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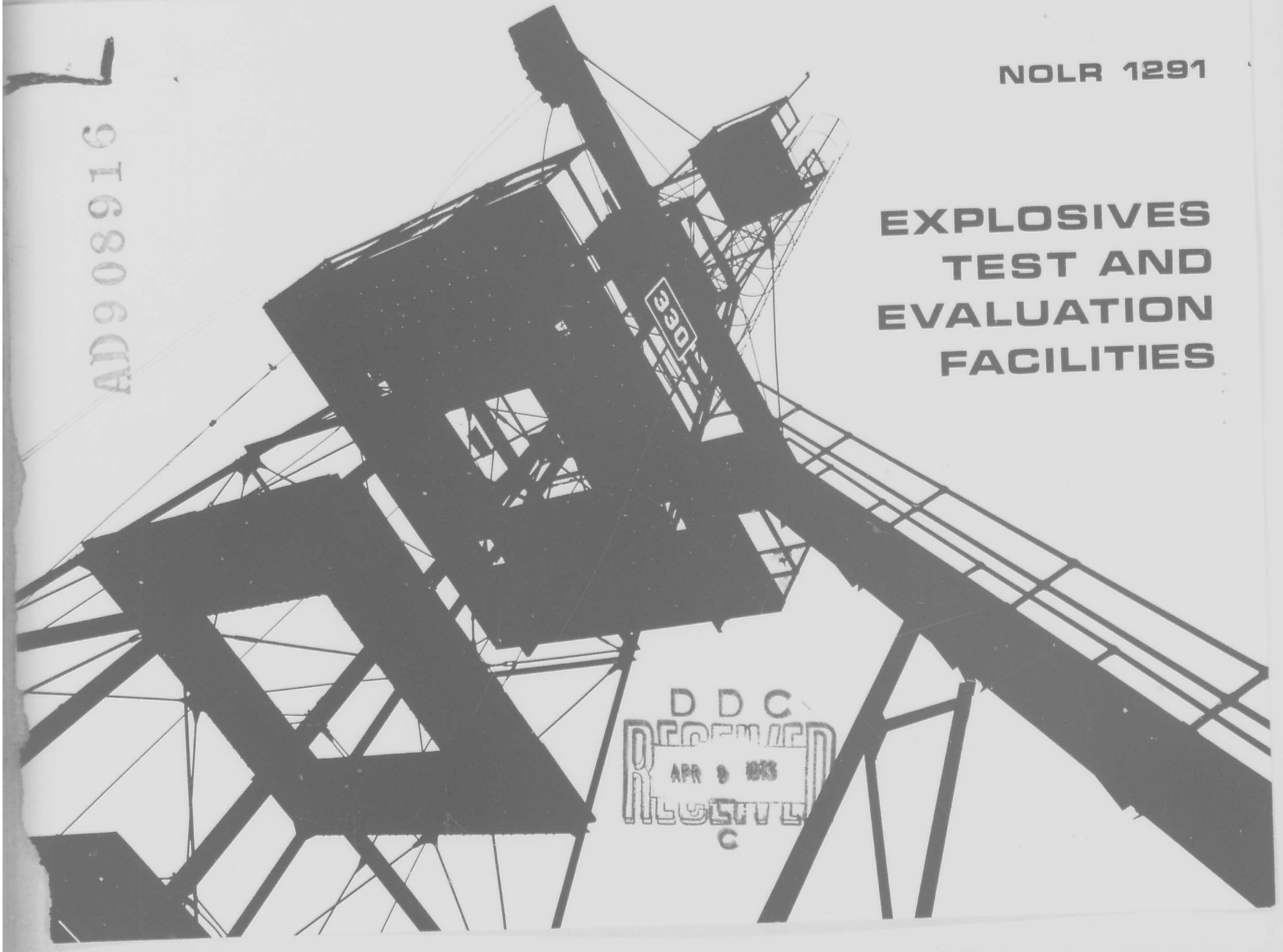
NOLR 1291

EXPLOSIVES TEST AND EVALUATION FACILITIES



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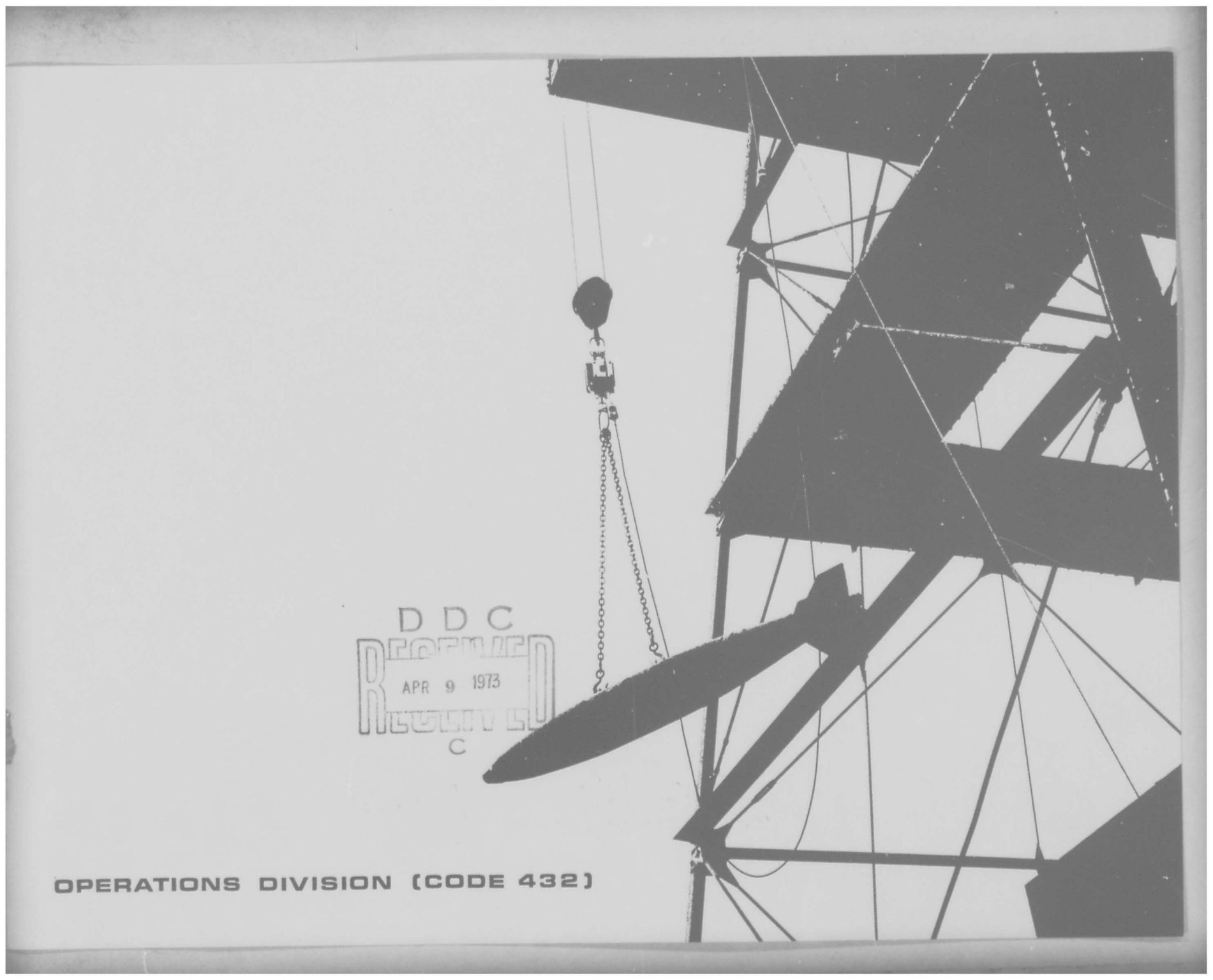
NAVAL ORDNANCE LABORATORY, WHITE OAK, SILVER SPRING, MD. 20910



OPERATIONS DIVISION (CODE 432)

FOREWORD

This report is provided as a reference document for explosive hardware. The successful development of explosive devices used in ordnance or other defense or space application requires a rigorous test and evaluation program to assure high reliability in use, and a high factor of safety in handling. The NOL explosives test facilities are utilized for such test and evaluation programs.

Capt. Robert Williamson II
Commander

G. K. Hartmann

Dr. G. K. Hartmann
Technical Director

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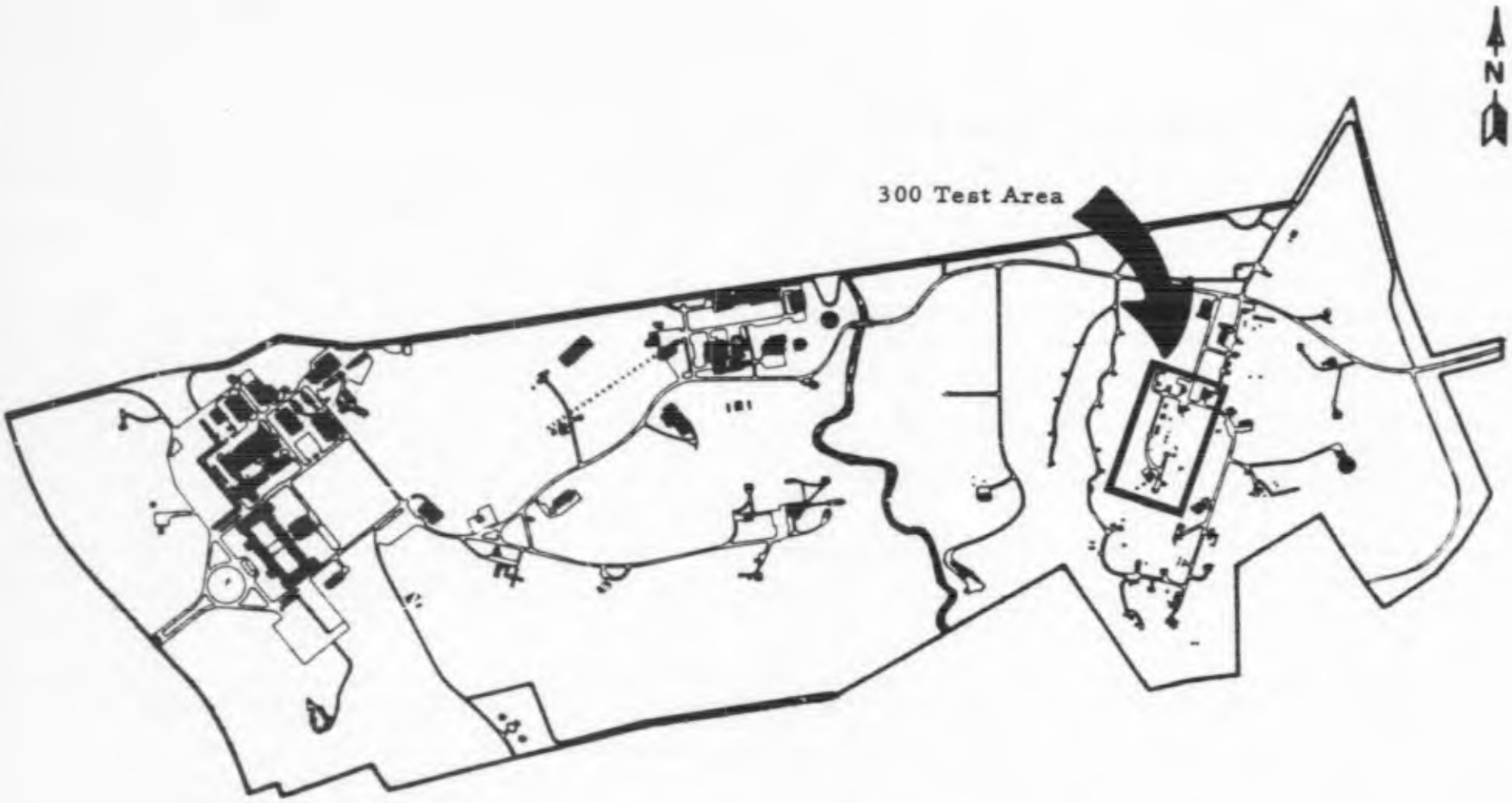


The Naval Ordnance Laboratory

INTRODUCTION

The facilities described herein are utilized for all NOL projects that involve explosive devices. They provide a vital tool for ordnance development. These specialized facilities are also available to other agencies on a not-to-interfere basis.

The explosive test and evaluation facilities are located in the 300 Area of the Naval Ordnance Laboratory (NOL). These facilities have been in existence since NOL moved to the White Oak, Maryland location in 1948, and are used for all projects that involve explosive devices during the course of the development process.

This report documents the type of work that can be accomplished in this area, and the equipment and machines available for Laboratory explosive test work. A facility such as this requires constant upkeep and modernization and included in this report are plans for a new explosive environmental building to replace the many outdated and temporary structures that have been used throughout the years.

Many of the Explosives Test and Evaluation buildings and facilities, covering approximately 10 acres, are pictured here from the top of the 40 ft tower. This area is manned by engineers and technicians of the Operations Division, Code 432, and is supported by detached Technical Shop personnel. Strong support for special tasks and facility changes is provided by the Public Works Department and the Technical Shops.

Engineers from all segments of the Laboratory and outside activities are permitted to conduct tests and experiments in the area, under the control of Operations Division personnel. Strict adherence to Standard Operating Procedures (SOP's) is enforced for safety reasons.

The machines, test rigs and other facilities available in this test area are described in the following chapters of this report.

Explosive Handling and Storage

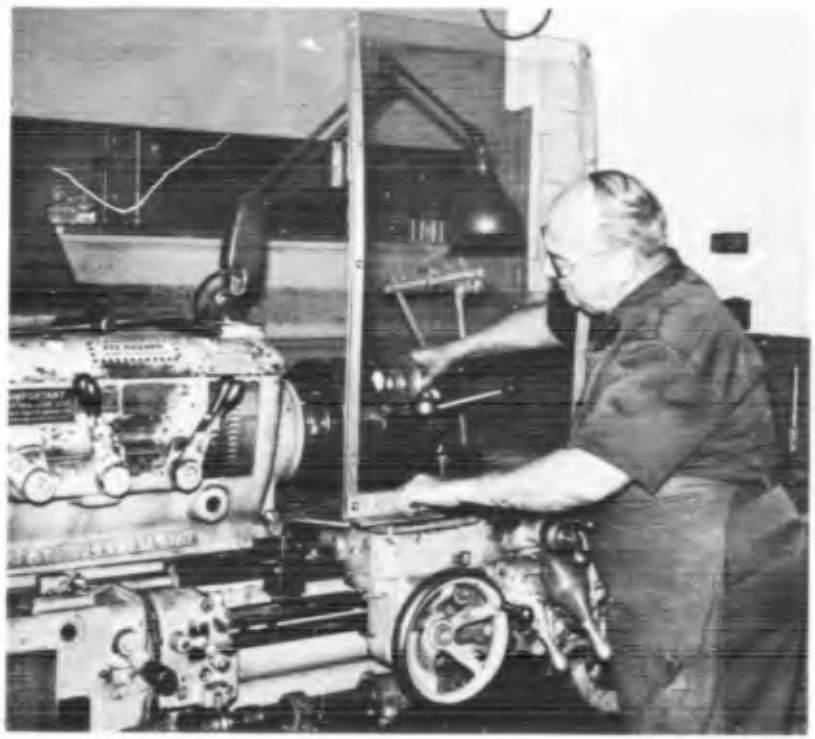
EXPLOSIVE HANDLING AND STORAGE

Explosive material is stored at NOL in special magazines. For tests in the evaluation facilities, the material is brought in by explosives handling truck and logged into the local vault type magazine, Building 366, for storage where careful control of all material is maintained. Material is allocated to the various test areas from this magazine. Upon completion of the tests, the explosive items are moved to a breakdown building where they can be safely examined and subjected to radiographic inspection and other appropriate diagnostic measurements needed to verify the effects of the test conditioning. The material is either expended in tests or returned to magazine storage pending disposition or further testing.

Temporary overnight storage of material in an unknown or hazardous condition is provided by remotely located temporary magazines. In general, the limits* of explosive material in the area are:

	Total High Explosive	Maximum per unit weight
Magazine (Bldg 366):	75 lbs	1 lb
Environmental Machines:	55 lbs	1 lb
Firing Chambers:	0.5 lb	0.5 lb
Drop Towers	1.0 lb	1.0 lb
Non-Destructive Testing Inspection:	On per case basis with special approval of Safety Department, Code 960.	

* These are standard limits; exceptions are made on a per case basis with approval of the Safety Department, Code 960.



One of the major efforts of the explosives area is the engineering inspection of tested items. A fully equipped machine shop is utilized for remote disassembly of explosive loaded ordnance. The breakdown of ordnance containing boosters and explosive charges weighing up to one pound is performed on a remotely controlled lathe. Explosive devices are set up on the lathe *(near left)* which is located in a barricaded cell. Lathe operation is controlled remotely from outside the cell *(far left)*. The technician can observe the operation through explosion proof glass in the cell wall.

The shop is also used for machining and modifying explosive loaded devices. An on-site 260 KVA X-ray machine is used to take X-rays of material and determine the condition of tested items prior to detailed inspection and disassembly. A listing of machines and equipment used for the breakdown and engineering inspection is given in Appendix A.

Buildings 369-1, 2, 3, and 4

NATURAL ENVIRONMENT SIMULATION EQUIPMENT

Equipment is available at the Laboratory to simulate extremes of natural environments (temperature, humidity, and salt corrosion) that may occur anywhere in the world. Because of the safety requirements necessary for testing explosive devices, each piece of equipment must be somewhat isolated, preferably within cubicles in explosive-type buildings. In addition, this equipment has safety cutoffs, and limitations are imposed on the quantity of explosives allowed in the chambers.

The major pieces of equipment are located in Buildings 303, 306, and 369. Operating characteristics for this equipment are listed in Appendix A.

BUILDING 303. The Temperature and Humidity Laboratory is located in Building 303 which is the principal building for natural environmental simulation testing.

This building has temperature chambers which are capable of environmental testing in the following modes:

1. Heating only
2. Cooling only
3. Heating-Cooling-Humidity

These chambers *(left)* are recessed in individual cubicles with reinforced concrete walls. The chamber temperature settings and the ON-OFF-MODE control switching are made at the chambers. The control system of the Conrad and Wyle Chambers are equipped with cams for variable temperature control and have the capability for shifting cycles automatically.

BUILDING 369. Building 369 comprises a group of three adjacent structures for natural environmental testing.

Buildings 369-2 and 3 are two-cell structures with walls and floors constructed of 3-inch thick welded armor plate. The cells are also separated by armor plate.

One cell, Building 369-2, houses the Webber temperature and humidity chamber. This temperature chamber *(near left)* operates only at atmospheric pressure. Distilled water is used for humidification cycles.

The second cell, Building 369-3, houses the Industrial salt spray chamber in which salt corrosion tests are performed to simulate sea and seashore conditions. Test specimen in the chamber *(far left)* is subjected to a salt fog maintained by spray nozzles.

Buildings 369-1 and 4, formerly steel gun turrets, house the Aminco heating and humidity chambers.

BUILDING 306. A Thermotron three-zone thermal shock chamber is located in Building 306. This unit uses electric power for heating and liquid CO_2 receiver-compressor system for cooling.

A test specimen, placed in a carrier between the hot and cold chambers, can be quickly power shifted from one temperature zone to another (ambient, hot, or cold). The sequence and timing of operation may be manually or automatically selected. Chamber temperatures are monitored on a chart recorder located in the control room of the building.

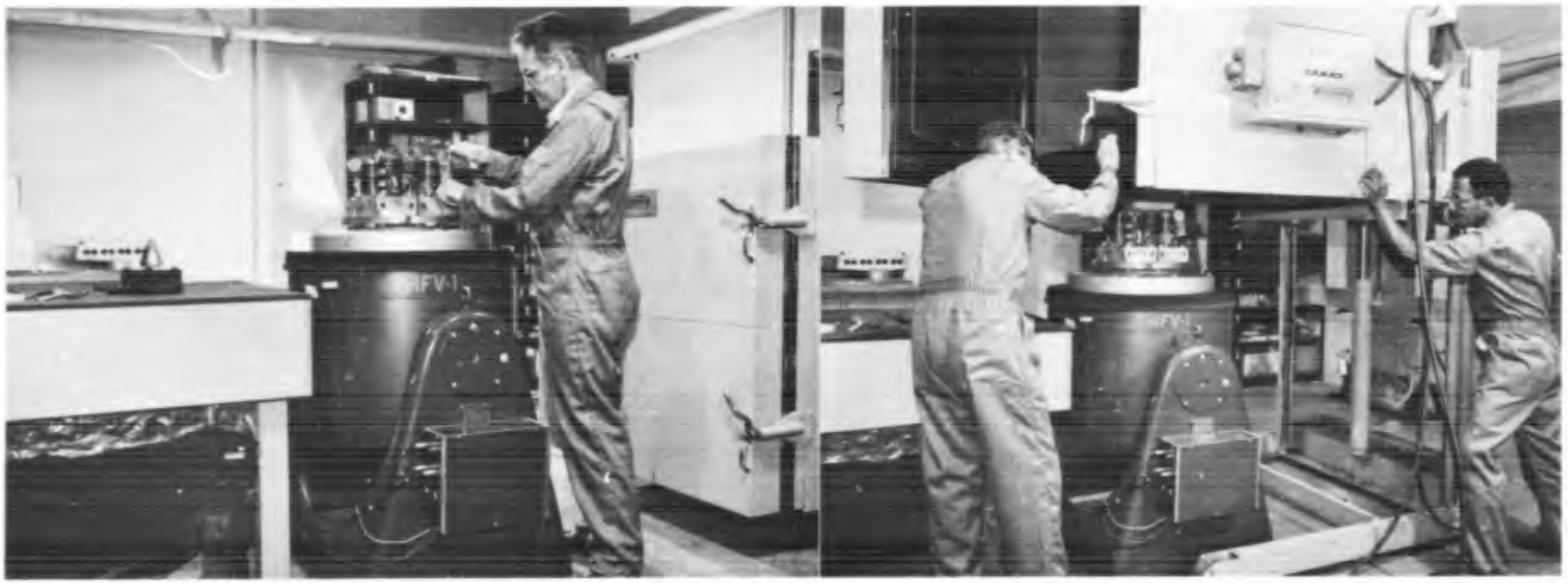
Back of Building 306 and adjacent to the liquid CO_2 receiver-compressor unit is an NOL conditioning chamber. This chamber is large enough to temperature test a weapon system.

This unit is portable and may be used at any location that affords electric power for heating and control. Cooling may be achieved by either liquid or solid CO_2.

Console for the Ling Vibration System

VIBRATION

Vibration is one of the most common environments that all explosive devices must withstand. Facilities are available to conduct tests under a wide variety of vibration frequencies and amplitudes with provisions for vibration testing at various temperatures. As with all explosive testing, this equipment is controlled from another room or building.



LING VIBRATION TESTING EQUIPMENT. The Ling system consists of an electrodynamic vibrator, and a control console. A temperature chamber is available for this system with the capability of controlling the specimen's temperature from -65°F to +160°F. The specifications of the system are given below:

1. Vibrator Model B300
2. Amplifier Model CP 10/16
3. Force rating - sine - 6000 lbs
4. Displacement (peak-to-peak) - 1 inch
5. Velocity limit - 45 in/sec
6. Maximum bare table acceleration - 100g
7. Frequency range - 5-3000 Hz
8. Maximum table load
    a. 10g - 544 lbs
    b. 20g - 244 lbs
    c. 30g - 144 lbs

MB VIBRATION TESTING EQUIPMENT. The MB system consists of an electrodynamic vibrator *(near left)* and a control console *(far left)*. A temperature chamber is available for this system, controlling the temperature from -65°F to +160°F. The specifications of the system are given below:

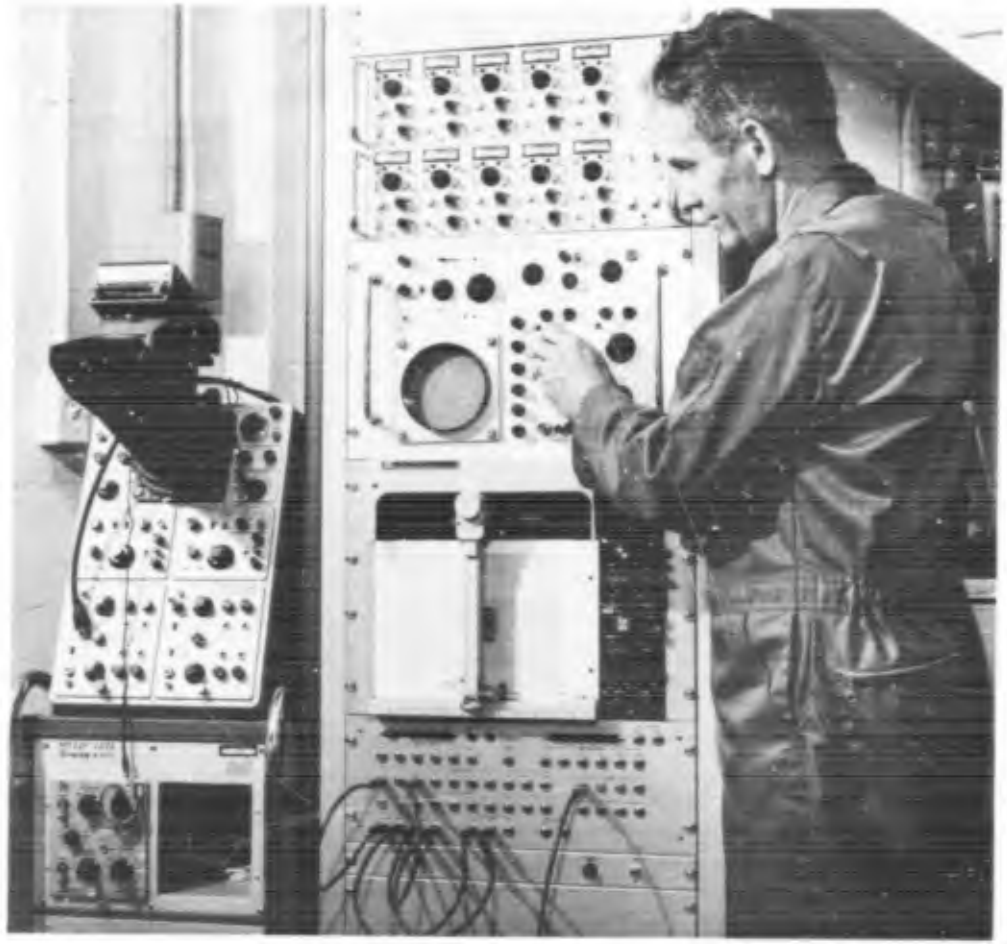
1. Vibrator Model C-10E
2. Amplifier Model T151
3. Force vector - 1200 lbs
4. Displacement (peak-to-peak) - 1 inch
5. Velocity limit - 34 in/sec
6. Maximum bare table acceleration - 65g
7. Frequency range - 5-3000 Hz
8. Maximum table load
    a. 10g - 102 lbs
    b. 20g - 42 lbs
    c. 30g - 22 lbs

NOL VIBRATION TESTING EQUIPMENT. There are two NOL Type 2C mechanical vibrators available for low frequency testing. One vibrator is for ambient temperature testing only *(far left)* while the other vibrator has a temperature chamber *(near left)* with the capability of controlling the temperature from -65°F to +160°F. The specifications for the vibrators are as follows:

1. Frequency range - 10 to 60 Hz (discrete steps)
2. Displacement (peak-to-peak) - 0.125 inch
3. Load capacity - 500 lbs at 5g (peak)
4. Table size - 33 in x 40 in

CGS VIBRATION TESTING EQUIPMENT. The CGS vibration system consists of an electrohydraulic actuated slip table and a control console. A temperature chamber for the range of -65°F to +160°F is available for this system. The specifications for the system are as follows:

1. Force rating - 8250 lbs
2. Frequency range - 10 to 60 Hz
3. Displacement (peak-to-peak) - 1 inch
4. Load capacity - 1000 lbs at 2g (peak)
5. Table size - 48 in x 48 in



VIBRATION MONITORING EQUIPMENT. An Unholtz-Dickie vibration monitoring console is available for use with any of the vibration equipment. The console contains 10 charge amplifiers, an oscilloscope, an AC to log DC converter (dual channel) and a two pen X, Y1, Y2 plotter. The equipment can be used to monitor 10 accelerometer locations and plot any two for a comparison of the accelerations over the frequency range.

Test Specimen after 40 Foot Drop Test

SHOCK

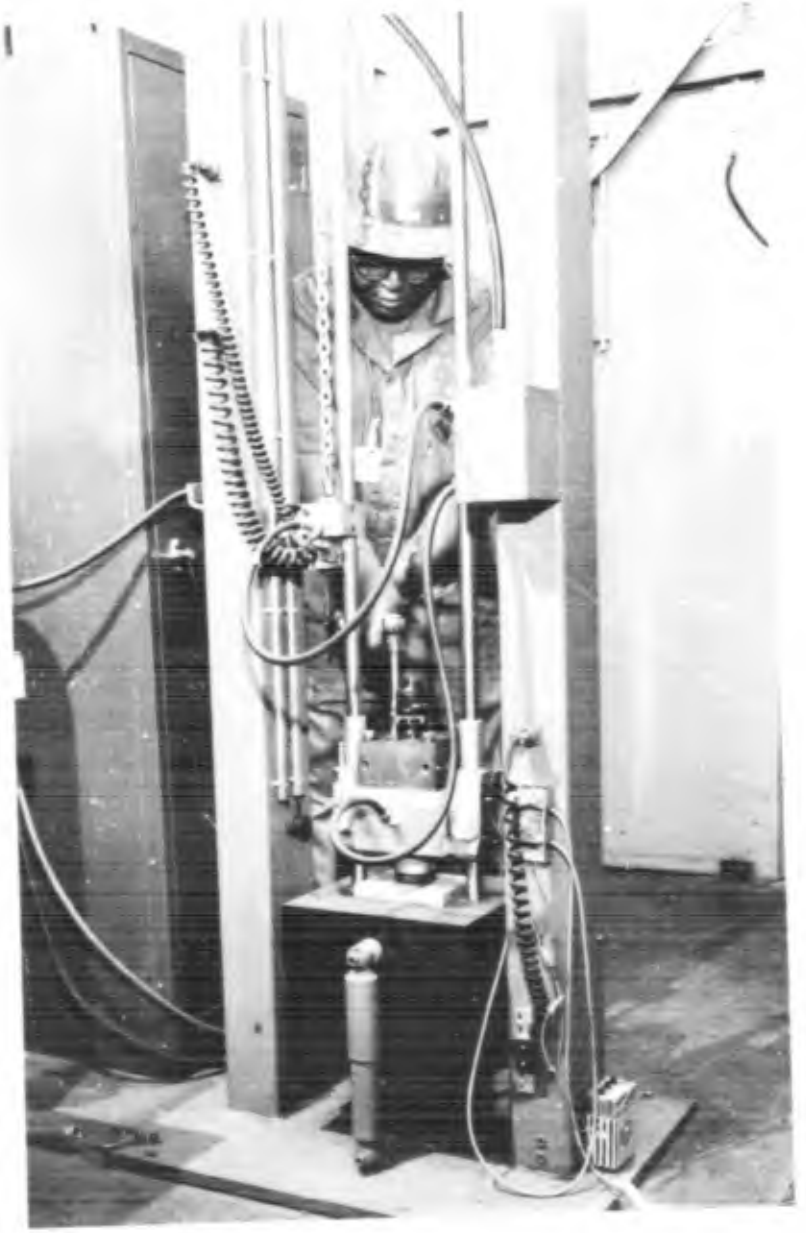
Primary requisites of all ordnance are safety during handling shocks and reliability during deployment. A wide variety of shock machines has been assembled to provide the capability of exploring the response of explosive devices to shock. These machines and facilities are described in this chapter. As is usual with all explosive testing, the operational controls are separated from the test equipment.

JUMBLE MACHINE. The jumble machine tests the safety and ruggedness of explosive device designs. The test consists of tumbling a bare device in a rotating, closed, wood-lined metal box. Three boxes are available depending on the size of the item to be tested.

JOLT MACHINE. The jolt machine is used to test the safety and ruggedness of explosive device designs. These items are mounted to wooden arms which are dropped 4 inches onto a leather padded wooden anvil. Adapters are available for mounting test specimens to the jolt arms.

REPEATED IMPACT PACKAGE TESTER. An L.A.B. Corporation Transportation Simulator is used for repeated or recurring impact tests of packaged hardware. The 31 x 41 inch table, which has a maximum load of 400 pounds, is fenced to keep the package on the table. During operation, the table has a circular motion in the vertical plane with a one inch double amplitude. The frequency is varied to obtain a 3/16-inch separation between the table and the package being tested.

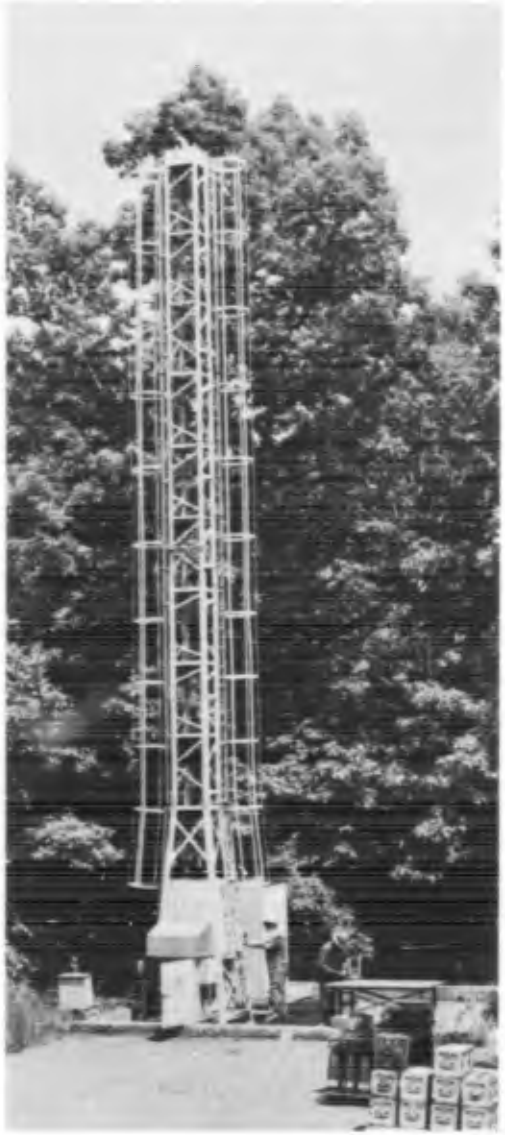
TEST SET, VHG (VERY HIGH GRAVITY) IMPACT. The VHG Impact Test Set is used to perform impact safety tests in the range of 100,000 g, on components containing up to 10 grams of secondary explosives and hardware items weighing less than 10 pounds with envelope dimensions less than 12 inches in diameter and 10 inches in height. Impact is produced by firing a 30-pound steel piston upward in a vertical air-gun toward a test carriage just above the gun muzzle. An operational description and calibration and maintenance procedures for the test set are given in AD 533.



IMPAC 66 SHOCK TEST MACHINE. The Impac 66 Shock Test Machine is used for shock tests of hardware components. The main specifications of the tester are as follows:

1. Overall height - 7 ft 5 in
2. Table size - 6 in x 6 in
3. Maximum specimen height - limited by drop height
4. Specimen weight for maximum performance - 0 to 10 lbs
5. Table weight - 18 lbs
6. Maximum specimen weight - 50 lbs
7. Minimum pulse duration - 200 microseconds
8. Maximum acceleration - 5000 g's

The control console for the tester contains two charge amplifiers for accelerometers, a peak g holding meter, memoscope to record the shock pulse and the tester operational controls. The machine is capable of being programmed to repeat a shock with a counter to record the number of impacts.



FORTY-FOOT GUIDED DROP TOWER. The forty-foot drop tower is used to shock test items in the region of 100,000 g's. The item to be tested is mounted to a test carriage which is guided throughout its fall by steel cables. The carriage impacts a steel anvil at the base of the tower. A shield is provided at the base so small items can be dropped from the control box at the tower. For larger items (containing more explosive than can be contained by the shield), the tower is operated from a nearby building.


TEST FIRING
WARNING SIGNAL
SOUND HORN


330

FORTY-FOOT FREE FALL DROP TOWER. The forty-foot free fall drop tower is used for safety testing explosive devices installed in inert weapons. The center enclosed area at the base of the tower has a four-inch steel plate, 7 feet wide and 7 feet long on a concrete foundation. There is also an outboard steel plate four inches thick and 8 feet 9 inches wide and 17 feet 6 inches long. A hoist with a 2000-pound capacity and a remote controlled quick release clamp is used to position and drop the test items. The tower can be controlled from a station near the tower or from a nearby building depending on the amount of explosive being tested.

TWO-FOOT FUZE DROP TESTER. The two-foot fuze drop tester is one example of special test fixtures that are designed and used at NOL. Although specifically designed to test impact switches in electric bomb fuzes, this tester can be used to test other impact devices. Table size is 10-1/2 inches by 12 inches, drop height is a maximum of 24 inches.

Building 376

PRESSURE AND LEAK TEST EQUIPMENT

Sealing of explosive components to improve storage properties and operation in both reduced air pressure at high altitudes and high water pressure is a fundamental requirement for ordnance. There are three leak testers and one pressure testing facility located in temporary Building 376.


SAFE FIRE

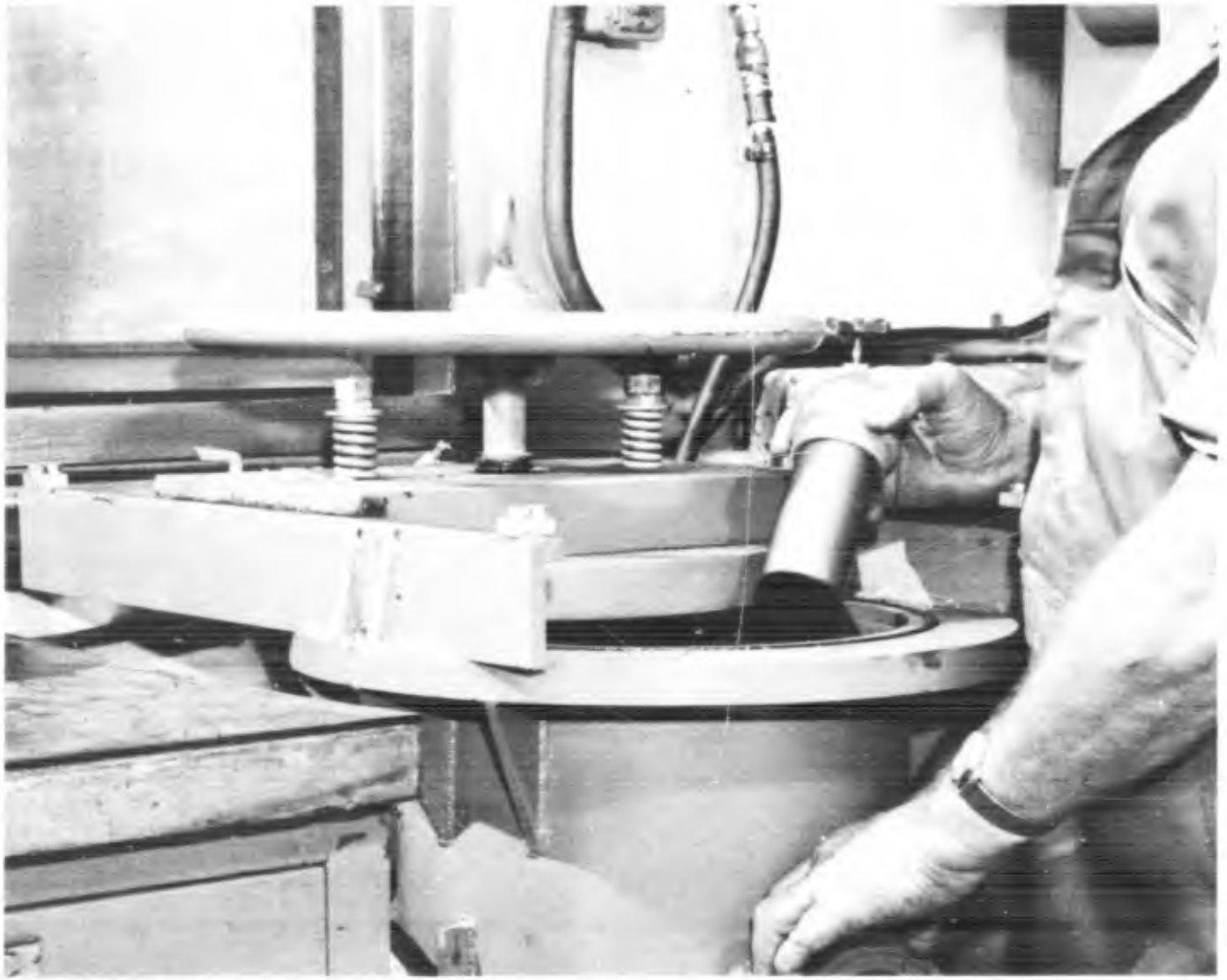
VACUUM-BUBBLE TEST SET. The vacuum-bubble test set *(left)* consists basically of a shielded bell jar with a fixture capable of moving the test item into and out of the water. A standard vacuum pump is used to reduce the internal pressure. Leaks are detected by watching for escaping bubbles.

VEECO HELIUM LEAK DETECTOR. This is a commercial instrument *(far left)* using the mass spectrometer principle to detect helium molecules. The test item, depending on the configuration, may either be filled with helium, sealed, and tested for leaks; or may be placed in a helium atmosphere under pressure for a period of time, removed, and tested for leaks.

CEC HELIUM LEAK DETECTOR. This *(near left)* is similar to the Veeco instrument, but somewhat less sensitive.

The helium detectors are used where small leaks are of concern (10^{-5} to 10^{-8} atm cc/sec). The vacuum-bubble test will detect larger leaks more reliably. A combination of both types of leak tests may be used on a particular item. The leak test of MIL-STD-331, Test 118, may be performed with these facilities. Capabilities of the equipment appear in the following table.

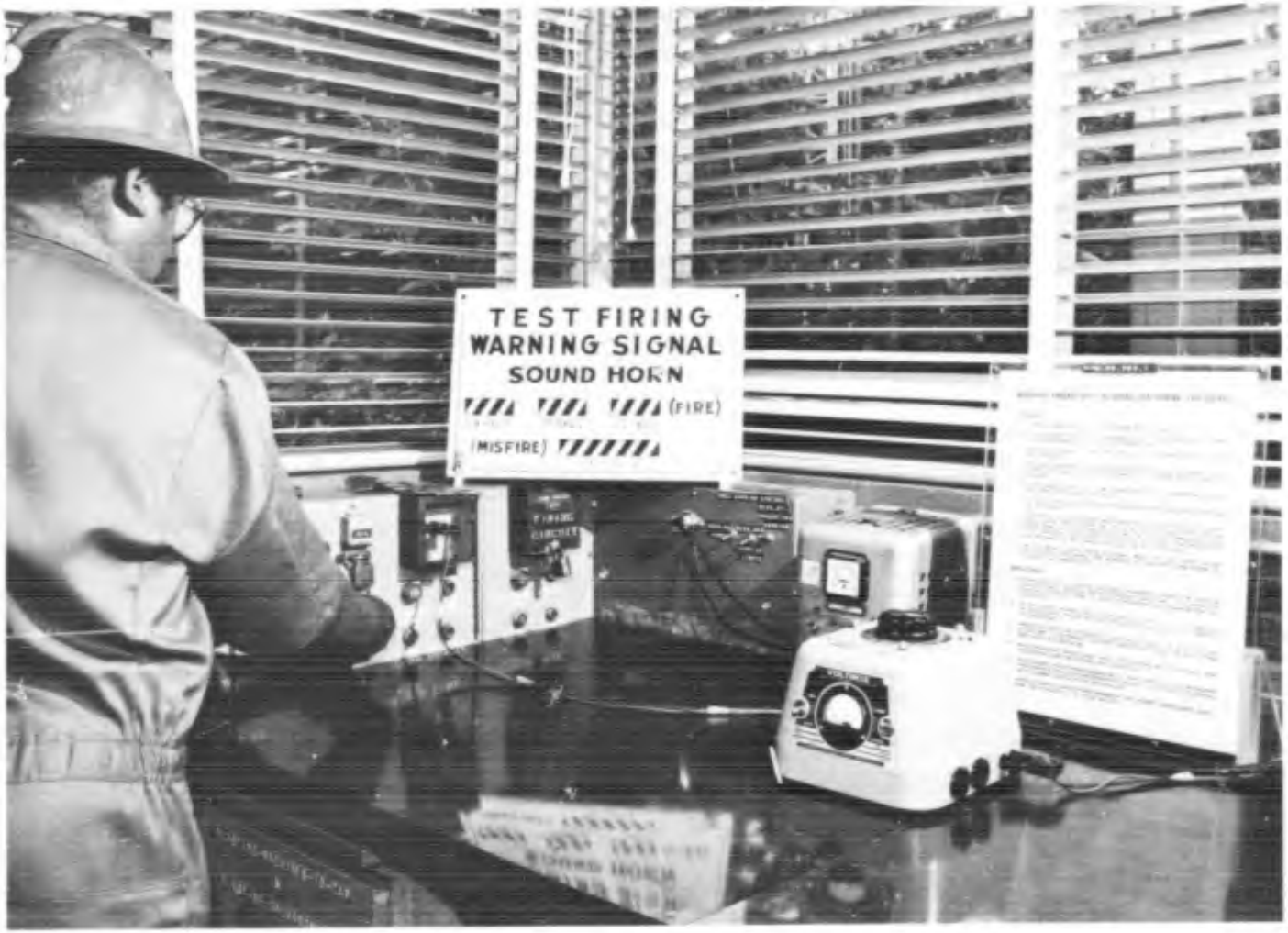
TYPE OF DETECTOR	MIN. DETECTABLE LEAK (atm cc/sec)	APPROX. SIZE
Vacuum-Bubble	1×10^{-4}	24" deep x 15" dia
Veeco Helium	1×10^{-8}	Standard bell jar
CEC Helium	1×10^{-7}	Standard bell jar



PRESSURE. The pressure facility is limited in that only a storage capability of small explosive items is available. Two chambers are available. Pressure limits and chamber dimensions are given below.

MAXIMUM PRESSURE	APPROXIMATE INTERNAL SIZE
100 psi	18" deep x 12" dia
450 psi	18" deep x 12" dia

The pressure may be generated by an air compressor developing up to 90 psi, a gas bottle with pressure regulator up to the maximum of the chambers, or a hydraulic pump to reach chamber maximum. In special cases, arrangements can be made with other areas in the Laboratory to obtain larger pressure vessels on a temporary basis.



Building 363

FIRING CHAMBERS AND TEST EQUIPMENT

After exposure to simulated environments, there remains the problem of assessment of the effects. With one-shot explosive devices, the usual procedures include nondestructive testing, inspection, and finally, firing tests to ascertain changes in input sensitivity and output performance. Facilities and specialized instrumentation are available for firing tests of explosives and loaded ordnance. The items tested range in size from individual explosive components, including primers, detonators, fittings, actuators, and initiators, to completely loaded ordnance devices and mechanisms including fuzes, torpedo exploders, mine mechanisms, and gas generators.

All firing areas are also available for nondestructive tests, including assembly and disassembly of explosive items, electrical measurements, and physical measurements.

Most of the explosive component firing tests are conducted in Building 306 where a wide variety of specialized instruments and small firing chambers are used for nondestructive testing, input sensitivity studies, and explosive output tests. The equipment includes the Mk 136 test set *(near left)*, constant current test sets with vented firing chambers *(center left)*, and instrumentation used for capacitor discharge and electrical pulsing sensitivity tests *(far left)*.

Special instrumentation is constructed for unique studies and as required to simulate weapon circuits. Where explosive components are contained in next higher assemblies such as fuzes complete with booster, gas generators, torpedo exploders, and safety and arming devices, it is sometimes necessary to design special fixtures for operational and safety tests.

Firing tests to determine explosive train reliability and out-of-line safety are a necessary part of any evaluation program of these devices. The firing area for these devices is generally chosen from several available locations to accommodate the size and nature of the device.

BUILDING 306 contains three firing chambers, each with electrical safety interlocks and venting systems, for electrical firing tests. Two additional chambers, containing Mk 136 Test Sets, are available for stab or percussion initiation with a maximum safe charge of 1.0 gram.

Building 363 has a concrete-walled room which may also be sealed by a steel door and used for general firing tests *(left)*. Shutters are available for remote actuation by lanyards or for electric wiring. The maximum safe charge is limited to 2.0 grams.

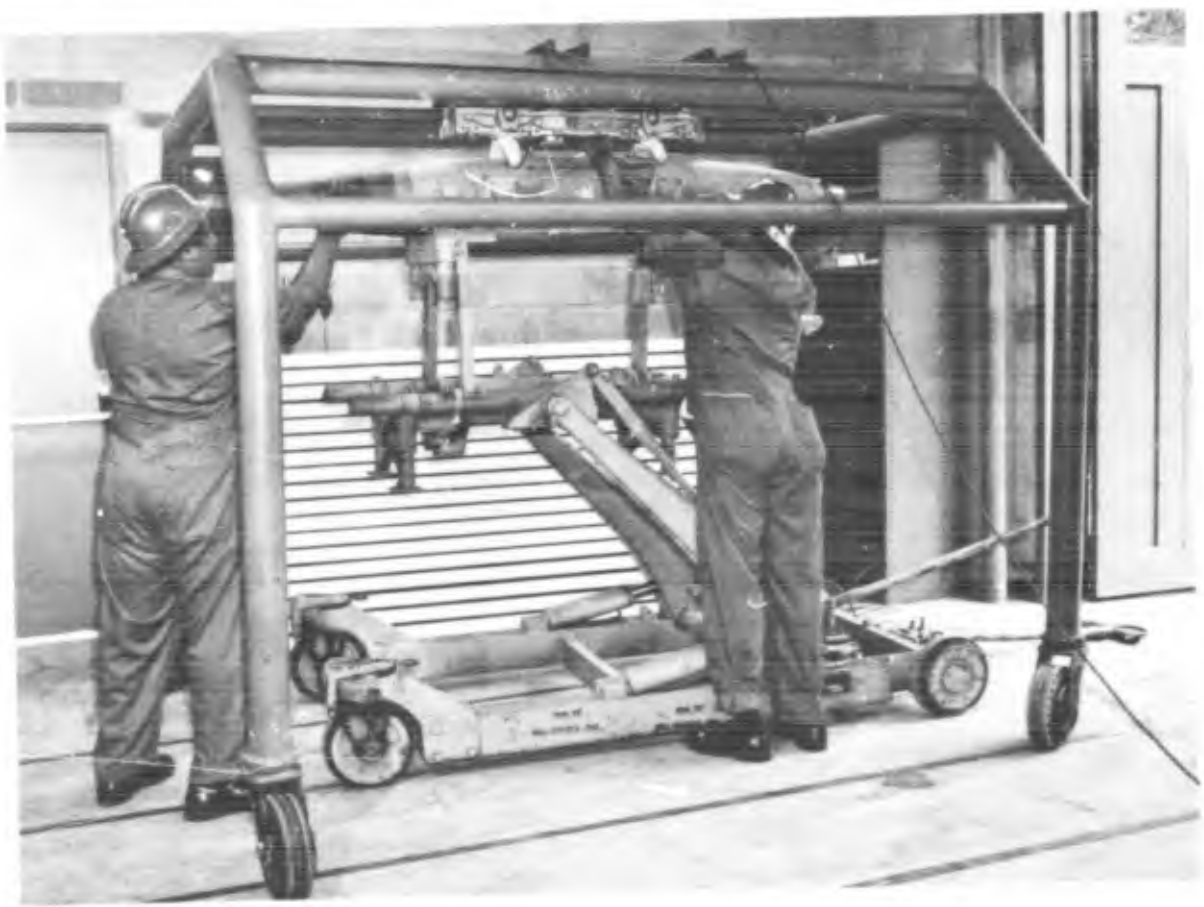

371

BUILDING 371 is a converted gun shield *(far left)*. This facility, located approximately 100 feet from Building 363, is used for firing of explosive charges up to 1.0 pound. The firing operations are remotely controlled from Building 363. Building 371 is often used for output studies of explosive trains. Shown is the setup for remote initiation of a projectile fuze *(above left)* and the utilization of a steel dent block *(below left)* to measure output performance of the booster.


370

BUILDING 370. Another outdoor firing facility for the testing of explosives is Building 370, a modified gun slide. This facility, which is remotely controlled from Building 363, is used for firing tests of explosives up to 1.0 pound. When a requirement exists for firing tests of explosives with an output greater than 1.0 pound H. E., arrangements are made to use other facilities, including bomb proofs at the Laboratory where five pound charges can be fired or at other government field activities where tests involving fully loaded warheads can be conducted.

BUILDING 301. A steel enclosed workbench space is available for handling initiators in Building 301. Self-contained items are fired in this area.

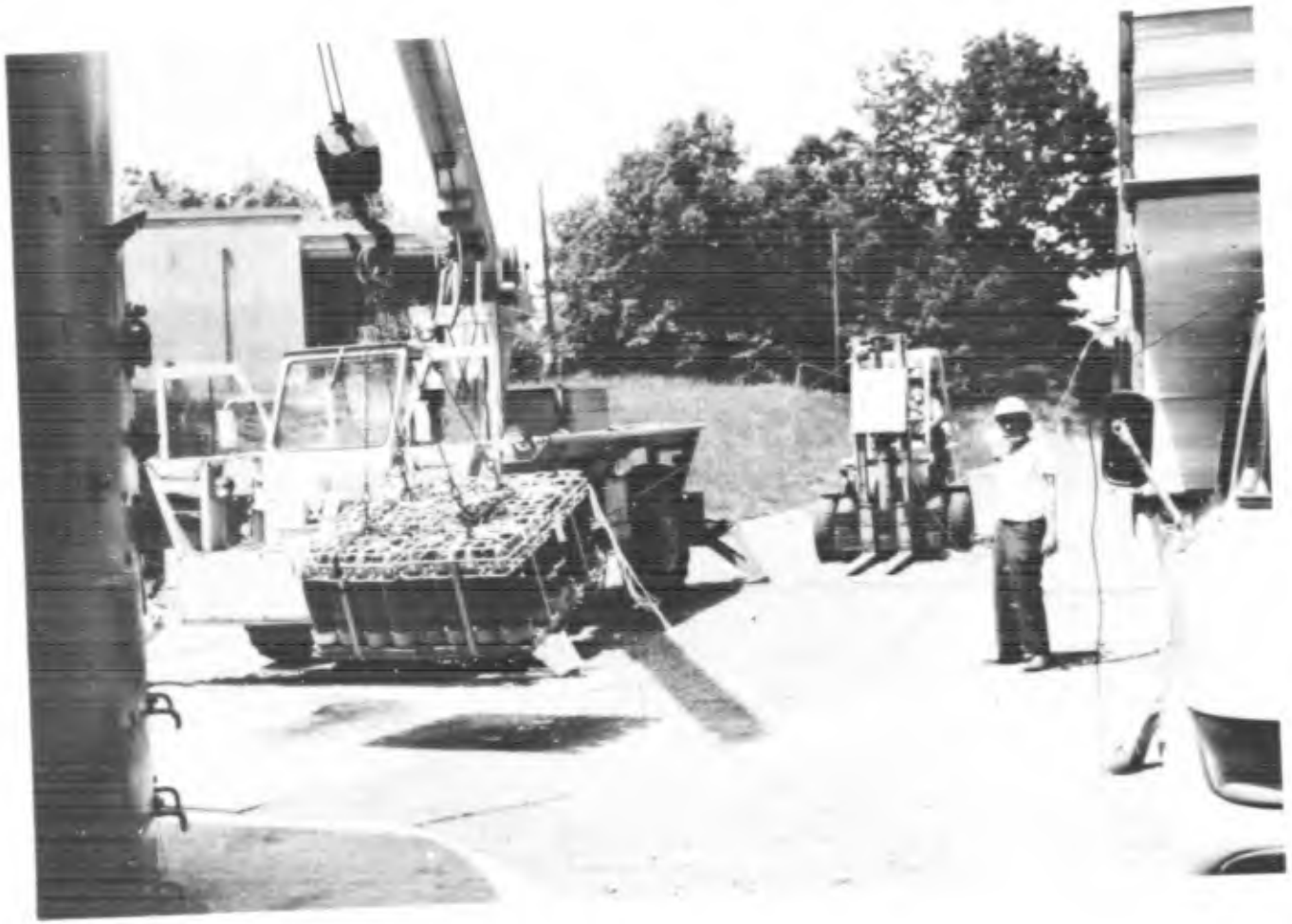


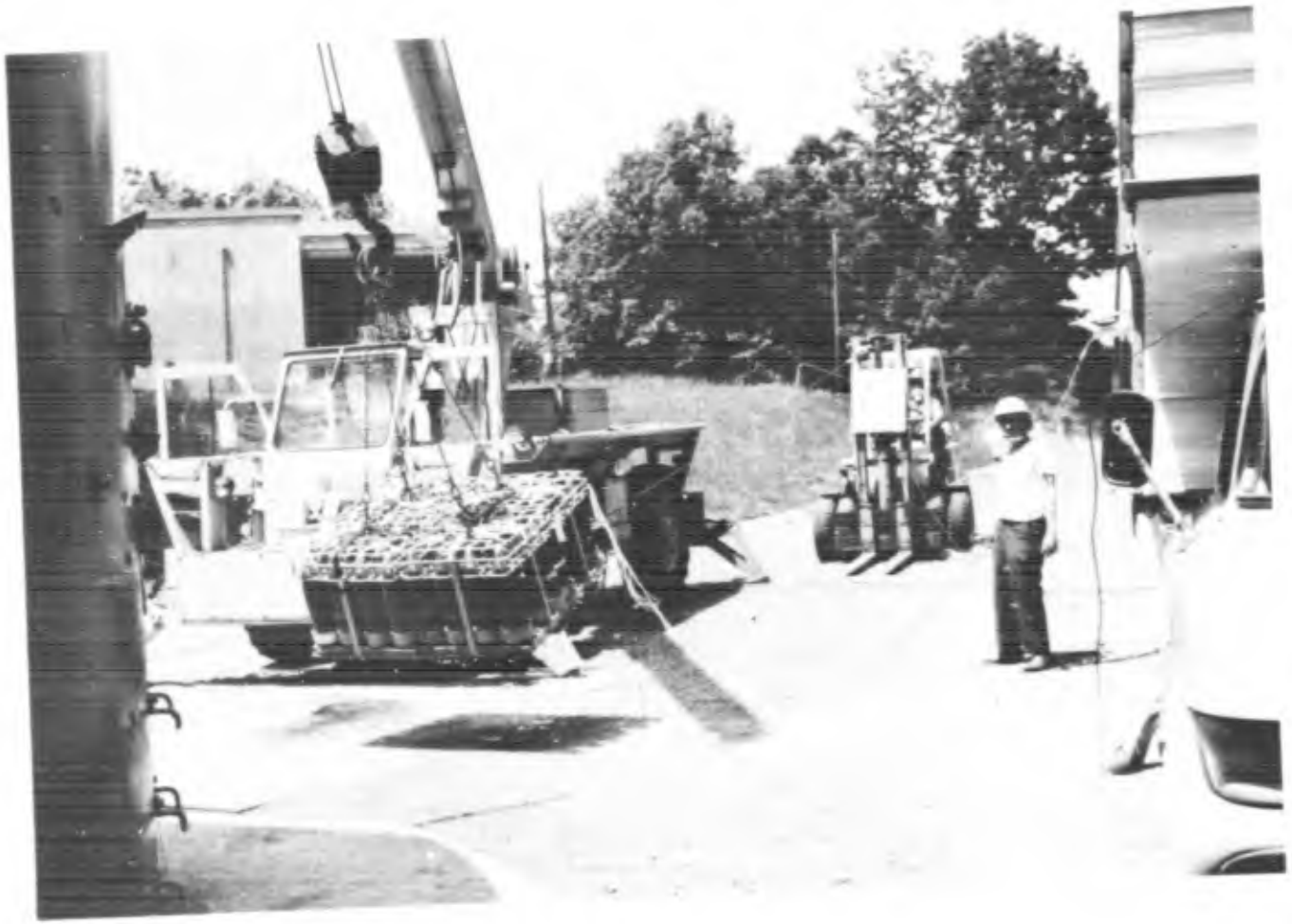
SPECIAL CAPABILITIES

In addition to providing the facilities, staff, and equipment needed for the conduct of environmental and simulation tests, the 300 Area is also utilized for special tailor-made tests and other unique operations involving explosive loaded ordnance.

Two sites are available for ejection tests and fit-compatibility tests of air-launched weapons. These include an outside site *(next page)* with instrumented van and an indoor location *(left)*. All current Navy bomb racks are available for tests and Air Force racks are obtained as needed for specific test programs. Ejection tests, with appropriate instrumentation, are used not only for operability and compatibility tests, but also to verify system safety for accidental-release-on-deck situations.

Two centrifuges, one with a five-foot arm and the other with a ten-foot arm, are available for acceleration testing up to 100 g's with a maximum test load of 50 lbs. The larger centrifuge is presently being installed in an armor plate structure for safe, remote operations. The smaller unit is primarily used in operational simulation tests of electric bomb fuzes, but is also available for specific tests.

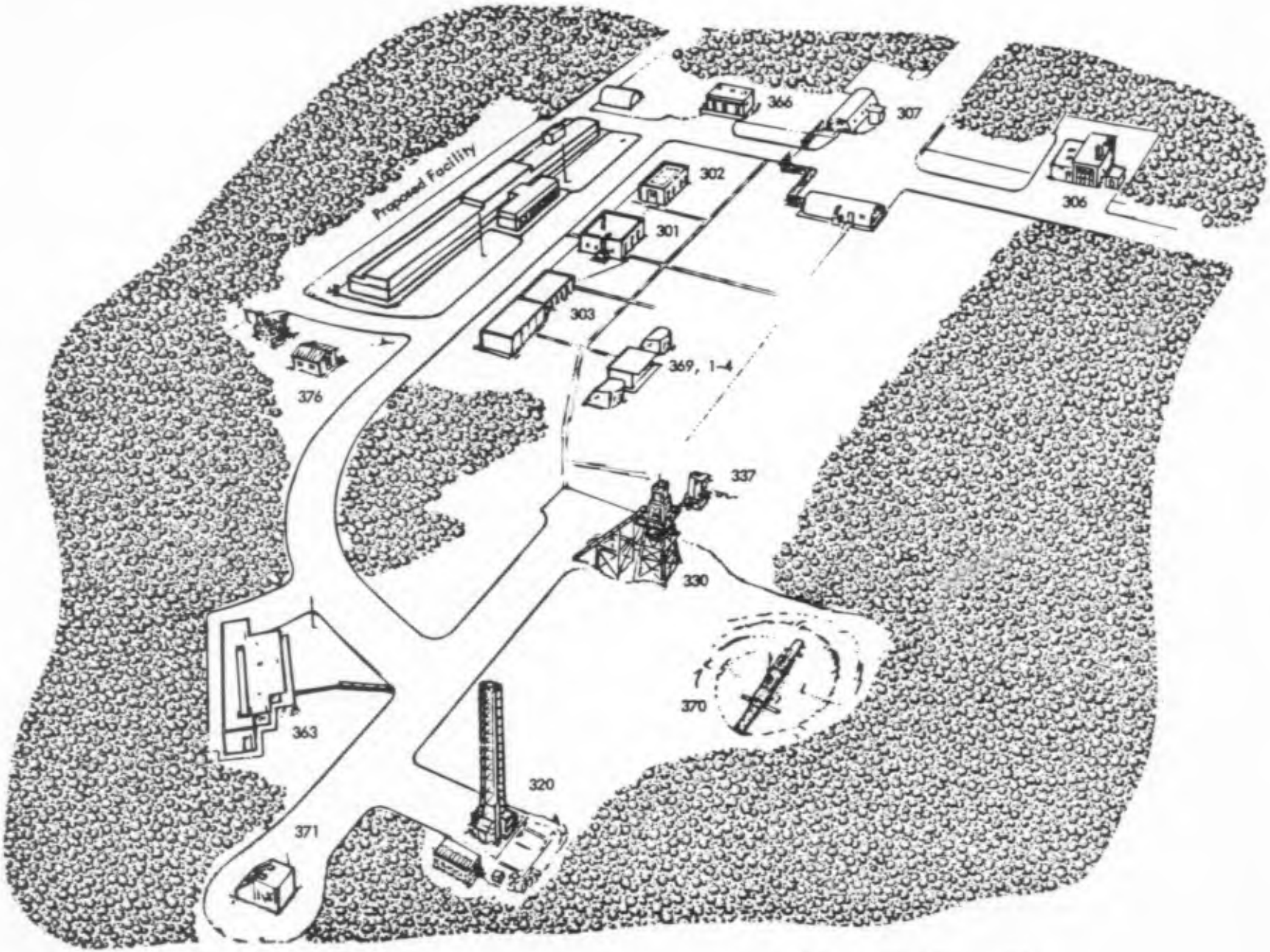




A wide variety of system tests and weapon assembly/handling tests is conducted both indoors and outdoors. These tests include functioning studies with partially loaded ordnance, fit, assembly, rough handling simulation, and hard surface impact testing. A torpedo crane, fork lift, and a number of crane and hoists are available for use in systems tests.

Other field tests are designed on a one-shot basis to expedite work and reduce costs, such as a test setup *(left)* made to evaluate a proposed new round for the 50 cal. machine gun.

In addition to being used for test purposes, this area is often utilized for the assembly or modification of explosive loaded ordnance. If necessary, this work can be accomplished in a semi-production line manner using area ordnancemen and technicians. Examples of this type of work include the modification of a number of flares for a Fleet exercise, the disassembly and modification of in-service projectile fuzes for special tests, and the assembly of explosive charge units for deployment by combat personnel.

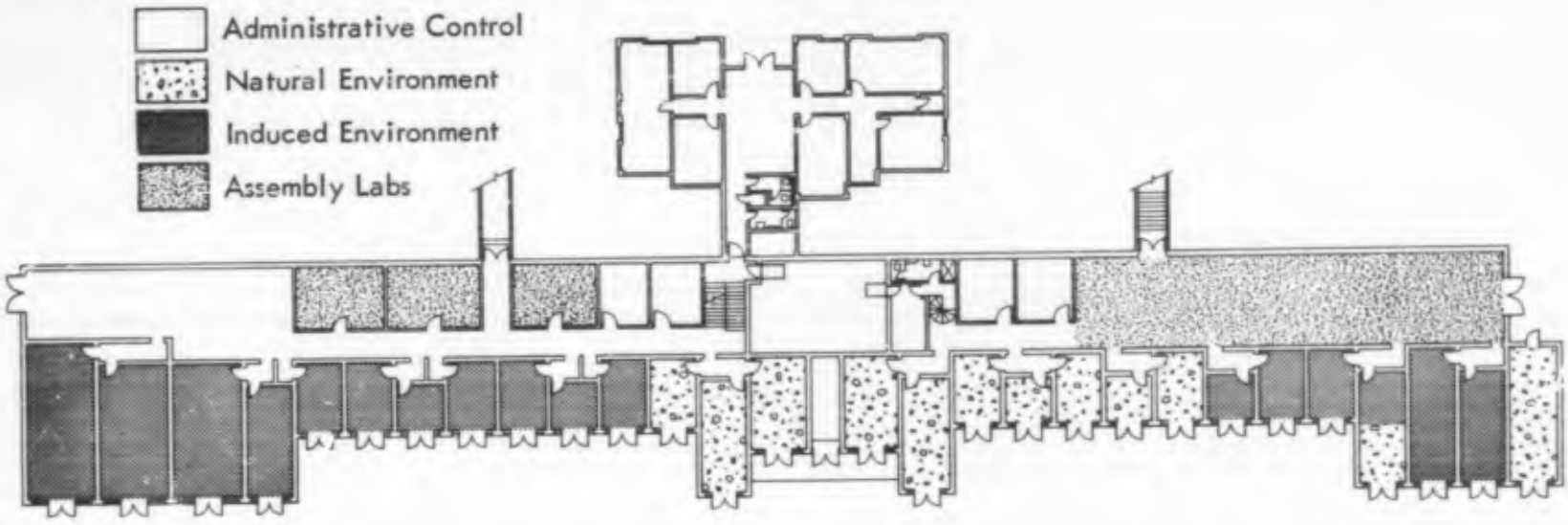


300 Test Area Facilities

FUTURE PLANS

A new building *(left)* to be known as the Explosives Environmental Building (MIL-CON Project No. P-041, FY 74) has been requested for construction at the Explosives Evaluation Facility of the Air and Surface Evaluation Department. Except for the outdoor facilities which will remain, most of the existing usable facilities will be relocated in the individual test cells in this building. Additional new test equipment will be acquired and installed to give the Explosive Evaluation Facility a greater overall systems test capability.

Present buildings from which equipment and personnel will be removed will either be converted to special use or to storage purposes, or will be removed from the area.



Plans call for the construction of a combination one story office-laboratory building having a 53-foot by 335-foot laboratory and a 71-foot by 35-foot office attached to form the T-shaped building. The laboratory section will consist of work space plus 28 test cells, each constructed to meet the performance and safety conditions of the facility that it will house.

This new building will serve to bring most of the existing scattered facilities under one roof where inspection, testing, and analysis can be conducted more efficiently. Of equal importance, the new building will have the capability of assembling and testing of weapon systems as a whole, as well as component testing. The necessity for isolation of each test for safety requirements is ensured by the unique construction plan of individual test cells.

APPENDIX A

MAJOR SHOP EQUIPMENT

ITEM	EXPLOSIVE LIMIT (H.E.)*	REMARKS
18 inch Lathe	1.0 lb	Remote control, in barricaded cell
2 inch Drill Press (Automatic feed)	1.0 lb	In barricaded cell
12 inch Lathe	0.2 lb	To be installed in barricaded cell, remote control
Vertical Mill	0.2 lb	To be installed in barricaded cell, remote control
18 inch Horizontal Bandsaw	1.0 lb	Remote operation
12 inch Lathe	200 gms	Operator protected by shields, protective gear
Vertical Mill	2.0 gms	Operator protected by shields, protective gear
Various Drill Presses, Misc Arbor Presses	2.0 gms	Operator protected by shields, protective gear
Vertical Bandsaw	2.0 gms	Operator protected by shields, protective gear

* These are limits for normal operations. Special exceptions can be obtained on per case basis with approval of Safety Department.

TEMPERATURE AND HUMIDITY ENVIRONMENTAL CHAMBERS

DESIGNATION	LOCATION	FUNCTION	CHAMBER SIZE W" x D" x H"	TEMPERATURE RANGE (Safe Operation)	HUMIDITY RANGE	MAX. HI-EXPLOSIVE CHARGE	
Webber	B:369-2	Heat-cool Humidity	60 x 36 x 36	-80°F to +160°F	95% at +160°F	1 lb/unit	10 lb/bldg
Aminco - 7	B:369-1	Heat Humidity	52 x 26 x 24	Ambient to +160°F	95% at +160°F	2 lb/unit	20 lb/bldg
Aminco - 8	B:369-4	Heat Humidity	52 x 26 x 24	Ambient to +160°F	95% at +160°F	2 lb/unit	10 lb/bldg
Conrad - 1	B:303	Heat-cool Humidity	24 x 24 x 24	-80°F to +160°F	95% at +160°F	1 lb/unit	5 lb/bldg
Conrad - 2	B:303	Heat-cool Humidity	24 x 24 x 24	-80°F to +160°F	95% at +160°F	1 lb/unit	5 lb/bldg
Wyle - 1	B:303	Heat-cool Humidity	24 x 24 x 24	-80°F to +160°F	95% at +160°F	1 lb/unit	5 lb/bldg
Wyle - 2	B:303	Heat-cool Humidity	24 x 24 x 24	-80°F to +160°F	95% at +160°F	1 lb/unit	5 lb/bldg
Aminco - 1	B:303	Heat Humidity	26 x 26 x 26	Ambient to +160°F	95% at 160°F	1 lb/unit	5 lb/bldg
Aminco - 2	B:303	Heat Humidity	26 x 26 x 26	Ambient to +160°F	95% at 160°F	1 lb/unit	5 lb/bldg
Aminco - 3	B:303	Heat Humidity	26 x 26 x 26	Ambient to +160°F	95% at 160°F	1 lb/unit	5 lb/bldg
Revco	B:303	Cool	48 x 15 x 16	Ambient to -80°F	-	1 lb/unit	5 lb/bldg
NOL Conditioning Chamber	B:306	Heat-cool	36 x 132 x 36	-80°F to +160°F	-	1 lb/unit	-

3-ZONE THERMAL SHOCK ENVIRONMENTAL CHAMBER

DESIGNATION	LOCATION	FUNCTION	CHAMBER SIZE W" x D" x H"	TEMPERATURE RANGE * (Safe Operation)	HUMIDITY RANGE	MAX. HI-EXPLOSIVE CHARGE	
Thermotron	B:306	Heat-cool	24 x 24 x 24	-85°F to +160°F	-	1 lb/unit	10 lb/bldg

SALT SPRAY ENVIRONMENTAL CHAMBER

Industrial	B:369-3	Corrosive Fog	48 x 26 x 34	95°F	-	1 lb/unit	10 lb/bldg

* For special tests temperature can be raised to 390°F.

VIBRATION TESTING EQUIPMENT

TYPE	FORCE OUTPUT Sinusoidal-PK	Random-RMS	FREQUENCY RANGE	MAX. TEST LOAD
Electrodynamic				
Ling Model B300	6,000 lbs	5,000 lbs	5-3,000 Hz	544 lbs
MB Model C-10E	1,200 lbs		5-3,000 Hz	102 lbs
Mechanical				
NOL Type 2C *	5,000 lbs		10-60 Hz	500 lbs
Electrohydraulic				
CGS	8,250 lbs		10-60 Hz	1,000 lbs

* Two machines

SHOCK TESTERS

TYPE	NOTES
Jumble	Three box sizes depending on size of device
Jolt	Four-inch drop of wooden arm onto leather padded wood anvil
Repeated Impact	Frequency varied to obtain 3/16" separation between package and tester
VHG Test Set	Ten-pound (max) test item - 100,000 g
Impac 66	Fifty-pound (max) test item - 5,000 g for ten-pound test item
Forty-foot Guided Drop Tower	100,000 g test - item mounted on guided carriage
Forty-foot Free Fall Tower	Items weighing up to 2,000 lbs can be dropped onto a 4" thick steel plate
Two-foot Drop Tester	Two-foot drop height - used to check impact switches in electric bomb fuzes