of the rate for radiationless transitions.

In a process which involves electronic transitions, the rate constant can be separated into an electronic part which describes how the process is induced and a nuclear statistical part which describes how nuclear motion participates in the process. For this to be achieved one must be able to determine and calculate the vibronic coupline matrix elements. Use of the Hertzberg-Teller expansion is enhanced by viewing the previously unconsidered second order expansion as significant.

The correct second-order expression for the nuclear coordinate dependent of the electronic Hamiltonian was verified. To be consistent, the use of this second order expansion requires the use of second-order perturbation theory. The evaluation of the second-order Hamiltonian produced a new electron operator

$\left(\Sigma_j \left(\frac{\vec{r}_{jp}}{r^5_{jp}}\right)_o\right)$ from which two-center integrals could be evaluated

in a Slater-type-orbital basis to produce coupling constants. The resulting integrals and operators involving two atomic orbitals

centered on two nuclei will result in coupling matrix elements from which the radiationless transition rate can be calculated.

Although many of the simple integrals were calculated and validated, the complex integrals have resisted analytical resolution, allowing only the most general of results which do not posess the accuracy necessary for evaluation of the coupling constants.

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VALIDATION OF FILTER MATERIALS FOR PERSONNEL PROTECTION DURING PERISCOPE COATING

Researcher: Professor Charles F. Rowell

Sponsor: David W. Taylor Naval Ship Research and Development Center

The application of water-repellent coatings to periscope windows is an important part of maintenance of combat capability. This procedure, which is done at the end of each patrol, uses corrosive and hazardous chemicals. Further, the procedure requires meticulous attention to detail if the manual application is to be successful.

The David W. Taylor Naval Ship Research and Development Center has developed an assembly which carries out much of the work electrically once it is strapped onto the periscope. Treatment of the effluent from the coater is required to protect personnel.

By the use of a technique developed to use the gas chromatography/mass spectrometry, two adsorbent materials were found satisfactory to provide the needed protection. The material suggested is only two percent as costly as the original material designated.

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A SURVEY OF LIGHT/RADIATION SENSITIVE SYSTEMS

Researcher: Associate Professor John W. Schultz

Sponsor: National Security Agency

The researcher produced a literature survey with the aid of computerized information services.

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HIGH-PRESSURE AUTOGENOUS IGNITION TEMPERATURES OF A STEAM TURBINE LUBRICATING OIL IN NITROGEN AND OXYGEN MIXTURES

Researcher: Professor Don G. Sheets

Sponsor: David W. Taylor Naval Ship Research and Development Center

The autogenous ignition temperature of an MS 2190-TEP petroleum oil was measured in oxygen-nitrogen atmospheres ranging from 20 parts per million to 100 percent oxygen (balance being nitrogen). The measurements were performed in the David Taylor Naval Ship R&D Center high-pressure autogenous ignition temperature apparatus at pressures from 0.1-20 megapascals (15-3000 pounds per square inch). The results showed that oxidation took place in the nitrogen-oxygen mixtures with only 0.11 percent oxygen (oil was oxidized to carbon and a blackened sludge). At 20 parts per million oxygen, the oil withstood oxidation at temperatures up to 315°C (600°F), indicating that thermal decomposition alone was not the sludge-forming process.

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THERMAL OXIDATIVE STABILITY OF SHIP PROPULSION FUELS

Researcher: Professor John Zimmerman

Sponsor: David W. Taylor Naval Ship Research and Development Center

In order to investigate the thermal oxidative stability of synthetic diesel fuels prepared from shale oil. the ASTM procedure D3241, "Thermal Oxidation Stability of Aviation Turbine Fuels (JFTOT Procedure)" - the acronym stands for jet fuel thermal oxidation test - was used to test eleven different fuels. These included two jet fuels, one a JP-5 (Navy jet fuel prepared from petroleum sources) and the other a demonstration jet fuel prepared from Paraho shale oil. The other nine fuels were diesel types, eight diesel fuel marines (DFM's), which are petroleum products, and one demonstration diesel fuel prepared from Paraho shale oil.

Results of the testing, which determined in two different ways the amount of deposit formed when a specified volume of the aerated fuel was pumped through a tube held at a constant high temperature, showed that the performance of the two shale-based fuels was superior to that of most of the petroleum fuels. This result was not very surprising in view of the extensive processing (largely hydrotreating) to which the shale fuels had been subjected.

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SYNTHESIS OF AZULOQUINONES

Researcher: Professor Charles F. Rowell

Although the chemical literature contains theoretical calculations about the azuloquinones, no one has yet synthesized any of the 16 isomers.

Exploratory studies to ascertain whether any of the azulene synthetic routes could be adapted to this purpose have been undertaken. One of the more general routes through pyridinium salt cleavage was found unsuitable but a recent technique via a carbene intermediate seems to be more adaptable.

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A STUDY IN PLANT BIOLOGICAL TECHNIQUES: THE WARBURG APPARATUS AND THE MICROTOME

Researcher: Midshipman 2/C Joseph L. Donovan, Jr.

Adviser: Assistant Professor D. Lawrence Weingartner

This project pursued three objectives:

(1) the use of a colchicine solution on orchid seeds in order to induce a doubling of chromosomes, i.e. a tetraploid state, (2) the use of paraffin sections in order to observe the nuclei and chromosomes of the treated orchids and (3) a measure of the rate of metabolism and photosynthesis of orchid plants by the use of a Warburg apparatus. The first two objectives were not achieved due to lack of viability in the seeds. The number sprouting was too small to permit meaningful measurements. Warburg measurements gave good results on the rate of photosynthesis and respiration of orchid leaves and were the highlight of the project.

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PREPARATION AND IR ANALYSIS OF BIS (CHROMIUMTRICARBONYL) DIARENE COMPOUNDS

Researcher: Midshipman 1/C Scott Finn

Adviser: Lieutenant Commander Thomas E. Bitterwolf, USNR

This project sought to develop synthetic techniques for the preparation of compounds containing two chromium atoms on a diarene and for the analysis of these compounds. By adapting and expanding on the work of Top and Jaouen (J. Organometallic Chemistry, 182 [1979],381) on the reaction of diarenes and chromiumhexacarbonyl in butyl ether and tetrahydrofuran, eight new dimetal compounds were prepared. In a few cases where rigidly held diarenes were used, it has been possible to isolate two dimetal compounds believed to differ in the relative position of the two metal centers. As the reaction sequence produces both singly- and doubly-metallated compounds, it has proved necessary to find a rapid method for distinguishing between the two. We have found that the dimetal compounds have a characteristically higher melting point than the singly-metallated compounds, and that the dimetal compounds are generally very insoluble in common organic solvents. A further diagnostic tool was found to be the IR spectra of the compounds. The singly-metallated diarene compounds give IR spectra which have a pair of sharp absorptions in the characteristic region for metal bound carbonyls, while the dimetallated compounds have as many as four very broad absorptions in the same region.

Preliminary work indicates that the photolysis of bis (chromiumtricarbonyl) biphenyl with bis(diphenylphosphine) methane gives at least three products which were isolated but were found to be decomposed by air before they were characterized. Work is continuing on these phosphine-bridged compounds which will be examined as possible hydrogen liberation agents for surface modified electrodes.

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PREPARATION OF 1 ARYL-SUBSTITUTED FERROCENYL ALCOHOLS

Researcher: Midshipman 2/C Michael Golightly

Adviser: Lieutenant Commander Thomas E. Bitterwolf, USNR

The synthesis of 1 aryl-substituted ferrocenyl alcohols which was accomplished in this research is a component of a broader effort directed toward the preparation of compounds in which two metal atoms are held in closely adjacent positions so that the nature of the metal-metal interactions and the possibility of cooperative catalysis between the metals can be investigated. In the work described here, it is intended that ferrocene be used as the framework upon which a second metal center can be placed. For this purpose, it has been necessary to construct ferrocenes containing an arene group on one ring and a second group, preferably a phosphine, on the second ring. One approach to this calls for the synthesis of arene substituted ferrocenyl alcohols, which can in principle be prepared by Friedel-Crafts alkylation or acylation of trimethylammonium-methylferrocene.

It was found that alkylation and arylation are accompanied by oxidation of the trimethylammoniummethyl to a carboxylic acid, so that the substituted acid is recovered in high yield. Reduction of the acid with a metal hydride gives the desired alcohol in excellent yield.

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CRYOSCOPY OF HETEROPOLY ELECTROLYTES IN SATURATED SODIUM SULFATE SOLUTION

Researcher: Midshipman 1/C Steven G. Haupt

Adviser: Professor Orville W. Rollins

The effect of a non-common ion on the transition temperature of saturated sodium sulfate decahydrate was first evaluated. The

study involved KNO_3 as the electrolyte and revealed that the molal freezing (transition) point depression per non-common ion at infinite dilution is 3.37°C for this solvent.

Having determined the molal freezing point constant, the following new, and well-analyzed, heteropoly tungstates were subjected to similar studies:

$Na_{6.6}[H_{1.4}GaO_rAlO_6W_{11}O_{30}]\cdot 20\ H_2O$ and $(NH_4)_6Na_2[GaO_4Cr(III)O_6W_{11}O_{30}]\cdot 12\ H_2O$.

The experiments showed that the number of non-common ions produced, in the saturated sodium sulfate solution at 33°C, was 1.00 and 7.2, respectively. This shows that the Ga-Al heteropoly anion is very stable under these conditions (with no detectable dissociation), and that the preparation was free of low molecular weight impurities. The Ga-Cr heteropoly anion appears to dissociate slightly.

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NEW HETEROPOLY TUNGSTATES

Researchers: Midshipmen 1/C Albert R. Nagao, Steven G. Haupt, Michael D. Thomas, and Mary F. Hewitt

Adviser: Professor Orville W. Rollins

The new undecatungstogallate (III), $(NH_4)_6Na_2[GaO_4Cr(III)O_6W_{11}O_{30}]\cdot 12H_2O$, was prepared and analyzed for all constituents except constitutional oxygen (and water by difference). The calculated percentage composition is: NH_4, 3.43; Na, 1.45; Ga, 2.21; Cr, 1.65; and W, 64.1. The experimental values were: NH_4, 3.92, Na, 1.42; Ga, 1.84; Cr, 1.95; and W, 64.3.

The preparation was also subjected to cryoscopic studies in saturated sodium sulfate solution and an x-ray crystallographic investigation employing Cu Kα radiation (Ni filtered).

Results of the cryoscopy revealed that the preparation produces 7.2 non-common ions per mole in aqueous sodium sulfate solution at 33°C. The heteropoly anion is therefore very stable under these conditions.

Twenty-one lines in the x-ray diffraction pattern were indexed for a face-centered cubic system. There were no lines corresponding

to those impossible combination of $h^2 + k^2 + \ell^2$. Using the crystallographic unit cell edge of 21.77 Å, and the requirement of 8 formula weights per unit cell (a restriction imposed by one of the possible space groups Fm3m, $F\bar{4}3m$, F4 32 or F23) the calculated density is 4.1 g/ml. The experimental pycnometer value was 3.9 g/ml. The x-ray study also showed that the new chromium (III) undecatungstogallate (III) anion has the Keggin-type structure.

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INTERACTIONS OF COBALT(III) AND CERIUM (IV) WITH CARBOXYLIC ACIDS

Researcher: Midshipman 1/C Rex G. Putnam, Jr.

Adviser: Assistant Professor Graham T. Cheek

The original intent of this research was to investigate complexes formed between carboxylate anions and transition metal cations. In the case of Co(III), however, it was found that the carboxylate ligands underwent oxidation as opposed to complexation. The focus of the research then shifted to the oxidation aspect of this interaction, utilizing Ce(IV) as an oxidant. The action of ceric ammonium nitrate on phthalic acid (a bifunctional carboxylic acid) in acetonitrile as solvent was found to produce phthalic anhydride instead of the expected oxidation products. This study was extended to an aliphatic diacid (succinic acid), the reaction also producing the anhydride. These results are extremely interesting in view of the fact that acid anhydrides are themselves used as drying agents, illustrating the great affinity of Ce(IV) for water in a nonaqueous solvent. Analysis of the cerium ion remaining after the reaction (by iodimetry) showed that approximately 75 percent of the cerium had remained in the oxidized state, supporting the above observation that the reaction involves dehydration and not redox activity.

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THE POTASSIUM CONTENT OF ORANGE JUICE

Researcher: Midshipman 1/C Mary F. Hewitt

Adviser: Professor Orville W. Rollins

The potassium content of several varieties of commercially available frozen orange juice was determined using flame photometry. Samples of fresh orange juice were also studied. All samples after a filtration showed a decided decrease in their potassium level. Overall the potassium content of frozen orange juice was found to be approximately 1.5 times that of the fresh variety.

The study is significant because the many people who are under care of physicians for certain cardiovascular ailments are directed to supplement their potassium intake by drinking orange juice. Some physicians are unaware of the difference cited above and will strongly recommend fresh orange juice over the other.

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VIBRONIC COUPLING IN POLYATOMIC MOLECULES

Researcher: Midshipman 1/C Mark A. McCormick

Adviser: Assistant Professor Mark L. Elert

The quality of a molecular electronic wavefunction is generally evaluated on the basis of its ability to predict static molecular properties such as bond lengths, vibrational force constants, and dipole moments. The CNDO semiempirical scheme for electronic structure calculations is quite successful according to these criteria, and is widely used because of the relative speed of execution of the computer code.

Vibronic coupling between molecular electronic states is an example of a dynamic property which can be calculated from the electronic wavefunction. Vibronic coupling constants for the formaldehyde molecule were computed through first order in the Herzberg-Teller Expansion based on a CNDO wavefunction. The necessary integrals over products of Slater orbitals were evaluated using two-dimensional 32-point Gauss-Legendre numerical quadrature. The results differ by nearly an order of magnitude from the coupling constants calculated from an accurate SCF wavefunction, indicating that the CNDO technique may be inadequate for predicting dynamic molecular properties.

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SYNTHESIS OF TRIS(DIPHENYLPHOSPHINO) METHANE, "TRIS", COMPOUNDS

Researcher: Midshipman 1/C Scott D. Waddle

Adviser: Assistant Professor Edward D. Walton

The synthesis of three adducts of "Tris" with members of the oxygen family (S, Se) were carried out along with attempts at synthesis of the corresponding Tris oxides. The "Tris" compounds have interesting nuclear magnetic resonance features, and conditions for obtaining phosphorus-31 NMR spectra were worked out. Addition of various members of the oxygen family (chalcogens) produced predictable changes in the P-31 chemical shifts. TrisS, TrisSS, TrisSSe were prepared, while attempts to obtain the Tris oxides and to add a third chalcogen led to decomposition to "Bis" products. This breakdown was shown to be temperature dependent. The preparation of TrisSSeSe, by addition of Se to TrisS, yields BisSSe and two unidentified compounds (δ^{31}p=81 and 84) at 80° in benzene, both when two equivalents of Se were consumed and when significant amounts of Se remained unreacted.

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STUDIES ON THE SYNTHESIS OF THIOSEMICARBAZONES DERIVED FROM 2-ACETYL-3-PHENYLINDOLE AS POTENTIAL ANTIMALARIAL AND ANTIBACTERIAL AGENTS

Researcher: Midshipman 1/C Thomas Yavorski

Adviser: Professor Samuel P. Massie

A study was made of the preparation of thiosemicarbazone derivatives of 2-acetyl-3-phenylindole. Ethyl acetoacetate and benzyl chloride were first reacted to form ethyl-α-acetyl-β-phenyl-propionate. This was then converted to α-phenylbutane-β,δ-dione-β-phenylhydrazone by introducing benzenediazoniumchloride. Indole cyclization was accomplished by adding hydrochloric acid to give 2-acetyl-3-phenylindole. Subsequently, this ketone was reacted with S-methyldithiocarbazate to form the thiosemicarbozide, which was reacted with amines to form the desired product.

Previous work has shown that the thiosemicarbazone group alpha to a heterocyclic nitrogen which was unsaturated showed interesting biological properties. This preparation involves a thiosemicarbazone group which was alpha, but not conjugated with the heterocyclic nitrogen. Biological studies of this compound may reveal whether the conjugation is necessary for these types of compounds to be effective as medicinal agents.

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CHEEK, Graham, Assistant Professor, co-author, "Studies in Room Temperature Chloroaluminates," Molten Salt Symposium, 3rd ed., G. Mamantou, ed., Elsevier, 1981.

The room-temperature molten salt system n-butylpyridinium chloride: aluminum chloride has been found to be a useful medium in which to carry out electro-chemical and spectroscopic studies of organic compounds. As a probe of the complexing ability (Lewis acidity) of the aluminum-containing species in the melt, the electro-chemical and spectroscopic (infrared) behavior of 9, 10-anthraquinone (AQ) has been investigated. Large positive shifts in the potential for reduction of this quinone were observed as the melt was made increasingly acidic (by addition of aluminum chloride), with three distinct processes being observed electrochemically. This behavior has been interpreted as being due to the stepwise complexation of the carbonyl groups of the AQ molecule by aluminum chloride in the melt. Support for this view has been obtained from the infrared spectrum of the corresponding solutions, showing a decrease of 150 cm^{-1} for the carbonyl stretching frequency of AQ. These studies indicate that, although aluminum chloride exists principally as $Al_2Cl_7^-$ in the acidic melt, its acidic properties are still quite remarkable.

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ELERT, Mark L., Assistant Professor, co-author, "Photodissociation of the Formaldehyde Molecule: Does It or Doesn't It?", Chemical Reviews 80 (1980), 403-416.

The considerable conceptual and practical difficulties associated with the photodissociation dynamics of polyatomic molecules are well-known. As a result, there is not a single polyatomic molecule for which the "mechanism" of photo-dissociation is unambiguously established, i.e., where we know which electronic states are involved and how the nuclear motions are coupled.

The one polyatomic molecule which has probably been studied more thoroughly than any other--from the point of view of fragmentation dynamics--is formaldehyde. A wealth of information is available concerning properties of the molecule in all of the electronic states accessible at the energies of interest, and a great deal of kinetic data on the dissociation process has also been reported. Several theoretical models have been proposed to describe the dissociation mechanism, and yet some aspects of the experimental data remain puzzling.

In this review, two recent theoretical approaches to the problem are outlined. The camping matrix formalism of Elert, Heller, and Gelbart is described and contrasted with the alternative

methods employed by van Dijk, Kemper, and Buck. A summary of the new features of the dissociation process which have been established beyond any reasonable doubt is presented, and the theoretical and experimental questions which have yet to be resolved for this "prototypical" photodissociation system are discussed.

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ROLLINS, Orville W., Professor, "Nickel (II) undecatungstogallate (III). Preparation, Properties, Structure and Salts," Journal of Inorganic Nuclear Chemistry, 42 (1980), 1368.

Both Na - and NH_4, Na - salts of nickel (II) undecatungstogallate (III) were prepared and analyzed for all constituents except constitutional oxygen. The preparations were also subjected to potentiometric titrations, cryoscopy in saturated sodium sulfate solution, x-ray crystallography, and visible-UV, and near IR spectral studies.

The studies revealed that (1) the new heteropoly anion reacts with 4.0 moles of protons per mole of the complex; (2) the heteropoly anion dissociates to produce 1.22 non-common ions in saturated sodium sulfate solution, at 33°C; (3) an equilibrium was proposed for the dissociation mentioned above and a value was calculated for the equilibrium constant; (4) the equilibrium constant changes with concentration; (5) the nickel (II) ions are octahedrally surrounded by oxygen atoms in the anion; (6) the NH_4^- Na salt crystallizes in the cubic system with a unit cell edge of 22.44 Å, with 8.15 (exper.) formula weights per crystallographic unit cell. All in accord with the possible space group Fm3m, F42, F432, or F23; and (7) the new anion has a Keggin-type structure.

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WALTON, Edward, Assistant Professor, co-author, "Unsymmetrical Bis-Phosphorus Ligands: Synthesis and Nuclear Magnetic Resonance Studies of Some Derivatives of Bis(diphenylphosphino)methane," Inorganic Chemistry, 19(1980), 1982.

The complete series of 15 compounds of the type $(C_6H_5)_2P(X)CH_2P(Y)(C_6H_5)_2$, where X and Y (X = Y and X = Y) are an electron pair, O,S,Se, or CH_3^+, have been synthesized. In addition, several coordination compounds of the monoselenide ligand, viz., $[(C_6H_5)_2P(Se)CH_2P(C_6H_5)_2]\ M(CO)_4$, where M = Cr, Mo, or W, and $[(C_6H_5)_2P(Se)\ CH_2P(C_6H_5)_2]\ HgX_2$, where X = Cl, Br, or I, have been prepared. Where appropriate these compounds have been characterized by proton, carbon-13, and phosphorus-31 NMR spectrometry. From a correlation between the chemical shifts of the methylene protons

and the charge on phosphorus in the $(C_6H_5)_2P(X)CH_2P(Y)(C_6H_5)_2$ derivatives, it is found that the effective positive charge on phosphorus increases in the order $(C_6H_5)_2P-<(C_6H_5)_2P(O)-<(C_6H_5)_2P(S)-<(C_6H_5)_2P(Se)-<(C_6H_5)_2PCH_3^{-+}$. Coupling constants of phosphorus with selenium-77, carbon-13, and phosphorus are given as are selenium-phosphorus stretching frequencies as measured by Raman spectroscopy.

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WALTON, Edward, Assistant Professor, co-author, "Mercury II and Cadmium II Halide Complexes of Tertiary Phosphine Sulphides and Selenides," Canadian Journal of Chemistry, 58(1980), 1476.

The ^{31}P NMR data are reported for Ph_3PSe complexes of Hg(II) and Cd halides and for some miscellaneous complexes of tertiary phosphine sulfides and selenides with the same metal halides. The ligands in the complexes are labile in solution at room temperature but the exchange can be "frozen out" in certain cases at reduced temperature. The $^{77}Se-^{31}P$ coupling constants are less in the complexes than in the free ligands and ^1JPSe decreases in each observable case with decreasing temperature. Two bond $^{199}Hg-^{31}P$ coupling is observed in some of the cooled solutions of the complexes.

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WALTON, Edward, Assistant Professor, co-author, "Polydentate Ligands Containing Phosphorus. Some Derivatives of Tris(diphenylphosphino) methane," Phosphorus Sulfur, 9 (1980), 123.

$[Ph_2P(X)]_2CHPPh_2$(X = S,Se,0), $Ph_2P(X)CH(PPh_2)_2$(X = S,Se), $[Ph_2P(S)]_3$ CH and $[Ph_2P(S)](Ph_2P(Se)]CHPPh_2$ were prepared. Thus, treating $Ph_2P(S)CH_2Li$ with Ph_2PCl gave $Ph_2P(S)CH(PPh_2)_2$. Reaction of $(Ph_2P)_3CH$ with $M(CO)_6$(M=Cr,W) gave $[(Ph_2P)_3CH]M(CO)_4$ where $(Ph_2P)_3CH$ behaved as a bidentate ligand.

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BITTERWOLF, Thomas E., Lieutenant Commander, USNR,and Michael J. GOLIGHTLY, Midshipman 2/C,"Conformational Behavior of Protonated Bridged Ferrocenes," 15th Middle Atlantic Regional Meeting, American Chemical Society, 7-9 January 1981, Washington, D.C.

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ELERT, Mark L., Assistant Professor,"Effects of Intrinsic Defects on the Electronic Structure of Trans-polyacetylene," American Conference on Theoretical Chemistry, Boulder, Colorado, June 1981.

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ELERT, Mark L., Assistant Professor, "Intrinsic Defects in Trans-polyacetylene," Middle Atlantic Regional Meeting of the American Chemical Society, Washington, D.C., January 1981.

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WALTON, Edward D., Assistant Professor, "The History of Black Scientists - Then and Now," Black History Month, David Taylor Naval Ship Research and Development Center, 10-11 February 1981.

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MATHEMATICS DEPARTMENT

Professor Theodore J. Benac, Chairman

Research is an integral part of the professional activities of the members of the Mathematics Department. Areas of research reflect a wide range of interests. Present activity includes research in group theory, algebraic geometry, topology, non-standard analysis, analytic function theory, number theory, lattice theory, graph theory, differential equations, and statistics. In a growing number of cases the research supports on-going engineering projects and is concerned with problems such as solving the heat equation, computer modelling for solid-state investigations, and statistical analysis of data.

The research activity of the staff has produced a considerable number of scholarly articles and presentations. Sources of funding have included the Naval Academy Research Council, the National Science Foundation, the David Taylor Naval Ship Research and Development Center and the ASW Special Projects Office.

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TACTICAL USE OF SONOBUOYS FOR ASW

Researcher: Associate Professor Peter P. Andre and Lieutenant Commander David A. Ward, USN

Sponsor: Anti-Submarine Warfare Special Projects Office

The project studied the optimal use of verniers of the AQA7-V6 processor in fixed-wing ASW missions. The idea of an effective FOM was modified to fit the three-vernier configuration of the V-6. A Bayesian update scheme was developed to allow for adjustments of estimates of signal strength after a period of no detection on station. The program is now being modified to fit the Navy's ICAP system and will be tested by Wingslant.

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INHOMOGENEOUS CAUCHY-RIEMANN EQUATIONS AND THEIR APPROXIMATIONS

Researcher: Assistant Professor James L. Buchanan

Sponsor: Naval Academy Research Council

In this project inhomogeneous Cauchy-Riemann equations are studied which have the form d*V=V*B where V is an unknown function of n-complex variables, d* is the n-variable Cauchy-Riemann operator, and B is a (0.1) -differential form with coefficients which are analytic in the 2n variables z and z^*. The assumption of analyticity permits solutions via the theory of Volterra integral equations. In the case n=2, the investigator has found all "nonsingular" choices of B which permit solutions to exist (the equation is overdetermined). In the only one of these cases previously studied (by A. Koohara) simpler conditions have been found. For all cases, conditions on data are given for unique solutions. The investigator is now studying the extent to which the results for n=2 can be extended to n>2 and intends to look at similar problems for semi-linear Cauchy-Riemann equations.

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THE COMMUTATOR CALCULUS APPLIED TO FREE PRODUCTS

Researcher: Assistant Professor Anthony M. Gaglione

Sponsor: Naval Academy Research Council

The object of this project is to study the factor groups, $\bar{G}_m = G_m/G_{m+1}$, of the lower central series arising from a class of groups, G, which are free products. In particular, G=G(1)*G(2)*...G(s) where each G(i) is a finitely-generated Abelian group. It is assumed that at least one of the free factors, G(i), has torsion. In collaboration with H.V. Waldinger, the investigator has now found presentations for the groups $\bar{G}_m$ where $1 \leq m < 2p-1$ (here p is the smallest prime dividing the orders of any of the generators of G). This was done by applying methods from the commutator calculus established by the investigator and Waldinger in 1975.

As a by-product of this investigation a number of commutator identities were derived. For future work on group theoretic problems, it is important that these identities be collected, proved, and generalized.

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COVERING PROPERTIES OF TOPOLOGICAL SPACES WITH SET THEORETIC ASSUMPTIONS

Researcher: Assistant Professor Marlene E. Gewand

Sponsor: Naval Academy Research Council

The purpose of this project is to expand upon and to generalize the results of a previous Naval Academy Research Council project, "A Study of Covering Properties of Scattered Topological Spaces." That investigation yielded several results concerning the Lindelöf degree of finite and countable products of scattered Lindelöf spaces. Also it was shown that the Lindelöf degree of the G_δ- topology on a countable product of compact scattered spaces is no greater than the cardinality of the continuum.

One of the objectives of this project is to determine the Lindelöf degrees of the G_δ- and G_α- topologies on countable and uncountable products of Lindelöf scattered spaces. Techniques used in obtaining earlier results are not applicable, in their present form, to these questions involving higher cardinalities. It appears that set theory may play a major role in the solution of these problems.

Another objective of this project is to examine the covering properties possessed by finite, countable, and uncountable products of paracompact scattered spaces.

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GRADED MODULES AND PROJECTIVE ALGEBRAIC GEOMETRY

Researcher: Assistant Professor Charles C. Hanna

Sponsor: Naval Academy Research Council

This project is a continuation of a project sponsored by the Naval Academy Research Council, entitled, "Basic Elements in Graded Ring Modules." Its goal is to expand on algebraic results obtained in that project and to apply them to algebraic geometry, specifically to vector bundles on quasi-projective schemes.

Let A be a homogeneous graded ring, and let X be a subspace of Project A. Let M be a finitely-generated graded A-module, and let N be a graded submodule of M. If P is in X, k(P) is the quotient field of A/P; M x k(P) is a finite-dimensional vector space over k(P). The dimension of the image of N in this vector space is denoted b(N,M,P). *The X-dimension of P is the maximum* length of a chain of primes ascending from P. A homogeneous element m of M is basic in M at P if b((x),M,P)=1.

Theorem: If b(N,M,P) exceeds the X-dimension of P for every P in X, then N contains a homogeneous element which is basic in M at every P in X.

Theorem: Let X be a quasi-projective scheme over a noetherian ring and let E be a vector bundle on X. If the rank of E exceeds the dimension of X, then some line bundle is a subbundle of E.

Corollary: Let A be a ring with only finitely many maximal ideals, and let E be a vector bundle on projective N-space over A. If the rank of E exceeds N, then some O(n) is a subbundle of E.

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THE TEMPERATURE PROFILE OF THE ELECTRIC ARC IN THE VICINITY OF THE CATHODE

Researcher: Assistant Professor Gail Kaplan

Sponsor: David W. Taylor Naval Research and Development Center, Annapolis Laboratory

An ordinary differential equation originally derived by G. Ecker has been explored with the aim of obtaining the temperature profile of an electric arc in the vicinity of the cathode. The solution to the linearized form of the Ecker equation provides the most promising means for giving a reliable picture of the temperature profile throughout the region near the cathode.

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A SENSITIVITY ANALYSIS OF DETECTION TO VARIATIONS OF SOURCE LEVEL

Researcher: Associate Professor Arthur A. Karwath

Sponsor: Antisubmarine Warfare Project Management 4, Crystal City

In this research, a continuation of work started in 1978, a probabilistic model associated with detection of acoustic energy is studied. The basic data arose from comparing a new processor to processors that have been in the fleet. The project is "classified".

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MODELLING ASPECTS OF THE NASA/GODDARD DATA MANAGEMENT SYSTEM

Researcher: Associate Professor Peter A. McCoy

Sponsor: NASA/ASEE Summer Faculty Fellowship

The purpose of this study is to develop a Linear Performance Model (LPM) for the Resource Effective Data Systems (REDS) team that will simulate the NASA Data Management System (DMS) for a 17-satellite model run of 45 days. The model is executed interactively in the Data Systems Dynamic Simulation language on the VAX 11/780 computer.

The LMP is derived by linearizing the present REDS Modular Performance Model (MPM) which models the DMS under a 17-satellite load. THE LPM treats the 17-satellite load as a single entity; driving the system with a series parameterization as opposed

to the parallel method. System loading at each of its eleven nodes is determined from frequency distributions calculated from current data.

The advantages of the LPM are reduction of core memory (approximately 10/1) and computational time (approximately 2/1). Furthermore, the use of common nodes and facilities is more representative of the real world than the separate nodes and changes in satellite loading. It is anticipated that both system models will produce equivalent results.

******

PHYSICS OF THE WELDING ARC

Researcher: Associate Professor Peter A. McCoy

Sponsor: David W. Taylor Naval Research and Development Center, Annapolis Laboratory

A heat source moves at constant speed along a smooth curve on a planar surface whose specific heat is a function of position and temperature. This process is modelled by a non-linear parabolic equation that is solved iteratively as an equivalent hyperbolic equation in the complex-plane. The solution is then specified in real coordinates relative to the moving heat source. No quasistationary assumption is made.

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INTERPLAY BETWEEN TOPOLOGY AND GEOMETRY

Researcher: Assistant Professor Mark D. Meyerson

Sponsor: Naval Academy Research Council

The objective is to study, unify, and solve several problems which are of special interest because they are simultaneously topological and geometrical, and to consider geometric approaches to topological problems. Examples of results in these areas include a geometric proof of the Borsuk-Ulam Theorem, an example showing that some tame knots cannot be linked by a straight line, Roger Fenn's Table Theorem, results on dilations, and placing hyperbolic geometry on 3-manifolds.

It is hoped that the methods used by the investigator in a paper with Richard Jerrard and a paper with Alden Wright can be combined to attack several of these problems.

This is the third year of a NARC grant. Several results have been found and published or submitted on the topics of dilations and table theorems.

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DIOPHANTINE APPROXIMATIONS

Researcher: Assistant Professor Michael L. Robinson

Sponsor: Naval Academy Research Council

The objective of this project is to obtain irrationality measures for certain classical constants. Using off-diagonal Pade approximations, the best known irrationality measures for certain k-th roots are achieved (e.g., the cube root of 2). By combining a method of Beuker's with Laplace's representation for Legendre polynomials, the investigator has found the first effective irrationality measure for Riemann's zeta function evaluated at 3. Work is now in progress to obtain similar results for other number classes.

******

EXTENSION OF THE $\hat{A}$-CHARACTERISTIC CLASS TO SINGULAR SPACES

Researcher: Assistant Professor James M. Stormes

Sponsor: Naval Academy Research Council

The purpose of this project is to find and characterize a family of possibly singular spaces for which the $\hat{A}$-characteristic class may be defined. This will be accomplished by determining necessary and sufficient topological restrictions upon the structure of complex projective varieties for the existence of a canonical fundamental class in KO-homology theory.

The necessary and sufficient conditions are known in the non-singular case. Complex projective varieties can be stratified, that is, decomposed into non-singular constituents. The plan of investigation is to study the relationship of this decomposition to the construction of fundamental classes in K-theory and KO-theory.

At present, this study is focusing on cone bundles, varieties of a special type which reflect the local structure of arbitrary varieties. The solution of the problem for these spaces will be a major part of the project.

******

A STUDY OF HOPF MAPS

Researcher: Assistant Professor JoAnn S. Turisco

Sponsor: Naval Academy Research Council

The problem under consideratin is the study of the existence and classification of certain quadratic mappings of spheres whose form resembles that of the classical Hopf fibrations. This problem is closely related to one concerning composition of quadratic forms. To study existence, the methods involve the association to each such Hopf map a Jordan pair and studying the chain structure of principal inner ideals corresponding to a family of maximal idempotents.

There is a double action by the orthogonal groups on quadratic mappings of spheres. The investigator is working towards a formula describing the (finite) number of double cosets of such maps defined over an IR-lattice. Results of this kind have already been obtained.

The investigator is also continuing work on the computations of the automorphism group and Tate-Shufarevich set for Hopf maps defined over an algebraic number field. In this way a "Hasse Principle" can be examined for general Hopf maps.

Finally, the relationship between Hopf maps and multiplication on elliptic curves is being explored.

******

ANALYSIS OF PROJECT LINEAR CHAIR DATA

Researchers: Assistant Professor John C. Turner and Professor John Geremia (Mechanical Engineering Department)

Sponsor: David W. Taylor Naval Ship Research and Development Center, Annapolis Laboratory

The purpose of this classified, on-going project is to analyze data arising from Project Linear Chair. The study necessitated extensive data manipulation, including transferring data between different computer systems, and verifying distributional assumptions about the data based only on statistics gathered at the time of data acquisition. This has required developing new techniques as well as applying maximum likelihood methods to the data. In addition, analysis of variance has been applied to determine appropriate groupings of the data, and regression analysis will be used to determine relationships between different components of the data.

******

COMPUTER MODELING OF RARE EARTH AND ALKALI METAL DOPED ALKALINE EARTH FLUORIDES

Researcher: Assistant Professor Peter J. Welcher

Sponsor: Naval Academy Research Council

In rare earth doped calcium fluoride there are over 18 different types of defects observed under selective laser excitation. At least seven of these are observable by dielectric relaxation techniques. The basic problem is to determine the atomic configurations of each of the defects. This is done by matching the results of computer modelling with experimental data. Beside calcium fluoride, the structures of strontium and barium fluorides have been investigated. Work is currently underway in two areas (1) studies of defects involving alkali metals in calcium, strontium, barium, or lead fluoride, and (2) migration energies (enthalpies) for various rare earth dopants. Further work is planned on more complex defect structures involving the rare earth dopants. This basic research is significant in battery construction and corrosion in reactors.

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ORTHOMODULAR GEOMETRIES AND THEIR COORDINATIZING SEMIGROUPS

Researcher: Assistant Professor Karen E. Zak

Sponsor: Naval Academy Research Council

The object of this investigation is to continue research into the correspondence between properties of orthomodular geometries which have coordinatizing Baer *-semigroups and the existence of a coordinatizing semigroup with special properties. It is known that any orthomodular geometry in which 1 is finite and which satisfies the Janowitz condition can be coordinatized by a *-regular dimension *-semigroup. (This is the main result of fiscal 1980 NARC-supported research). The following questions are to be considered: Is this theorem (without *-regularity) extendable to the locally finite case? What can be said in the Type III case? Are there identifiable properties of the geometry which correspond to the existence of a semigroup with polar decomposition?

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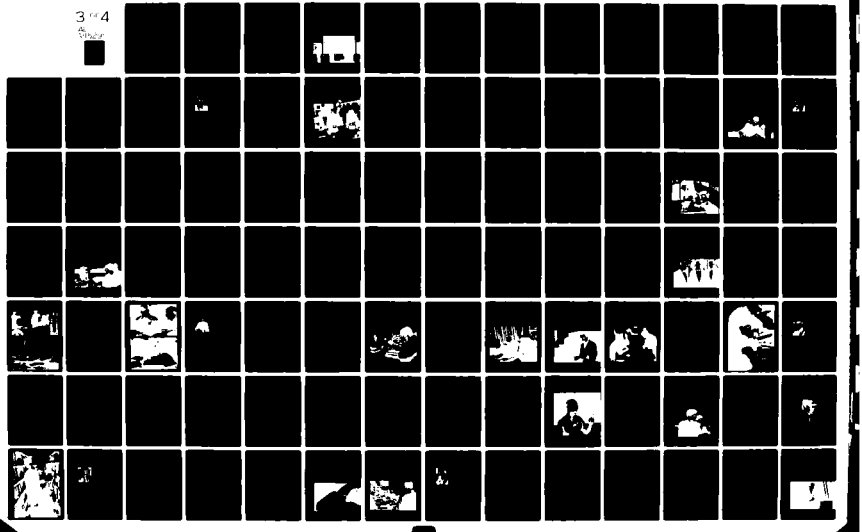

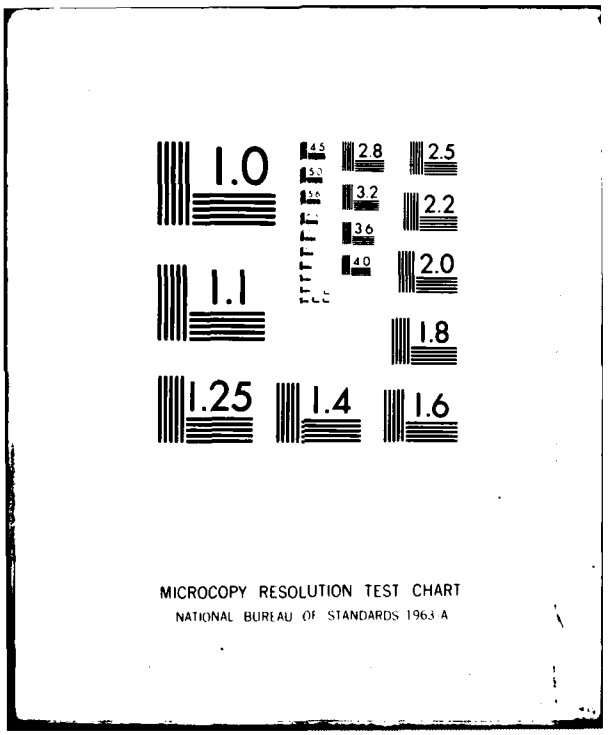
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CONICAL SPECTRA AND TRANSLATION GROUP AUTOMORPHISMS OF W*-ALGEBRAS

Researcher: Associate Professor Frederic I. Davis

Let the group of all translations on an n-dimensional real linear space L be represented by a strongly continuous group of spatial automorphisms of a W*-algebra A. If the representation satisfies a spectrum condition with respect to a proper cone K in L, then it is known that the automorphisms are inner. Using the partial order defined on L by K, it is shown that the unitary operators in A which implement the automorphisms may be chosen so that their generators have spectrum in K.

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HOMOGENEOUS PRIME IDEALS

Researcher: Assistant Professor Charles C. Hanna

This project seeks to generalize results of Ohm and Pendleton to graded rings. Of particular interest are results connecting various topological properties of subspaces of the homogeneous prime ideal spectrum of a graded ring A with corresponding properties of related subspaces over the base ring and over graded ring extensions of A. The following results have been obtained: (1) If A is a Z-graded or Z_+-graded ring with noetherian graded spectrum, then the graded spectrum of $A(X)$ is also noetherian, where X is an indeterminate of positive homogeneous degree; (2) If the graded spectrum of A is noetherian, so is the whole spectrum; (3) The graded spectrum of A is noetherian if and only if the prime spectrum of the base ring is noetherian. The above results are false if "graded spectrum" is replaced by Proj.

A major goal is a theorem relating the properties "the base ring is j-noetherian" and "the maximal elements of Proj A form a noetherian space."

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PRECONVERGENCE COMPACTNESS AND P-CLOSED SPACES

Researcher: Associate Professor Robert A. Herrmann

This is a continuation of research into the elementary properties associated with preconvergence spaces and their relation to topological spaces. In particular, the following result has been established for S_o, the set of all nonprincipal ultrafilter extensions of a preconvergence space (X,q): if (X,q) is T_1 and the second projective P_2: X x Y onto Y is a (preconvergence) closed mapping for each $Y \varepsilon S_o$, then X is (preconvergence) compact. This result is applied to the topologically generated θ, δ, w, rc, u and s-preconvergence structures and yields as corollaries all the known topological results associated with the above theorem and H-closed, nearly-compact, completely Hausdorff-closed, S-closed, Urysohn-closed and R-closed topological space.

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TESTING MEAN OF NON-NEGATIVE VARIABLE

Researcher: Professor Harold M. Kaplan

This project, which is essentially completed, involves testing the mean of a non-negative variable by Markov's Inequality. The test easily gives a one-sided confidence interval. If circumstances are right, the asymptotic efficiency can approach 100%.

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COEFFICIENTS OF MEROMORPHIC UNIVALENT FUNCTIONS

Researcher: Instructor Anna Tsao

Let g(z) belong to the class of functions analytic and meromorphic outside the unit disk except for a simple pole with residue 1 at infinity. Then g(z) can be written as $g(z) = z + b_0 + b_1 z^{-1} + b_2 z^{-2} + \ldots\ldots$ A well-known conjecture asserts that the modulus of b_n is less than or equal to $2/(n+1)$. The conjecture is true when n is 1 or 2, but was known to be false when n is 4 or an odd integer greater than 1. Using second variational techniques which generalize a method of Goluzin, explicit counterexamples to the conjecture have been constructed for <u>all</u> n greater than 4. This completely settles the conjecture.

******

QUICK AND DIRTY STATISTICAL PACKAGES

Researcher: Assistant Professor John C. Turner

This project develops a fairly general method for writing statistical packages in Fortran. The method is fairly easy, and a basic package can be written in a few hours. The advantages to writing one's own packages are that they can be used in developing a specialized technique of statistical analysis, learning tools for specific methodology, and are completely portable.

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SEASONAL TRENDS IN UNEQUALLY SPACED DATA: DISTRIBUTION OF SPECTRAL ESTIMATES

Researcher: Assistant Professor John C. Turner, co-investigator

This project is an extension of work performed last year involving the development of a method for the estimation of seasonal trends in time series data that are either unequally spaced or have missing values. The method developed was a modified Buys-Ballot filter with Hamming or Hanning filtering. In this stage of the project, the distribution of the spectral estimates obtained after removing a seasonal trend was investigated. A Monte Carlo approach was used. It was found that the spectral estimates had virtually the same distribution as do spectral estimates from the usual model. It was also discovered that even when a large percentage of the data was missing, the method was accurate in estimating the seasonal trend.

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VIDEO EXTENSION FOR STORAGE TUBE GRAPHICS

Researcher: Assistant Professor John C. Turner and CADIG

This project is continued from last year. Its purpose is to develop a microprocessor-based line monitor that will enable graphics from the Tektronix 4010 series of storage tube displays to be displayed on a video monitor. This stage is essentially complete, and the device has been used in several courses. In the past year the function has been extended to allow the graphics to originate with the Tektronix 4052 microcomputer and be transmitted via the General Purpose Interface Bus (GPIB) to the video display.

******

GROUP NORMS AND THE GRADING OF CHRONOLOGIES

Researcher: Assistant Professor William P. Wardlaw

Group norms are defined and some of their properties investigated. In particular, each group norm is shown to define a metric on the group. A natural norm, the generator norm, is shown to be obtainable for any set of generators of the group.

Group norms on the symmetric group provide a measure of how far a rearrangement of the integers 1, 2, ..., n is from the standard order. Hence such norms provide a possible way of grading a chronology--a list of items which the student is asked to arrange in chronological order.

The investigator is examining group norms and similar constructions in hopes of finding a rational method of grading chronologies. Later the strong connections these ideas have to hypothesis testing for correlation of paired data are to be investigated.

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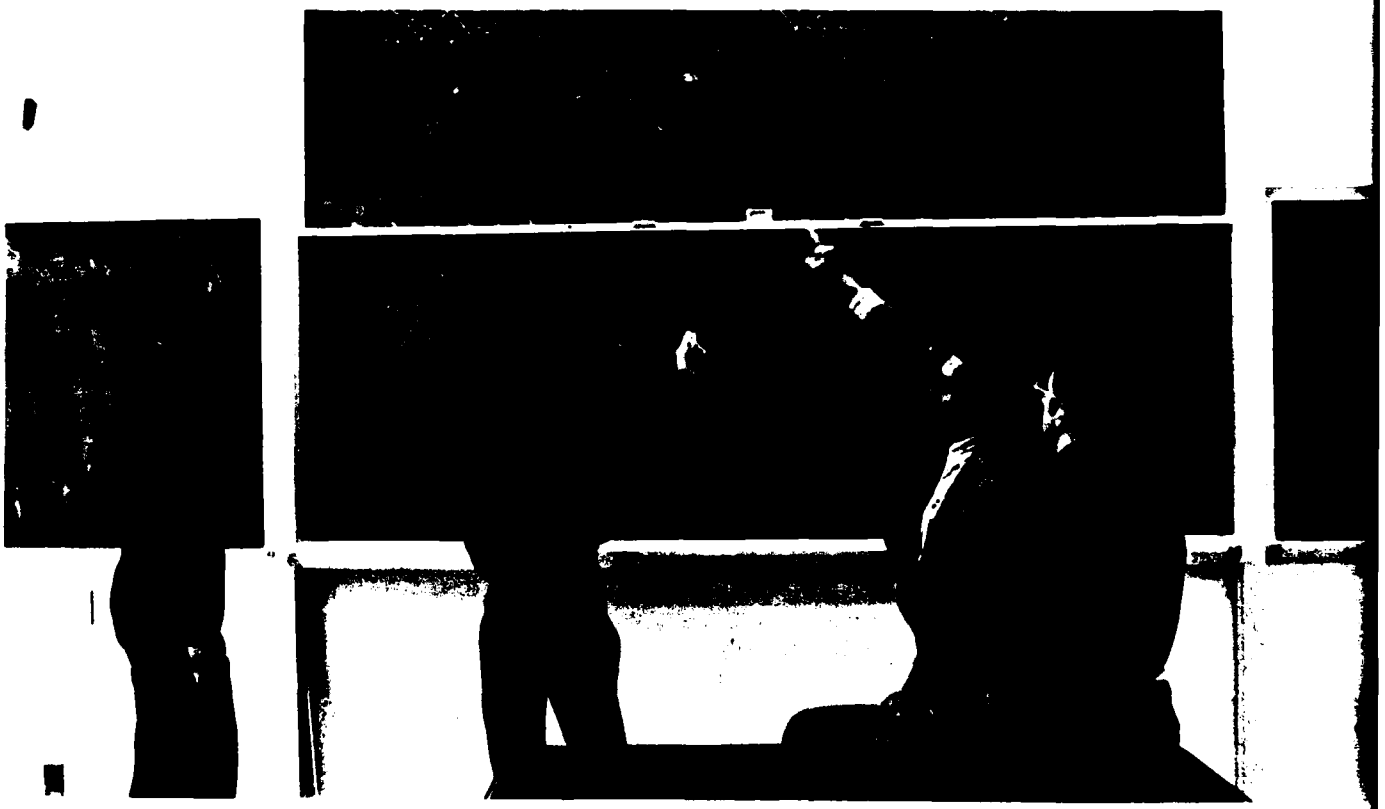

SEMI-BOOLEAN ALGEBRA

Researchers: Midshipmen 2/C Peter Haglich, Timothy Thomas, and Paul Owen

Adviser: Professor James C. Abbott

To develop an adequate research background, a two-semester seminar was organized to provide an in-depth study of various mathematical topics and their interrelations. Particular consideration was given to semi-Boolean algebras, orthosubtraction algebras orthomodular lattices with applications to Hilbert Space Theory, quantum logic, empirical logic and the theory of manuals.

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ANALYSIS OF PASSIVE SONOBUOY POSITIONING TO MINIMIZE THE AREA OF UNCERTAINTY OF A SUBMARINE CONTACT

Researchers: Midshipmen 1/C James M. Rice and John H. Wilson

Adviser: Lieutenant Commander Louis J. Giannotti, USN

The researchers investigated a scenario in which a 1052-class fast frigate with a shipboard helicopter attempted to best fix the position of a passive enemy submarine contact by using only four passive sonobuoys. The measure of effectiveness for the different tactics is the area of uncertainty where the submarine is located. The study was conducted using a geometric analysis which was expanded to include the many variables of the ship-submarine scenario by development of a computer simulation.

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OPERATIONAL AVAILABILITY: ITS DEFINITION AND LOGICAL USES

Researchers: Midshipmen 1/C James D. Heffernan and Gregory L. Point

Advisers: Lieutenant Commander Ted R. Maynard, USN, and Associate Professor Randall K. Spoeri (Applied Science)

The Operational Availability of a system with a given number of components was determined using the failure and repair rates of each component. This was done for various series and parallel system configurations. Formulas for expected Operational Availability were developed, and computer simulations performed to check their accuracy. The mean and variance of the number of space parts required per system per day were used to tabulate the expected number of spaces needed by the system per day for several confidence levels.

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BUCHANAN, James L., Assistant Professor, co-author, "The Hilbert Problem for Hyper-analytic Functions," Applicable Analysis, 11 (1980), 303-323.

Certain first order elliptic systems of partial differential equations in the plane are transformable to a normal form whose solutions are termed hyperanalytic functions. In this paper, known results on analytic representations of distributions and distributional boundary value problems are extended to the hyper-analytic case by establishing an invertible homomorphism between the hyperanalytic functions and hypercomplex-valued analytic functions. Examples of such representations are given. The results are then applied to the solution of the Hilbert problem: Find a function W which is hyperanalytic in the upper- and lower-half planes and satisfies the jump condition $W_+ - GW_- + g$ on the real axis. The hypercomplex function G is permitted to have a finite number of discontinuities; hence, the solutions will have distributional boundary value.

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D'ARCHANGELO, James, Associate Professor, "On the Whittaker Differential Equation and Laplace Transforms," Bulletin of the Calcutta Mathematics Society, 70 (1980) 349-354.

Recent results of Philip Hartman concerning the existence and uniqueness of solutions of certain ordinary differential equations are applied to Whittaker's equation. Representations of Whittaker functions and their products are obtained in a direct simple way in terms of Laplace-Stieltjes transforms of hypergeometric functions. In particular, the use of the results of Hartman makes it unnecessary to verify the convergence of any integrals and simplifies the task of identifying the determining functions in the Laplace-Stieltjes solutions.

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GAGLIONE, Anthony M., Assistant Professor, "A Generalization of the Bracketing Process Applied in the Commutator Calculus," Communications in Algebra, 8-10 (1980), 961-981.

The rank of the Abelian group $\bar{F}_n = F_n/F_{n+1}$ is given by Witt's formula, where F is a free group of finite rank and F_n is the nth subgroup of the lower central series of F. This was derived by H. Meier-Wunderli (1952) and by M. Hall Jr. (1959) using the bracketing process.

This paper generalizes the bracketing process to completely solve a problem of H. V. Waldinger (see Journal of Algebra, 5(1967), 41-58). It should also be noted that the result of this paper, which was derived by group theoretic methods, is a special case of a more general result due to J. Labute obtained by Lie algebraic methods.

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HERRMANN, Robert A., Associate Professor, "Generalized Continuity and Generalized Closed Graphs," Casopis Pěstování Matematiky 105 (1980), 192-197.

The major purpose of this investigation is to use tH-monad theory and to discuss relations between (tH,sK)-continuity, tH,sK)-closed graphs and topological continuity. This has produced improvements in published results on compactness, H-closedness, αA-compactness, completely-compactness, SA-compactness.

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HERRMANN, Robert A., Associate Professor,"A Nonstandard Approach to Pseudotopological Compactifications," Zeitschrift für Mathematische Logik und Grundlagen der Mathematik, 4 (1980), 361-384.

This is an exhaustive study of the q-monad and nonstandard enlargement theory applied to pseudo and pre-topological convergence structures and compactification theory. Thirty-six propositions answer numerous questions associated with one and "n" point compactifications, projective maxima and minima, locally compact convergence spaces, locally quasi-H-closed spaces, one point near-compactifications, and the like.

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HERRMANN, Robert A., Associate Professor, "Perfect Maps and Remoteness," Bulletin of the Calcutta Mathematical Society, 70 (1978)413-419.

This paper investigates various relations between (tH,sK)-perfect maps, (tH,sK)-compact maps and the nonstandard concept of remoteness. In particular, it is shown that remoteness gives simple set-theoretic characterizations for these concepts. Applications are made to the θ and δ convergence structures.

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HERRMANN, Robert A., Associate Professor, "A Note On Convergence Spaces and Closed Graphs," Proceedings of the Conference on Convergence Structures, Cameron University, (1980), pp. 72-77.

The major goal of this research is not only to investigate convergence space closed graph theory but also to show that many recent results relative to generalizations of the topological concepts of the closed graph such as strongly closed graphs or maps with property S are in reality simply convergence space corollaries.

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HERRMANN, Robert A., Associate Professor, "Convergence Spaces and Closed Graphs," Mathematical Reports of the Academy of Sciences of Canada, II (1980), 203-208.

This is a fourth report in a series of investigations answering various unsolved problems relative to convergence spaces and closed graphs. Applications are given to the θ,δ, rc and other topologically-generated convergence structures.

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LERNER, Bao Ting, Assistant Professor, co-author, "Semigroup Compactifications of Semidirect Products," Transactions of the American Mathematical Society, 265 (1981), 393-404.

Let S and T be semigroups, P their semidirect product, and F a C*-algebra of bounded, complex-valued functions on P. Necessary and sufficient conditions are given for the F-compactification of P to be expressible as a semidirect product of compactifications of S and T. This result is used to show that the strongly almost periodic compactification of P is a semidirect product and that, in certain general cases, the analogous statement holds for the almost periodic compactification and the left uniformly continuous compactification of P. Applications are made to wreath products.

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McCOY, Peter A., Associate Professor, "Bernstein Theorems for a Parabolic Equation in One Space Variable," Approximation Theory, Vol. 3, E. W. Cheney, ed. New York: Academic Press, 1980, pp. 643-646.

Classical theorems of S. N. Bernstein type relate the domain of regularity of an analytic function of a single complex-variable with a sequence of best local polynomial approximates. Extensions are given for analytic solutions of the non-characteristic Cauchy problem for the heat equation with analytic coefficients.

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McCOY, Peter A., Associate Professor, "A Mean Boundary Value Problem For A Generalized Axisymmetric Potential On Doubly Connected Regions," Journal of Mathematical Analysis and Applications, 76 (1980), 213-221.

An explicit expansion formula is given that recaptures a GASP (generalized axisymmetric potential) in a region between two concentric hyperspheres from the arithmetic means of the boundary data taken on sets of equally spaced hypercircles. Consequently, a GASP with smooth boundary data is uniquely determined by these means and a characterization of the means determines those that harmonically continue to a hypersphere. A canonical solution for the interior Dirichlet problem on doubly connected symmetric domains is then given for GASP with sufficiently smooth extension to the boundaries.

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MEYERSON, Mark D., Assistant Professor, "Equilateral Triangles and Continuous Curves," Fundamenta Mathematicae, 110 (1980), 1-9.

If M is a simple closed curve in the plane, then for all, except perhaps two, points x of M we can find points y and z of M such that xyz is an equilateral triangle. The same result holds if M is a connected manifold, with or without boundary, of dimension at least two in E^n. Let T be a triod, an embedding of the letter "T", in E^n. Then one leg of T is such that for any point x of that leg, we can find points y and z of T such that xyz is an equilateral triangle. Given triangle D, there exist three points forming a similar triangle on every simple closed curve in every metric space if and only if D is isoceles with apex angle at most 60°.

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PENN, Howard L., Associate Professor, "Using Computer Graphics to Teach The Heat Equation," Computers and Education, 4 (1980), 111-122.

The purpose of this paper is to describe two TV tapes produced by the author. The first tape presents the graphs of the solutions to three heat-equation problems. These graphs were obtained by using the computer to sum up the first several terms of the Fourier Series solutions. The second tape contains the graphs of the solutions to five heat-equation problems with radiating into the air boundary conditions. The solutions are no longer Fourier series. Therefore, the computer was used to find the first hundred eigenvalues by Newton's method and then to add the first several terms of the solution.

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ROBINSON, Michael L., Assistant Professor, "Legendre Polynomials and Irrationality," Journal für der Reine und Angewandte Mathematik, 318 (1980), 137-155.

Using Pade approximations to log(1-x) and properties of Legendre polynomials improvements are obtained for irrationality measures of the logarithms of certain algebraic numbers including log 2.

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WELCHER, Peter J., Assistant Professor, co-author, "The Activation Volume for Dimer Re-orientation in Rare Earth Doped Calcium Fluorides," Journal Physics C: Solid State Physics, 13 (1980), 661-666.

The activation volume for the RIV relaxation, that is for the reorientation of a dimer, has been determined for calcium fluoride crystals doped with europium, gadolinium, terbium or dysprosium. The results range from 1.05 $\pm$ 0.15 cm^3mol^{-1} for europium to 0.3 $\pm$ 0.15 cm^3mol^{-1} for dysprosium. These values are appreciably less than the activation volumes for the motion of bound interstitial or bound on free vacancies. In contrast, the activation enthalpies for the reorientation of the dimer are rather greater than those for interstitials or vacancies. These results, together with the results of a computer simulation show that a 2-2-2 cluster cannot be responsible for the relaxation. It is pointed out that a gettered 2-2-2 cluster cannot be ruled out, and, in fact, contains several of the characteristics which are consistent with the experimental results of the present work.

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WELCHER, Peter J., Assistant Professor, "Symmetric Products and the Stable Hurewicz Homomorphism," Illinois Journal of Mathematics, 24 (1980), 527-544.

The main purpose of Algebraic Topology is to investigate homology theories as invariants describing topological spaces via algebraic constructions. The Hurewicz homomorphism is an important tool in this work, as it allows the comparison of the unknown with the known. Spectra are a technical generalization of spaces which are useful in this study of homology theories.

In this paper, the symmetric product of a spectrum is defined. General properties of similar functors of topological spaces are studied in order to establish basic properties of the symmetric and cyclic products, both reduced and unreduced. Classical results, mostly due to Nakaoka, are examined from a modern viewpoint using localization, and are in most cases improved. These results are then used to study a conjecture of G. W. Whitehead on the Hurewicz homomorphism's kernel. The conjecture is shown to be equivalent to a general form of the Kahn-Priddy theorem. The conjecture is thus true in certain instances, and counterexamples are given to show that it does not always hold.

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ANDRE, Peter P., Associate Professor, "A Figure of Merit Concept for MultiLine ASW Detection," Symposium of the Military Operations Research Society, Annapolis, 4 June 1980.

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BENAC, Theodore J., Professor,"Calculus With the Computer," Sectional Meeting of Mathematical Association of America, Towson, Maryland, 16 November 1980.

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BUCHANAN, James L., Assistant Professor, "Elliptic Systems in the Plane," Annual Winter Meeting of American Mathematical Society, San Francisco, 10 January 1981.

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CHAMBERLAIN, Michael, Assistant Professor, "How to Win at Chuck-a-Luck," Sectional Meeting of Mathematical Association of America, Towson, Maryland, 15 November 1980.

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GAGLIONE, Anthony M., Assistant Professor, "Basic Commutators and Extensions Applied to Free Products," Annual Summer Meeting of American Mathematical Society, Ann Arbor, Michigan, 19 August 1980.

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GAGLIONE, Anthony M., Assistant Professor, "A Theorem on Basic Commutators," Annual Winter Meeting of American Mathematical Society, San Francisco, 7 January 1981.

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GAGLIONE, Anthony M., Assistant Professor, co-author, "Nilpotent Products Investigated by the Magnus Algebra and Generalized Bracketing," Sectional Meeting of American Mathematical Society, Kenosha, Wisconsin, 31 October 1980.

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GEWAND, Marlene E., Assistant Professor, "The Lindelof Degree of Scattered Spaces and Their Products," Spring Topology Conference, Blacksburg, Virginia, 20 March 1981.

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HANNA, Charles C., Assistant Professor, "'Going up' in a Graded Ring," Annual Winter Meeting of American Mathematical Society, San Francisco. 7 January 1981.

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KALME, John S., Associate Professor, "The Use of Partial and Multiple Coherence Spectral Analysis of Accelerometer Recordings in Source and Path Identification of Structure-Borne Noise on Surface Ships," Federal Republic of Germany-Netherland-U.S. Meeting on Trilateral Task Proposal for Surface Ship Noise Transmission Path Investigations, David W. Taylor Naval Ship Research and Development Center, Annapolis Laboratory, 11 December 1980.

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LERNER, Bao Ting, Assistant Professor, "An Amenability Property of Semidirect Products of Semigroups," Sectional Meeting of American Mathematical Society, Pittsburgh, 15 May 1981.

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McCOY, Peter A., Associate Professor, co-author, "Applications of Temperature Profiles Generated by a Source Term in Motion; A Non-Linear Heat Equation," Annual Winter Meeting of American Mathematical Society, San Francisco, 9 January 1981.

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McCOY, Peter A., Associate Professor, "Boundary Value Problems of the First Kind for an Elliptic Equation on Select Plane Domains," Special Session on Elliptic Systems in the Plane, Annual Winter Meeting of American Mathematical Society, San Francisco, 10 January 1981.

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McCOY, Peter A., Associate Professor, "Recapturing Solutions of an Elliptic Partial Differential Equation," International Conference on the Spectral Theory of Differential Operators, Birmingham, Alabama, 26 March 1981.

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McCOY, Peter A., Associate Professor, "H^p Representations of Ultraspherical Expansions," International Conference on Contemporary Trends in Complex Analysis, Lexington, Kentucky, 26 May 1981.

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MEYERSON, Mark D., Assistant Professor, "On Table Theorems," Conference on Geometry and Topology of 3- Manifolds, Bowdoin College, 10 July 1980.

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MEYERSON, Mark D., Assistant Professor, "UMAP-Math Modules," Sectional Meeting of Mathematical Association of America, Towson, Maryland, 15 November 1980.

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MOULIS, Edward J., Jr., Assistant Professor, "Bounds on the Functional $|a^3 + \mu a_2^2|$ for Classes of Functions Related to Functions with Bounded Boundary Rotation," Sectional Meeting of American Mathematical Society, Pittsburgh, 15 May 1981.

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PENN, Howard, Associate Professor, "A Solution for Rubix's Cube," Sectional Meeting of Mathematical Association of America, Williamsburg, Virginia, 11 April 1981.

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SANDERS, Thomas J., Associate Professor, "A Vietoris Theorem in CG-Shape," Annual Winter Meeting of American Mathematical Society, San Francisco, 8 January 1981.

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SCHWENK, Allen J., Associate Professor, "An Eigenvector Characterization for Removal Cospectral Sets of Vertices In a Graph," Annual Summer Meeting of American Mathematical Society, Ann Arbor, Michigan, 21 August 1980.

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SCHWENK, Allen J., Associate Professor, "Cospectral Graphs in Chemistry," Session for Graph Theory in Contemporary Science and Technology, American Association for the Advancement of Science, Toronto, Canada, 5 January 1981.

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SCHWENK, Allen J., Associate Professor, "Are Odd Graphs Spectrally Unique?" Special Session on Graph Theory, Annual Winter Meeting of American Mathematical Society, San Francisco, 9 January 1981.

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SCHWENK, Allen J., Associate Professor, "Pseudosimilarity and Reconstruction," New York Academy of Sciences: Graph Theory Day, III., New York City, 4 April 1981.

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TURISCO, JoAnn, Assistant Professor, "The Automorphism Group of Certain Hopf Maps," Annual Winter Meeting of American Mathematical Society, San Francisco, 9 January 1981.

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TURNER, John C., Assistant Professor, co-author, "Video Extension for Storage Tube Graphics," National Computer Graphics Association Conference, Washington, D.C., 15 June 1980.

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TURNER, John C., Assistant Professor, "Seasonal Trends in Unequally Spaced Data: Distribution of Spectral Estimates," Annual Summer Meeting of American Statistical Society, Houston, Texas, 12 August 1980.

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TURNER, John C., Assistant Professor, "Introductory Probability and Statistics with the Computer," Sectional Meeting of Mathematical Association of America, Towson, Maryland, 16 November 1980.

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WARDLAW, William P., Assistant Professor, "Group Norms and the Grading of Chrolologies," Sectional Meeting of Mathematical Association of America, Williamsburg, Virginia, 11 April 1981.

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WELCHER, Peter J., Assistant Professor, "Computer Modeling of Point Defects in the Alkaline Earth Fluorides," American Physical Society, Phoenix, Arizona, 17 March 1981.

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ZAK, Karen E., Assistant Professor, "Orthomodular Geometries And Their Coordinatizing Semigroups," Annual Winter Meeting of American Mathematical Society, San Francisco, 10 January 1981.

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OCEANOGRAPHY DEPARTMENT

Commander Richard A. Anawalt, USN, Chairman

During the 1980-1981 academic year, faculty research (in a broad range of atmospheric and oceanographic areas) was regularly undertaken by both civilian and military members of the Oceanography Department. Not only does this research provide the opportunity for the faculty to keep abreast of current technology and theory, but it also serves as a basis for qualified midshipmen to undertake related research projects, particularly those dealing with the Chesapeake Bay, where their work can be supported by the Departmental research vessel.

Funding for these research activities has been available from a number of sources, including grants from or contracts with the DMA, Naval Air Systems Command, Naval Environmental Prediction Research Facility, National Oceanic and Atmospheric Administration, Naval Facilities Engineering Command, Office of Naval Research, National Environmental Satellite Service, Naval Oceanographic Office, and the Naval Academy Research Council.

Specific areas of research activity with the Department include but were not limited to sedimentation processes and properties, light attenuation, estuarine pollution and circulation, estuarine ecology, marine biofouling, dredging, environmental planning for Naval operations, climatology, sea surface temperature mapping, statistical weather forecasting, and bathymetry.

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SATELLITE TRAINING IN DATA ANALYSIS

Researcher: Associate Professor John W. Foerster

Sponsor: Naval Environmental Prediction Research Facility, Monterey, California

Training and support was received for the use of satellites to map sea surface temperatures. The use of computer and interactive graphics was stressed in this project. The program has resulted in a system being developed for use with the Naval Academy computer.

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APEX PREDATOR ACTIVITY AS RELATED TO AIR/SEA INTERACTION IN THE DENMARK STRAIT

Researcher: Associate Professor John W. Foerster

Sponsors: Explorers Club, Naval Academy Research Council, Office of Naval Research, and NavOCEANO

This study proposed to gather knowledge of whale activity relative to subtle oceanic conditions such as wind stress and forage biota activity. An intense 35-day oceanographic cruise in the Denmark Strait forms the core of the data acquisition and hypothesis testing. The grant request is based on the hypothesis that wind from the north through east to south directions induces mass water movements across the Island Shelf of Iceland. During May and June this stimulates biological production of forage biota attracting feeding whales. Environmental satellites and a towed data-collecting vehicle will be incorporated into the study.

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ANALYSIS OF THE OPTICAL PROPERTIES OF ESTUARINE WATERS

Researcher: Professor Jerome Williams

Sponsor: Defense Mapping Agency

One of the more promising methods of acquiring bathymetric data involves the utilization of an airborne laser system. Although it appears that a major system limitation is water clarity, there is some doubt as to which particular optical parameter best describes water clarity as applied to the system. Data exist for the two most common water clarity parameters-- the beam attenuation coefficient and the diffuse light attenuation coefficient--

but no satisfactory relationship between the two has been determined for turbid water. By acquiring data in Chesapeake Bay during different seasonal periods, it is hoped that it will be possible to develop a satisfactory relationship. Two cruises have been deployed during the period indicated, and the data will be analyzed during the 1981-1982 period.

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CLIMATOLOGY OF THE CHESAPEAKE BAY

Researcher: Midshipman 1/C Jeffrey Crowell

Adviser: Commander Richard A. Anawalt, USN

A project was begun in 1979 to update the Annapolis climatological data base because the published climatology of Annapolis is based on data from 1931-1960. Since the project began, it has been expanded to include the climatology of the of the entire Chesapeake Bay area. It is expected that the project will continue for at least five more years because of the voluminous amount of data available. Three stations (Annapolis, Baltimore-Washington International Airport, and Solomons Island, Maryland) have been completed. Data which have been archived into a computer data base include Maximum Temperature, Minimum Temperature, Average Temperature, Degree Days Precipitation.

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PILOT STUDY OF A SHORT-RANGE STATISTICAL FORECAST PROCEDURE AT WASHINGTON NATIONAL AIRPORT

Researcher: Midshipman 1/C Donald Forbes

Adviser: Lieutenant Commander Wayne L. Patterson, USN

There is a wealth of forecast fields and satellite imagery available to guide the meteorological forecaster. The lead time from issuance to the valid time of the product is generally greater than 12 hours and, in most cases, 24 hours. A forecaster for an air field, however, is primarily concerned with a lead time of only 1 to 12 hours after issuance of the forecast. With modern high speed computers and developing statistical forecast methods, categorical forecasts of 1 to 24 hours are becoming possible.

Verification of a computerized statistical forecasting technique developed by Dr. Robert Miller of NOAA Technique Development Laboratory is the goal of this project. The program was obtained from Wayne Sweet of the Naval Environmental Prediction Research Facility, Monterey, California, and was adapted for use on the U. S. Naval Academy's computer.

Weather observational data covering a 3-year period at Washington National Airport was obtained from the Naval Oceanographic Detachment, Asheville, North Carolina. From these data, 45 cold frontal passes were selected. The observed weather con-

tions 5 hours prior to frontal passage were used as input to the program. Forecast values were compared with actual observed values for parameters of wind speed, wind direction, ceiling height, visibility, and dew-point depression. Contingency tables for the above parameters were constructed at hourly intervals from 3 hours prior to 3 hours following frontal passage. From each contingency table, a Heidke skill score was computed.

Because of an error in the instructions for program input coding, the Heidke skill scores were invalid. The project was reinitialized and is scheduled for completion during the summer of 1981.

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AN ANALYSIS OF THE METHODS USED IN BATHYMETRY

Researcher: Midshipman 1/C Carlos Sanchez-Caparros

Adviser: Professor Jerome Williams

Sponsor: Defense Mapping Agency

The various techniques and devices commonly utilized in the production of bathymetric charts are described and documented. To illustrate the methodology of a particular sequence of operations, previously collected depth-data from the upper reaches of the South River were analyzed in the hopes of producing a chart. A special computer plotting program was generated for this purpose.

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HOFFMAN, John F., Professor, "Current Dredging Practices." Proceedings of Symposium on Dredging and Sedimentation Control. Naval Facilities Engineering Command, 1980.

The current state of the art of dredging is discussed. Descriptions of eight types of dredges are included. Methods of dredge spoil-disposal and dredging costs are presented.

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HOFFMAN, John F., Professor, "European Dredging--A State of the Art." Proceedings, Coastal Zone '80. American Society of Civil Engineers, November 1980.

The U. S. Army Corps of Engineers is directed by the Rivers and Harbors Act of 1899 to maintain the depth of navigable waterways with funding appropriated annually by the Congress. The U.S. Navy has the responsibility of maintaining the depths of pier slips, turning basins, and approach channels to their facilities. Dredging of Navy pier slips etc. is either done, under the auspices of the Corps of Engineers, by private contractors hired by the U. S. Navy or, in some instances, by the U.S. Navy itself.

Coping with shoaling problems in the maintenance of water depths in pier berths by dredging requires a different approach from that used by the Corps of Engineers in the maintenance of water depths in channels. The problems are different.

This report concerns advances in dredging equipment and techniques in Europe. The Naval Facilities Engineering Command and the Office of Naval Research (London) sponsored the author for a three-month tour of pertinent facilities in six European countries.

The agencies or activities visited may be categorized as follows: dredging firms (2), dredging equipment manufacturers (1) port and river authorities (8), governmental departments (other than those included elsewhere in this list) (3), laboratories concerned with dredging and/or sedimentation in harbors (6), and universities (3). During the time spent in Europe, conferences were held with more than 40 persons in Belgium, England, France, Germany, Holland, and Scotland.

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HOFFMAN, John F., Professor, "Investigation Into Deep-draft Vessel Berthing Problems at Selected U. S. Naval Facilities," Report, E. G. and G. Washington Analytical Services Center, Inc. 1980.

Described in this report are the results of a detailed investigation of shoaling in the pier slips and associated waterways of six deep-draft harbors used by the U.S. Navy. These are the Naval Air Station at Alameda, California, the Naval Station and Naval Shipyard at Charleston, South Carolina, the Naval Station at Mayport, Florida, the Naval Station at Norfolk, Virginia, the Naval Air Station at Pensacola, Florida, and the Naval Air Station, North Island, San Diego, California. In addition to shoaling, the bioclogging of the screens of aircraft carriers' "sea chests" at Norfolk was investigated.

Prior to the investigation of specific harbors, home-porting information was updated. Also updated were data concerning the crafts of Aircraft Carriers (CV, CVT, CVN), Fast Combat Support Ships (AOE), Oilers (AO), and Replenishment Oilers (AOR). Initially, submarines were included in this study, but information at pertinent installations, such as Charleston, was considered as classified and little if any information was available.

As a result of updating Table 7-4 in "Design Manual 26 - Harbor and Coastal Facilities" the Maximum Operating Load of aircraft carriers was found to exceed the Limit in all carriers except for the U.S.S. Eisenhower.

Tidal extremes for the subject harbors were also updated. Extreme Low Water at the installations investigated ranged from 2.2 feet below the reference datum at Pensacola, (Mean Low Water for the East and Gulf coasts and Mean Lower Low Water for the West coast) to 3.3 feet below the reference datum at Charleston.

The problem of offshore as well as onshore dredge spoil-disposal is addressed. Included are discussions on the use of the elutriate test, the bioassay, and the in-situ bioassay in determining the toxicity of the dredge spoil.

Retardation of the deposition of sediments or the flushing of pier slips of resuspended sediments are ways of reducing the costly dredging burden. A section in the report addresses the methods of sediment control.

Information in this report based on interviews and other research is contained in sections entitled: Ship Movement, Current Velocity, Elevations of Bottom Tips of Pilings (should future deepening necessitate lowering the elevation of the bottom of a slip), Shoaling and Shoaling Rate, Submarine Sediments,

Dredging, Dredge Spoil Disposal, Problems, and Recommendations.

Eight general recommendations are made. These include use of air bubble agitation to remove sediments from pier slips, changing the datum for dredging to Extreme Low Water from Mean Lower Low Water, and investigating the feasibility of various dredging approaches to reduce dredging costs and down time for pier slips.

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HOFFMAN, John F., Professor, "Storm Surge Study," King's Bay Submarine Support Base, Georgia.

Review of documents, newspapers, etc. dating back to 1870 indicated that in the period between 1870 and the present the largest storm surge experienced along the southeast coast of Georgia occurred during October 1898. The water level elevation was 14.6 feet above mean low water. References in documents suggest that a more devastating storm surge may have taken place early in the 1800's. However, only qualitative information was presented.

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WILLIAMS, Jerome, Professor, and Frederick A. SKOVE, Assistant Professor (Applied Science), "The Effects of Recreational Boating on Turbidity in Relation to Submerged Aquatic Vegetation," Final Report under Grant No. R-806136-01-0, U.S. Environmental Protection Agency.

Since water clarity is one of the parameters that might affect submerged aquatic vegetation (SAV), this study was performed to assess the role of recreational boating in increasing turbidity by resuspension. A heavily utilized portion of the South River in Anne Arundel County was chosen as the study site with a non-ski area of Broad Creek used as a control. Measurements of suspended sediments were compared to tidal currents, runoff as deduced from precipitation values, wind, and boat traffic recorded as the number passing a specified point per unit time. The measurements indicated some correlation existed among each of the parameters and turbidity; with wind having the greatest. However, it was also indicated that in this study area, and probably others as well, background, i.e. prior to disturbances, Secchi Disc Readings indicated water clarity was at such a low level that any additional turbidity input might create severe light limiting problems for SAV.

Although the correlation between wind and turbidity appears to be much higher than that between boat traffic and turbidity, boat traffic may be an important factor, since it occurs much more frequently during the SAV growing season than high winds.

It was therefore concluded that (1) power boat activity does probably cause some increase in suspended sediments by resuspension; (2) this resuspension probably occurs mainly in the shoreline area; (3) the nature of the shoreline is an important factor; (4) even though the boat-induced turbidity increase may be small, it may be enough to exceed the SAV light-limit threshold; (5) because of tidal exchange, activities in one branch of an estuary directly affect conditions in the rest of the estuary, and (6) any mechanism that adds silt to the estuarine system (such as runoff) will directly influence the boat contribution by making more material available for resuspension.

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WITTING, James M., Visiting Professor, "A Note on Green's Law," Journal of Geophysical Research, 86 (20 March 1981), 1995-1999.

Green's Law for the propagation of a linear nondispersive wave in a gradually varying medium conserves energy, which is a quadratic integral property. Green's Law does not conserve linear integral properties, and other waves must arise. This paper treats some general properties that these additional waves must possess for a class that includes long linear water waves in a channel of gradually varying section. The major finding is that both a reflected wave and a re-reflected tail are required to satisfy all of the conservation laws. Integral properties of these additional waves are derived.

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HOFFMAN, John F., Professor, "European Dredging - A State of the Art," Proceedings, Coastal Zone '80. American Society of Civil Engineers. November, 1980.

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JECK, Richard K., Visiting Research Professor, "Icing Characteristics of Low Altitude Supercooled Layer Clouds," American Institute of Aeronautics and Astronautics 19th Aerospace Sciences Meeting, St. Louis, Missouri, 12-15 January 1981.

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JECK, Richard K., Visiting Research Professor, "Intercomparison of PMS Particle Size Spectrometers," Government Coordination Meeting on Aircraft Icing, NASA/Lewis Research Center, Cleveland, Ohio, 12-13 May 1981.

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WILLIAMS, Jerome, Professor, "If Turbidity is a Factor in the Decline of SAV, What is the Major Cause of the Turbidity Increase?" Fall 1980 Meeting of the Atlantic Estuarine Research Society, Virginia Beach, Virginia, 5-8 November 1980.

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PHYSICS DEPARTMENT

Professor Gerald P. Calame, Chairman

Research in the Physics Department is encouraged for three reasons: it contributes towards a deeper understanding of the workings of the physical universe; it maintains faculty expertise; and it gives midshipmen opportunities to gain direct appreciation of both the joys and the difficulties of research through participation in research courses and in Trident Scholar projects.

The ongoing research in the Department reflects the wide range of expertise in the Department's faculty. Present activities include studies in Acoustics, Computer-Assisted Education, Electric and Magnetic Properties of Materials, Fiber Optics, Laser Optics and Technology, Magnetic Signatures of Ships, Radiation Effects in Solids, Solar-Energy Studies, Solar System Astronomy, and Solid-State Physics, with the Solid-State Physics group being especially active.

This year, the Department's research efforts were supported by the David Taylor Naval Ship Research and Development Center, the Department of Energy, the National Aeronautics and Space Administration, the National Bureau of Standards, the Naval Research Laboratory, and the Naval Academy Research Council.

Midshipmen majoring in physics are encouraged to participate in the Department's research program, either through the 490-series or through the Trident Scholar Program. It should be noted that three of the six Trident Scholars for the year were Physics Majors.

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TRAPPED IONS IN SPACE

Researchers: Midshipmen in Sigma Pi Sigma (ΣΠΣ) Physics Honor Society

Advisers: Assistant Professor Francis D. Correll and Lieutenant Commander Jeffery M. Perin, USN

Sponsor: Naval Research Laboratory (NRL)

This experiment is an official project of the Academy's chapter of the ΣΠΣ Physics Honor Society, and it is being carried out in collaboration with the Laboratory for Cosmic Ray Physics at the Naval Research Laboratory (NRL).

The goal of the experiment, which is tentatively scheduled to be flown aboard the Space Shuttle in 1984, is to study the unexpectedly large numbers of heavy ions that were first observed to be present at high altitudes above the earth during a Skylab experiment in 1975. The present experiment will employ a device similar in concept to a simple box camera to record the numbers and kinds of heavy ions encountered during the flight. Instead of photographic film, however, this "camera" will contain thin sheets of Lexan, a widely-used transparent plastic. When cosmic-ray ions strike the Lexan film, they will produce minute tracks in the plastic, which can be observed with a microscope after the film is etched in a strong chemical solution. By studying the numbers, lengths, diameters, and other properties of the tracks, the USNA-NRL team will be able to deduce the numbers of ions of different types that struck the apparatus as it flew through space.

The results of the TRIS experiment will help to answer a question concerning the origin of these heavy charged particles--whether they emerge from the Sun as part of the Solar Wind or whether they come from outside our solar system. The experiment will also provide new information about the way in which charged particles are guided, and sometimes trapped, by the Earth's magnetic field. This information may, in turn, be useful for predicting the possible effects of these ions on men and equipment that are placed in orbit for long periods of time.

This project has recently been approved and is just getting underway.

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ACOUSTICAL SPECTROSCOPY

Researcher: Associate Professor Donald W. Brill

Sponsor: David W. Taylor Naval Ship Research and Development Center, Annapolis Laboratory

A study was made of the natural frequencies for compressional acoustic waves inside a body placed in a vacuum. The bodies investigated were the sphere, spheroid and cylinder in an effort to demonstrate that the resonant frequencies of a sphere do indeed split into those for a prolate spheroid. Furthermore, as the spheroid becomes more prolate, it is hoped that its resonant frequencies will be seen to merge with those of a cylinder.

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EFFECTS OF ION IMPLANTATION ON OXIDATION RESISTANCE AND FATIGUE LIFE OF TITANIUM TURBINE BLADE MATERIALS

Researcher: Assistant Professor Francis D. Correll

Sponsor: Naval Research Laboratory (NRL)

The object of this research is to study the effects of implanted Ba and Pt ions on the oxidation resistance of pure Ti and of Ti turbine blade alloys, and to correlate the oxidation resistance of these materials with their fatigue life at elevated temperatures.

This work is part of a large-scale effort in progress at NRL to study how several important properties of metals, such as their wear resistance, corrosion resistance, and fatigue life, may be modified by the implantation of various kinds of energetic ions.

In this project, samples of pure Ti and of Ti alloys such as Ti-6Al-4V will be implanted with Ba and Pt ions. Typical ion energies will be in the range 50-100keV, and typical fluences in the range 10^{-10} atoms/cm . Rutherford backscattering measurements and nuclear reaction profiling will be used to determine oxidation rates and implant redistribution effects in the treated specimens. Standard mechanical tests, such as the rotating-beam test, will be used to measure the fatigue life of the various samples, and correlations between their mechanical properties, corrosion properties, and implantation histories will be studied.

Although investigations of this type have been performed at NRL for several years, this particular project is still in the development stage. Measurements are expected to begin during the summer of 1981.

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POLARIZATION EFFECTS IN THE THREE-NUCLEON SYSTEM

Researcher: Assistant Professor Francis D. Correll

Sponsor: U.S. Department of Energy

This project is part of an ongoing study at Los Alamos Scientific Laboratory of polarization effects in nuclear reactions and scattering. Its immediate goal is to obtain highly specific data on spin-dependent effects in nucleon-deuteron breakup reactions. The results of these measurements on the relatively simple three-nucleon system will be used to test the predictions of sophisticated phenomenological models of the nucleon-nucleon (NN) interaction.

Beams of polarized deuterons in the energy range 10-20 MeV have been used to bombard gaseous hydrogen targets or thin plastic films containing hydrogen. Elastically-scattered protons or proton emerging from the deuteron breakup reaction $^{1}H(d,pp)n$ have been detected, and reaction yields for various spin states of the incident deuteron beam have been measured. From these measurements, polarization analyzing powers for the elastic scattering and deuteron breakup reactions have been deduced, and the results have been compared with the predictions of a sophisticated computer calculation that employs a realistic phenomenological form for the NN interaction. These experiments and calculations have been performed for several selected kinematic configurations in which the analyzing powers are expected to be especially sensitive to the detailed properties of the NN force. Several different forms for the force have been considered, and comparisons of their ability to reproduce the experimental data have been made.

The experimental phase of this project is essentially complete. Some calculations, evaluation of the results, and publication of the conclusions remain to be done.

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INVESTIGATION OF TONE GENERATION BY FLOW OVER WALL-MOUNTED CAVITIES

Researcher: Professor Samuel A. Elder

Sponsor: David W. Taylor Naval Ship Research and Development Center, Bethesda, Maryland

The purpose of the project is to develop a model of tone generation by flow over wall cavities, applicable to the control or elimination of cavity tone effects in ship design. A detailed investigation is being made of the separate shear layer and its interaction with the leading and trailing edges of the cavity. Experimental measurements are being taken both at the Anechoic Flow Facility of the David W. Taylor Naval Ship Research and Development Center, Carderock, Maryland, and in the U. S. Naval Academy Tow Tank Facility, Annapolis, Maryland. Theoretical work involves the adaptation of a feedback amplifier model of cavity oscillation, using root locus technique. A proposal to extend the present contract until September 1982 has been submitted.

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DYNAMICAL PLANETARY MAGNETOSPHERIC FIELD MODELING

Researcher: Assistant Professor Irene M. Engle

Sponsor: Naval Academy Research Council

The model of the Mercury magnetospheric field is being extended using a more precise mathematical modeling of the near-planet region of the magnetospheric surface currents in an attempt to provide a smoother, more "physical" connection to the model magnetotail.

To a basic, self-consistent magnetospheric field model of Jupiter are being added modifications to allow for the tilt of the Jovian planetary dipole with respect to the incident solar wind direction. Additionally, formulation of a model of the co-rotating axial current sheet which is NOT axially symmetric but which satisfies Maxwell's equations is being pursued.

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RADIATION EFFECTS IN FIBER OPTIC MATERIALS

Researcher: Associate Professor John J. Fontanella

Sponsor: Naval Research Laboratory

The primary purpose is to perform optical and dielectric absorption and electron spin resonance measurements on various samples of fused silica in order to further characterize and properly identify the radiation sensitive defect center found dielectrically during the past year. Specifically, it is felt that the observed relaxation is due to an aluminum-alkali center and an attempt will be made to correlate the dielectric signal to the well-known aluminum-associated electron spin resonance spectrum. The correlation will be attempted by varying radiation dose and carrying out isochronal annealing studies. In addition, studies of the effect of radiation on the low temperature hydroxyl associated relaxation may be carried out. Finally, a wide selection of silicate glasses may be studied dielectrically.

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DEFECT PROPERTIES OF FLUORITE CRYSTALS AND RELATED MATERIALS

Researchers: Associate Professor John J. Fontanella and
Assistant Professor Mary C. Wintersgill

Sponsor: North Atlantic Treaty Organization

This project represents a collaborative effort between USNA and the University of Kent at Canterbury. The projects involved are as follows:

a. Large single crystals of PbF_2 doped with varying concentrations of rare earth ions will be grown.

b. Audio-frequency capacitance and conductance measurements will be made on the various crystals over the temperature range 4.2 to 400K at zero pressure and in the temperature range 77 to 400K at pressures up to 0.4 GPa. These measurements will detect any dipolar complexes which exist within the crystals. The variations of the strengths of the various complexes with dopant concentration will give insight into the nature of the complexes as will the activation energies, activation volumes, and reciprocal frequency factors. The variation of the complexes with different dopant ions also provides additional useful information.

c. A.c. conductivity measurements will be made from room temperature up to the melting point. These measurements will

reveal the effect of doping on the temperature of the thermal anomaly. The data below the thermal anomaly will be analyzed by computer techniques to yield the defect parameters.

d. The complementary information from (b) and (c) will give a comprehensive picture of the defect structure of these materials and its relationship to the superionic behavior.

The plan outlined in the last paragraph will then be employed to study the other systems in this program.

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DIELECTRIC PROPERTIES OF POLAR FLUIDS IN THE SUPERPRESSED STATE

Researchers: Associate Professor John J. Fontanella and
Assistant Professor Mary C. Wintersgill

Sponsor: National Bureau of Standards (NBS)

A three-terminal cylindrical cell has been constructed for making complex impedance measurements in liquids and plastic crystals at audio frequencies. Pressures up to 15 kbar can be obtained over the temperature range 200-400K. In addition, the cell contains a thermocouple for differential thermal analysis studies.

Some preliminary measurements have been performed on carbon tetrachloride. The cell is obviously capable of producing excellent data on liquids. Consequently, one of the goals of the project can now be achieved since a careful study of liquids in the superpressed state can be made. The preliminary results do not indicate any dramatic dielectric anomalies in the superpressed state. However, there appears to be a decrease in the curvature in that region. More careful studies are now being carried out.

The results in the solid region are also very interesting in that a sharp transition is not observed. The most obvious explanation is that this is due to the cell design. One check is currently being made by using an alternative cell with a different geometry. This cell is the one constructed at NBS, and it will also be used to study phase transitions in other fluids.

Finally, the cylindrical cell appears to give very good data for the dielectric properties of the plastic phase far above the phase transitions and will be used to study other materials.

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SPECTROSCOPY OF WELDING ARC

Researchers: Professor Ralph A. Goodwin and Associate Professor Bruce H. Morgan

Sponsor: David W. Taylor Naval Ship Research and Development Center, Annapolis Laboratory

To facilitate the attainment of satisfactory welds in naval construction, DWTNSRDC is studying the basic physics of the welding process. The subject project has as its designated goal the determination of temperature in an electric inert-gas shielded welding-arc by the identification and quantification of spectral line intensities, using photographic techniques.

First results and reason combine to suggest that it will be necessary to employ technique and analysis by which temperature as a function of distance from the arc's symmetry axis can be ascertained, rather than characterizing the arc by some overall bulk temperature. This indicates that optical components must be used so that the entrance slit of the spectrograph can selectively view various parts of the arc.

Results when the work-piece is moving relative to the welding electrode (simulating actual welding operation) will be compared with those obtained with no relative motion.

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MAGNETOELASTIC EFFECTS IN ULTRASERVICE STEELS

Researcher: Associate Professor Carl S. Schneider

Sponsor: David W. Taylor Naval Ship Research and Development Center, Annapolis Laboratory

Magnetic instability due to environmental stresses and thermal fluctuations is being investigated for high stress steels used in ships. The reversible and irreversible, non-linear, anisotropic, inhomogeneous and time-dependent problem of magnetization in finite steel bodies has progressed from initial data accumulation to theoretical modeling of magnetization changes from stress coaxial with applied field. The effects of continued stressing (vibration) have been studied in the uniaxial case, and plans are underway to include stress sensitivity to explain anhysteretic non-linear effects and to study the effects of stress transverse to applied field. The biaxaial and hydrostatic effects on ships continue as the ultimate objective.

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DEFECTS IN III-V SEMICONDUCTORS

Researcher: Professor Robert N. Shelby

Sponsor: Naval Research Laboratory (NRL)

The purpose of this research is to identify and study electronic trapping states (defects) in III-IV semiconductors with specific emphasis on native, ion implantation induced and fabrication induced defects in GaAlAs and InP. This program is a part of the NRL program of materials characterization of important semiconductors.

An important part of the effort was a study of the defects introduced in Be-implanted GaAlAs by various annealing and encapsulation methods. This study showed the appearance of new defect states as the annealing temperature was taken above 800°C.

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GENERATION OF TUNABLE VACUUM ULTRAVIOLET RADIATION

Researchers: Assistant Professor Lawrence L. Tankersley with Mr. John Reintjes (NRL)

Sponsor: Naval Research Laboratory (NRL)

A program to develop sources of vacuum ultraviolet (VUV) radiation based on rare gas halide (RGH) lasers is being pursued. During the last year, a pulse-slicing system was developed. Its use has increased the peak power of our XeCl laser system from 1 MW to and estimated 40 MW. The increased power enables the researchers to be the first group to quintuple a RGH laser.

Strong broadband VUV radiation was observed from laser pumped Xe gas. The properties of this potential significant VUV source are still being investigated.

A favorable review of the proposed neutral hydrogen monitor has been received, and Department of Energy funding for the project next year is expected. A neutral atomic hydrogen source for this effort is being developed. The preliminary development of the source will be done at the Naval Academy.

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NUCLEAR QUADRUPOLE STUDIES OF As_2O_3

Researcher: Professor Donald J. Treacy

Sponsor: Naval Research Laboratory

Nuclear Quadrupole Resonance (NQR) measurements were made on glassy and crystalline samples of As_2O_3 to determine the structure of this compound and to identify photostructural changes which occur after illumination with laser light.

Measurements were conducted on vitreous As_2O_3 and three crystalline phases. The complete NQR spectra of arsenolite (the cubic phase), claudetite I (a monoclinic phase), and an unidentified crystalline phase were obtained. The lineshape for the glassy form was established. The relaxation rates for spin-lattice and spin-spin processes were recorded on all samples for the temperature range from 4.2 to 300K. The glassy phase shows a temperature dependence for the spin-spin relaxation rate that may be the first reported observation of this phenomena.

The structure of the vitreous form resembles that of claudetite I.

Photostructural measurements will be made on glassy As_2O_3.

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HIGH PRESSURE ELECTRICAL PROPERTIES OF MATERIALS

Researchers: Assistant Professor Mary C. Wintersgill and
Associate Professor John J. Fontanella

Sponsor: National Science Foundation

Three items of equipment have been obtained for augmentation of research facilities. Those items are an automated, audio-frequency impedance bridge, a 0.2 GPa gas compressor, and a Bourdon gauge capable of measuring pressures up to 0.7 GPa.

The most important features of the principal subject of this proposal, the impedance bridge, are a continuous frequency capability over a relatively wide range and a high level of sensitivity. In addition, it will be fully microprocessor-controlled and compatible with the auxiliary facilities mentioned below. The bridge offers a choice of capacitance, resistance and G/ω measurements with a range of signal-average sampling times. These capabilities are even better than the CGA-78 bridge currently being used at USNA on a temporary loan from Case Western Reserve University.

The addition of a compressor capable of handling gases at high pressures to the existing apparatus will significantly extend the range of temperatures at which pressure related Dielectric Relaxation (DR) measurements may be taken. At present, 150K is the lowest temperature at which DR can be measured under pressure, whereas 50K will be easily accessible with the new gas pump. Finally, the high pressure Bourdon gauge will complete a system for studying phase transitions in solids.

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RADIATION EFFECTS ON TRANSMISSION IN OPTICAL FIBER SYSTEMS

Researcher: Midshipman 1/C William H. Hilarides

Adviser: Professor Richard L. Johnston

Sponsor: Naval Research Laboratory and Trident Scholar Program

A study was made of the effects of 14.7 MeV neutrons on transmission in optical fibers. This study was done with monochromatic light in the spectral range from 700 to 1700 nanometers. Of the fibers studied, two were high purity silica fibers, and two were germanium-doped core silica fibers. An important result of the study was that the radiation-induced damage was wavelength related. The induced damage decreased rapidly as the wavelength increased from 800 to 1100 nanometers. This trend was due primarily to the energy levels of traps formed as the bombarding neutrons broke bands within the silica. Several other interesting trends were noted. First, the water content of the fiber effected the amount of induced damage. Secondly, the method by which the fiber was made effected the damage levels. These trends deserve further study, but because the data base was so small, more specific conclusions were not possible.

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CHARACTERIZATION OF TRAPPING STATES IN SEMICONDUCTORS

Researcher: Midshipman 1/C Harvey S. Hopkins

Adviser: Professor Robert N. Shelby

Sponsor: Trident Scholar Program

Defect energy states within the band gap are known to affect the performance of semiconductors in terms of response time. The characterization of defects is the first step in understanding how they act and how one may use them to benefit diode performance. Characterization of a defect includes among other quantities, the energy difference from the band endge, and the capture cross-section of the energy state. Deep Level Transient Spectroscopy (DLTS) is a very powerful experimental method using the transient capacitance properties reverse-biased p-n junction diodes to characterize defects. A particular electron trap in n-type GaAlAs, known as the DX center, was studied in this work using two different DLTS experimental setups. A complex model was proposed for the DX center consisting of a ground plus an excited state with independent capture cross-sections and communication between the two levels. Since classical analysis of DLTS data yields misleading results when a complex trap is considered, a computer simulation and curve-fitting technique was used to determine the trap structure and parameters. This technique gave values of .295 eV for the ground state energy, .219 eV for the excited state, prefactor values on the ground, excited, and communication prefactor of 1.02×10^{7}, 2.2×10^{8}, and 5.58×10^{5}, respectively.

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THE USE OF PLASTIC CRYSTALS AS PRESSURE CALIBRATION DEVICES

Researcher: Midshipman 1/C Mark E. Middleton

Advisers: Associate Professor John J. Fontanella and Assistant Professor Mary C. Wintersgill

Sponsor: Trident Scholar Program

It was proposed to study liquid-solid and solid-solid phase transitions using differential thermal analysis (DTA) and dielectric relaxation techniques. In particular, studies were made of carbon tetrachloride, cyclohexane, and cyclohexanol at elevated pressures. All three of these substances exhibit plastic phases in which the molecules are rotationally disordered. The liquid-plastic solid phase transition was observed in all samples, and super-pressing was observed as pressure increased beyond the

normal transition pressure. The transition to the plastic phase was also noted to be gradual rather than the conventional sharp transition, a phenomenon which appeared to be intrinsic to the materials.

One of the objectives of the project was to investigate the usefulness of the transition as a pressure calibration fixed point, and while the freezing transition proved unsatisfactory because of the super-pressing, the melting transition on decreasing pressure was very well-defined and could prove useful. Further research is indicated to determine the cause of the unusual transition characteristic.

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COMPUTERIZED ITEM ANALYSIS FOR MULTIPLE CHOICE EXAMS

Researcher: Midshipman 3/C Richard N. Emmons, III

Adviser: Associate Professor Bruce H. Morgan

A standard method of assessing the internal consistency of multiple-choice examinations is to correlate student performance on individual test items with overall raw scores. In one approach, the students are divided into five groups by exam raw score: low, middle, middle high, and high. Then any individual test item is assessed by determining what percent of each group selected the correct answer. This provided information on how "easy" or "hard" a particular item was, giving some light on how successfully that topic was taught, and also indicates how well the item discriminates among the students for achievement-ranking purposes. Hidden ambiguities or other faults in an item may be revealed by a negative correlation between performance on the item and on the test as a whole. The testing value of each distractor (wrong answer choice) can be similarly assessed.

The purpose of the project was to develop a computer program to carry out this process and present the results in both tabular and graphical form. A three-dimensional array was used in the program to handle the mass of data involved. The program is designed for use on a Tektronix 4010 graphical display terminal. It has been placed on line in the physics computer library, L.SP***.

Data from the SP211 final exam given in December 1979 was entered into the computer as part of this project, and is on call in a sub-library of L.SP***. The Data Processing Division helped carry out preliminary processing of the data ending with a printout showing for each of the five achievement groups the number of students who selected each of the answers provided, for each of the fifty questions.

Midshipman Emmons consulted with the physics computer librarian, Assistant Professor Peter Welcher (Mathematics Department), and the Academic Computing Center staff in carrying out this very successful project, for which he received academic credit in SR201 Fundamentals of Resources Management.

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MERCURY MAGNETISPHERE AND MAGNETOTAIL MODELING

Researcher: Midshipman 1/C Philip O. Nolan

Adviser: Assistant Professor Irene M. Engle

Recent attempts to model Mercury's magnetospheric field, based on a dipole magnetic field linearly displaced from the planet's center plus a resulting solar wind interaction effect, have produced a reasonably good fit to the Mercury magnetic field measurements. The measurements used for the best fit to date were those obtained during the Mariner I and Mariner III flybys. The data for each of the flybys are not totally consistent with the data for the other flyby, and the fit was done with the assumption that the same physical conditions of the overall Hermean magnetispheric neighborhood prevailed at the time of each flyby. This latter assumption is not necessarily correct. In this project, the researcher undertook an investigation of the effect of different solar wind pressures present at the Hermean magnetospheric boundary at the times of the different flybys. The best fit for each set of data was used to determine the predicted variation of the incident solar wind pressure and the resulting variations in the properties of the modeled Hermean magnetospheric field for the two different times.

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TRANSMISSION CHARACTERISTICS OF AN As_xSe_{1-x} FILM

Researcher: Midshipman 1/C Matthew Paggi

Adviser: Professor Donald J. Treacy

Transmission measurements were made in the spectral range from 2.5 μm to the electronic absorption edge on a glassy film of As_xSe_{1-x}. The sample gave a well-resolved set of fringes which, in principle, allows one to make a very accurate determination of the complex index of refraction.

The mathematical problem of fitting the observed spectrum was solved and a suitable computer program was written.

The sample showed a small but systematic change in the index of refraction in the near IR. This result was compared to transmission measurements on other samples of As_xSe_{1-x} to determine if this test is sufficiently sensitive to distinguish between films of slightly different composition.

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ELECTRICAL PROPERTIES OF DOPED-LEAD FLUORIDE CRYSTALS

Researcher: Midshipman 1/C T. Dwyer

Adviser: Assistant Professor Mary C. Wintersgill

Samples of doped-lead fluoride were obtained and were cut and polished to the required thickness. Electrical relaxation measurements were performed using a fully automated, microprocessor controlled impedance bridge, in the temperature range 5.5-400K. Relaxation peaks were observed in the imaginary part of the complex dielectric constant. These peaks were computer-fitted by a standard expression to obtain the activation parameters for the relaxation.

This work is part of an on-going investigation of the electrical properties of lead fluoride, which is of prime importance as a possible low-temperature super-ionic conductor. The data obtained will be essential to the identification of the defect structures and conduction mechanisms operating in this solid electrolyte.

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SPEED OF SOUND IN LOW-TEMPERATURE LIQUIDS

Researcher: Midshipman 1/C Richard F. Marsh

Adviser: Professor Samuel A. Elder

A miniaturized sound velocity measuring apparatus was designed, based on the Greenspan/Tscheigg "sing-around velocimeter" principal. The purpose of the project was to perfect a system for making sound velocity measurements in low temperature liquids. It was planned to construct a device small enough to be inserted into a liquid helium dewar. The fabrication of the apparatus was done by Mr. N. Stead, of the Physics Technical Support Staff. Much time was spent in tests and redesign to overcome experimental difficulties. Chief among these were RF-leakage and poor signal-to-noise ratio. Successful measurements were made of the sound speed in water at room temperature. Because of lack of time, it was not possible to extend the measurements to low temperature liquids. However, experience was gained which should be useful in follow-up projects.

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HIGH ENERGY DISCHARGES IN WATER

Researcher: Midshipmen 1/C Henry Zajac

Adviser: Professor Donald J. Treacy

This project was suggested by some work done, 1977 to present, in USSR on a larger scale.

The object of the series of experiments was to determine what kind of signal is propagated through water when a high voltage is discharged in water.

A Tesla coil was used to provide the high voltage discharge. A series of signals was recorded as a function of electrode separation and distance from the source. The experiments show that a signal is propagated through the water (as opposed to through air and then into the water). These signals showed near-field attenuation characteristics on the scale on which the experiment was conducted.

The problem should be investigated on a larger scale.

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CORRELL, Francis D., Assistant Professor, co-author, "The Description of Polarization Analyzing Powers for Three-Body Breakup Reactions," Nuclear Instruments and Methods, 179 (1981), 283.

The geometrical aspects of the measurement of polarization analyzing powers for nuclear reactions with three particles in the final state are discussed. Primary emphasis is on reactions induced by polarized spin-½ or spin-1 projectiles, such as the $^{2}H(\vec{p},pp)n$ and $^{1}G(\vec{d},pp)n$ reactions. The effects of parity conservation and rotational invariance are considered, and it is shown that for certain geometrics in which identical particles are detected, these considerations place restrictions on the number of non-vanishing analyzing powers. A new convention is proposed for the description of analyzing powers in such reactions, and a table and some figures that may be useful as aids in planning experiments are presented.

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CORRELL, Francis D., Assistant Professor, co-author, "Kinematically Incomplete Three-nucleon Breakup Reaction $^{1}H(\vec{d},p)pn$ at 16 MeV," Physical Review C, 23 (1981), 960.

The researcher measured the analyzing powers A_y, A_{xx}, A_{yy}, and A_{xz} for the kinematically incomplete three-nucleon breakup reaction $^{1}H(\vec{d},p)pn$ at a deuteron bombarding energy of 16.0 MeV. Similar data for the elastic channel were obtained at the same time. Data were acquired at laboratory angles from 15.0° to 42.5°. The detected proton continua extended over a range in excitation energy E* for the residual pn system, and this range varied from E*=0-2.6 MeV at 15.0° to E*=0-0.2 MeV at 42.5°. The experimental energy resolution was about 150 keV (lab). The breakup tensor analyzing powers attain magnitudes as large as about 0.2 at the lowest excitation energies. Faddeev calculations have been performed for a variety of final-state configurations having E*=0 and 200 keV and indicate that a full kinematically-incomplete calculation would probably show no major disagreement with the data.

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CORRELL, Francis D., Assistant Professor, co-author, "Low Energy Charged-Particle Fusion Reactions," IEEE Transactions on Nuclear Science, NS-28 (1981), 1339.

The researcher initiated a program at Los Alamos to measure cross sections for the charged-particle reactions D(t,n) ^{4}He, T(t,2n) ^{4}He, D(d,n) ^{3}He, and D(d,p)T that are fundamental to the understanding of controlled thermonuclear fusion. Interest in these processes is primarily in the region below 100-keV bombarding energy, and accordingly the design range for the measurements in 10-120 keV. Our desired accuracy is 5% or less, compared with present systematic uncertainties of up to 50%. The experiment features a negative ion source and highly stable injector for the low-energy beam, measurement of beam intensity with a precision calorimeter, a windowless cryogenic target, calibration of the target density with a high-energy Van de Graaf beam, and a time-of-flight laser spectrometer to determine the absolute energy. Preliminary data have been obtained on the d+d reactions while preparations are underway for introducing tritium into the system.

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CORRELL, Francis D., Assistant Professor, co-author, "A New Level in ^{7}Li," Bulletin of the American Physical Society, 26 (1981), 565.

Analysis of ^{4}He(t,t)^{4}He elastic scattering has given evidence for a weak but distinct level at about 9.6 MeV excitation in the ^{7}Li system. A recent analysis of the n+^{6}Li interaction has also found a need to include such a level. Additional details and a comparison with an R-matrix analysis and with previous work will be shown. It appears that the results of the R-matrix analysis can be used to eliminate multiple solutions in our energy-independent analysis.

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CORRELL, Francis D., Assistant Professor, co-author, "Polarized Triton Scattering from ^{26}Mg, ^{27}Al, and ^{28}Si at 17 MeV," Polarization Phenomena in Nuclear Physics - 1980, AIP Conference Proceedings No. 69 (1981), 496.

The researcher measured differential-cross-section and analyzing-power distributions for 17-MeV polarized tritons elastically scattered from targets of ^{26}Mg, ^{27}Al, and ^{28}Si in the angular range from 20° to 160°. An optical model (OM) analysis of the data revealed that reasonably good fits to the differential cross-sections could be obtained, especially for scattering angles

smaller than 120°, but that only fair fits to the analyzing powers could be found, even for the most forward angles. This result is consistent with earlier analyses of polarized triton-scattering from heavier targets, and it demonstrates again that analyzing power data constrain the OM parameters more than do the cross-section data alone. Also, the inability of the OM to fit the back-angle data, combined with the relatively small analyzing powers for angles greater than 100°, suggest that compound-nuclear contributions to the scattering may be important in that angular range. Finally, the OM parameters for ^{26}Mg(t,t) scattering deduced from the present work have been shown to agree quite well with those deduced from studies of ^{26}Mg(^{3}He, ^{3}He) scattering, but both sets of parameters were found to be in disagreement with predictions of the folding model. This disagreement indicates that the scattering of composite particles like tritons and helions is not well described by such simple models.

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CORRELL, Francis D., Assistant Professor, co-author, "Tensor Analyzing Powers in the ^{1}H($\vec{d}$,pp)n Reaction at 16 MeV. II. The Collinear Configurations," Polarization Phenomena in Nuclear Physics - 1980, AIP Conference Proceedings No. 69 (1981), 1252.

Several kinematically-complete three-nucleon breakup experiments have been performed recently to study collinear configurations of the three final-state nucleons that result when one of them is left at rest in the c.m. system. Such configurations are of interest because of suggestions that physical observables measured under those conditions may provide new information about the existence of three-body forces or about the off-shell properties of the nucleon-nucleon (NN) interaction.

To study this problem further, the researcher measured several tensor analyzing powers, as well as the more commonly-mueaured breakup cross sections, for two different collinear configurations in the ^{1}H($\vec{d}$,pp)n reaction at 16 MeV. Spin-dependent observables, such as the analyzing powers, are of special interest because they are expected to contain more information than the spin-averaged breakup cross-sections do about the dynamics of the breakup reaction. The researcher compared the experimental data with the results of Faddeev calculations made using a separable NN potential that includes S-, P-, and D-waves and a $^{3}S_{1}$-$^{3}D_{1}$ term, and found that the calculations reproduce the data satisfactorily.

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CORRELL, Francis D., Assistant Professor, co-author, "Tensor Analyzing Powers in the $^1H(\vec{d},pp)n$ Reaction at 16 MeV. I. The Symmetric, Constant-Relative-Energy Configurations," Polarization Phenomena in Nuclear Physics - 1980, AIP Conference Proceedings No. 69 (1981), 1249.

Most kinematically-complete three-nucleon breakup experiments are designed to explore certain limited regions of phase-space where the physical observables are expected to be especially sensitive to the detailed nature of the reaction dynamics. One interesting group of kinematic configurations is characterized by equal polar angles of the two identical, detected particles and equal relative energies between all pairs of particles. In such configurations, a single breakup-amplitude is expected to be dominant, and this amplitude is believed to be particularly sensitive to the short-range characteristics of the nucleon-nucleon (NN) interaction.

The researcher has measured the tensor analyzing powers A_{xx} and A_{yz} in the $^1H(\vec{d},pp)n$ reaction at 16 MeV for a series of these "symmetric, equal-relative-energy" (SCRE) configurations. Here, are reported the experimental results, compared with the results of recent Faddeev calculations performed using a separable NN potential. In general, the agreement between the measured and calculated values seems fairly good, although there is some indication that the measured values of A_{yz} are slightly smaller than the calculations predict, whereas for A_{xx} the opposite appears to be true.

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ELDER, Samuel A., Professor, co-author, "Mechanisms of Flow-excited Cavity Tones at Low Mach Number," Journal of the Acoustical Society of America, 69, (1981), S117.

Experimental studies on a wall-mounted cavity in laminar and turbulent subsonic flow provide new insights into mechanisms of tone generation as wind speed is varied. Contributions to tone generation from turbulent boundary layer fluctuations, acoustic background noise, sheartone feedback coupling, and cavity resonator feedback coupling, respectively, can now be quantitatively sorted-out on the basis of theoretical models. Effect of turbulent eddy size on random-noise cavity excitation is found to agree qualitatively with wave filter hypothesis. A new theory of laminar pipetones will be presented which is similar to but complements an earlier model of turbulent pipetones. This includes an improved method of estimating phase velocity of interface waves at pipetone resonance frequencies.

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ENGLE, Irene M., Assistant Professor, co-author, "Mercury's Magnetosphere and Magnetotail Revisited," Journal of Geophysical Research, 86, (1980), 1617.

Magnetic observations which are not complicated by currents of trapped plasma are a good test of geomagnetopause and geomagnetotail predictions. Recent attempts to model the Hermean magnetospheric field based on a planet-centered magnetic multipole field with a quadrupole moment in addition to the planetary dipole field or a dipole field linearly displaced from planet center and no quadrupole moment have produced reasonable good fits to the Mercury magnetic field measurements. In this work the researcher finds a better fit for a dipole displacement from the planet center by making use of an improved representation of the magnetic field in the magnetotail, where many of the Mercury measurements were made. The rms deviation of the data was reduced from 10. or 11.γ to 9.3 γ by employing this new tail-field representation. Also, by making use of this new tail-field representation, a best fit is found for a dipole displacement of -0.0285 R_M (earlier, 0.026 R_M) toward the dawn in the magnetic equatorial plane and 0.17 R_M (earlier, 0.189 R_M) northward along the magnetic dipole axis, where R_M is the planet radius. Thus with only minor adjustments in the displacement vector of the dipole from the planet center a measurable improvement is achieved in the fit of the data by using the improved magnetotail field representation.

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FONTANELLA, John J., Associate Professor, and Mary C. WINTERSGILL, Assistant Professor, "The Activation Volume for Type I Dipoles in Lanthanum Doped Strontium Fluoride," Journal of Physics C: Solid State Physics 13 (1980) 3449-3455.

The audio frequency complex dielectric constant has been measured for lanthanum-doped strontium fluoride at pressures up to 0.4 GPa over the temperature range 240-260 K. Consequently the reorientation of Type I dipole (substitutional rare-earth and nearest neighbor interstitial fluorine charge compensator) has been studied. The activation volume for the motion is found to be 3.26 cm^3/mol. For comparison, a theoretical value of 3.29 cm^3/mol is calculated using Flynn's dynamical diffusion model. In addition, the thermal expansion coefficient of the activation volume is found to be negative and the compressibility is about an order of magnitude larger than that of the bulk material.

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FONTANELLA, John J., Associate Professor, and Mary C. WINTERSGILL, Assistant Professor, "Dielectric Relaxation Studies of Alkali Metal Doped Calcium Fluoride," Journal of Physics C: Solid State Physics 13 (1980) 3457.

The audio frequency dielectric constant has been determined over the temperature range 5.5-400K for various samples of lithium, sodium, potassium and rubidium doped calcium fluoride. A distinct, alkali-metal associated relaxation is observed in each case. The activation energy for reorientation is largest for the sodium dopant. A physical argument based on ion size is given supporting the assignment of the principal peaks to substitutional alkali metal-nearest neighbor fluorine vacancy pairs. It is noted that the current interpretation is consistent with the empirical observation that in all materials studied to date, the energy for reorientation of a bound interstitial or vacancy around a substitutional ion is less than or equal to the energy for motion of the free species. Finally, it is pointed out that anion excess materials have a stronger tendency to form impurity clusters than do anion deficient materials.

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GRAHAM, Billie J., Professor "Solar Bagasse Drying in the Dominican Republic," Report submitted to State Sugar Council of the Dominican Republic, 28 November 1980.

Bagasse, the waste product from processed sugar cane, has the potential to be used as a fuel to fire boilers and produce electricity. This report made an assessment of the Dominican Sugar Council's current use of bagasse and identified areas where bagasse can be utilized. A pilot facility, using solar energy, has been designed to dry bagasse and prepare it as a fuel for boilers. Because the project is experimental in character, the solar system will be a hybrid active-passive system which should deliver on the order of 2.5×10^3 BTU/yr.

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LINK, Joseph W., Lieutenant, USN, and John J. FONTANELLA, Associate Professor, "Temperature Variation of the Dielectric Properties of Bismuth Germanate and Bismuth Germanium Oxide," Journal of Applied Physics 51 (1980) 4352.

The unclamped complex dielectric constant for bismuth germanium oxide ($Bi_{12}GeO_{20}$) and bismuth germanate ($Bi_4(GeO_4)_3$) has been determined at audio frequencies over the temperature range 6-325K. For bismuth germanate, no dipolar impurities were observed. For bismuth germanium oxide, a strong dipolar impurity has been

observed with an activation energy of 0.041 eV and a reciprocal frequency factor of 1.86×10^{-13}s. The strength of the relaxation is found to be correlated with the coloration of the sample. Possible origins of the relaxation are discussed. The results for the imaginary part of the dielectric constant were used to arrive at corrected values of the real part of the unclamped dielectric constant over the full range of temperatures. While absolute values are accurate to about 0.5%, the precision of the data is better than 0.1% relative to the room temperature value.

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LINK, Joseph W., Lieutenant, USN, Mary C. WINTERSGILL, Assistant Professor, and John J. FONTANELLA, Associate Professor, "Pressure Variation of the Low-Frequency Dielectric Constants of Some Antisotropic Crystals," Journal of Applied Physics 52 (1981), 936-939.

The low frequency dielectric constant for quartz, sapphire, calcite and magnesium fluoride has been measured both parallel and perpendicular to the optic axis at several temperatures over the pressure range 0 to 0.3 GPa. The results, when compared with the reported values for the effect of pressure on the high frequency dielectric constant, indicate that pressure decreases the infrared contribution to the dielectric constant for all materials except calcite. Consequently, the infrared polarizability decreases with pressure for calcite perpendicular to the optic axis, but increases with pressure parallel to the optic axis. In addition, it is shown that the volume independent temperature derivative of the low frequency dielectric constant is positive for sapphire, calcite, and magnesium fluoride showing that cubic terms in the lattice potential energy dominate, while for quartz, the derivative is negative, implying that quartic terms are dominant.

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SCHNEIDER, Carl S., Associate Professor, co-author, "Vibration Induced Magnetization," Journal of Applied Physics, 52 (1981), 2425.

Brown's theory of stress-induced magnetization has been extended using the irreversible differential susceptibility, $X_{irr}(H)$, and Kondorsky's rule beyond the Rayleigh region with the concepts of macroscopic stress field, $H\sigma$, and reversible stress sensitivity. A graphical representation of the susceptibility integrals is given and simplified results for Rayleigh stresses confirmed experimentally for mild steel along with details of the magnetization change throughout the first cycle. The fraction of

stress-active or 90° domain walls was determined from the fit of the data to the theory to be $f = 0.61 \pm .02$ in excellent agreement with Brown's prediction of $\sqrt{2}/(1+\sqrt{2}) = 0.59$. Continued symmetric tension/compression cycling of Rayleigh stresses generates increased magnetization equal to the p-series times the first cycle magnetization, where p is not less than two, its value at the coercive field. Thus vibration-induced magnetization converges rapidly, never exceeds $\pi^2/6$ times the first cycle magnetization, and does not contribute to significant long term instability.

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TANKERSLEY, Lawrence L., Assistant Professor, co-author, "Generation of 61.6nm Radiation by Fifth Harmonic Conversion of XeCl Laser Radiation," Conference on Lasers and Electro-optics Digest of Technical Papers, June 10-12 1981, p. 12.

The first observation of fifth harmonic conversion of XeCl laser radiation, producing coherent radiation of 61.6 nm, is reported. Dependence on Ar pressure and comparisons with third harmonic conversion are discussed.

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TREACY, Donald J., Professor, co-author, "Nuclear Quadrupole Resonance Probes of Structural and Photostructural Properties of Glassy As_2Se_3, As_2O_3 and As_2S_3," Journal Physical Society of Japan 49A, (1980), 1155.

NQR lineshape studies indicate that the photo-induced structural changes in bulk, vitreous As_2Se_3 are not gross bonding changes as occur in fast-evaporated films but rather consist of more subtle rearrangements primarily involving non-bonding electrons. The As sites in bulk, vitreous As_2O_3 are similar to those in the layered crystalline mineral claudetite I and bear little resemblance to those in the more common crystalline form (arsenolite).

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TREACY, Donald J., Professor, co-author, "Relaxation Phenomena in ^{75}As NQR of Glassy and Crystalline As_2O_3," Bulletin American Physical Society, 26 (1981), 418.

Spin-lattice and spin-spin relaxation rates (T_1^{-1} and T_2^{-1}), respectively have been studied both as functions of frequency and temperature in glassy As_2O_3 and in two crystalline modifications (arsenolite and claudetite). In the two crystalline forms values

of $T_2 \cong$ 600 μsec are observed which are independent of temperature and result from dipolar interactions between As nuclei. T_1 in arsenolite and claudetite increases extremely rapidly at low temperatures, as is observed in many crystalline solids where Raman phonon processes dominate the relaxation. In glassy As_2O_3 both T_1 and T_2 are observed to vary slowly with temperature ($\alpha T^{-(1+\alpha)}$, $\alpha \cong 1$) between 4.2 and 300 K. At 77K, T_1 = 4.5 μsec and T_2 = 70 μsec. This behavior is suggestive of relaxation via disorder modes where "spectral diffusion" plays an important role.

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WINTERSGILL, Mary C., Assistant Professor, John J. FONTANELLA, Associate Professor, Peter WELCHER, Assistant Professor, R. J. KIMBLE, Major, USMC, co-authors, "The Activation Volume for Dimer Reorientation in Rate Earth Doped Calcium Fluoride," Journal of Physics C: Solid State Physics, 13 (1980), L661.6.

The activation volume for the RIV relaxation, that is for the reorientation of a dimer, has been determined for calcium fluoride crystals doped with europium, gadolinium, terbium or dysprosium. The results range from 1.05+ 0.15 cm^3 mol^{-1} for europium to 0.3 ± 0.15 cm^3 mol^{-1} for dysprosium. These values are appreciably less than the activation volumes for the motion of bound interstitials or bound or free vacancies. In contrast, the activation enthalpies for the reorientation of the dimer are rather greater than those for interstitials or vacancies. These results, together with the results of a computer simulation, show that a 2-2-2 cluster cannot be responsible for the relaxation. It is pointed out that a gettered 2-2-2 cluster cannot be ruled out and, in fact, contains several of the characteristics which are consistent with the experimental results of the present work.

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WINTERSGILL, Mary C., Assistant Professor, and John J. FONTANELLA, Associate Professor, co-authors, "Dielectric Relaxation Studies of Alkali-metal-doped Strontium and Barium Fluoride," Journal of Physics C: Solid State Physics, 13 (1980), 6525.36.

The audio-frequency dielectric constant has been determined over the temperature range 5.5 400 K for various samples of alkali-doped strontium and barium fluoride. For strontium fluoride, strong relaxations are found for sodium, potassium, and rubidium dopants and the activation energy is largest for the potassium dopant. For barium fluoride, strong relaxations are observed for potassium and rubidium, and the activation energy is larger for

rubidium. A physical argument based on ion size and activation energy is given supporting the assignment of the principal peaks to substitutional alkali-metal-nearest-neighbor-vacancy pairs. The activation energy for the motion of the bound vacancy in rubidium-doped barium fluoride is found to be about the same as that reported for the motion "free" vacancies and consequently the current interpretation is consistent with the empirical observation that in all materials studied to date the energy for reorientation of a bound interstitial or vacancy around a substitutional ion is less than or equal to the energy for motion of the free species. As a consequence, it is predicted that the activation energy for the motion of "free" vacancies in strontium fluoride should be greater than or equal to 0.59 ± 0.02 eV. Relatively large activation energy relaxations are observed for lithium in strontium fluoride and lithium and sodium in barium fluoride. These relaxations are attributed to substitutional-interstitial alkali-metal pairs.

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ENGLE, Irene M., Assistant Professor, and Philip O. NOLAN, Midshipman 1/C, "The Hermean Magnetospheric and Magnetotail Field", 1981 Spring Meeting of the American Physical Society, Baltimore, 20-23 April 1981.

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FONTANELLA, John J., Associate Professor, and Mary C. WINTERSGILL, Assistant Professor, "Effect of Pressure on Dielectric Relaxation in the Alkaline Earth Fluorides," Conference on Physics of Dielectric Solids, University of Kent at Canterbury, Canterbury, Kent, United Kingdom, 8-11 September 1980.

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KIMBLE, R. J., Major, USMC, Peter J. WELCHER, Assistant Professor, John J. FONTANELLA, Associate Professor, and Mary C. WINTERSGILL, Assistant Professor, "Computer Modeling of Point Defects in the Alkaline Earth Fluorides," 1981 March Meeting of the American Physical Society, Phoenix, Arizona, 16-20 March, 1981.

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FONTANELLA, John J., Associate Professor, and Mary C. WINTERSGILL, Assistant Professor, "The Relation Between Local and Free Diffusion in the Alkaline Earth Fluorides," 1981 March Meeting of the American Physical Society, Phoenix, Arizona, 16-20 March 1981.

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FONTANELLA, John J., Associate Professor, Mary C. WINTERSGILL, Assistant Professor, and Peter J. WELCHER, Assistant Professor, "The Relation Between Free and Bound Ion Motion in the Alkaline Earth Fluorides," International Conference: Defects in Insulating Crystals, Riga, Latvia, USSR, 18-23 May 1981.

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FONTANELLA, John J., Associate Professor, Mary C. WINTERSGILL, Assistant Professor, and Peter J. WELCHER, Assistant Professor, "The Relation Between Free and Bound Ion Motion in Some Fluorides," International Conference on Fast Ionic Transport in Solids, Gatlinburg, Tennessee, 18-22 May 1981.

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FONTANELLA, John J., Associate Professor, "Thermally Stimulated Depolatization Measurements of Heavily Doped CaF_2," 1981 March Meeting of the American Physical Society, Phoenix, Arizona, 16-20 March 1981.

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SHELBY, Robert N., Professor, co-author, "Transient Capacitance Study of Be^+ Implanted GaAlAs," Meeting of the American Physical Society in Phoenix, Arizona, 16-20 March 1981.

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WINTERSGILL, Mary C., Assistant Professor, and John J. FONTANELLA, Associate Professor, "Dielectric Relaxation in Ionic Crystals at Cryogenic Temperatures," Gordon Research Conference on Dielectric Phenomena, Holderness School, Plymouth, New Hampshire, 28 July - 1 August 1981.

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WINTERSGILL, Mary C., Assistant Professor, "Studies of Defects in Alkaline Earth Fluorides," Wake Forest University Physics Department Seminar, 9 April 1981.

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WINTERSGILL, Mary C., Assistant Professor, "Electrical Relaxation in Alkali Metal Doped Fluorite Structure Materials," University of Pittsburgh Physics Department Seminar, 13 March 1981.

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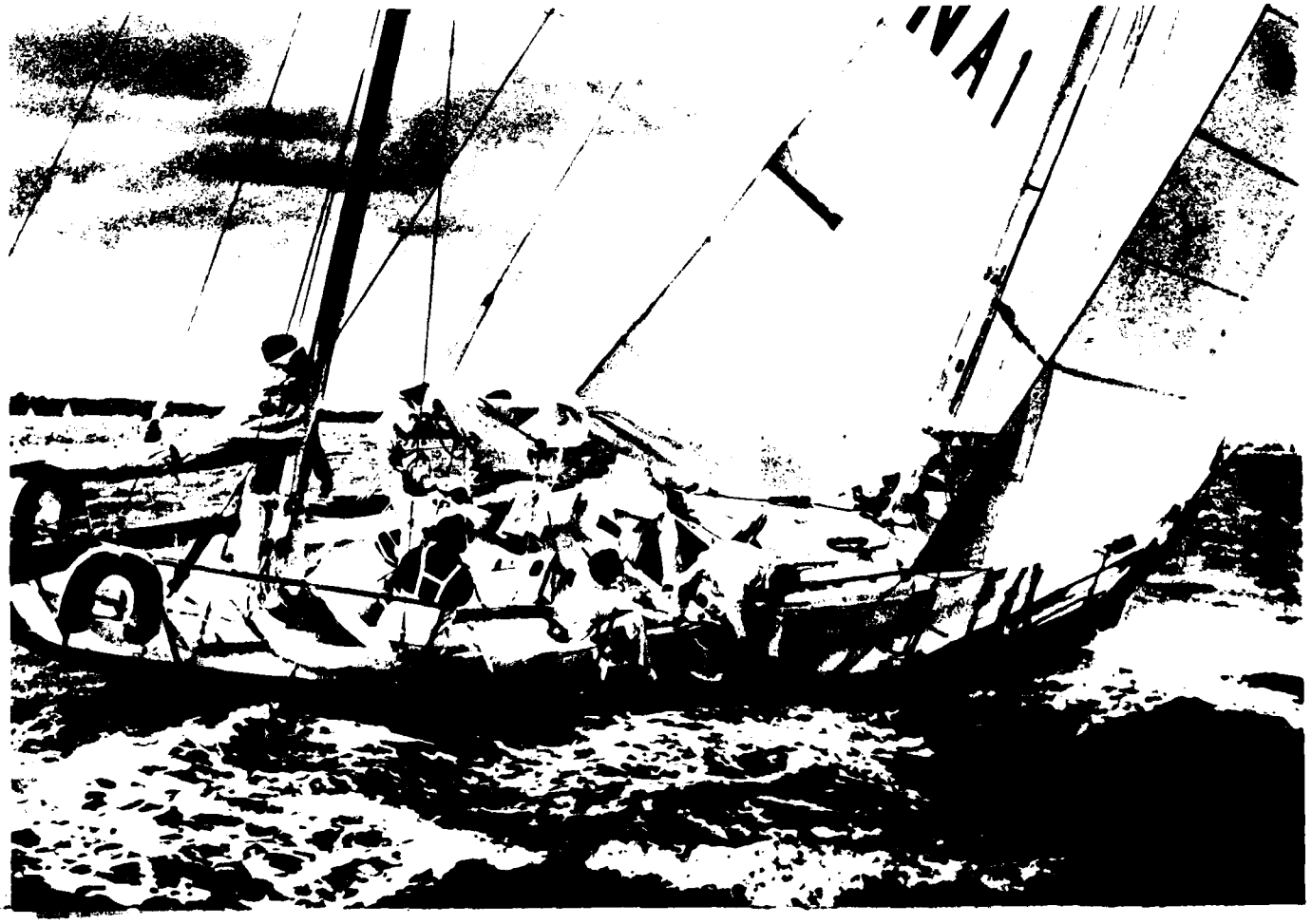

DIVISION OF

PROFESSIONAL DEVELOPMENT

LEADERSHIP AND LAW DEPARTMENT

Commander John M. McGrath, USN, Chairman

Research programs conducted by the Leadership and Law Department are typically applied to and directly support institutional objectives. Currently members of this department conduct research to support, through program development or program validation, the integration of the women's program, officer career development, and midshipmen professional development. Associate Professor Harrison acts as Division Research Coordinator. Dr. Bela Feher was Visiting Professor during this Academic year.

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DEVELOPMENTAL STRUCTURE AND ADULT SOCIALIZATION

Researchers: Associate Professor Patrick R. Harrison and Visiting Professor Bela Feher

Sponsor: Naval Scientist Training and Exchange Program

This program of research uses cohort sequential designs to look at adult socialization in particular roles and settings. Two years worth of data of midshipmen across classes which measured perception of organizational climate, perceptions of power and leadership, and specific attitudes is being used for the core analysis. Performance, motivation and values are all considered in defining socialization in this research program.

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A DEVELOPMENTAL MODEL FOR EVALUATING THE PERFORMANCE OF SERVICE ACADEMY GRADUATES

Researcher: Associate Professor Patrick R. Harrison

Sponsor: U. S. Naval Academy (Division of Professional Development)

Owen's developmental-integrative model is used to bring together diverse sources of data to provide for the ongoing evaluation of the performance of Naval Academy graduates. Based on biographical data that summarizes experience prior to entry at the Naval Academy, midshipmen are classified into homogeneous subsets. The subsets are then evaluated relative to independent performance measures during the midshipmen's four years at the Academy and at three points in their active duty career. The model provides a basis for defining career patterns and feeding information back for program validation and career analysis at different points. Biographical data has been taken on the Class of 1984. Initial clusters are being evaluated.

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EXPERIMENTAL SIMULATION OF BEHAVIORAL RESEARCH PROBLEMS

Researcher: Associate Professor Patrick R. Harrison

Sponsor: U. S. Naval Academy (Instructional Development Program)

This project develops a large-scale interactive computer simulation of behavioral research problems that span the topic areas of the Military Psychology Course including motivation, perception, learning, memory, personality, and physiology. The students conduct experiments in simulation mode, developing research strategies, formulating meaningful results and conclusions. The simulator also provides a 'build' simulator which teaches staff members how to program their own simulations into the system. The project is in the second year of development.

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ELECTRONIC WARFARE

Researcher: Lieutenant Wayne L. Rogers, USN

Sponsor: Defense Intelligence Agency

This study analyzes the U. S. Navy's capability to perform in the electronic warfare (EW) environment. Results from NATO maritime exercise, Northern Wedding 78, are considered as well as subsequent U. S. Navy exercises. This research presents an overview of the Soviet/Warsaw Pact EW capability. Specific U. S. vulnerabilities are discussed and recommendations made.

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SMALL SCALE HYDROELECTRIC POWER

Researcher: Lieutenant Wayne L. Rogers, USN

Sponsor: Naval Academy Research Council

Increasingly scarce and expensive fossil fuels have made the energy crisis facing the United States very real. Generating electricity for the U. S. currently consumes 14% of our natural gas and 17% of our petroleum supplies. When this is combined with other uses, our nation is constrained to import about one-half of our oil from foreign sources. It is imperative, therefore, that alternative sources of energy be explored and developed. Hydropower is one such source.

Hydropower is a clean, renewable energy source. The United States Army Corps of Engineers has estimated at least ten percent of the 50,000+ dams in the United States could economically produce power. Many of these sites are only suitable for small scale development (less than 25 megawatts).

This study assesses the feasibility of small scale hydropower development. The outcome of the research is policy recommendation for federal, state and local governments to facilitate development.

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AN ECOLOGICAL MODEL OF CAREER DEVELOPMENT

Researcher: Associate Professor Patrick R. Harrison

Current models of career development can be described in terms of three generic classes: (1) psychological models that use the developing personality as the central construct in career development; (2) organizational models that describe career development in terms of the immediate interactions of individuals with particular structures within an organization; and (3) sociological models with focus on macro-variables that constrain and direct career development. The purpose of this study is to develop a general systems framework which incorporates the elements of the three generic career development models. The general systems model is presented as a hierarchically organized interactional system to account for the strong effects of physically and psychologically distant environments on the individual's career development.

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CHARACTERISTICS OF SUICIDE ATTEMPTERS IN A MARINE RECRUIT POPULATION

Researcher: Lieutenant Dennis A. Kelly, MSC, USN, and
Lieutenant Mary Wasileski, MSC, USNR

A sample of 312 Marine Corps recruits in basic training who were seen for evaluation at the Mental Health Unit at the Marine Corps Recruit Depot in San Diego, California, were divided into three groups consisting of those who had made a suicide gesture or attempt during training, those who were considered training problems but who had not engaged in suicidal behavior, and those who were routine administrative referrals. All subjects were administered a personal history questionnaire and a mood state questionnaire. In addition, training folders and sick call entries were reviewed.

Among the suicide attempters, the most frequently employed method of self-injury was poisoning with either household-type products or prescribed medications. Most of the reported reasons for the attempts centered on the stresses of boot camp and a desire to effect immediate discharge. Almost half of the suicide attempters used the attempt as a direct threat. Biographical data revealed a higher percentage of pre-enlistment suicidal behavior among these individuals than among the other two groups, and invariably, more problematic and socially deviant backgrounds as well. Despite completing fewer days of training

than their cohorts, the suicide attempters had been involved in more NJP's, and a significantly higher percentage of them were ultimately recommended for ADSEP because of unsuitability. Finally, the suicide attempters displayed more negative affect on the mood questionnaire than did the other two groups.

Diagnostically, the typical suicide attempter in this study exhibited a pattern of characterological disturbance. The problem of reinforcement of suicidal behavior in this type of individual was discussed.

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HARRISON, Patrick R., Associate Professor, co-author, "Comparison of Men and Women at the United States Naval Academy: Outcomes and Processes in their Development," Technical Report abstracted and available through Educational Resources Information Center, 1980.

This report summarizes the results of the integration of women at the U. S. Naval Academy after the first four years. Naturally occurring probes that represent traditional unobstrusive measures provided the basis for the description of the outcomes and processes. Areas of discussion include policy, admissions and attrition, academic and military performance, physical standards, conduct and authority, leadership performance, dating, fraternization, and general living conditions in Bancroft Hall.

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KELLY, Dennis A., Lieutenant, USN, "Characteristics of Suicide Attempters in a Marine Recruit Population," Fourth Annual Navy Mental Health Professionals Meeting, San Diego, California, 21-24 April 1981.

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ROGERS, Wayne L., Lieutenant, USN, "The Role of Government in the Development of Small Scale Hydropower." Waterpower '81, and International Conference on Hydropower, June 1981.

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DIVISION OF
U. S. AND INTERNATIONAL STUDIES

ECONOMICS DEPARTMENT

Associate Professor Roger D. Little, Chairman

Research plays a vital role in enhancing both the quality of the Economics Department's academic instruction and instructor enthusiasm. These complementary roles are evidenced throughout the Department's course offerings in such areas as money and banking, economic development, history of economic thought, macroeconomic policy, environmental policy, training,and military manpower issues. Under the auspices of the Naval Academy Research Council, the Office of Naval Research, the Federal Home Loan Bank Board, the Department of Commerce, and the Department of Labor through the Brookings Institution, sponsored departmental research represents a high level of involvement across a range of national concerns. As a growing area of responsibility within the department, this research adds significantly to the currency and vitality of classroom teaching as well as holding promise of increased scholarly output.

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SOCIOECONOMIC CHARACTERISTICS OF THE ALL VOLUNTEER FORCE: FURTHER EVIDENCE FROM THE NATIONAL LONGITUDINAL SURVEYS

Researchers: Associate Professors J. Eric Fredland and
Roger D. Little

Sponsor: Office of Naval Research

The objective of this work is to ascertain the characteristics and labor market experience and progress of those who serve in the military as compared with their peers who do not. Such information is potentially useful in designing recruiting strategies and manning requirements. The proposed work involves expanding the scope of a study done by the same researchers for ONR, "Socioeconomic Characteristics of the All Volunteer Force: Evidence from the National Longitudinal Survey, 1979"; and also using the male youth cohort of the 1966-1976 National Survey to make some comparisons between the youth of the 1960s and the youth of the late 1970s with respect to participation in the military.

The research methodology involves multivariate statistical analysis. Four activities are to be completed: 1) discriminant analysis of socioeconomic characteristics of the civilian and military samples, disaggregated by racial group and sex; 2) investigation of correlates of job satisfaction of military as compared to civilian workers; 3) assessment of opportunity costs of those who served in 1966-1972 in comparison with those who joined in the late 1970s; and 4) examination of the relative propensity of veterans in the 1966 sample to acquire further schooling.

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DEMAND-DRIVEN EMPLOYMENT GENERATION IN THE REGIONAL ECONOMY

Researcher: Assistant Professor Arthur Gibb, Jr.

Sponsor: Naval Academy Research Council

In the typical developing nation, the rural-urban distinction has been set at so low a level that the larger agricultural market centers have been separated statistically from their hinterlands by being classified as urban places. One result is that it is not possible to analyze adequately the employment linkages between the farm and non-farm sectors of the rural economy. This obstacle has become a critical problem now that rural-urban migration, rural employment, and achieving a relatively dispersed pattern of urbanization have become leading policy issues in these nations.

Three regional studies of non-agricultural activities in the Philippines, Malaysia, and Sierra Leone are examined for the mutually reinforcing evidence they provide on non-agricultural employment. The Philippine and Sierra Leone studies measure non-agricultural employment directly. The former restricts itself to full-time employment. The latter covers both full-time and part-time employment but restricts itself to manufacturing activities. From these studies it is possible to estimate the extent of agriculture-based non-agricultural employment nationally and the proportion of it that is demand-driven.

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AGRICULTURE-BASED URBANIZATION

Researcher: Assistant Professor Arthur Gibb, Jr.

Sponsor: Naval Academy Research Council

The objective of this research is to define the structure of urbanization in Thailand and Malaysia in 1970, both functionally and geographically, using full-time non-agricultural employment as the measure of urban activities. The research will follow the methodology used in earlier research on the Philippines. The value of the research is in developing an analytically tractable definition of urbanization which then can be employed in policy analysis with respect to three problem areas: urbanization, employment, and migration. The project is on-going.

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FURTHER ANALYSIS OF FOUR TAX POLICIES

Researcher: Associate Professor Rae Jean B. Goodman

Sponsor: Federal Home Loan Bank Board

This study looked at the impact of four alternative tax policy proposals on the tax revenue, the types of savings and loans which would gain or lose, the extent of the gains or losses, and the housing and home mortgage markets. The primary conclusion was that the current system offers the greatest benefits for the largest number of savings and loans. The alternative systems restricted savings and loans to specific behavior and community services in order to obtain the tax benefits. The current system is somewhat restrictive but not as narrowly as the alternatives.

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TAX IMPLICATIONS OF BANK HOLDING COMPANY ACQUISITION OF SAVINGS AND LOANS

Researcher: Associate Professor Rae Jean B. Goodman

Sponsor: Federal Home Loan Bank Board

This brief study investigated the possibility of bank holding companies acquiring savings and loan associations and removing the savings and loan from its primary market: mortgages. The conclusion of the paper was that unless a consolidated tax return were filed and a bank holding company could guarantee substantial losses on the part of one of its subsidiaries, a bank holding company could not reduce its taxes by removing a savings and loan company's participation in the mortgage market.

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IMPACT OF NEW FIR AND NET WORTH REQUIREMENTS ON SAVING AND LOAN ASSOCIATIONS

Researcher: Associate Professor Rae Jean B. Goodman

Sponsor: Federal Home Loan Bank Board

The Federal Home Loan Bank Board issued new regulations concerning the basis for FIR and Net Worth held by savings and loan associations. This study investigates the impact of these new regulations on savings and loan associations operations and financial position. The primary objective is to show that savings and loan associationshave benefitted by the change in regulations and, hence, can meet their requirements.

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TAX-BASED PROPOSALS TO STIMULATE SAVINGS AND MORTGAGE LENDING

Researcher: Associate Professor Rae Jean B. Goodman

Sponsor: Federal Home Loan Bank Board

This paper surveys the numerous methods under consideration of stimulating savings, investment and mortgage lending, and provides estimates of tax expenditures, savings, and mortgage flows associated with the various proposals. The proposals considered are: the Reagan economic program, an extension of Individual Retirement Accounts, an extension of interest and dividend exclusion, a tax-exempt savings certificate, tax-deferred annuities, an individual housing account, an education savings account and mortgage revenue bonds. The proposals provide a variety of tax expenditures to savings and mortgage lending relationships. The more general proposals provide the widest benefits and hence are politically more palatable.

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PERSPECTIVES OF A TOURING ECONOMIST: ALFRED MARSHALL IN THE UNITED STATES, 1875

Researcher: Professor Clair E. Morris

Sponsor: Sabbatical Leave

Alfred Marshall, prominent 19th Century English Economist who taught at Cambridge University, made a cross-country tour of the United States in the summer of 1895 when he was 33 years old. He visited numerous manufacturing facilities and interviewed laborers as well as top business executives. He was the guest of leading American economists and important men of letters. Wherever, he went, he took copious notes and wrote detailed correspondence to his mother about his impressions of life and times in the American economy.

The intent of this study has been to cull his written material relative to the trip to determine if there are some perspectives yet unpublished. Initial results suggest that there is potential for a scholarly article which might be of interest to such journals as the History of Political Economy or the Journal of Economic History.

Sabbatical research during the fall of 1980 when forays were made into the Marshall Papers at Cambridge University represented the first stage of this project. A great volume of notes and copies of documents was accumulated. A sifting of this material is currently underway as is a continuing review of the existing literature. It is anticipated that the project will be completed by the end of summer 1981.

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THE THIRD WORLD ARMS MARKET

Researcher: Midshipman 1/C Eugene B. Rex

Adviser: Assistant Professor Arthur Gibb, Jr.

Sponsor: Trident Scholar Program

This study analyzes determinants of demand and supply in the Third World arms market. The relationship between arms imports and six economic variables is studied, with emphasis on the use of economic variables to forecast arms demand. Arms imports are found to be systematically related to economic variables in a number of the countries studied. Arms demand is significantly correlated with GNP in thirty of the forty countries. Based upon this correlation, forecasts of arms demand are made using estimates of future GNP levels. These estimates show that Africa and the Middle East will be the largest arms demanding regions in the next decade.

On the supply side, the United States' market share and the share of major supplying nations to the Third World are analyzed. During the period 1965 to 1978, U. S. share is found to have declined significantly, particularly in Africa and Latin America. Soviet and European shares have increased in most regions. Market share trends combined with demand projections indicate that U. S. policy toward Africa and Latin America will be of importance in the future.

Current U. S. arms policy is reviewed, with emphasis on the effect of this policy on arms transfers to Africa and Latin America. The relationship between U. S. military assistance and market share is also analyzed. Arms credits are found to be concentrated in two regions, East Asia and the Middle East, and in two countries, the Republic of Korea and Israel.

The paper ends with a reiteration of major conclusions and comments on the U. S. policy implication of these conclusions.

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SOCIOECONOMIC STATUS OF WORLD WAR II VETERANS BY RACE: AN EMPIRICAL TEST OF THE BRIDGING HYPOTHESIS

Researchers: Associate Professors J. Eric Fredland and Roger D. Little

Recent research has suggested that military service can improve an individual's place in the income distribution or enhance socioeconomic status. One underlying explanation for the relationship between military service and this subsequent labor market success put forth in the military sociology literature is the bridging hypothesis. The bridging argument is that military service provides geographical mobility, personal independence, education and training, and experience with bureaucratic structures --all of which are potentially important in providing veterans with good jobs. The benefits are expected to accrue particularly to minorities who might not acquire these characteristics otherwise. Using multivariate statistical techniques, the researchers attempt to verify empirically various aspects of the bridging argument. They use a cohort of World War II veterans from the National Longitudinal Survey as the data base. They find that some elements of the bridging hypothesis are important in explaining the relation between military service and earnings, and between military service and socio-economic status. Particularly, education, government service, occupational training, and commitment to work are found to differentiate veterans from non-veterans. Work on this project is largely complete.

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SELF-EMPLOYMENT: WHO ENTERS AND WHO LEAVES

Researcher: Associate Professors J. Eric Fredland and Roger D. Little

This research investigates socioeconomic and job satisfaction characteristics of four groups of employed males 45 to 59 years of age over the period 1966-1971. Men who are employees and men who are self-employed during this period are compared to those who switch classifications. Of particular interest is whether or not "psychic income" accrues to those who are self-employed or those who switch to self-employment. Evidence is that it does. The self-employed work more hours for approximately the same income; they are more committed to, and express a better attitude toward their job; they plan to retire later in life. The job attitude of those who become self-employed was the worst of any group while they were employees but is the best of any group after they switch to self-employment. There is evidence that other family members increase their labor force participation and contributions to family income in order to ease the transition of those who are switching classifications.

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HISTORY OF FEDERAL TAXATION OF FINANCIAL INSTITUTIONS

Researcher: Associate Professor Rae Jean B. Goodman

This is a survey of federal taxation of commercial banks, savings and loan associations, credit unions, and mutual savings banks. Not all financial institutions have been treated equally under federal tax laws. This paper serves to summarize the differences in the tax treatment, why the tax treatment is different, and what the impact of differential tax treatment has been.

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GROUPING ERROR IN THE CALCULATION OF MOMENTS OF FINITE DISTRIBUTIONS

Researcher: Associate Professor Arthur Royall Whitaker

The second and fourth central moments of frequency distributions are useful for studying variation and heterogeneity. As a practical matter, individual values are frequently grouped in tables having up to ten or fifteen intervals. Sheppard noted that calculations from such groupings overstate the true second moment because interval midpoints are more widely dispersed than interval means, and the developed a correction formula based on interval width. It is commonly said that Sheppard's correction must be used with care, because it overcorrects.

This investigation has so far established that (1) Sheppard neglected within-interval variations, (2) Sheppard's correction does not, therefore, overcorrect in platykurtic, normal, or slightly leptokurtic distributions, (3) the grouping error also affects (in particular) the fourth moment, and (4) the amount and direction of error depend on the heterogeneity of the data. Further investigation will develop a table of correction factors for the second and fourth moments, based on the observed second and fourth moments and the number of intervals. At present, only equal intervals are under investigation.

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INTEREST-EARNING, ONE HUNDRED PERCENT COMMERCIAL BANK RESERVES, WITH CESSION OF IDLE EXCESS RESERVES TO THE U. S. TREASURY

Researcher: Associate Professor Arthur Royall Whitaker

Providing excess reserves by direct credits to reserve accounts (instead of by net open market purchases) would reduce "inside time" for the effectiveness of changes in monetary policy and permit some independence of monetary measures and interest-rate measures. Requiring one hundred percent primary reserves against demand deposits would then, by reducing the monetary base multiplier, reduce monetary response to fluctuations in demand, reduce the inflationary impact of any given level of federal deficits, perfect the Federal Reserve's control over the growth of MIB, further reduce inside time, and further increase the independence of controls over interest rates from the effects of money growth controls. Interest on reserves would continue to create excess reserves, thus permitting lending and deposit creation with no change in the business of commercial banking. Both to keep the money supply growing and moving, and to

encourage the banks to be aggressive in seeking loan opportunities, excess reserves (i.e., loan authorizations) not used by the banks would be ceded to the Treasury.

******

FREDLAND, J. Eric, Associate Professor, and Associate Professor Roger D. LITTLE, "Self-Employed Workers: Returns to Education and Training," Economics of Education Review, 1 (Summer 1981), 315-337.

This paper reports on an empirical investigation of human capital returns to owners of unincorporated non-farm businesses, and compares the results with those for a similar cohort of employees. Data are from the older male cohort of the National Longitudinal Survey. A single equation semi-log regression model is self-employed workers are basically consistent with results for employees, but some differences emerge. As hypothesized, returns to general training are somewhat larger and returns to specific training somewhat smaller for self-employed workers. The time path of returns associated with job tenure also differs.

******

JOHNSON, F. Reed, Assistant Professor, "Income Distributional Effects of Air Pollution Abatement: A General Equilibrium Approach," Atlantic Economic Journal, 8 (December 1980), 10-11.

Abatement measures require producers to substitute more costly inputs for environmental inputs, inducing a certain pattern of price changes for private goods and factors. Policies which reduce air pollution consequently influence real income distribution in three ways:

1. While prices of certain commodities rise, damage to certain consumption goods also decreases in response to a better environment. The burden and benefit of these changes will be borne differentially to the extent that consumption bundles differ among various groups.

2. Changes in composition of output and improvements in productivity and health resulting from lower pollution levels induce changes in factor demand, supply, and prices which alter disposable incomes for various groups.

3. While everyone consumes improvements in regional air quality equally in physical terms, various groups value improvements differently.

Net changes in real income depend on the relative magnitudes of these effects. The task of incorporating these three effects into an estimate of redistributive effects of air pollution abatement thus involves (1) calculation of income equivalents of private good price/quantity changes, (2) computation of general equilibrium changes, and (3) valuation of public or collective good benefits. While some development and application of each of these techniques can be found in the literature, this study is apparently the first attempt to combine them in evaluating net incidence of public policy where relative prices change.

******

BOLIN, Phil W., Lieutenant Commander, USN, Mark W. HESS, Lieutenant, USN, and Roger D. LITTLE, Associate Professor, "Military Vocational Training: Its Impact on the Post-Service Earnings Path," 50th Annual Southern Economic Association Conference, Washington, D. C., 5-7 November 1980.

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FREDLAND, J. Eric, Associate Professor, Roger D. LITTLE, Associate Professor, and George THOMAS, Adjunct Professor, "Entry Level Jobs of Veterans," Inter-University Seminar Twentieth Anniversary Conference, Chicago, Illinois, 23-25 October 1980.

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GIBB, Arthur G., Jr., Assistant Professor, "Agriculture-Based Cities in Southeast Asia," Association for Asian Studies at Lexington, Virginia, January 1981.

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GIBB, Arthur G., Jr., Assistant Professor, "Demand-Driven Employment Generation in the Rural Economy" Eastern Economics Association Meetings, Philadelphia, Pennsylvania, 9 April 1981.

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JOHNSON, F. Reed, Assistant Professor, "Coal Development and the National Parks: The Case of the Allen-Warner Valley Energy System," U. S. Naval Academy Faculty Energy Seminar, Annapolis, Maryland, 19 March 1981.

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JOHNSON, F. Reed, Assistant Professor, "Valuing Esthetic Impacts of Coal Mining near Bryce Canyon National Park," U.S. Department of the Interior Policy Analysis Seminar, Washington, D.C., 10 February 1981.

******

WHITAKER, A. Royall, Associate Professor, Critical Review of Lester Thurow's Zero-Sun Society, Canadensis, Pennsylvania, October 1981.

******

WHITAKER, A. Royall, Associate Professor, Lecture on Deficit Financing and How It Can Create Inflation, MENSA Meeting, Baltimore, Maryland, April 1981.

******

LANGUAGE STUDIES DEPARTMENT

Professor John D. Yarbro, Chairman

Research activities in the Department this year represent wide-ranging interests. In terms of time frames and geography, they include 15th-century Spain, 17th-century Germany, 18th-century France and Asia, 20th-century Portugal and China; in subject areas, Spanish poetry, Neo-Latin German drama, French and Oriental philosophy, Anglo-Portugese journalism, modern Chinese military leadership, U. S. Navy manpower, and faculty evolution at the Naval Academy.

The extent of participation by civilian faculty members has been good, in view of heavy teaching loads, academic support work, and committee tasks. It is noteworthy that four of the projects described on the following pages utilized Naval Academy computer facilities.

Support for sponsored projects has come from the Naval Academy Research Council, the Defense Intelligence Agency, the Naval Military Personnel Command, the Tinker Foundation, and the Gulbenkian Foundation.

******

SIMILARITIES BETWEEN JEAN-JACQUES ROUSSEAU'S HUMANISTIC FORMATION AND CLASSICAL EAST ASIAN IDEALS

Researcher: Assistant Professor Steven T. Brent

Sponsor: Naval Academy Research Council

Although Rousseau's cultural heritage is firmly rooted in Western European thought, there nevertheless appear to be certain striking similarities between his humanistic precepts and classical East Asian ideals. Owing to the remoteness and seeming dissimilarity of these two cultural traditions, comparatively little research has been done to uncover the correspondences which do indeed exist between their respective ideals. The researcher is examining Rousseau's theories in this regard, in order to discover the fundamental ideas which he shares with classical East Asian doctrines.

During academic year 1980-1981 the researcher has studied sources in area libraries, including the Library of Congress and the Johns Hopkins University Library. He will continue his investigations in libraries in France in the summer of 1981.

******

THE THEATER OF JACOB MASEN, S. J.

Researcher: Associate Professor Michael C. Halbig

Sponsor: Naval Academy Research Council

Using as a base his translations of Jacob Masen's Neo-Latin plays, the researcher is seeking in this project (1) to lay out a detailed biographical description of Masen's involvement with the theater and (2) to discuss his plays in the setting of the 17th century in Germany.

After gathering materials in West Germany, Rome, and Paris for more than a month during the summer of 1980, the researcher has studied and organized his findings during academic year 1980-1981. In the summer of 1981 he plans to write an account of Masen's activities in the theater as author, producer, and critic.

The researcher has pioneered in using the computer to control and analyze material in research in the humanities and to edit texts. He is taking full advantage of the Naval Academy computer facilities to increase efficiency and accuracy in his current project.

******

ANALYSIS OF OCCUPATIONAL STANDARDS OF USN ENLISTED PERSONNEL

Researcher: Professor John A. Hutchins

Sponsor: Naval Military Personnel Command

Consultant: Associate Professor Mahlon F. Stilwell (Retired)

In this long-term project, continued at a high level of activity during the past academic year, the researcher and consultant are utilizing the Naval Academy computer facilities to review, analyze, and standardize the job descriptions and requirements for advancement of all Navy enlisted ratings.

******

AN AUTOMATED BIOGRAPHICAL FILE ON CHINESE MILITARY LEADERSHIP

Researchers: Associate Professors D. T. Y. Lee and R. G. Tomlinson

Sponsor: Defense Intelligence Agency

This research, begun in 1976 with initial funding from the Naval Academy Research Council, has continued with support of the Defense Intelligence Agency. The researchers are developing computerized files on military leaders of China by employing summaries prepared according to strict syntactical rules, with embedded computer flags to enable the computer to search biographies and develop summaries in the aggregate along 18 characteristics, or to link logically different leaders as they progress through their careers.

Raw data gathered mainly during travels in Asia have been translated and the files now consist of some 425 biographies. As the data base fills out, it is anticipated that hierarchical clustering techniques will be used to establish a clear pattern of ascendancy in the leadership.

This research is an in-depth and current analysis, and it is linked to an "appearance file" wherein the public appearances of Chinese military leaders are noted and coded. This innovation will permit researchers to pinpoint the political activities of the major military figures.

******

AN INDEX OF THE ANGLO-PORTUGUESE NEWS: 1937-1977

Researcher: Professor Emeritus Guy J. Riccio

Sponsor: The Tinker Foundation and the Gulbenkian Foundation

The Anglo-Portuguese News, a predominantly English-language bi-weekly newspaper published in Lisbon, has been in continuous existence since it was founded in 1937. The purpose of this project is to compile a complete index of this newspaper for the first forty years of its publication, i.e., the period from 1937 to 1977 inclusive. This period corresponds to the microfilm files of the paper recently acquired by the Library of Congress.

The index will make this publication, virtually unavailable heretofore in this country, more accessible to humanistic scholars concerned with Portugal's domestic scene, her views of events, personalities, and other manifestations of the human spirit both at home and abroad, and particularly with aspects of the centuries-old alliance with Great Britain during the World War II and its aftermath.

The Index is being prepared and edited by means of inputs into the Naval Academy computer.

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JUAN DE MENA'S COPLAS DE LOS SIETE PECADOS MORTALES: A CRITICAL EDITION

Researcher: Assistant Professor Gladys M. Rivera-La Scala

This book presents a critical edition and analysis of Juan de Mena's Coplas de los siete pecados mortales and of its three continuations. The Coplas, Mena's final work, unfinished before his death in 1456, was completed in successive continuations by Gómez Manrique, Pero Guillén de Segovia, and Fray Jerónimo de Olivares. The poem encompasses the then popular theme of the seven deadly sins personified in dramatic debate with Reason.

Dr. Rivera-La Scala aims to establish authentic texts of Mena's work and its continuations, from close comparative study of all known manuscripts and early printings, and also to provide statistical and textual analysis of principal variants.

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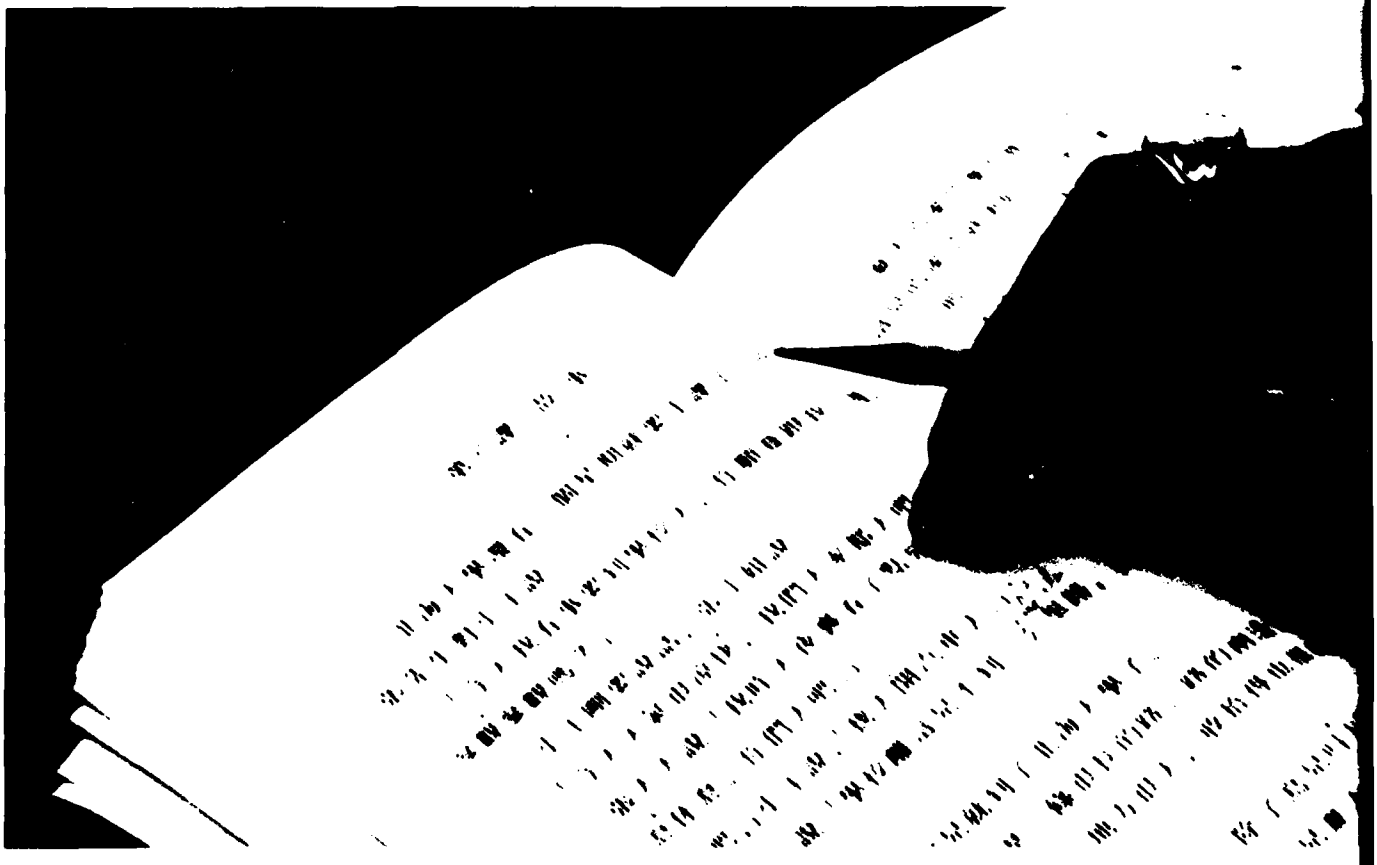

YARBRO, John D., Professor, "The Military-Civilian Faculty at the Naval Academy, 1960-81," Shipmate, 44 (June, July-August 1981), 34-36, and 35-37.

This is a study of the evolution of the faculty during a period of significant upgrading of the curriculum and of reorganization of academic administration.

The combined military-civilian faculty, unique among the service academies, is now stronger than ever before--in terms of advanced degrees, research, other scholarly-professional activities, and responsibility for academic programs and departmental administration.

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POLITICAL SCIENCE DEPARTMENT

Professor G. Pope Atkins, Chairman

Political Science Department faculty members and midshipmen majors, as in past years, actively conducted extensive research in all fields of the discipline during the 1980-1981 academic year. Nine faculty members and nine midshipmen pursued twenty-five original projects. They were undertaken in the specific areas of national security policy, international conflict, arms transfers, international terrorism, civil-military relations, political elites, U. S. congressional politics, Constitutional law, energy and the environment, and politics in Africa, Asia, Eastern Europe, Latin America, the Middle East, and the Soviet Union. Research was supported by funds from four different sources. Among the published results were a book, an article in a professional journal, a series of newspaper commentaries, and a book review. Accepted for publication were another book and three journal articles. Ten reports were submitted, three computer data banks completed, and ten papers presented at professional conferences. In addition, a faculty member served as program chairman for a large three-day professional conference, and a departmental committee organized a conference on civil-military relations held at the Naval Academy. Faculty members regularly lectured and led seminars at other academic institutions, war colleges, and civic organizations. As this summary indicates, political science research during Academic Year 1980-1981 continued to support quality education and academic excellence at the Naval Academy.

******

AN EVALUATION OF COMPETING THEORETICAL PERSPECTIVES FOR UNDERSTANDING POLITICAL CHANGES IN SOUTHERN AFRICA

Researcher: Assistant Professor Helen E. Purkitt

Sponsor: Naval Academy Research Council

This study utilizes four theoretical perspectives of international conflict to examine systematically changes in Southern Africa since the Portuguese withdrawal. Its purpose is to develop a computer-based information system and quantitative indicators of changes that may escalate into regional and/or larger international crises.

******

RESEARCH AND TRAVEL IN SOUTHEAST ASIA

Researcher: Associate Professor Robert L. Rau

Sponsor: Institute for International Exchange of Scholars (Fulbright-Hays Award)

During the summer 1980 intersessional period, Associate Professor Robert L. Rau was awarded a Fulbright-Hays grant to participate in a study project in Southeast Asia. He was one of a group of nine American scholars in social science disciplines who were selected to travel in Indonesia, Malaysia, Philippines, Singapore, and Thailand to study the organization and functioning of the Association of Southeast Asian Nations. During this period, Dr. Rau was invited to lecture on "Security Cooperation in ASEAN" and "U. S. National Security Policy in Southeast Asia" at selected research institutes, University seminars and other organizations.

******

WORLD ARMS TRANSFER

Researcher: Associate Professor Rodney G. Tomlinson

Sponsor: U. S. Arms Control and Disarmament Agency

Major world powers like the United States, the Soviet Union, France, Great Britain, Canada, and some lesser powers, derive international influence through the transfers of weapons to smaller nations. The initial penetration of a nation might begin with simple hand-held infantry weapons and progress upwards with more complex pieces that require military advisors and technicians. The increasing involvement with the military of a small nation increases the influence that a donor nation may exert for its own political ends. This research examined information related to arms transfers and cast it into an analytic structure suitable for quantitative summarization. The final report was completed in September 1980. Findings indicate that nations can be "entrapped" by a donor nation. The donor nation then tries to circumscribe the freedom of action of the recipient nation. Once a smaller nation is entrapped, the influence of the donor nation might extend into other segments of the recipient nation's political system.

******

BIOGRAPHIC ANALYSIS OF CHINESE LEADERSHIP

Researchers: Associate Professor Rodney G. Tomlinson and Associate Professor Daniel T. Y. Lee (Language Studies Department)

Sponsor: Defense Intelligence Agency

This study is an analysis of 18 biographic characteristics of the leaders of the Peoples Republic of China. English-text summaries are prepared according to strict syntactical rule with imbedded computer flags affixed to proper names and locations permitting researchers to link names with names and locations. Research includes automated linkages of "who knows whom," identifying rising stars in the Chinese hierarchy. Research is on a continuing basis and includes the development of a public appearance file that will be linked to the biography file. When complete, it will be possible to develop seniority lists and study patterns in the behavior of Chinese leaders.

******

CONGRESS MOVES INTO THE COMPUTER AGE

Researcher: Associate Professor Stephen E. Frantzich

This book-length study analyzes the causes, procedures and consequences of introducing modern information technology to the U.S. Congress. Research crosses the boundaries of traditional works on technological innovation which seldom focus on political institutions and processes, organization theory, information theory, and more traditional political analyses of the Congress. Emphasis is given to the activating and restraining forces which circumscribe both individual and organizational innovation. The potential impact of computer-based information on decision-making, power distribution, electoral security, and the process of representation is predicted, described, and evaluated.

******

CITIZENS IN UNIFORM: POLITICAL PARTICIPATION BY MEMBERS OF THE U. S. MILITARY

Researcher: Associate Professor Stephen E. Frantzich

Using a large sample of politically-interested college graduates (Naval Academy Foreign Affairs Conference alumni), this analysis compares the political participation levels of four sub-groups: Academy graduates currently in the military, Academy graduates not in the military, civilian college graduates in the military, and civilian college graduates not in the military. Using only those aspects of political participation which members of the military are legally allowed to involve themselves in, it becomes clear that being in the military and having attended a service Academy independently retard political involvement. While this research cannot explain the causes of this phenomenon, it does show that low participation rates stem from attitudinal factors and not solely from the typical "inconvenience" argument associated with low military involvement in partaking of the rights they attempt to secure for the rest of the nation.

******

TRENDS IN INTERNATIONAL TERRORISM, 1968-1979

Researcher: Assistant Professor Helen E. Purkitt

This study uses data from the RAND Terrorism Chronology for the 1968-1979 period to answer three questions: 1) Are increases in international terrorist incidents since the late 1960s due to random or systemic processes? 2) To what extent can systemic contagion effects explain increases in international terrorism during this period? 3) Is it useful to treat international terrorism as a single aggregate phenomenon at the global level? Evidence from three Poisson based stocastic process models do not support the hypothesis of important contagion effects and raises doubts about the validity of recent trends to label international terrorism as some sort of organized internet.

******

FOREIGN POLICY OF POLAND UNDER THE COMMUNIST REGIME

Researcher: Assistant Professor Arthur R. Rachwald

This book-length study inquires into the pattern of foreign policy of dependence. It attempts to demonstrate that the foreign policy of Poland has been designed to achieve three major goals: (1) political and economic recovery; (2) permanent international recognition of the Oder-Neisse line as the "final" western border of Poland; and (3) international security through alliance with the Soviet Union and the collective security system in Europe.

******

ASEAN SECURITY IN THE 1980s: THE MARITIME DIMENSION

Researcher: Associate Professor Robert L. Rau

The security relations of the ASEAN states bilaterally and within ASEAN is the major focus of the research. The present security conditions in the South China Sea, the Philippine Archipelago, and the Indonesian Archipelago are also developed.

******

SINGAPORE'S ROLE IN ASEAN

Researcher: Associate Professor Robert L. Rau

This research develops the major foreign policy, international trade, and security positions adopted by Singapore in its membership in the Association of Southeast Asian Nations. Singapore's role as the innovator and leader in the economic and trade areas is emphasized.

******

INSIDE THE IRANIAN REVOLUTION: PERSIAN POLITICS AND U.S. POLICY

Researcher: FSO-3 John D. Stempel

This book explores how the political dynamics of the Iranian revolution evolved from 1977 to 1980. Beginning with a description of the Shah's political system, the various opposition forces, and the U.S.-Iranian historic involvement, the author traces the interplay of economic and political aspects that brought social and political instability to Iran. The Shah's decision to liberalize politics and the growth of an active and effective opposition are related to critical events during the revolutionary period. The ascendency of Khomeini, the final collapse of the Pahlavi dynasty, and the emergence of a chaotic, fundamentalist, religious government are emphasized. Special attention is paid to the way separate factors intertwined to produce outcomes Westerners did not expect and Iranians dared not hope for, ending with the release of the 52 American hostages in January 1981. The author draws on his detailed knowledge of events as a participant-observer of Iran's revolutionary upheaval.

******

ATTITUDES OF MALE MIDSHIPMEN TOWARD FEMALES, 1976-1980

Researcher: Associate Professor Rodney G. Tomlinson

Female midshipmen have attended the Naval Academy since 1976. This study replicates a 1976 study by the U.S. Naval Personnel Research Center and updates findings for the period 1979 and 1980. Findings indicate that simplistic faith in the contact hypothesis, that males will come to accept females at the Naval Academy, is misplaced. A series of complex factors appear to make integration of females more difficult than first supposed. Male attitudes do not appear to have changed much since 1976.

******

PATTERNS IN BILATERAL RELATIONS OF NATIONS

Researcher: Associate Professor Rodney G. Tomlinson

When categorized by types of behavior, bilateral relations between nations display patterns that can characterize the status of the relationship. Changes to the pattern can, in many cases, foretell future changes long before they can be detected by conventional methods. Research to date indicates that patterns are not always unique to one bilateral relationship; rather, we find that families of patterns exist that we can classify along known dimensions like "friendly - hostile" or "strong - weak." The interaction of these patterns could hold the key to detecting signs of policy change or the onset of international crises. The objective of this research is to develop warning indicators of impending change in a relationship and bring this impending change to the attention of foreign affairs analysts.

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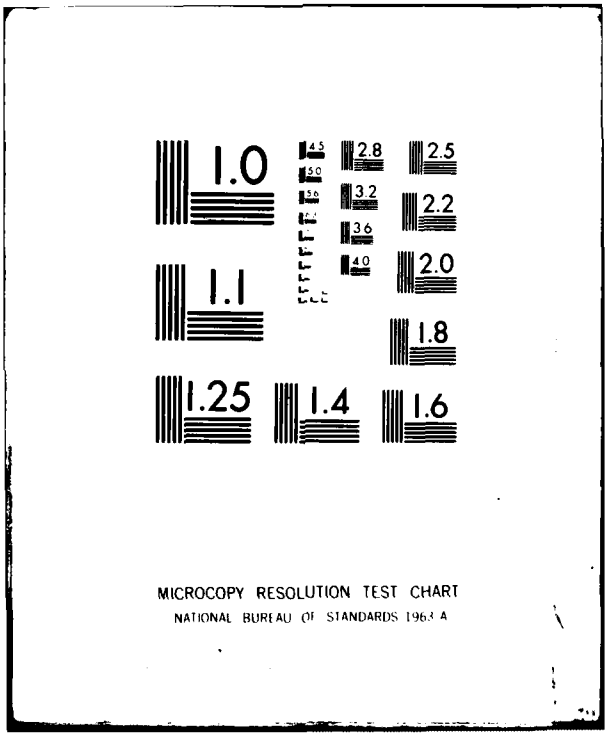
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SOVIET OIL POLICY FOR THE 1980s

Researcher: Midshipman 1/C Gary Becker

Adviser: Assistant Professor Arthur R. Rachwald

The USSR is now at the height of its oil prosperity. However, past mistakes and present policies have produced future limitations. It appears that sometime during the 1980s the Soviets will go from being a net exporter to importing at least some energy needs. When the oil crisis does come, the Soviet policy response will be determined by the character of the top leadership. Should the leadership of today continue in power, this response will probably assume a more restrained form. However, should a younger group of leaders come to power, one could expect a more adventuristic policy. These leaders, most of whom would be of the post-World War II generation, would not have experienced their country's wartime devastation and might be inclined to risk violent confrontation with the West.

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EFFECT OF POLISH DEVELOPMENTS ON OTHER EAST-BLOC NATIONS

Researcher: Midshipman 1/C David R. Gulling

Adviser: Assistant Professor Arthur R. Rachwald

Recent labor unrest in Poland sent waves of fear through other East European bloc nations. The far-reaching concessions gained by Polish workers included establishment of independent trade unions as an alternative to the communist party center of political and economic power. Reaction of other countries in the Societ bloc ranged from sealing off borders to strong statements against Polish developments. The communist leaders of Eastern Europe are aware that several countries have many of the symptoms that have plagued Poland, such as low productivity, cumbersome bureaucracies, heavy indebtedness, and constant shortages of food and consumer goods. However, the other Eastern bloc nations do not have the same mixture of political, social, and cultural environment that is present in Poland. This may enable the communist authorities in Eastern Europe to prevent the reforms won by the Polish workers from advancing into other nations. Still, the future developments will be determined by two factors: what will the Polish people actually receive for their strife, and how long will it last?

******

ELECTION 1980: WHAT CAUSED THE LANDSLIDE?

Researcher: Midshipman 1/C Arthur Karatzou

Adviser: Associate Professor Stephen E. Frantzich

The 1980 election can be interpreted in a number of ways. Some would argue that Republican success in the presidential race and the Senate was due to a conservative shift in the electorate. Others lay the blame on disgust with Jimmy Carter, while another group fervently argues that the increased activity of well-organized and financed political action committees (PACS) were the deciding factor. Using both empirical and impressionistic data, this paper concludes that while all factors were of some importance, the purported ideological shift was considerably less important than the other factors.

******

THE WORKERS' REVOLT IN POLAND

Researcher: Midshipman 1/C Mark F. Landers

Adviser: Assistant Professor Arthur R. Rachwald

In July 1980, immediately after the introduction of an increase in the price of meat, strikes broke out in a number of factories throughout Poland. As a result of these and other fast-moving events, the communist system in Poland was transformed from the one-party dictatorship to a relatively open and democratic model. The major reforms won by the Polish workers included the acceptance of the creation of free trade unions, self-governing and independent of the party and employers; the right to strike; freedom of the press; and the right to profess religion. These reforms, unprecedented for the communist state, indicated a tendency toward institutional pluralism in Poland. They are expected to have a permanent impact on the international communist system.

******

MILITARY COURTS-MARTIAL: THE IMPACT OF U.S. v. JORDAN

Researcher: Midshipman 1/C Daniel P. Mack

Adviser: Professor John A. Fitzgerald

This paper examines the impact of the two United States v. Jordan cases on the criminal trial of U. S. servicemen abroad. In the first Jordan decision, the Court of Military Appeals reversed twenty-one years of precedent and held that searches conducted by foreign police officials must meet American constitutional safeguards to be admitted in an American court-martial abroad. In a rare reversal, the Court of Military Appeals held that any type of American participation in a foreign search, whether direct or indirect, "triggered" the necessary American constitutional standards.

******

PRESIDENTIAL SYMBOLISM AND PUBLIC RELATIONS

Researcher: Midshipman 1/C Gary R. Mack

Adviser: Associate Professor Stephen E. Frantzich

Presidents have increasingly used symbolism as a power-resource in dealing with the public and other institutions of government. This paper traces the theory and historical evidence of the use of presidential symbolism particularly in the non-campaign period. Particular emphasis is given to the use and impact of symbolism during the Carter presidency and some predictions are made for the Reagan years.

******

POLITICS AND LITERATURE IN ARGENTINA

Researcher: Midshipman 2/C Benjamin W. Moody

Adviser: Professor G. Pope Atkins

Political philosophy in Latin America has traditionally been expressed in literary fiction rather than in formal theory. Argentina's experience in this regard has been particularly rich. This project surveys literature in the original Spanish language related to Argentine political thought during the formative years of national development. It searches for common themes among the writers as well as areas of divergence and analyzes them in terms of the social and political environment of the times.

******

A COMPUTER MODEL OF CONGRESSIONAL VOTING

Researcher: Midshipman 1/C Anthony G. Romero

Adviser: Associate Professor Stephen E. Frantzich

The purpose of this project is to develop a computer data base of background and voting records of Congressmen of the 96th Congress. This data includes biographical data, district and state census data, committee membership and seniority data, interest group rating data, campaign finance information, and roll call vote positions on Department of Defense and National Security related bills. Several specific tasks are carried out. These include the capability to retrieve information about each member of any group of members in fixed format, statistical study to determine those factors most significant to the voting patterns of Congressmen, and documentation of computer application and creation of a program user's step-by-step instruction manual. The results of the statistical study outline both methodology and findings.

******

POLITICAL AND MILITARY FUNCTIONS OF THE WARSAW PACT

Researcher: Midshipman 1/C James A. Speirs

Adviser: Assistant Professor Arthur R. Rachwald

The Soviet Union has had success in establishing integration and stability among Warsaw Pact countries. Since the major disturbances of 1956, the Soviets have obtained "normalization" in Czechoslovakia; leadership transition in East Germany; continuing control over Hungary; peaceful containment of the 1970 Polish revolt; and have confined deviation in Romania to narrow limits. Despite these achievements, Eastern Europe still causes problems for the Soviets in the area of intra-bloc security. Nationalist and pro-Western tendencies pose a threat of rebellion against the Soviet model of communism, and the Warsaw Pact will continue to perform police functions within the Soviet bloc. The greatest threat to the integration process within the Warsaw Pact framework stems from the recent revolt in Poland and the growing split between pro-Soviet East Germany and Czechoslovakia with relatively independent Romania, Poland, and Hungary.

******

ATKINS, G. Pope, Professor and Chairman, Arms and Politics in the Dominican Republic. Boulder, Colorado: Westview Press, 1981.

This book, published as part of the series "Westview Special Studies on Latin America and the Caribbean," is a chronicle and interpretation of recent military-political events in the Dominican Republic. It analyzes the political behavior of armed forces and national police since the civil war and U. S. intervention of 1965. The Dominican experience with arms and politics is a case of noninstitutionalized civil-military relations. That is, relations revolved around personal interactions among the president or his key associates and important military officers, as well as among the officers themselves, rather than depending on processes involving a bureaucratically well-organized "presidency" and "military establishment." The period encompasses the course of Joaquín Balaguer's lengthy presidency (1966-78) and the remarkable events surrounding the 1978 election of president Antonio Guzmán and the subsequent first months of his administration. The most important political dynamics had to do with the role of armed forces in political processes. Under Balaguer, the key factor was the president's personal manipulation of numerous officers employing a variety of techniques. Guzmán's principal goal was to "depoliticize" the armed forces. It was realized to a remarkable degree within the first six months of his administration. The author made extended visits to the Dominican Republic to conduct interviews, observe events, and review materials difficult to obtain outside the country.

******

PAONE, Rocco M., Professor, "Japan: Energy Vs. Environment," Pacific Community, 9 (August 1980), 107-130.

This article stresses the development of Japan's energy policy and the ensuing conflict between that policy and environmentalists. The Japanese government was forced to locate energy plants in sparsely populated areas and yet was able to advance development in nuclear and several other types of energy. The attitude of the masses toward nuclear development, at times vitriolic, also supported such progress because of industrial needs and employment opportunities. Much stress is placed on the newest Japanese energy programs, particularly on the Sunrise Project i.e., solar, wind, and ocean-thermo-energy.

******

ATKINS, G. Pope, Professor, "Second Annual Conference of the Middle Atlantic Council on Latin American Studies (MACLAS), Program Chairman, Philadelphia, Pennsylvania, April 1981.

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COCHRAN, Charles L., Professor, "Telecommunications and International Law," National Telecommunication and Information Agency Seminar, December 1980.

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FRANTZICH, Stephen E., Associate Professor, "Continuity and Change in Congress and the Presidency in Light of the 1980 Election." Washington WINTERIM Seminar, Washington, D.C., January 1981.

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FRANTZICH, Stephen E., Associate Professor, "Viewing Congress As a Career," Midwest Political Science Association Convention, Cincinnati, Ohio, 17 April 1981.

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FRANTZICH, Stephen E., Associate Professor, "Who Makes Our Laws?: The Power of Individual Members of the U. S. Senate," American Political Science Association Convention, Washington, D.C., 4 September 1980.

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PURKITT, Helen E., Assistant Professor, "An Evaluation of Competing Theoretical Perspectives for Understanding Political Changes in Southern Africa," International Studies Association, Philadelphia, 19 March 1981.

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RAU, Robert L., Associate Professor, "ASEAN Security in the 1980s: The Maritime Dimension," International Studies Association, 18 March 1981.

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RAU, Robert L., Associate Professor, "Singapore's Role in ASEAN," Southeastern Conference of the Association for Asian Studies, Lexington, Virginia, 23 January 1981.

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RACHWALD, Arthur R., Assistant Professor, "Pluralism in the Soviet Bloc?" International Studies Association, Philadelphia, 21 March 1981.

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RACHWALD, Arthur R., Assistant Professor, "Soviet Military Power as a Foreign Policy Instrument," U.S. Air Force Conference on the Soviet Union, Reston, Virginia, 25 September 1980.

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STEMPEL, John D., FSO-3, "Myth, Reality and the Iranian Revolution," American Political Science Association, Washington, D.C., 30 August 1980.

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This annual report summarizes the research work of the Naval Academy faculty amd midshipmen for the period July 1980 through June 1981. Sponsored and independent research projects are listed by title, followed by the names of the investigators and an abstract. A list of publications and their abstracts are included as well as presentations at professional meetings, conferences, and seminars.

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