DATA CALL 66
INSTALLATION RESOURCES

Activity Information:

Activity Name:	DBO Indian Head
UIC:	43628
Host Activity Name (if response is for a tenant activity):	Naval Surface Warfare Center
Host Activity UIC:	00174

DATA CALL 66
INSTALLATION RESOURCES

Table 1A - Base Operating Support Costs (Other Than DBOF Overhead)			
Activity Name: Defense Printing Service		UIC: ~~AH~~ 43628	
Category	FY 1996 BOS Costs ($000)		
	Non-Labor	Labor	Total
1. Real Property Maintenance Costs:			
1a. Maintenance and Repair			
1b. Minor Construction			
1c. Sub-total 1a. and 1b.			
2. Other Base Operating Support Costs:			
2a. Utilities			
2b. Transportation			
2c. Environmental			
2d. Facility Leases			
2e. Morale, Welfare & Recreation			
2f. Bachelor Quarters			
2g. Child Care Centers			
2h. Family Service Centers			
2i. Administration			
2j. Other (Specify)			
2k. Sub-total 2a. through 2j:			
3. Grand Total (sum of 1c. and 2k.):			

N/A (DPS is DBOF)

UIC : 43628

DATA CALL 66
INSTALLATION RESOURCES

b. Funding Source. If data shown on Table 1A reflects more than one appropriation, then please provide a break out of the total shown for the "3. Grand-Total" line, by appropriation:

Appropriation	Amount ($000)
N/A	

c. Table 1B - Base Operating Support Costs (DBOF Overhead). This Table should be submitted for all current DBOF activities. Costs reported should reflect BOS costs supporting the DBOF activity itself (usually included in the G&A cost of the activity). For DBOF activities which are tenants on another installation, total cost of BOS incurred by the tenant activity for itself should be shown on this table. It is recognized that differences exist among DBOF activity groups regarding the costing of base operating support: some groups reflect all such costs only in general and administrative (G&A), while others spread them between G&A and production overhead. Regardless of the costing process, all such costs should be included on Table 1B. The Minor Construction portion of the FY 1996 capital budget should be included on the appropriate line. Military personnel costs (at civilian equivalency rates) should also be included on the appropriate lines of the table. Please ensure that individual lines of the table do not include duplicate costs. Also ensure that there is no duplication between data provided on Table 1A. and 1B. These two tables must be mutually exclusive, since in those cases where both tables are submitted for an activity, the two tables will be added together to estimate total BOS costs at the activity. Add additional lines to the table (following line 21., as necessary, to identify any additional cost elements not currently shown). **Leave shaded areas of table blank.**

Other Notes: All costs of operating the five Major Range Test Facility Bases at DBOF activities (even if direct RDT&E funded) should be included on Table 1B. Weapon Stations should include underutilized plant capacity costs as a DBOF overhead "BOS expense" on Table 1B..

Table 1B - Base Operating Support Costs (DBOF Overhead)			
Activity Name: DBO Indian Head		UIC: 43628	
Category	FY 1996 Net Cost From UC/FUND-4 ($000)		
	Non-Labor	Labor	Total
1. Real Property Maintenance Costs:			
1a. Real Property Maintenance (>$15K)			
1b. Real Property Maintenance (<$15K)			
1c. Minor Construction (Expensed)			
1d. Minor Construction (Capital Budget)			
1c. Sub-total 1a. through 1d.			
2. Other Base Operating Support Costs:			
2a. Command Office			
2b. ADP Support			
2c. Equipment Maintenance			
2d. Civilian Personnel Services			
2e. Accounting/Finance			
2f. Utilities	$43		$43
2g. Environmental Compliance			
2h. Police and Fire			
2i. Safety			
2j. Supply and Storage Operations			
2k. Major Range Test Facility Base Costs			
2l. Other (Specify)			
2m. Sub-total 2a. through 2l:	$43		$43
3. Depreciation			
4. Grand Total (sum of 1c., 2m., and 3.) :	$43		$43

DATA CALL 66
INSTALLATION RESOURCES

Table 2 - Services/Supplies Cost Data	
Activity Name: DBO Indian Head	UIC: 43628
Cost Category	FY 1996 Projected Costs ($000)
Travel:	$0
Material and Supplies (including equipment):	$126
Industrial Fund Purchases (other DBOF purchases):	$0
Transportation:	$3
Other Purchases (Contract support, etc.):	$407
Total:	$536

DATA CALL 66
INSTALLATION RESOURCES

Table 3 - Contract Workyears	
Activity Name: Defense Printing Service	**UIC:** ~~AH~~ 43628
Contract Type	**FY 1996 Estimated Number of Workyears On-Base**
Construction:	
Facilities Support:	
Mission Support:	
Procurement:	
Other:*	
Total Workyears:	

N/A (DPS has tenants only; do not support installations)

UIC: 43628

DATA CALL 66
INSTALLATION RESOURCES

b. Potential Disposition of On-Base Contract Workyears. If the mission/functions of your activity were relocated to another site, what would be the anticipated disposition of the **on-base contract workyears** identified in Table 3.?

1) Estimated number of contract workyears which would be transferred to the receiving site (This number should reflect the number of jobs which would in the future be contracted for at the receiving site, not an estimate of the number of people who would move or an indication that work would necessarily be done by the same contractor(s)):

N/A

2) Estimated number of workyears which would be eliminated:

N/A

3) Estimated number of contract workyears which would remain in place (i.e., contract would remain in place in current location even if activity were relocated outside of the local area):

N/A

UIC: 43628

DATA CALL 66
INSTALLATION RESOURCES

c. "Off-Base" Contract Workyear Data. Are there any contract workyears located in the local community, but not on-base, which would either be eliminated or relocated if your activity were to be closed or relocated? If so, then provide the following information **(ensure that numbers reported below do not double count numbers included in 3.a. and 3.b., above):**

No. of Additional Contract Workyears Which Would Be Eliminated	General Type of Work Performed on Contract (e.g., engineering support, technical services, etc.)
N/A	N/A

No. of Additional Contract Workyears Which Would Be Relocated	General Type of Work Performed on Contract (e.g., engineering support, technical services, etc.)
N/A	N/A

I certify that the information contained herein is accurate and complete to the best of my knowledge and belief.

NEXT ECHELON LEVEL (if applicable)

NAME (Please type or print) _____ Signature _____

Title _____ Date _____

Activity _____

I certify that the information contained herein is accurate and complete to the best of my knowledge and belief.

NEXT ECHELON LEVEL (if applicable)

NAME (Please type or print) _____ Signature _____

Title _____ Date _____

Activity _____

I certify that the information contained herein is accurate and complete to the best of my knowledge and belief.

MAJOR CLAIMANT LEVEL

R. M. MOORE, RADM, SC, USN
NAME (Please type or print)

Signature

AUG 24 1994
Date

COMMANDER
Title

NAVAL SUPPLY SYSTEMS COMMAND
Activity

I certify that the information contained herein is accurate and complete to the best of my knowledge and belief.

DEPUTY CHIEF OF NAVAL OPERATIONS (LOGISTICS)
DEPUTY CHIEF OF STAFF (INSTALLATIONS & LOGISTICS)

W. A. EARNER
NAME (Please type or print)

Signature

8/30/94
Date

Title

BRAC-95 CERTIFICATION

EFFECTED LOCATION(S):

DPS-Wide

DATA CALL BEING CERTIFIED:

BRAC-95 Data Call #66

Per SECNAV NOTE 11000 dtd 8 Dec 93

"I certify that the information contained herein for the following location(s) is accurate and complete to the best of my knowledge and belief."

WILLIAM J. PORTER
NAME (Please type or print)

W J Porter
Signature

Acting Director
Title

8/15/94
Date

DPS Headquarters
Activity

Enclosure (1)

NSWC Indian Head

"LAB" JOINT CROSS-SERVICE GROUP GUIDANCE PACKAGE

See Revised DC

Section I: Taskings
1.1 Guidelines
1.2 Standards
1.3 Assumptions
1.4 Measures of Merit
1.5 Activities
1.6 Common Support Functions

Section II: Capacity of DOD Components
2.1 Workload
2.2 Excess Capacity

Section III: Capability of Activities to Perform Common Support Functions
3.0 Mission
3.1 Location
3.2 Personnel
3.3 Workload
3.4 Facilities & Equipment
3.5 Expansion Potential

Section IV: Appendices
A. Macro Process/Schedule
B. List of Activities
C. Common Support Functions

SECTION I: TASKING

In accordance with the Deputy Secretary of Defense memorandum dated 7 Jan 94, the Laboratory Joint Cross-Service Group (LJCSG) with DOD components should, where operationally and cost effective, strive to: retain in only one Service militarily unique capabilities used by two or more Services; consolidate workload across the Service to reduce capacity; and assign operational units from more than one Service to a single base. Specifically, the purpose of the LJCSG is:

- Determine common support functions and bases to be addressed by LJCSG
- Establish guidelines, standards, assumptions, measures of merit, data elements and milestone schedules for DOD Component conduct of cross-service analysis of common support functions
- Review excess capacity analysis
- Develop closure or realignment alternatives
- Analyze cross-service trade-offs

The following information identifies to the Services common support functions and data element requirements necessary to support the cross-service analysis of these common support functions.

1.1 Guidelines

Because the DOD components are organized differently, "Lab" activities are considered to be those involved in the following life cycle efforts: Science and technology, and/or engineering development, and/or in-service engineering.

Service missions and force structure will be as stipulated in the FY1995-2000 Defense Planning Guidance and Interim Force Structure Plan.

The Military Departments will use the projected funding in the FY95 President's Budget Submission (Future Years Defense Plan -- FYDP) and an estimate of funds that will be received from outside the military department for execution.

If "lab" excess capacity exists, the Military Departments will start to reduce it where operationally and cost effective through a combination of downsizing in place within the departments, internal service consolidation, and cross service alternatives.

The Military Departments will gather, exchange, and analyze data collected per this guidance call for Common Support Functions (Appendix C) at "lab" activities (Appendix B) in accordance with the milestones and schedule dates identified in Appendix A.

- Cross-service alternatives will result in an aggregate reduction in the overall "lab" infrastructure across the Military Departments -- personnel/funding/facilities and equipment.

Common cross-service Measures of Merit will be consistently applied for all cross-service alternatives.

Integration of weapon systems/components into operational forces will remain with the individual Military Departments responsible for those forces.

1.2 Standards

Evaluation of cross-service alternatives will be consistent with PL 101-510 (as amended) and the eight BRAC criteria. Only certified data will be used.

The COBRA cost model will be used to calculate estimated costs, estimated savings, and Return on Investment (ROI) of alternatives leading to proposed closures and realignments. Common inputs will be used for Military COBRA runs incorporating cross-service alternatives.

Military value analysis will be conducted by the Military Departments IAW Title 10, USC responsibilities.

1.3 Assumptions

"Lab" Common Support Functions and activities identified herein represent the major opportunities for developing cross-service alternatives. The Military Departments are not precluded from proposing other cross-service alternatives to reduce excess capacity as they assess the full complement of "lab" functions.

Previous BRAC decisions will be factored into cross-service alternatives.

"Lab" capacity will be based on budgeted workyears. A workyear is considered to be 2080 hours adjusted for time not on the job (e.g. sick leave, annual leave, etc.)

1.4 Measures of Merit

The following Measures of Merit represent the outcome from the DOD component final realignment and closure recommendations that are supported by the capabilities data which will be gathered by activity and common support function in Section III of this guidance.

- Reduction of "lab" infrastructure

- Return on investment (COBRA)
- Military value (BRAC criteria 1-4) -- the composite assessment of the quality of the remaining "lab" infrastructure

1.5 Activities

The Military Departments will collect capacity data for each "lab" activity identified in Appendix B. The "lab" activities were selected by considering all individual aggregates of personnel and facilities located at one base, under the same commander, performing predominantly science and technology (S&T), engineering development, and/or in-service engineering work. Small subelements of these "lab" activities were included with the activity. Larger subelements were broken out and defined as separate activities. The list of activities was then narrowed down to the list in Appendix B based on a joint Military Department assessment of common support functions with cross-service potential.

1.6 Common Support Functions

The common support functions (CSFs) were selected as shown in Appendix C based on a joint Military Department assessment of commonalty and cross-servicing potential. Common support functions which were already consolidated and being cross serviced were not included.

Common Support Functions are divided into two categories: product and pervasive. Product functions include all S&T, engineering development, and in-service engineering efforts associated with a product from all funding sources. Pervasive functions only include those efforts that are S&T funded, i.e. Technology Base (6.1)/Exploratory Development (6.2)/Advanced Development (6.3).

SECTION II: CAPACITY OF DOD COMPONENTS

2.1 **Workload**. Use the following table to describe historic and projected workload at each activity in terms of funding and workyears. Assume previous BRAC closures and realignments are implemented on schedule. Projected funding will be derived from FY95 President's Budget Submission (Then year dollars). Past fiscal year data shall begin with FY86 or at the inception of the activity as it existed on 1 Oct 93. (BRAC Criteria I & IV)

Workload for
INDIAN HEAD Division, Naval Surface Warfare Center (IHDIV, NSWC)

Information Required	Fiscal Years											
	86	87	88	89	90	91	92	93	94	95	96	97
Total Funds Programmed ($M)	172	169	152	155	206	231	229	199	195	212	208	199
Total Actual Funds ($M)	191	198	192	199	219	234	251	216				
Programmed Workyears	2337	2323	2351	2265	2459	2809	2733	2456	2314	2187	2077	1980
Actual Workyears	2418	2242	2514	2733	2866	2892	2719	2443				

** FY94 and outyears include the BRAC 93 consolidation of the Explosives Research and Underwater Warheads function at IHDIV which was implemented on 4/3/94 to consolidate full spectrum life cycle management at one site.*

- Budgeted workyears are the selected indicator of the "lab" infrastructure's capacity at an aggregate level for each Military Department. They include both workyears funded directly by the Military Department and the workyears funded from organizations outside the Military Department.

Workyears = government personnel and on-site FFRDCs and SETAs

2.2 **Excess "Lab" Capacity -- Measured at the DOD Component Level**

- Excess "Lab" Capacity = Sum of the Peak Workyears - Sum of the Projected Workyears
  -- Peak at each activity = Highest value between FY86 (or since inception of organization) and FY93
  -- Projected at each activity = Estimated at FY97

SECTION III: CAPABILITY OF ACTIVITIES TO PERFORM COMMON SUPPORT FUNCTIONS (CSFs): Provide the information described for each common support function listed in Appendix C in which you are actively engaged.

3.0 Mission: Describe the major capabilities at your activity contributing to the common support function in bulletized format. Describe any relationship and interconnectivity with other functions (common or otherwise) in support of the overall activity mission.

Mission for IHDIV, NSWC:

ENERGETICS FOR ALL WARFARE CENTERS, MILITARY DEPARTMENTS, AND THE ORDNANCE INDUSTRY.

Energetics **are items such as rockets, missiles, warheads, mines, explosive devices and gun ammunition, which use explosives, propellants, specialty chemicals, and pyrotechnics.**

- Provide capability to develop, manufacture, and support Energetic materials and systems for the Navy and DoD.
- Assure a viable technical base for the development and manufacture of Energetics.
- Advance the state of Energetics manufacturing processes and products.
- Assure effective transition of products from laboratory scale to full-scale production to service use.
- Develop advanced explosive formulations and processes for the Navy and DoD.
- Provide a foundation of technical expertise to sustain the industrial base and assist commercial sources in trouble-shooting and qualifying their processes and products.
- Assure Energetic materials from private industry satisfy government requirements.
- Analyze and recommend make/buy decisions to assure a viable cost effective defense industrial base. Serve as a second source and "smart buyer".

- Provide a flexible and comprehensive technical base to respond to mobilization or surge requirements and to expedite development and introduction of new or improved products that address unforeseen threats during military emergencies such as Operations Desert Shield and Storm.

- Fill the void left by private sources no longer able to produce Energetics due to technical, environmental, safety, liability issues or insufficient profit margin. Indian Head has become the producer of last resort for Energetic/specialty chemicals which are not available from any other source, domestic or foreign (e.g. man-rated percussion primers for Aircrew Escape Systems, nitramine gun propellant used in 105 mm tank guns).

Energetics span a lot more than The Weapons Common Support Function (CSF). IHDIV performs substantial Energetics work for mines and underwater weapons systems not included in the Weapons CSF definition. The WEAPONS CSF includes a little over half of all our Energetics Science & Technology, Engineering Development, and In-Service Engineering work.

The Indian Head Division of NSWC is a niche organization. This is an uniquely military business which requires specialized expertise and very expensive facilities; $1.2B in Indian Head's case. Our motto is "Providing Energetic Solutions" since we perform research and development, engineering, manufacturing technology, low volume production and in-service engineering for Energetic products.

An important spinoff of this technical capability is a warm production base for mobilization. The advantage of this was most recently seen during Desert Storm when we produced rockets and mine clearing explosives three shifts a day. The war was over before the mothballed Army or private sector plants could be brought into operation.

Our mission is to work on Energetic products for all areas of Naval Warfare (not just Surface Warfare), and a significant portion of our work is performed for the Army, Air Force and private defense contractors as well. Another facet of our mission is to develop production processes for explosives and propellants and to transfer these processes to the private sector. In time of war we have the technical expertise to kickstart the dormant industry.

As the defense budget decreases and the weapons portion bears the greatest proportional decrease, Indian Head Division's importance to the DoD is greater than ever. Private companies will get out of the business (see DuPont letter on next page) and DoD will need IHDIV to fill the gaps and sustain Energetics processing capability and know-how. Based on DoD procurement plans for Energetics products, production volumes will be way down, the cost of environmental compliance will skyrocket and large, expensive facilities supporting the CFF's will become idle. The Navy has been planning for this and has already taken some actions to consolidate Energetics work at Indian Head. The Navy's explosives research and undersea warhead development work (about 300 workyears) has been transferred from NSWC White Oak, Maryland to Indian Head and the explosive loading facilities at Naval Weapons Station Yorktown have been shut down with the work transferred to Indian Head.

The Department of the Navy has established imperatives for the future, one of which is to ensure redundant plants for explosives or similar hazardous materials. As long as we have a military, someone has to provide Energetics technology and facilities to produce ordnance that performs. This is a military core capability and the government assumes full liability for safety and any incidents that inflict damage on our citizens. Responsibility for safety of the public exposed to military ordnance and safety for the military personnel that use military ordnance must be assumed by the government. NSWC Indian Head's full spectrum capability provides this in practice. By "full spectrum" we mean not just a full array of Energetics products but the RDT&E, production, and sustaining engineering provided by a single set of tightly integrated experts and facilities.

IHDIV has developed unique expertise as an activity with many individual experts in the specialized areas of Energetics development and material processing. This expertise is sustained by the synergism arising from manufacturing technology with on-site development, test and evaluation, technical documentation, engineering design, and other support functions. These unique skills cannot be severed from the physical facility without an irreparable loss to the Navy and DoD of knowledge of Energetic material processing that is unavailable at any other single activity.

Even though most of the missile propulsion systems were developed by a private contractor, it is still IHDIV which is called upon by the program manager to provide the technical expertise to resolve production or fleet use problems with the energetic materials portion of the weapon systems. Without the combined experience of the three functions at Indian Head, no one would be able to provide this support for the Navy.

DuPont Specialty Chemicals

November 9, 1993

Mr. Sam Waggener
Naval Surface Warfare Center
Warhead Section Code G-22
Dahlgren, VA 22448

Dear Mr. Waggener:

We regret to inform you that DuPont will Discontinue the manufacture of explosive products in the U.S. on January 31, 1994. DuPont sold its commercial explosives business in 1933 The volume of explosives Specialties, including detonators, squibs and "Detasheet" flexible explosives has declined in recent years, and it is no longer a strategic component of the DuPont business portfolio. Explosives operations at our Falling Waters, WV and Pompton Lakes, NJ

The volume of explosives Specialties, including detonators, squibs and "Detasheet" flexible explosives has declined in recent years, and it is no longer a strategic component of the DuPont business portfolio.

January 31, 1994.

We thank you for your past patronage. If you wish to place a final order, please call Bob Russo at (800) 962-9919. If we can help answer other questions, please call me at (302) 774-8376.

Sincerely,

T. J. Enright
Business Manager

IHDIV has the following Joint Service Missions:

- Tri-Service Cartridge and Propellant Actuated Devices, and Aircrew Escape Propulsion Systems (CAD/PAD/AEPS) Responsibility - The Joint Logistics Commanders consolidated Tri-Service CAD/PAD/AEPS activities at IHDIV. Indian Head's functional responsibility spans the CAD/PAD/AEPS life cycle and includes development, acquisition management, manufacturing, quality evaluation, test and evaluation, maintenance, rework, systems modification and disposal (Joint Agreement on Consolidation of CAD/PAD/AEPS Functions, 3 Oct 1973; Joint Agreement Approving the Implementing Plan on Consolidation of CAD/PAD/AEPS Functions, 9 July 1974). IHDIV has over 300 direct workyears for this functional responsibility.

- Tri-Service Design Agent for 2.75" Rocket - Documented in the Tri-Service Configuration Management Plan for Hydra 70/2.75" (28 Aug 92). This responsibility assigned by the Single Manager for Conventional Ammunition Production, Surge, and Mobilization Requirements (29 Sep 88). 2.75 inch rocket is used by all services.

- Tri-Service Jet Assisted Take-Off Rocket (JATO) - The Navy funds full spectrum responsibility of JATOs at Indian Head and the Army funds Army and Air Force Rocket Motor engineering responsibilities under MIPR 31 P4Q 3PH 425, December 1993.

- MK 22 MOD 4 Rocket Motor for Mine Clearing Line Charges (MICLIC) - Indian Head Division is the joint service design agent for the MK 22 MOD 4 Rocket Motor used for MICLIC. No document officially assigned this mission.

- Smokey SAM Rocket - Indian Head Division is the design agent and In-Service Engineering Agent and provides production and engineering support for the Navy and Air Force for the rocket, launcher, and igniter. Responsibility assigned by Air Force Fund Document LIWD-93-020.

3.1 Location

3.1.1 **Geographic/Climatological Features:** Describe any geographic/climatological features in and around your activity that are relevant to each CSF. Indicate and justify those that are required versus those that just serve to enhance accomplishing the mission of the activity. For example, clear air at high altitude that increases quality of atmospheric, ground-based laser experiments in support of the weapons CSF. (BRAC Criteria I)

Because of the hazardous nature of Energetics manufacturing, there are special requirements for an infrastructure with Explosive Safety Quantity Distance arcs separating hardened buildings, large amounts of processing water, and large quantities of steam for curing and processing. Indian Head is uniquely situated on a penninsula. The surrounding water provides a source water for processing and fire protection at no cost.

IHDIV is located on a peninsula. The surrounding water and government owned land, which is restricted to development, provides good isolation. Indian Head has its own power and steam generation capability. There is no developable land adjacent to the Division, and the Code of Federal Regulations gives the Commander complete authority over the adjacent waterway.. This location provides natural isolation. Consequently, there is no threat of encroachment caused by high density residential or industrial development.

3.1.2 **Licenses & permits:** Describe and list the licenses or permits (e.g., environmental, safety, etc.) that your activity currently holds and justify why they are required to allow tests, experiments, or other special capabilities at your location for each CSF. For example, permit to store and use high explosives. (BRAC Criteria I)

- 19-00174-S1NP -- This is a Nuclear Regulatory Commission (NRC) license for Depleted Uranium radioactive material contained in two x-ray machines in our facilities (Buildings 731 and 1140). The license is required to operate the x-ray facilities.

- 19-00174-P1NP -- This is a NRC license for Cesium 137 radioactive material at six sealed sources at Building 873 (Power House). The license is required to operate ash level detectors. The power house provides process steam for Energetics operations at IHDIV and has a cogeneration capability to produce 70% of the station's electrical power requirements.

- Controlled Hazardous Substances Facility Permit for IHDIVNAVSURFWARCEN - Permit Number A-223. This permit allows for the storage of hazardous waste for an extended amount of time and treatment of various hazardous waste streams.

- Oil Operations Permit - Permit Number 94-OP-0666. This permit allows the delivery of oil by truck tank and the operation of numerous above-ground oil storage systems.

- Subpart X Permit Application for IHDIVNAVSURFWARCEN (under interim status). Permit Number MD4170024109. This permit application allows for the thermal treatment of explosives and explosives contaminated waste.

- National Pollution Discharge Elimination System (NPDES) - Permit Number 88-DP-2515A. Permits the discharge of industrial wastewater to surface waters.

- National Pollution Discharge Elimination Systems (NPDES) - Permit Number 93-DP-2528. Permits the discharge of domestic and industrial wastewater to surface waters after treatment at Indian Head's sewage treatment plant.

- Air Emissions Permit to Operate Number 08-00040. Permits the operation of three coal-fired boilers from the Activity's Power Plant and one reactor from the Activity's Biazzi Nitration Plant.

- State Water Appropriation Permits CH71G005, CH71G205, CH71G105, CH92G007, CH92G013, CH71S005, CH91G044. Permits drawing well water and river water used for potable water, cooling water, process water, sanitary facilities and fire protection.

3.1.3 **Environmental constraints:** Describe and list the environmental or land use constraints present at your activity which limit or restrict your current scope for each CSF, i.e., would not allow increased "volume" or "spectrum" for the CSF. Example -- Volume: frequency of a type of experiment. Example -- Spectrum: Current permit to detonate high explosives will not allow detonation or storage of increased quantity of explosives without legal waiver (state law) or relocation of surrounding (non-govt) buildings. (BRAC Criteria II)

- Controlled Hazardous Substances Facility Permit for IHDIVNAVSURFWARCEN - Permit Number A-223. This permit describes the waste types and maximum volumes that can be stored. In addition, the specific hazardous waste treatments are listed. However, changes can be made through permit modifications to include additional waste types, volumes, and treatments.

- Oil Operations Permit - Permit Number 94-OP-0666. This permit lists the above-ground oil storage systems. Additional storage systems can be included with a permit modification.

- Subpart X Permit Application for IHDIVNAVSURFWARCEN (under interim status) - Permit Number MD4170024109. This permit includes the maximum amount of waste that can be treated per event. In addition, operations are restricted during adverse weather conditions such as thunder, lightning, high wind, heavy rain, and fog.

- National Pollution Discharge Elimination Systems (NPDES) - Permit Number 88-DP-2515A. Our current sewage treatment plant is designed to treat 500,000 gallons per day. We currently treat 300,000 gallons per day. We could easily expand our population by 60%, without permit modification. We would only need written notification 180 days before the planned expansion.

- National Pollution Discharge Elimination Systems (NPDES) - Permit Number 93-DP-2528. Our current sewage treatment plant is designed to treat 500,000 gallons per day. We currently treat 300,000 gallons per day. We could easily expand our population by 60%, without permit modification. We would only need written notification 180 days before the planned expansion.

- State Water Appropriation Permits CH71G005, CH71G205, CH71G105, CH92G007, CH92G013, CH71S005, CH91G044. Volume of water which can be withdrawn is limited, however Potable water at both Indian Head and Stump Neck show room for expansion in population and facitlies.

3.1.4 **Special Support Infrastructure:** List and describe the importance of any mission related special support infrastructure (e.g. utilities) present at your location for your activity. (BRAC Criteria I)

With the exception of electricity, IHDIV produces or provides all the Activity's utility needs. Approximately 70% of the Activity's electrical power is generated as a by-product to steam production. The remaining is purchased from a local utility provider.

Steam is produced at the Goddard Power Plant (GPP) and the Steam B Booster Plant. Though steam is used for heating, ventilation and air conditioning throughout the Activity, its principle purpose is to support the development, manufacturing, and testing of energetic materials and components.

IHDIV treats all of its domestic waste water. Naval Surface Warfare Center, Indian Head Division does not have to rely on neighboring municipalities to treat its waste water.

Currently IHDIV treats small quantities of industrial waste water generated by several energetics processing and testing processes. In the First Quarter of Fiscal Year 1995, MILCON P-106 will be brought on-line. This MILCON will connect approximately 50 industrial waste streams to the Waste Water Treatment Plant.

Because of the sensitive nature of the energetic manufacturing processes at the Naval

Surface Warfare Center, Indian Head Division, we provide high pressure and a large volume of river water to serve sprinkler and deluge systems throughout the energetics processing areas. River water is also used for contact and non-contact cooling. This high pressure and large volume of river water assures the continued safety of the energetic manufacturing process.

3.1.5. **Proximity to Mission-Related organizations:** List and describe the importance and impact of not having nearby organizations which facilitate accomplishing or performing your mission -- e.g. operational units, FFRDCs, universities/colleges, other government organizations, and commercial activities. Restrict your response to the top five. Complete the following: (BRAC Criteria I)

Common Support Functions	Name	Type of Organization	Distance	Workyears Performed by Your Activity	Workyears Funded by Your Activity
WEAPONS	Naval Surface Warfare Center, Dahlgren/Carderock Divisions	Laboratory	35-50	19	2
WEAPONS	Naval Sea Systems Command (NAVSEA)	Echelon 2 Command	30	326	0
WEAPONS	Naval Air Systems Command (NAVAIR)	Echelon 2 Command	30	357	0
WEAPONS	Office of Naval Research (ONR)	Echelon 1	30	37	0
WEAPONS	Naval Ordnance Center (NOC)/Naval Explosives Ordnance Technology (ORDED)	Fleet support	0	67	0

Within the Naval Surface Warfare Center a synergism of complimentary expertise exists between surface ship capabilities at Carderock Division, combat systems capabilities at Dahlgren Division and the component-level energetics technology at Indian Head Division. The move of the explosives R & D and underwater warheads from White Oak to IHDIV, coupled with their close physical proximity, has made the Indian Head and Dahlgren Divisions a very powerful warheads and explosives team.

This teaming further strengthens the functional connection to Carderock. The functional integration and close proximity of these three Divisions is key to the successful and cost effective delivery of full spectrum research, development, test and evaluation, engineering and fleet support.

Our location, within 30 miles of Washington DC, makes us readily accessible to our Navy, Army, Marine Corp and non-DoD customers.

Additionally, we fall within the clustering of universities, and private industry which allows close cooperation and creates a synergism of proximity, promoting teamwork, efficiency and transfer of knowledge. Recent examples include a CRADA signed between IHDIV and Talon Manufacturing Company, Inc., Paw Paw, West Virginia, and IHDIV and the University of Maryland, which provide for sharing scientific and technical knowledge, expertise and advice, physical facilities and special instrumentation.

We are co-located with the Navy's Ordnance Command (NOC) and the Tri-service Explosive Ordnance Disposal (EOD) School and EOD Technology Division. The NOC depends on IHDIV, Safety Technical Center for ordnance safety expertise and IHDIV, Ordnance Environmental Support Office for ordnance environmental expertise. Through our development and processing of ordnance and energetics, we have developed a sizable pool of experts in ordnance and energetics safety and environmental matters. We draw upon this expertise to share knowledge within the ordnance community. The NOC is our sponsor for CAD/PAD rework and quality evaluation (surveillance.) With co-location, we have gained efficiencies in exchanging information and developing a shared knowledge base. We support the EOD community via design, development, manufacture, and testing of equipment for low-intensity conflict applications.

Our proximity to the concentration of Navy home ports on the East and Gulf Coasts positions us within easy access to our fleet customers.

3.2 Personnel:

3.2.1 **Total Personnel:** What is the total number of government (military and civilian), on-site federally funded research and development center (FFRDC), and on-site system engineering technical assistance (SETA) personnel engaged in science and technology (S&T), engineering development and in-service engineering activities as of end FY93? For individuals that predominantly work in CSFs, involved in more than one CSF, account for those individuals in the CSF that represents the preponderance of their effort. (BRAC Criteria I)

WEAPONS CSF Only

Types of personnel	Number of Personnel			
	Government		On-Site FFRDC	On-Site SETA
	Civilian	Military		
Technical	**461**	**4**	**0**	**0**
Management (Supv)	**72**	**2**	**0**	**0**
Other	**143**	**1**	**0**	**0**
TOTAL	**676**	**7**	**0**	**0**

NOTE: The BRAC 93 consolidation of the Explosives Research and Underwater Warheads function at IHDIV was implemented on 4/3/94 to consolidate full spectrum life cycle management at one site. Two Hundred seventy civilians were added to our rolls including 202 Technical, 39 Management and 29 Other. These personnel are included above to more accurately show IHDIV's current capability. ***IHDIV has 1244 personnel actively performing the Energetics S&T, Engineering Development, and In-Service Engineering (NOT JUST CSF's).***

3.2.2 **Education:** What is the number of government personnel actively engaged in S&T, engineering development and in-service engineering activities by highest degree and type of position? Provide the data in the following table: (BRAC Criteria I)

WEAPONS CSF Only (*Civilians ONLY. Information unavailable for military.)

Type of Degree/ Diploma	Number of Government Personnel by Type of Position*		
	Technical	Management (Supv)	Other
High School or Less	68	4	105
Associates	15	2	17
Bachelor	278	40	18
Masters	73	20	3
Doctorate (include Med/Vet/etc.)	27	6	0
TOTAL	461	72	143

NOTE: The BRAC 93 consolidation of the Explosives Research and Underwater Warheads function at IHDIV was implemented on 4/3/94 to consolidate full spectrum life cycle management at one site. 270 civilians were added to our roles. These personnel are included above to more accurately show IHDIV's current capability. ***IHDIV has 1244 personnel actively performing the Energetics S&T, Engineering Development, and In-Service Engineering (NOT JUST CSF's) including 33 Doctorates, 95 Masters, and 95 Associates degrees.***

3.2.3 **Experience:** What is the experience level of government personnel? Fill in the number of government personnel in the appropriate boxes of the following table. (BRAC Criteria I)

WEAPONS CSF Only

Type of Position	Years of Government and/or Military Service				
	Less than 3 years	3-10 years	11-15 years	16-20 years	More than 20 years
Technical	13	206	73	28	141
Management (Supv)	0	7	12	14	39
Other	5	50	33	22	33
Total	18	263	118	64	213

NOTE: The BRAC 93 consolidation of the Explosives Research and Underwater Warheads function IHDIV was implemented on 4/3/94 to consolidate full spectrum life cycle management at one site. 270 civilians were added to our roles. These personnel are included above to more accurately show IHDIV's current capability.

3.2.4 **Accomplishments During FY91-93:** For government personnel answer the following questions.

3.2.4.1 How many patents were awarded and patent disclosures (only count disclosures with issued disclosure numbers) were made? (BRAC Criteria I)

CSF	Disclosures	Awarded	Patent Titles (List)
Weapons	1		Round Strand Cutter & Vacuum Chuck
Weapons	1		Miniscale Ballistic Motor Testing
Weapons	1		High Pressure Slab Motor
Weapons	1		Rocket Motor Test Set for Systems
Weapons	1		Corrosion Resistant Reactor
Weapons	1		Nitration of Cyclodextrin
Weapons	1		1,3,4-Oxadiazoles Containing The Pentafluorothio (Sf5) Group
Weapons	1		2-Azido-2,2-Difluoroethanol
Weapons	1		2-Polynitroalky-5-Perfluoroalkyl-1,3,4-Oxa diazoles
Weapons	1		5,7-Dinitro-5,7-Diaza-1,3-Dioxabicyclo(3:3:0)Octan-2-One
Weapons	1		Alternate Methods of Preparation of e and y Polymorphs of Hexanitroisowurzitane
Weapons	1		Binders For Melt Castable Plastic Bonded Explosives
Weapons	1		Booster Explosive Rings
Weapons	1		Complexation Of Cyclodextrin Nitrate With Nitrate Ester Plasticizers
Weapons	1		Concentration Of Isotopic Hydrogen By Temperature Gradient Effect In....
Weapons	1		Detonation Through Solid-State Explosive Fiber Bundle
Weapons	1		Dynamic Compaction Processing System
Weapons	1		Energetic Melt Cast Explosives
Weapons	1		Energetic Polymer

Weapons	1		Flexible Sheet Explosive
Weapons	1		High Density Energetic Materials
Weapons	1		High Energy Plastic Bonded Explosives
Weapons	1		High Melting Aromatic Nitrate Esters
Weapons	1		High-Melting Amino Aromatic Nitrate Esters
Weapons	1		Improved Ammonium Dinitrimide (ADN) Synthesis
Weapons	1		Improved Ammonium Dintramide Synthesis (Confidential)
Weapons	1		Improved Process for N-Chloromethyl Nitramines
Weapons	1		Improved Process for Synthesis of 1,7-Dihydroxy-2,4,6-trinitro-2,4,6-triazahept ane (3ND)
Weapons	1		Improved Thurst Expansion Engine
Weapons	1		Material And Method For Fast Generation Of Hydrogen Gas And Steam
Weapons	1		Method Of Recycling Dosimeters
Weapons	1		Mine Classification System
Weapons	1		Modified Channel Effect For Solid Explosive Detonation Waves
Weapons	1		N,N'-Bis(4,4,4-Trinitrobutyryl)Hydrazine
Weapons	1		Nitration Of Cyclodextrin
Weapons	1		Nitridation of Hafnium
Weapons	1		N-(2-Hydroxyethyl Nitrate)-2,4,6-Trinitrobenzamide
Weapons	1		Pentafluorosulfanylnitramide Salts (U)
Weapons	1		Poly (fluoroalkoxyphosphazene - Cycloaliphatic Nitramine Based Molding Powders
Weapons	1		Process For Preparing Ammonium Dinitramide
Weapons	1		Process For Producing Hydroxy Terminated Nitramines
Weapons	1		Process For Producing N-Chloromethyl Nitramines

Weapons	1		Round Strand Cutter & Vacuum Chuck
Weapons	1		Spiro(N,N'-Dinitroethylenediamino)Cyclotriphosphazenes
Weapons	1		Steady-State, High Dose Neutron Generation & Concentration Apparatus....
Weapons	1		Underwater Turbojet Engine
Weapons		1	2-Polynitroalky-5-Perfluoroalkyl-1,3,4-Oxa diazoles
Weapons		1	An Improved Synthesis of Cyanogen from Glyoxime
Weapons		1	Bis(2-Fluoro-2,2-Dinitroethyl)Carbonate, Pentafluorosulfanylimine
Weapons		1	Bis(2-Nitro-2-Azapropyl)Ether
Weapons		1	Bonding Agent of Composite
Weapons		1	Booster Explosive Rings
Weapons		1	Complexation of Cyclodextrin Nitrate with Nitrate Ester Plasticizers
Weapons		1	Densifying & Stablizing Ingredient
Weapons		1	Electrical Firing Circuit
Weapons		1	Embedded Can Booster
Weapons		1	Energetic Binders For Plastic-Bonded Explosives
Weapons		1	Energetic Plasticizer & Improved Gas Producing Charges
Weapons		1	Fast Shutter Fpr Protection From Electromagnetic Radiation
Weapons		1	Flexible Sheet Explosive
Weapons		1	Hazardous Material Removal Using Strippable Coatings
Weapons		1	High Density Energetic Materials
Weapons		1	High Melting Aromatic Nitrate Esters
Weapons		1	High-Melting Amino Aromatic Nitrate Esters
Weapons		1	Hydroxylammonium Nitrate Process
Weapons		1	Improved Procedure For Chemical Compounds
Weapons		1	Improved Thurst Expansion Engine

Weapons		1	Isotactic Poly(Glycidyl Nitrate) and Synthesis thereof
Weapons		1	Launching Projectiles With Hydrogen Gas Generated From Aluminum Fuel....
Weapons		1	Launching Projectiles With Hydrogen Gas Generated From Titanium-Water...
Weapons		1	Material And Method For Fast Generation Of Hydrogen Gas And Steam
Weapons		1	Melt Cast Thermoplastic Elastomeric Plastic Bonded Explosive
Weapons		1	Method Of Preparation Bis(Dinitropropyl) Formal/Dinitrobutyl .....
Weapons		1	Method of Producing Triaminoguanidine Nitrate
Weapons		1	Method Of Recycling Dosimeters
Weapons		1	Monopropellant Composition
Weapons		1	N,N'-Bis(4,4,4-Trinitrobutyryl)Hydrazine
Weapons		1	N-(2-Hydroxyethyl Nitrate)-2,4,6-Trinitrobenzamide
Weapons		1	Process for Producing Improved Poly(Glycidyl Nitrate)
Weapons		1	Process For Producing N-Chloromethyl Nitramines
Weapons		1	Shaped Charge with Explosively Driven Liquid Follow Through
Weapons		1	Underwater Turbojet Engine
Weapons		1	Warhead Casing
Total	**46**	**37**	

NOTE: The BRAC 93 consolidation of the Explosives Research and Underwater Warheads function at IHDIV effective was implemented effective 4/3/94 to consolidate full spectrum life cycle management at one site. 270 civilians were added to our roles. The table above includes 40 patent disclosures and 30 patent awards from these personnel. This information may appear in the Dahlgren Division, NSWC input for this datacall, but is included here to more accurately describe the current capabilities of IHDIV.

3.2.4.2 How many papers were published in peer reviewed journals? (BRAC Criteria I)

CSF	Number Published	Paper Titles (List)
Weapons	24	See list below
Total	24	

1. "Nitro- and Fluoropolyformals, II Novel Polyformals from a.w-Fluoro-and Nitrodiols," H. Adolph, L. Nock, J. Goldwasser, and R. Farncomb, Journal of Polymer Science, Vol. 29, 719-727, 1991.

2. "Defect Density Measurements in Shocked Single Crystal Ammonium Perchlorate by X-Ray Photoelectron Spectroscopy," B. C. Beard, H. W. Sandusky, B. C. Glancy, and W. L. Elban, Journal of Materials Research 7, 3266 (1992).

3. "Quantitative Correlation of XPS Linewidth with Dislocation Density in Shock Loaded Ammonium Perchlorate," B. C. Beard, H. W. Sandusky, B. C. Glancy, and W. L. Elban, Surface and Interface Analysis 20, 140 (1993).

4. "Polynitroalkyl Derivatives of $SF_5N{=}CCl_2$, Nitrations of SF_5 Imines," M. E. Sitzmann and R. D. Gilardi, J. Fluorine Chem. 63, 203 (1993).

5. "Polynitroaliphatic Explosives Containing the Pentafluorosulfanyl (SF5) Group: The Selection and Study of a Model Compound.", M. E. Sitzmann, W. H. Gilligan, D. L. Ornellas, and J. S. Thrasher, Energetic Mat., 8(4), 352 (1990).

6. "N-Pentafluorosulfanyl-N-Nitro Carbamates", M. E. Sitzmann, J. Fluorine Chem., 52(2), 195 (1991).

7. "The Isolation of a Bi(2,4,6,8-tetraazabicyclo[3.3.0]octane) from the Reaction of Flyoxal with Benzylamine," M. Chaykovsky, W. M. Koppes, T. P. Russell, R. Gilardi, C. George, and J. L. Flippen-Anderson, J. Org. Chem., 1992, 57, 4295-4297

8. "Structure-Reactivity Aspects of Nitroalkyl Acetate Hydroysis," D. E. Gallis, B. J. Acken, J. A. Warchaw, A. L. Richardson, DeL R. Crist, D. Cichra, J. Org. Chem., 55, 1990.

9. "High Bubble Energy Explosive Testing," R. Doherty and D. Cichra, Shock and Vibration Technology Review, Vol. 2, No. 4, July/Aug 1992.

10. "Nitro- and Fluoropolyformal. III. copolyformals from Mixtures of Fluoro- and Nitro a.w.-diols." L. A. Nock, J. M. Goldwasser, and H. G. Adolph, Journal of Polymer Science, Vol. 29, 1133-1149, 1991.

11. "Hydrogen Migrations in a Constrained Cyclohexylidene. H(ax)/H(eq) Shift Ratios in Thermal and Photic Bamford-Stevens Reactions," A.G. Stern, A. Nickon, M. C. Ilao, Tetrahedon, 1993, 49 (36), 8107-8118.

12. "Hydrogen Rearrangements in Carbenes. Inherent Migration Ratios in Thermal and Photic Bamford-Stevens Reactions," A. Nickon, A. G. Stern, M. C. Ilao, Tetrahedon Lett., 1993, 34 (9), 1391-1394.

13. "Syntheses of Brexan-2-one and Ring Expanded Congeners," J. Org. Chem, 1992, 57, 5342-5352.

14. "Hydrogen Trojectories in Alkene to Carbene Rearrangements. Unequal Deuterium Isotope Effects for the Axial and Equatorial Paths," A. Nickon, M.C. Ilao, A. G. Stern, M. F. Summers, J. Am. Chem. Soc., 1992, 114, 9230-9232.

15. "A Convenient Laboratory Synthesis of Cyanogen," R. L. Willer, D. J. Park, A. G. Stern, Synthetic Commun., 1990, 20, 2901-2906.

16. "Polynitroaliphatic Explosives Containing the Pentafluorosulfanyl (SF 5) Group: The Selection and Study of a Model Compound," M. E. Sitzmann, W. H. Gilligan, D. L. Ornellas and J. S. Thrasher, J. Energetic Mat., 8 (4), 352, 1990.

17. "Improved Synthesis of 2,2,2-Trinitroethyl Ethers," M. E. Sitzmann and H. G. Adolph, Synth. Comm., 20 (21), 3303, 1990.

18. "N-Pentafluorosulfanyl-N-Nitro Carbamates," M. E. Sitzmann, J. Fluorine Chem., 52 (2), 195, 1991.

19. "Synthesis and Stability of 2,4,6-Trinitrobenzylamine," M. E. Sitzmann and H. G. Adolph, Heteroatom Chem., 4 (1), 51, 1993.

20. "Polynitroalkyl Derivatives of SF5N=CC12: Nitrations of SF5 Imines," M. E. Sitzmann and R. D. Gilardi, J. Fluorine Chem., 63, 203, 1993.

21. "An Investigation into Propellant Stability," G. Stine, Journal of Analytical Chemistry Volume 63, 1991

22. "Have LC Lab, Will Travel (Testing Propellant Stability After Desert Storm)," G. Stine, Journal of Analytical Chemistry Volume 64, 1992

23. "Concurrent Engineering: The Cost Effective Solution for the Development and Support of Military System and Equipment," K. Grote, Journal of American Society of Naval Engineers (ASNE), July 1993.

24. "Nitro- and Fluoropolyformals, II Novel Polyformals from a.w-Fluoro-and Nitrodiols," H. Adolph, L. Nock, J. Goldwasser, and R. Farncomb, Journal of Polymer Science, Vol. 29, 719-727, 1991.

NOTE: The BRAC 93 consolidation of the Explosives Research and Underwater Warheads function at IHDIV effective was implemented effective 4/3/94 to consolidate full spectrum life cycle management at one site. 270 civilians were added to our roles. The list of papers below includes 20 papers published by these personnel in peer reviewed journals. This information will appear in the Dahlgren Division, NSWC input for this datacall, but is included here to more accurately describe the current capabilities of IHDIV.

3.3 Workload

3.3.1 FY93 Workload

3.3.1.1 **Work Year and Lifecycle:** Identify the number of actual workyears executed for each applicable CSF in FY93 for each of the following: government civilian; military; on-site FFRDCs; and on-site SETAs. (BRAC Criteria I)

"LAB"	Fiscal Year 1993 Actual			
	Civilian	Military	FFRDC	SETA
Science & Technology	22	0	0	0
Engineering Development	83	0	0	0
In-Service Engineering	292	6	0	0

NOTE: IHDIV FY 93 Total Energetics (NOT JUST CSF's) civilian direct workyears were 28 in S&T, 105 in Engineering Development, and 693 In-Service Engineering. The BRAC 93 consolidation of the Explosives Research and Underwater Warheads function at IHDIV was implemented on 4/3/94 to consolidate full spectrum life cycle management at one site. 270 civilians were added to our roles. In FY95 these personnel will perform another 211 direct workyears in Energetics that are not included above.

3.3.1.2 **Engineering Development By ACAT:** For each Common Support Function (e.g. airborne C4I) at each activity engaged in engineering development, provide:

- For each ACAT IC, ID, and II program (as defined in DODI 5000.2):
  - The name of the program
  - A brief program description
- For each ACAT III and IV programs:
  - The number of such programs
  - A list of program names
- For each program not an ACAT I, II, III, IV:
  - The number of such programs
  - A list of program names
- For the purpose of this question, any program between Milestone I and IV and containing demonstration and validation (Dem/Val 6.4)/Engineering and Manufacturing Development (EMD 6.5) funds in the FY95 PBS is considered to be engaged in engineering development (BRAC Criteria I).

Engineering Development	Name or Number	Work-years (FY93 Actual)	FY93 Funds Received (Oblig. Author.)	Narrative
ACAT IC		0	0	
ACAT ID	Standard Missile II Block IV	4	516K	Technical Support for Propulsion Unit/Warhead Development
ACAT II		0	0	
ACAT III/IV		0	0	

Other	**4**	**79**	**15,681K**	**Technical Support for Mine Countermeasures Deployment & Explosive Technologies** **Energetic Material Development for Navy Insensitive Munitions Program** **Energetic Material Process Development for Various Weapons** **Ordnance Environmental Processing Technology Development**

3.3.1.3 **In-Service Engineering:** For each Common Support Function at each activity engaged in in-service engineering, list the in-service engineering efforts, the FY93 funds (from all sources) obligated for these efforts, the FY93 workyears for these efforts, and the weapon system(s) supported by these efforts. In-service engineering consists of all engineering support of fielded and/or out of production systems and includes efforts to improve cost, throughput, and schedule to support customer requirements as well as mods and upgrades for reliability, maintainability, and performance enhancements. (BRAC Criteria I)

Common Support Functions	**In-Service Engineering Efforts (List)**	**FY93 Actual**		**Weapon System(s) Supported**
		Funds Received (Obligation Authority)	**Work years**	
WEAPONS	Propellant characterization and Aging Studies & DEMIL Technical Support	1,123K	11	**ICBMs/SLBMs** Trident

WEAPONS	Propellant/Propulsion Unit Fleet Support, and Technical Support for Production Engineering, Design, Configuration Management, Technical Documentation, Testing, Engineering Investigations, and Logistics	29,566K	170	**MISSILE/RKTS** Standard Missile Sidewinder Harpoon/SLAM Sparrow Phoenix Penguin AMRAAM Maverick HARM Hellfire 2.75" Rkt 5" Rkt MK22 Line Throwing RKT for MICLIC **CRUISE MISSILES** Tomahawk **GUN AMMO** 20mm to 16" Navy Gun Ammo Army 105mm Tank Round

WEAPONS	Explosive/Warhead Process Development, Fleet Support, and Technical Support for Production Engineering, Design, Configuration Management, Technical Documentation, Engineering Investigations, and Testing	5,370K	25	**MISSILE/RKTS** Standard Missile Sidewinder Harpoon/SLAM Sparrow Phoenix Penguin AMRAAM Maverick HARM Hellfire TOW 2.75" Rkt 5" Rkt Patriot LAW SMAW **CRUISE MISSILES** Tomahawk **BOMBS** MK 80 Series Bombs GBU-24 BLU-110, 111 **GUN AMMO** 20mm to 16" Navy Gun Ammo

WEAPONS	Explosive and Propellant QE/Surveillance	1,864K	13	**MISSILES/RKTS** Navy Air Launched Missiles Standard Missile 2.75" Rocket **CRUISE MISSILES** Tomahawk **GUN AMMO** 20mm to 16" Navy Gun Ammo Marine Corps Gun Ammo
WEAPONS	Tactical Nuclear Weapons Support	2,946K	43	Navy Tactical Nuclear Weapons
WEAPONS	Other Support	5,456K	30	All Navy Ordnance
TOTAL		$46,325K	292	

NOTE: ***IHDIV has 693 workyears of Energetics In-Service Engineering Work (NOT JUST CSF's).***

3.3.2 Projected Funding

3.3.2.1 **Direct Funding:** For each applicable CSF, identify direct mission funding by appropriation from FY94 to FY97. Use FY95 PBS for FY95-FY97. (BRAC Criteria I)

FUNDING ($K)

CSF	FY94	FY95	FY96	FY97
WEAPONS				
RDT	26,987	43,232	41,482	36,729
WPN	11,914	10,596	8,326	7,588
O&MN	13,949	13,452	13,374	13,250
OPN	396	309	281	261
SCN	312	312	306	320
DBOF	4,627	4,429	2,854	2,489
Other Navy	60	100	100	60
Other Army	2,497	1,686	1,219	1,242
Other AF	456	408	359	360
Private Parties	130	212	195	212
Other Govt.	87	300	300	300
FMS	4,004	3,364	3,219	3,223
TOTAL	65,419	78,400	72,015	66,034

3.3.2.2 **Other Obligation Authority:** For each applicable CSF, identify reimbursable and direct-cite funding (other obligation authority expected) from FY94 to FY97. Funding allocation must be traceable to FY95 PBS. (BRAC Criteria I)

FUNDING ($K)

CSF	FY94	FY95	FY96	FY97
WEAPONS	0	0	0	0

3.4 Facilities and Equipment

3.4.1 **Major Equipment and Facilities:** Describe major facilities and equipment necessary to support each Common Support Function (include SCIFs). If the facilities and equipment are shared with other functions, identify those functions and the percentage of total time used by each of the functions. Provide labeled photographs that picture the breadth and scope of the equipment and facilities described. If it is unique to DOD, to the Federal Government, or to the US, describe why it is unique. Insert the replacement cost. For this exercise, Replacement cost = (Initial cost + capital investment) multiplied by the inflation factor for the original year of construction. (BRAC Criteria II)

Common Support Function	Major Facility or Equipment Description	Unique To			Replacement Cost* ($K)
		DOD	Federal Gov't	U. S.	
Weapons	Energetics Material Research Laboratory			X	24,000
	Weapons Product Development			X	148,000
	Nitramine Gun and High Energy Propellant Facility			X	90,000
	Chemicals Processing		X		97,000
	Composite Propellant/PBX Processing				130,000
	Extruded Energetics Products Facility		X		85,000
	Ordnance Test and Evaluation Facility		X		45,000
	Chemical/Physical Characterization				28,000

* Replacement cost has been computed to be consistent with the BRAC 95 Military Value Data Call #5.

MAJOR FACILITY DESCRIPTIONS:

Technical Center Site	Indian Head Division, NSWC
Facility/Equipment Nomenclature or Title	Energetic Materials Research Laboratory

The energetic material research laboratory consists of the following facilities:

Energetic materials formulation and characterization laboratories
Energetic chemicals synthesis laboratory
Energetic chemicals pilot plant
Explosive/propellant aging facilities
Explosive storage magazines

The Energetic Materials Research Laboratory at Indian Head is unique within DOD because of the breadth of capability which it provides. This one facility supports not only laboratory scale functions (synthesis of new materials, formulation of new explosives or propellants, and characterization of these materials) but also provides the ability to develop the scale up these new materials so that they can be evaluated for weapon system application.

The Indian Head Division provides for the Navy (and DOD) **the only capability, at one location, to synthesize, formulate, and scale up for development any type of chemical, propellant, explosive, or pyrotechnic which may be required for weapons applications.** The complex of facilities and equipment provided by the Energetic Materials Research Laboratory is utilized today for R&D projects for new chemicals and formulations, environmental processes, and characterization studies.

Development of new formulations, improvements in the synthesis techniques for new chemical ingredients, and the characterization of the products are conducted in the laboratory facilities at the milligram to the gram scale using state-of-the-art instrumentation. Several laboratory buildings are used for this purpose, with each building being further divided into numerous individual laboratories. These facilities are also heavily used for programs to determine the aging characteristics of propellants and explosives in order to predict the safe life of units loaded with the materials and any

changes in performance as a function of age. Typical programs which are supported here include formulation of new insensitive, minimum smoke propellants for missile application (Navy 6.2), the Navy's Insensitive Munitions Advanced Development program, and characterization studies for weapon systems such as Trident, Harpoon, Standard Missile, Penguin, and a variety of aircrew escape propulsion units. A new effort now beginning is to develop a replacement propellant for torpedo application which will be cleaner burning. The characterization capability provided by this facility is also extensively used to resolve problems which arise during the production of propellants and explosives, both at Indian Head and at other facilities. Modern composite propellants and explosives are very sensitive to minor changes in the properties of the raw materials, and a sophisticated capability to evaluate the chemical and physical properties of the raw materials as well as their interaction in the final product is essential to maintaining a quality product.

The **chemicals pilot plant facility** is used to provide increased quantities of new energetic chemicals and to prove out the synthesis methods developed in the laboratory. This work may begin with the synthesis of a few grams using glassware and can be scaled up through a variety of equipment as large as 1000 gallon glass lined reactors. Programs supported by this capability include the Navy's 6.1 materials and 6.2 explosive and propulsion efforts as well as sponsors in the other services. Materials such as ADN, CDN; and TNAZ are being synthesized here.

The combined cost to replace the facilities and equipment is $24M.

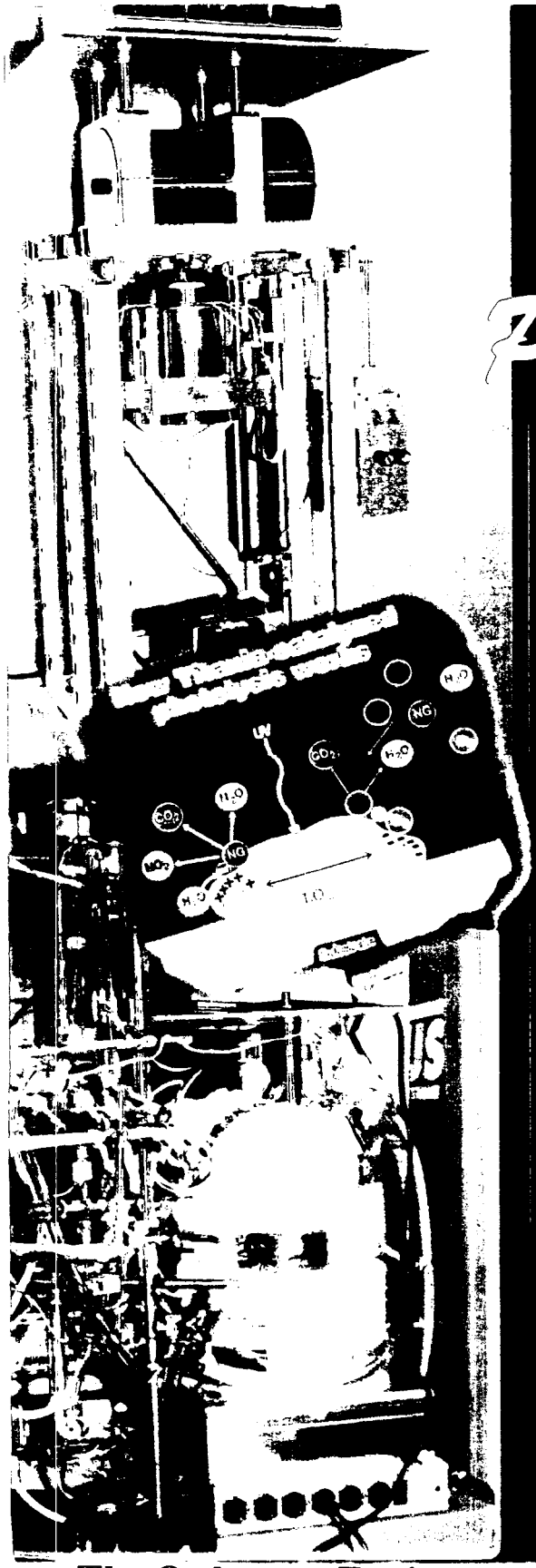
Some portions of the energetic materials research capability provided by the facility and people at Indian Head are available from other DOD or private sector sources. Facilities such as the U. S. Army Armaments Research Development and Engineering Center at Picatinny Arsenal, NJ, the NAWC Weapons Division, China Lake, CA, and two of the DOE facilities have laboratory capabilities for the synthesis of new materials, formulation of propellants and explosives, and characterization of these materials. However, we believe only IHDIV has the capability to continue the synthesis beyond the laboratory scale. Several private sector firms also have laboratory capabilities similar to the government laboratories discussed above. As with the government labs, the capability for scaling up the new materials is very limited. Only Indian Head, by providing the ability to begin with the synthesis and characterization of a new energetic molecule and continue its development through pilot scale manufacture, ensures that the

Navy and DOD will have the capability to provide itself with any needed energetic material in the future.

Separation of the energetic materials R&D capability from an active production facility and from the design agent/in-service engineering functions for these materials would result in a loss for all three functions. The R&D group would lose the experience gained from being involved in the transition of new materials developed in the laboratory as they are scaled up for processing in a production type facility. This interaction helps to ensure a smoother transition. The scale up of materials developed in an isolated laboratory environment frequently suffers because techniques which are feasible on a small scale can have serious problems on a larger scale. The production and engineering functions would suffer because the basic knowledge of the R&D group would not be available to help solve problems which occur in the production of the very complex propellants and explosives now required for modern weapon systems or in determining the causes of failures which may occur during fleet use. The impact of this loss would be felt in virtually all weapon systems in use by the fleet, including surface and air launched missiles (both warheads and propulsion), gun ammunition (projectiles and propelling charges), bombs, torpedos (warheads and propulsion), mines, mine countermeasures (deployment systems and explosive charges), aircrew escape systems, stores separation charges, and transfer systems.

One of the BRAC 93 decisions was to transfer the Navy's principal RDT&E capability for explosives, explosive components, and warheads technology from the White Oak site of the Dahlgen Division of NSWC to the Indian Head Division. Effective 3 April 1994, this transfer was completed organizationally, and over the next 2-3 years the physical move will be completed; the initial movement of people is in fact beginning this year. In order to make maximum use of existing facilities, minimize the costs of the move, and to achieve maximum benefit from the merger of the two groups, Indian Head's existing R&D facilities and people discussed in this section have been organizationally combined with the energetics group transferred from White Oak. These same Indian Head facilities will form the base for all of the RDT&E work to be done by the combined group. As the people, with their equipment move from White Oak to Indian Head, the types of work supported by this facility will expand considerably. The effort on synthesis of new energetic materials and the formulation and testing of new explosive formulations will be considerably larger than today. Work which will represent an expansion of capability will include concept and proof-of-principle studies of new warhead designs, development of detonators and initiation trains, and the modeling and simulation of explosives and warheads using advanced mathematical techniques. The detonation physics studies will require the construction of an experimental facility with a series of bombproof chambers for the conduct of highly instrumented, controlled detonation experiments on new explosives and warhead concepts. The work done by this group is primarily for Navy R&D programs, such as

the 6.2 Explosives and Underwater Warheads, 6.2 Mine Countermeasures, and 6.3B Insensitive Munitions Advanced Development projects. Considerable work is also done for other Navy development programs and for the other services.



Photocatalytic

Treatment of Air Contaminated with Explosives

Indian Head engineers are working with Florida Solar Energy Center scientists to develop a photocatalytic oxidation process to treat air streams contaminated with nitroglycerine and solvents.

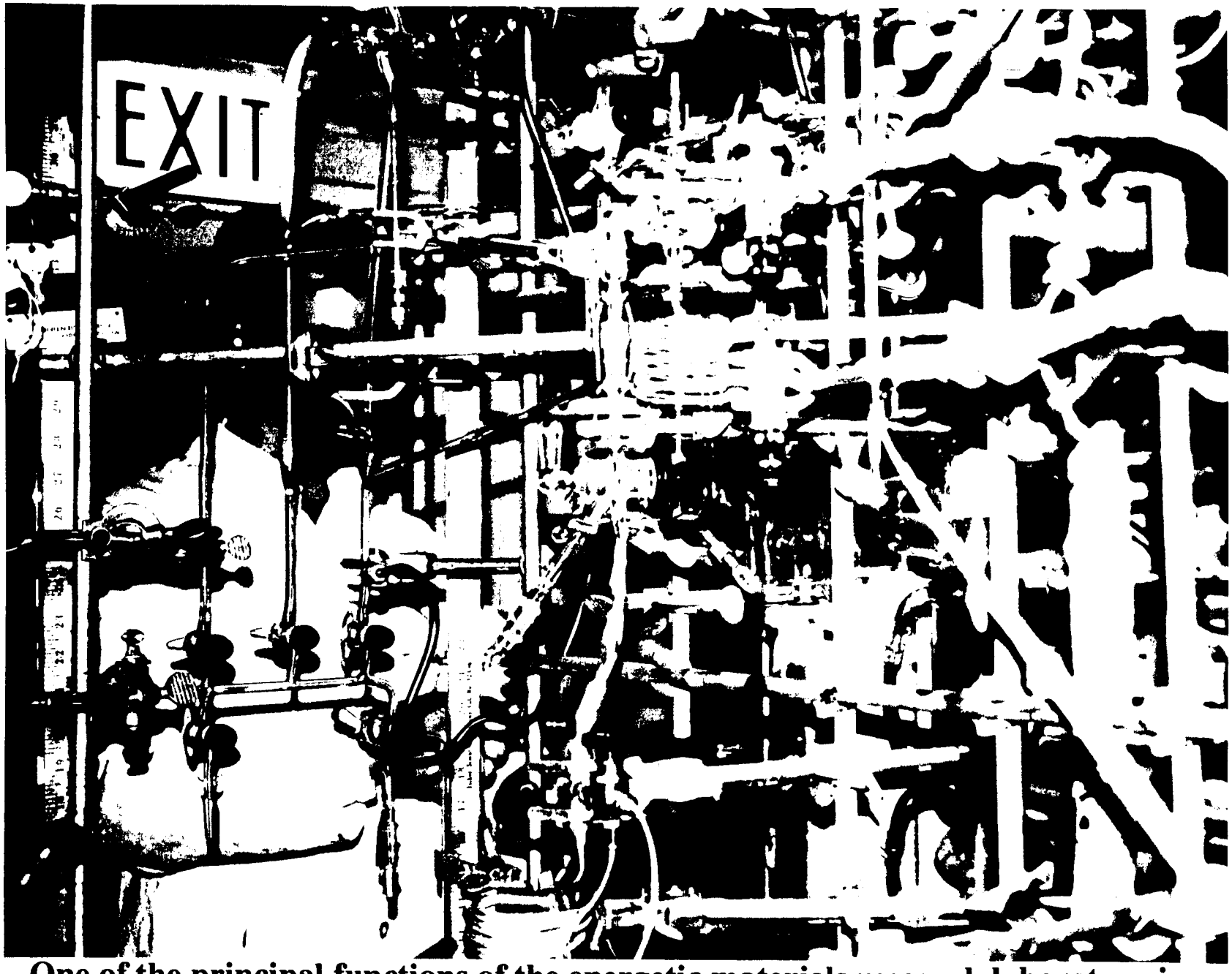
The photocatalytic process uses ultraviolet light and a titanium dioxide catalyst to convert 99%+ of the contaminants into environmentally benign compounds.

The process has been successfully demonstrated on the bench scale and is currently being scaled up to the pilot scale. The ultimate goal is the full scale implementation of the process at a DoD facility to demonstrate the technology for wide-spread application.

The bench scale and pilot scale units will be used for future feasibility studies on other candidate DoD air streams.

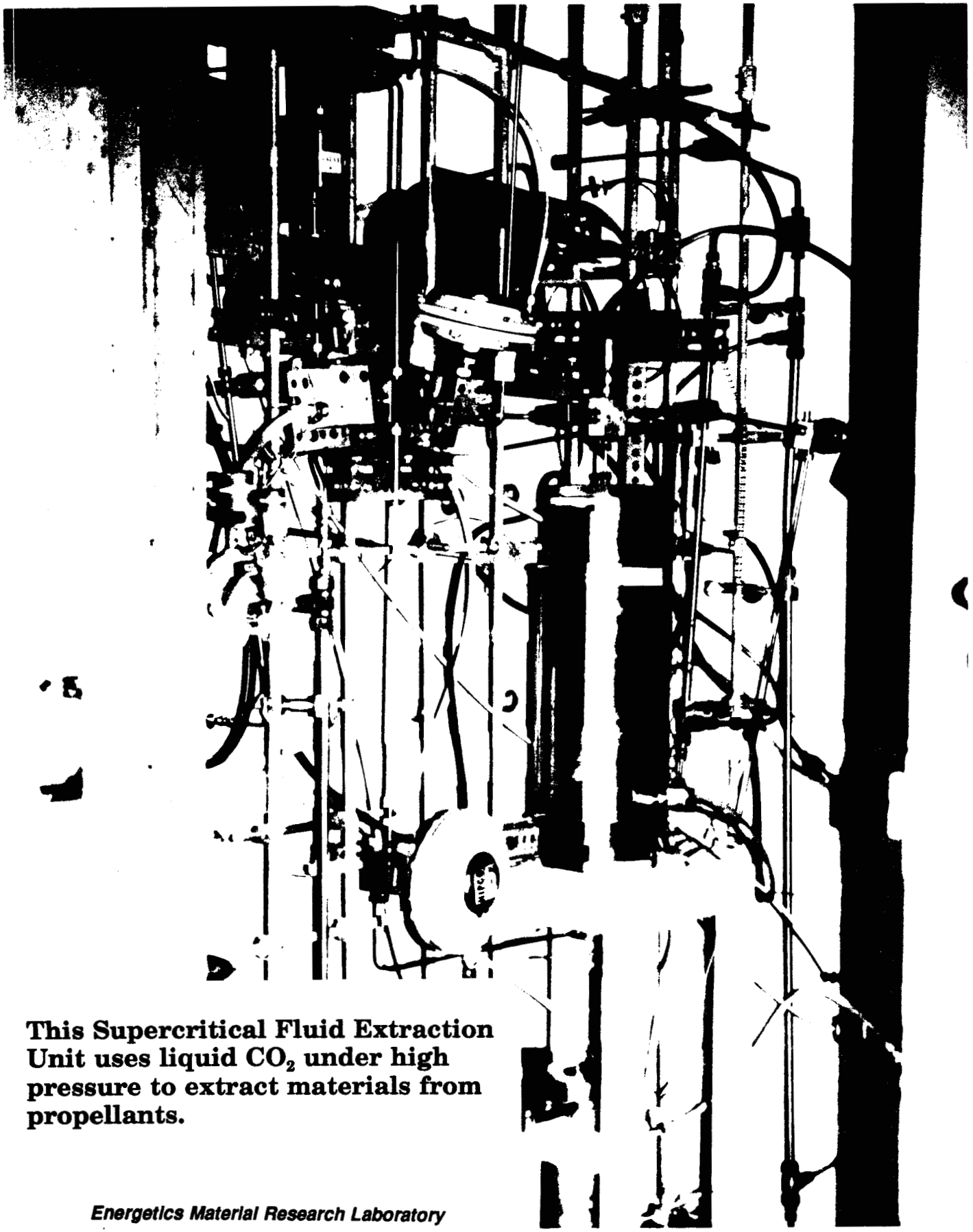
The Ordnance Environmental Support Office (OESO) is responsible for the evaluation and coordination of environmental technology proposals, determination of critical technology, maintenance of ordnance environmental database, and recommendations for Navy policies and procedures for environmental compliance.

Energetics Materials Research Laboratory



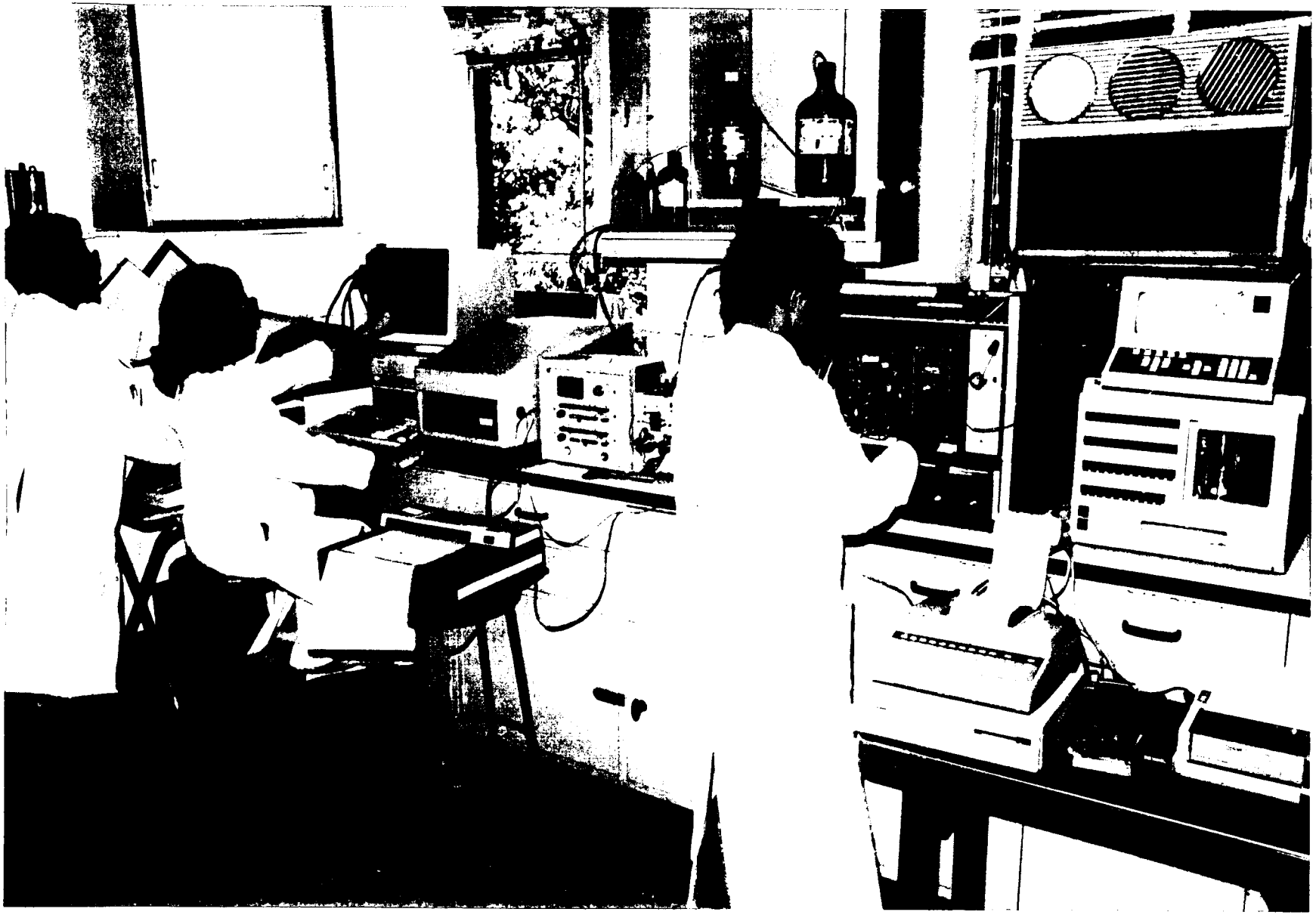
One of the principal functions of the energetic materials research laboratory is to develop and scale up the synthesis of new materials. The first step in this process is the use of laboratory glassware, shown here arranged for a multi-step synthesis procedure.

Energetics Materials Research Laboratory



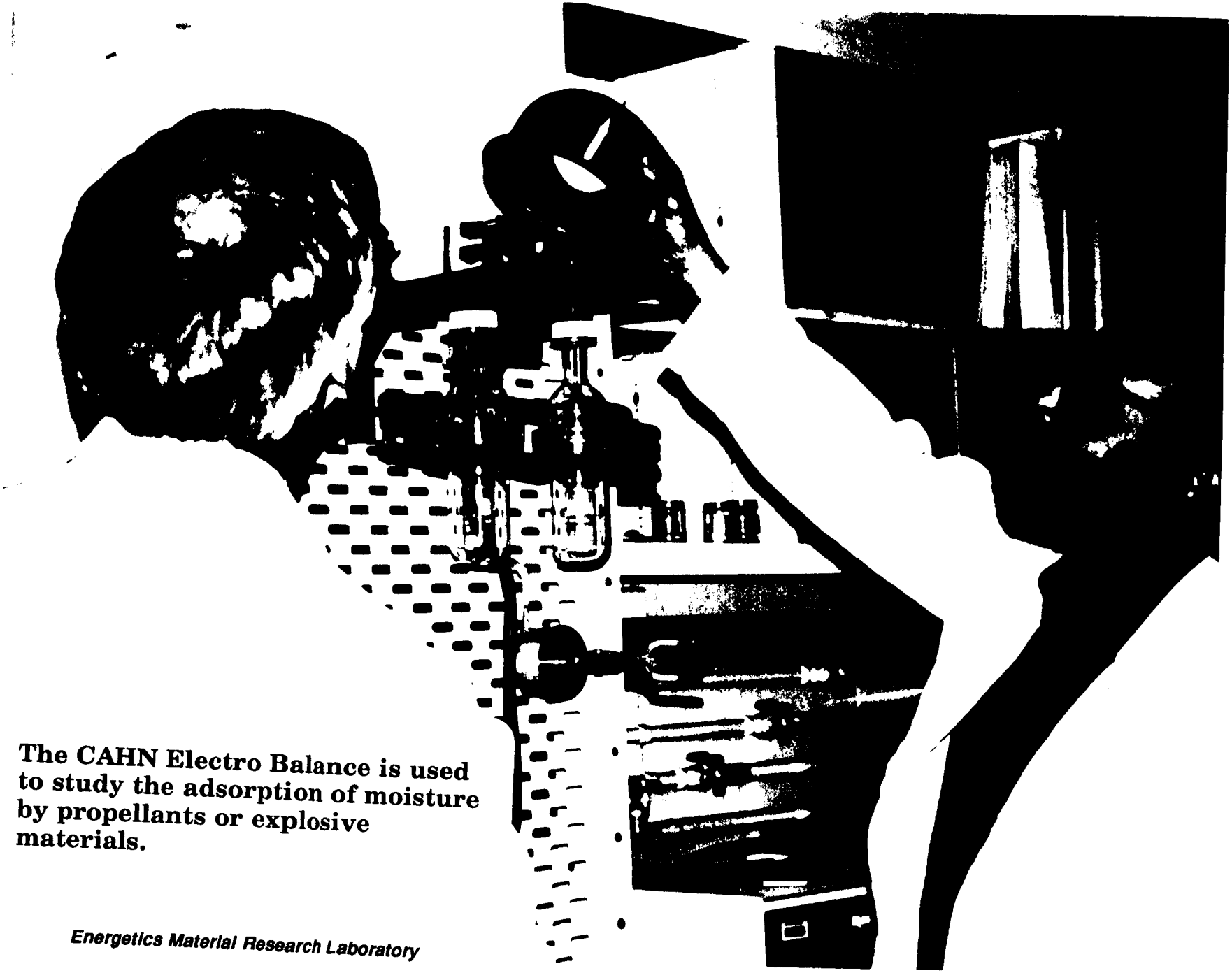
This Supercritical Fluid Extraction Unit uses liquid CO_2 under high pressure to extract materials from propellants.

Energetics Material Research Laboratory



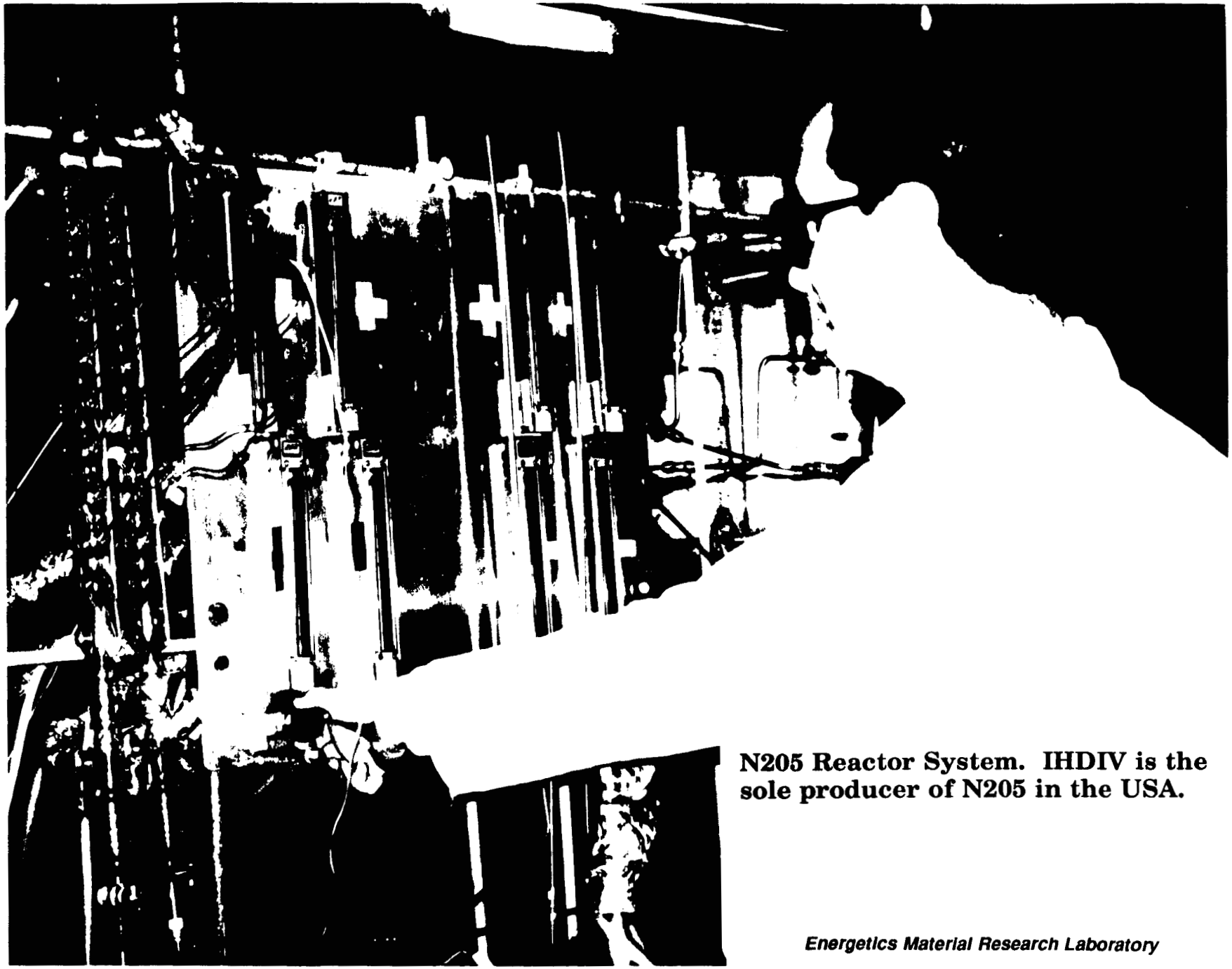
High Performance Liquid Chromatography. Instrumented equipment for rapid analysis of organic liquids.

Energetics Materials Research Laboratory

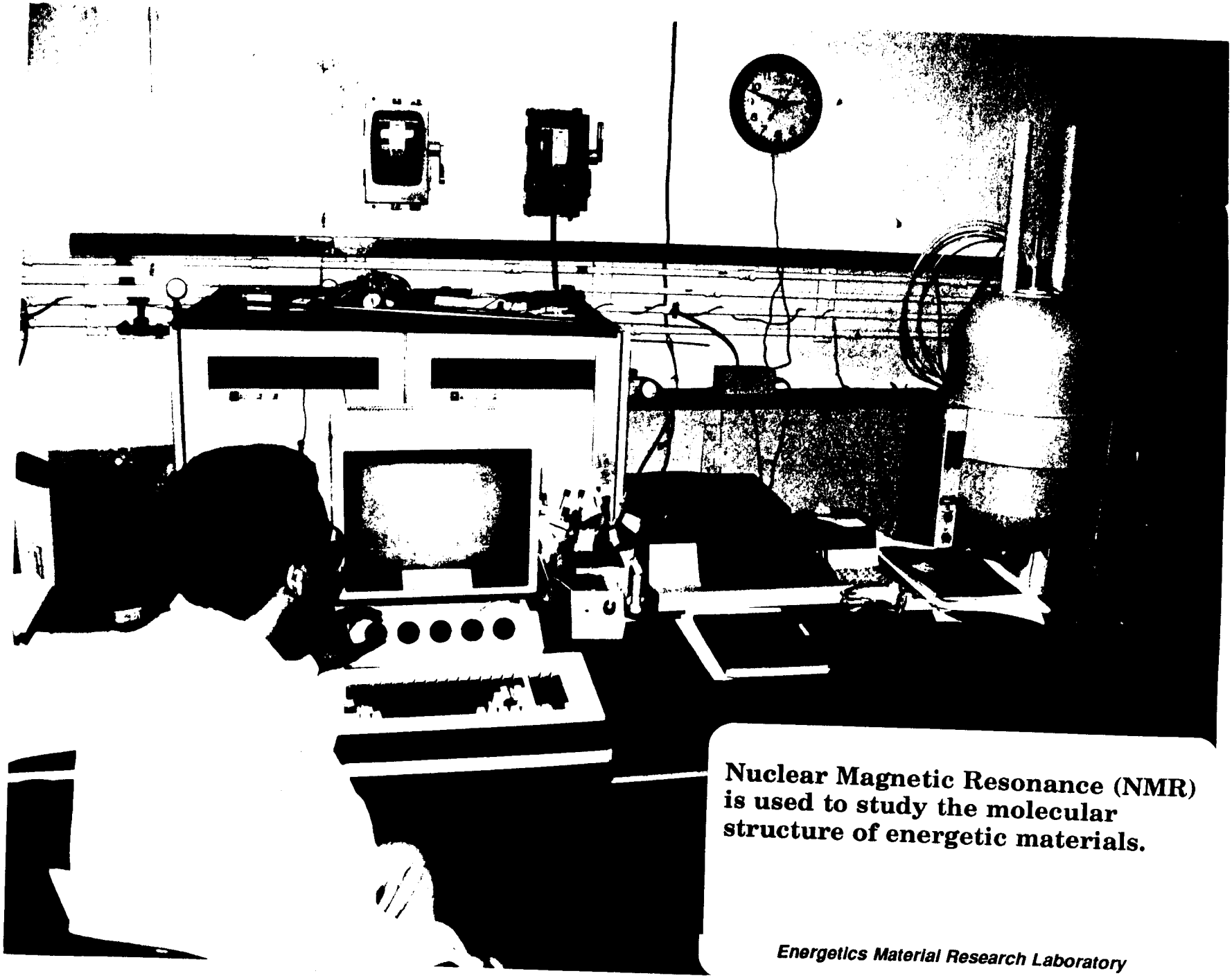


The CAHN Electro Balance is used to study the adsorption of moisture by propellants or explosive materials.

Energetics Material Research Laboratory



N205 Reactor System. IHDIV is the sole producer of N205 in the USA.

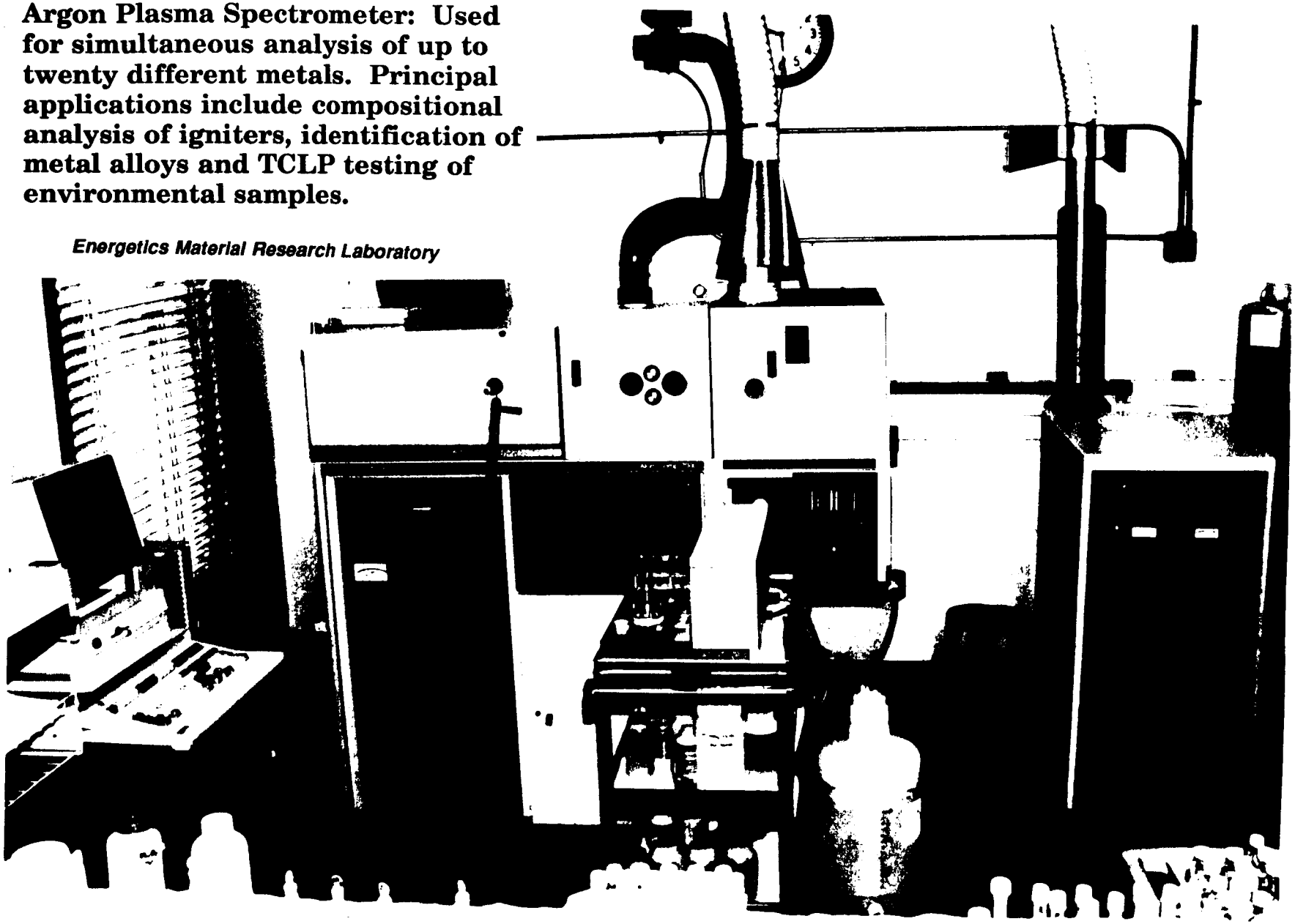


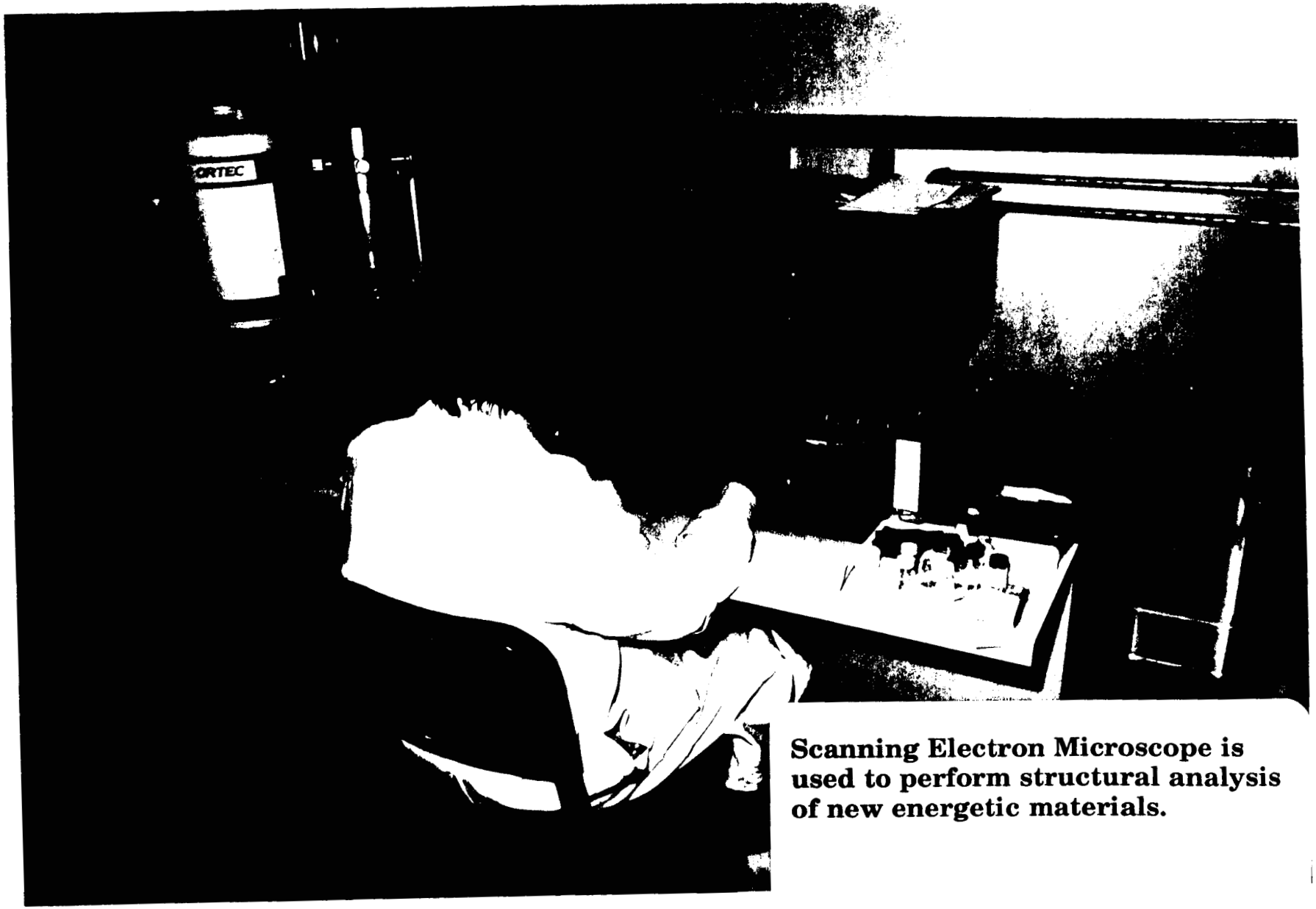
Nuclear Magnetic Resonance (NMR) is used to study the molecular structure of energetic materials.

Energetics Material Research Laboratory

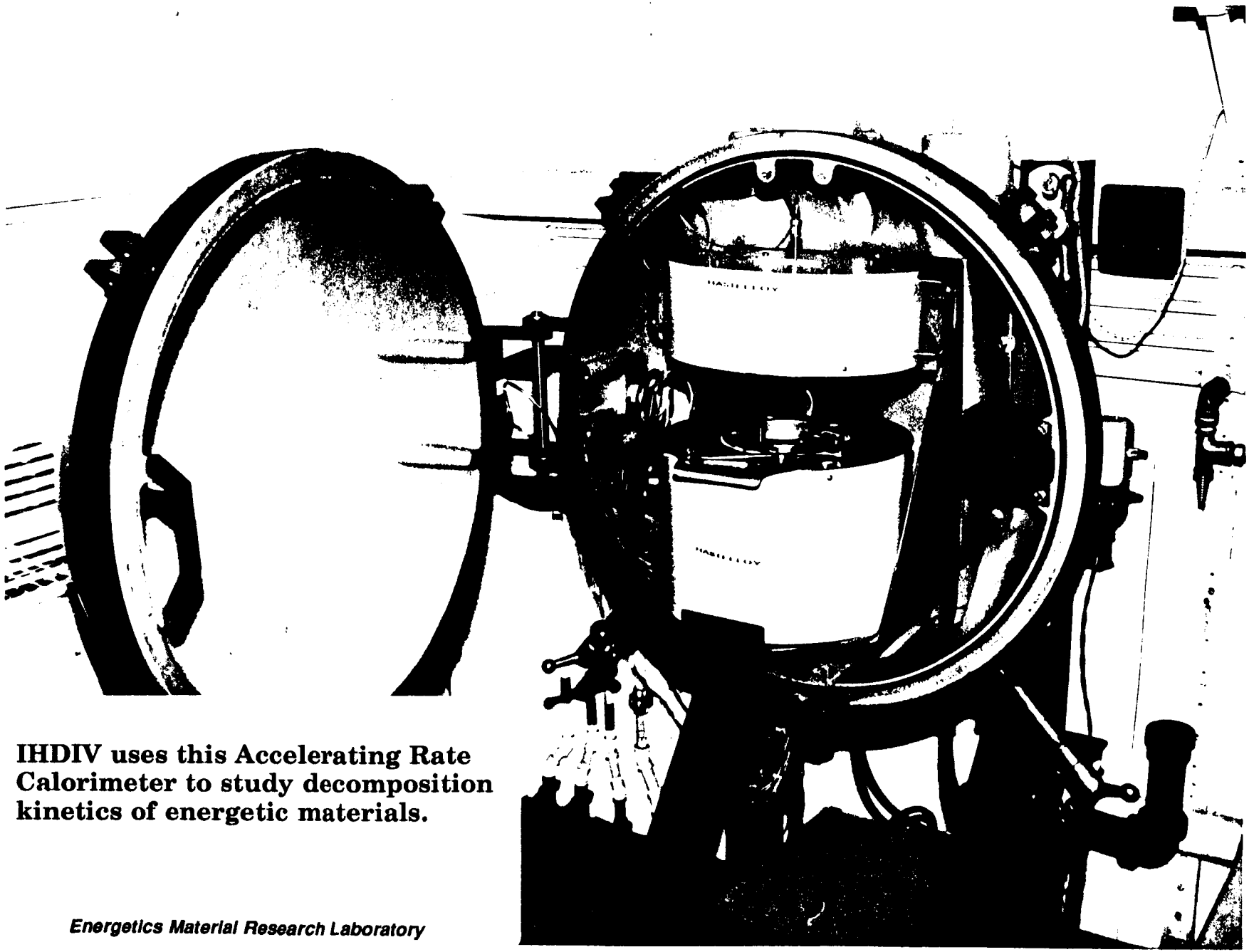
Argon Plasma Spectrometer: Used for simultaneous analysis of up to twenty different metals. Principal applications include compositional analysis of igniters, identification of metal alloys and TCLP testing of environmental samples.

Energetics Material Research Laboratory





Scanning Electron Microscope is used to perform structural analysis of new energetic materials.

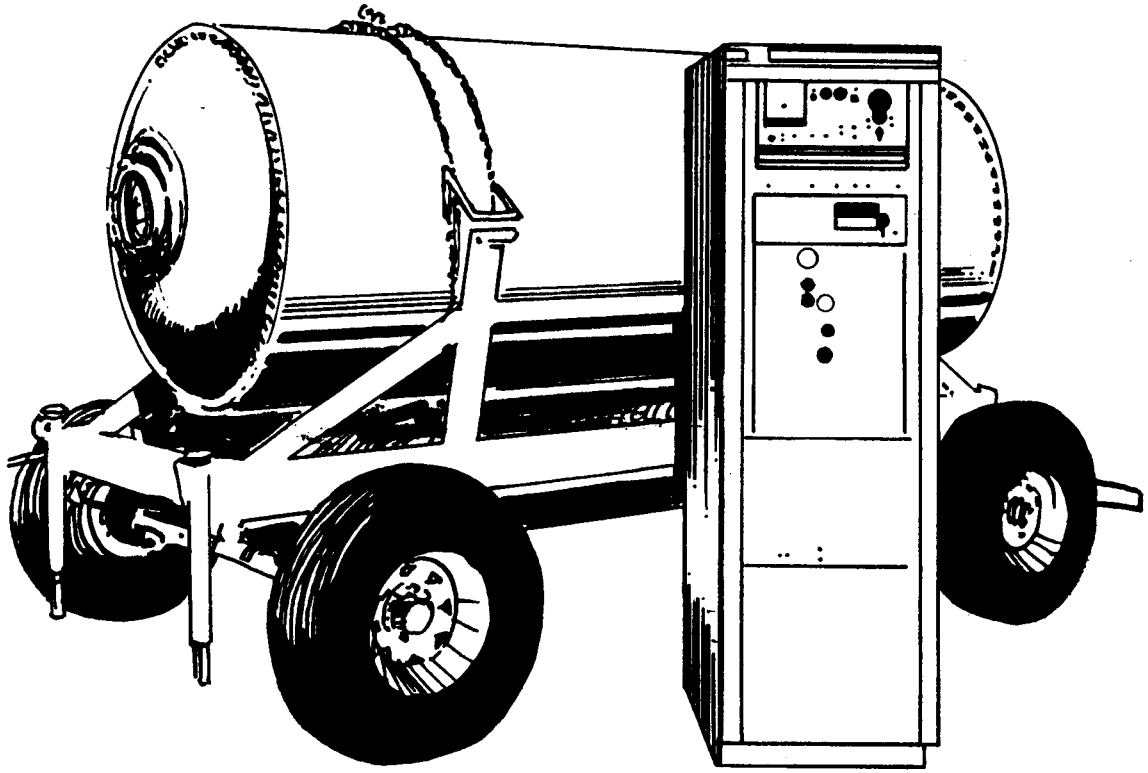


IHDIV uses this Accelerating Rate Calorimeter to study decomposition kinetics of energetic materials.

Energetics Material Research Laboratory

Using test methods designed at IHDIV, compatibility and thermal studies are performed on propellant and explosives formulations.

Energetics Material Research Laboratory



2.3 MeV X-Ray System

Technical Center Site	Indian Head Division, NSWC
Facility/Equipment Nomenclature or Title	Weapons Product Development

The weapons product development capability at Indian Head is devoted to the development of energetic materials (propellants, explosives, and pyrotechnics) and the units into which they are loaded (rocket motors, JATOS, gun propelling charges, igniters, and warheads). The functions performed in these areas include development, design engineering, modeling and analysis, fleet support engineering, and production support. The facilities which support this capability consist of the following major areas:

Composite propellant and explosives facility
Gun/solvent propellant facility
Solventless double base facility
Melt Cast Explosive Mixing/Casting Facility
Explosives Press Loading Facility
Pyrotechnic materials facility
Continuous processing facility
Rocket motor case braiding facility
Rocket motor/warhead process development facility
Explosive/propellant curing facilities
Explosive storage magazines
Engineering analysis and design facility

The facilities include substantial office space to house the engineers and technicians involved in the design and engineering work on the weapons products themselves.

This complex of facilities and equipment provides the Navy's (and DOD's) only capability, at one location, for:

* the development and scale-up of any type of propellant, explosive, or pyrotechnic which may be required for weapons applications;

* the development of new processes and techniques for the manufacture of any type of propellants, explosives, and pyrotechnics;

* the development of processes for the loading of new rocket motors, warheads, and igniters.

Composite Propellant and Explosives Facility

Development of new composite explosives and propellants is conducted using a series of vertical mixers which range in size from one pint to 150 gallons. Once the basic sensitivity and stability characteristics of new formulations have been established in the laboratory, they are transitioned into this series of mixers for scale up and process development. It is here that the formulation is optimized, the process is modified as necessary to achieve desired properties, and the samples prepared for performance and survivability testing. A variety of support equipment necessary to provide any required particle size of oxidizer or fuel, to cast samples, and to prepare them for test are also available. Several multi-purpose, multi-cell buildings are necessary to support all these functions. This facility is used in the development of propellants and explosives for use in aircrew escape propulsion (AEPS) units, Jet Assisted Takeoff (JATO) propulsion units (MK 128), unguided rockets (2.75"), torpedo warheads (MK 122), missile warheads (MK 125), mine counter-measure explosive devices and propulsion units (DEMNS).

The facility also includes a PBX continuous mixer and PBX injection loader developed under the IMAD program. The former uses a Programmable Logic Controlled (PLC) twin screw extruder and loss-in-weight feeders to mix and load the PBX. This process yields less waste than does conventional batch mixing, and is inherently safer because less material is processed at any one time. It can also achieve much higher production rates at a lower capital investment than with batch processing. The injection loader is used to load highly viscous PBX explosives into submunitions such as JSOW and Tomahawk, and detonation cords for Surf Zone. Currently submunitions are primarily loaded with melt cast explosives which do not meet vulnerability requirements. The injection loading process allows us to load the less vulnerable PBX explosives into these submunitions. In addition to these safety improvements, it can greatly improve the explosive load quality and production rate versus conventional casting methods.

The larger mixers are primarily used to develop explosive loading processes for new munitions loaded with PBX explosives. A list of munitions recently, currently, or soon to be developed or improved by the Yorktown Detachment are: Standard Missile,

Penguin, Surf Zone, Tomahawk, SLAM, 5"/54 gun ammunition, 76 mm gun ammunition, Penetrator Bomb, HARM, Deformable Warhead, ESSM and JSOW. We use data collected from these explosive loadings to prepare the Navy Munitions Data (NMD) specification that provides the requirements for production explosive loading of ordnance. The NMD governs in-house and contractor production. During production, this facility is used to conduct studies to help resolve production problems for munitions such as AMRAAM, HARM, Tomahawk, G.P. Bombs, Penetrator Bomb, Standard Missile, Penguin, gun ammunition, MK 50 Torpedo, and other programs.

Mixer, 150 Gallon APV Advanced Vertical Planetary (AVM): This mixer is now being installed in Bldg 1122 to replace the 150 Gallon Baker Perkins Planetary Mixer located at Building 854 which is nearing the end of its useful service life. **This mixer, the only one of its kind in the country**, has a great range of operating parameters available to the operators and engineers. The mixing time will be one-quarter of the present time in current vertical mixers, and the **products made will be the most accurately formulated in the ordnance industry.** It will be used to mix plastic bonded explosives and composite propellants for programs such as the aircrew escape propulsion units, the Navy Insensitive Munitions Advanced Development Program, and other developmental programs. The explosives and propellants can only be made in this type of equipment due to the high viscosity of the materials being mixed. The mixer cost $1,100,000.

The facility also contains a high pressure water washout system that is operated from two remote control sites, one (building 459) close by for smaller items and another (building 1782) for larger items. The washout system uses pressurized water and specially designed nozzles to cut the explosive from the munition. The facility is used to develop explosive downloading procedures for new munitions, particularly those loaded with PBX explosives. Downloading procedures are required for all new munitions for life cycle management. These procedures are documented in the Navy Munitions Data specifications as an appendix. This facility is also used for downloading rejected explosive loaded production hardware so that the hardware may be reused. The facility is essential for life cycle management of new munitions and has been used to develop demil procedures for AMRAAM, Maverick, Bombs, Tomahawk, gun ammunition, HARM, Standard Missile, MK 50 Torpedo, Penguin, and other programs.

Process development and scale up of most of the explosive formulations developed in the Navy's 6.2 Explosives and Underwater Warheads, and Insensitive Munitions Advanced Development (IMAD) programs are conducted in this facility. It is also used to resolve processing problems which occur both at Indian Head and at private

contractors in the production of warheads and rocket motors. With the variety of equipment available and the technical expertise in the properties of composite propellants and explosives, quick process variables studies are completed to provide solutions to processing or materials variables related problems.

Melt Cast Explosive Mixing/Casting Facility

The main purposes of this facility are to develop mixing and loading processes for new melt cast explosives and to explosive load special test charges with melt cast explosives. It houses several melt kettles from lab size to a 3,000 lb. kettle which are used to scale-up new explosive formulations to ensure that they can be produced safely and efficiently. For example, this facility will be used to scale-up a new melt cast thermoplastic explosive (TPX) for the IMAD program that is a candidate explosive for the Joint Direct Attack Munition (JDAM) program. The larger mixers are used to develop explosive loading processes for new munitions loaded with melt cast explosives. Two of these mixers are connected to vacuum chambers required for high quality loading munitions such as penetrating warheads. We use data collected from such explosive loadings to prepare the Navy Munitions Data (NMD) specification that provides the requirements for production explosive loading of ordnance. The NMD governs in-house and contractor production. During production, this facility is used to conduct studies to help resolve production problems for munitions such as Harpoon, SUS and G. P. Bombs.

The facility is also used to produce special test charges such as special Shock Test Charges and fragmentation block charges. The former are used for testing ship hull designs and the latter for evaluating and qualifying new munitions. These are special charges required in such limited quantities that private industry has not been interested in producing them. Our facility provides the Navy a source for such items where responsiveness, quantity or uniqueness make industry production impractical. Finally, this facility is used to dry coated explosive materials used to make PBX explosives.

The current replacement cost of the facility is approximately $5,035K. This is the replacement cost of the building and ancillary equipment only and does not include the cost of procurement and installation of the processing equipment.

Explosives Press Loading Facility

The primary purpose of this facility is to develop explosive pressing processes for new booster and main charge explosives and munitions. The facility was specifically designed for this purpose. The main facility contains a specially designed blast wall so that personnel are protected without having to retreat to a remote site. This makes our pressing operations very efficient. Many presses are contained in this facility including hand presses, 10 ton to 2000 ton presses, an extrusion press, and automated presses. The facility also houses preheat ovens and blenders. The 2000 ton press, one of the largest in the country, is operated remotely from building 539.

This facility is essential to ensuring that explosive processes involving pressed explosives are safe and effective prior to transitioning to production. The presses are used to evaluate the pressing properties of new pressed explosives and to evaluate proposed composition changes to existing explosive formulations for the IMAD program. The presses are also used to develop explosive loading processes for new munitions loaded with pressed explosives. A list of munitions recently, currently, or soon to be developed or improved by the Yorktown Detachment are: 5"/54 gun ammunition, 76 mm gun ammunition, SABRE boosters, MK 23/24 Cutter, Predator and LAW. We use data collected from these explosive loadings to prepare the Navy Munitions Data (NMD) specification that provides the requirements for production explosive loading of ordnance. The NMD governs in-house and contractor production. Also, this facility is used to conduct loading studies aimed at resolving production problems. Some of the equipment is typical of production equipment and well suited for this purpose.

Gun/Solvent Propellant Facility

This facility for the development of gun and other solvent processed propellants represents the only capability in the country to scale up from the laboratory to near production scale those highly viscous propellants which must be processed in a horizontal mixer using solvents, extruded into the desired shape, and then granulated. At the present time, such propellants are typically used for gun system applications. This facility has been used for the development of all of the highly loaded nitramine gun propellants (LOVA) since the mid-1970's by both the Navy and Army. One of these propellants, M43, is in production for the Army's M900 tank round. Variants of this propellant are now being developed and scaled up in this facility for use in the Navy's Advanced Gun Weapon System and Electrothermal chemical (ETC) gun programs as well as the Army's future 120 MM tank gun ammunition.

Solventless Double Base Facility

Solventless processed double base propellants are still widely used in many rocket, JATO, aircrew escape, and mine countermeasure units. Except for the production capability at Radford Army Ammunition Plant, this facility represents the only active capability to process solventless double base propellants remaining in the country; it is the only developmental capability remaining. Included in this capability are the rolling mills for the processing of the propellant and pilot scale extrusion presses for forming it into the required shapes. Recent successes here include the development of formulations for the 2.75" rocket which do not use lead compounds to control the propellant burning rate. Higher performance propellants for application to underseat rocket motors (pilot ejection) which also do not depend on lead ballistic modifiers are now being developed.

Pyrotechnic Materials Facility

The processing of pyrotechnic materials to support development programs for new CAD items is also supported by a variety of mixing, blending, and pressing equipment. Such materials are more sensitive to accidental initiation than most propellants and explosives, and they must be handled in very small quantities and with great care. As a part of this overall capability, an entirely new process for the process of the pyrotechnic materials used in most flares and igniters (MTH and MTV) is being developed which will be much safer and environmentally cleaner. Instead of using large quantities of volatile organic solvents to mix these materials, a new cryogenic process using liquid nitrogen as the process solvent is being developed. This process will also find application for other pyrotechnic type materials once developed.

Continuous Processing Facilities

Continuous processing of energetic materials has been studied for many years. Until recently, however, the process control and analytical techniques were not available to make it feasible to produce a composite propellant or explosive with acceptable quality. With the recent advances in both areas, it is now possible that continuous processing can be successful. Continuous processing offers a safer and more economical method for making both propellants and explosives. In addition, future, very high energy formulations, with very high solids loading densities, will only be processable with continuous processing. A very versatile continuous processing facility has been established, which is capable of processing materials which require mixing or mixing

and extrusion. This facility has just been upgraded with advanced feed systems for solid oxidizers and a computerized control system.

Continuous Mixer/Extruder: Used for the continuous processing of energetic materials. This process offers a higher degree of safety as fewer chemicals are in the system at any given time, it is more efficient, and produces a more uniform final product. This is a fixed asset with a replacement cost of $1,000,000. It weighs 10,000 lbs.

Rocket Motor Case Braiding Facility

Effort has been ongoing for several years to develop the technology of braiding composite cases (or inhibitors) onto live rocket motor grains. A complete R&D facility has been established which can be used to overbraid a live rocket motor grain; it also has the capability to do this continuously. Extruded composite propellant rocket motor grains for the 2.75" rocket have been overbraided already. Further efforts to inhibit such grains, for application to the Navy's Advanced Rocket System program are underway. The same technology is also being applied to the braiding of detonating cord for use in mine countermeasure programs, where stronger cords are needed to withstand the forces exerted during rocket deployment.

Over Braiding Machine: State-of-the art equipment used for overbraiding energetic materials with composite fibers and resin as a manufacturing process for tactical rocket motors. This process offers benefits of a greater structural integrity conformity and cost effectiveness. This is a fixed asset with a replacement cost of $750,000. It weighs 20,000 lbs.

Rocket Motor/Warhead Process Development Facility

Various facilities and equipment are also available for the casting, assembly, and disassembly of rocket motors, warheads, and test devices. Such capability is essential if the new propellants and explosives are to be tested for performance and to support development programs for new units. These facilities are designed to be very versatile, so that any type of unit can be loaded without requiring fabrication of new tooling. A variety of warhead, JATO, aircrew escape, and mine countermeasure programs are supported with these facilities.

Engineering Analysis and Design Facility

The analysis and design facility provides the computational equipment and staff to

support the various weapons product development programs which are conducted. The facility is equipped with a computer workstation system which is the equivalent of a supercomputer. The analytical functions which are performed include internal and external ballistics, thermal, structural, and thermodynamic modeling. This analytical capability is essential for the support of all development programs conducted at Indian Head (i.e., Advanced Rocket System, mine countermeasure deployment systems, aircrew escape propulsion unis, JATOs, ElectroThermal Gun) as well as the design agent and fleet support engineering roles (Tomahawk, Standard Missile, Harpoon, Sidewinder). As discussed previously, BRAC 93 combined all explosives research and underwater warhead technology within the Indian Head Division, and this transfer was organizationally completed on 3 April 1994. As discussed above in this section, Indian Head has been a strong supporter of the explosives and warheads development programs for many years, with the process development and scale up functions being supported by Indian Head's pilot plant. This organizational combination will only serve to make this a more successful transfer from the laboratory to pilot plant and on to weapon system application. The transfer will also increase the development capability at Indian Head by the addition of the underwater warhead development group, which will form one part of the overall weapon product development capability.

The combined replacement cost of IHDIV's Weapons Development facilities and equipment is about $148M.

The total energetic materials R&D capability at Indian Head (laboratory and pilot plant) is unique among DOD and private industry in this country because it is basically all-encompassing. There are other DOD and private sector facilities which have pilot plant and/or production capability for propellants, explosives, or pyrotechnics. Some specific examples would include:

- U. S. Army Armaments Research Development and Engineering Center, Picatinny Arsenal, NJ: Laboratory and limited pilot scale capability for non-composite gun and rocket propellants;

- NAWC Weapons Division, China Lake, CA: Laboratory and pilot plant for composite missile propellants and explosives;

- U. S. Air Force Wright Laboratory, Eglin AFB, FL: Laboratory and pilot scale capability for explosives;

- Los Alamos and Lawrence Livermore National Laboratories: Laboratory capability for explosives;

- Hercules, Thiokol, ARC, Aerojet: Laboratory, pilot plant, and production capability for composite missile propellants.

The Indian Head Division provides all of the above capabilities at one site as well as the ability to do R&D, low rate manufacture, and engineering support for all the other types of energetic materials not provided by these other facilities: nitramine based gun propellants, non-composite rocket propellants (both solvent and solventless processed), pyrotechnics, and energetic chemicals. Only Indian Head, by providing the total capability within one facility to support all aspects of all potentially required energetic materials, ensures that the Navy and DOD will have available the capability to provide itself with any needed energetic material in the future.

Separation of the energetic materials capability from an active production facility and from the development, design agent, and fleet support engineering functions for these materials would result in a loss for all three functions. The R&D group would lose the experience gained from being involved in the transition of new materials and their processes from the pilot plant to production. This involvement helps to ensure a smoother transition. The production function will lose because the knowledge of the R&D group will not be available to help in solving problems which occur during production. The mutual benefit from having a team approach to the development of weapons products loaded with propellants or explosives is obvious. The impact of this loss would be felt in virtually all weapon systems in use by the fleet, including surface and air launched missile (both warheads and propulsion), gun ammunition (projectiles and propelling charges), bombs, torpedos (warheads and propulsion), mines, mine countermeasures (deployment systems and explosive charges), aircrew escape systems, stores separation charges, and transfer systems.

The best demonstration of the value of the synergistic combination of -R&D, production, and engineering functions is the number of in-service weapons systems which are supported during their production and fleet use life cycles. Indian Head engineers and scientists are regularly used to resolve production, hardware, and performance problems with virtually all of the propulsion systems used in the fleet:

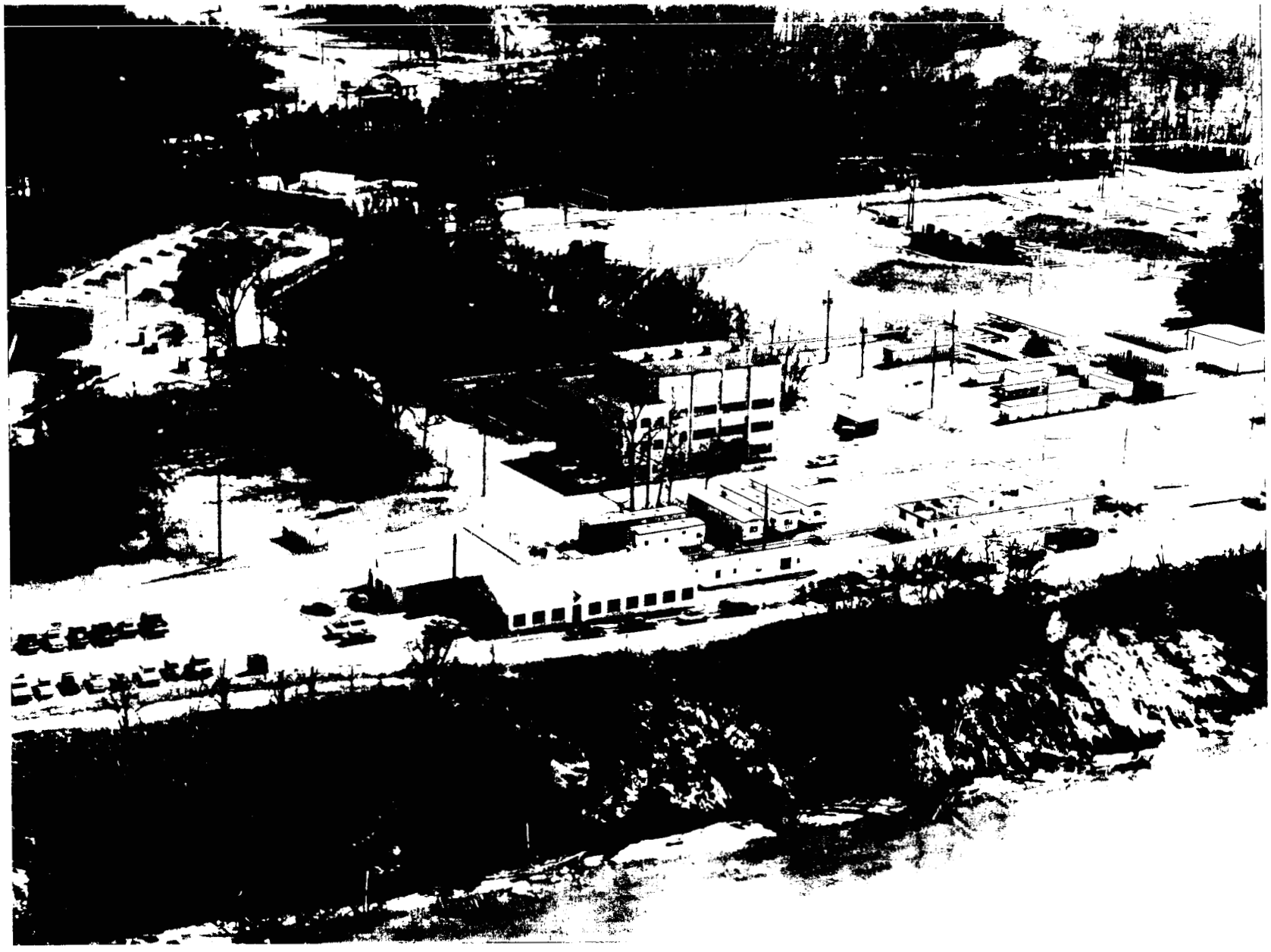
- Missiles: Tomahawk, Standard Missile, Harpoon, Penguin, Sidewinder, Sparrow;

- Rockets: 2.75", 5" Zuni, Mine Clearing Line Charge (MCLIC)

- Guns: 76 MM, 5"/54;

- Aircrew Escape: All systems.

Even though most of the missile propulsion systems were developed by a private contractor, it is still Indian Head which is called upon by the program manager to provide the technical expertise to resolve production or fleet use problems with the energetic materials portion of the weapon systems. Without the combined experience of the three functions at Indian Head, no one would be able to provide this support for the Navy.



The Patterson Pilot Plant is used primarily for scale up of propellants, explosives, pyrotechnics and chemicals. Research laboratories transfer technology to the Pilot Plant for process development, producibility, technical data verification and eventual transition to industry.

Weapons Product Development

These pictures illustrate the range of scale-up capability and the variety of process equipment that exists in Indian Head Division's Pilot Plant.

Weapons Product Development

PBX Vertical Planetary Mixers

1 gallon

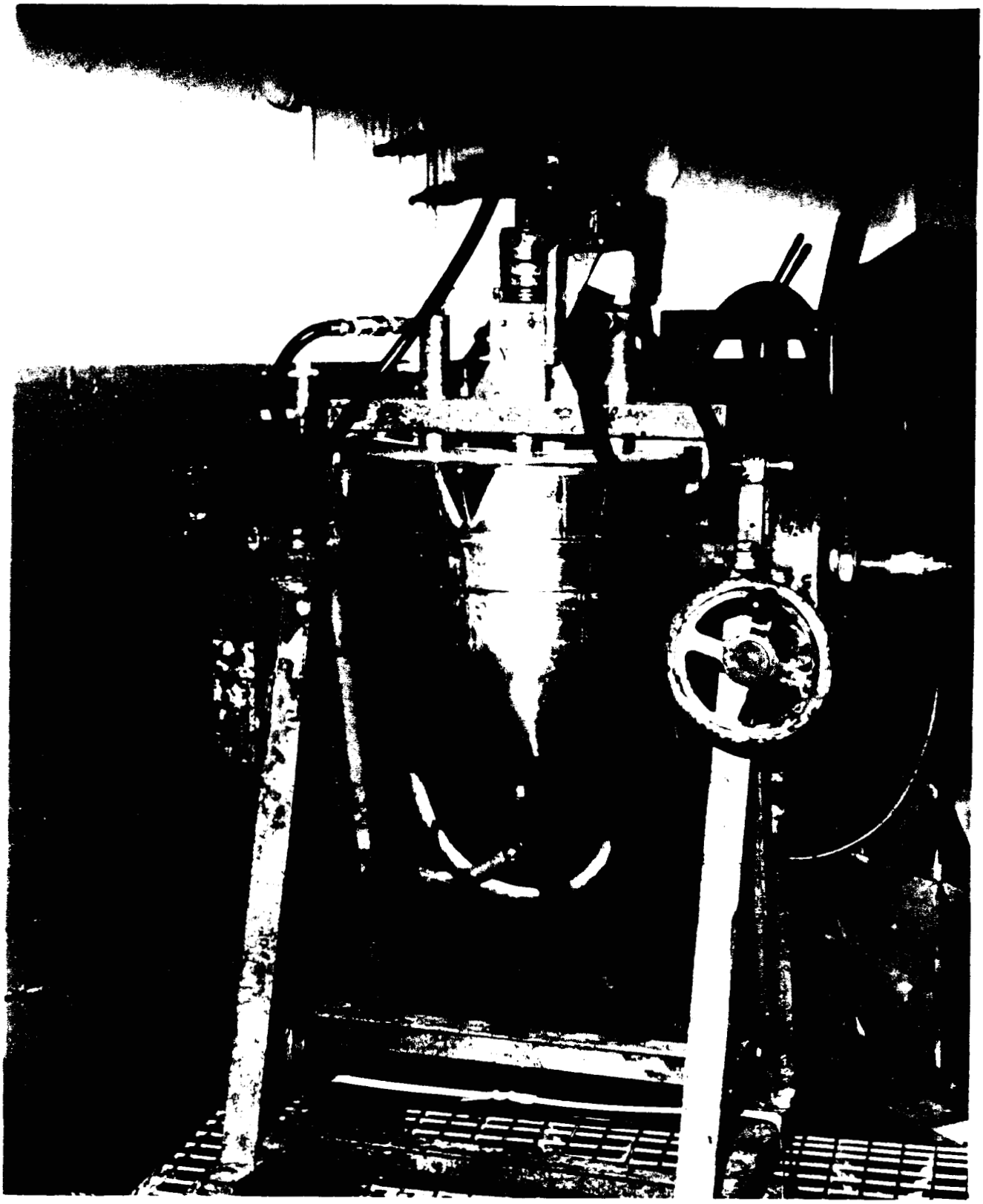
2 gallon

30 gallon

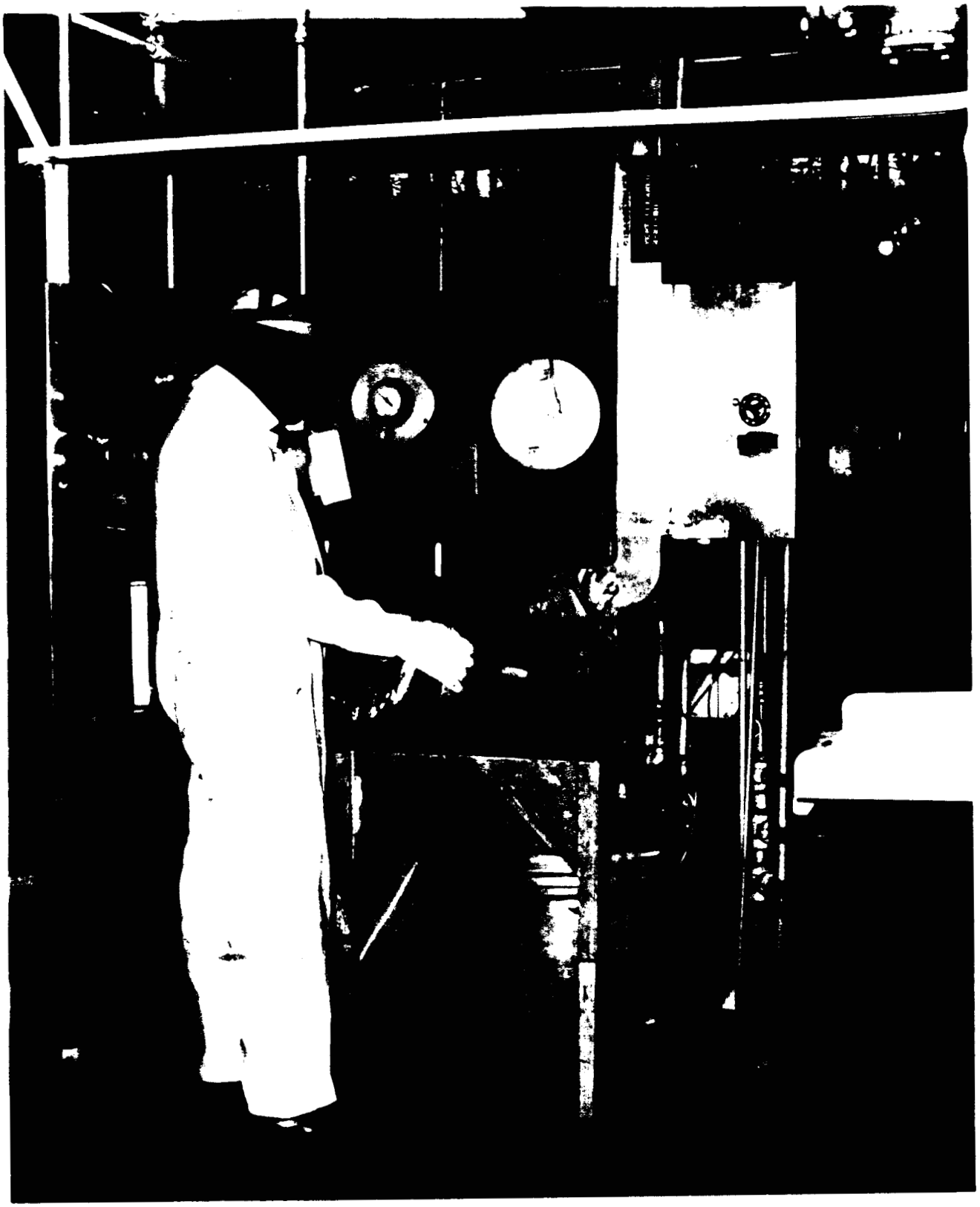
150 gallon

NSWC IHDIV uses these mixers to perform process development and scale-up for composite explosives and propellants.

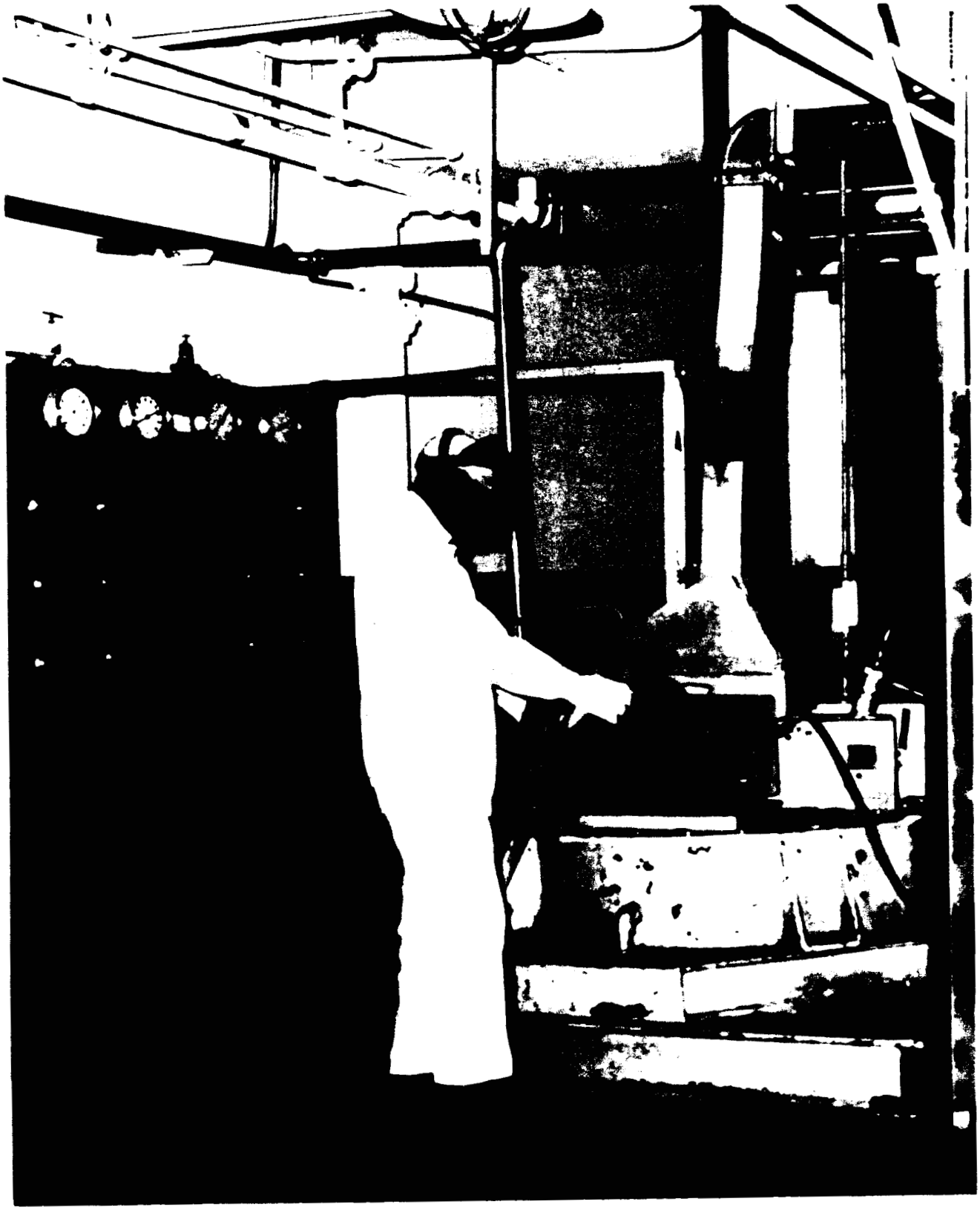
150 Gallon Vertical Planetary Mixer
(IHDIV owns two)



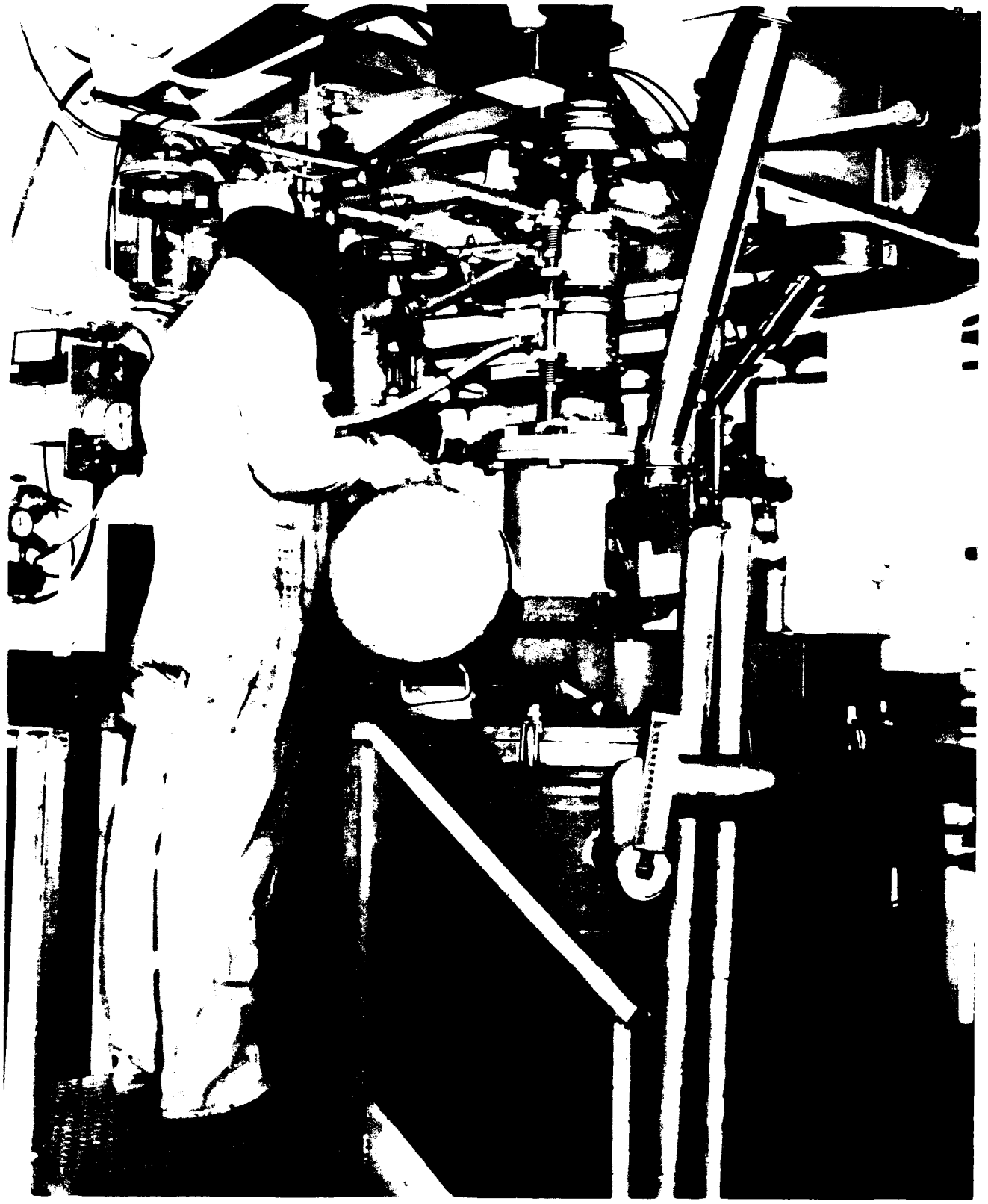
30 Gallon Melt Kettle - used to develop mixing and loading processes for new melt-cast explosives.



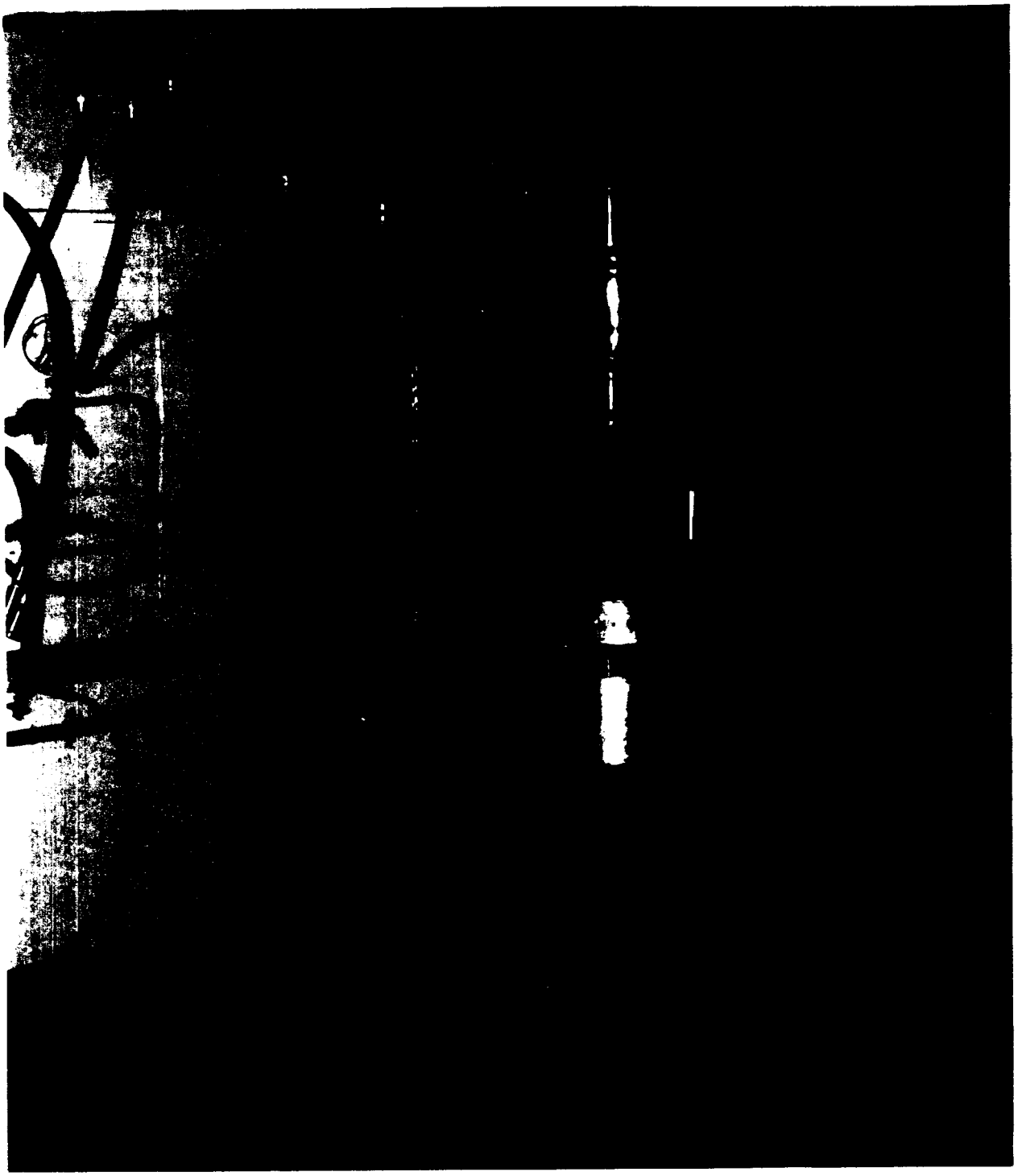
45 Gallon Melt Kettle - used to develop mixing and loading processes for new melt-cast explosives.



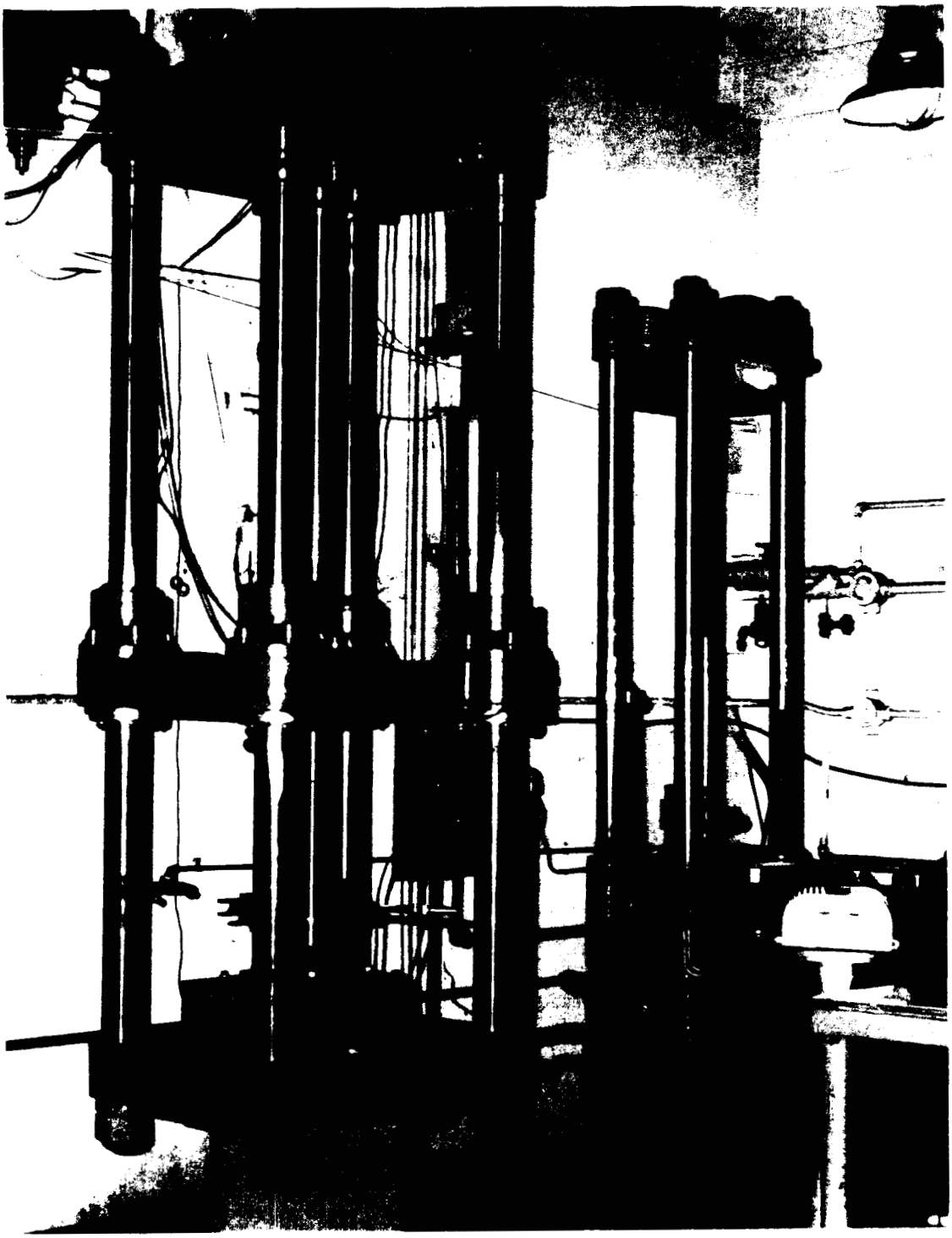
85 Gallon Melt Kettle - used to develop mixing and loading processes for new melt-cast explosives.



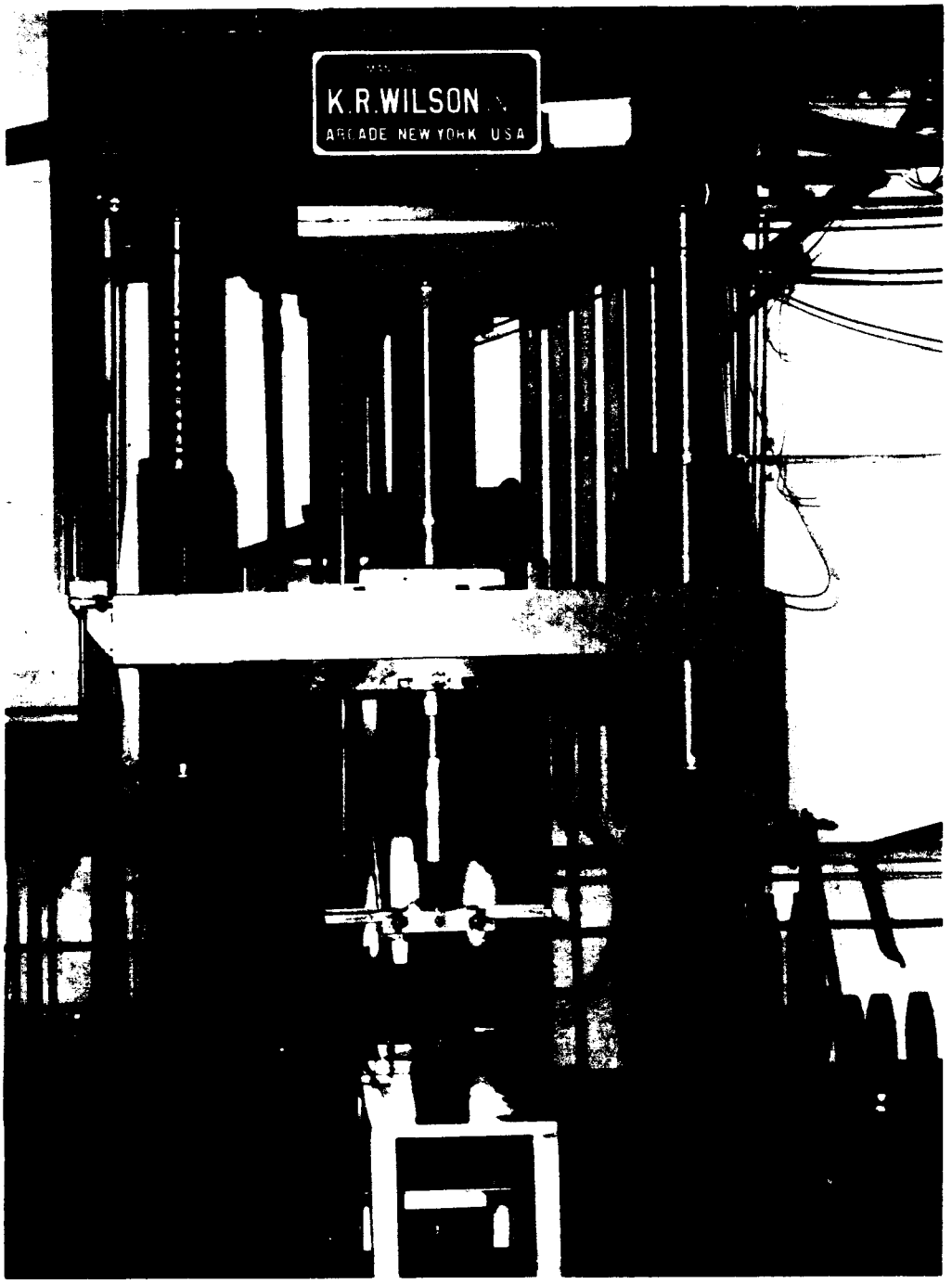
210 Gallon Melt Kettle - used to develop mixing and loading processes for new melt-cast explosives. Largest of its kind at any DOD pilot plant facility.



10 Ton Press - explosive pressing capability to evaluate pressed explosives and develop explosive pressing processes.



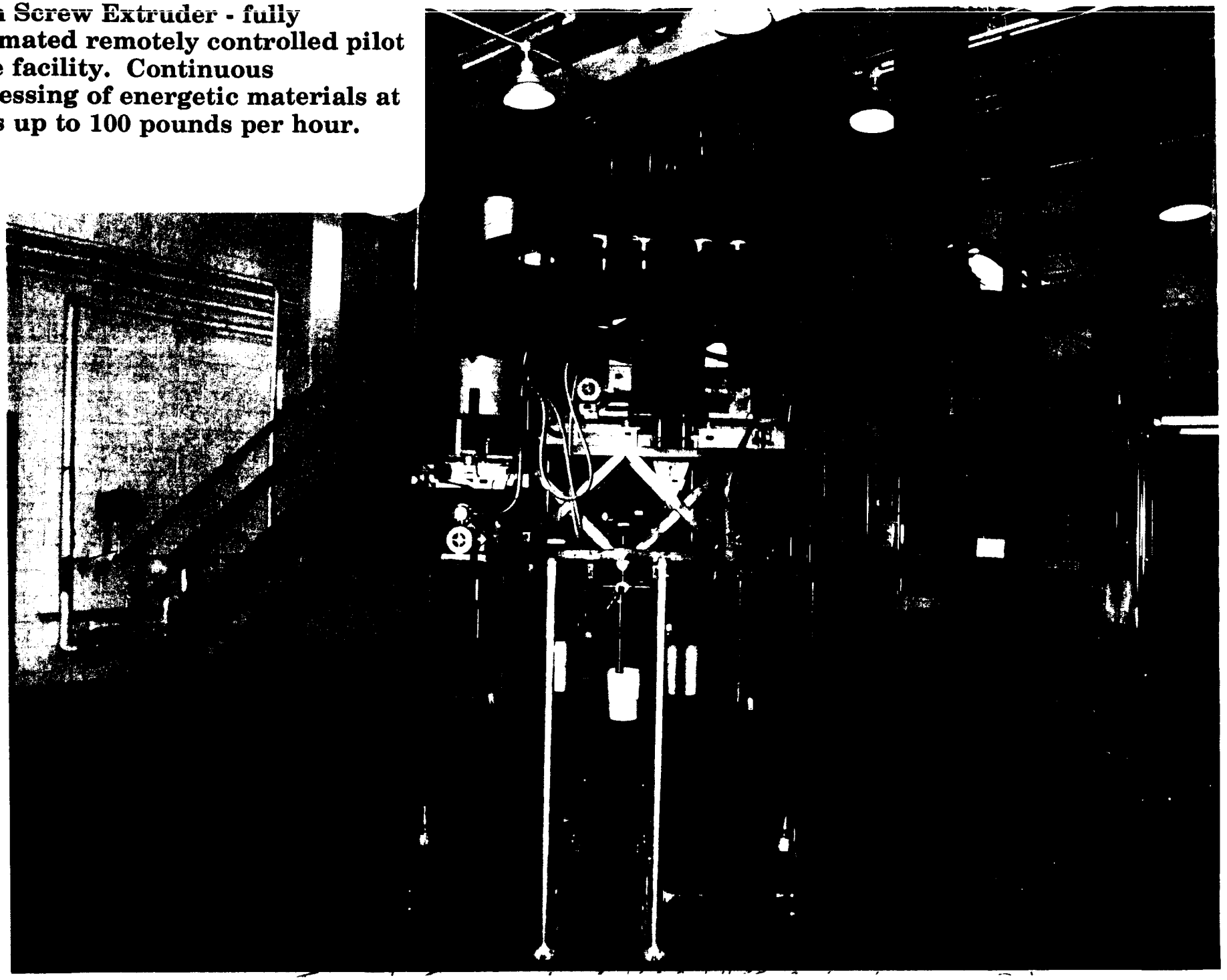
30 Ton Press - explosive pressing capability to evaluate pressed explosives and develop explosive pressing processes. Replicates the explosive presses used at Crane Army Ammunition Plant to manufacture gun ammunition.

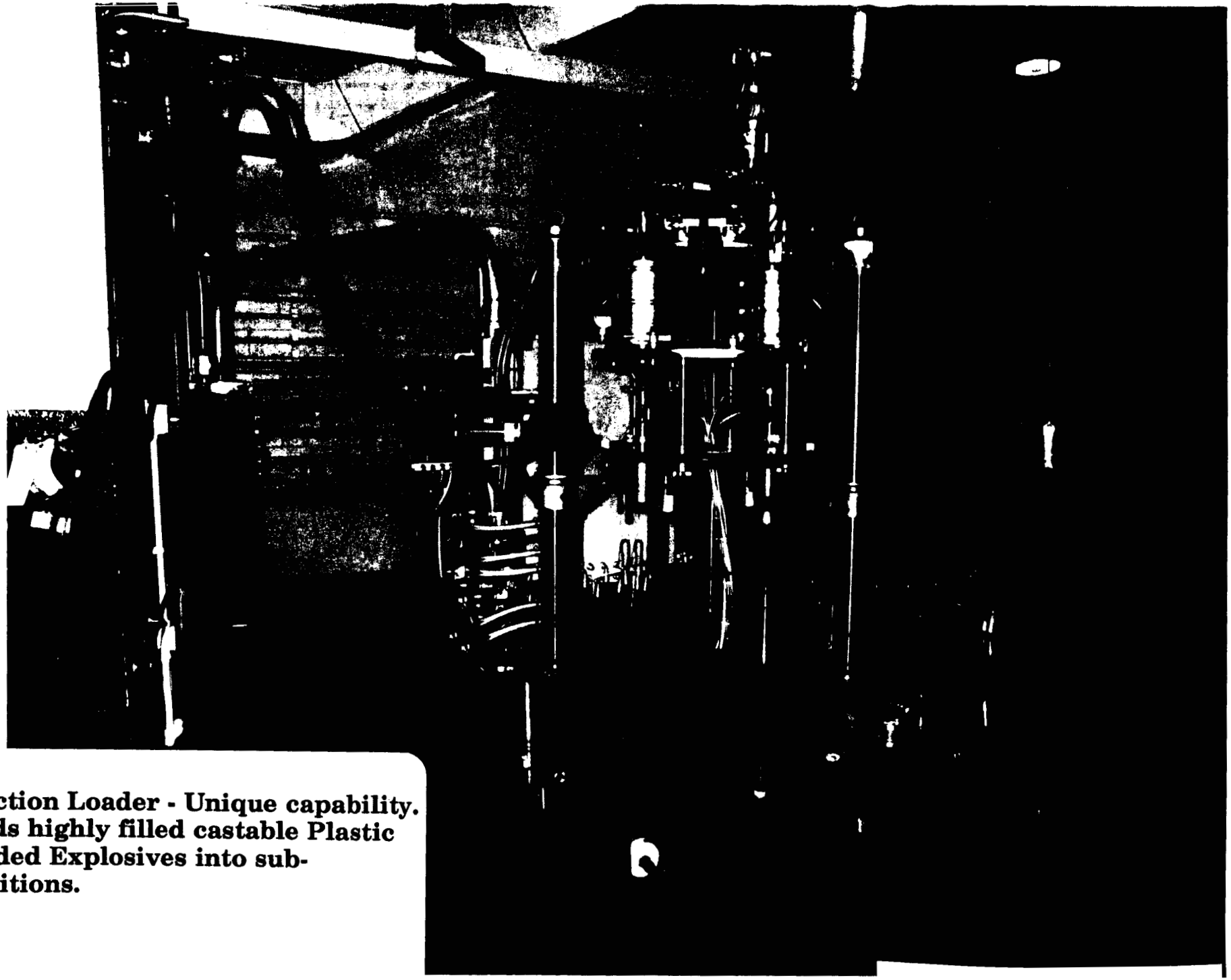


200 Ton Press - an explosive pressing capability to evaluate pressed explosives and develop explosive pressing processes.

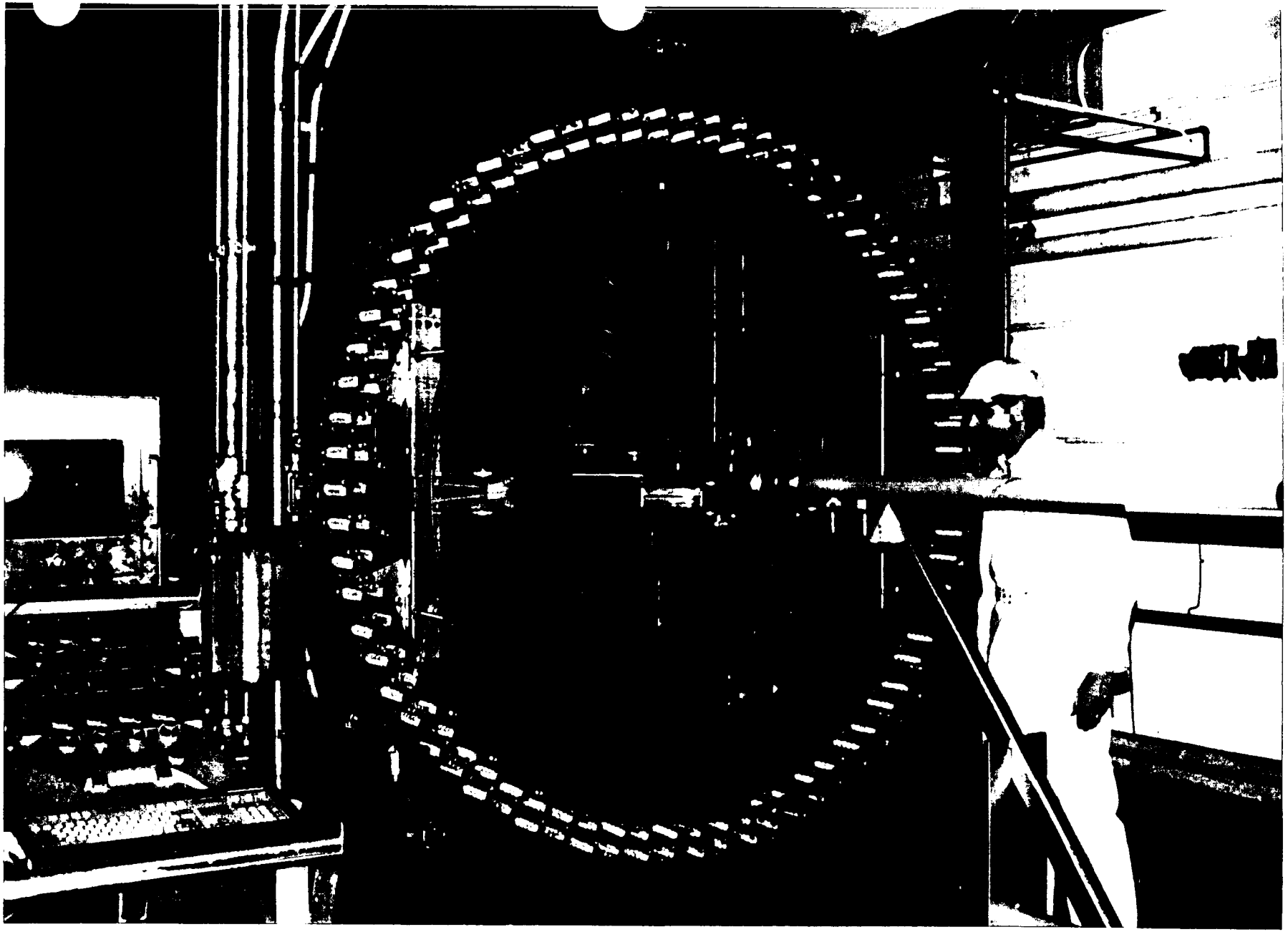
2,000 Ton Press - explosive pressing capability to evaluate pressed explosives and develop explosive pressing processes. Largest press at any pilot plant facility in the U.S.

Twin Screw Extruder - fully automated remotely controlled pilot scale facility. Continuous processing of energetic materials at rates up to 100 pounds per hour.





Injection Loader - Unique capability. Loads highly filled castable Plastic Bonded Explosives into sub-munitions.



Over Braiding Machine

Weapons Product Development

Technical Center Site	Indian Head Division, NSWC
Facility/Equipment Nomenclature or Title	Nitramine Gun and High Energy Propellant Facility

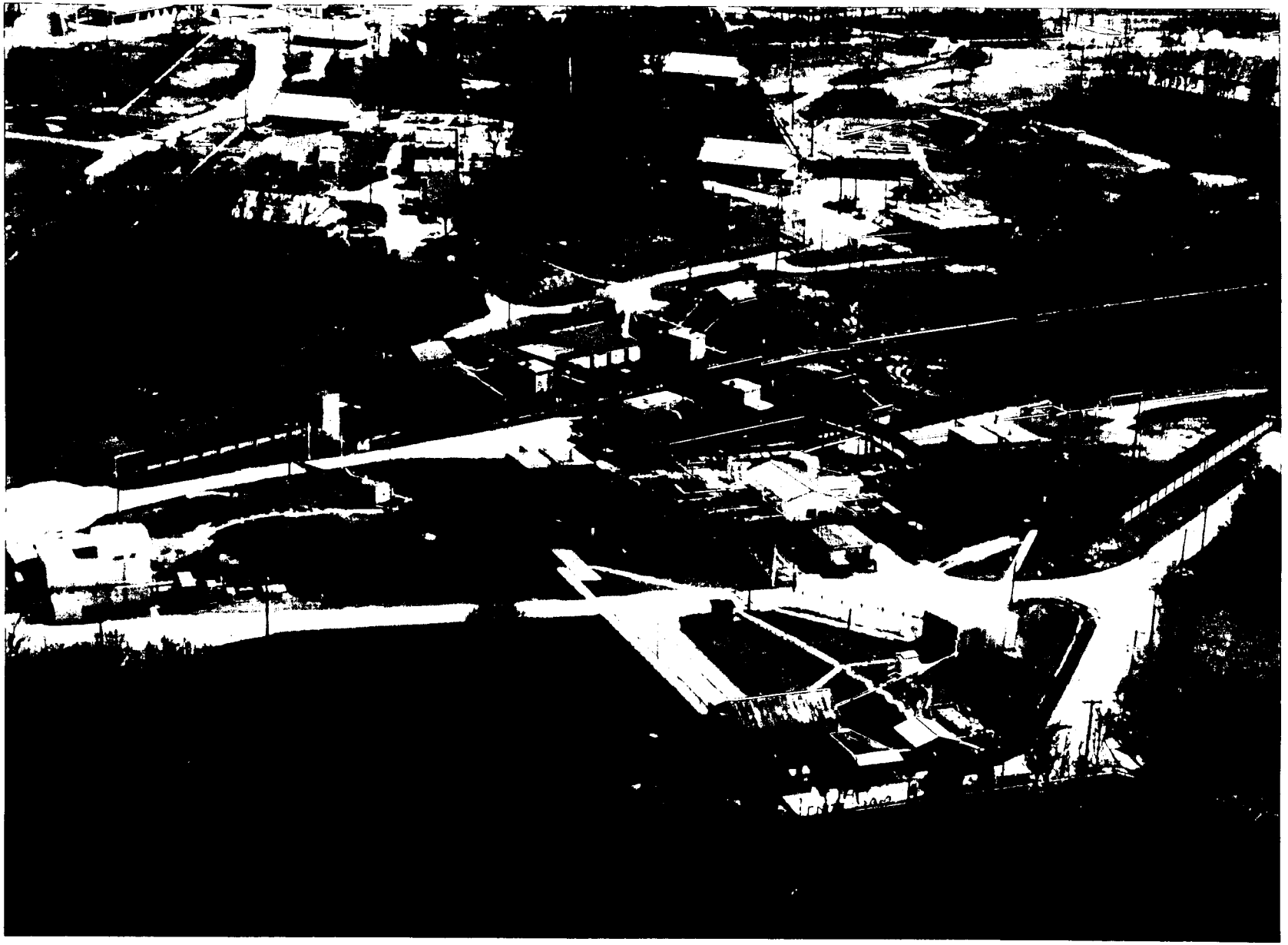
This facility provides development/production cycle support for casting powders and gun propellants used by the tri-service community. Single base, multi-base, and nitramine solid propellant formulations can be developed and produced at this facility. The technical personnel provide the core expertise to develop products and processes that meet the specific needs of a gun system or missile program in the research and development phase. The facility is used to produce qualification lots and complete low rate initial production (LRIP) to prove out product producibility. Low production rates can be maintained to establish DoD core capability and a center for technology transfer to the private sector if large production quantities are needed. The technical expertise maintained at the facility can act as an industry watch dog and provide engineering support in this role. Processing studies and engineering investigations performed during on site production broaden the technical knowledge maintained at the facility and provide product improvement. The facility is a component of the national mobilization base and has a production surge capacity that can be attained far more quickly than facilities in the private sector. The mission of the facility is accomplished with strict regard for environmental compliance as well as an unsurpassed safety record which has been enhanced by its exposure to the Navy's center of excellence for safety located at Indian Head.

A typical example of this facility's capability is the success of the M43 nitramine gun propellant program. The Army came to Indian Head for development of a propellant with unprecedented performance to be used in the 105 mm gun of the M1 main battle tank. Indian Head's unique combined resources from the gun system design branch, pilot plant facility, and nitramine gun propellant production facility worked together with synergistic effect to complete the task. The formulation and process development led to qualification lots and LRIP. Desert Storm mobilization efforts ramped production rates to surge capacity in two months. Standard production rates were maintained after Desert Storm to complete the 2 million pound requirement for the program. Engineering studies and investigations were performed that reduced unit cost and improved product performance. This facility is uniquely qualified to develop and produce nitramine gun propellants because of the attendant technical expertise and the

agility of the facility. Finely ground nitramines may not be transported geographically because of its sensitivity. This facility uses its own grinding process to prepare the nitramines for incorporation into the product and remains the only qualified producer of M43 gun propellant in the world.

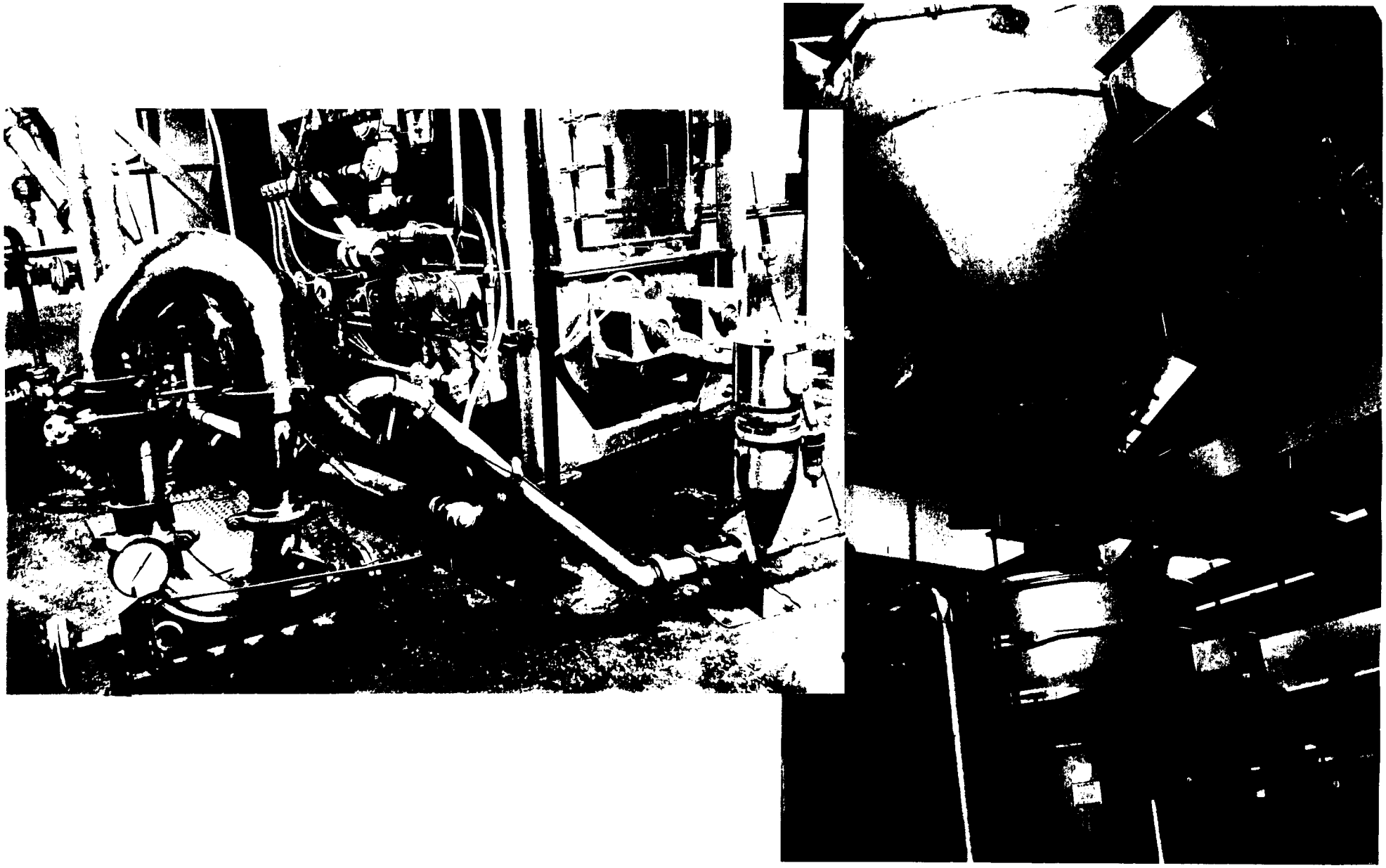
The estimated cost of replacing the facility is $90 million. The buildings have unique designs that accommodate the processing equipment inside and would have to be duplicated at a new site. The costs include equipment, structures, and environmental and safety infrastructure necessary to run explosive operations. However, the technical and configuration management costs are not included.

Although there are other Government and commercial facilities with similar facilities, many of these are sized for World War II type requirements and have long been shut down. **Other companies may have some capabilities but do not have the ability to dry and grind the raw nitramine on-site.** This is an important factor since this material cannot be transported in the ground state.



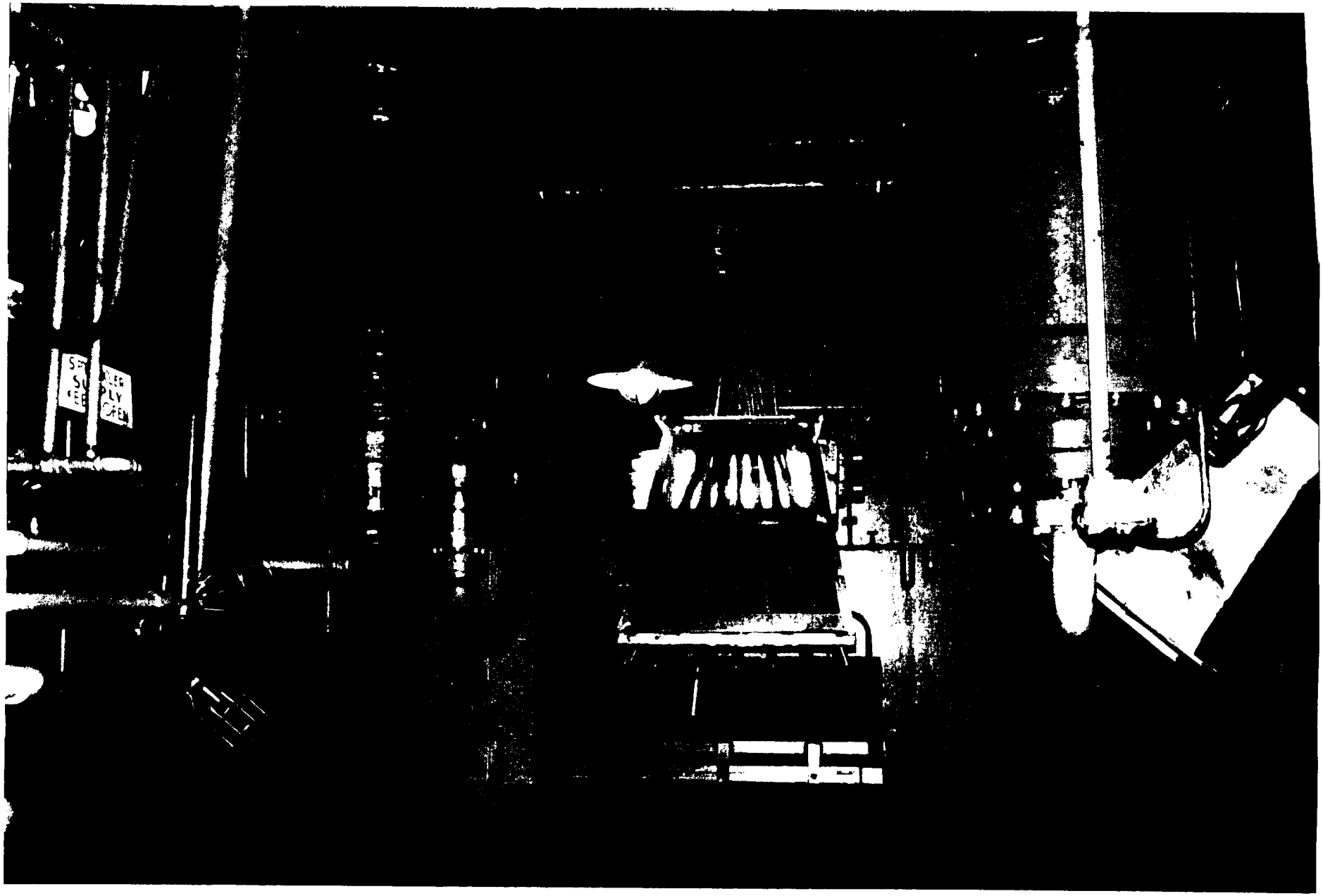
Originally designed to produce Polaris casting powder this facility has evolved over the years to produce Poseidon casting powder and is presently used in the production of the M43 gun propellant for the Army's M-1 tanks.

Nitramine Gun Propellant Facility



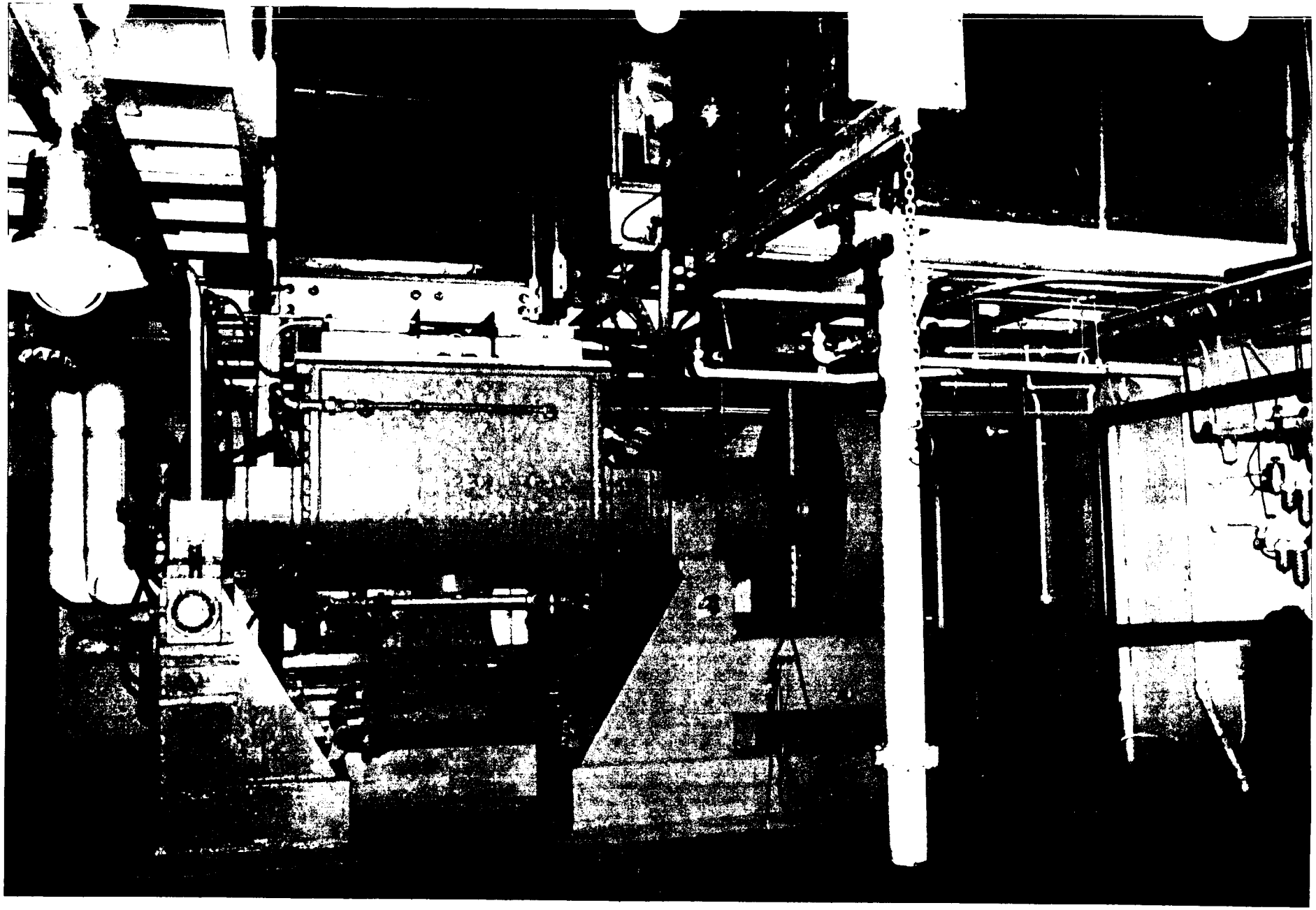
RDX Drying and Grinding Equipment

Nitramine Gun Propellant Facility



500 Ton Vertical Extrusion Press
(IHDIV owns two)

Nitramine Gun Propellant Facility



150 Gallon Horizontal Sigma Blade Mixers (IHDIV owns two)

Nitramine Gun Propellant Facility

Ingersoll-Rand Centac Air Compressor

Nitramine Gun Propellant Facility

Technical Center Site	Indian Head Division, NSWC
Facility/Equipment Nomenclature or Title	Chemicals Processing Facilities

The primary purposes of the Chemical Processing Facilities (CPF) are to produce and process energetic chemicals for the DOD for use in solid rocket motors, warheads, fuels, and other ordnance items. The chemical plants comprising the CPF, and their primary purposes, are as follows:

a) Qualification and Process Development:

For all of the programs described below and any future energetic chemical requirements, these facilities will serve as the location for the development and scale-up of the manufacturing process, leading to full-scale production capable of meeting program requirements. This work complements the capability of our chemistry laboratories and pilot plant, providing the next step in the transition of new chemicals from the lab to service use.

The most recent example of this was the development of the solventless nitroglycerin lacquer for the Trident missile program. This unique formulation eliminated the use of an organic VOC solvent, in this case methylene chloride, a carcinogen and ozone depleter, while providing a stable high-strength formulation of nitroglycerin capable of meeting DOT sensitivity tests for shipment across the US. Within two years from the time the initial inquiry was made by the customer, the formulation was developed in the laboratory, a process developed and scaled-up, and a facility constructed and operated producing quality lacquer on the first attempt.

No other facility, government or private, provides this wide range of services at one location.

b) Production: The table below summarizes the plants, products, and weapons programs supported by the four chemical production plants:

Facility	Principal Products	Programs Supported	Notes
Biazzi Nitration Plant	Otto Fuel II	MK 46/MK 48 Torpedoes	Sole Producer US/NATO
	Nitroglycerin	Trident Missile Vandal Target Booster	Only qualified producer
Moser Nitration Plant	TMETN (trimethyloethane trinitrate) TEGDN (trimethylene glycol dinitrate)	SLMM Underwater Mine Quickstrike Mine MK 46 Torpedo Warhead MK 14 Mobile Mine Destructor	Currently being considered for use in new gun propellants and low signature rocket motor propellants
	BTTN (butanetriol trinitrate) DEGDN (diethylene glycol dinitrate) NG (nitroglycerin) PGDN (propylene glycol dinitrate) EGDN (ethylene glycol dinitrate)	No programs for Moser Plant production of these products are currently supported, but have previously existed and have been produced in this plant	Moser Plant is a multi-product nitration plant with three separate production modes, to meet specific production requirements for each of these nitrate esters
PNC Plant	Pelletized Nitrocellulose	SLMM Underwater Mine Quickstrike Mine MK 46 Torpedo Warhead MK 14 Mobile Mine Destructor	Sole producer of PNC for US/NATO; currently being considered for use in new gun propellants and low signature rocket motor propellants

HBNQ Plant	High Bulk Nitroguanidine	Standard Missile (surface-to-air) Hawk Missile (surface-to-air)	Sole producer of HBNQ for U.S.

c) Energetic Chemical Acquisition and Technical Support:

The CPF has the capability, as demonstrated numerous times in the past, to provide the technical guidance and support for the purchase and qualification of energetic and specialty chemicals. This provides the government with a "smart-buyer" capability in chemicals by knowing, understanding, and being able to perform these processes. The in-house knowledge and capability to produce chemicals keeps contractor pricing competitive. IHDIV's capability to produce these chemicals when a contractor fails to deliver quality chemicals at a competitive cost assures availability of high energy and specialty chemicals to meet critical defense requirements.

Two recent examples of this include the qualification of Atlas, a private-industry source, for the production of Otto Fuel II, and the qualification and subsequent purchases of TMETN and TEGDN from Trojan, another private-industry source, for production of SLMM and QuickStrike mines. The CPF personnel did this effectively due to their knowledge and experience in producing these materials for over 40 years.

d) Technical Assistance/Guidance to Government/Industry:

The CPF provides government and industry with a source of analytical expertise, extensive chemical synthesis, scale-up, and production experience, and chemical processing knowledge. Chemists and engineers draw on this experience when considering safety aspects of chemicals to safely design and evaluate production processes. Analytical procedures have been developed by NSWCIH which are now used throughout DoD, private industry, EPA, and international laboratories. Experience in the synthesis and scale-up of many new chemicals have resulted in full-scale process designs of superior safety and operational support for many weapons programs.

e) In-Service Engineering Agent Support:

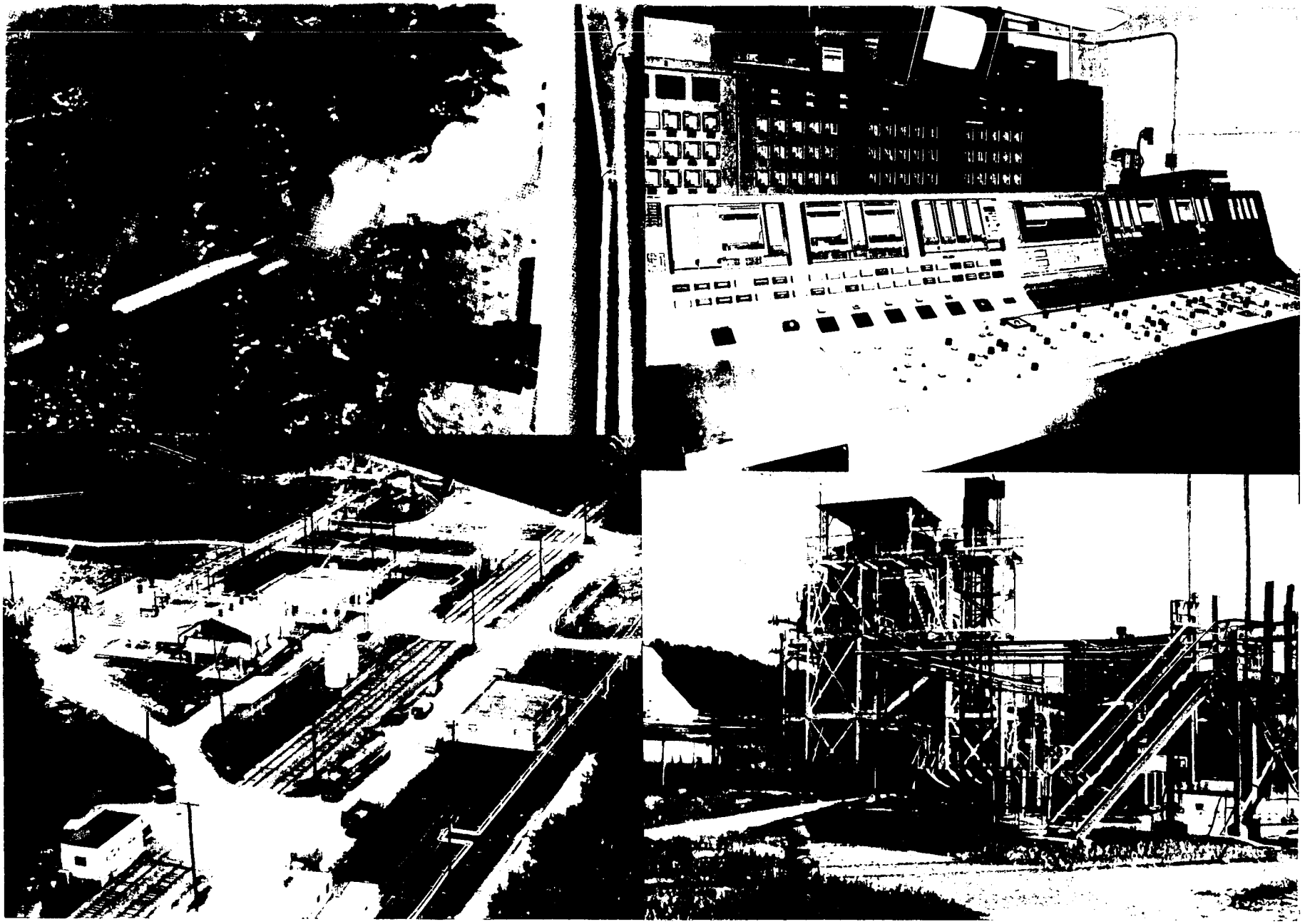
The on-site CPF provides close interaction with the In-Service Engineering Agent (ISEA) Office, allowing quick response to fleet requests and investigations. Production and quality records are readily available on-site for these requests resulting in rapid response time during these requests and investigations. The on-site CPF provides the

ISEA, and thereby the fleet, with technical product knowledge and resources needed to respond to the frequent inquiries.

Facility	Equipment Replacement Cost	Building/Utility Replacement Cost
Biazzi Nitration Plant	$12,000,000	$35,000,000
Moser Nitration Plant	$8,000,000	$20,000,000
PNC Plant	$4,250,000	$6,000,000
HBNQ Plant	$750,000	$4,000,000

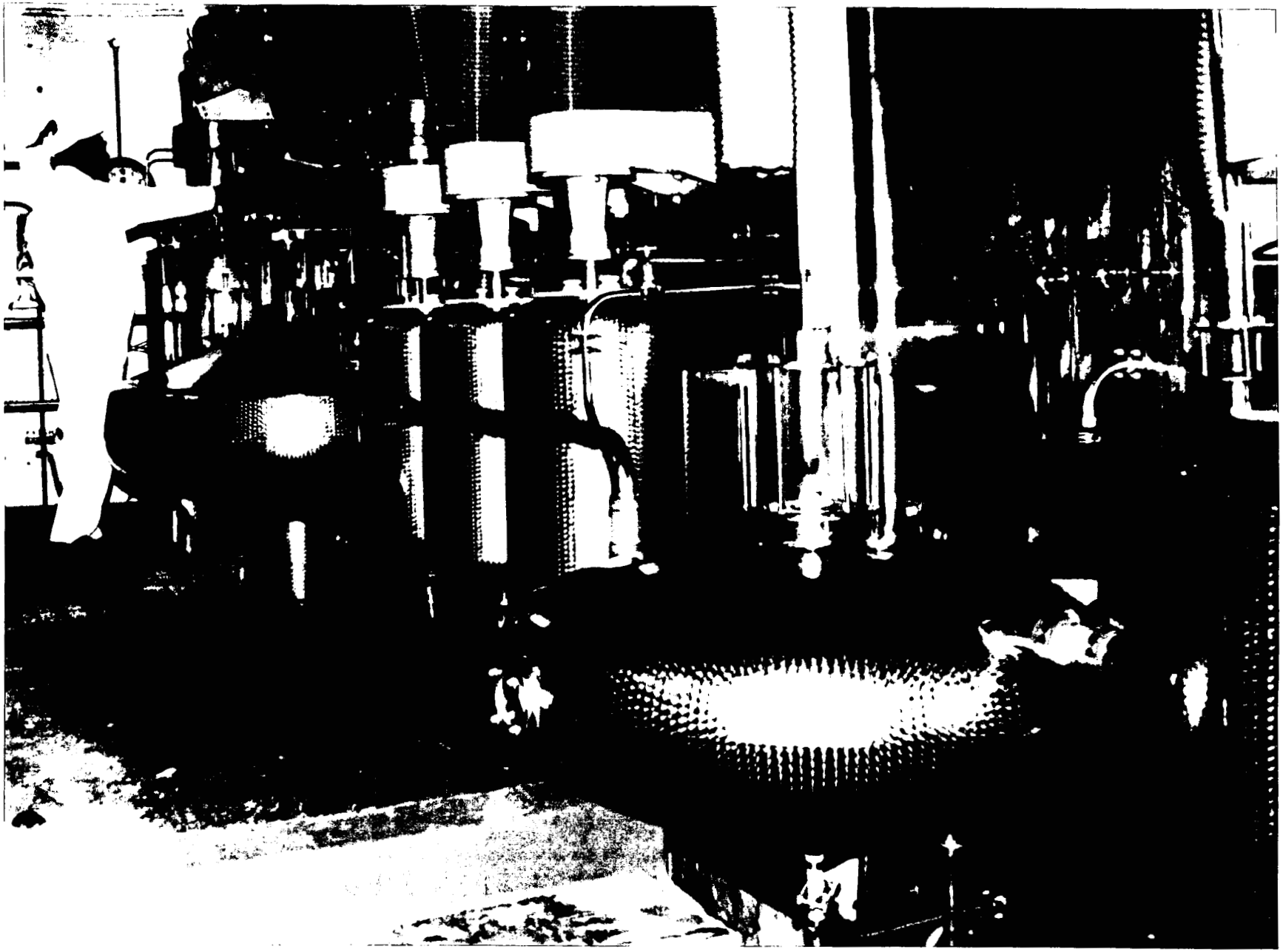
The Biazzi Nitration Facility is currently the only producer of Otto Fuel II for the US and all NATO countries and the only qualified source of Nitroglycerin for the Trident program.

The PNC Facility and the HBNQ Facility are currently the only producers of their products for the US and NATO countries (PNC) and for the US (HBNQ), respectively.



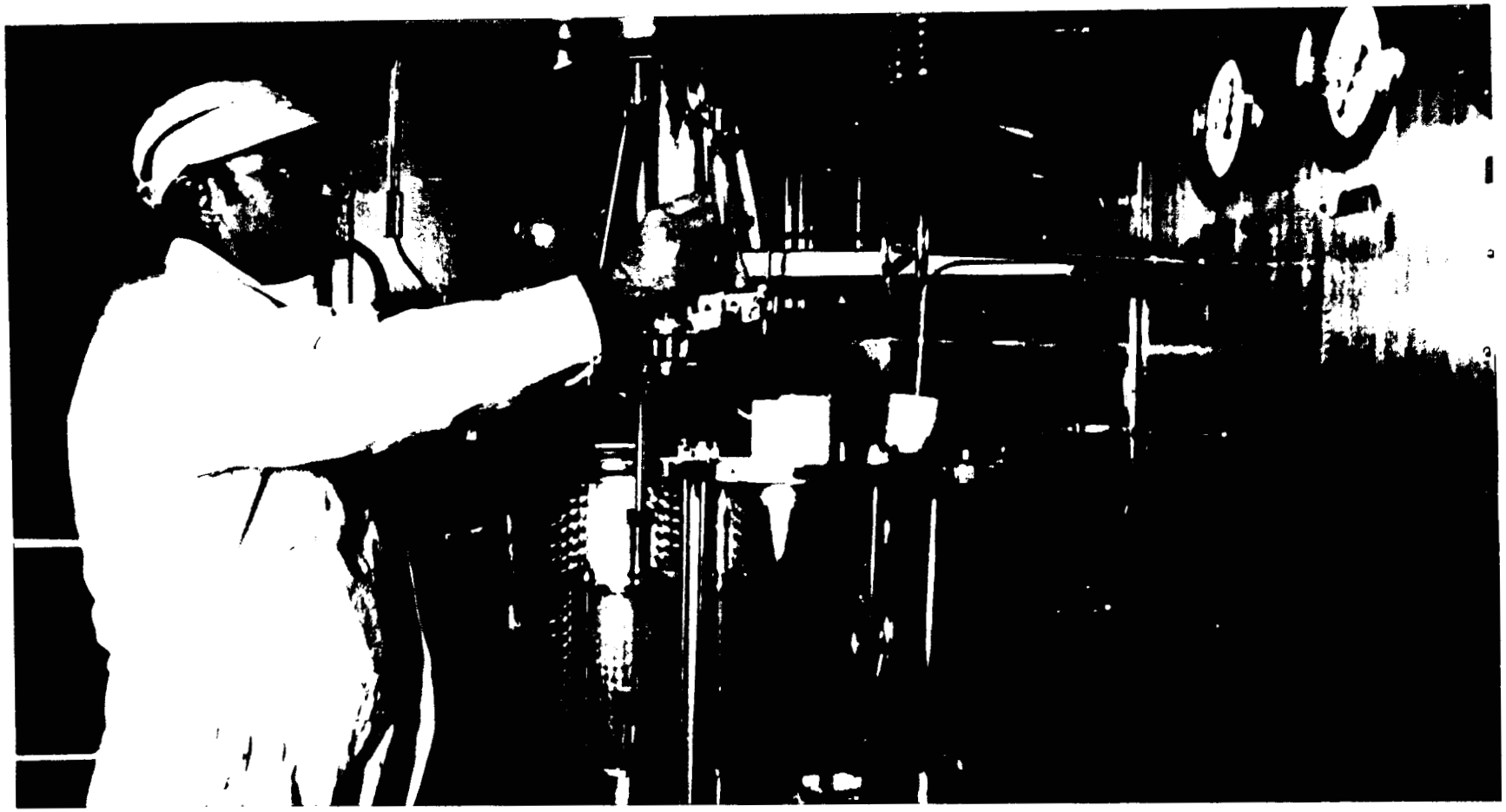
The three chemical facilities highlighted here produce critical chemicals that are used in torpedoes and in making Navy PBX warheads. The torpedo shown here is a recipient of OTTO Fuel made in the Biazzi plant. The warheads use chemical ingredients from the Moser and PNC plants.

Chemicals Processing



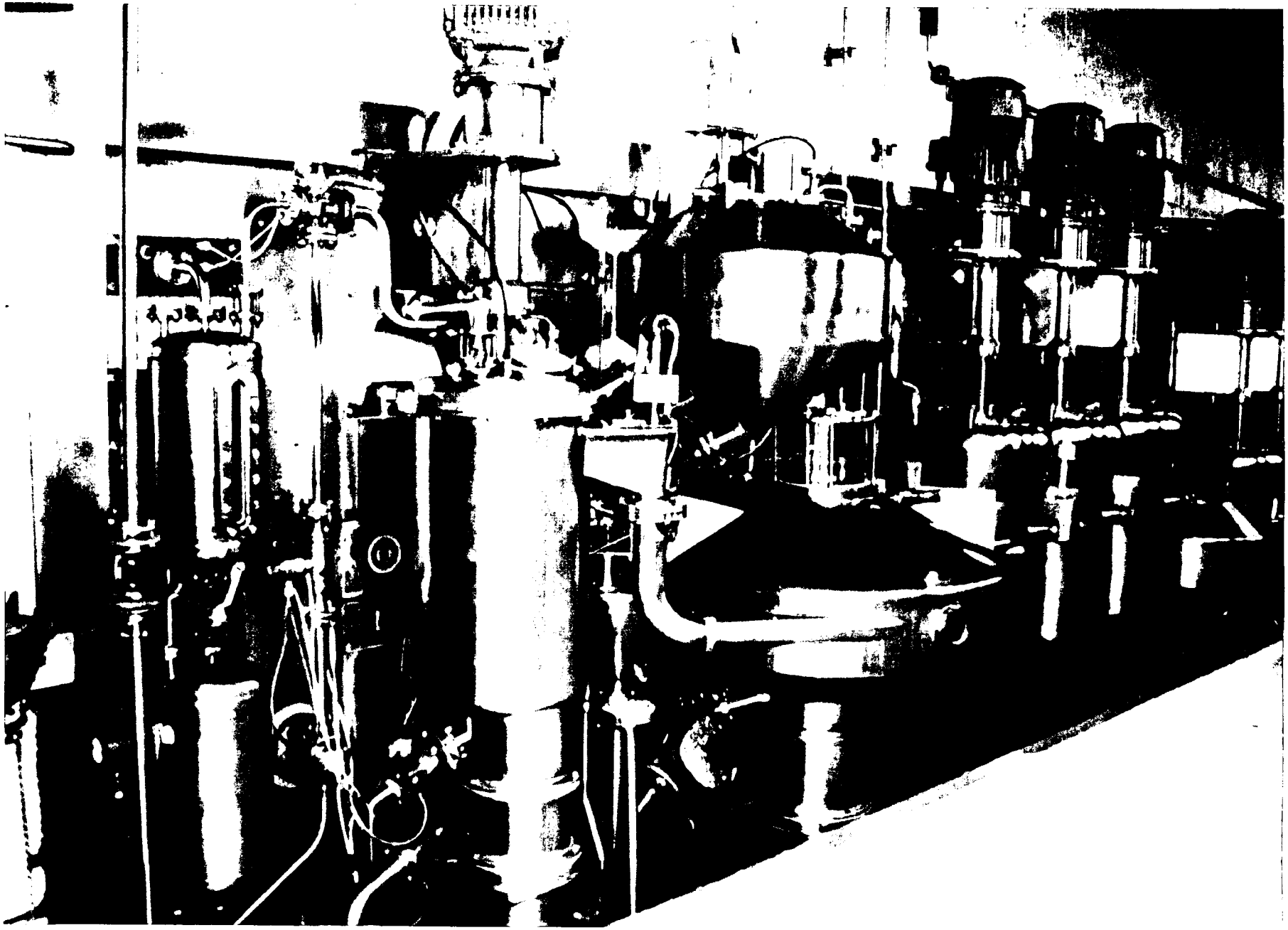
Biazzi Nitration Processing Equipment

Chemicals Processing



Nitroglycerin, which is manufactured in this plant, is used in the Vandal, and Trident lacquer program. Indian Head also manufactures and is the sole producer of OTTO Fuel which is used to propel Navy torpedoes.

Chemicals Processing



Moser Nitration Processing Equipment

Chemicals Processing

Technical Center Site	Indian Head Division, NSWC
Facility/Equipment Nomenclature or Title	Composite Propellant/PBX Processing

The primary purpose of the composite propellant and plastic bonded explosive (PBX) ordnance materials manufacturing plant complex is to:

- Mix and cast solid propellants and PBX explosives.
- Assemble rocket motors, warheads, igniters and land/water mine countermeasure systems.
- Perform depot level maintenance, regrain, retrofit and rework on rocket motors and warheads.

This facility provides the flexibility to accomplish workload ranging from:

- Process development
- Scale-up
- Technical Data Package Validation
- Low Rate Initial Production
- Full Production

Advanced processing equipment has the capability to produce all cast propellants and explosives currently used by the Department of Defense. Some of the products produced at this facility for use by the Navy, Army , Air Force and private industry include:

Mk 107 Torpedo Warhead
Mk 103 Torpedo Warhead
Mk 122 Torpedo Warhead
Mk 115 Standard Missile Warhead
Mk 125 Standard Missile Warhead
Sidewinder Warhead
Phoenix Warhead
Maverick Warhead
Mk 14 Explosive Device

5 INCH/54 Projectile

Anti-Personnel Obstacle Breaching System (APOBS)
Distributed Explosive Technology (DET) Arrays
Distributed Explosive Mine Neutralization System (DEMNS)

SR121-NP-1/2 Jet Assisted Take-Off (JATO) Propulsion System
Mk 23 JATO
Mk 128 JATO
Medium Range Unmanned Aerial Vehicle Booster

Smokey SAM Simulator
Sagger SAM Simulator

In addition to producing new products, these facilities are used to download, regrain, and perform depot level rework/maintenance. This work is performed to return overage, defective or damaged systems to a ready-for issue condition.

This facility also produces propellant and explosive items to meet short term emergency requirements. The flexibility and diversity of this facility allows for rapid response to emerging and quickly changing requirements. These capabilities include rapid process development, prototyping and fielding of propellant and explosive systems/subsystems. During Operation Desert Storm we accelerated development, manufactured and fielded APOBS and the MK 14 Explosive Devices to defeat new enemy threats.

This facility is used to manufacture cast composite/PBX systems as they transition from development to low rate production, such as DEMNS, DET , MK 128 JATO and APOBS. New manufacturing processes technologies developed by IHDIV's Pilot Plant are incorporated and optimized to ensure a smooth transition from development to production. This transition involves scaling-up from 30 or 150 gallon development mixes to 420 gallon production sized mixes. Once the production process is fully defined and optimized, low rate initial production verifies the adequacy of the technical data package for full scale production.

Equipment integral to this facility with a replacement value ≥ $500,000:

a. Vented Suppressive Shield: This piece of equipment is designed to contain and suppress a detonation equivalent to 100 pounds of TNT. The equipment is installed in a secure (clearance required) facility. The purpose of the equipment is to house explosive

operations that would otherwise have to be done in a remote location. It is a fixed asset with a cost of $516,000. **This piece of equipment is the largest of its type in the world. No similar piece of equipment exists that would be capable of processing tactical warheads in the 25 to 100 pound range.**

b. Vacuum Casting System: This system is specifically designed to vacuum cast any composite explosive or propellant product up to six feet in length and 2,000 pounds. The system is designed to be as flexible as possible, thereby minimizing or eliminating complete tooling redesign that was always necessary in the past for a new product. This is a fixed asset with a replacement cost of $1,349,000. **No similar system exists that would be capable of processing as wide a range of tactical warheads and rocket motors.**

c. Spray Lining Machine: This equipment consists of a computer controlled spray lining machine designed to spray single or multicomponent liners onto the inside diameter of rocket motor cases ranging in size from 5 inches to 18 inches in diameter and from 3 feet to 12 feet long. This is a fixed asset with a replacement cost of $750,000.

d. 420 Gallon Baker Perkins Vertical Planetary Mixer: Is used to mix plastic bonded explosives and composite propellants for programs such as the MK 122 Torpedo Warhead, the MK 125 Standard Missile Warhead, the MK 14 Mine Clearing Warhead, the MK 107 Torpedo Warhead, the MK 64 5" Projectile Warhead, SR121-NP JATO, MK 128 JATO, MK 23 JATO, Javelin Rocket Motor, DEMN's Rocket Motor, Smokey SAM Simulator, and Sagger SAM Simulator. In addition mixes are made as required to support various changing developmental efforts. The explosives and propellants can only be made in this type of equipment due to the high viscosity of the materials being mixed. This is a fixed asset with a replacement value of $1,500,000.

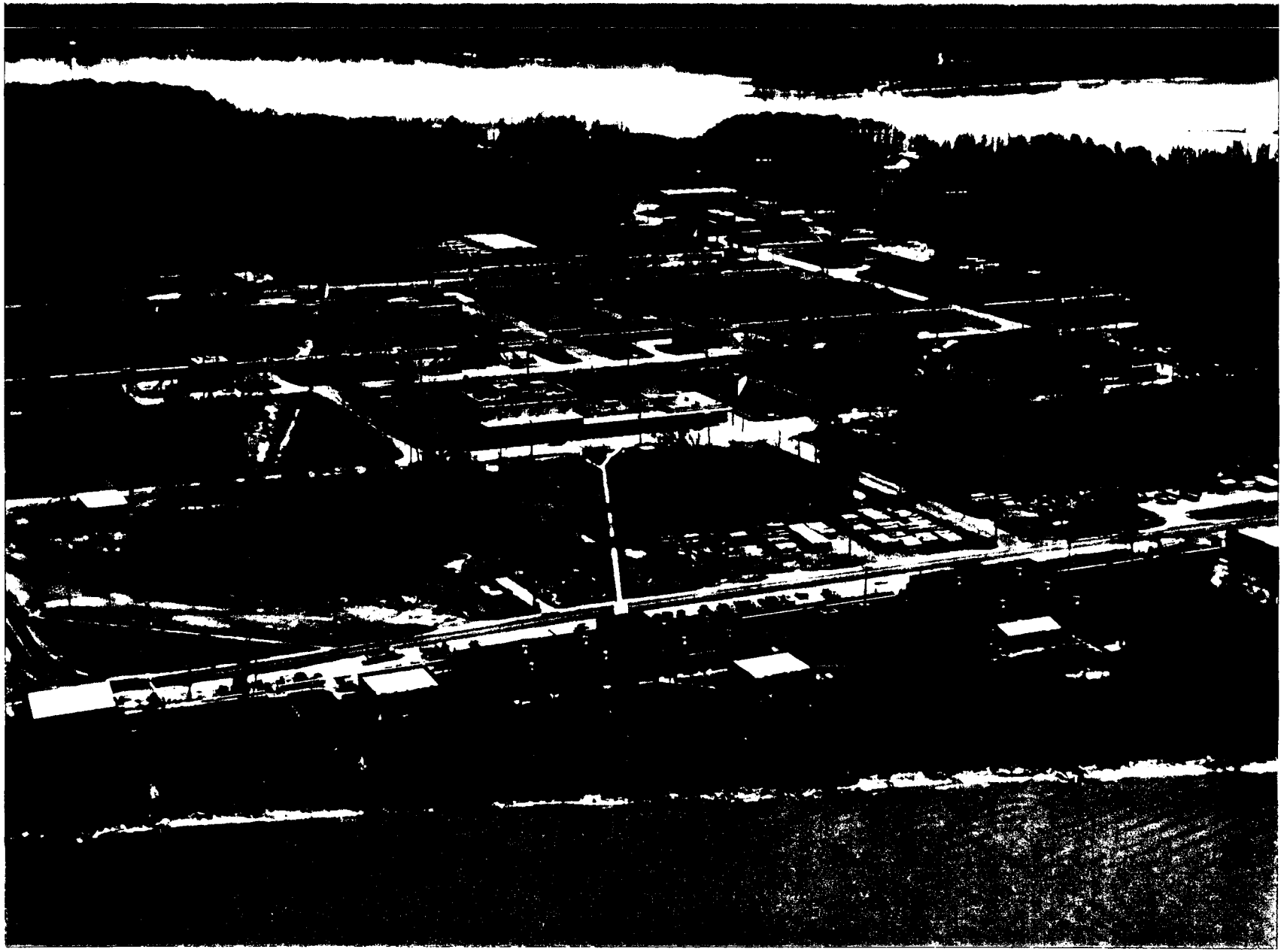
e. Solid Feed System: This equipment consists of a solids feed system designed to feed ammonium perchlorate, RDX, HMX, and other solid components into explosive and propellant mixes. This is a fixed asset with a replacement value of $800,000.

f. Dust Collection System: This piece of equipment consists of five baghouses designed and built to collect ground Ammonium Perchlorate (A.P.) from an air transport stream after it had been ground to the required particle size in a jet mill. This is a fixed asset with a replacement value of $1,000,000.

g. Abrasive Blasting System: This piece of equipment was designed and built to use grit (steel, sand, glass beads, etc) to remove corrosion from the interior of rocket motor chambers prior to further processing. **It is a one of a kind system designed to handle rocket motor cases from 5 inches to 18 inches in diameter and from 3 to 12 feet in length.** This is a fixed asset with a replacement value of $600,000.

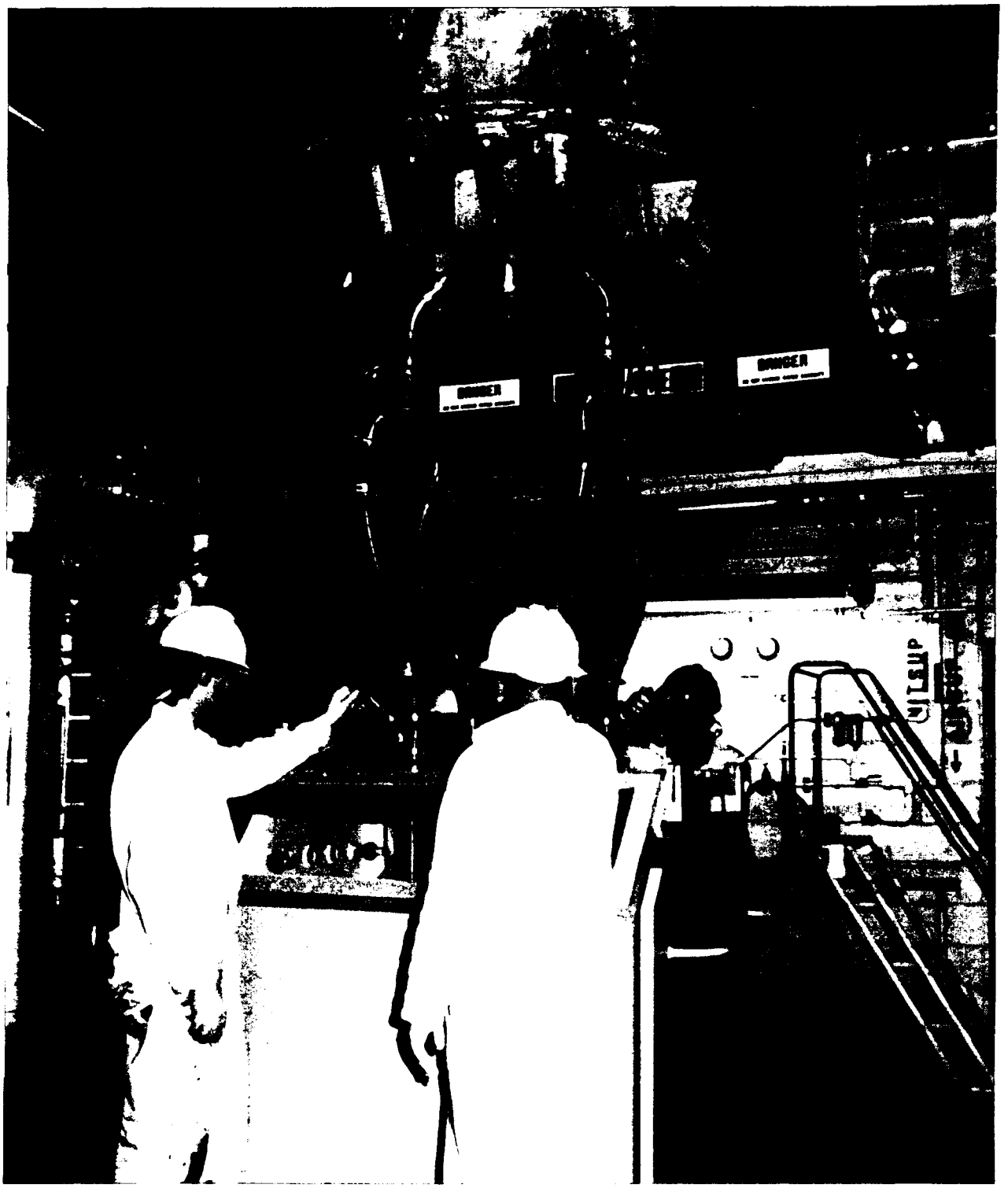
i. Radiographic Inspection System: This equipment consists of radiographic equipment installed in a secure (clearance required) facility. The system is configured to radiographically inspect warheads. This is a fixed asset with a replacement value of $600,000.

This facility consists of over 30 major processing buildings. The cost of replacing these buildings and the "fixed equipment" contained therein would be in excess of $130,000,000.



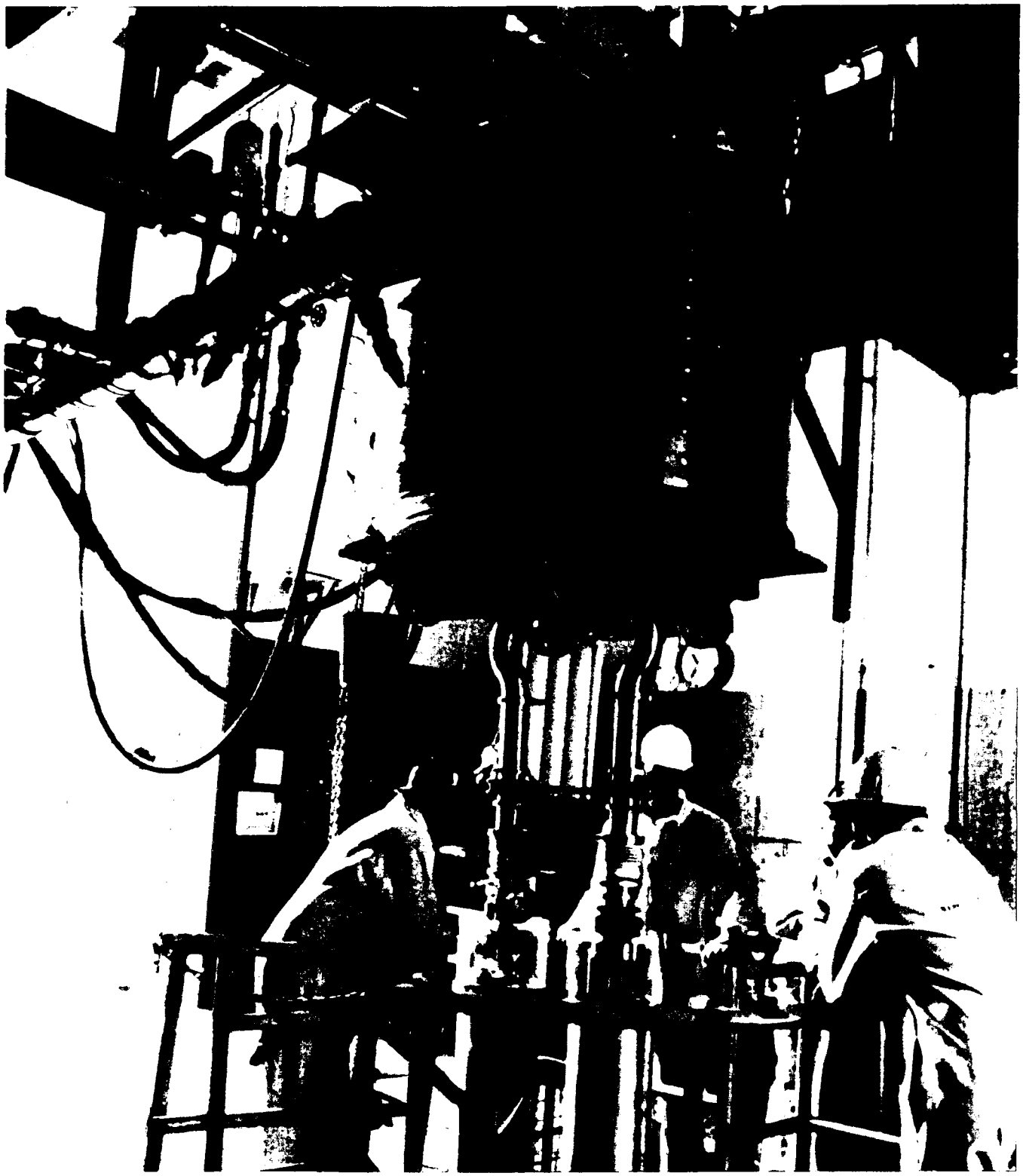
Composite propellant and plastic bonded explosives (PBX) are manufactured in the Cast Plant. Within these facilities operations range from ingredient preparation, mixing, casting, curing, disassembling, assembling of composite rocket motors and all currently approved PBX explosives used in Navy munitions.

Composite Propellant/PBX Processing

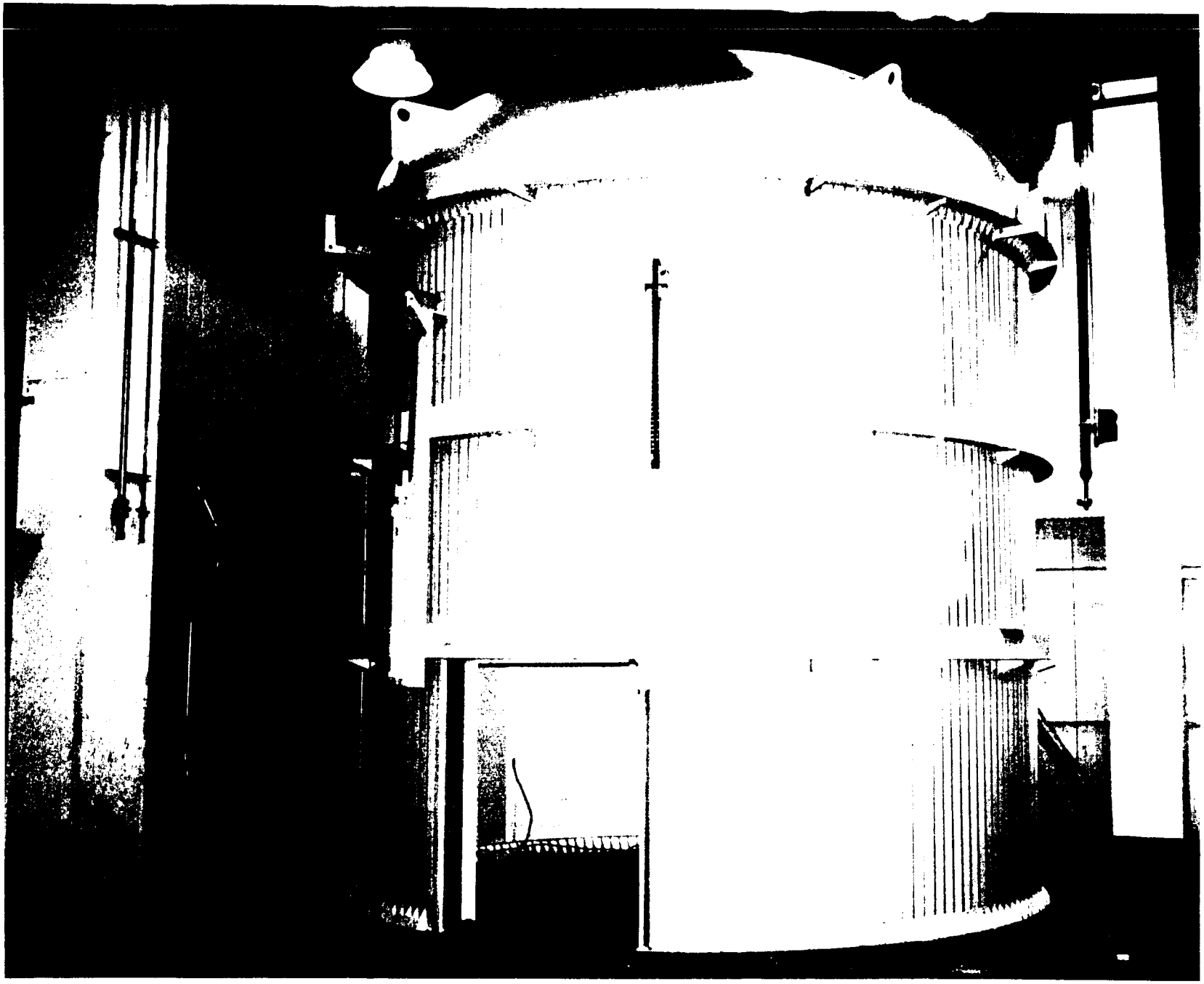


Certified operators are casting PBX explosive into warhead chambers using a vacuum bell.

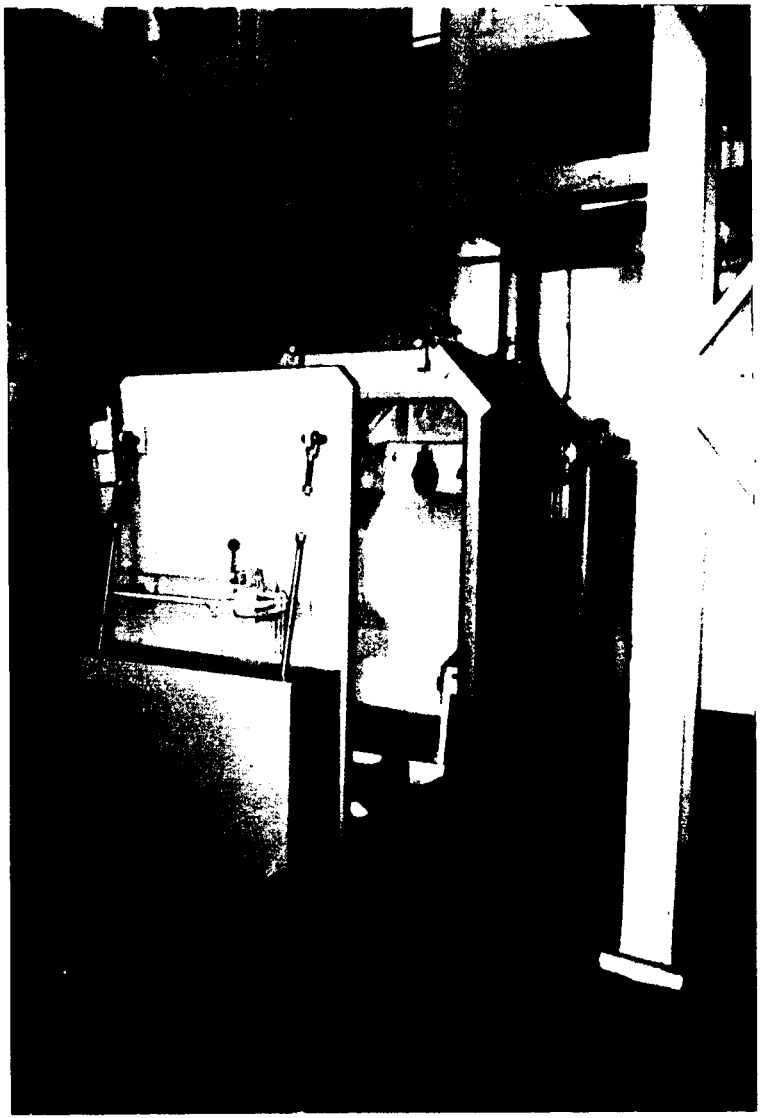
300 Gallon Baker Perkins Vertical Planetary Mixer

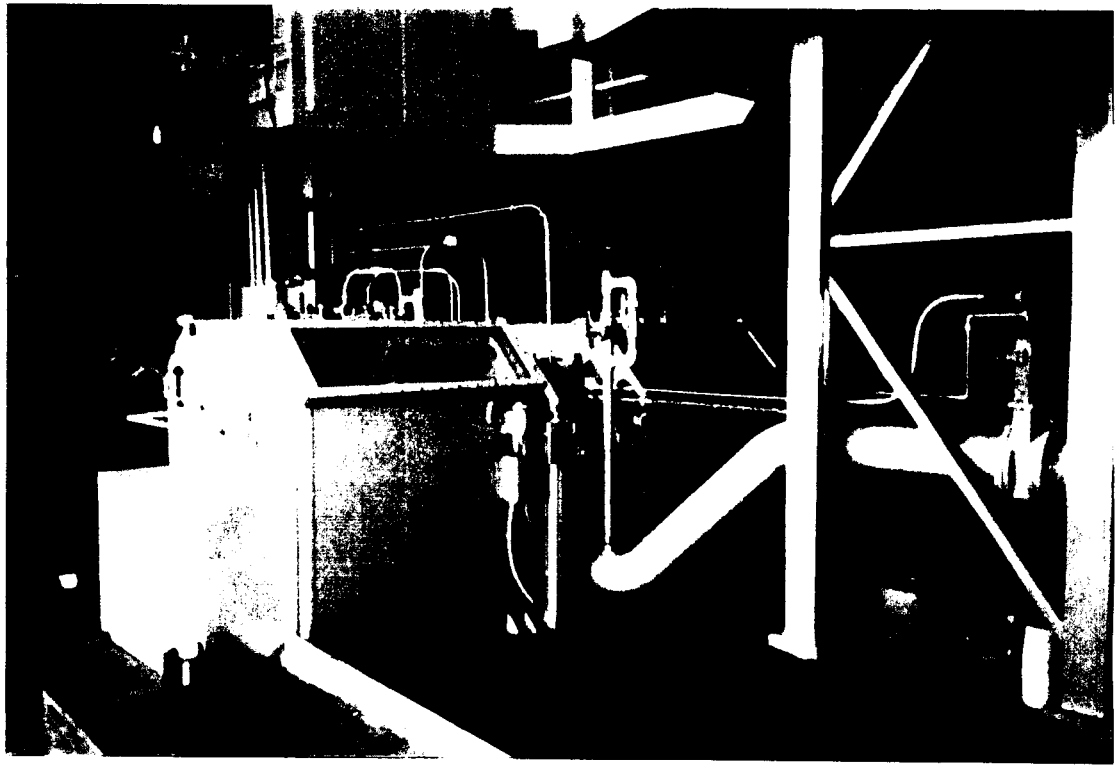


This is a composite propellant being vacuum cast from the 300 gallon vertical mixer into a javelin motor chamber.

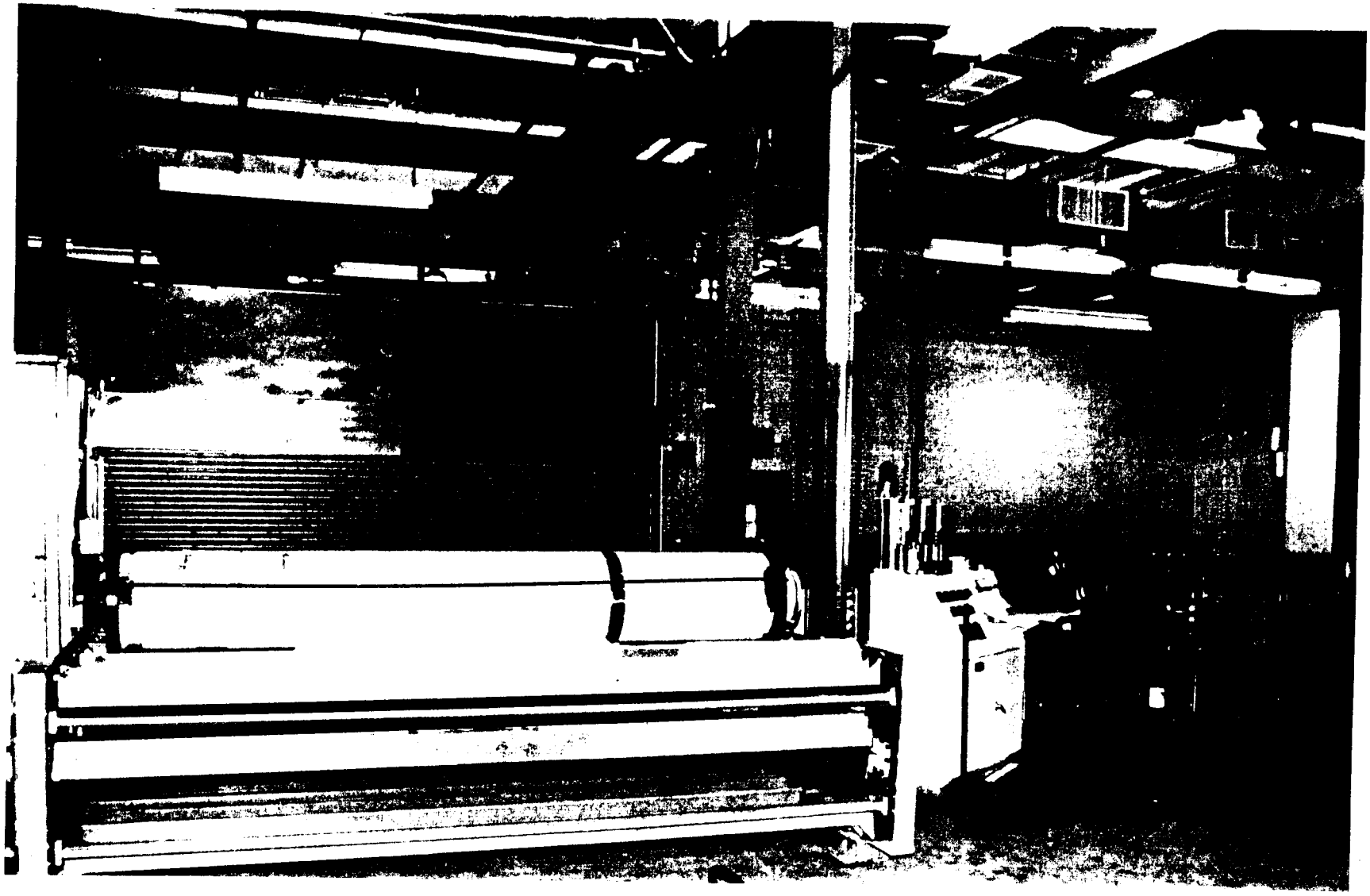


Vented Suppressive Shield

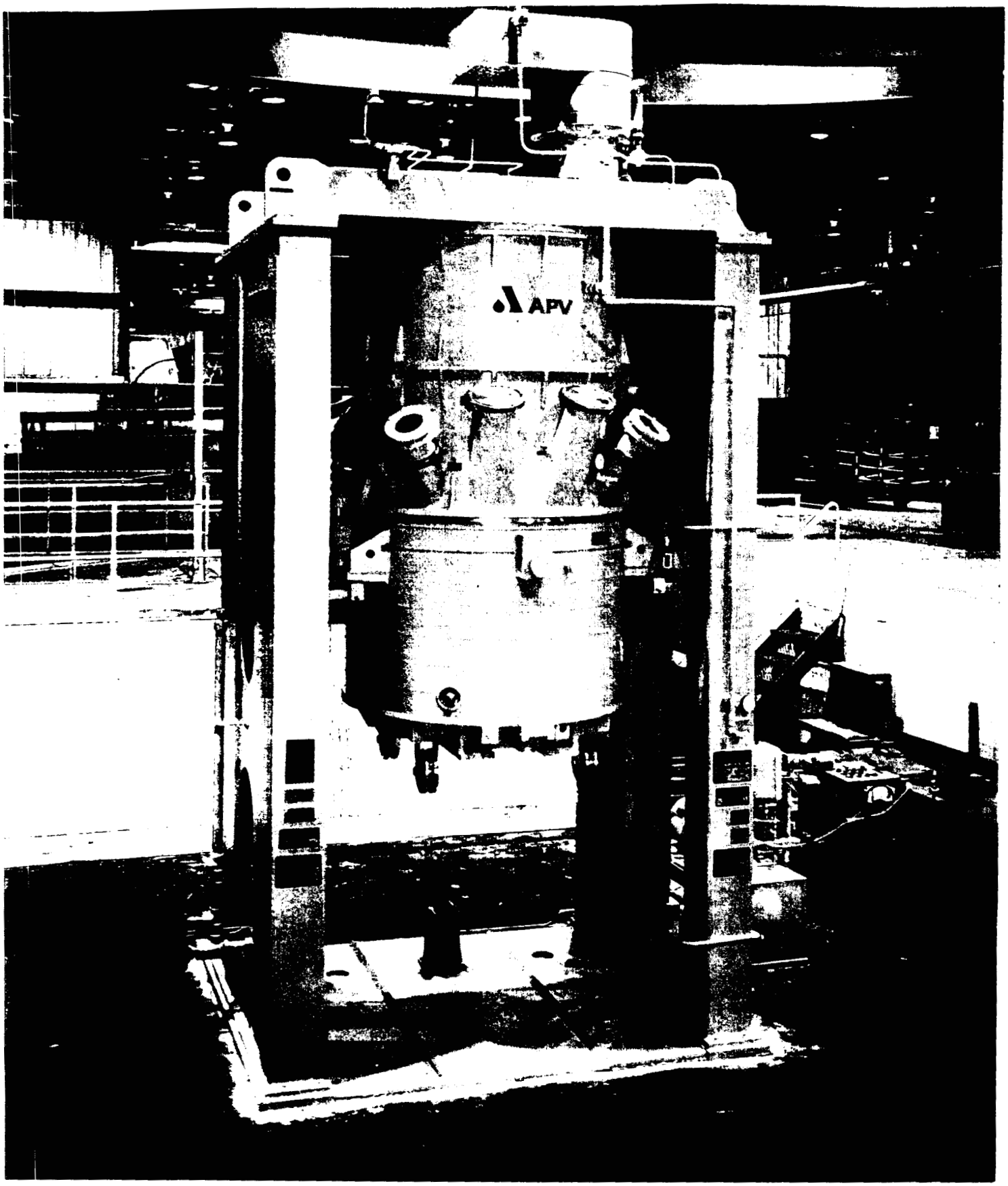




Vacuum Casting System

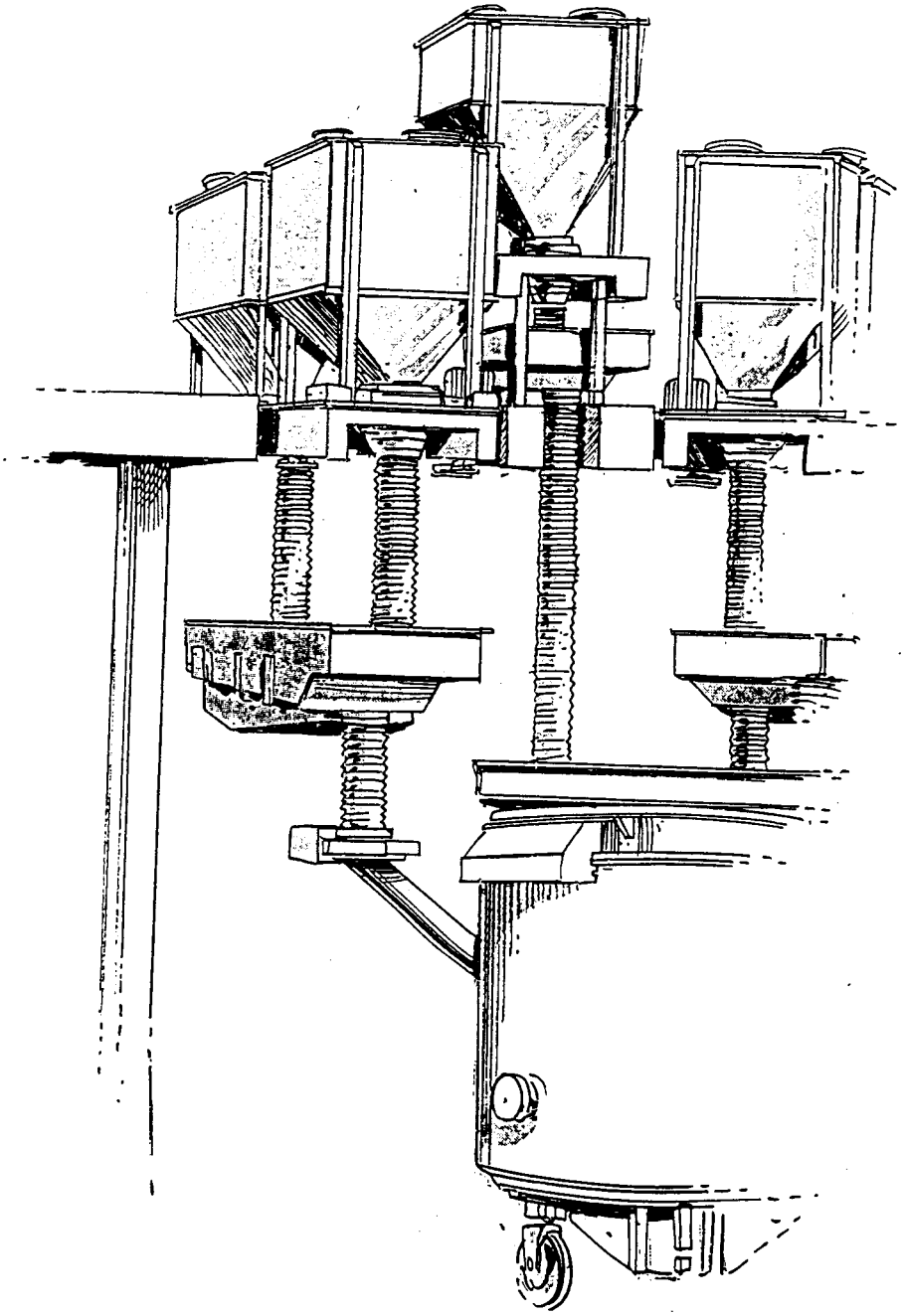


Spray Lining Machine

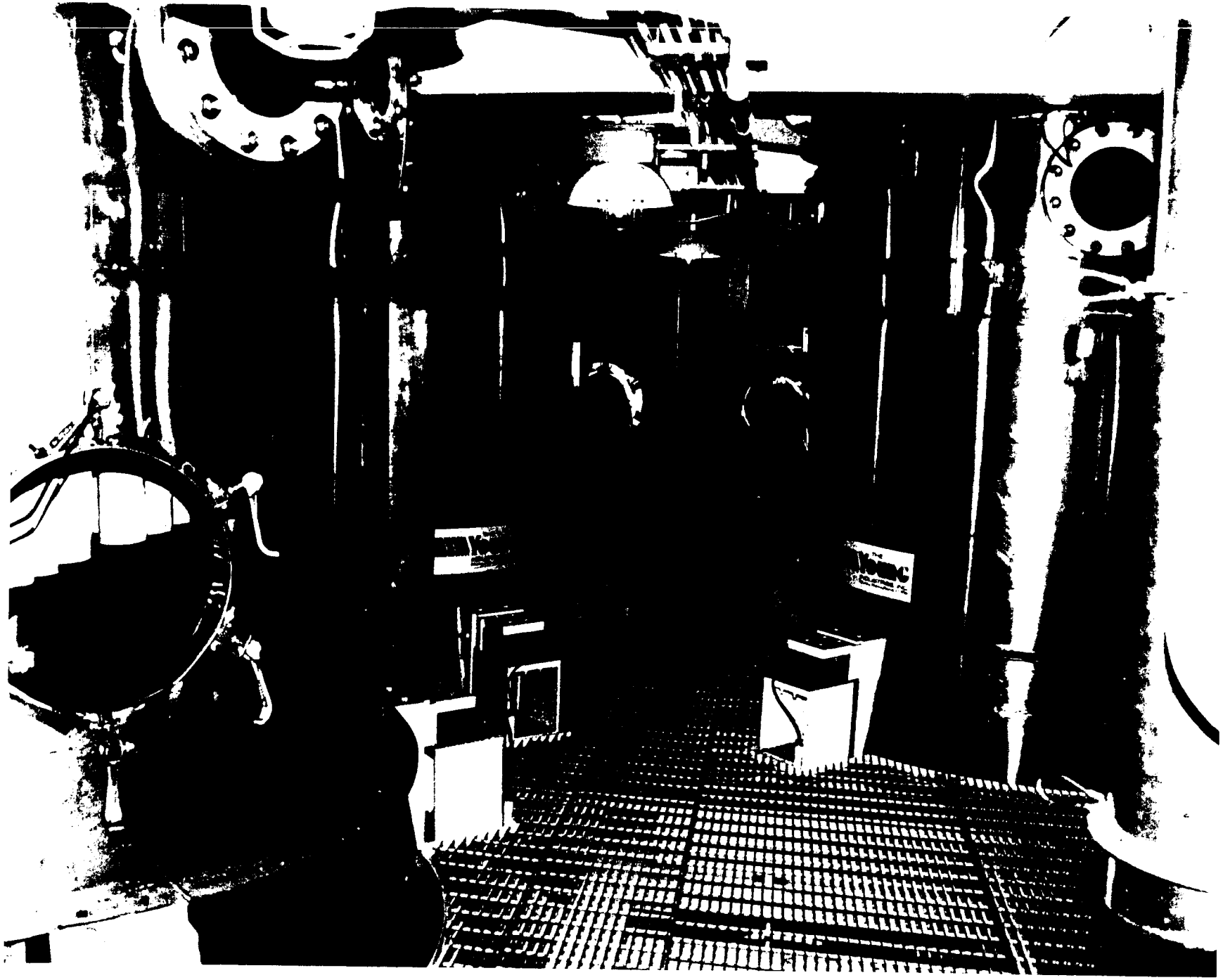


420 Gallon Baker Perkins Vertical Planetary Mixer

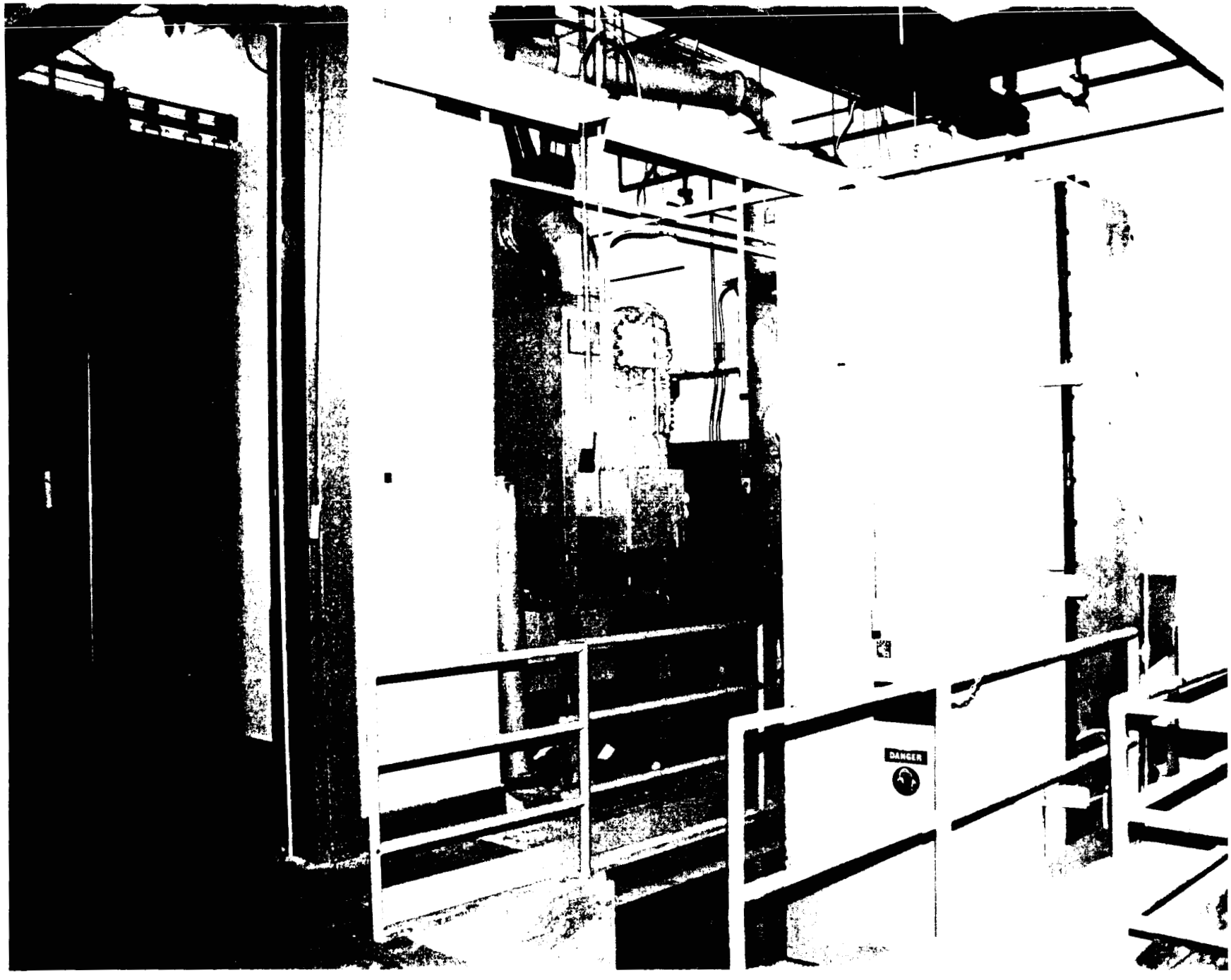
Composite Propellant/PBX Processing



Solid Feed System



Dust Collection System



Abrasive Blasting System

Radiographic Inspection System

Composite Propellant/PBX Processing

Technical Center Site	Indian Head Division, NSWC
Facility/Equipment Nomenclature or Title	Extruded Energetics Products Facility

This facility is the only government-owned, government-operated extrusion plant in the country for the manufacture of propellant grains for solid rocket motors. The primary purpose of this facility is to manufacture, load, assemble, disassemble, and rework:

- extruded composite and double base solid propellant grains
- propellant systems,
- ignition devices for rocket igniters,
- safe and arm devices,
- gun primers,
- rocket motors, and
- Propellant Actuated Devices/Aircrew Escape Propulsion System rocket motors and cartridge grains.

Other capabilities provided include:

- **Conduct manufacturing methods and technology studies,**
- **Prove out production equipment and tooling,**
- **Develop extrusion processes for new products and identify facility requirements for production,**
- **Support private industry by transferring new products from preproduction and pilot production to quantity manufacturing,**

- **Assist in developing final specifications for products,**
- **Develop safety guidelines and improving operational methods, and**
- **Provide a back up capability to private industry production** (which was utilized in 1988-92, when Radford Army Ammunition Plant's MK 90 grainline was shutdown due to fatalities) and serving as a mobilization base as seen during Desert Storm for the Mk 22 Mod 4 Rocket Motor.

The facility's production activities include: MK 117 Jet-Assisted Take-Off (JATO) motors; MK 22 solid rocket motors for the Mine Clearing Line Charge (MICLIC) system; MK 90 motors for the Hydra 70 weapons system (2.75" rocket), MK 1 RAPEC, M9 Rocket Catapult, and M37 Rocket Catapult motors for aircraft ejection systems; and production activities for the ASROC and Zuni systems. These facilities are flexible and can be adapted for many other uses to do specialty production or to quickly react to a need.

Equipment integral to this facility with a replacement value ≥ $500,000:

a. Seven 15" Horizontal Extrusion Presses: The primary purpose of the horizontal presses is to process double-base and composite propellants. These presses have supported the 2.75" rocket (used by all services), ASROC, and ZUNI programs, MICLIC's MK 22 line throwing rocket system, and various AEPS (Aircrew Escape Propulsion System) programs.

The replacement value of each press system is estimated at $1,000,000.

b. Two 3" Spiral Multi-Wrap Machines: The primary purpose of this machine is to apply a peripheral inhibitor on double-base propellant grains to inhibit the burn during rocket motor firing. Multiple layers of inhibitor tape are applied simultaneously in a spiral pattern on the outside circumference of the propellant. These machines have supported the 2.75" rocket program. This machine has replacement value of $500,000. The manufacturer of this equipment no longer produces this type of machine.

c. 5" Spiral Multi-Wrap Machines: The primary purpose of this machine is to apply a peripheral inhibitor on double-base propellant grains to inhibit the burn during rocket motor firing. Multiple layers of inhibitor tape are applied simultaneously in a spiral pattern on the outside circumference of the propellant. This facility has supported the ZUNI program, MICLIC's MK 22 line throwing rocket system and DEMNS system.

This machine is characterized as a fixed asset. The replacement value of this facility is $500,000. The manufacturer of this equipment no longer produces this type of machine.

d. 3" Dowel Rod Machine: The primary purpose of this machine is to machine the outside diameter of double-base propellant grains. This machine is used to supported the 2.75" weapon system. This is a fixed asset with a replacement value of $900,000.

e. 5" Dowel Rod Machine: The primary purpose of this machine is to machine the outside diameter of double-base propellant grains. This machine has supported the ZUNI weapon system and MICLIC's MK 22 line throwing rocket system. The equipment would have to be removed through the top or side of the building requiring roof or wall removal. The replacement value of this machine is $900,000.

f. Real-Time Radiographic Machine: The primary purpose of the real-time radiographic machine is to inspect the internal characteristics of propellant grains. The machine utilizes non-destructive inspection techniques and is capable of 3600 inspection along the entire length of the grains. This facility has supported the 2.75" weapon system.

The replacement cost of this equipment is $3,000,000.

The Extruded Energetics Products Facility at Indian Head operates 90 buildings. Replacement cost is estimated at $85M.

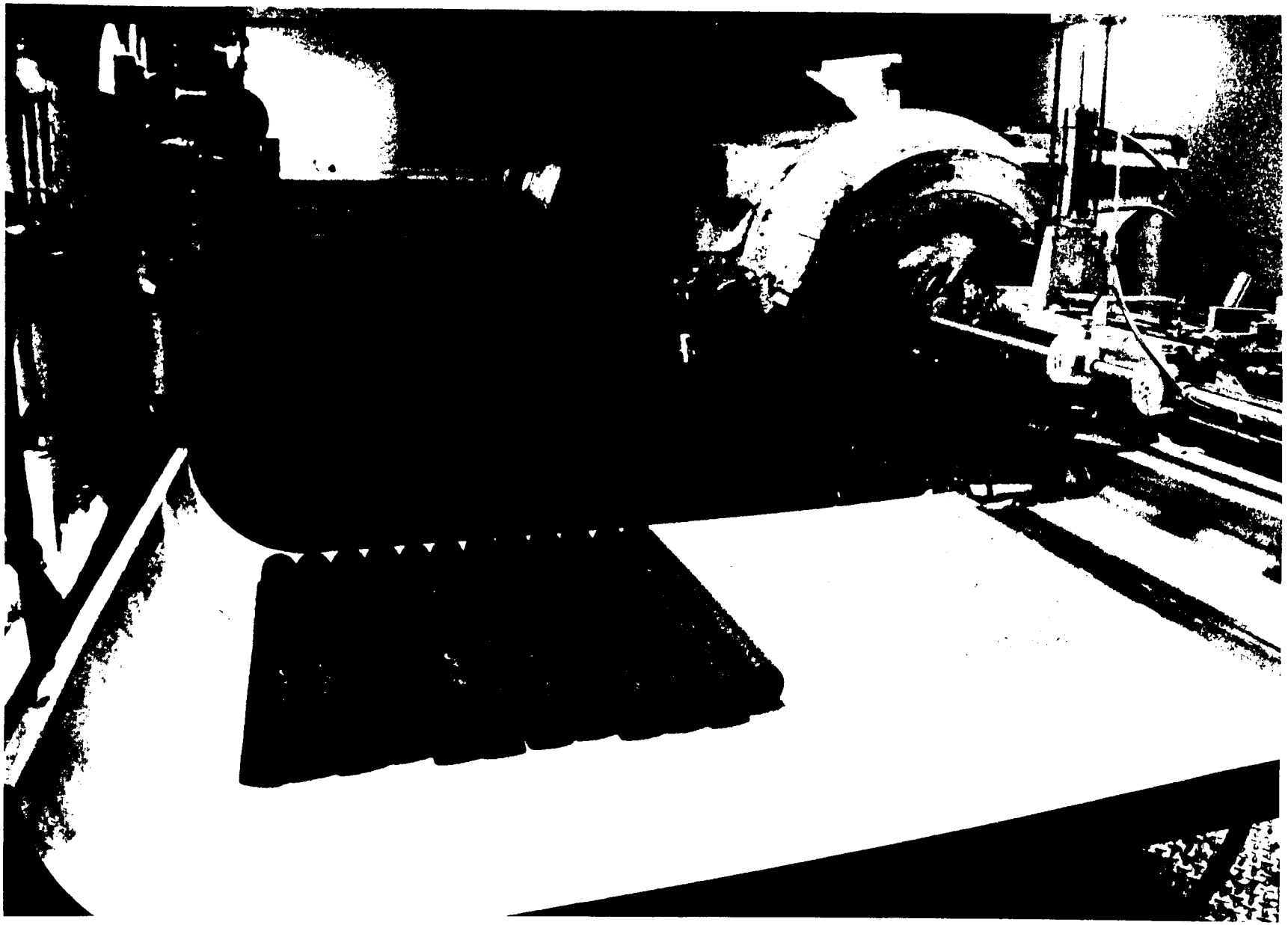
Indian Head and Radford Army Ammunition Plant are the only active facilities which have the capability to extrude up to 12 inch diameter propellant grains in the United States. **Indian Head is the sole source to machine 5 inch and larger extruded rocket motors.**

With the current warfighting scenario of regional conflicts, it is unlikely that large production capabilities will be needed. IHDIV provides the surge capability that will be required with this type of conflict for a variety of energetic products. Without Indian Head's surge capability, the Navy and DoD will suffer the delay and startup costs of large manufacturing facilities.

Recent history has demonstrated the value of the Navy having an active double-base extruded facility - the surge requirement during Desert Storm/Desert Shield and to supplement the void created as a result of Radford Army Ammunition Plant being shut down for a prolonged period of time because of an explosive incident.

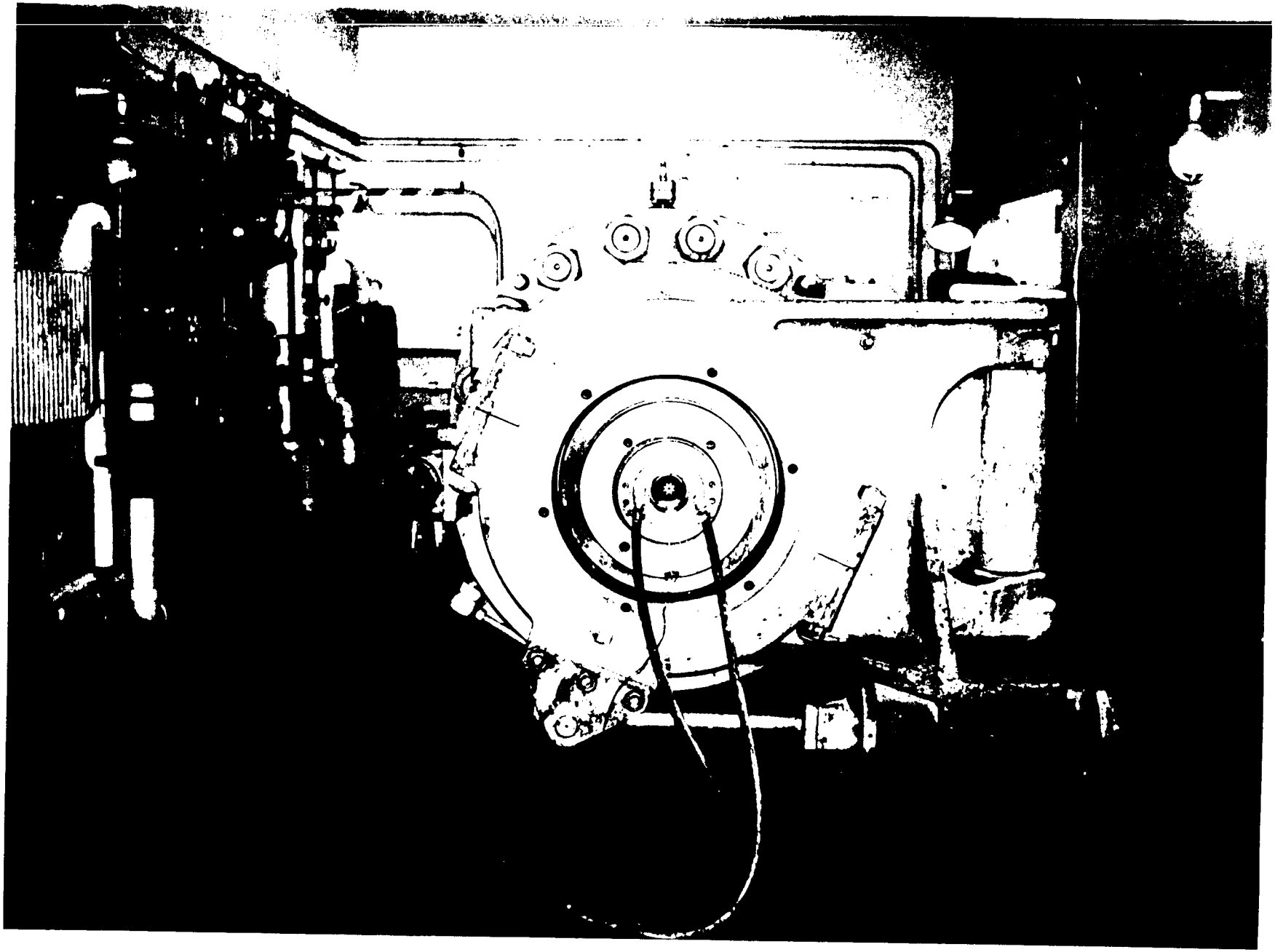
The Extrusion plant is the only government owned government operated facility for the production of solventless propellant grains for solid rocket motors.

Extruded Energetics Products Facility

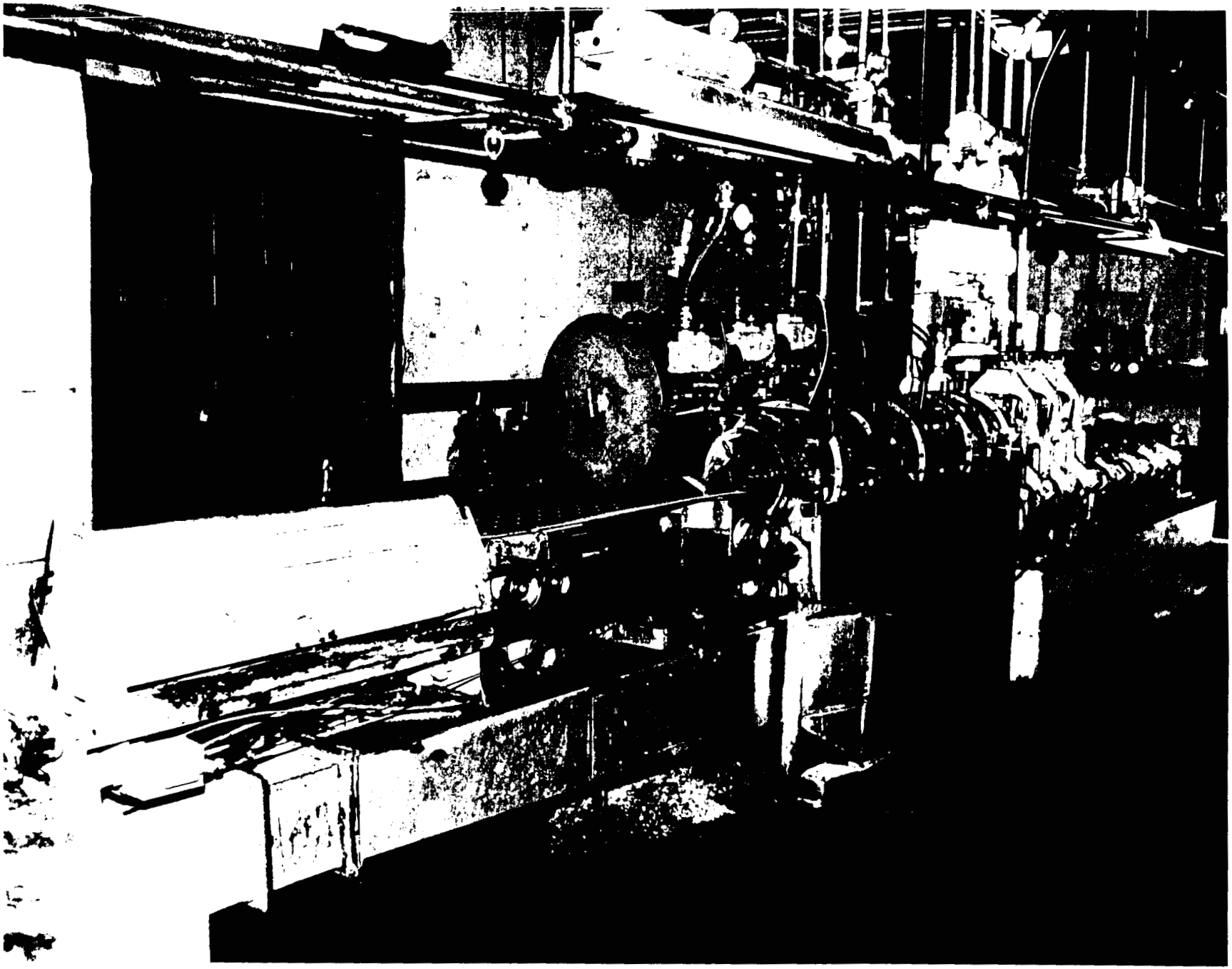


2.75" rocket grains are but one of the many products that are extruded at Indian Head Division. Pictured is one of seven 15" horizontal extrusion presses.

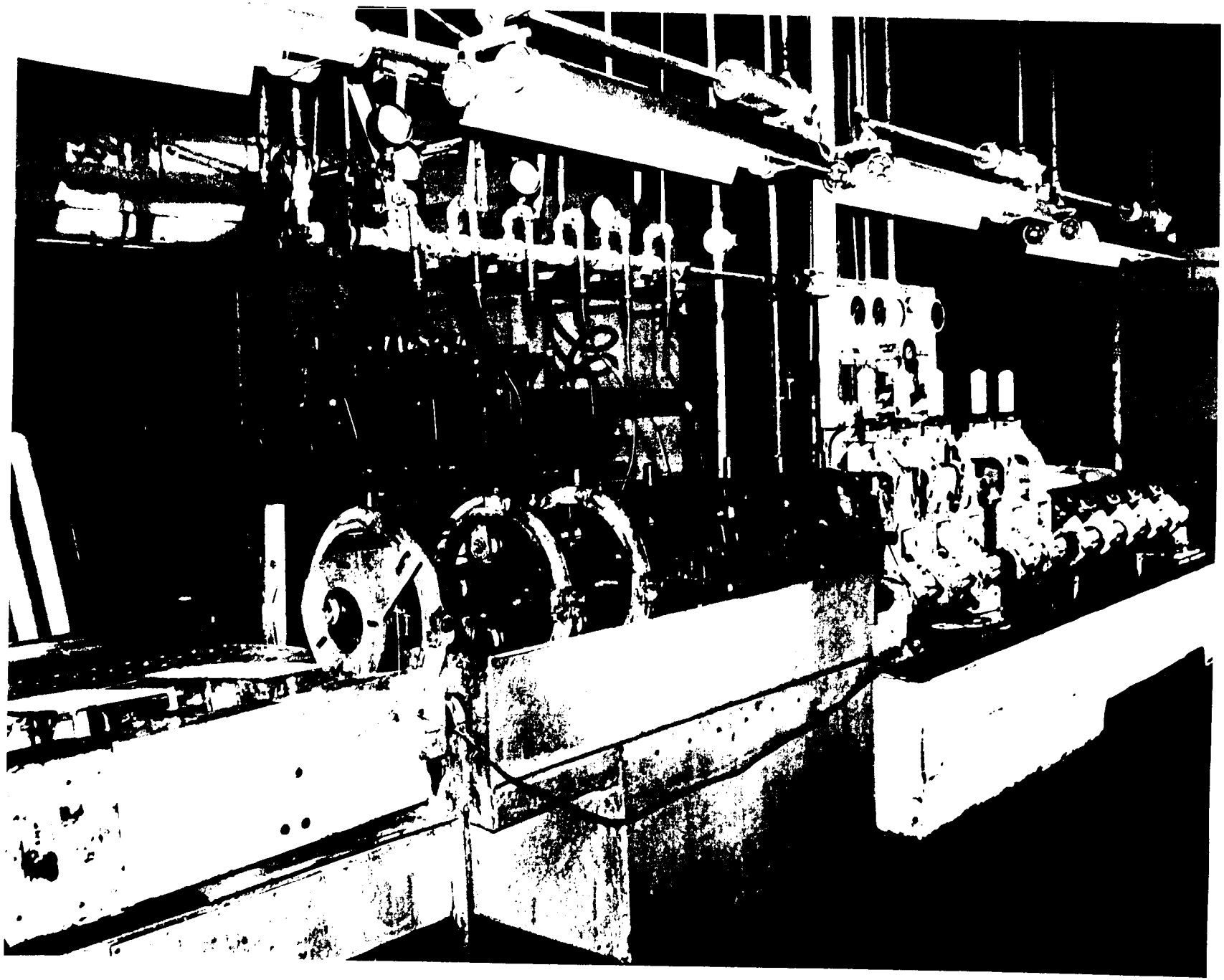
Extruded Energetics Products Facility



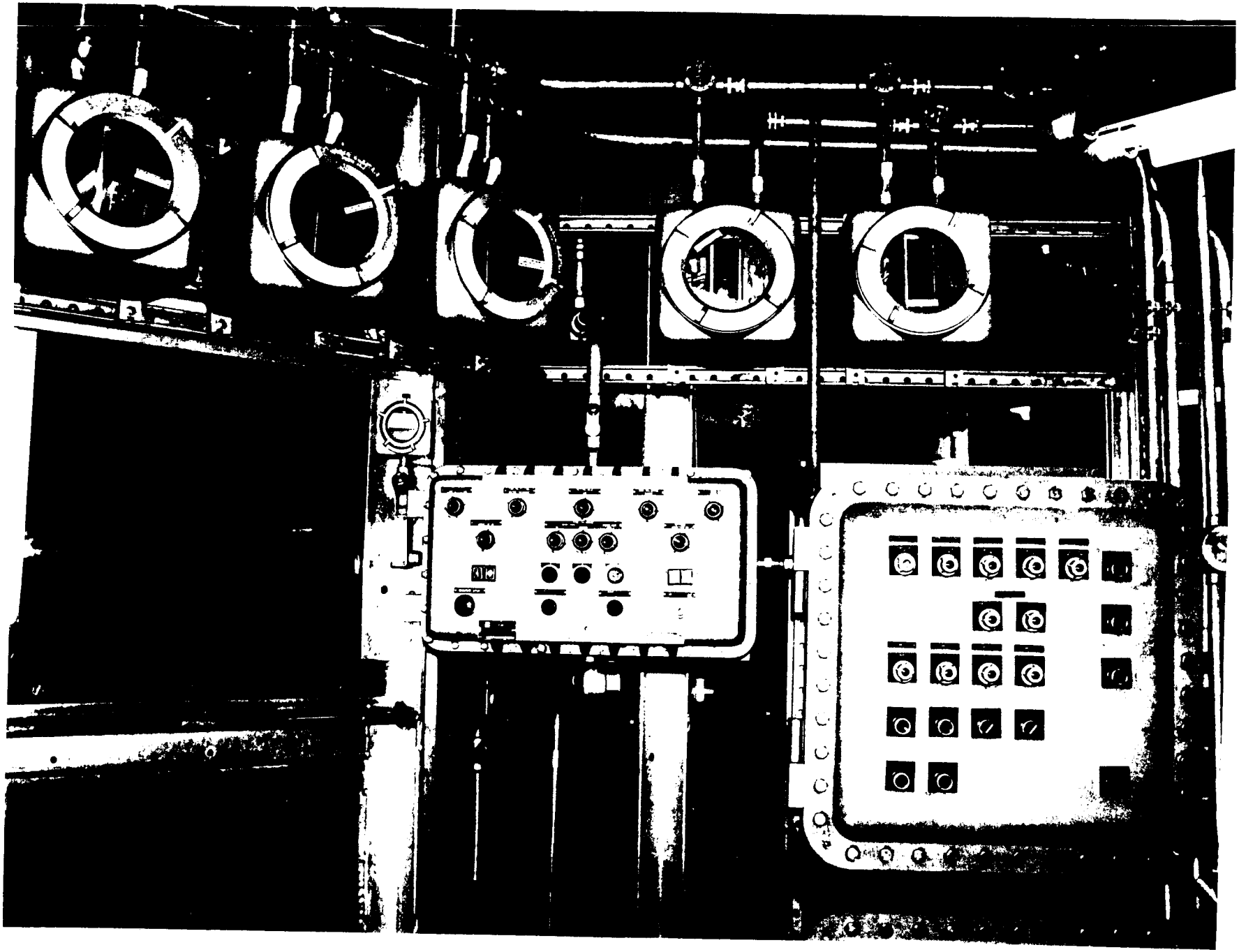
15" Horizontal Extrusion Press
(IHDIV owns seven)



3" Spiral Multi-Wrap Machines

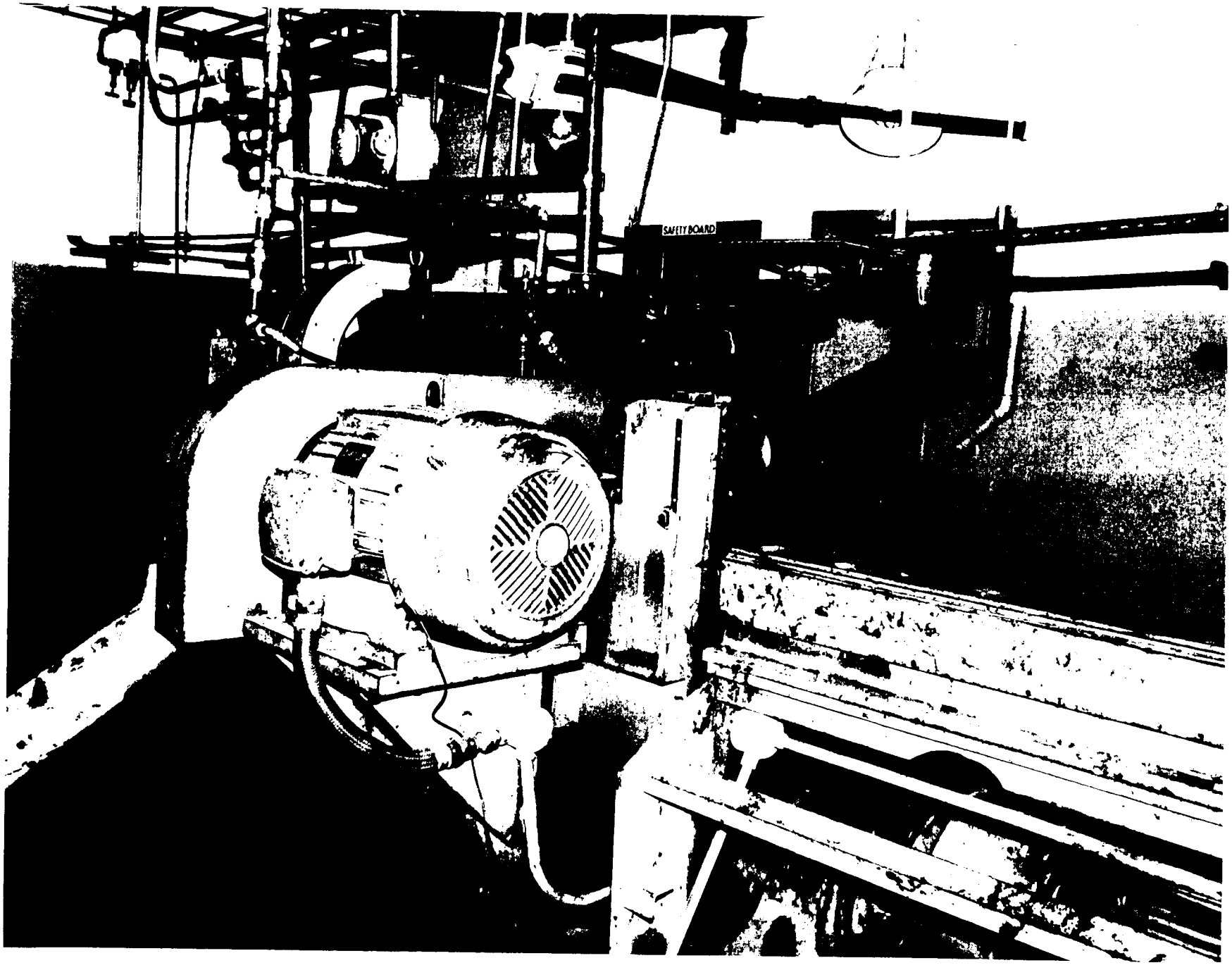


5" Spiral Multi-Wrap Machines



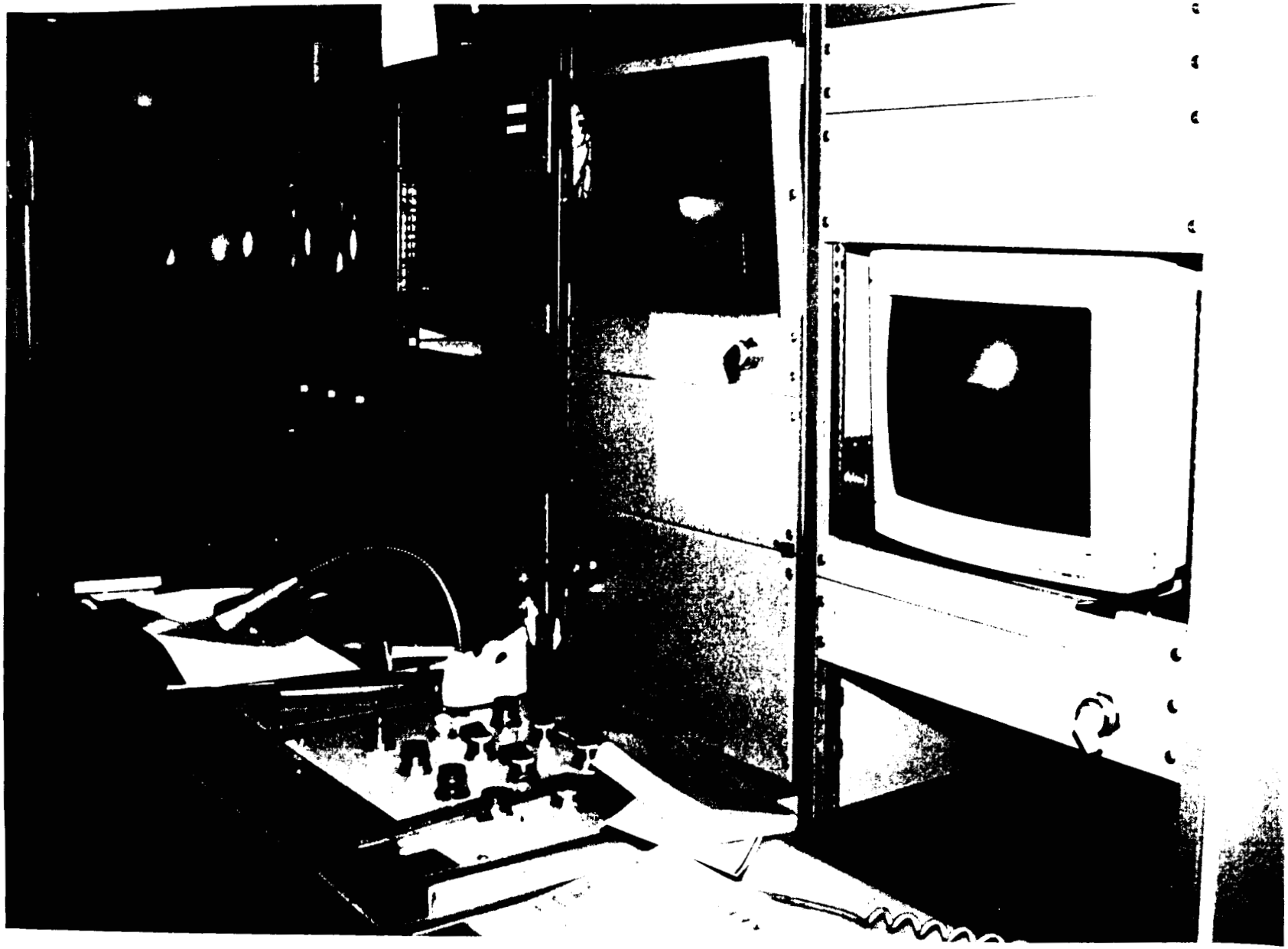
3" Dowell Rod Machine

Extruded Energetics Products Facility



5" Dowell Rod Machine

Extruded Energetics Products Facility



Real-Time Radiographic Machine

Extruded Energetics Products Facility

Technical Center Site	Indian Head Division, NSWC
Facility/Equipment Nomenclature or Title	Ordnance Test & Evaluation Facility

The ability to test ordnance items in support of development, production, quality evaluation, malfunction, and fleet support programs is a critical part of the complete technical capability provided by Indian Head.

The ordnance test and evaluation capability at the Indian Head Division is made up of five major components:

Rocket motor ballistic test
Environmental test
Non-destructive test

The rocket motor ballistic test facility is used to static fire rocket motors in support of development, lot acceptance, quality evaluation, and malfunction investigation programs. The facility provides the capability to environmentally condition and fire the motors to simulate the real conditions which will be experienced in the fleet. Real-time data analysis and reduction, video coverage, and high speed photography ensure complete characterization of the performance of the rocket motor. These tests are performed for those units developed or produced at Indian Head and by private contractors. Typical programs supported include all aircrew escape propulsion units, all JATO units, Standard Missile, HARM, Sidewinder, and AMRAAM.

All new ordnance items must be evaluated at the environmental extremes to which they may be exposed in order to ensure reliable and safe performance during service use. The environmental test facility is designed to provide this capability for rocket motors, warheads, aircrew escape propulsion units, and CADS. The facilities provide the capability to evaluate the response of ordnance items when exposed to mechanical stimuli (shock, drop, vibration, lead, hydrostatic pressure, and acceleration) and climatic extremes (altitude, temperature, humidity, thermal shock, salt-fog, wind and rain, and sand and dust). A special test capability which is included in the environmental is the 300,000 volt electrostatic discharge (ESD) facility. **One of only four in the country, it is unique in the ability to measure voltage and current during testing.** Units are

tested here as part of qualification, surveillance, lot acceptance, and malfunction programs. After undergoing a series of environmental tests, the ordnance items is usually then test fired in one of our ballistic test facilities to determine the effects of the environmental cycling on performance. Typical units tested include Standard Missile, Sidewinder, HARM, various JATOS, and CAD/PADs.

The non-destructive test (NDT) facility is required in order to inspect ordnance items and metal parts for flaws, improper assembly, foreign materials, and any other anomalies which may have occurred during manufacture, storage, or service use. There are five primary techniques which are utilized: radiography, dye penetrant, magnetic particle, eddy current, and ultrasonic. Indian Head has two radiographic (x-ray) sites, with a total of eight x-ray units. ordnance items up to five feet in diameter, 18 feet long, and 4,000 pounds of Class 1.1 explosive weight can be x-rayed. A separate building is used for the other four techniques. The NDT techniques are used to inspect units after manufacture, environmental testing, or a malfunction.

The combination of these facilities provides Indian Head with the total capability to support development, production, quality evaluation, and malfunction investigation for ordnance items.

Equipment integral to this facility with a replacement value ≥ $500,000:

Tomahawk Functional Ground Test (FGT) System: The primary purpose of this equipment is to interface and gather data during Tomahawk Missile FGT. This asset has a replacement value of $6-7 million. **This is the only government owned Tomahawk FGT capability.**

Component Thrust Vector (Ormond Inc.) - Tomahawk: This equipment is a multi component test stand used in testing the MK 106/MK 111 booster to determine serviceability. **This is a one of a kind test stand.** This is a fixed asset with a replacement value of $750,000 - $1,000,000. **This is the only government owned multi-component test stand for the Tomahawk Booster (MK 106/MK 111).** If this capability were lost, the Navy could not perform quality evaluation (service life evaluation) on the Tomahawk Booster.

Large Motor Test Digital Data Acquisition System (HP-1000): This equipment is used to acquire digital data from rocket motor static-fire operations. It supports lot acceptance testing of production items, quality evaluation for fleet returns and special tests. This asset is moveable with a replacement value of $2,000,000.

Small Motor Test Digital Data Acquisition System (HP-1000): This equipment is used to acquire digital data from rocket motor static-fire operations. It supports lot acceptance testing of production items, quality evaluation for fleet returns and special tests. This asset has a replacement value of $2,000,000.

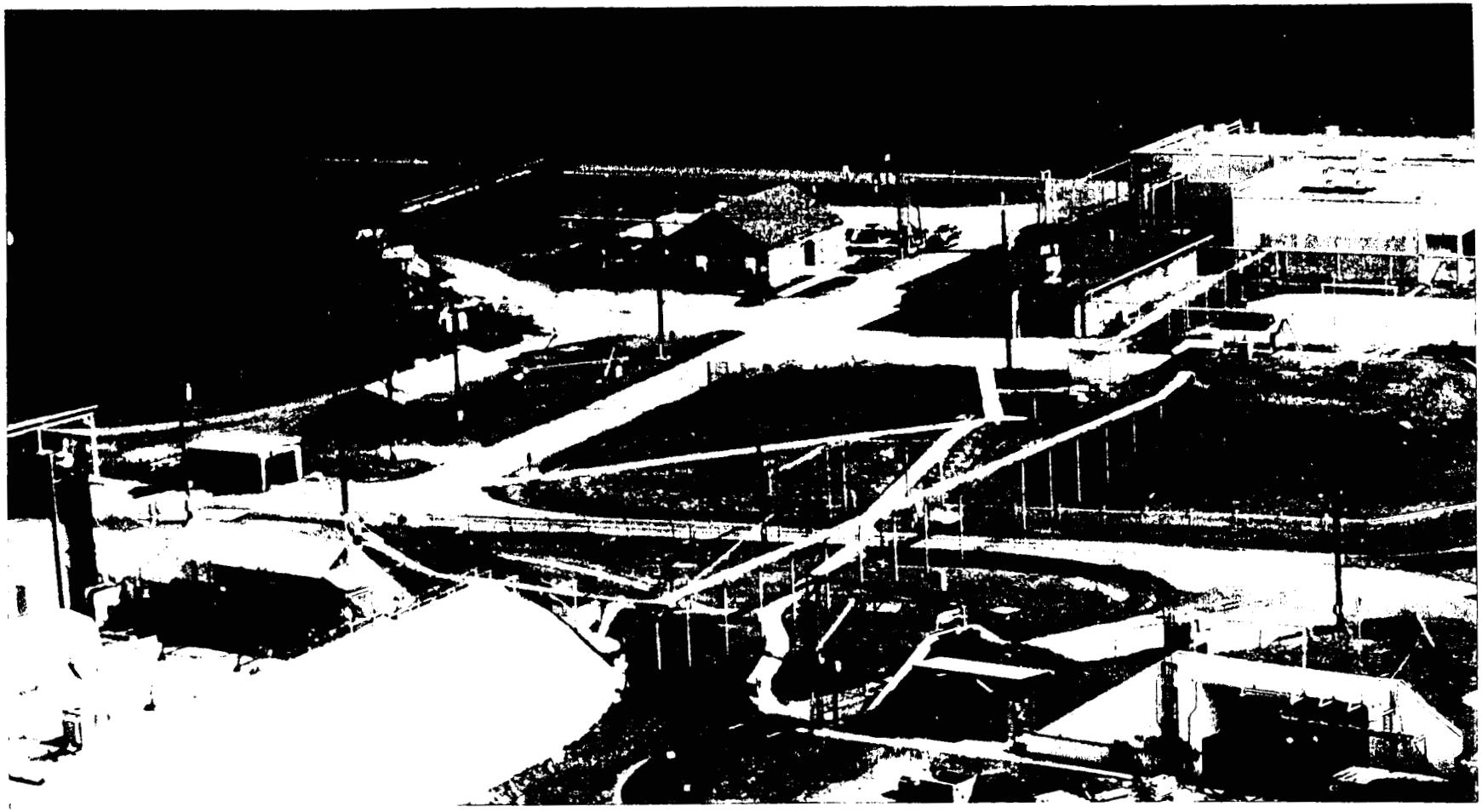
Large Motor Test Automatic Data Acquisition Equipment: This equipment is used to acquire digital data from rocket motor static-fire operations. It supports lot acceptance testing of production items, quality evaluation for fleet returns and special tests. This asset has a replacement value of $1,200,000.

Small Motor Test Automatic Data Recording Equipment: This equipment is used to acquire digital data from rocket motor static-fire operations. It supports lot acceptance testing of production items, quality evaluation for fleet returns and special tests. This asset has a replacement value of $1,000,000.

High Energy Real-Time Radiographic Inspection System: The high energy real-time radiographic inspection system is composed of four different x-ray sources up to 4 million-electron-volts (4 MeV), including a 200kvp microfocus source, and three manipulator systems located in two different buildings. The primary purpose for this equipment is to non-destructively inspect energetic and non-energetic materials for flaw detection, signs of aging, improper assembly, foreign materials in the raw materials or manufactured propellants, or any other anomalies that might occur. These energetic materials can be up to 5 feet in diameter and up to 18 feet in length with a maximum explosive weight of 4,000 pounds of Class 1.1 or 10,000 pounds of Class 1.3. This asset has a replacement value of $3,300,000.

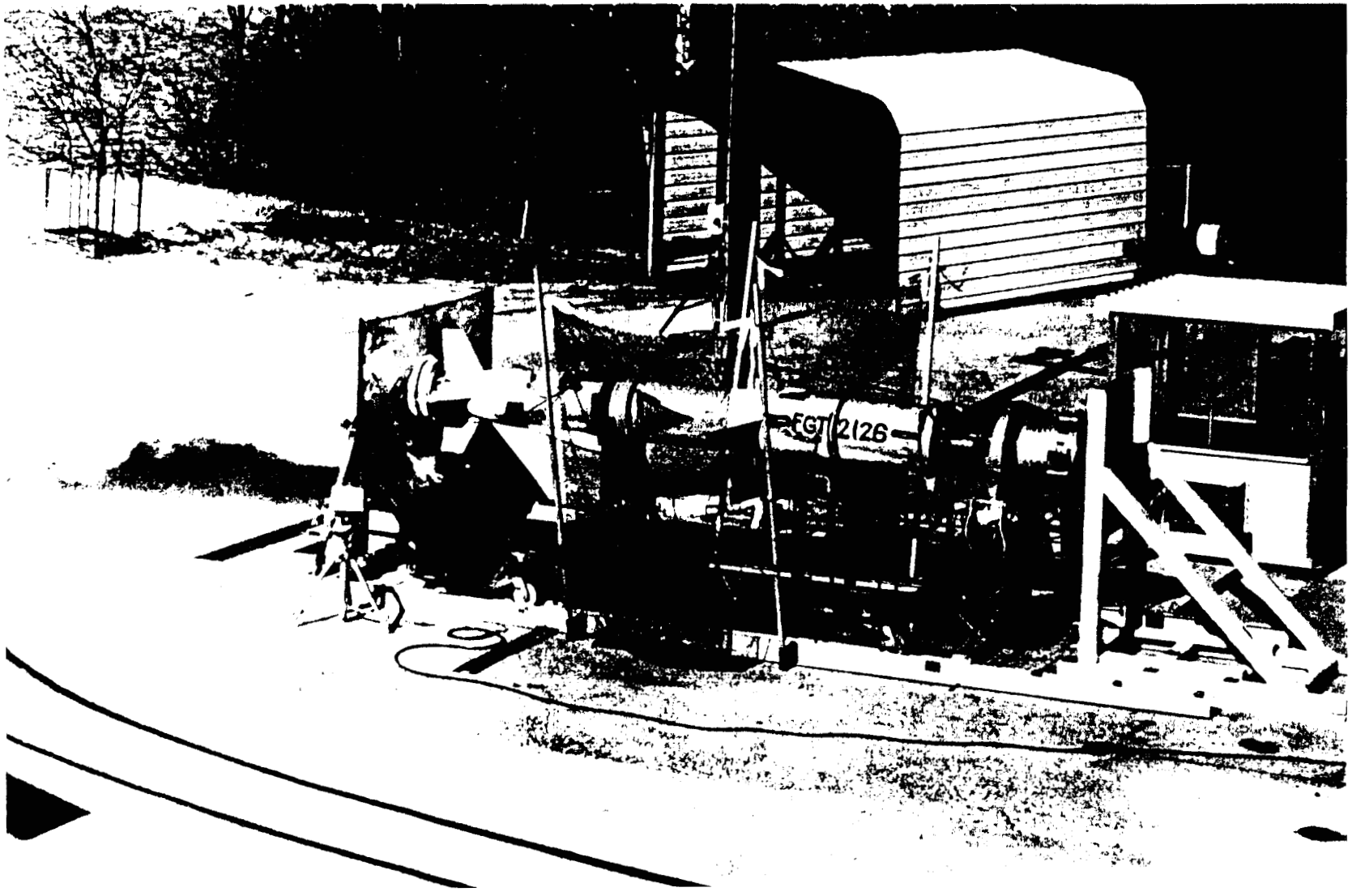
Digital/Analog Vibration Control System includes 20,000 Lb-F Electromagnetic Shaker: The vibration system is used to conduct environmental vibration tests on a wide array of ordnance and inert items to simulate adverse environmental conditions that the item will be exposed to during its normal service life.

There are 39 main buildings which comprise the ordnance test & evaluation facility. Their estimated replacement values is $ 17,700 K. The equipment used in this facility has an estimated replacement value of $ 27,300 K.



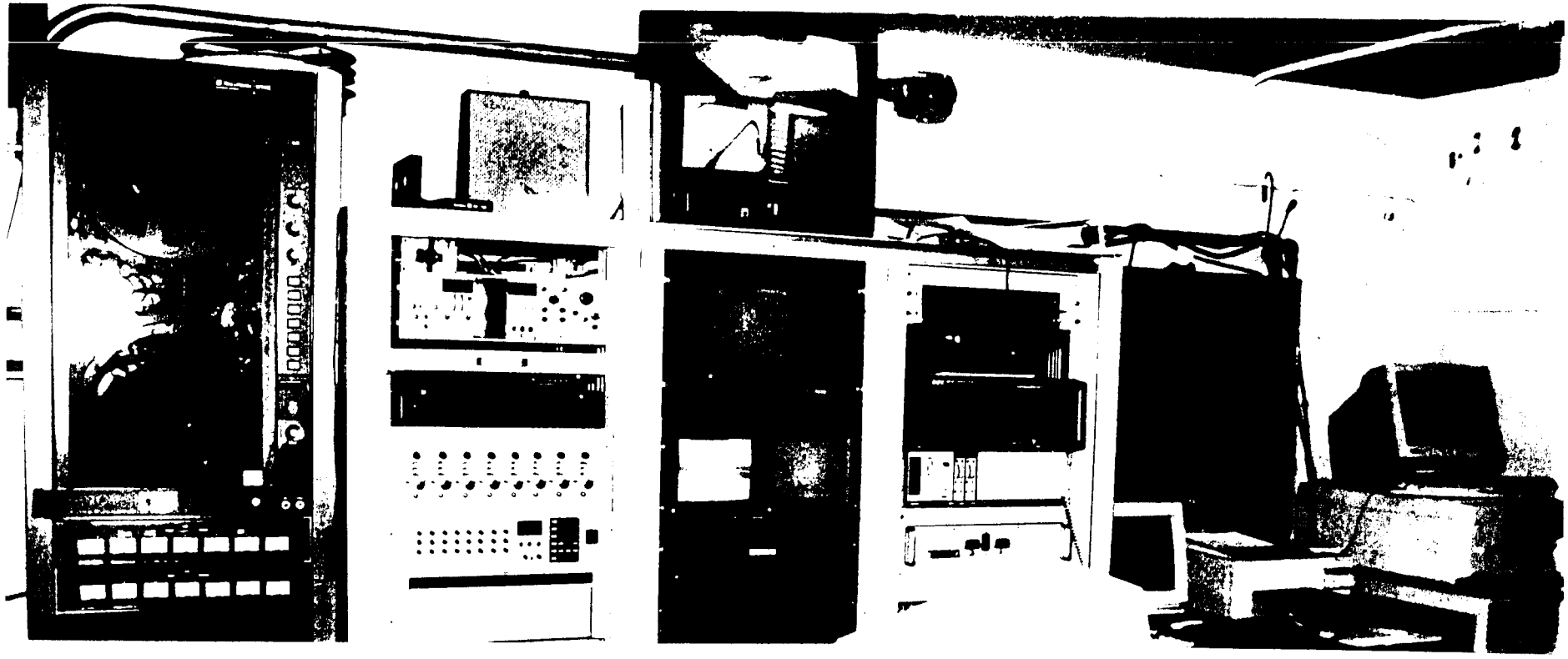
Our missile and rocket motor test firing facilities are used to determine ballistic parameters during all phases of motor life cycle at temperatures to which the items are likely to be exposed during fleet use.

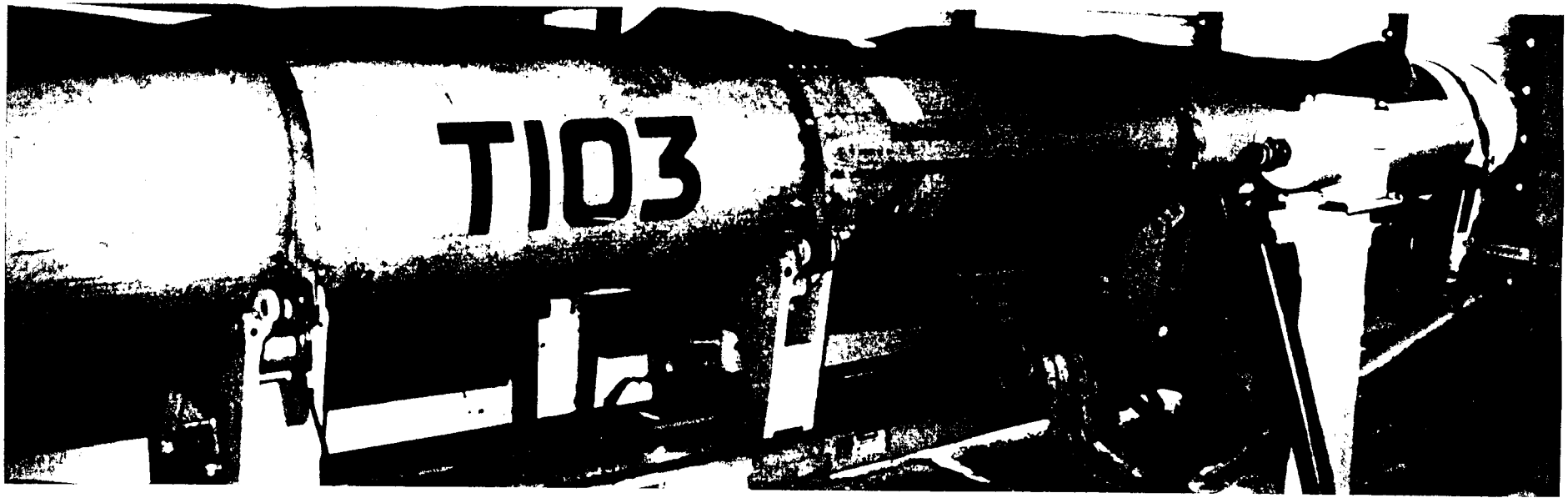
Ordnance Test & Evaluation Facility



A unique capability, the functional ground test for the Tomahawk cruise missile allows for continued evaluation of program enhancement and fleet inventory analysis.

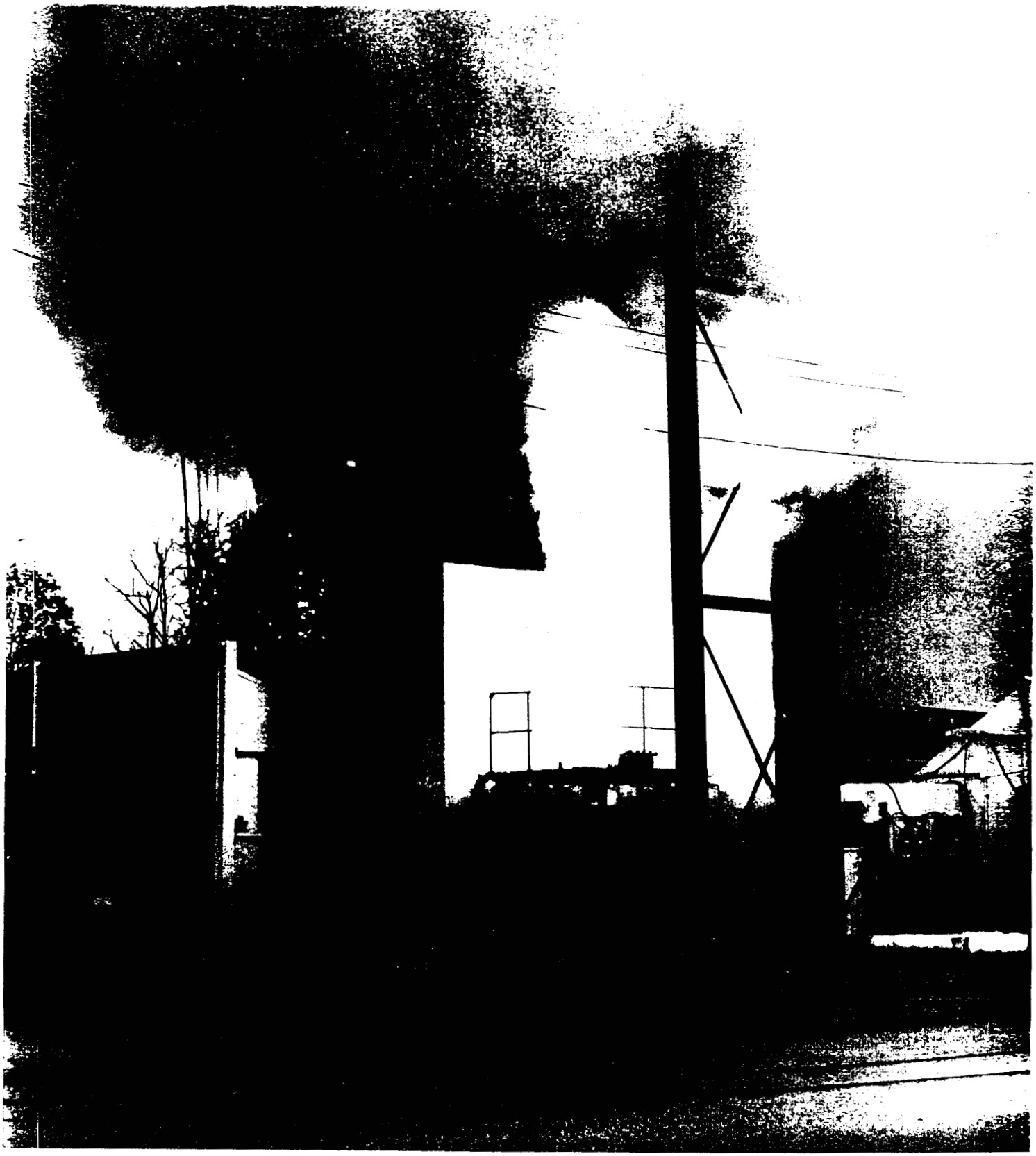
Ordnance Test & Evaluation Facility





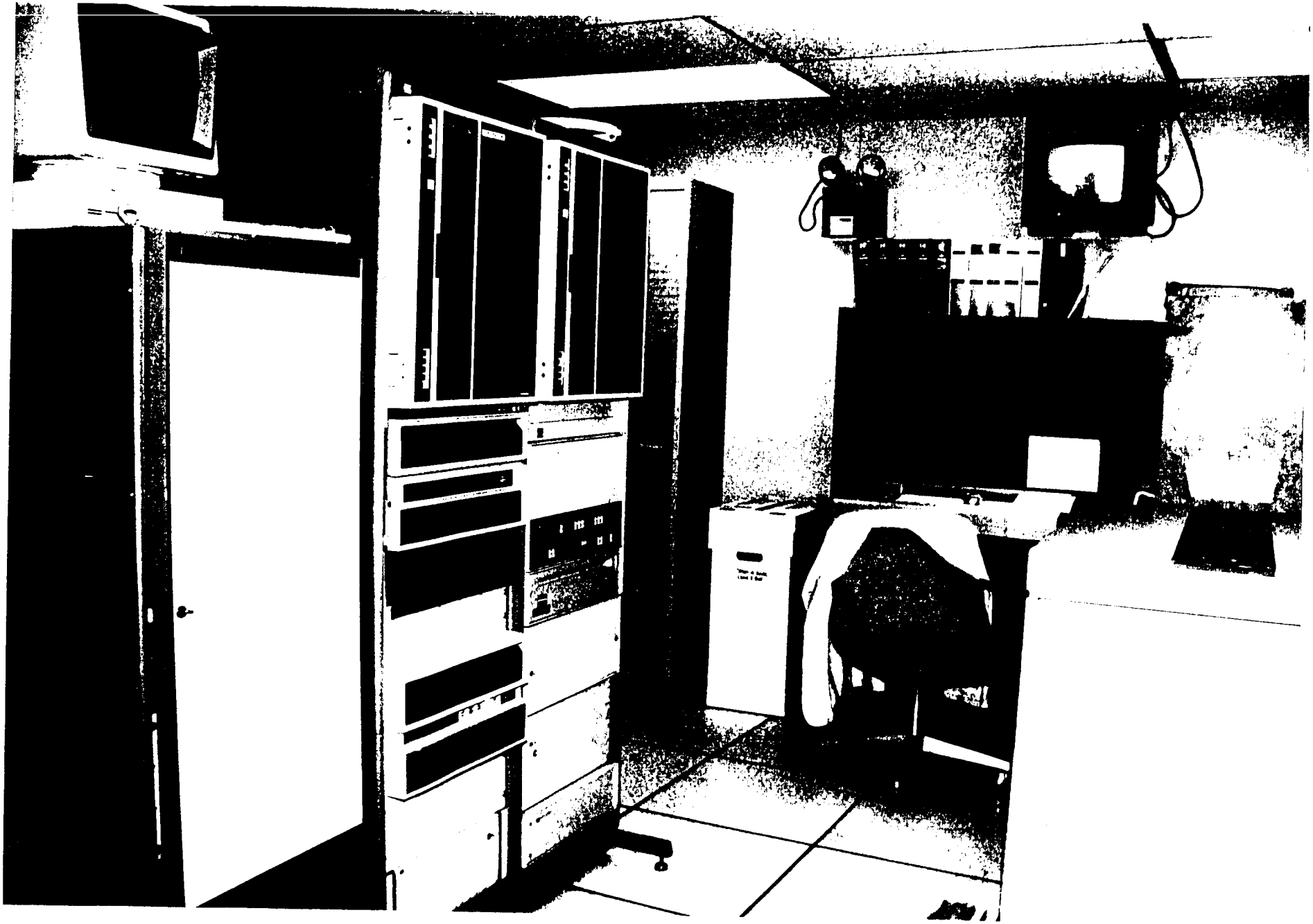
Tomahawk Functional Ground Test (FGT) System

Ordnance Test & Evaluation Facility



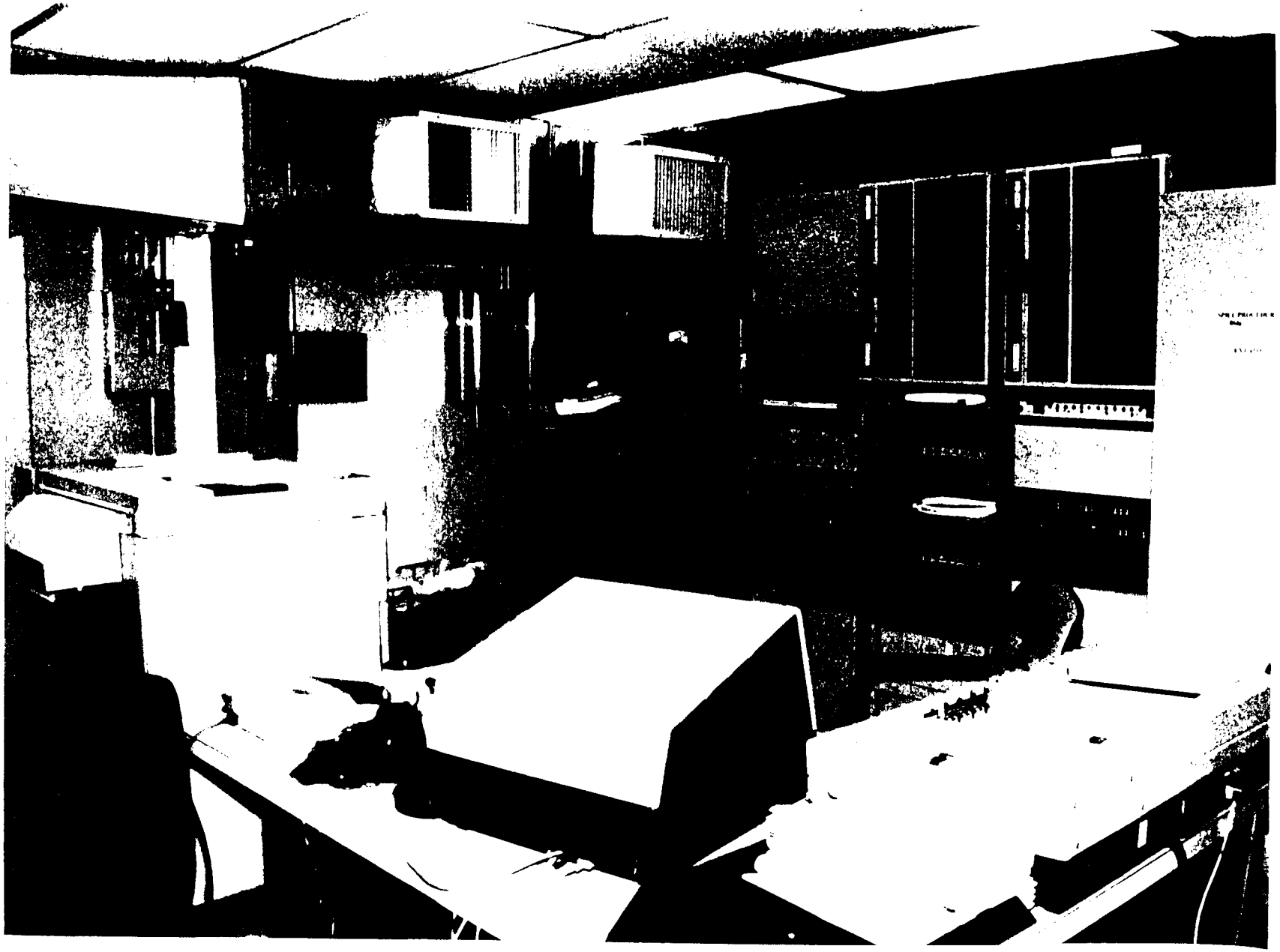
Component Thrust Vector

Ordnance Test & Evaluation Facility



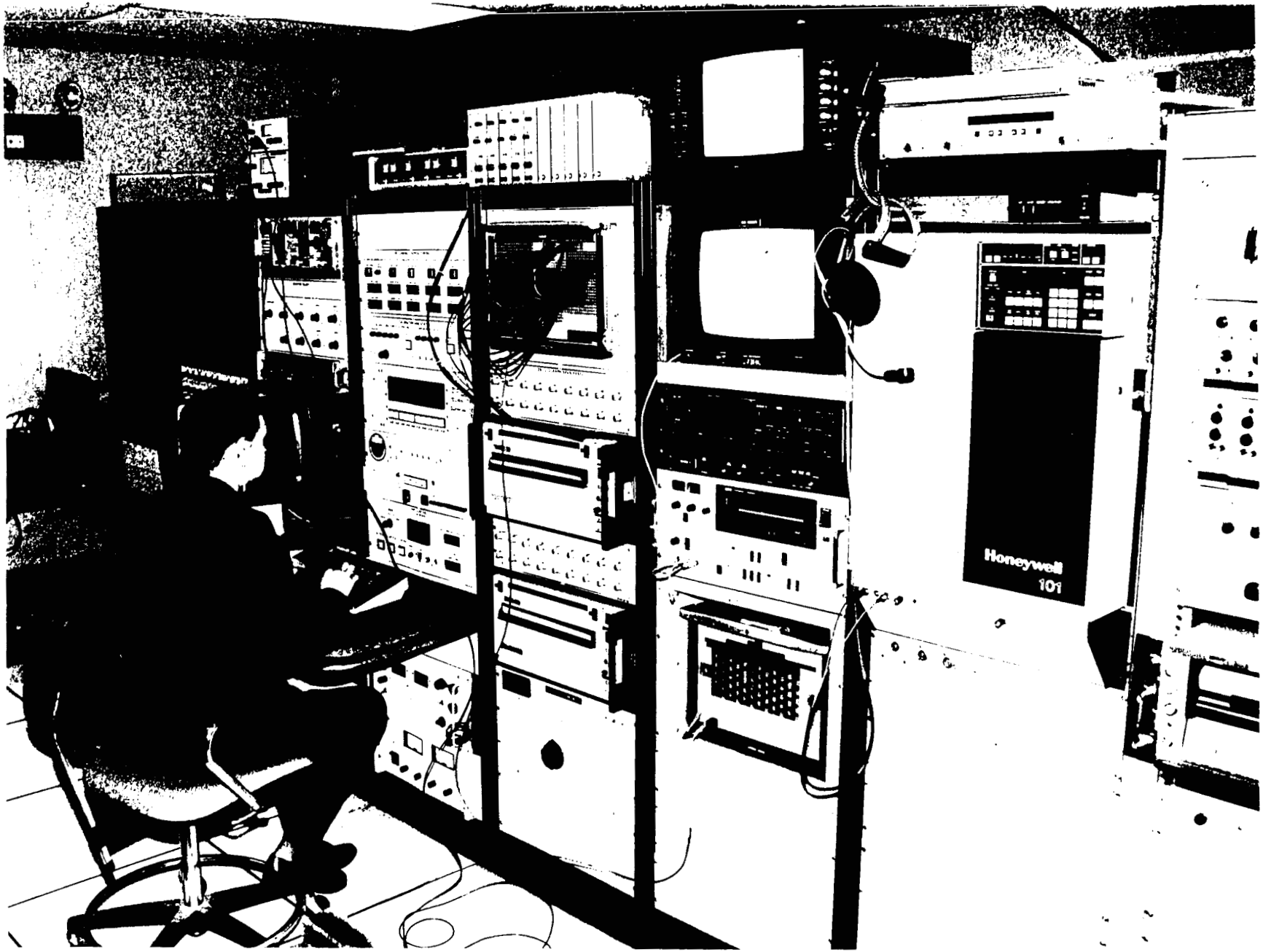
Large Motor Test Digital Data Acquisition System (HP-1000)

Ordnance Test & Evaluation Facility



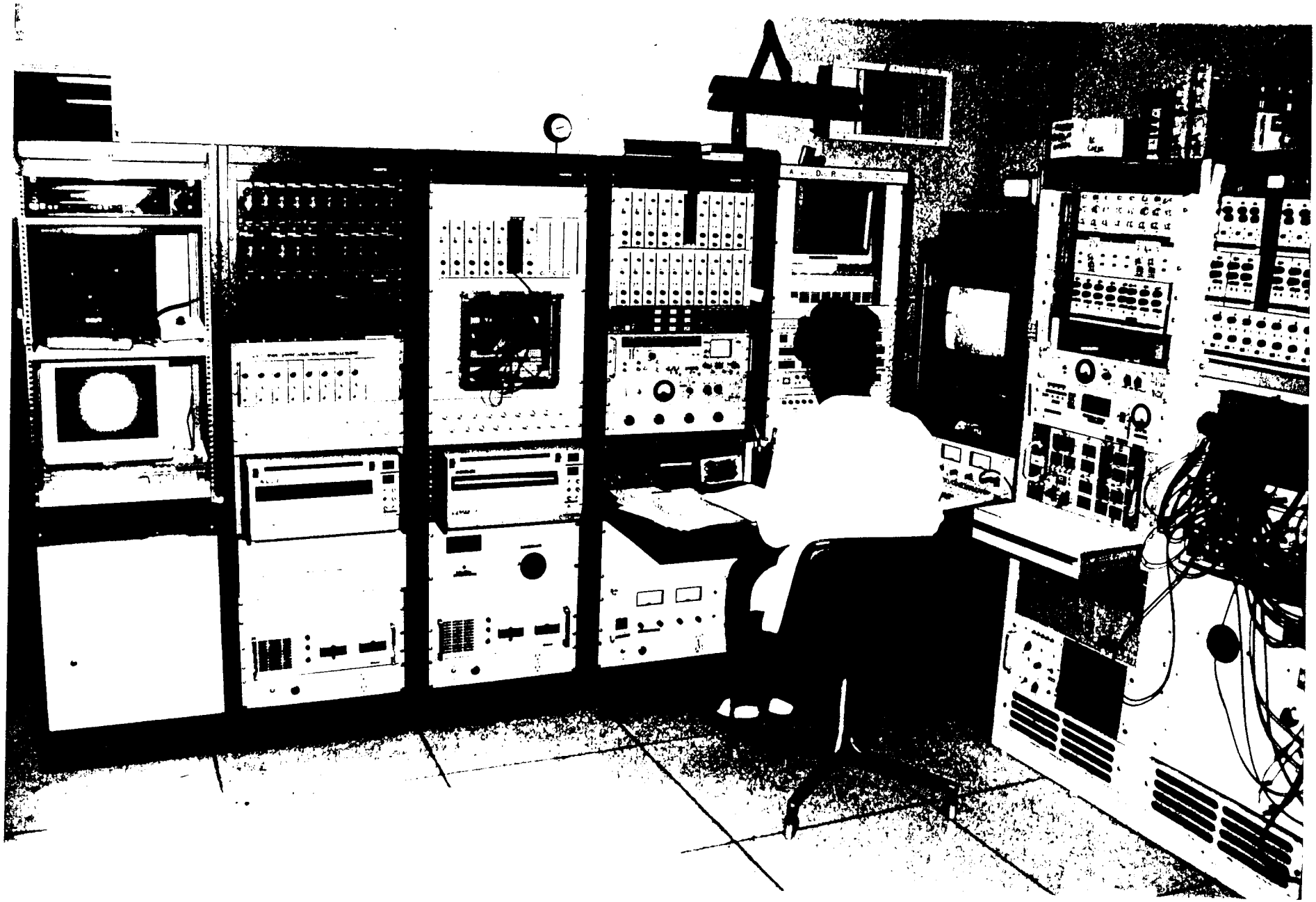
Small Motor Test Digital Data Acquisition System (HP-1000)

Ordnance Test & Evaluation Facility



Large Motor Test Automatic Data Acquisition Equipment

Ordnance Test & Evaluation Facility

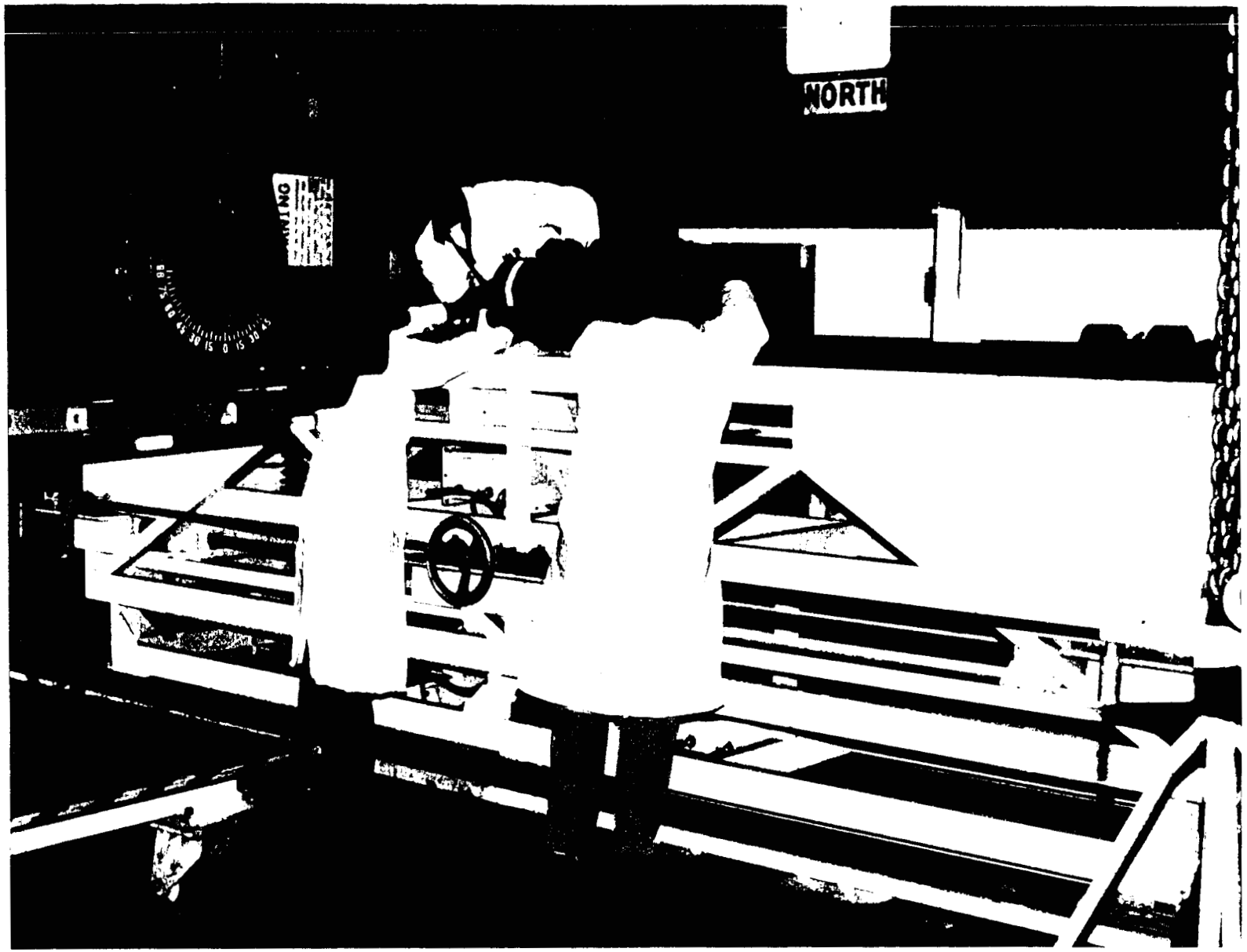


Small Motor Test Automatic Data Recording Equipment

Ordnance Test & Evaluation Facility

High Energy Real-Time Radiographic Inspection System

Ordnance Test & Evaluation Facility



Radiographic facilities house real time x-ray equipment to determine in-process defects in manufactured units. Conventional film radiography is used extensively to non-destructively inspect energetic and non-energetic materials for flaw detection, signs of aging, improper assembly and foreign materials.

Ordnance Test & Evaluation Facility

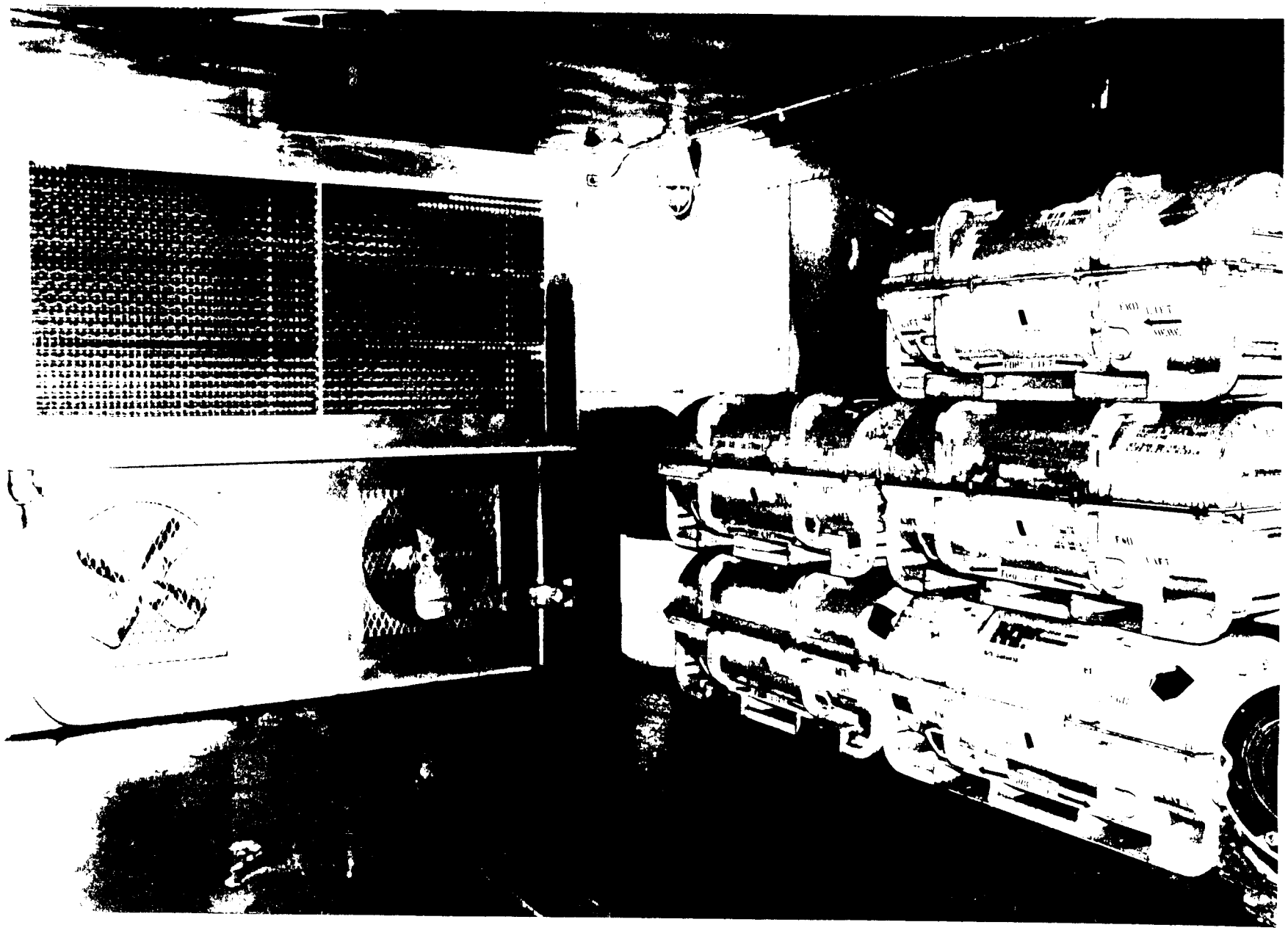
3.5 Expansion Potential

3.5.1 **Laboratory Facilities:** Use facilities records as of fourth-quarter FY93 in answering the following (in sq ft) for each CSF: (BRAC Criteria II)

Common Support Function	Facility or Equipment Description	Type of Space*	Space Capacity (KSF)		
			Current	Used	Excess
WEAPONS	Energetics Material Research Laboratory	TECHNICAL	63.3	63.3	0
		ADMIN.	.5	.5	0
		STORAGE	2.4	2.4	0
		UTILITY	0	0	0
WEAPONS	Weapons Product Development	TECHNICAL	45.6	45.6	0
		ADMIN.	32.6	32.6	0
		STORAGE	0	0	0
		UTILITY	0	0	0
WEAPONS	Nitramine Gun & High Energy Propellant Facility	TECHNICAL	56.5	56.5	0
		ADMIN.	7.2	7.2	0
		STORAGE	50.1	50.1	0
		UTILITY	5.9	5.9	0
WEAPONS	Chemicals Processing	TECHNICAL	22.1	22.1	0
		ADMIN.	2.3	2.3	0
		STORAGE	6.6	6.6	0
		UTILITY	0	0	0
WEAPONS	Composite Propellant/PBX Processing	TECHNICAL	160.0	160.0	0
		ADMIN.	16.0	16.0	0
		STORAGE	15.2	15.2	0

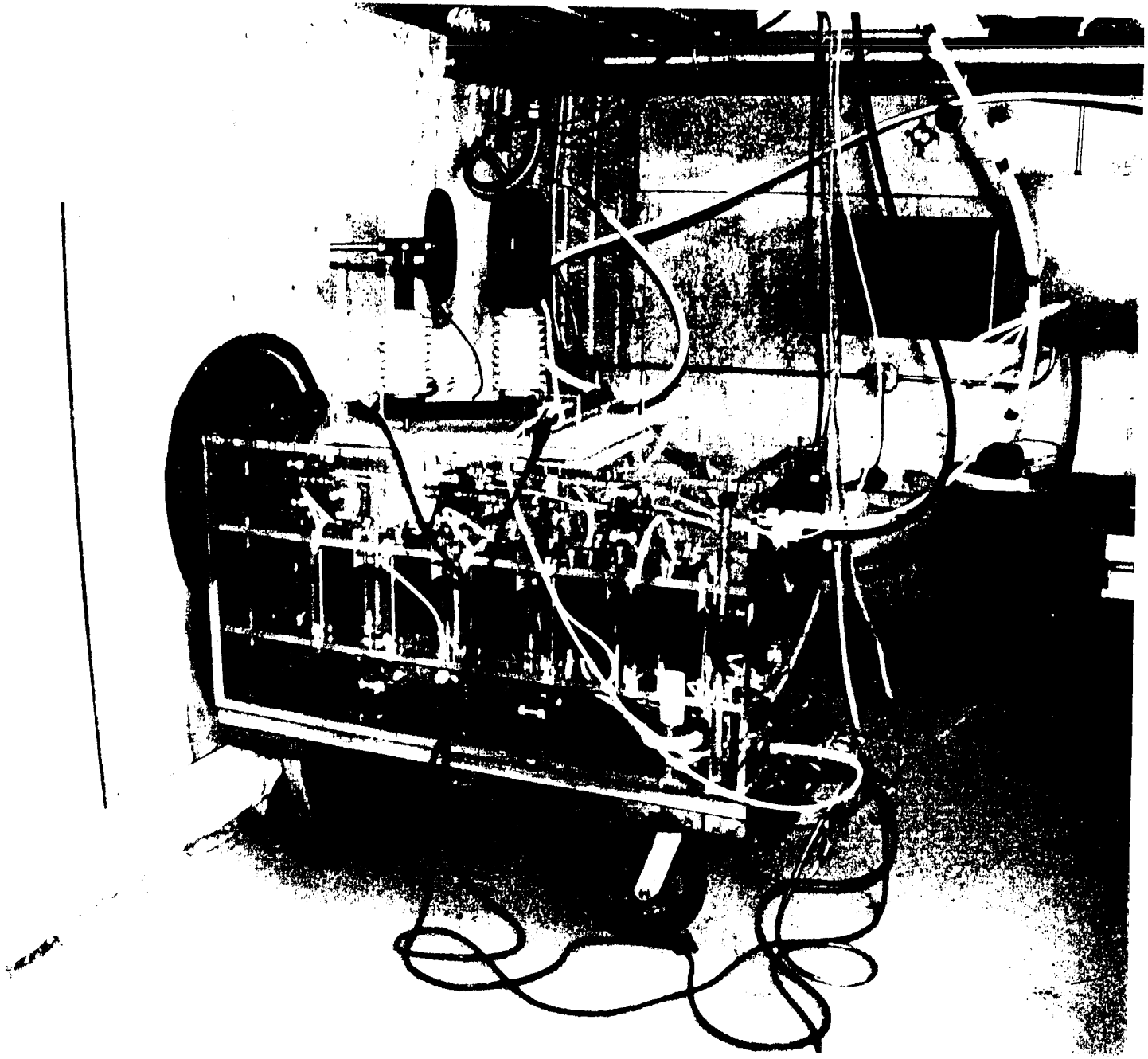
Environmental vibration test system simulates shock and vibration experience during operational use. Test items include electronics related to ordnance, igniters, cartridges, rocket motors, missiles, and warheads.

Ordnance Test & Evaluation Facility



This temperature and humidity chamber, part of the Enviromental Test Facility is 2300 cubic feet and can control humidity and 1 to 99 percent R.H. IHD is presently running a 6 month temperature and humidity test for a joint US/UK Harpoon program.

Ordnance Test & Evaluation Facility



The Marx Generator is used to provide 300,000 volt energy source for electrostatic discharge (ESD) test.

Ordnance Test & Evaluation Facility

Technical Center Site	Indian Head Division, NSWC
Facility/Equipment Nomenclature or Title	Chemical/Physical Characterization

The major function of chemical and physical characterization facilities at Indian Head is the performance of the testing and analysis necessary to determine the properties of the standard energetic materials (propellants, explosives, pyrotechnics, and chemicals) and the raw materials used in their manufacture which are processed on a regular basis, whether for development or production. When raw materials for use in energetics are delivered by a supplier, chemical analyses are performed to determine if the material meets specification requirements. After propellants or explosives are made, the materials are characterized for their chemical and physical properties (i.e., chemical composition, stability, density, mechanical properties, burning rate). These tests are typically performed on each mix of propellant or explosive which is loaded into a motor or warhead to ensure quality and performance.

The facility supports all in-house research and development and production programs with characterization of energetic materials. Where standard propellants or explosives are being used in a development program, this facility characterizes the energetic material. This facility also performs all of the chemical analyses on samples taken as part of our monitoring program to ensure compliance with environmental regulations; as such, it must be certified as an analytical laboratory.

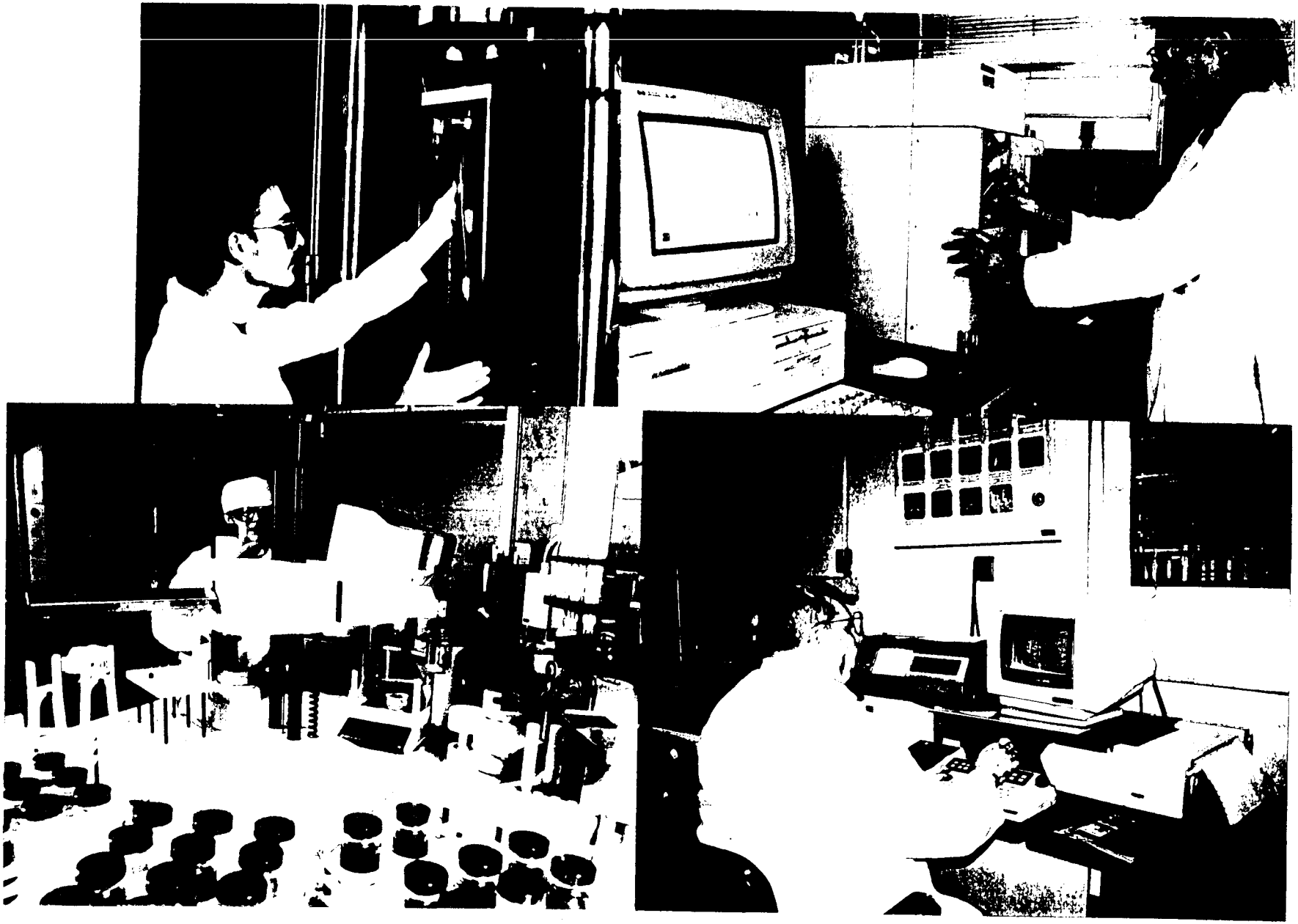
The performance of chemical and physical analysis on the energetic materials processed at Indian Head is integral to the performance of the production, engineering, and fleet support missions of Indian Head. Without an on-site capability to perform this function, it would be impossible to perform the other work in a safe and reliable manner; nor would it be possible to ensure the safety of the ordnance loaded for delivery to the fleet. This capability is an inherent part of operating a facility where energetic materials are processed.

Equipment integral to the facility with replacement value > $500,000:

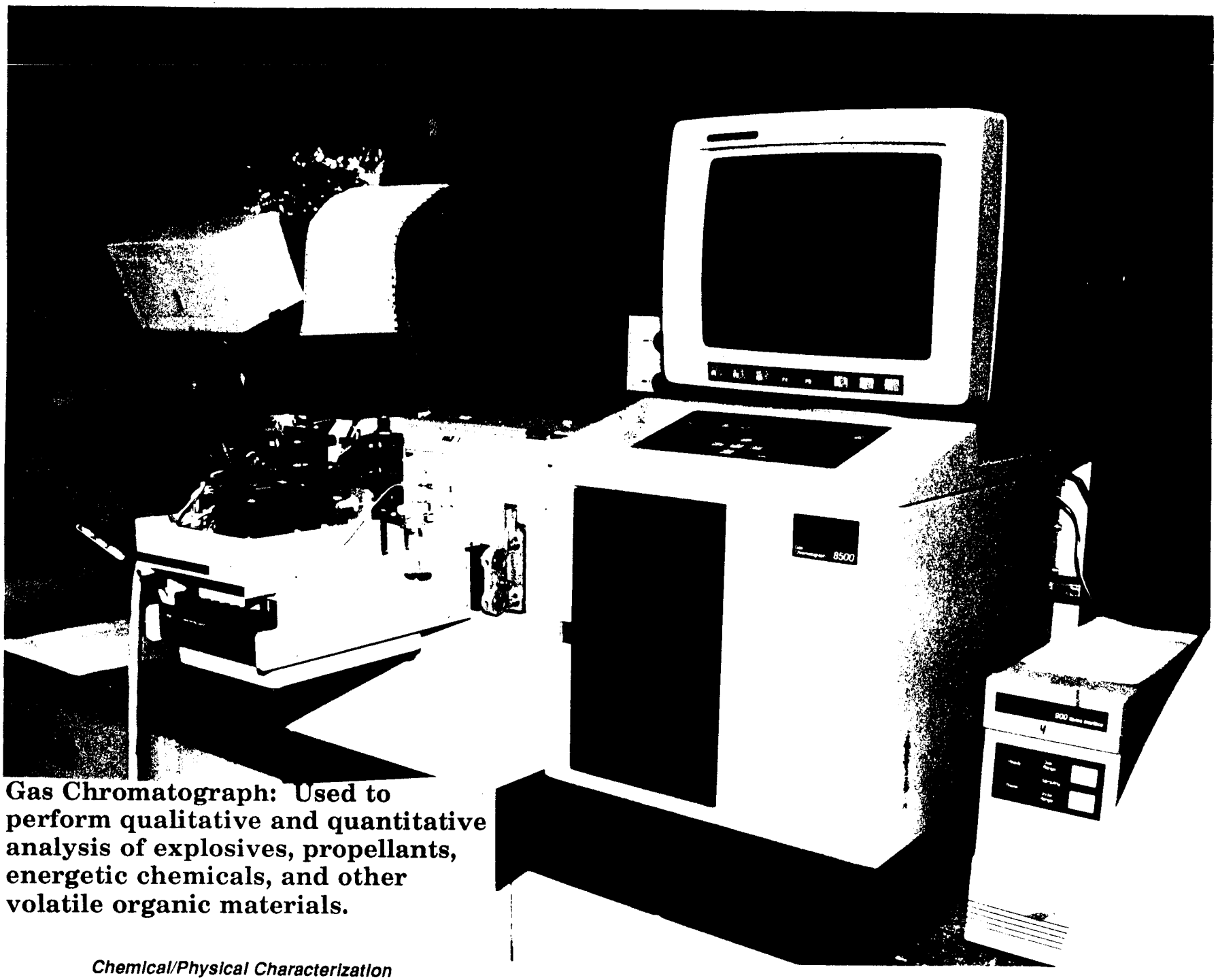
Boring Mill: The boring mill is a machine used to cut propellants and explosives from a remote location. **This machine is specially designed to accommodate larger propellant samples and rocket motors.** The mill is completely versatile and its capabilities are almost unlimited. The equipment is fixed. The machine is set on a special foundation and machine parts are trued and leveled with respect to each other. Remote control circuitry is run with conduit to the two remote control rooms at the machining facility. The cost to replace the boring mill is $900,000.

High-Rate Tester: The test system is used to perform static tests (tensile, compression) on propellant and other energetic materials to define the mechanical behavior of the materials. The machine was specially designed to simulate the stresses and strains propellants would encounter upon ignition or detonation. The replacement value of the equipment is $850,000.

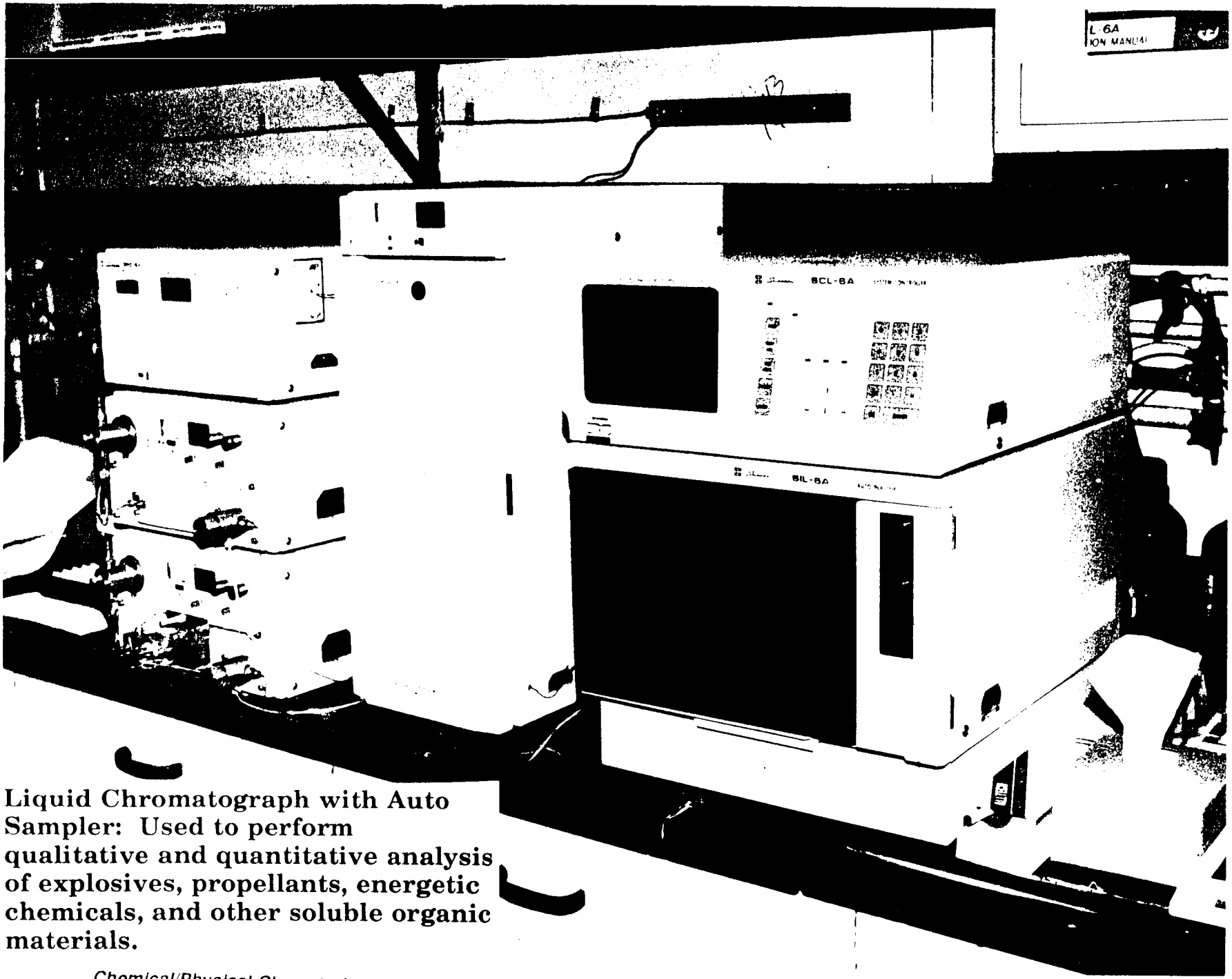
There are seventeen main buildings that comprise the Chemical/Physical Characterization test facility. Their estimated replacement value of the buildings and equipment is about $28,000K.



A sample of Indian Head Division's capabilities. Clockwise from top left: material characterization using the high rate/high pressure tester, the chemical extractors which determines residual propellant stabilizers, automated robotic system for propellant sample preparation, and microspectroscopy analysis of metals.

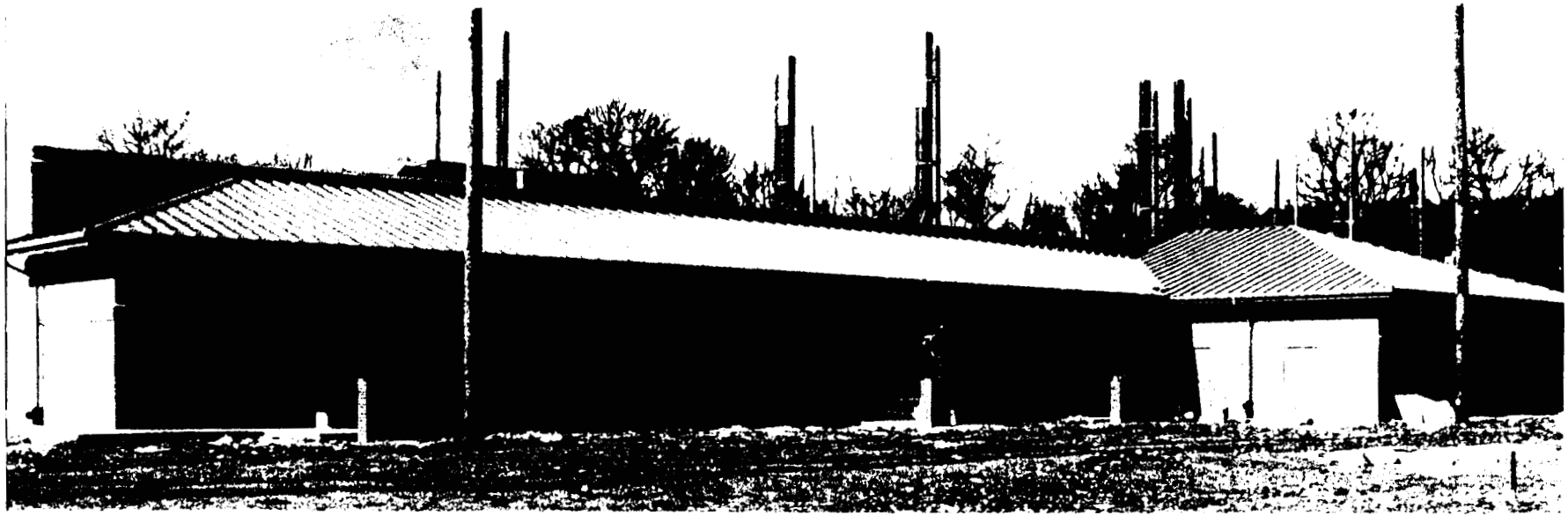


Gas Chromatograph: Used to perform qualitative and quantitative analysis of explosives, propellants, energetic chemicals, and other volatile organic materials.



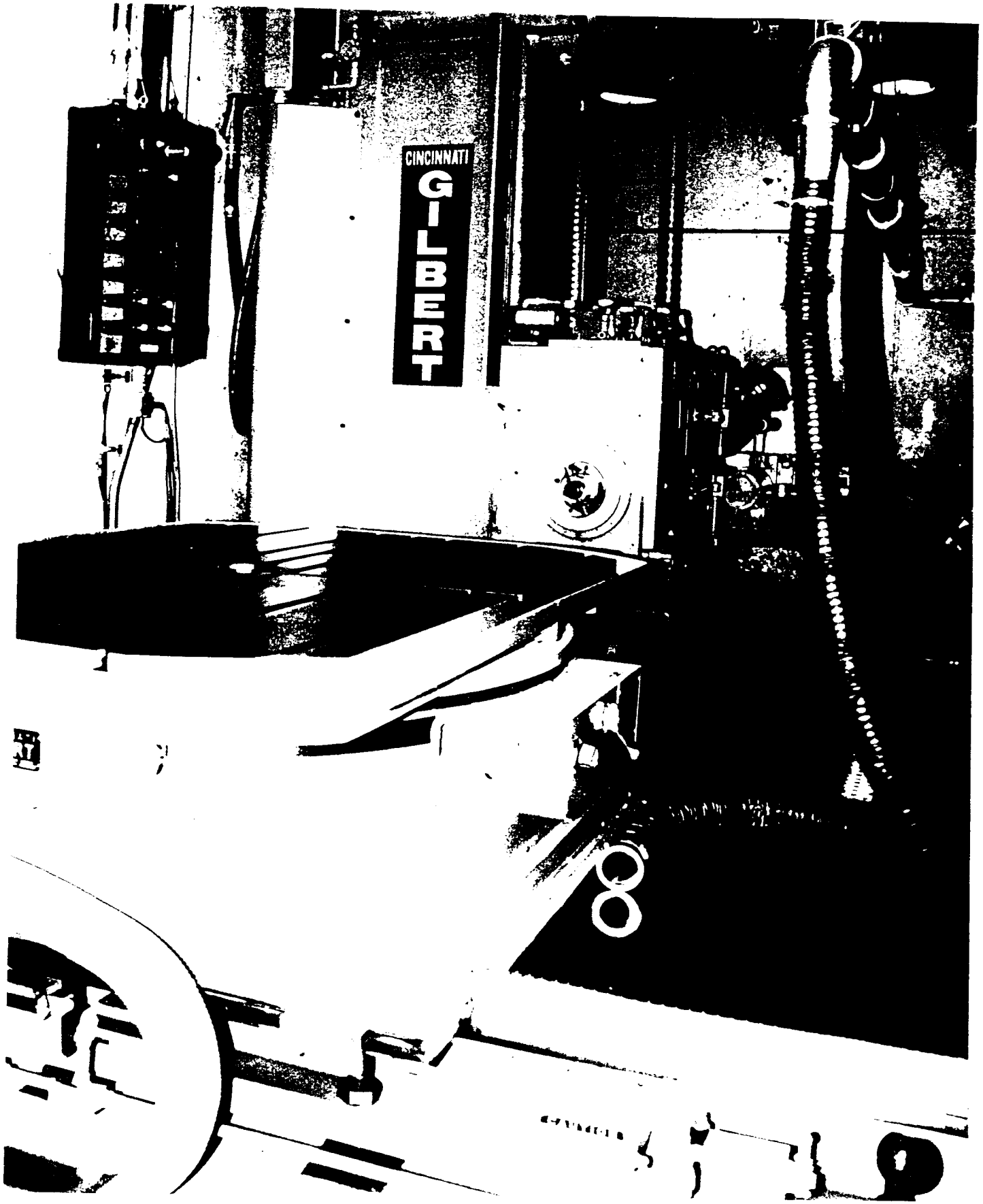
Liquid Chromatograph with Auto Sampler: Used to perform qualitative and quantitative analysis of explosives, propellants, energetic chemicals, and other soluble organic materials.

Chemical/Physical Characterization

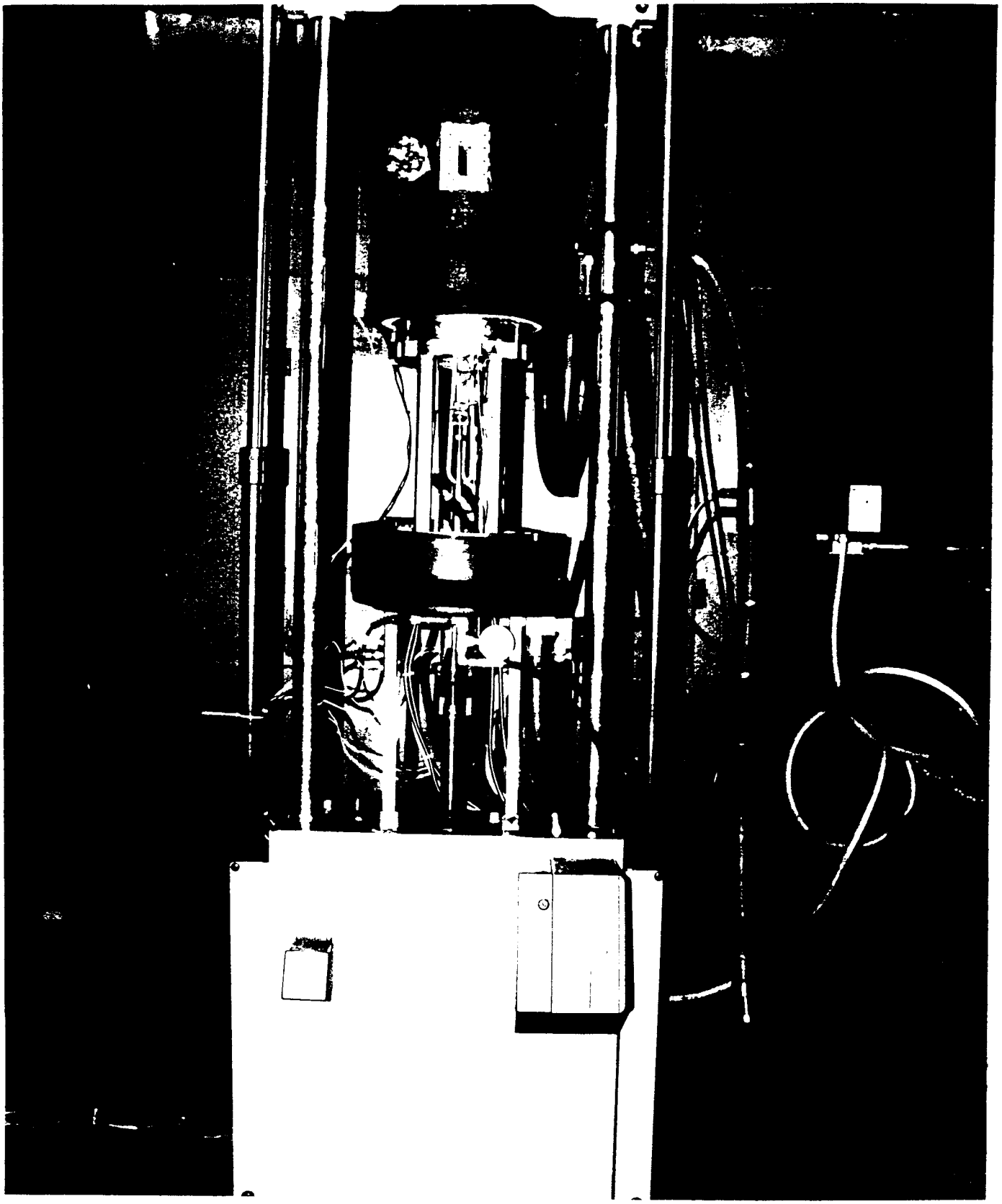


These laboratories perform physical/chemical/material characterization analyses of chemical raw materials, in process materials, and finished products. Material characterization may include determination of plume signature, ballistic performance, smoke generation and mechanical properties.

Chemical/Physical Characterization



Boring Mill



High-Rate Tester

		UTILITY	30.0	30.0	0
WEAPONS	Extruded Energetics Products Facility	TECHNICAL	80.5	80.5	0
		ADMIN.	14.7	14.7	0
		STORAGE	36.0	36.0	0
		UTILITY	.5	.5	0
WEAPONS	Ordnance Test & Evaluation Facility	TECHNICAL	51.3	51.3	0
		ADMIN.	9.8	9.8	0
		STORAGE	15.0	15.0	0
		UTILITY	4.2	4.2	0
WEAPONS	Chemical/Physical Characterization	TECHNICAL	45.7	45.7	0
		ADMIN.	0	0	0
		STORAGE	7.0	7.0	0
		UTILITY	0	0	0

* Administrative, Technical, Storage, Utility

3.5.1.1 Describe the capacity of your activity to absorb additional similar workyears categorized in the same common support function with minor facility modification. If major modification is required, describe to what extent the facilities would have to be modified. (Use FY97 workyears as your requirement) (BRAC Criteria III)

Based on peak staffing levels and projected (FY 97) requirements, **IHDIV could absorb 300 workyears of energetics S&T, engineering development, and in-service engineering for Explosives and Energetics products in current facilities without major modifications. The Navy has the largest in-house explosives development capability among the Services. The Navy's primary and most complete explosives development lab is IHDIV.**

3.5.1.2 If there is capacity to absorb additional workyears, how many additional workyears can be supported? (BRAC Criteria III)

IHDIV could absorb **300-500 additional workyears of low rate Energetics production** (mine & warhead loading, cartridge and propellant actuated devices, rockets, gun propellant, specialty chemicals, etc.) by extending to **multi-shift operations**.

3.5.1.3 For 3.5.1.1 and 3.5.1.2 (above) describe the impact of military construction programs or other alteration projects programmed in the FY95 PBS. (BRAC Criteria II)

No impact.

3.5.2 **Land Use:** Provide number of buildable acres for additional laboratory/administrative support construction at your installation. (BRAC Criteria II)

IHDIV has 828 additional buildable acres.

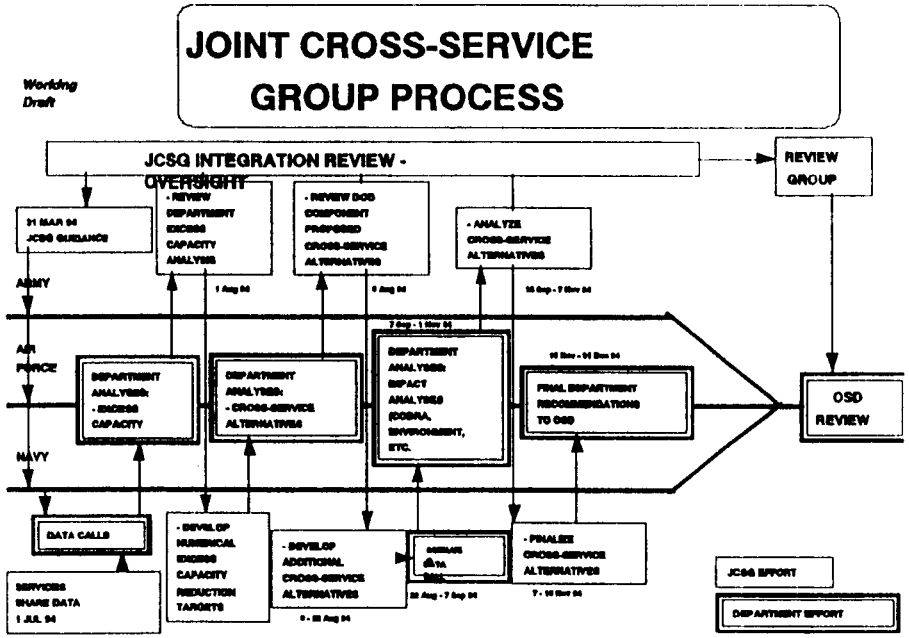
3.5.3 **Utilities:** Provide an estimate of your installation's capability to expand or procure additional utility services (electric, gas, water). Estimates should be provided in appropriate units -- e.g. KWH of electricity. (BRAC Criteria II)

Electric capacity:	25,900 KWH
Electric demand (peak):	14,450 KWH
Expansion potential:	11,450 KWH
Gas:	None
Potable water cap'y:	2,467,920 GPD
Potable water demand (peak):	1,405,000 GPD
Expansion potential:	1,062,920 GPD

SECTION IV: APPENDICES

A. Macro Process/Schedule
B. List of Activities
C. Common Support Functions

APPENDIX A


JOINT CROSS-SERVICE
GROUP PROCESS
Working Draft
JCSG INTEGRATION REVIEW -
OVERSIGHT
REVIEW GROUP
ARMY
AIR FORCE
NAVY
OSD REVIEW
DATA CALLS
JCSG EFFORT
DEPARTMENT EFFORT

APPENDIX B

LIST OF ACTIVITIES

AIR FORCE

1. Armstrong Lab, Brooks AFB
2. Armstrong Lab, Tyndall AFB
3. Armstrong Lab, Wright-Patterson AFB
4. Armstrong Lab, Williams AFB
5. Human Systems Center, Brooks AFB
6. Wright Lab, Wright-Patterson AFB
7. Wright Lab, Eglin AFB
8. Aeronautical Systems Center, Wright-Patterson AFB
9. Aeronautical Systems Center, Eglin AFB
10. Oklahoma City Air Logistics Center, Tinker AFB (In-service engineering)
11. Ogden Air Logistics Center, Hill AFB (In-service engineering)
12. San Antonio Air Logistics Center, Kelly AFB (In-service engineering)
13. Sacramento Air Logistics Center, McClellan AFB (In-service engineering)
14. Warner-Robins Air Logistics Center, Robins AFB (In-service engineering)
15. Phillips Lab, Kirtland AFB
16. Phillips Lab, Hanscom AFB
17. Phillips Lab, Edwards AFB
18. Space & Missile Center, Los Angeles AFB
19. Space & Missile Center, Norton AFB
20. Sacramento Air Logistics Center, Peterson AFB
21. Rome Lab, Griffiss AFB
22. Rome Lab, Hanscom AFB
23. Electronic Systems Center, Hanscom AFB
24. Sacramento Air Logistics Center, Peterson AFB (In-service engineering)

ARMY

1. Army Research Lab (ARL), Adelphi, MD
2. ARL, Aberdeen Proving Grounds (APG), MD
3. ARL, White Sands Missile Range, NM
4. ARL, NASA Langley, VA
5. ARL, NASA Lewis, OH
6. Natick Research, Development and Engineering Center, Natick, MA

7. Aviation Research, Development and Engineering Center, St Louis, MO
8. Aviation Troop Command, Aeroflight Dynamics Directorate, Moffitt Field, CA
9. Aviation Troop Command, Aviation Applied Technology Directorate, Fort Eustis, VA
10. Edgewood Research, Development and Engineering Center, Aberdeen Proving Ground, MD
11. Communications Electronics Command Research, Development and Engineering Center, Ft Mammoth, NJ
12. Communication Electronics Command Research, Development and Engineering Center - Night Vision EO Directorate, Ft Belvoir, VA
13. Missile Research, Development and Engineering Center, Redstone Arsenal, AL
14. Armaments Research, Development and Engineering Center, Picatinny Arsenal, NJ
15. Armaments Research, Development and Engineering Center, Benet Labs, Watervliet Arsenal, NY
16. Tank-Automotive Command Research, Development and Engineering Center, Warren, MI
17. USA Research Institute of Infectious Diseases, Ft Detrick, MD
18. Walter Reed Army Institute of Research, Washington D.C.
19. USA Institute of Surgical Research, Ft Sam Houston, TX
20. USA Aeromedical Research Lab, Ft Rucker, AL
21. Medical Research Institute of Chemical Defense Aberdeen Proving Grounds, MD
22. USA Research Institute of Environmental Medicine, Natick, MA
23. Construction Engineering Research Laboratory, Champaign, IL
24. Cold Regions Research and Engineering Lab, Hanover, NH
25. Topographic Engineering Center, Alexandria, VA
26. Waterways Experiment Station, Vicksburg, MS
27. USA Research Institute for Behavioral & Social Sciences, Alexandria, VA
28. Simulation, Training and Instrumentation Command (STRICOM), Orlando, FL

NAVY

1. Naval Air Warfare Center, Weapons Division, China Lake
2. Naval Air Warfare Center, Weapons Division, Point Mugu
3. Naval Air Warfare Center, Aircraft Division, Patuxent River
4. Naval Air Warfare Center, Aircraft Division, Indianapolis
5. Naval Air Warfare Center, Aircraft Division, Lakehurst
6. Naval Research Lab, Washington D.C.
7. Naval Research Lab Detachment, Bay St Louis
8. Naval Surface Warfare Center, Carderock Division, Bethesda
9. Naval Surface Warfare Center, Carderock Detachment, Annapolis

10. Naval Surface Warfare Center, Crane Division
11. Naval Surface Warfare Center, Crane Detachment, Louisville
12. Naval Surface Warfare Center, Dahlgren Division
13. Naval Surface Warfare Center, Dahlgren Detachment, Panama City
14. Naval Surface Warfare Center, Indian Head Division
15. Naval Surface Warfare Center, Port Hueneme Division
16. Naval Command, Control, and Ocean Surveillance Center, RDT&E Division, San Diego
17. Naval Command, Control, and Ocean Surveillance Center, In-Service Engineering, West Coast Division, San Diego
18. Naval Command, Control, and Ocean Surveillance Center, In-Service Engineering Division, Charleston
19. Naval Aerospace Medical Research Center, Pensacola
20. Naval Biodynamics Lab, New Orleans
21. Naval Dental Research Lab, Great Lakes
22. Naval Health Research Center, San Diego
23. Naval Medical Research Institute, Bethesda
24. Naval Undersea Warfare Center, Keyport Division, WA
25. Naval Surface Warfare Center, Carderock, Philadelphia Detachment
26. Naval Undersea Warfare Center, Newport, RI
27. Naval Undersea Warfare Center (Newport), New London, CT
28. Naval Personnel Research and Development Center, San Diego, CA

DEPARTMENT OF DEFENSE

1. Armed Forces Radiobiology Research Institute (AFRRI), Bethesda, MD

APPENDIX C

COMMON SUPPORT FUNCTIONS (DEFINITIONS LISTED FOLLOWING PAGES)

Product Functions

1. Air Vehicles
   - Fixed
     - -- Structure
     - -- Propulsion
     - -- Avionics
     - -- Flight Subsystems
   - Rotary
     - -- Structure
     - -- Propulsion
     - -- Avionics
     - -- Flight Subsystems

2. Weapons
   - ICBMs/SLBMs
   - Conventional Missiles/Rockets
   - Cruise Missiles
   - Guided Projectiles
   - Bombs
   - Guns and Ammunition
   - Directed Energy
   - Chemical/Biological

3. Space Systems
   - Launch Vehicles
   - Satellites
   - Ground Control Systems

4. C4I Systems
   - Airborne C4I
   - Fixed Ground-Based C4I
   - Ground Mobile C4I

Pervasive Functions

1. Electronic Devices
2. Environmental Sciences
3. Infectious Diseases
4. Human Systems
5. Manpower and Personnel
6. Training Systems
7. Environmental Quality
8. Advanced Materials

DEFINITIONS

COMMON SUPPORT FUNCTIONS

Product Functions

1. Air Vehicles. Air vehicles are broken out into common support functions for fixed wing and rotary wing. Includes but not limited to all science and technology, demonstration and validation, engineering development, and production activities which support employment and in-service engineering of air vehicles. Included are all air vehicles including their application as UAV's and targets.

. - Structures. Includes but not limited to all air vehicles structure technology, engineering and production efforts. Include technology and engineering practices which advance structural design and analysis; advanced structural concepts and fabrication techniques; and structural integrity.

- Propulsion. Includes but not limited to all technology, engineering and production efforts associated with air vehicle propulsion such as turbine engine, rotorcraft power drive, and hypersonic propulsion components. Such components include compressors, inlets and nozzles, turbines, mechanical systems and control, gears, bearings, shafts, and clutches. In addition, include associated subsystems activities such as turborocket, turboramjet and rotorcraft transmissions; and supporting technical and engineering disciplines.

- Avionics. Includes but not limited to all technology, engineering and production efforts associated with the air platform's integrated avionics system. The avionics suite includes but is not limited to weapon delivery systems, electronic warfare, navigation, communications, radar, electro-optic sensors, signal/data processing and associated software system and support. Includes efforts associated with developing the integrated avionics system (i.e. optimizing functional partitioning, distribution and integration of avionics/related functions).

- Flight Subsystems. Includes but not limited to all technology, engineering and production efforts for air vehicle support systems such as landing gear; transparent crew enclosures; egress systems; mechanical equipment integrity; electrical component integrity; subsystem integration; and aircraft power, pressurization, and temperature control systems.

2. Weapons. Includes but not limited to all science and technology, demonstration and validation, engineering development, and production activities which support employment

and in-service engineering of ICBMs/SLBMs, conventional missiles and rockets, cruise missiles, guided projectiles, bombs, guns and ammunition, directed energy and chemical/biological munitions. Include with each weapon as appropriate, all related technology, engineering and production activities such as fusing/safe and arm, missile propulsion, warheads and explosives, and guidance and control.

3. Space. Includes but not limited to all science and technology, demonstration and validation, engineering development, and production activities which support employment and in-service engineering of launch vehicles, satellites and associated ground control systems (satellite control only; ground systems for telemetry of data included in C4I). Include under satellites, all technology, engineering and production activities associated with space communications and space-based surveillance (and associated sensors) and space-based C4I.

4. C4I. Includes but not limited to all science and technology, demonstration and validation, engineering development, and production activities which support employment and in-service engineering of airborne, fixed ground-based and mobile ground based C4I systems. Include all technology, engineering and production activities associated with communications networks, radios and links, distributed information systems, data fusion, decision aids, and associated computer architectures.

Pervasive Functions (6.1, 6.2, and 6.3)

1. Electronic Devices. Includes but not limited to all science and technology activities supporting development of semiconductor and superconductor materials for optoelectronic, acoustic and microwave devices. Include all associated electronic materials/device fabrication and processing.

2. Environmental Sciences. Includes but not limited to all science and technology activities to improve measurement, characterization and modeling of the earth atmosphere and space environment. Examples include global prediction systems, space effects, and celestial backgrounds/astronomical reference sources.

3. Infectious Diseases. Includes but not limited to all science and technology activities which preserve manpower and performance by the prevention and treatment of militarily important infectious diseases that occur naturally worldwide.

4. Human Systems. Includes but not limited to all science and technology activities to enable, protect, sustain and enhance human effectiveness in DOD operations. The focus of

this pervasive, multi-disciplinary area is the human and therefore impacts all DOD systems and operations. This area includes: (1) human performance definition, assessment, and aiding; (2) physiologic bioeffects of toxic hazards, ionizing and non-ionizing radiation, biodynamic (bio-mechanical) stress, and extreme environments; (3) military operational medicine; and (4) generic, human-centered design standards/methodologies for crew station subsystems, information management and display, and life support.

5. Manpower and Personnel. Includes but not limited to all science and technology activities which support four broad areas: (1) selection and classification of DOD personnel (including pilots); (2) identification of operational tasks performed and requirements for skills, knowledge, and aptitudes; (3) matching the right people with the jobs they are best suited for according to the needs of DOD, (4) and developing techniques for measuring and enhancing the productivity of the operational force.

6. Training Systems. Includes but not limited to all science and technology which support training of personnel, including training strategies, devices and simulators, and computer aided intelligent tutoring systems.

7. Environmental Quality. Includes but not limited to all science and technology activities which support the development of technologies to reduce the environmental costs of DOD operations while ensuring mission accomplishment is not jeopardized by adverse environmental impacts. Specifically, this area encompasses technologies to: (1) identify and cleanup sites contaminated with hazardous materials as a result of DOD operations (cleanup); (2) ensure DOD compliance with current and anticipated local, national, and international environmental laws and treaties (compliance); (3) minimize DOD use of hazardous materials and reduce DOD hazardous waste generation (pollution prevention); and (4) provide for protection of natural resources under DOD stewardship (conservation).

8. Advanced Materials. Includes but not limited to all science and technology activities related to structural, high temperature, electromagnetic protection, electronic, magnetic, optical, and biomolecular materials. Note: excludes materials areas which were included in DDR&E decision of 18 Mar 94 related to the Army's Materials Research Facility at Aberdeen Proving Ground and the Navy's Materials Facility at Carderock.

NSWC INDIAN HEAD
DATA CALL #12

JL
SEA 04X
5/13/94

I certify that the information contained herein is accurate and complete to the best of my knowledge and belief.

NEXT ECHELON LEVEL (if applicable)

CAPT David G. Maxwell
NAME (Please type or print)

Signature

Commander
Title

8 May 94
Date

Indian Head Division, NSWC
Activity

I certify that the information contained herein is accurate and complete to the best of my knowledge and belief.

NEXT ECHELON LEVEL (if applicable)

RADM(SEL) D.P. SARGENT, JR.
NAME (Please type or print)

Signature

Commander
Title

5/11/94
Date

Naval Surface Warfare Center
Activity

I certify that the information contained herein is accurate and complete to the best of my knowledge and belief.

MAJOR CLAIMANT LEVEL

G. R. STERNER
NAME (Please type or print)

Signature

Title Commander
Naval Sea Systems Command

5-13-94
Date

Activity

I certify that the information contained herein is accurate and complete to the best of my knowledge and belief.

DEPUTY CHIEF OF NAVAL OPERATIONS (LOGISTICS)
DEPUTY CHIEF OF STAFF (INSTALLATIONS & LOGISTICS)

J.B. GREENE JR.
NAME (Please type or print)

Signature

ACTING
Title

23 May 1994
Date

NSWC INDIAN HEAD
DATA CALL #12

JL
SEA 09X
5/13/94

BRAC-95 CERTIFICATION

Reference: SECNAVNOTE 11000 of 08 December 1993

In accordance with policy set forth by the Secretary of the Navy, personnel of the Department of the Navy, uniformed and civilian, who provide information for use in the BRAC-95 process are required to provide a signed certification that states "I certify that the information contained herein is accurate and complete to the best of my knowledge and belief."

The signing of this certification constitutes a representation that the certifying official has reviewed the information and either (1) personally vouches for its accuracy and completeness or (2) has possession of, and is relying upon, a certification executed by a competent subordinate.

Each individual in your activity generating information for the BRAC-95 process must certify that information. Enclosure (1) is provided for individual certifications and may be duplicated as necessary. You are directed to maintain those certifications at your activity for audit purposes. For purposes of this certification sheet, the commander of the activity will begin the certification process and each reporting senior in the Chain of Command reviewing the information will also sign this certification sheet. This sheet must remain attached to this package and be forwarded up the Chain of Command. Copies must be retained by each level in the Chain of Command for audit purposes.

I certify that the information contained herein is accurate and complete to the best of my knowledge and belief.

ACTIVITY COMMANDER

CAPT David G. Maxwell
NAME (Please type or print)

Signature

Commander
Title

8 May 94
Date

Indian Head Division, NSWC
Activity

DATA CALL 63
FAMILY HOUSING DATA

205

Information on Family Housing is required for use in BRAC-95 return on investment calculations.

Installation Name:	**NSWC Indian Head**
Unit Identification Code (UIC):	**00174**
Major Claimant:	**NAVSEA**

Percentage of Military Families Living On-Base:	**55%**
Number of Vacant Officer Housing Units:	**0**
Number of Vacant Enlisted Housing Units:	**40**
FY 1996 Family Housing Budget ($000):	**34.0**
Total Number of Officer Housing Units:	**3**
Total Number of Enlisted Housing Units:	**1**

Note: All data should reflect figures as of the beginning of FY 1996. If major DON installations share a family housing complex, figures should reflect an estimate of the installation's prorated share of the family housing complex.

I certify that the information contained herein is accurate and complete to the best of my knowledge and belief.

MAJOR CLAIMANT LEVEL

J. E. BUFFINGTON, RADM, CEC, USN
NAME (Please type or print)

Signature

COMMANDER
Title

7/20/94
Date

NAVAL FACILITIES ENGINEERING COMMAND
Activity

I certify that the information contained herein is accurate and complete to the best of my knowledge and belief.

DEPUTY CHIEF OF NAVAL OPERATIONS (LOGISTICS)
DEPUTY CHIEF OF STAFF (INSTALLATIONS & LOGISTICS)

W. A. EARNER JR

NAME (Please type or print)

Signature

Title

7/25/94
Date

BRAC-95 CERTIFICATION

Reference: SECNAV NOTE 11000 dtd 8 Dec 93

In accordance with policy set forth by the Secretary of the Navy, personnel of the Department of the Navy, uniformed and civilian, who provide information for use in the BRAC-95 process are required to provide a signed certification that states "I certify that the information contained herein is accurate and complete to the best of my knowledge and belief."

The signing of this certification constitutes a representation that the certifying official has reviewed the information and either (1) personally vouches for its accuracy and completeness or (2) has possession of, and is relying upon, a certification executed by a competent subordinate.

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I certify the information contained herein is accurate and complete to the best of my knowledge and belief.

ACTIVITY COMMANDER

W.A. Waters, CAPT, CEC, USN
NAME (Please type of print)

Commanding Officer
Title

NORTHNAVFACENGCOM
Activity

Signature

7/7/99
Date

BRAC-95 CERTIFICATION

I certify that the information contained herein is accurate and complete to the best of my knowledge and belief.

Sandra B. Culbertson
NAME (Please type or print)

Sandra B. Culbertson
Signature

Housing Management Specialist
Title

7/6/94
Date

Division

Housing/Real Estate
Department

NORTHNAVFACENGCOM
Activity

Enclosure (1)

TAB B

SPECIAL FACILITIES AND EQUIPMENT

FACILITIES/EQUIPMENT CAPABILITY FORM

Facility	Page
Energetic Materials Research Laboratory	1
Weapons Product Development	9
Nitramine Gun and High Energy Propellant	20
Chemicals Processing	28
Ordnance Device Development and Prototyping	38
Composite Propellant/PBX Processing	45
Explosive Safety and Ordnance Environmental Support	54
Extruded Products	59
Magazines	67
Weapons Simulator/Emulator	70
Multibase Propellant Production	76
Ordnance Test and Evaluation	82
Chemical/Physical Characterization	90
Additional equipment not integral to facilities above	95

SPECIAL FACILITIES AND EQUIPMENT
FACILITIES/EQUIPMENT CAPABILITY FORM

Technical Center Site	Indian Head Division, NSWC
Facility/Equipment Nomenclature or Title	Energetic Materials Research Laboratory

1. State the primary purpose(s) of the facility/equipment.

The energetics material research laboratory consists of the following facilities:

Energetic materials formulation and characterization laboratories
Energetic chemicals synthesis laboratory
Energetic chemicals pilot plant
Explosive/propellant aging facilities
Explosive storage magazines

The Indian Head Division provides for the Navy (and DOD) the only capability, at one location, to synthesize, formulate, and scale up for development any type of chemical, propellant, explosive, or pyrotechnic which may be required for weapons applications. The complex of facilities and equipment provided by the Energetic Materials Research Laboratory is utilized today for R&D projects for new chemicals and formulations, environmental processes, and characterization studies. This complex includes 5 laboratory buildings, 17 support buildings, 25 magazines and storage boxes, and 8 aging/conditioning ovens.

Development of new formulations, improvements in the synthesis techniques for new chemical ingredients, and the characterization of the products are conducted in the laboratory facilities at the milligram to the gram scale using state-of-the-art instrumentation. Several laboratory buildings are used for this purpose, with each building being further divided into numerous individual laboratories. These facilities are also heavily used for programs to determine the aging characteristics of propellants and explosives in order to predict the safe life of units loaded with the materials and any changes in performance as a function of age. Typical programs which are supported here include formulation of new insensitive, minimum smoke propellants for missile application (Navy 6.2), the Navy's Insensitive Munitions Advanced Development program, and characterization studies for

weapon systems such as Trident, Harpoon, Standard Missile, Penguin, and a variety of aircrew escape propulsion units. A new effort now beginning is to develop a replacement propellant for torpedo application which will be cleaner burning. The characterization capability provided by this facility is also extensively used to resolve problems which arise during the production of propellants and explosives, both at Indian Head and at other facilities. Modern composite propellants and explosives are very sensitive to minor changes in the properties of the raw materials, and a sophisticated capability to evaluate the chemical and physical properties of the raw materials as well as their interaction in the final product is essential to maintaining a quality product.

The chemicals pilot plant facility is used to provide increased quantities of new energetic chemicals and to prove out the synthesis methods developed in the laboratory. This work may begin with the synthesis of a few grams using glassware and can be scaled up through a variety of equipment as large as 1000 gallon glass lined reactors. Programs supported by this capability include the Navy's 6.1 materials and 6.2 explosive and propulsion efforts as well as sponsors in the other services. Materials such as ADN, CDN, and TNAZ are being synthesized here. **While the development and synthesis of new chemicals is critical to weapons development, equally important is the ability to provide ingredients that are no longer produced by the original manufacturers. For example:**

* The developer of the chemical curative used in the Sidewinder rocket motor, the Standard Missile rocket motor, Mk56, and several aircraft escape systems, ceased the manufacture of the item because it was not profitable. A new source was developed in private industry, but the material was not as pure as required for the manufacture of propellant. The IHDIV developed a process to purify the material to make it acceptable for propellants. This effort avoided a costly program to replace the propellant. The curative was methyl aziridinyl phosphine oxide (MAPO).

The aging facilities are used to artificially age propellants and explosives in order to more quickly predict the safe service life of these materials. Samples of the materials are periodically withdrawn and taken to the laboratories for characterization. Aging and surveillance studies for programs such as Trident and Harpoon as well as for new formulations developed in programs such as the Navy's Insensitive Munitions Advanced Development effort are supported.

The Navy's principal R&D program to develop technologies to ensure that energetic materials can be made in compliance with environmental requirements is also conducted here. These efforts are conducted to find solutions for existing environmental problems as well as to meet future requirements with application at Navy and private facilities. Technologies now being investigated include bioremediation of contaminated soil, use of energetic material waste as a boiler fuel, application of molten salt

disposal techniques for energetics as a replacement for open or closed burning, and use of ultraviolet light energy to decompose volatile organic compounds given off during processing operations before venting into the air.

One of the BRAC 93 decisions was to transfer the Navy's principal RDT&E capability for explosives, explosive components, and warheads technology from the White Oak site of the Dahlgen Division of NSWC to the Indian Head Division. Effective 3 April 1994, this transfer was completed organizationally, and over the next 2-3 years the physical move will be completed; the initial movement of people is in fact beginning this year. In order to make maximum use of existing facilities, minimize the costs of the move, and to achieve maximum benefit from the merger of the two groups, Indian Head's existing R&D facilities and people discussed in this section have been organizationally combined with the energetics group transferred from White Oak. These same Indian Head facilities will form the base for all of the RDT&E work to be done by the combined group. As the people, with their equipment move from White Oak to Indian Head, the types of work supported by this facility will expand considerably. The effort on synthesis of new energetic materials and the formulation and testing of new explosive formulations will be considerably larger than today. Work which will represent an expansion of capability will include concept and proof-of-principle studies of new warhead designs, development of detonators and initiation trains, and the modeling and simulation of explosives and warheads using advanced mathematical techniques. The detonation physics studies will require the construction of an experimental facility with a series of bombproof chambers for the conduct of highly instrumented, controlled detonation experiments on new explosives and warhead concepts. The work done by this group is primarily for Navy R&D programs, such as the 6.2 Explosives and Underwater Warheads, 6.2 Mine Countermeasures, and 6.3B Insensitive Munitions Advanced Development projects. Considerable work is also done for other Navy development programs and for the other services.

Equipment integral to this facility with a replacement value ≥ $500,000:

a. 2-Stage Gas Gun: This gun assembly is used for determining the susceptibility of ordnance items to fragment impact. This asset is moveable with a replacement cost $750K. Total weight is 11,000 lbs. and 500 cubic ft. (including gas field equipment). This equipment is currently located at the Indian Head Division On-Site Office White Oak, MD and will move to Indian Head Division when the function transfers (per BRAC 93).

b. 2.3 MeV X-Ray System: This system is used for Flash Radiography of objects through thin metal and water. This system is portable with a replacement cost of $5OOK. It weighs 8,500 lbs. and takes up 425 cubic ft. of space. This equipment is currently located at the Indian Head Division On-Site Office White Oak, MD and will move to Indian Head Division when the function transfers (per BRAC 93).

2. Indicate whether the facility/equipment is portable, moveable or fixed as defined by paragraph 6, page 12 of this data call.

The facilities are fixed and cannot be moved.

3. Provide the replacement value of the facility/equipment. Report the facility/equipment cost separate from any building and utilities that may be integral to the facility/equipment.

The combined cost to replace the facilities and equipment currently at Indian Head is $24M. Once the equipment now located at the White Oak site has been moved to Indian Head, the value of the facilities and equipment will be increased by $7-8M. The bombproof facility now being designed will add an additional $10M in facilities value.

4. Provide the gross weight and cube of the facility/equipment. N/A

5. Indicate any "special" utility support required by this facility/equipment other than normal electrical power.

Virtually all of the facilities require steam, 90-100 psi compressed air, and 220 and 440 volt power, and high pressure water for the fire protection system.

6. Indicate any special budget requirements for the facility/equipment (i.e., special foundations, non-ferrous materials, shielding, hardening, etc.).

All buildings in which energetic materials are handled require electrical grounding systems, lightning protection (depending on the value of the facility), deluge systems with automatic sensing equipment, special conductive floors, special construction to minimize propagation from one area to another, explosion proof electrical equipment, etc. All buildings must be sited in accordance with the quantity-distance requirements of OP-5. In the laboratories, armored fume hoods are needed for the small scale synthesis and formulation studies. The explosive storage facilities require special construction and protection, including earthen mounds.

7. State any environmental control requirements for the facility/equipment (i.e., temperature, humidity, air scrubbing).

Most of the chemicals, propellants, explosives, and pyrothechnic materials developed in these facilities require strict control of the temperature and humidity conditions throughout processing, so that large HVAC systems are part of nearly all the facilities. In the laboratories, the fume hoods must be vented outside the laboratories. In order to be

compliant with environmental regulations, process streams from all of these operations (including water and air) must be controlled and cleaned before release into the environment. In addition, all explosive waste from any operation must be disposed of in a controlled manner.

8. Indicate if this facility/equipment would be extremely difficult or impossible to replicate or relocate at another site and the impact to the Department of the Navy if this facility/equipment were lost. Consider existing Government-wide and commercial capabilities as the replication and impact statements are formulated.

The Energetic Materials Research Laboratory at Indian Head is unique within DOD because of the breadth of capability which it provides. This one facility supports not only laboratory scale functions (synthesis of new materials, formulation of new explosives or propellants, and characterization of these materials) but also provides the ability to develop the scale up of these new materials so that they can be evaluated for weapon system application.

This facility is fixed and therefore relocation or replication of the existing facility would be an extensive undertaking. Because of the special safety requirements for laboratories involved with energetic materials, especially since the work being done is research in nature and thus involves new materials whose characteristics are generally not known, the buildings now being used would have to be replaced at a cost of approximately $19.5M. It would not be acceptable to simply transfer the work to a general purpose laboratory.

Some portions of the energetic materials research capability provided by the facility and people at Indian Head are available from other DOD or private sector sources. Facilities such as the U. S. Army Armaments Research Development and Engineering Center at Picatinny Arsenal, NJ, the NAWC Weapons Division, China Lake, CA, and two of the DOE facilities have laboratory capabilities for the synthesis of new materials, formulation of propellants and explosives, and characterization of these materials. However, none has the capability to continue the synthesis beyond the laboratory scale. Several private sector firms also have laboratory capabilities similar to the government laboratories discussed above. As with the government labs, the capability for scaling up the new materials is very limited. Only Indian Head, by providing the ability to begin with the synthesis and characterization of a new energetic molecule and continue its development through pilot scale manufacture, ensures that the Navy and DOD will have available the capability to provide itself with any needed energetic material in the future.

Separation of the energetic materials R&D capability from an active production facility and from the design agent/in-service engineering functions for these materials would result in a

loss for all three functions. The R&D group would lose the experience gained from being involved in the transition of new materials developed in the laboratory as they are scaled up for processing in a production type facility. This interaction helps to ensure a smoother transition. The scale up of materials developed in an isolated laboratory environment frequently suffers because techniques which are feasible on a small scale may have serious problems on a larger scale. The production and engineering functions will lose because the basic knowledge of the R&D group will not be available to aid in solving problems which occur in the production of the very complex propellants and explosives now required for modern weapon systems or in determining the causes of failures which may occur during fleet use. The impact of this loss would be felt in virtually all weapon systems in use by the fleet, including surface and air launched missiles (both warheads and propulsion), gun ammunition (projectiles and propelling charges), bombs, torpedos (warheads and propulsion), mines, mine countermeasures (deployment systems and explosive charges), aircrew escape systems, stores separation charges, and transfer systems.

The synthesis, formulation, characterization, and environmental studies performed now in this laboratory are done by research chemists, chemical engineers, and skilled technicians with long term experience in the handling of energetic materials. At the research level, the sensitivity of new materials is generally unknown; expert, knowledgeable personnel are vital to safely handle such materials and to assess their utility. With the addition of the explosives and warheads functions from White Oak, the list of critical skills has expanded to include warhead concept design, detonation physics, explosive initiation mechanisms, detonator and initiation train design, and explosive and warhead modeling. Retaining a core of experts in all of these critical technologies is vital for the proper conduct of research programs with energetic materials and to support the Navy's weapon systems. The expertise provided by this group cannot be replaced without many years of expensive hands on experience for new scientists and engineers. Movement of the group will undoubtedly result in the loss of much of this vital experience and the consequent loss to the Navy of the capability to support existing and future weapons systems.

9. Indicate how and when the facility/equipment was transported and or constructed at the site.

The principal laboratory buildings were built in the 1950's. They have been updated and regularly modernized since then. The laboratory equipment has been replaced over the past several years and is state-of-the-art. The explosive/propellant aging facilities were completely updated and installed within the past 10 years.

10. List the functional support areas (previously provided in Tab A) that this facility/equipment support. Refer to Appendix A for the list of functional support areas.

2.5 Mines
2.7 Explosives
2.12 Weapons Propulsion
2.13 Other Ordnance
8.2 Countermeasures
9.1 Navy Strategic Systems
10.3 Facilities Engineering

This facility supports the following NSWC Technical Capabilities:

Rocket/Missile/Gun Propulsion
Energetics Manufacturing/Manufacturing Technology
Cartridge/Propellant Actuated Devices/Aircrew Escape Propulsion Systems
Explosives

11. Provide the historical utilization average for the past five fiscal years (1989-1993). Define the unit of measure used.

89-93 Average of 48 workyears

12. Provide the projected utilization data out to FY 1997.

94 50 Workyears
95 41 Workyears
96 50 Workyears
97 82 Workyears

This includes 23 workyears in 96 and 56 workyears in 97 for the Explosives Research and Underwater Warheads functions moving from Dahlgren Division Detachment White Oak, MD to Indian Head Division, NSWC per BRAC 93.

13. What is the approximate number of personnel used to operate the facility/equipment?

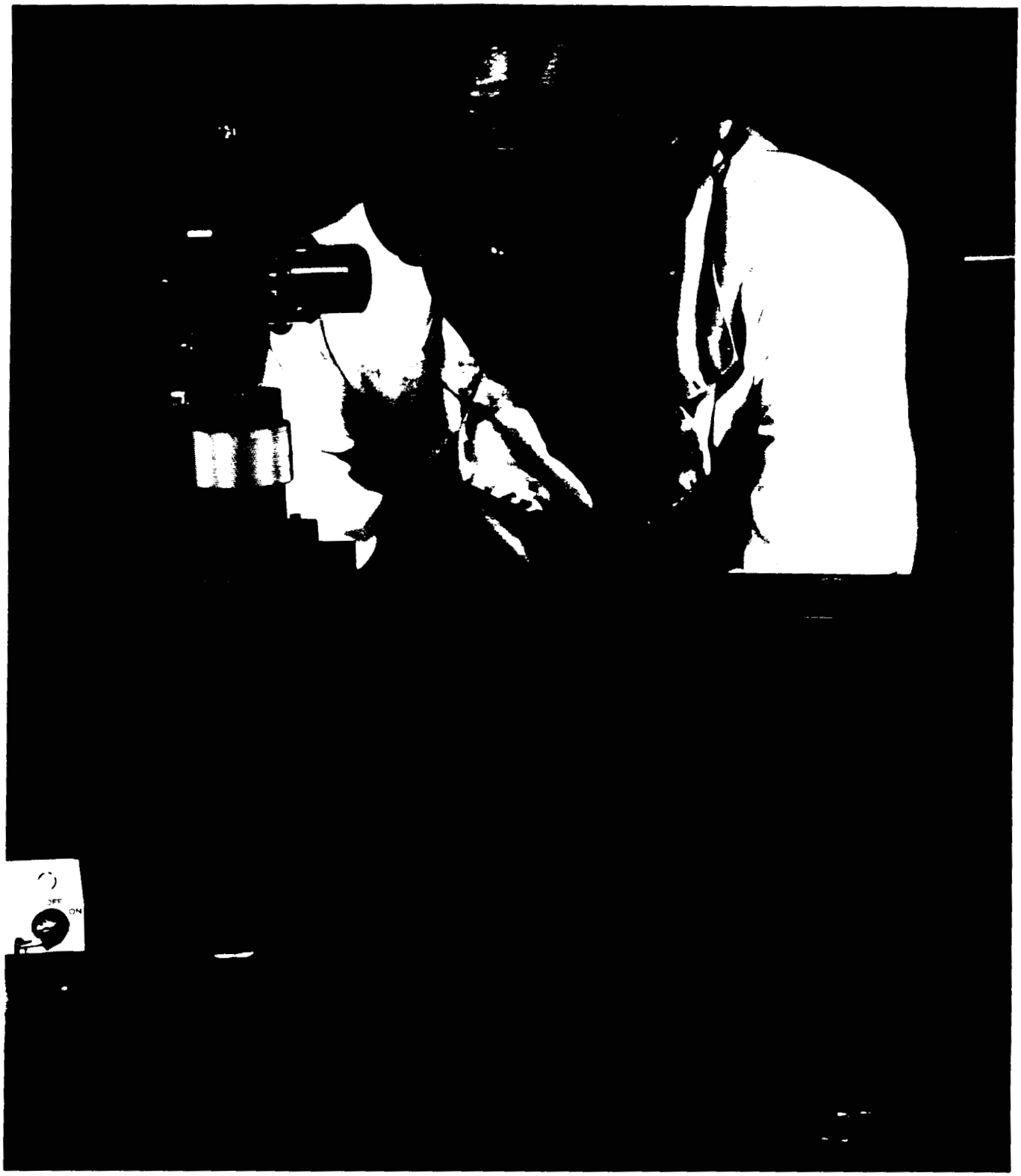
By FY 1997, the number of scientists, engineers, and technicians using this facility will be approximately 100. The synthesis, formulation, and characterization studies performed in this laboratory are done by a group of research chemists, chemical engineers, and skilled

technicians with long term experience in the handling of energetic materials. At the research level, the sensitivity of the materials being developed is being determined, and only expert, knowledgeable personnel can safely handle such materials. Having a core of such experts is vital to the proper conduct of research programs with energetic materials. Included among this group are the nation's experts in nitrate ester chemistry and the characterization of composite propellants. With the addition of the explosives and warheads concepts groups from White Oak, the mentioned expertise will be expanded to include synthesis of new energetic chemicals, formulation of new explosives, detonation physics, explosive initiation mechanisms, and warhead conceptualization.

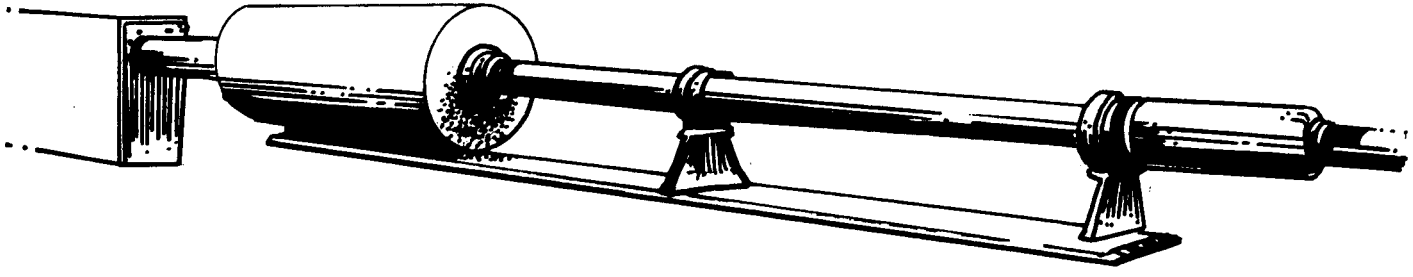
14. What is the approximate number of personnel needed to maintain the equipment?
two people

15. Provide one 8 1/2 x 11 black and white photo of the facility/equipment.

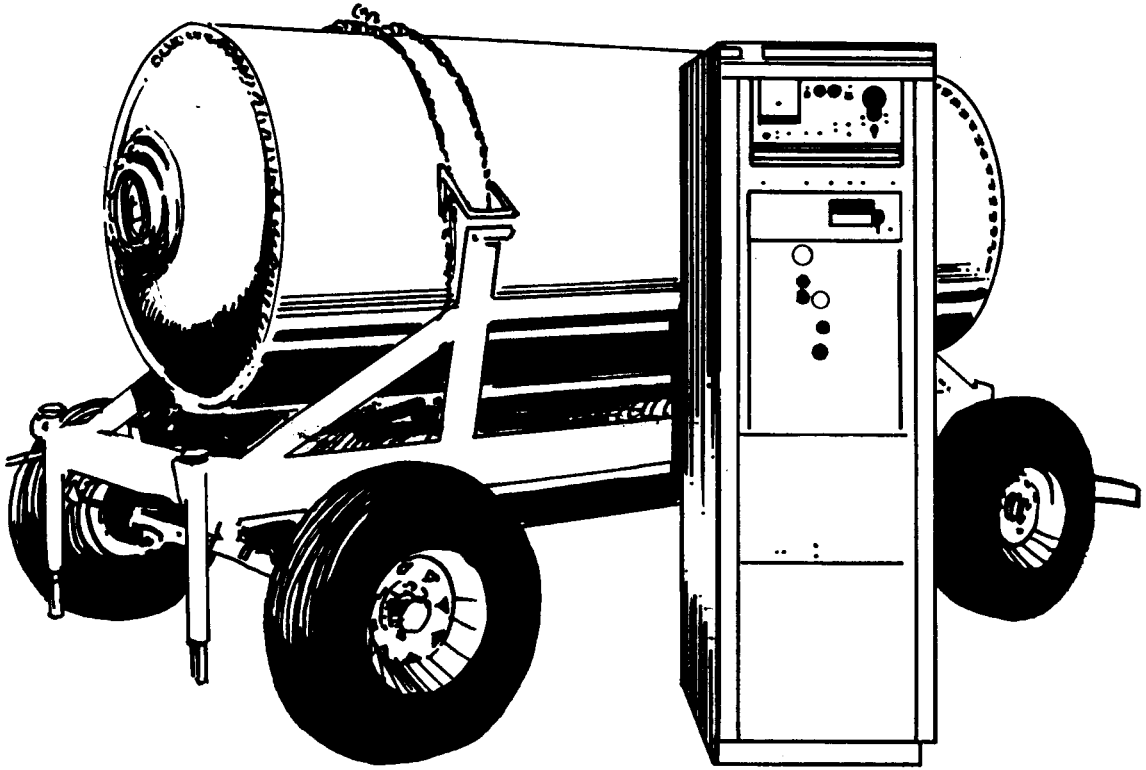
High Performance Liquid Chromatography. Instrumented equipment for rapid analysis of organic liquids.



The Laser Initiated Transfer Energy Subsystem (LITES). A newly developed technology used in initiation of energetic devices such as aircrew ejection seat and aircraft emergency egress systems.



2-Stage Gas Gun



2.3 MeV X-Ray System

SPECIAL FACILITIES AND EQUIPMENT
FACILITIES/EQUIPMENT CAPABILITY FORM

Technical Center Site	Indian Head Division, NSWC
Facility/Equipment Nomenclature or Title	Weapons Product Development

1. State the primary purpose(s) of the facility/equipment.

The weapons product development capability at Indian Head is devoted to the development of energetic materials (propellants, explosives, and pyrotechnics) and the units into which they are loaded (rocket motors, JATOS, gun propelling charges, igniters, and warheads). The functions performed in these areas include development, design engineering, modeling and analysis, fleet support engineering, and production support. The facilities which support this capability consist of the following major areas:

Composite propellant and explosives facility
Gun/solvent propellant facility
Solventless double base facility
Pyrotechnic materials facility
Continuous processing facility
Rocket motor case braiding facility
Rocket motor/warhead process development facility
Explosive/propellant curing facilities
Explosive storage magazines
Engineering analysis and design facility

Though not listed by name, the facilities include substantial office space to house the engineers and technicians involved in the design and engineering work on the weapons products themselves.

This complex of facilities (20 major operating buildings, 70 support buildings and ovens, and 33 explosive storage magazines) and equipment provides the Navy's (and DOD's) only capability, at one location, for:

* the development and scale-up of any type of propellant, explosive, or pyrotechnic which may be required for weapons applications;

* the development of new processes and techniques for the manufacture of any type of propellants, explosives, and pyrotechnics;

* the development of processes for the loading of new rocket motors, warheads, and igniters.

Development of new composite explosives and propellants is conducted using a series of vertical mixers which range in size from one pint to 150 gallons. Once the basic sensitivity and stability characteristics of new formulations have been established in the laboratory, they are transitioned into this series of mixers for scale up and process development. It is here that the formulation is optimized, the process is modified as necessary to achieve desired properties, and the samples prepared for performance and survivability testing. A variety of support equipment necessary to provide any required particle size of oxidizer or fuel, to cast samples, and to prepare them for test are also available. Several multi-purpose, multi-cell buildings are necessary to support all these functions.

This facility is used in the development of propellants and explosives for use in aircrew escape propulsion units, JATO propulsion units (MK 128), unguided rockets (2.75"), torpedo warheads (MK 122), missile warheads (MK 125), mine countermeasure explosive devices and propulsion units (DEMNS). Process development and scale up of most of the explosive formulations developed in the Navy's 6.2 and Insensitive Munitions Advanced Development programs are conducted in this facility. **The ability of Indian Head Division's technical personnel to have "hands on" training in the processing of propellants, explosives, rocket motors, and warheads provides the navy and other services with experts to solve problems. Indian Head Division personnel have:**

-Served on special teams to solve problems during development of MK 104 Standard Missile, MK 111 Tomahawk Booster, Low Smoke Sidewinder and others.

-Served on "red teams" to determine causes of malfunctions of fielded systems like MK 90 Rocket, MK-111 Tomahawk, MK 56 Standard Missile and others.

Hands on experience proves invaluable in these type endeavors. It is also used to resolve processing problems which occur both at Indian Head and at private contractors in the production of warheads and rocket motors. With the variety of equipment available and the technical expertise in the properties of composite propellants and explosives, quick process variables studies are completed to provide solutions to processing or materials variables related problems.

This facility for the development of gun and other solvent processed propellants represents the only capability in the country to scale up from the laboratory to near production scale

those highly viscous propellants which must be processed in a horizontal mixer using solvents, extruded into the desired shape, and then granulated. At the present time, such propellants are typically used for gun system applications. This facility has been used for the development of all of the highly loaded nitramine gun propellants (LOVA) since the mid-1970's by both the Navy and Army. One of these propellants, M43, is in production for the Army's M900 tank round. Variants of this propellant are now being developed and scaled up in this facility for use in the Navy's Advanced Gun Weapon System and Electrothermal chemical (ETC) gun programs as well as the Army's future 120 MM tank gun ammunition.

Solventless processed double base propellants are still widely used in many rocket, JATO, aircrew escape, and mine countermeasure units. Except for the production capability at Radford Army Ammunition Plant, **this facility represents the only active capability** to process solventless double base propellants remaining in the country; it is the only developmental capability remaining. Included in this capability are the rolling mills for the processing of the propellant and pilot scale extrusion presses for forming it into the required shapes. Recent successes here include the development of formulations for the 2.75" rocket which do not use lead compounds to control the propellant burning rate. Higher performance propellants for application to underseat rocket motors (pilot ejection) which also do not depend on lead ballistic modifiers are now being developed.

The processing of pyrotechnic materials to support development programs for new CAD items is also supported by a variety of mixing, blending, and pressing equipment. Such materials are more sensitive to accidental initiation than most propellants and explosives, and they must be handled in very small quantities and with great care. As a part of this overall capability, an entirely new process for the process of the pyrotechnic materials used in most flares and igniters (MTH and MTV) is being developed which will be much safer and environmentally cleaner. Instead of using large quantities of volatile organic solvents to mix these materials, a new cryogenic process using liquid nitrogen as the process solvent is being developed. This process will also find application for other pyrotechnic type materials once developed.

Continuous processing of energetic materials has been studied for many years. Until recently, however, the process control and analytical techniques were not available to make it feasible to produce a composite propellant or explosive with acceptable quality. With the recent advances in both areas, it is now possible that continuous processing can be successful. Continuous processing offers a safer and more economical method for making both propellants and explosives. In addition, future, very high energy formulations, with very high solids loading densities, will only be processable with continuous processing. A very versatile continuous processing facility has been established, which is capable of processing materials which require mixing or mixing and extrusion. This facility has just

been upgraded with advanced feed systems for solid oxidizers and a state-of-the-art computerized control system. Rheology studies are underway to understand the effects of process variables on the resultant mechanical properties of LOVA gun propellants; this is a joint effort with the Army. A NUNN cooperative program with France is about to begin to develop the technology to cast or extrude composite rocket motors using continuous processing. This technology will also be applicable to composite explosives as well.

Effort has been ongoing for several years to develop the technology of braiding composite cases (or inhibitors) onto live rocket motor grains. A complete R&D facility has been established which can be used to overbraid a live rocket motor grain; it also has the capability to do this continuously. Extruded composite propellant rocket motor grains for the 2.75" rocket have been overbraided already. Further efforts to inhibit such grains, for application to the Navy's Advanced Rocket System program are underway. The same technology is also being applied to the braiding of detonating cord for use in mine countermeasure programs, where stronger cords are needed to withstand the forces exerted during rocket deployment.

Various facilities and equipment are also available for the casting, assembly, and disassembly of rocket motors, warheads, and test devices. Such capability is essential if the new propellants and explosives are to be tested for performance and to support development programs for new units. These facilities are designed to be very versatile, so that any type of unit can be loaded without requiring fabrication of major tooling. A variety of warhead, JATO, aircrew escape, and mine countermeasure programs are supported with these facilities.

A variety of curing and drying ovens as well as many storage buildings for hardware and chemicals are required in order to support all of the programs being conducted in these facilities; all of these are already in place. In addition, the many different types of explosives and propellants requires a large number of explosive storage magazines be available so that no incompatible storage results.

The analysis and design facility provides the computational equipment and staff to support the various weapons product development programs which are conducted. The facilty is equipped with a state-of-the-art computer workstation system which is the equivalent of a supercomputer. The analytical functions which are performed include internal and external ballistics, thermal, structural, and thermodynamic modeling. The complexity of this work is high, extending to 6-degree of freedom dynamic analysis, 3-dimensional ballistic, thermal, and structural analysis, and 2-phase, 2-dimensional interior ballistic modeling (for guns). This analytical capability is essential for the support of all development programs conducted at Indian Head (i.e., Advance Rocket System, mine countermeasure deployment systems,

aircrew escape propulsion unis, JATOs, Electrothermal Gun) as well as the design agent and fleet support engineering roles (Tomahawk, Standard Missile, Harpoon, Sidewinder).

All of the above capability is utilized by the engineering groups which perform the development programs for new weapons products (rocket motors, JATOs, aircrew escape propulsion, gun propulsion, mine countermeasure explosive and deployment systems) and provide design agent and fleet support engineering services for most of the Navy's propulsion systems. The joint location of all these capabilities and the opportunity for cross training of the professional staff ensures that the development engineers are aware of the capabilities of the energetic materials which may be utilized in a new weapon product.

As discussed previously, BRAC 93 combined all explosives research and underwater warhead technology within the Indian Head Division, and this transfer was organizationally completed on 3 April 1994. As discussed above in this section, Indian Head has been a strong supporter of the explosives and warheads development programs for many years, with the process development and scale up functions being supported by Indian Head's pilot plant. This organizational combination will only serve to make this a more successful transfer from the laboratory to pilot plant and on to weapon system application. Once the physical transfer to the Indian Head site is complete, there will be additional equipment capability added to this facility, particularly in the processing of melt pour/melt cast explosives and in the pressing of warheads; two capabilities which are now available at the Yorktown site of the Indian Head Division. The transfer will also increase the development capability at Indian Head by the addition of the underwater warhead development group, which will form one part of the overall weapon product development capability.

Equipment integral to this facility with a replacement value ≥ $500,000:

a. Continuous Mixer/Extruder: Used for the continuous processing of energetic materials. This process offers a higher degree of safety as fewer chemicals are in the system at any given time, it is more efficient, and produces a more uniform final product. This is a fixed asset with a replacement cost of $1,000,000. It weighs 10,000 lbs.

b. Over Braiding Machine: State-of-the art equipment used for overbraiding energetic materials with composite fibers and resin as a manufacturing process for tactical rocket motors. This process offers benefits of a greater structural integrity conformity and cost effectiveness. This is a fixed asset with a replacement cost of $750,000. It weighs 20,000 lbs.

c. Mixer, 150 Gallon Baker Perkins Planetary Vertical: This mixer is located at Bldg. 854. It is used to mix composite propellants and explosives for programs such as the aircrew escape propulsion units, the Navy's Insensitive Munitions Advanced Development

Program, and other developmental programs. The explosives and propellants can only be made in this type of equipment due to the high viscosity of the materials being mixed. This is a fixed asset with a replacement value of $1,000,000. It weights 35,000 lbs and it takes up 1,300 cubic feet of space.

d. Mixer, 150 Gallon APV Advanced Vertical Planetary (AVM): This mixer is now being installed in Bldg 1122. It will replace the 150 Gallon Baker Perkins Planetary Mixer located at Building 854 which is nearing the end of its useful service life. This mixer, the only one of its kind in the country, has a greater range of operating parameters available to the operators and engineers. The mixing time will be one-quarter of the present time in current vertical mixers, and the products made will be the most accurately formulated in the ordnance industry. It will be used to mix plastic bonded explosives and composite propellants for programs such as the aircrew escape propulsion units, the Navy Insensitive Munitions Advanced Development Program, and other developmental programs. The explosives and propellants can only be made in this type of equipment due to the high viscosity of the materials being mixed. Once installed in the facility being refurbished , it will be a fixed asset. The mixer itself cost $1,100,000. It weighs 35,000 lbs and it takes up 1,300 cubic feet of space.

2. Indicate whether the facility/equipment is portable, moveable or fixed as defined by paragraph 6, page 12 of this data call.

The facilities themselves are fixed and cannot be moved.

3. Provide the replacement value of the facility/equipment. Report the facility/equipment cost separate from any building and utilities that may be integral to the facility/equipment.

The combined replacement cost of facilities and equipment currently located at Indian Head is $125M. Once the physical transfer of the White Oak personnel and equipment is completed in FY97, the replacement value of the equipment will be increased by $9-$10M

4. Provide the gross weight and cube of the facility/equipment.

N/A

5. Indicate any "special" utility support required by this facility/equipment other than normal electrical power.

Virtually all of the facilities require steam, 90-100 psi compressed air, 220 and 440 volt power, and high pressure water for the fire protection system.

6. Indicate any special budget requirements for the facility/equipment (i.e., special foundations, non-ferrous materials, shielding, hardening, etc.).

All buildings in which energetic materials are handled require electrical grounding systems, lightning protection (depending on the value of the facility), deluge systems with automatic sensing equipment, special conductive floors, special construction to minimize propagation from one area to another (1-2 feet thick reinforced concrete walls and frangible roofs), explosion proof electrical equipment, etc. Control rooms for processing buildings must be hardened to provide personnel protection. All buildings must be sited in accordance with the quantity-distance requirements of OP-5. The explosive storage facilities require special construction and protection, including earthen mounds.

7. State any environmental control requirements for the facility/equipment (i.e., temperature, humidity, air scrubbing).

Most of the propellants, explosives, and pyrothechnic materials developed in these facilities require strict control of the temperature and humidity conditions throughout processing, so that large HVAC systems are part of nearly all the facilities. In order to be compliant with environmental regulations, process streams from all of these operations (including water and air) must be controlled and cleaned before release into the environment. In addition, all explosive waste from any operation must be disposed of in a controlled manner.

8. Indicate if this facility/equipment would be extremely difficult or impossible to replicate or relocate at another site and the impact to the Department of the Navy if this facility/equipment were lost. Consider existing Government-wide and commercial capabilities as the replication and impact statements are formulated.

The total energetic materials R&D capability at Indian Head (laboratory and pilot plant) is unique among DOD and private industry in this country because it is basically all encompassing. There are other DOD and private sector facilities which have pilot plant and/or production capability for propellants, explosives, or pyrotechnics. Some specific examples would include:

- U. S. Army Armaments Research Development and Engineering Center, Picatinny Arsenal, NJ: Laboratory and limited pilot scale capability for non-composite gun and rocket propellants;

- NAWC Weapons Division, China Lake, CA: Laboratory and pilot plant for composite missile propellants and explosives;

- U. S. Air Force Wright Laboratory, Eglin AFB, FL: Laboratory and pilot scale capability for explosives;

- Los Alamos and Lawrence Livermore National Laboratories: Laboratory capability for explosives;

- Hercules, Thiokol, ARC, Aerojet: Laboratory, pilot plant, and production capability for composite missile propellants.

The Indian Head Division provides all of the above capabilities at one site as well as the ability to do R&D, low rate manufacture, and engineering support for all the other types of energetic materials not provided by these other facilities: nitramine based gun propellants, non-composite rocket propellants (both solvent and solventless processed), pyrotechnics, and energetic chemicals. Only Indian Head, by providing the total capability within one facility to support all aspects of all potentially required energetic materials, ensures that the Navy and DOD will have available the capability to provide itself with any needed energetic material in the future.

This facility is fixed and therefore replication or relocation of this capability to another site would require investment of virtually all of the $125M value of the existing facility. Because of the size of much of the equipment involved, relocation would require demolition of part of the buildings in which the equipment is located. Obviously, all of the specialized fire protection, personnel protection, utilities, and environmental control systems would have to made available as well. Simply making use of the facilities available at other activities or companies would result in the Navy (and DOD) losing the only remaining capability to provide some types of propellants which may be needed for a weapon system.

Separation of the energetic materials capability from an active production facility and from the development, design agent, and fleet support engineering functions for these materials would result in a loss for all three functions. The R&D group would lose the experience gained from being involved in the transition of new materials and their processes from the pilot plant to production. This involvement helps to ensure a smoother transition. The production function will lose because the knowledge of the R&D group will not be available to help in solving problems which occur during production. The mutual benefit from having a team approach to the development of weapons products loaded with popellants or explosives is obvious. The impact of this loss would be felt in virtually all weapon systems in use by the fleet, including surface and air launched missile (both warheads and propulsion), gun ammunition (projectiles and propelling charges), bombs, torpedos (warheads and propulsion), mines, mine countermeasures (deployment systems and explosive charges), aircrew escape systems, stores separation charges, and transfer systems.

The best demonstration of the value of the synergistic combination of -R&D, production, and engineering functions is the number of in-service weapons systems which are supported during their production and fleet use life cycles. Indian Head engineers and scientists are regularly used to resolve production, hardware, and performance problems with virtually all of the propulsion systems used in the fleet:

- Missiles: Tomahawk, Standard Missile, Harpoon, Penguin, Sidewinder, Sparrow;

- Rockets: 2.75", Zuni, MCLIC;

- Guns: 76 MM, 5"/54;

- Aircrew Escape: All systems.

Even though most of the missile propulsion systems were developed by a private contractor, it is still Indian Head which is called upon by the program manager to provide the technical expertise to resolve production or fleet use problems with the energetic materials portion of the weapon systems. Without the combined experience of the three functions at Indian Head, no one would be able to provide this support for the Navy.

The knowledge and skills necessary to develop energetic materials and new processing technologies are not taught in any academic program. The academic training of the chemists and engineers who conduct these programs serves only as technical background for the knowledge gained through hands on work over several years. The typical chemist or engineer responsible for the development of a new propellant or explosive after it has been transitioned from the laboratory has at least five years of experience in the processing of such materials. They are supported by technicians and skilled workers with many years of experience in the operation of mixers, presses, and tooling required for the processing of modern energetic materials. Including the people transferred from White Oak, the group of people working at Indian Head provides national expertise in the development of composite propellants and explosives, solventless double base propellants, high energy gun propellants, continuous processing, and braiding technology. The same kinds of experience and hands-on training are required for a propulsion system designer or an analyst doing complicated structural or ballistic modeling. Retaining a core of expertise in these critical technologies is vital for the proper conduct of energetic materials development programs and to support the Navy's weapon systems. Movement of this group to a new site will undoubtedly result in the loss of much of this vital experience and the consequent loss to the Navy of the capability to support existing and future weapons systems.

9. Indicate how and when the facility/equipment was transported and or constructed at the site.

Most of the buildings used for energetics materials processing were built in the 1950's. In several areas (100 gallon and 150 gallon mixers, continuous mixer/extruder, extrusion presses), the equipment and facility were built together, with control systems, feed systems, etc. built into the buildings. Since they were originally built, most of the facilities have been modernized to include HVAC and computer control system.

10. List the functional support areas (previously provided in Tab A) that this facility/equipment support. Refer to Appendix A for the list of functional support areas.

2.7 Explosives
2.12 Weapons Propulsion
2.13 Other Ordnance
8.2 Countermeasures

This facility supports the following NSWC Technical Capabilities:

Rocket/Missile/Gun Propulsion
Energetics Manufacturing/Manufacturing Technology
Cartridge/Propellant Actuated Devices/Aircrew Escape Propulsion Systems
Explosives

11. Provide the historical utilization average for the past five fiscal years (1989-1993). Define the unit of measure used.

Average of 228 workyears per year from 1989-1993.

12. Provide the projected utilization data out to FY97.

94 222 Workyears
95 212 Workyears (reduction is caused by 3 April 1994 reorganization and transfer of 20 workyears to another department)
96 362
97 362

Increases in 96 and 97 for the Explosives Research and Underwater Warheads functions physically moving from White Oak, MD to Indian Head Division, NSWC per BRAC 93.

13. What is the approximate number of personnel used to operate the facility/equipment?

The knowledge and skills necessary to develop energetic materials and new processing technologies, to conduct ballistic modeling, or to design a rocket motor are not taught in any academic program. The academic training of the chemists and engineers who conduct these programs serves only as technical background for the knowledge gained through hands on work over several years. The typical chemist or engineer responsible for the development of a new propellant after it has been transitioned from the laboratory has at least five years of experience in the processing of such materials. They are supported by technicians and skilled workers with many years of experience in the operation of the mixers, presses, and tooling required for the processing of modern energetic materials. Included in this group are several nationally recognized experts in the development of composite propellants and explosives, high energy gun propellants, and continuous processing, and modeling.

By FY 1997, the number of scientists, engineers, and technicians using these facilities will be approximately 362.

14. **What is the approximate number of personnel needed to maintain the equipment?** Four people.

15. Provide one 8 1/2 x 11 black and white photo of the facility/equipment.

SPECIAL FACILITIES AND EQUIPMENT
FACILITIES/EQUIPMENT CAPABILITY FORM

Technical Center Site	Indian Head Division, NSWC
Facility/Equipment Nomenclature or Title	Nitramine Gun & High Energy Propellant Facility

1. State the primary purpose(s) of the facility/equipment.

The purpose of the facility is to provide development/production life cycle support for casting powders and gun propellants used by the tri-service community. Single base, multi-base, and nitramine formulations can be developed and produced at this facility. The technical personnel provide the core expertise to develop products and processes that meet the specific needs of a gun system or missile program in the research and development phase. The facility is used to produce qualification lots and complete low rate initial production (LRIP) to prove out product producibility. Low production rates can be maintained to establish DoD core capability and a center for technology transfer to the private sector if large production quantities are needed. The technical expertise maintained at the facility can act as an industry watch dog and provide engineering support in this role. Processing studies and engineering investigations performed during on site production broaden the technical knowledge maintained at the facility and provide product improvement. The facility is a component of the national mobilization base and has a production surge capacity that can be attained far more quickly than facilities in the private sector. The mission of the facility is accomplished with strict regard for environmental compliance as well as an unsurpassed safety record which has been enhanced by its exposure to the Navy's center of excellence for safety located at Indian Head.

A typical example of this facility's capability is the success of the M43 nitramine gun propellant program. The Army came to Indian Head for development of a propellant with unprecedented performance to be used in the 105 mm gun of the M1 main battle tank. Indian Head's unique combined resources from the gun system design branch, pilot plant facility, and nitramine gun propellant production facility worked together with synergistic effect to complete the task. The formulation and process development led to qualification lots and LRIP. **Desert Storm mobilization efforts ramped production rates to surge capacity in two months.** Standard production rates were maintained after Desert Storm to complete the 2 million pound requirement for the program. Engineering studies and investigations were performed that reduced unit cost and improved product performance.

This facility is uniquely qualified to develop and produce nitramine gun propellants because of the attendant technical expertise and the agility of the facility. Finely ground nitramines may not be transported geographically because of its sensitivity. This facility uses its own grinding process to prepare the nitramines for incorporation into the product and remains the only qualified producer of M43 gun propellant in the world.

Equipment integral to this facility with a replacement value ≥ $500,000:

a. Two 150 Gallon Horizontal Sigma Blade Mixers: The primary purpose of the 150 gallon mixers is to manufacture gun propellants and casting powders using the solvent melt process. This equipment has supported the Polaris missile, Poseidon missile, and the Army's 105 millimeter kinetic energy tank round. The mixers are fixed assets. The replacement cost of the mixing equipment is $650,000 each.

Exact replication of this equipment is difficult. The manufacturer of the mixers is no longer in business. New manufactures would have to be solicited. The most difficult aspect of relocating the equipment is the construction of appropriate buildings and supply of necessary utilities.

b. Two 500 Ton Vertical Extrusion Presses: The primary purpose of the vertical presses is to process gun propellants and casting powders manufactured. This facility has supported the Polaris missile, Poseidon missile, and the Army's 105 millimeter kinetic energy tank round. The extrusion presses are fixed assets. The replacement cost of each extrusion press is $550,000.

Exact replication of this equipment is possible. The manufacturers of the presses and hydraulic power are still in business. The most difficult aspect of relocating the equipment is the construction of appropriate buildings and supply of necessary utilities.

c. RDX Drying and Grinding Equipment: The primary purpose of the equipment is to dry and grind RDX to specification for direct use in M43 gun propellant production. The equipment supports the drying and grinding of RDX for the M43 gun propellant program and for various research initiatives performed on base. The equipment in this facility is fixed. The cost to replace the equipment is $800,000.

Moving the equipment is strongly discouraged due to the stresses that would be inflicted on the explosive handling equipment where fine cracks must be avoided. Stress fractures have caused detonations and total loss of facilities at other explosive drying locations in the past.

d. Ingersoll-Rand Centac Air Compressor: The compressed air system's primary purpose is to supply dry compressed air for the Nitramine Fine Grind Facility's RDX drying and grinding operations. The compressed air system is a fixed asset. The elaborate piping system would have to be cut up and scrapped since it was uniquely designed to fit its current location. The replacement value of the compressed air system is $550,000.00.

2. Indicate whether the facility/equipment is portable, moveable or fixed as defined by paragraph 6, page 12 of this data call.

This is a fixed facility. It is comprised of approximately 80 buildings, a high percentage of which are covered with earthen mounds. The buildings are configured and spaced in accordance with explosive processing facility design specified in governing Naval documents. Safety and environmental infrastructure connecting the buildings to waste water treatment facilities and high pressure river water for emergency deluge systems are necessary for operations and are unmovable. The facility has an isolated geographical position on a peninsula of the Potomac river which is advisable for explosive operations. Yet, it is close to Washington, DC providing ready access to the tri-service community.

3. Provide the replacement value of the facility/equipment. Report the facility/equipment cost separate from any building and utilities that may be integral to the facility/equipment.

The estimated cost of replacing the facility is $90 million. The buildings have unique designs that accommodate the processing equipment inside and would have to be duplicated at a new site. The costs include equipment, structures, and environmental and safety infrastructure necessary to run explosive operations. However, the technical and configuration management costs are not included. The value of this facility includes the collective knowledge of 3 decades of explosives processing. Safety, environmental, and processing lessons have been incorporated into operating procedures, equipment design, and facility layout that would difficult, if not impossible, to reproduce without this attendant expertise.

4. Provide the gross weight and cube of the facility/equipment. N/A

5. Indicate any "special" utility support required by this facility/equipment other than normal electrical power.

In addition to a normal electrical usage of 925 kW-hr, the facility also uses approximately 1700 kW of steam per hour. Steam is utilized as a heat transfer medium because it is much safer to use in an explosive environment than electric resistive heating. The facility uses 125 gallons of clean filtered water per hour. The facility also has a minimum of 125 psi of

river water available to the sprinkler systems at all times. In some applications the sprinkler must be able to deliver hundreds of gallons of water within minutes. The facility also has 100 psi of air available throughout the operating buildings.

The facility is also connected to the Center's waste water management system. This waste water management system includes secondary and tertiary treatments. This system was designed to minimize and eventually eliminate explosive waste emissions.

Currently the facility is interconnected with a "data highway system". This network includes using fiber optics and phone data links to operate a distributed control system. The facility is also connected to the Center's Local Area Network.

6. Indicate any special budget requirements for the facility/equipment (i.e., special foundations, non-ferrous materials, shielding, hardening, etc.).

The equipment is used to process energetics and therefore must follow the directives provided in safety regulations for storing, producing, handling and shipping explosives. Guidelines for building separation and the thickness of walls for processing buildings are also provided in these safety regulations. The operating buildings contain at least one to two feet of reinforced concrete walls. There are some buildings that are covered and surrounded by earthen mounds for blast containment. All of the operating building contain conductive floors. The equipment in those buildings are bonded so they maintain the same electrical potential. Some processing buildings contain frangible roofs.

Each operating building contain a fire protection deluge and sprinkler system. The operating buildings are protected from lightning by lightning rods that are tied to grounding girdles separate from the processing building.

The electrical equipment used in those buildings is explosion proof equipment which is usually two to three times more costly than non explosion proof equipment. In various cases stainless steel and non sparking material is used to manufacture the equipment and tools.

7. State any environmental control requirements for the facility/equipment (i.e., temperature, humidity, air scrubbing).

The facility processes large amounts of hazardous materials including powdered high explosives and volatile organic compounds (VOC). This requires that many of the buildings have scrubbers, condensers and filtering systems for air emission environmental controls. We are installing VOC catalytic incineration devices at both the mixers and drying areas in order to meet VOC emission regulations. Wastewater is processed through

settling tanks and carbon adsorption systems before being discharged. Oil/water separators are also present throughout the facility at process waste streams. Isopropyl alcohol is used as a desensitizing agent for transporting raw nitramines. Alcohol collected from our solvent recovery system is discharged into a bio-filtration system.

Since many of our ingredients absorb moisture, all our process areas are temperature and humidity controlled. Likewise, our compressed process air requires air drying and filtration systems. Temperature control is also critical on the processing equipment which is regulated by heating and cooling systems. Explosive dust collection systems are used in the powder handling facilities. Wet/dry separators are present to separate solid materials from process liquids.

8. Indicate if this facility/equipment would be extremely difficult or impossible to replicate or relocate at another site and the impact to the Department of the Navy if this facility/equipment were lost. Consider existing Government-wide and commercial capabilities as the replication and impact statements are formulated.

a. This facility is fixed and therefore would be very difficult to relocate for the following reasons:

- Quantity of buildings is high
- **Equipment removal would require the dismantling of many concrete hardened buildings, most of which are buried beneath earthen mounds**
- Removal and transportation of sensitive explosive handling equipment could jeopardize the safe use of this equipment due to possible cracking and misaligned clearances
- Equipment is uniquely dependent on the facilities in which it is housed regarding structural layout and necessary safety and environmental protection accessories such as blast barriers, grounding girdles, air emission and waste stream controls and safety egresses
- Rebuilding the infrastructure to house and support this type of equipment would be very costly

b. The facility loss impact to the Department of Defense would be:

- loss of only qualified and proven producer of M43 gun propellant which would jeopardize the Army's ability to field the high performance M900 kinetic energy round.
- loss of only capability to produce high energy nitramine gun propellants, which are in development of the Navy's Advanced Gun Weapon System and Army tank ammunition improvement programs.
- loss of core technical and operational expertise
- loss of role in acquisition process (i.e. production feasibility and qualification)
- loss of only LRP GOGO within DOD which serves as warm plant capable of surge production requirements
- loss of facility capable of flexible throughput rate and product changes contrasting with private sector specialization and limitations to only large volume production
- loss of propellant plant capable of drying and grinding raw nitramines on-site which is crucial since this material cannot be transported in a ground state

c. Although there are other Government and commercial facilities with similar equipment, the facilities were not designed for the safety requirements of processing high energy nitramine propellants; most of the facilities are shut down. None of the facilities with the ability to process the propellant have the ability to dry and grind the raw nitramine on-site. This is an important factor since this material cannot be transported in the ground state.

9. Indicate how and when the facility/equipment was transported and or constructed at the site.

Construction of the plant was started in 1959 and completed in 1962 to fully support the manufacture of base grain casting powder for the Polaris missile program. After successful completion of the Polaris program, the plant was chosen for development and production of base grain casting powder for the Poseidon missile program. The plant underwent a 14 million dollar modernization from 1981 to 1983 to support an urgent mobilization effort for the United Kingdom's Polaris missile fleet. This effort would not have been possible had not the NSWC/IHD plant been made available so quickly. In 1987, another plant modernization and modification effort sponsored by the US Army was

completed to support process acquisition of nitramine gun propellant technology. Transition to production of XM39 and M43 nitramine propellants were accomplished in the newly named Nitramine Gun Propellant Facility (NGPF). This plant is the sole producer of M43 and the largest nitramine propellant facility currently in production in the world. These modernization ventures has resulted in an up to date, warm manufacturing base capable of single, double and nitramine based propellant manufacture that can support gun and missile program requirements.

10. List the functional support areas (previously provided in Tab A) that this facility/equipment support. Refer to Appendix A for the list of functional support areas.

2.12 Weapons Propulsion

This facility supports the following NSWC Technical Capability:

Energetics Manufacturing/Manufacturing Technology

11. Provide the historical utilization average for the past five fiscal years (1989-1993). Define the unit of measure used.

1989 - LOVA propellant acquisition process and M43 product development - 20,000 pounds

1990 - Low Rate Initial Production (LRIP) M43 propellant for M900 program - 250,000 pounds

1991 - Surge production of M43 in direct support of Desert Storm conflict - 575,000 pounds

1992 - Standard production rates of M43 for M900 program - 400,000 pounds

1993 - Standard production rates of M43 for M900 program - 400,000 pounds

12. Provide the projected utilization data out to FY97.

1994 - Standard production rates of M43 for M900 program - 400,000 pounds

1995 - Acquisition process for advanced high energy nitramine propellant for use in 120mm gun system and civilian airbag dual use initiatives - 50,000

1996 - Low Rate Initial Production (LRIP) advanced high energy nitramine propellant and transfer of technology to private industrial base - 250,000 pounds

1997 - Product improvement program and warm base production support for advanced high energy nitramine propellant - 200,000 pounds

13. What is the approximate number of personnel used to operate the facility/equipment?

The plant requires a mixture of 65 operators and 7 engineering (technical) employees with highly specialized skills in order to support full spectrum propellant operations and a production rate of 50,000 pounds per month. As a sole producer of M43 gun propellant, the group represents the state of the art in nitramine propellant development and manufacturing knowledge.

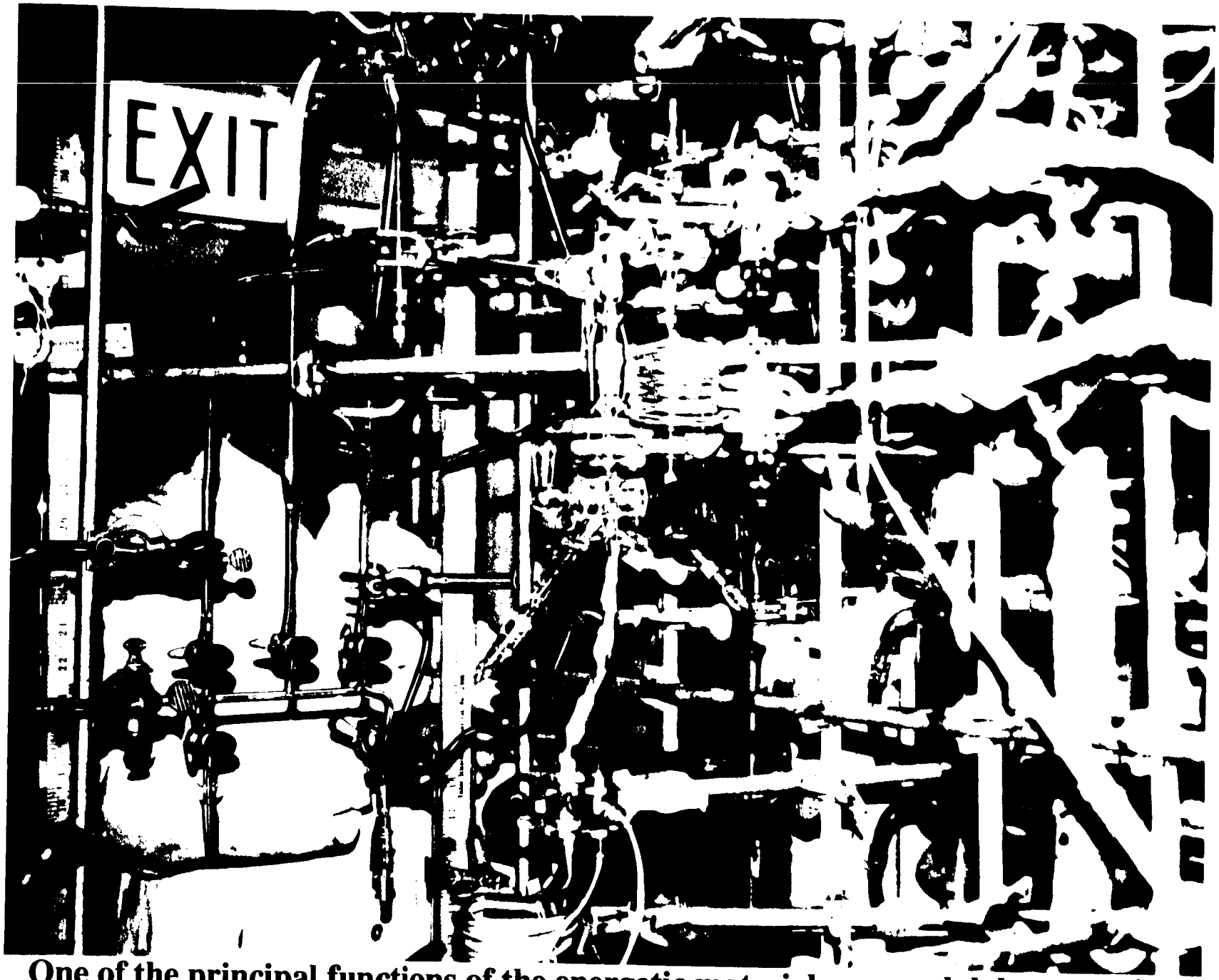
The engineering staff provides for process improvement studies, engineering studies, engineering investigations, plant modernization, quality control, personnel certification/training and equipment operational requirements. The facility has an individual on-site who is regarded as a DoD expert in nitramine propellant processing. This individual has researched, characterized and documented the nitramine propellant process so extensively, he is constantly requested as a technical advisor throughout DoD. He has consistently participated in propellant investigations undertaken by the US Army.

Operations personnel require a working knowledge of operational requirements for horizontal 150-gallon sigma blade mixers, various hydraulic propellant presses, fluid energy mills, and vacuum tumble drying equipment. Frequent cross training has developed a highly flexible and fast reacting workforce that can intimately operate the production areas with superior understanding and keen insight toward energetics manufacture.

14. What is the approximate number of personnel needed to maintain the equipment?

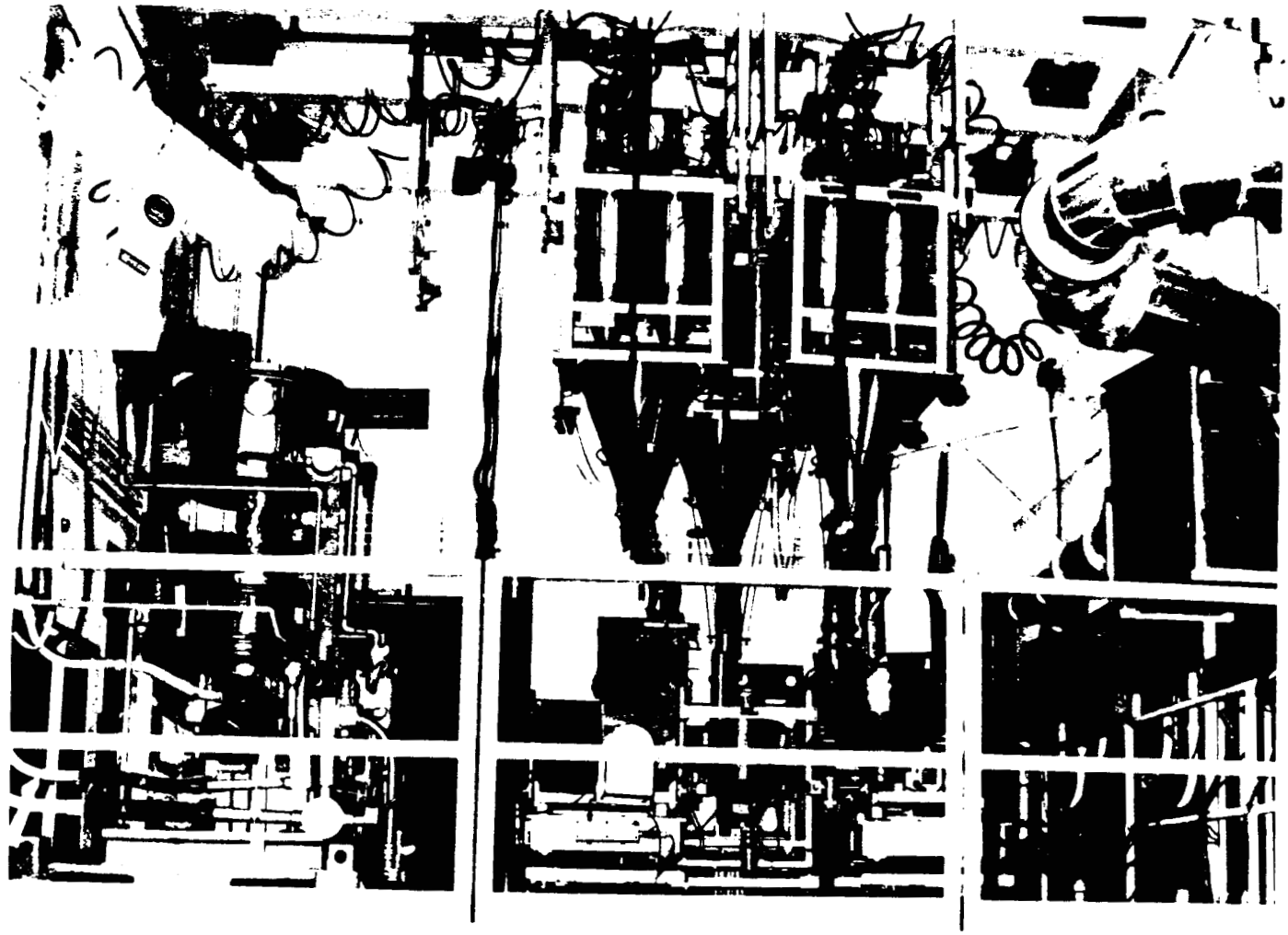
Six people are required to maintain the facility. Necessary skills include Equipment Mechanics, an Instrument Mechanic, a Pipe Fitter, and an Electrician. Highly specialized knowledge is required to maintain presses, control systems, and pneumatic control valves, including the design and trouble shooting of pneumatic control systems. Skills in maintaining mechanical, electrical, air, and fluid systems, as well as all piping in the facility are also required.

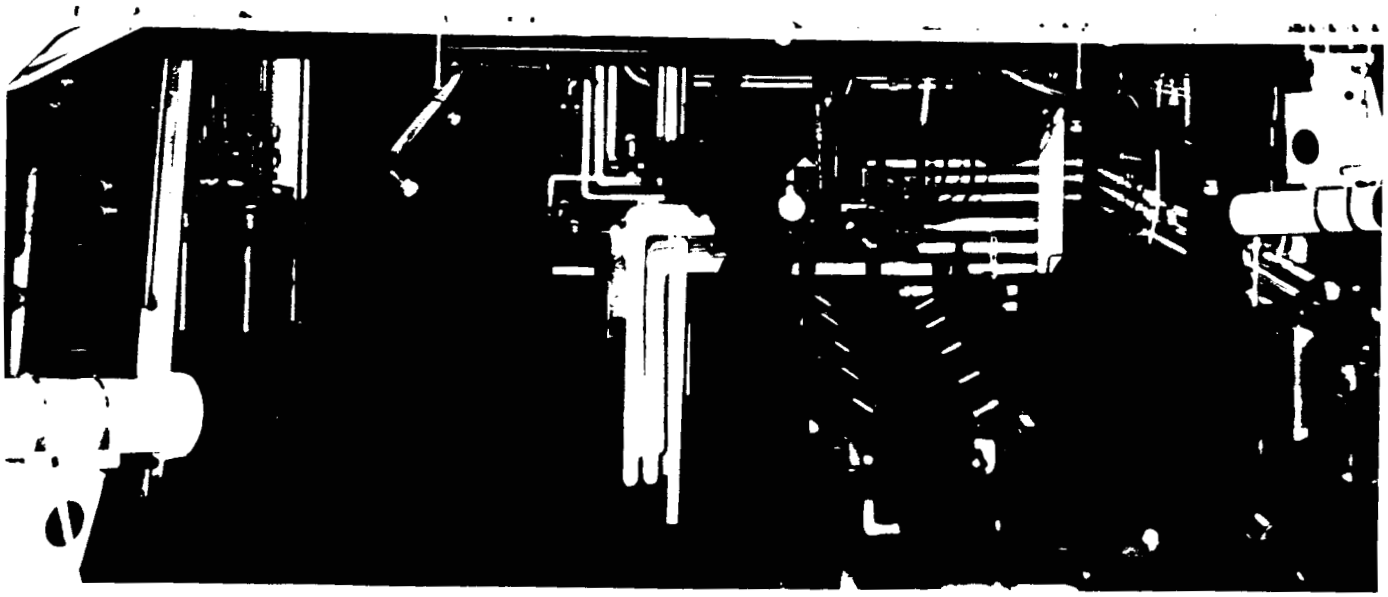
15. Provide one 8 1/2 x 11 black and white photo of the facility/equipment.



One of the principal functions of the energetic materials research laboratory is to develop and scale up the synthesis of new materials. The first step in this process is the use of laboratory glassware, shown here arranged for a multi-step synthesis procedure.

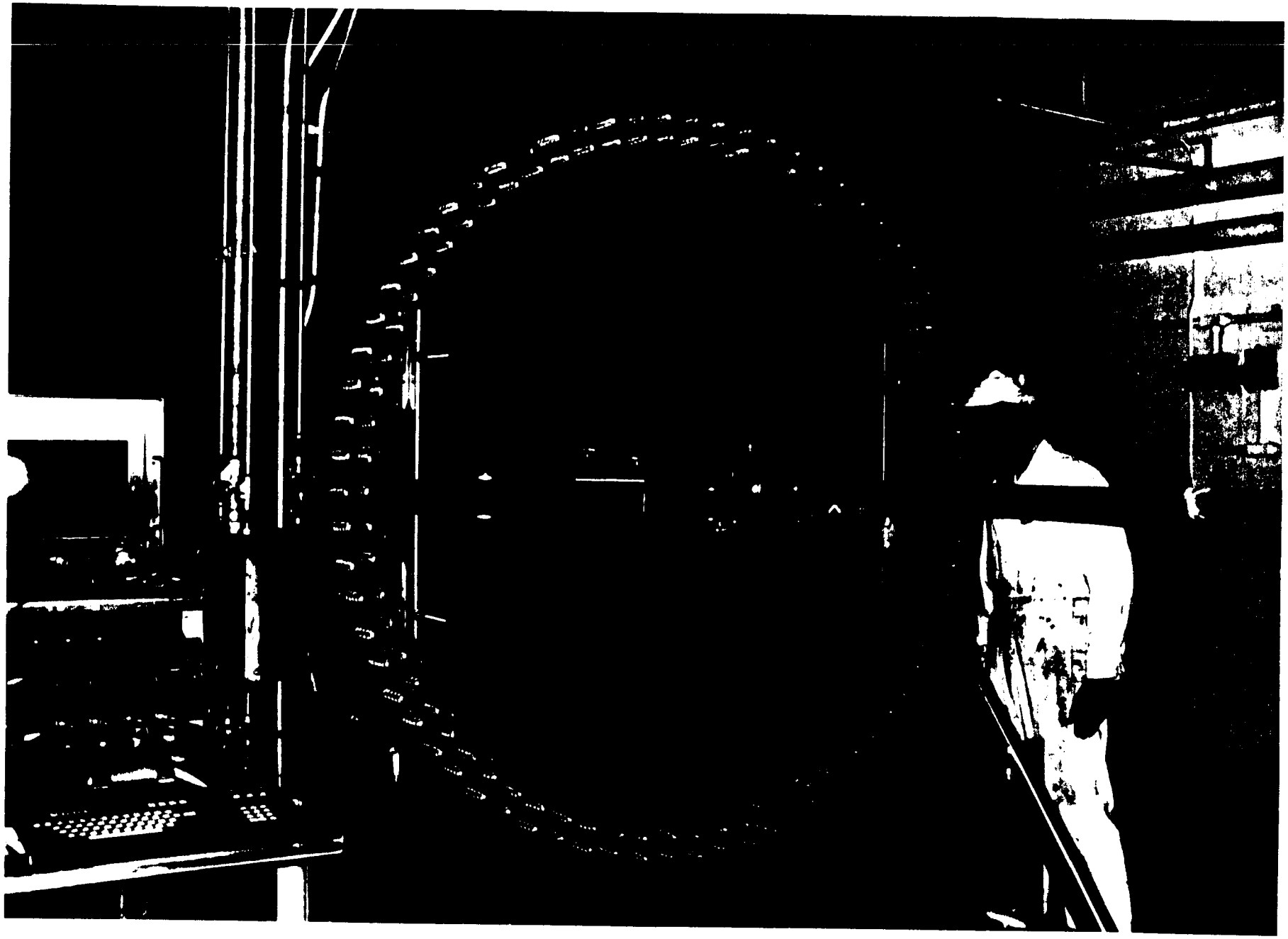
These pictures illustrate the range of scale-up capability and the variety of process equipment that exists in Indian Head Division's Pilot Plant.



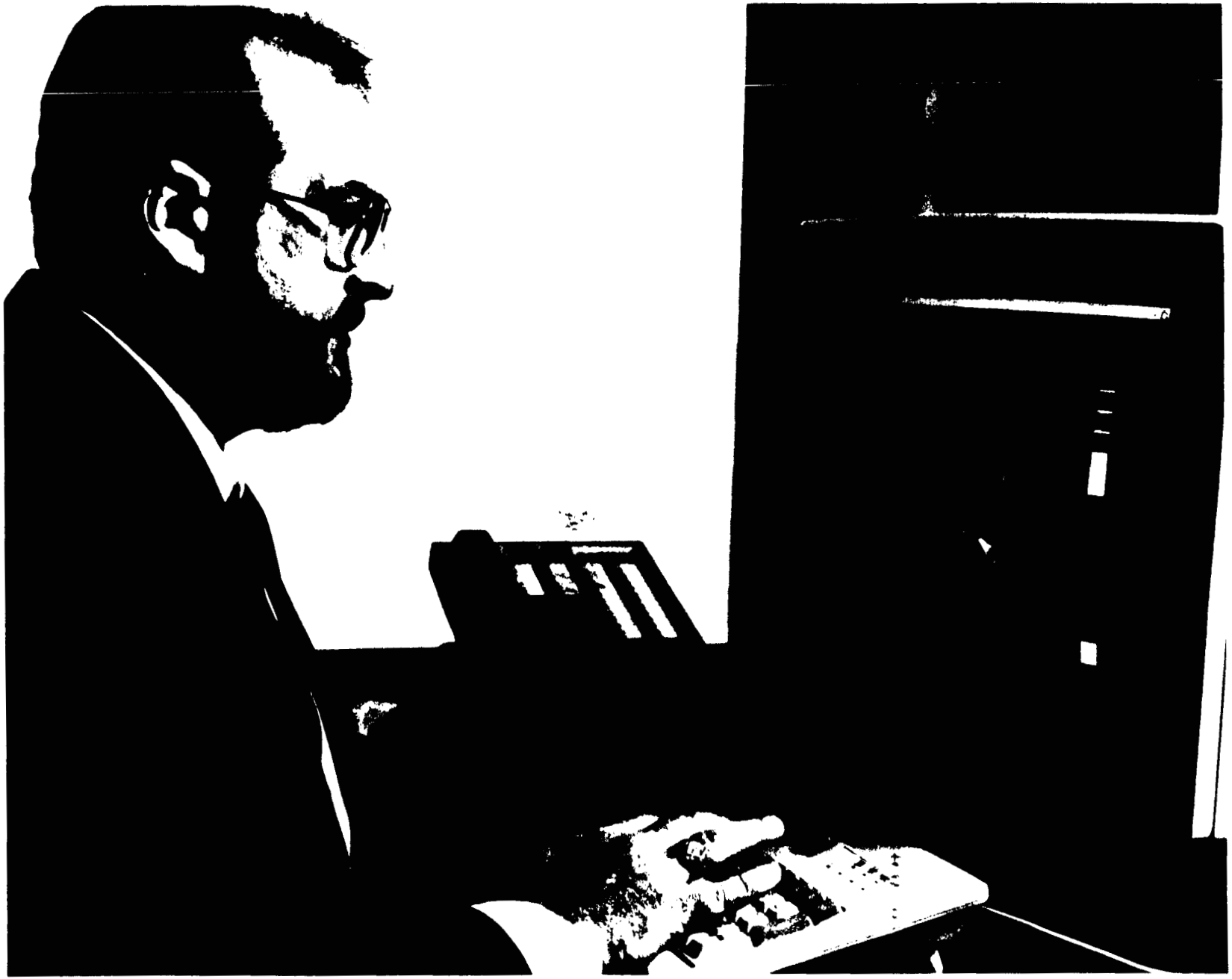


Continuous Mixer/Extruder

150 Gallon Vertical Planetary Mixer
(IHDIV owns two)



Over Braiding Machine



Computer simulation and modeling are used to design and analyze solid propellant rocket motors, rocket motor deployed mine countermeasure systems, and medium and large caliber guns. Analysis involves the determination of internal ballistics, external ballistics, thermal, and finite element structural analysis.

SPECIAL FACILITIES AND EQUIPMENT
FACILITIES/EQUIPMENT CAPABILITY FORM

Technical Center Site	Indian Head Division, NSWC
Facility/Equipment Nomenclature or Title	Nitramine Gun & High Energy Propellant Facility

1. State the primary purpose(s) of the facility/equipment.

The purpose of the facility is to provide development/production life cycle support for casting powders and gun propellants used by the tri-service community. Single base, multi-base, and nitramine formulations can be developed and produced at this facility. The technical personnel provide the core expertise to develop products and processes that meet the specific needs of a gun system or missile program in the research and development phase. The facility is used to produce qualification lots and complete low rate initial production (LRIP) to prove out product producibility. Low production rates can be maintained to establish DoD core capability and a center for technology transfer to the private sector if large production quantities are needed. The technical expertise maintained at the facility can act as an industry watch dog and provide engineering support in this role. Processing studies and engineering investigations performed during on site production broaden the technical knowledge maintained at the facility and provide product improvement. The facility is a component of the national mobilization base and has a production surge capacity that can be attained far more quickly than facilities in the private sector. The mission of the facility is accomplished with strict regard for environmental compliance as well as an unsurpassed safety record which has been enhanced by its exposure to the Navy's center of excellence for safety located at Indian Head.

A typical example of this facility's capability is the success of the M43 nitramine gun propellant program. The Army came to Indian Head for development of a propellant with unprecedented performance to be used in the 105 mm gun of the M1 main battle tank. Indian Head's unique combined resources from the gun system design branch, pilot plant facility, and nitramine gun propellant production facility worked together with synergistic effect to complete the task. The formulation and process development led to qualification lots and LRIP. **Desert Storm mobilization efforts ramped production rates to surge capacity in two months.** Standard production rates were maintained after Desert Storm to complete the 2 million pound requirement for the program. Engineering studies and investigations were performed that reduced unit cost and improved product performance.

This facility is uniquely qualified to develop and produce nitramine gun propellants because of the attendant technical expertise and the agility of the facility. Finely ground nitramines may not be transported geographically because of its sensitivity. This facility uses its own grinding process to prepare the nitramines for incorporation into the product and remains the only qualified producer of M43 gun propellant in the world.

Equipment integral to this facility with a replacement value ≥ $500,000:

a. Two 150 Gallon Horizontal Sigma Blade Mixers: The primary purpose of the 150 gallon mixers is to manufacture gun propellants and casting powders using the solvent melt process. This equipment has supported the Polaris missile, Poseidon missile, and the Army's 105 millimeter kinetic energy tank round. The mixers are fixed assets. The replacement cost of the mixing equipment is $650,000 each.

Exact replication of this equipment is difficult. The manufacturer of the mixers is no longer in business. New manufactures would have to be solicited. The most difficult aspect of relocating the equipment is the construction of appropriate buildings and supply of necessary utilities.

b. Two 500 Ton Vertical Extrusion Presses: The primary purpose of the vertical presses is to process gun propellants and casting powders manufactured. This facility has supported the Polaris missile, Poseidon missile, and the Army's 105 millimeter kinetic energy tank round. The extrusion presses are fixed assets. The replacement cost of each extrusion press is $550,000.

Exact replication of this equipment is possible. The manufacturers of the presses and hydraulic power are still in business. The most difficult aspect of relocating the equipment is the construction of appropriate buildings and supply of necessary utilities.

c. RDX Drying and Grinding Equipment: The primary purpose of the equipment is to dry and grind RDX to specification for direct use in M43 gun propellant production. The equipment supports the drying and grinding of RDX for the M43 gun propellant program and for various research initiatives performed on base. The equipment in this facility is fixed. The cost to replace the equipment is $800,000.

Moving the equipment is strongly discouraged due to the stresses that would be inflicted on the explosive handling equipment where fine cracks must be avoided. Stress fractures have caused detonations and total loss of facilities at other explosive drying locations in the past.

d. Ingersoll-Rand Centac Air Compressor: The compressed air system's primary purpose is to supply dry compressed air for the Nitramine Fine Grind Facility's RDX drying and grinding operations. The compressed air system is a fixed asset. The elaborate piping system would have to be cut up and scrapped since it was uniquely designed to fit its current location. The replacement value of the compressed air system is $550,000.00.

2. Indicate whether the facility/equipment is portable, moveable or fixed as defined by paragraph 6, page 12 of this data call.

This is a fixed facility. It is comprised of approximately 80 buildings, a high percentage of which are covered with earthen mounds. The buildings are configured and spaced in accordance with explosive processing facility design specified in governing Naval documents. Safety and environmental infrastructure connecting the buildings to waste water treatment facilities and high pressure river water for emergency deluge systems are necessary for operations and are unmovable. The facility has an isolated geographical position on a peninsula of the Potomac river which is advisable for explosive operations. Yet, it is close to Washington, DC providing ready access to the tri-service community.

3. Provide the replacement value of the facility/equipment. Report the facility/equipment cost separate from any building and utilities that may be integral to the facility/equipment.

The estimated cost of replacing the facility is $90 million. The buildings have unique designs that accommodate the processing equipment inside and would have to be duplicated at a new site. The costs include equipment, structures, and environmental and safety infrastructure necessary to run explosive operations. However, the technical and configuration management costs are not included. The value of this facility includes the collective knowledge of 3 decades of explosives processing. Safety, environmental, and processing lessons have been incorporated into operating procedures, equipment design, and facility layout that would difficult, if not impossible, to reproduce without this attendant expertise.

4. Provide the gross weight and cube of the facility/equipment. N/A

5. Indicate any "special" utility support required by this facility/equipment other than normal electrical power.

In addition to a normal electrical usage of 925 kW-hr, the facility also uses approximately 1700 kW of steam per hour. Steam is utilized as a heat transfer medium because it is much safer to use in an explosive environment than electric resistive heating. The facility uses 125 gallons of clean filtered water per hour. The facility also has a minimum of 125 psi of

river water available to the sprinkler systems at all times. In some applications the sprinkler must be able to deliver hundreds of gallons of water within minutes. The facility also has 100 psi of air available throughout the operating buildings.

The facility is also connected to the Center's waste water management system. This waste water management system includes secondary and tertiary treatments. This system was designed to minimize and eventually eliminate explosive waste emissions.

Currently the facility is interconnected with a "data highway system". This network includes using fiber optics and phone data links to operate a distributed control system. The facility is also connected to the Center's Local Area Network.

6. Indicate any special budget requirements for the facility/equipment (i.e., special foundations, non-ferrous materials, shielding, hardening, etc.).

The equipment is used to process energetics and therefore must follow the directives provided in safety regulations for storing, producing, handling and shipping explosives. Guidelines for building separation and the thickness of walls for processing buildings are also provided in these safety regulations. The operating buildings contain at least one to two feet of reinforced concrete walls. There are some buildings that are covered and surrounded by earthen mounds for blast containment. All of the operating building contain conductive floors. The equipment in those buildings are bonded so they maintain the same electrical potential. Some processing buildings contain frangible roofs.

Each operating building contain a fire protection deluge and sprinkler system. The operating buildings are protected from lightning by lightning rods that are tied to grounding girdles separate from the processing building.

The electrical equipment used in those buildings is explosion proof equipment which is usually two to three times more costly than non explosion proof equipment. In various cases stainless steel and non sparking material is used to manufacture the equipment and tools.

7. State any environmental control requirements for the facility/equipment (i.e., temperature, humidity, air scrubbing).

The facility processes large amounts of hazardous materials including powdered high explosives and volatile organic compounds (VOC). This requires that many of the buildings have scrubbers, condensers and filtering systems for air emission environmental controls. We are installing VOC catalytic incineration devices at both the mixers and drying areas in order to meet VOC emission regulations. Wastewater is processed through

settling tanks and carbon adsorption systems before being discharged. Oil/water separators are also present throughout the facility at process waste streams. Isopropyl alcohol is used as a desensitizing agent for transporting raw nitramines. Alcohol collected from our solvent recovery system is discharged into a bio-filtration system.

Since many of our ingredients absorb moisture, all our process areas are temperature and humidity controlled. Likewise, our compressed process air requires air drying and filtration systems. Temperature control is also critical on the processing equipment which is regulated by heating and cooling systems. Explosive dust collection systems are used in the powder handling facilities. Wet/dry separators are present to separate solid materials from process liquids.

8. Indicate if this facility/equipment would be extremely difficult or impossible to replicate or relocate at another site and the impact to the Department of the Navy if this facility/equipment were lost. Consider existing Government-wide and commercial capabilities as the replication and impact statements are formulated.

a. This facility is fixed and therefore would be very difficult to relocate for the following reasons:

- Quantity of buildings is high
- **Equipment removal would require the dismantling of many concrete hardened buildings, most of which are buried beneath earthen mounds**
- Removal and transportation of sensitive explosive handling equipment could jeopardize the safe use of this equipment due to possible cracking and misaligned clearances
- Equipment is uniquely dependent on the facilities in which it is housed regarding structural layout and necessary safety and environmental protection accessories such as blast barriers, grounding girdles, air emission and waste stream controls and safety egresses
- Rebuilding the infrastructure to house and support this type of equipment would be very costly

b. The facility loss impact to the Department of Defense would be:

- loss of only qualified and proven producer of M43 gun propellant which would jeopardize the Army's ability to field the high performance M900 kinetic energy round.
- loss of only capability to produce high energy nitramine gun propellants, which are in development of the Navy's Advanced Gun Weapon System and Army tank ammunition improvement programs.
- loss of core technical and operational expertise
- loss of role in acquisition process (i.e. production feasibility and qualification)
- loss of only LRP GOGO within DOD which serves as warm plant capable of surge production requirements
- loss of facility capable of flexible throughput rate and product changes contrasting with private sector specialization and limitations to only large volume production
- loss of propellant plant capable of drying and grinding raw nitramines on-site which is crucial since this material cannot be transported in a ground state

c. Although there are other Government and commercial facilities with similar equipment, the facilities were not designed for the safety requirements of processing high energy nitramine propellants; most of the facilities are shut down. None of the facilities with the ability to process the propellant have the ability to dry and grind the raw nitramine on-site. This is an important factor since this material cannot be transported in the ground state.

9. Indicate how and when the facility/equipment was transported and or constructed at the site.

Construction of the plant was started in 1959 and completed in 1962 to fully support the manufacture of base grain casting powder for the Polaris missile program. After successful completion of the Polaris program, the plant was chosen for development and production of base grain casting powder for the Poseidon missile program. The plant underwent a 14 million dollar modernization from 1981 to 1983 to support an urgent mobilization effort for the United Kingdom's Polaris missile fleet. This effort would not have been possible had not the NSWC/IHD plant been made available so quickly. In 1987, another plant modernization and modification effort sponsored by the US Army was

completed to support process acquisition of nitramine gun propellant technology. Transition to production of XM39 and M43 nitramine propellants were accomplished in the newly named Nitramine Gun Propellant Facility (NGPF). This plant is the sole producer of M43 and the largest nitramine propellant facility currently in production in the world. These modernization ventures has resulted in an up to date, warm manufacturing base capable of single, double and nitramine based propellant manufacture that can support gun and missile program requirements.

10. List the functional support areas (previously provided in Tab A) that this facility/equipment support. Refer to Appendix A for the list of functional support areas.

2.12 Weapons Propulsion

This facility supports the following NSWC Technical Capability:

Energetics Manufacturing/Manufacturing Technology

11. Provide the historical utilization average for the past five fiscal years (1989-1993). Define the unit of measure used.

1989 - LOVA propellant acquisition process and M43 product development - 20,000 pounds

1990 - Low Rate Initial Production (LRIP) M43 propellant for M900 program - 250,000 pounds

1991 - Surge production of M43 in direct support of Desert Storm conflict - 575,000 pounds

1992 - Standard production rates of M43 for M900 program - 400,000 pounds

1993 - Standard production rates of M43 for M900 program - 400,000 pounds

12. Provide the projected utilization data out to FY97.

1994 - Standard production rates of M43 for M900 program - 400,000 pounds

1995 - Acquisition process for advanced high energy nitramine propellant for use in 120mm gun system and civilian airbag dual use initiatives - 50,000

1996 - Low Rate Initial Production (LRIP) advanced high energy nitramine propellant and transfer of technology to private industrial base - 250,000 pounds

1997 - Product improvement program and warm base production support for advanced high energy nitramine propellant - 200,000 pounds

13. What is the approximate number of personnel used to operate the facility/equipment?

The plant requires a mixture of 65 operators and 7 engineering (technical) employees with highly specialized skills in order to support full spectrum propellant operations and a production rate of 50,000 pounds per month. As a sole producer of M43 gun propellant, the group represents the state of the art in nitramine propellant development and manufacturing knowledge.

The engineering staff provides for process improvement studies, engineering studies, engineering investigations, plant modernization, quality control, personnel certification/training and equipment operational requirements. The facility has an individual on-site who is regarded as a DoD expert in nitramine propellant processing. This individual has researched, characterized and documented the nitramine propellant process so extensively, he is constantly requested as a technical advisor throughout DoD. He has consistently participated in propellant investigations undertaken by the US Army.

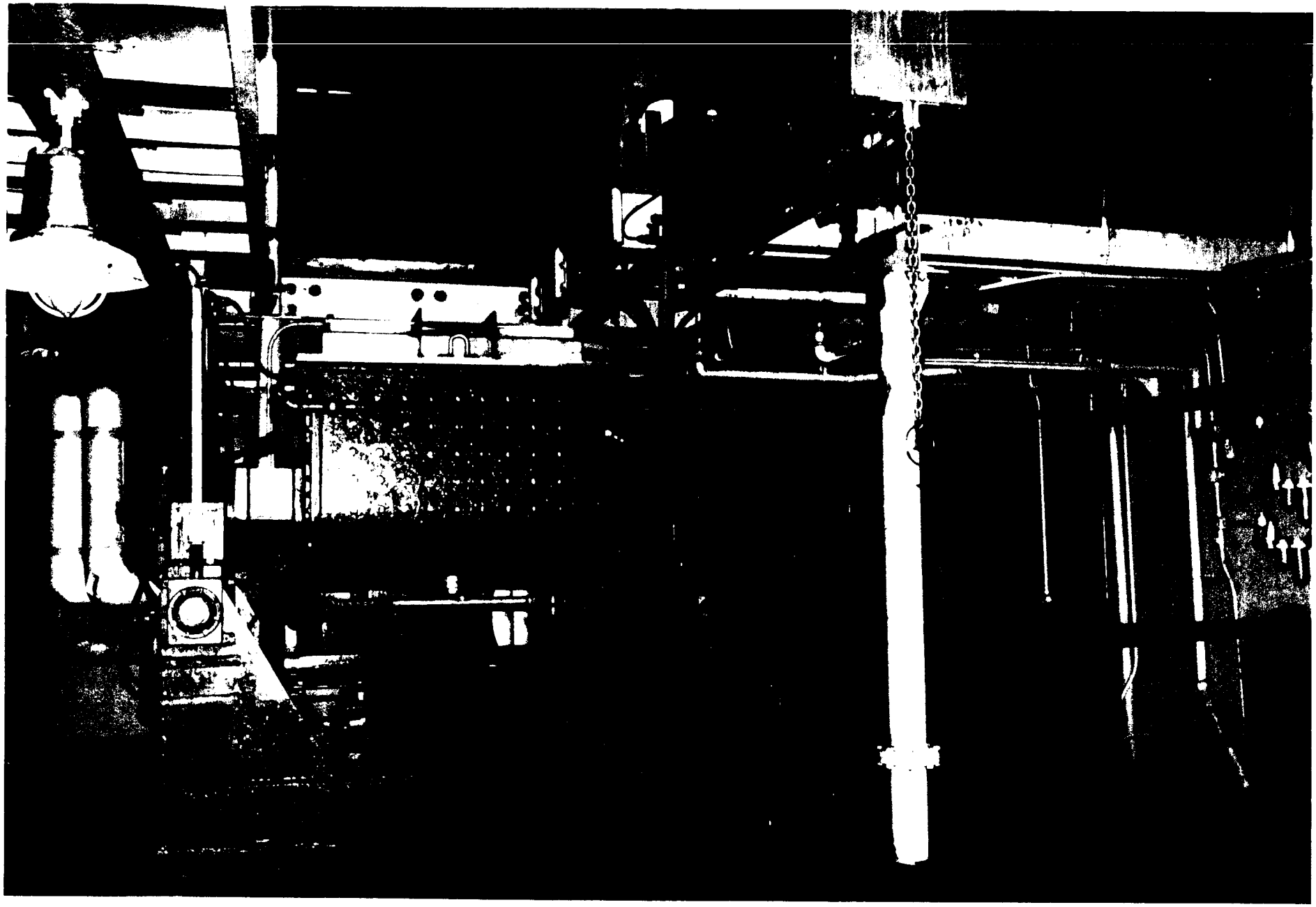
Operations personnel require a working knowledge of operational requirements for horizontal 150-gallon sigma blade mixers, various hydraulic propellant presses, fluid energy mills, and vacuum tumble drying equipment. Frequent cross training has developed a highly flexible and fast reacting workforce that can intimately operate the production areas with superior understanding and keen insight toward energetics manufacture.

14. What is the approximate number of personnel needed to maintain the equipment?

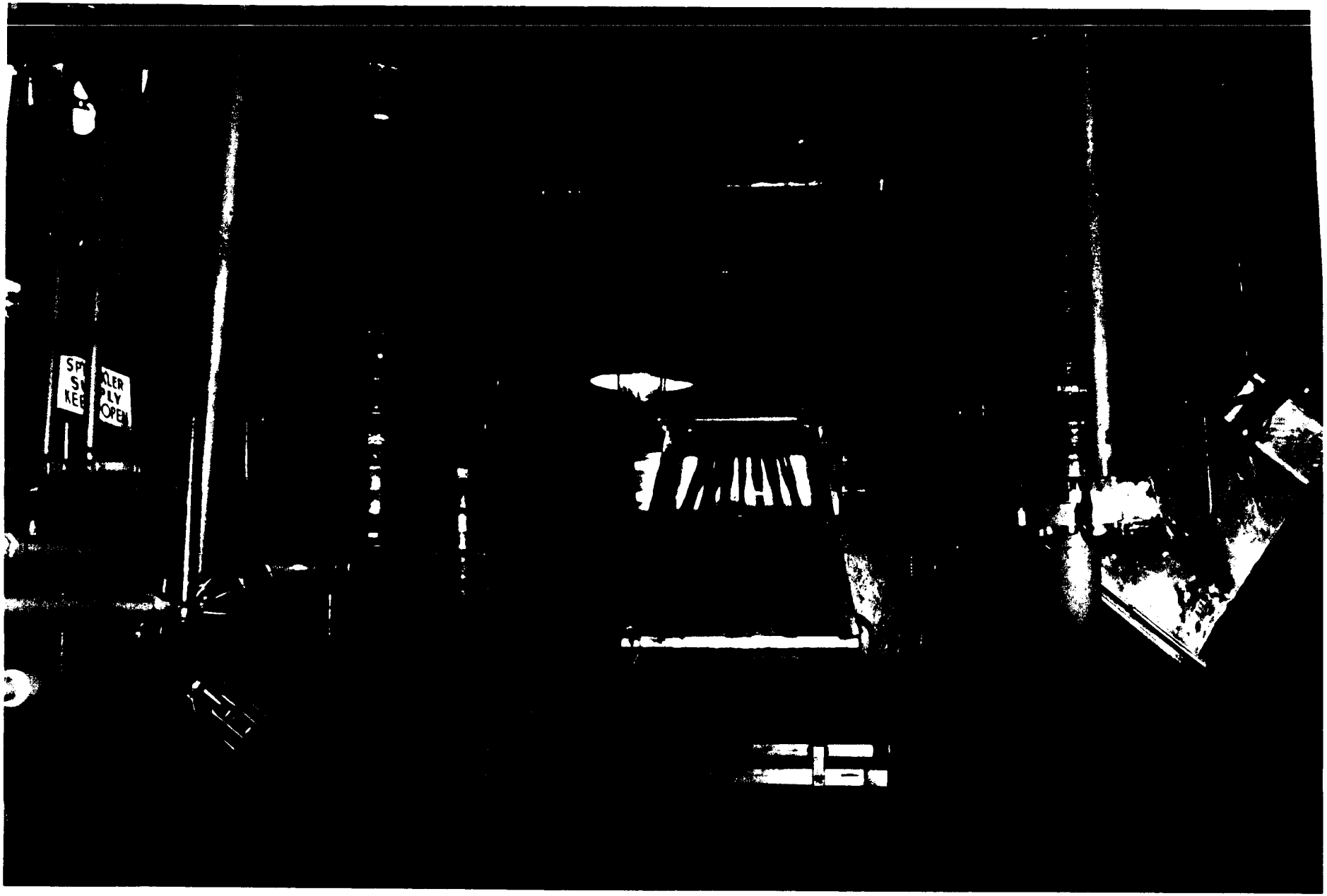
Six people are required to maintain the facility. Necessary skills include Equipment Mechanics, an Instrument Mechanic, a Pipe Fitter, and an Electrician. Highly specialized knowledge is required to maintain presses, control systems, and pneumatic control valves, including the design and trouble shooting of pneumatic control systems. Skills in maintaining mechanical, electrical, air, and fluid systems, as well as all piping in the facility are also required.

15. Provide one 8 1/2 x 11 black and white photo of the facility/equipment.

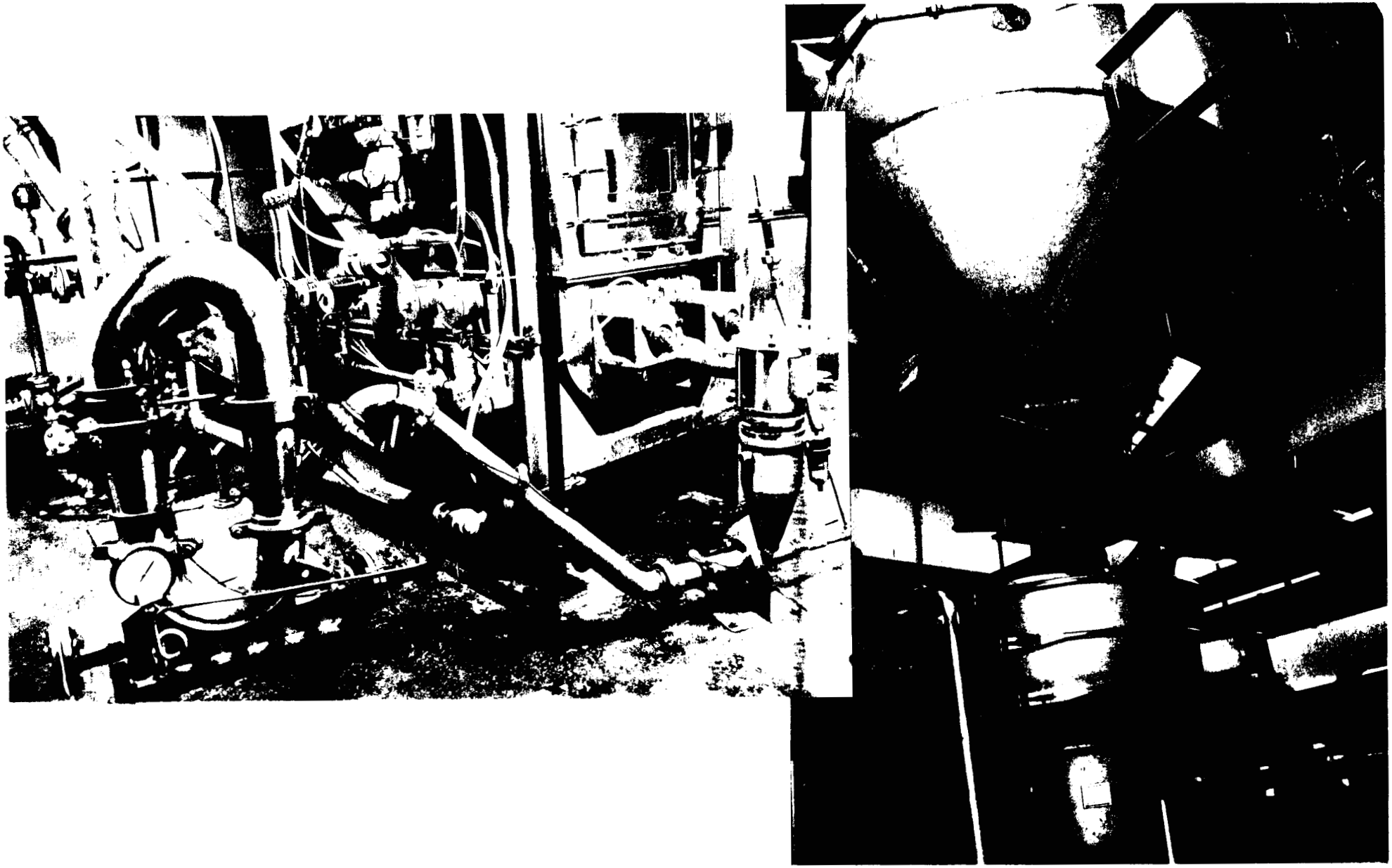
Originally designed to produce Polaris casting powder this facility has evolved over the years to produce Poseidon casting powder and is presently used in the production of the M43 gun propellant for the Army's M-1 tanks.



150 Gallon Horizontal Sigma Blade Mixers
(IHDIV owns two)



500 Ton Vertical Extrusion Press
(IHDIV owns two)



RDX Drying and Grinding Equipment

Ingersoll-Rand Centac Air Compressor

SPECIAL FACILITIES AND EQUIPMENT
FACILITIES/EQUIPMENT CAPABILITY FORM

Technical Center Site	Indian Head Division, NSWC
Facility/Equipment Nomenclature or Title	Chemicals Processing Facilities

1. State the primary purpose(s) of the facility/equipment.

The primary purposes of the Chemical Processing Facilities (CPF) are to produce and process energetic chemicals for the DOD for use in solid rocket motors, warheads, fuels, and other ordnance items. The chemical plants comprising the CPF, and their primary purposes, are as follows:

TABLE IS ON NEXT PAGE

a) Production: The table below summarizes the plants, products, and weapons programs supported by the four chemical plants:

Facility	Principal Products	Programs Supported	Notes
Biazzi Nitration Plant	Otto Fuel II	MK 46/MK48 Torpedoes	Sole Producer US/NATO
	Nitroglycerin	Trident Missile Vandal Target Booster	Only qualified producer
Moser Nitration Plant	TMETN (trimethyloethane trinitrate) TEGDN (trimethylene glycol dinitrate)	1211SLMM Underwater Mine Quickstrike Mine MK 46 Torpedo Warhead MK 14 Mobile Mine Destructor	Currently being considered for use in new gun propellants and low signature rocket motor propellants
	BTTN (butanetriol trinitrate) DEGDN (diethylene glycol dinitrate) NG (nitroglycerin) PGDN (propylene glycol dinitrate) EGDN (ethylene glycol dinitrate)	No programs for Moser Plant production of these products are currently supported, but have previously existed and have been produced in this plant	Moser Plant is a multi-product nitration plant with three separate production modes, to meet specific production requirements for each of these nitrate esters
PNC Plant	Pelletized Nitrocellulose	SLMM Underwater Mine Quickstrike Mine MK 46 Torpedo Warhead MK 14 Mobile Mine Destructor	Sole producer of PNC for US/NATO; currently being considered for use in new gun propellants and low signature rocket motor propellants
HBNQ Plant	High Bulk Nitroguanidine	Standard Missile (surface-to-air) Hawk Missile (surface-to-air)	Sole producer of HBNQ for U.S.

b) Qualification and Process Development:

For all of the above programs and any future energetic chemical requirements, these facilities will serve as the location for the development and scale-up of the manufacturing process, leading to full-scale production capable of meeting program requirements. This work complements the capability of our chemistry laboratories and pilot plant, providing the next step in the transition of new chemicals from the lab to service use.

The most recent example of this was the development of the solventless nitroglycerin lacquer for the Trident missile program. This unique formulation eliminated the use of an organic VOC solvent, in this case methylene chloride (a carcinogen and ozone depleter) while providing a stable high-strength formulation of nitroglycerin capable of meeting DOT sensitivity tests for shipment across the US. **Within two years from the time the initial inquiry was made by the customer, the formulation was developed in the laboratory, a process developed and scaled-up, and a facility constructed and operated, producing quality lacquer on the first attempt.**

No other facility, government or private, provides this wide range of services at one location.

c) Energetic Chemical Acquisition and Technical Support:

The CPF has the capability, as demonstrated numerous times in the past, to provide the technical guidance and support for the purchase and qualification of energetic and specialty chemicals. This provides the government with a "smart-buyer" capability in chemicals by not only knowing and understanding these processes, thereby preventing artificially-inflated contractor prices, but also the capability to produce these chemicals should the contractor fail to produce quality chemicals at a competitive cost.

Two recent examples of this include the qualification of Atlas, a private-industry source, for the production of Otto Fuel II, and the qualification and subsequent purchases of TMETN and TEGDN from Trojan, another private-industry source, for production of SLMM and QuickStrike mines. The CPF personnel did this effectively due to their knowledge and experience in producing these materials for over 40 years.

d) Technical Assistance/Guidance to Government/Industry:

The CPF provides government and industry with a source of analytical expertise, extensive chemical synthesis, scale-up, and production experience, and chemical processing knowledge. Chemists and engineers draw on this experience when considering safety aspects of chemicals to safely design and evaluate production processes. Analytical

procedures have been developed by IHDIV which are now used throughout DoD, private industry, EPA, and international laboratories. Experience in the synthesis and scale-up of many new chemicals have resulted in full-scale process designs of superior safety and operational support for many weapons programs.

e) Mobilization/Surge Capacity:

The CPF at IHDIV has time-and-again demonstrated its capability to adjust to everchanging production demands cost-effectively, even while simultaneously upgrading its facilities to meet stringent environmental regulations. And, as has been demonstrated consecutively for years in the past, the CPF has, during periods of increasing requirements, produced all of these chemicals concurrently by operating the plants on three shifts, meeting all production requirements.

Storage capacity for Otto Fuel II, the fuel for MK 46 and NM 48 torpedoes, has been expanded to a surge capacity of over 400,000 lbs, providing a capacity far greater than that available at any other facility.

f) In-Service Engineering Agent Support:

The on-site CPF provides close interaction with the In-Service Engineering Agent (ISEA) Office, allowing quick response to fleet requests and investigations. Production and quality records are readily available on-site for these requests resulting in rapid response time during these requests and investigations. The on-site CPF provides the ISEA, and thereby the fleet, with technical product knowledge and resources needed to respond to the frequent inquiries.

2. Indicate whether the facility/equipment is portable, moveable or fixed as defined by paragraph 6, page 12 of this data call.

The Chemicals Production Facilities are considered a "fixed assets." In many cases, buildings have been constructed around processing vessels, tanks, and other equipment, making the equipment itself a fixed asset (barring demolition of the buildings specifically to remove the equipment). Much of the equipment and processes are built into the facility/building, making them nearly impossible to relocate.

The buildings themselves are fixed assets as well, as they could not be relocated; new construction would be required. Special construction requirements, including concrete and earthen barricades, extensive lightning protection coupled with elaborate grounding systems, landscape elevation changes to allow for gravity flow between specific explosive processes, and necessary acreage to maintain the required building separation distances for explosive

safety. These chemical production facilities consist of approximately 105 separate but integrally-related buildings.

3. Provide the replacement value of the facility/equipment. Report the facility/equipment cost separate from any building and utilities that may be integral to the facility/equipment.

Facility	Equipment Replacement Cost	Building/Utility Replacement Cost
Biazzi Nitration Plant	$12,000,000	$35,000,000
Moser Nitration Plant	$8,000,000	$20,000,000
PNC Plant	$4,250,000	$6,000,000
HBNQ Plant	$750,000	$4,000,000

4. Provide the gross weight and cube of the facility/equipment.

N/A

5. Indicate any "special" utility support required by this facility/equipment other than normal electrical power.

Electrical: 480 VAC, II 0 VAC, 24 VDC
Compressed Air: 90 psi
Dry Compressed Air (for pneumatic instrumentation): 90 psi
Steam (for safety and efficiency in process heating): 125 psi
Refrigeration Systems: 3 each @ 100 tons cooling capacity
Well Water (filtered to maintain product quality)
Deionized Water (for weapons systems affected by ions and micro-contaminants)
River Water (non-contact process cooling for large volume low temperature difference)

6. Indicate any special budget requirements for the facility/equipment (i.e., special foundations, non-ferrous materials, shielding, hardening, etc.).

Wastewater treatment facilities to treat nitrate ester contaminated wastewater
Wastewater treatment facility to treat salt-laden wastewaters from production processes
Concrete and earthen barricaded buildings
Earth-covered explosive magazines
Conductive floors required in all explosives processing buildings new line Extensive

lightning protection systems coupled with stringent primary, secondary, and ordnance-grounding systems
Explosion-proof fixtures and/or intrinsically-safe electrical utilities required for all explosive processing buildings and explosive or flammable atmospheres
Elevation changes in landscape between buildings to allow for gravity flow
Vast acreage available to meet explosive safety distance requirements (Quantity-Distance)
Large chemical storage tank farms with spill containment and treatment capabilities
Exotic, corrosion-resistant alloys and other special materials of construction
Pharmaceutical/food-grade construction specifications for processing vessels and piping

7. State any environmental control requirements for the facility/equipment (i.e., temperature, humidity, air scrubbing).

These chemical facilities process large amounts of hazardous materials including explosive liquids and solids, powdered high explosives, strong acids/bases, and volatile organic compounds (VOC's). This requires specialized and storage and treatment facilities for all phases of environmental control: water, air, and solids.

We have demonstrated a proven good-performance record with the surrounding community and with the State of Maryland Department of the Environment by practicing a proactive strategy in solving environmental deficiencies. Environmental construction for the chemical production plants has exceeded $20 million over the past four years.

8. Indicate if this facility/equipment would be extremely difficult or impossible to replicate or relocate at another site and the impact to the Department of the Navy if this facility/equipment were lost. Consider existing Government-wide and commercial capabilities as the replication and impact statements are formulated.

The CPF is fixed and therefore would be extremely difficult to relocate for the following reasons:

a) These chemical facilities consist of approximately 105 buildings.

b) Equipment removal requires dismantling and demolition of buildings since, in many cases, buildings were constructed around the equipment. This process may result in damaging critical and unique process equipment.

c) Much of the equipment is large, bulky, and heavy, such as the large numbers of chemical storage tanks, many on the order of 10,000 - 15,000 gallons.

d) The infrastructure (utilities, barricades, topography) required to house and support these facilities is detailed and costly.

e) Real-estate requirements to separate the buildings to conform with explosive safety (quantity-distance relationship) requirements is large.

f) Environmental permitting and community support for wastewater discharge/treatment, air emissions, and solid waste treatment would be difficult to obtain.

The impact to the Department of Defense if these facilities were lost are:

a) The Biazzi Nitration Facility is currently the only producer of Otto Fuel II for the US and all NATO countries and the only qualified source of Nitroglycerin for the Trident program. It is questionable whether the private industry sources, (Atlas, Trojan, ICI, Hi-Tech) would be able to meet the production and quality demands as IHDIV has in the past. Contracts have been awarded to competitors but scheduling and quality problems were periodically encountered, which eventually required CPF engineering involvement to eliminate.

The PNC Facility and the HBNQ Facility are currently the only producers of their products for the US and NATO countries (PNC) and for the US (HBNQ), respectively.

c) Loss of the only GOGO nitration facility within the DOD. Due to the specialized nature of these facilities, there are very few sources for many of the products. The few sources within private industry can become the sole source for a major product because they have the only source for an ingredient. This can result in higher acquisition costs for DoD. Losing this capability would eliminate a "smart-buyer" capability for energetic chemicals within the DOD. These GOGO facilities enable the DOD to keep private-industry chemical costs from artificial inflation by maintaining engineering expertise to provide realistic cost estimates for production of various chemicals and by providing an alternate source of production, should private industry fail to meet quality and production demands at fair market prices.

d) Not only would loss of the CPF at IHDIV result in the loss of the aforementioned equipment, buildings, and facilities, but also the technical expertise which NSWCIH has been successful in maintaining in the past and present. This technical expertise has a solid history of performing on-time, quality production and delivery of its products to all its customers at stated costs, as well as maintaining the

technical knowledge, engineering agent support, and smart-buyer service capabilities on which the DoD has continually relied.

e) The most environmentally-compliant energetic chemicals producer in the US. Stringent State of Maryland environmental regulations, along with a proactive attitude by NSWCIH has resulted in nitration facilities ahead of all others in the US in terms of environmental compliance.

9. Indicate how and when the facility/equipment was transported and or constructed at the site.

The following table summarizes major repairs and upgrades to the CPF plants since their original construction.

Biazzi Nitration Plant	1951 - 1994
Moser Nitration Plant	1970 - 1991
NPC Plant	1953 - 1991
HBNQ Plant	1958 - 1990

10. List the functional support areas (previously provided in Tab A) that this facility/equipment support. Refer to Appendix A for the list of functional support areas.

2.5 Mines
2.7 Explosives
2.12 Weapons Propulsion
2.13 Other Ordnance
9.1 Navy Strategic Systems

This facility supports the following NSWC Technical Capability:

Energetics Manufacturing/Manufacturing Technology

11. Provide the historical utilization average for the past five fiscal years (1989-1993). Define the unit of measure used.

The annual CPF production rates for the last five years are as follows:

1989

Nitrate esters - 1,285,000 pounds
PNC - 96,130 pounds
HBNQ - 60,000 pounds

1990
Nitrate esters - 1,140,700 pounds
PNC - 75,800 pounds
HBNQ - 60,000 pounds

1991
Nitrate esters - 1,370,000 pounds
PNC - 63,000 pounds
HBNQ - 60,000 pounds

1992
Nitrate esters - 596,000 pounds
PNC - 70,000 pounds
HBNQ - 60,000 pounds

1993
Nitrate esters - 295,000 pounds
PNC - 5,000 pounds
HBNQ - 60,000 pounds

12. Provide the projected utilization data out to FY1997.

The projected workload for this facility is:

1994
Nitrate esters - 450,000 pounds
HBNQ - 60,000 pounds

1995
Nitrate esters - 400,000 pounds
HBNQ - 120,000 pounds

1996
Nitrate esters - 400,000 pounds

NOTE: If the signature propellant development efforts for missile propulsion application prove to be successful, production of PNC could continue at significant levels beginning in 1996.

13. What is the approximate number of personnel used to operate the facility/equipment?

The plant requires a mix of 25 employees with highly specialized skills including engineers, operators, and general support personnel to manufacture at economic production levels.

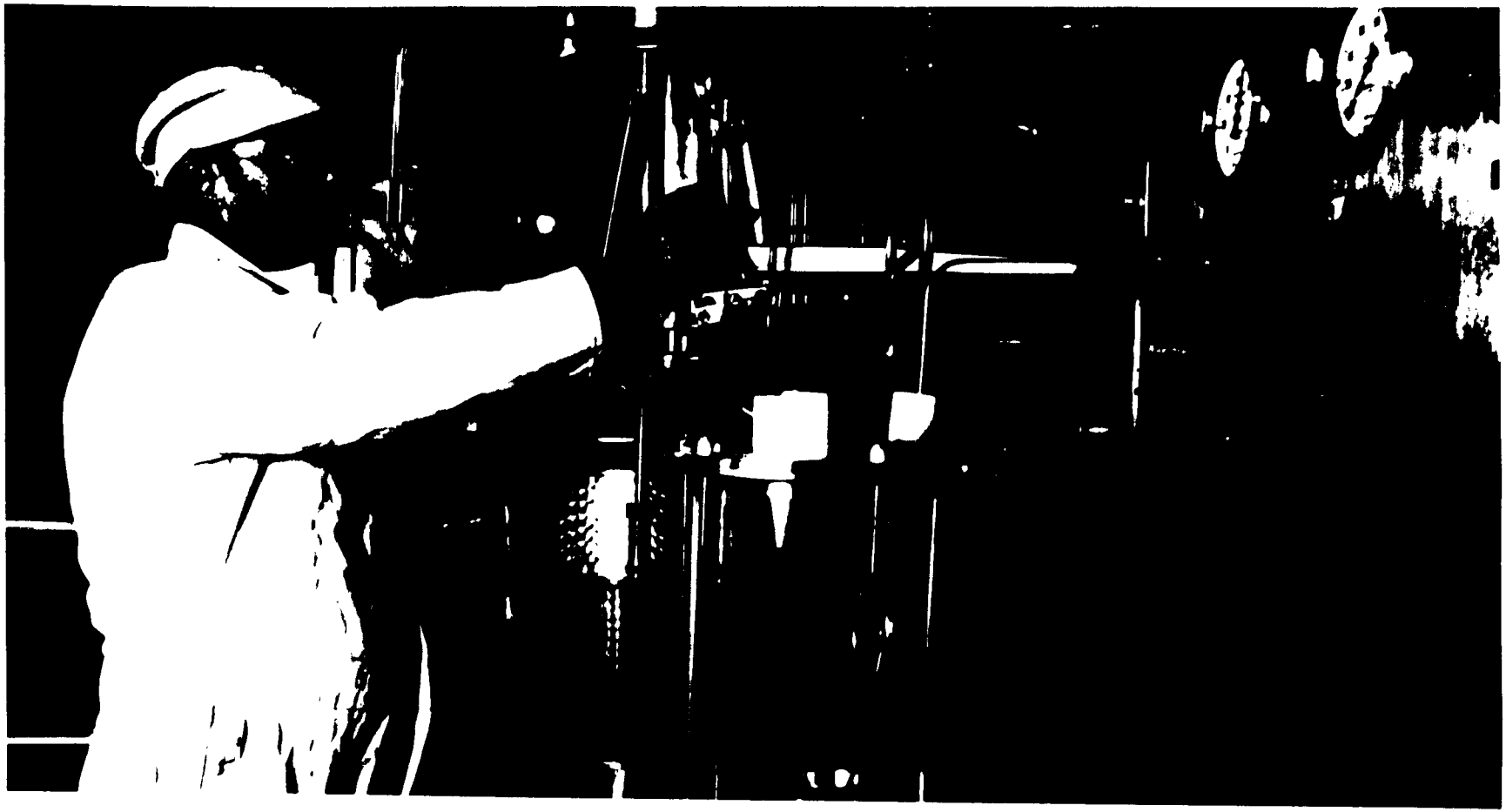
Engineers must have knowledge of theoretical concepts of nitration, pneumatic controls and interlocks used for manufacturing, handling and transfer of nitrate esters. Nitration technologists are integral members of the team during the scale-up phase. They provide technology support on physical properties, advising on the feasibility of concepts. They also advise on specialized processes for handling, separation, purification, and transfer of nitrate esters.

Operators must understand the operational techniques of the equipment located in the facility. They must be familiar with the properties of the materials and the basic chemical reactions involved for safe manufacture, handling and formulation of our nitrate ester products.

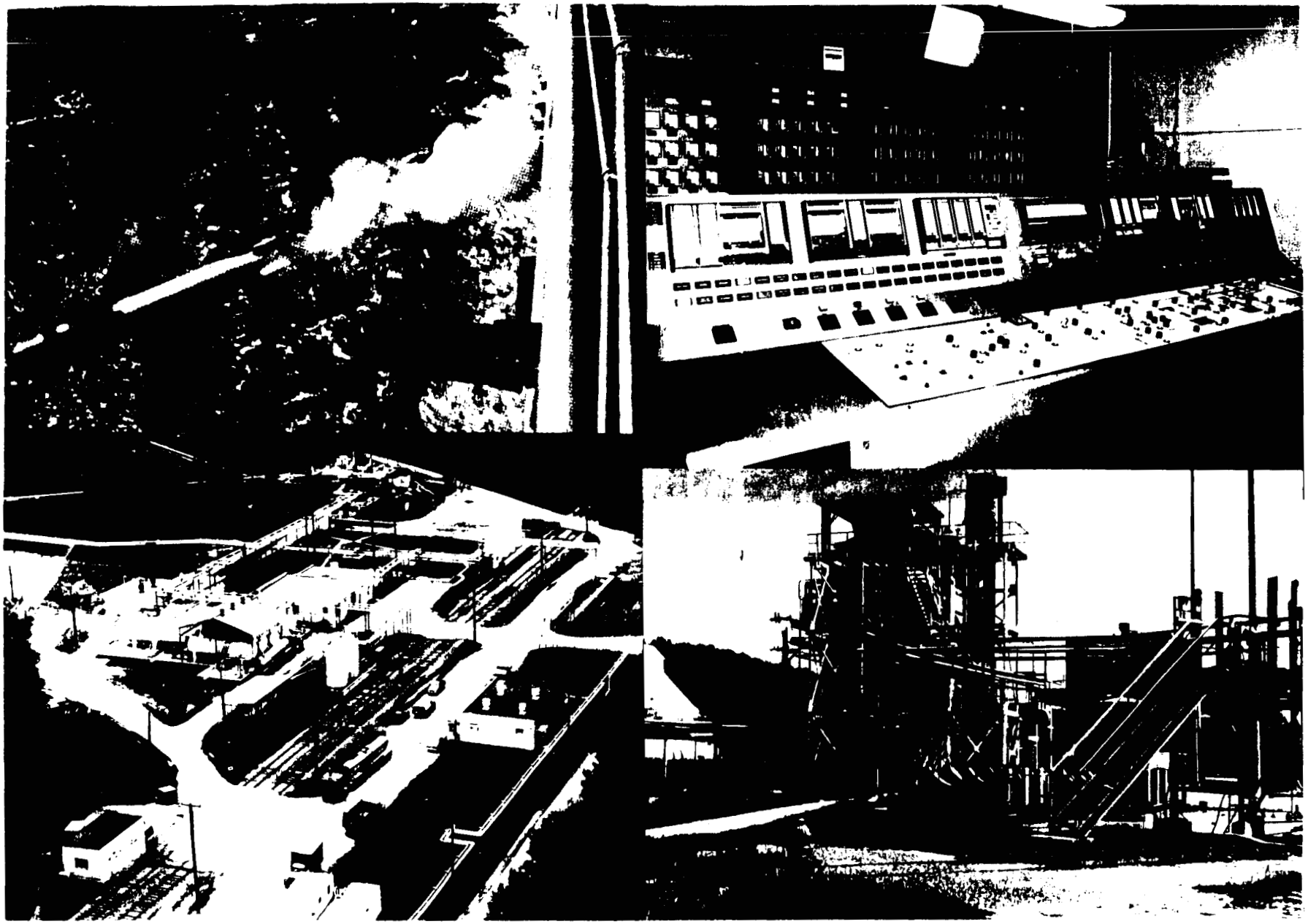
14. What is the approximate number of personnel needed to maintain the equipment?

Three full time Instrument Mechanics and Machinists are required to maintain the facility. Highly specialized knowledge is required to maintain control and interlock systems, and for troubleshooting and maintenance of pneumatic control systems. Specific skills are also required to maintain the many pumps, agitators, and compressors in this facility.

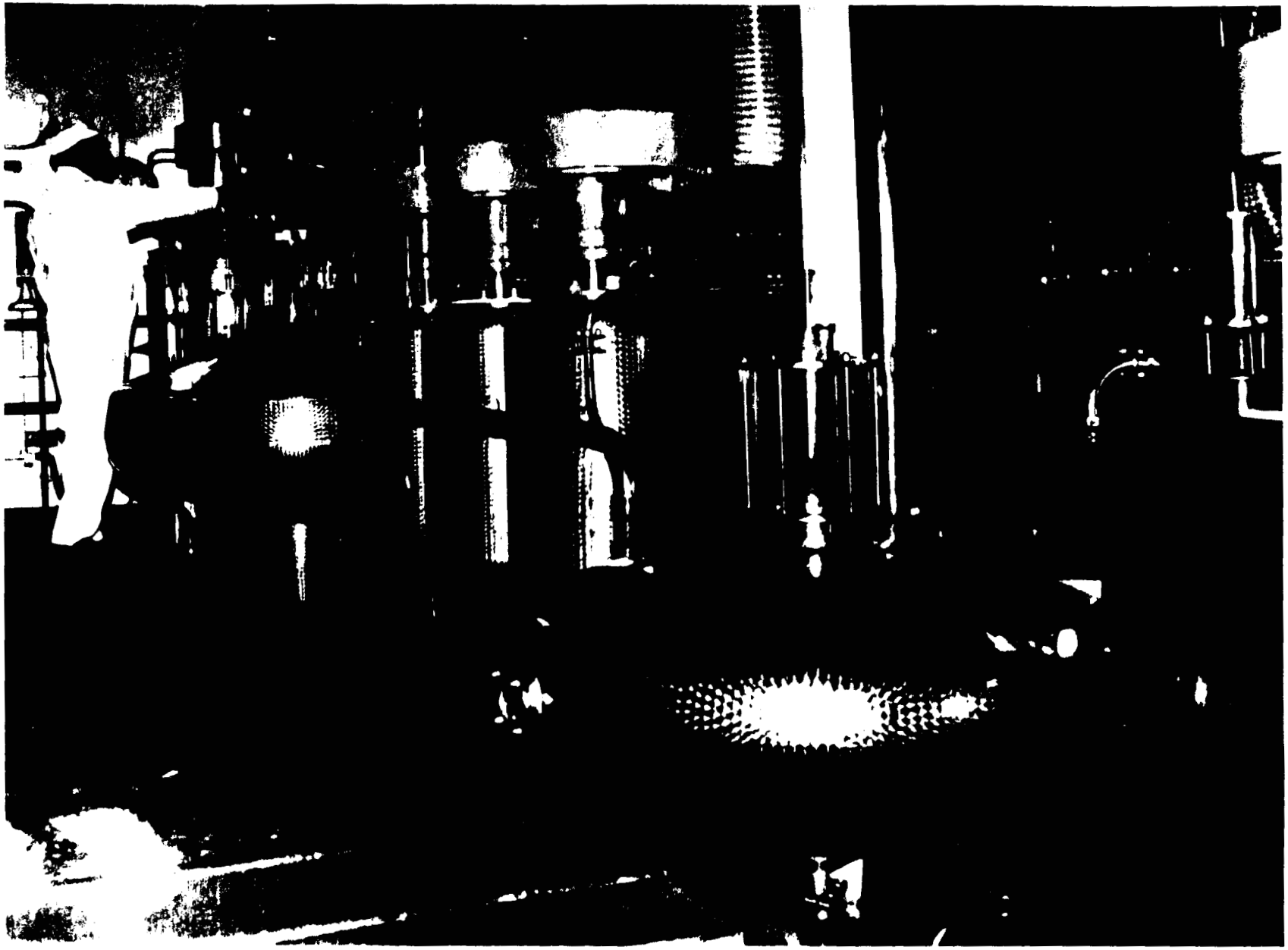
15. Provide one 8 1/2 x 11 black and white photo of the facility/equipment.



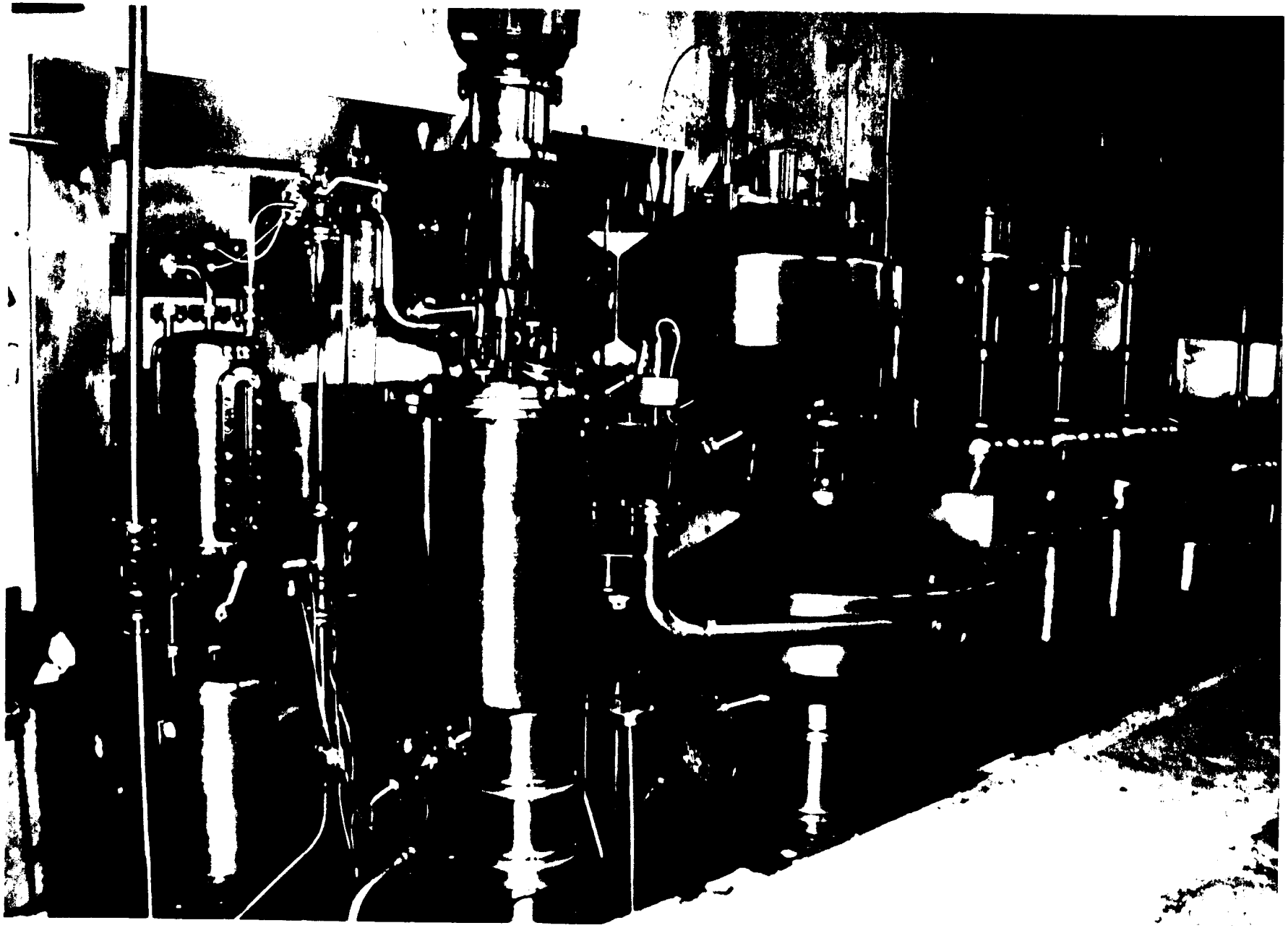
Nitroglycerin, which is manufactured in this plant, is used in the Vandal, and Trident lacquer program. Indian Head also manufactures and is the sole producer of OTTO Fuel which is used to propel Navy torpedoes.



The three chemical facilities highlighted here produce critical chemicals that are used in torpedoes and in making Navy PBX warheads. The torpedo shown here is a recipient of OTTO Fuel made in the Biazzi plant. The warheads use chemical ingredients from the Moser and PNC plants.



Biazzi Nitration Processing Equipment



Moser Nitration Processing Equipment

SPECIAL FACILITIES AND EQUIPMENT
FACILITIES/EQUIPMENT CAPABILITY FORM

Technical Center Site	Indian Head Division, NSWC
Facility/Equipment Nomenclature or Title	Ordnance Device Development and Prototyping

1. State the primary purpose(s) of the facility/equipment.

IHDIV holds the tri-service charter for support of CADs/PADs/AEPS; this includes RDT&E, engineering, acquisition, manufacturing, and fleet support. There are hundreds of devices in this category: man-rated percussion primers, impulse and delay cartridges, rocket catapults, and underseat rocket motors. They perform vital functions such as stores ejection, flare and chaff deployment, and sequencing and propulsion functions in aircrew escape and weapon systems. As a result, the critical nature of the relationship among engineering, manufacture and test cannot be understated. This facility provides the only DoD in-house capability to manufacture, load, assemble, disassemble, and rework cartridges, ballistic power systems, Cartridge Actuated Devices (CADs), Propellant Actuated Devices (PADs), Aircrew Escape Propulsion Systems (AEPS), and pyrotechnics such as delay and ignition compositions for all services and Foreign Military Sales. IHDIV provides research, development, design, engineering, and prototype capabilities that enable the development and transition of emerging technologies such as advanced laser initiation systems for CADs/PADs to operational evaluation and service use. Integrated manufacturing facilities provide pilot and low rate CAD/PAD/AEPS production with the ability to meet rapid response and mobilization requirements. Complementing these capabilities are specialized nondestructive and destructive test facilities. This full spectrum support is rounded out by a comprehensive fleet support capability providing integrated logistics support, maintenance engineering, and training of fleet personnel. **To retain the required organic expertise, we perform approximately 10% in-house production.** This allows us to:

- Qualify private contractors as producers of man-rated items and provide solutions to private industry manufacturing problems.
- Ensure a smooth transition from development to production,
- Develop methods to increase environmental compliance, safety, productivity and quality.

- Be the manufacturer of last resort when private industry won't or can't produce items (as was the case when Remmington Arms Corp. refused to build special primers due to product liability) and serve as a mobilization base.

- Provide the technical warranty for ensuring the maintenance and modification of deployed units regardless of manufacturer.

- Provide a rapid response to In-Service Engineering/Fleet problems by disassembling and building special test units.

- Support everchanging R&D efforts in a quick, cost effective manner.

- Be the sole source for several primers used by both DoD and private industry.

Equipment integral to this facility with a replacement value ≥ $500,000:

a. Propellant Actuated Devices (PAD) Reclamation Equipment: The primary purpose of this equipment is to clean motor tubes recovered from overage PADS. Cast propellant is washed out of these tubes using high pressure water. The recovered tubes can then be reused. This is a fixed asset with a replacement value of $650,000. This includes two 200 HP pumps, demil tank, lance system, settling tank, and computer control system.

The gross weight of the equipment is approximately 20,000 pounds. The equipment is approximately 810 cubic feet.

It would be difficult to relocate this facility at another site. The equipment cannot be removed without damaging the facility. Loss of this facility would increase the time required to rework PADs which may result in grounding of Navy, Air Force, and various FMS aircraft. Loss of this facility would also increase the cost to rework PAD items as well as add to the amount of waste for disposal.

b. Cartridge Actuated Device (CAD) Automated Thread Chaser: The primary purpose of the Automated Thread Chaser is to chase and gauge threads that have been secured by setscrews on hardware recovered during the disassembly of overaged CADS. The recovered parts can then be reused after plating. This is a fixed asset with a replacement value of $550,000. This piece of equipment is approximately 1,500 cubic feet. The gross weight of this piece of equipment is approximately 3,000 pounds.

It may be difficult to replicate this equipment at another site. There are some unique gauging stations which are considered proprietary to the contractor who supplied this equipment. If this equipment was lost it would force the use of a manually operated

chasing machine and manual inspection of threads. The result would be an increased cost to the government to rework CADS.

c. Iowa Loader: The primary purpose of the Iowa Loader is for the automatic manufacturing of PVU-series primers which are man-rated primers and are used in the production of aircrew-escape systems of tri-service aircraft. The Iowa loader is moveable; however, it has to be placed in an environmentally controlled facility. The primer mix must be stored in close vicinity to the Iowa Loader because of time limits on storage of the primer mix between mixing and loading into the primers. The replacement cost of the equipment is $833,000.

The gross weight of the Iowa Loader is 9,300 pounds and the cubic displacement of the facility (addition to Building 286) is 10,080 cubic feet.

Building 286 addition for Iowa Loader is not impossible to replicate at another site; however, the quality and manufacturing experience would be difficult, if not impossible, to replicate. If the capability of manufacturing man-rated primers was lost, it would greatly affect the readiness of fighter aircraft that use primers in their aircrew escape systems.

d. Laser Welder: The primary purpose of the Laser Welder is to hermetically seal man-rated cartridges used in aircrew-escape systems. The laser welder is moveable; however the laser must be disassembled and removed piecemeal and the size and location of the laser welder make orderly removal very difficult. The replacement cost of the laser welder/tooling is approximately $550,000. The gross weight of the laser welder is approximately 10,000 lbs; the cubic displacement of the bays that house the laser welder is approximately 4,500 cubic feet.

2. Indicate whether the facility/equipment is portable, moveable or fixed as defined by paragraph 6, page 12 of this data call.

Facilities are fixed.

3. Provide the replacement value of the facility/equipment. Report the facility/equipment cost separate from any building and utilities that may be integral to the facility/equipment.

Estimated replacement cost of the facility is $17.6M.

4. Provide the gross weight and cube of the facility/equipment.

N/A

5. Indicate any "special" utility support required by this facility/equipment other than normal electrical power.

90 psi compressed air, 220 & 440 volt, fresh water, Explosive Deluge Sprinkler System.

6. Indicate any special budget requirements for the facility/equipment (i.e., special foundations, non-ferrous materials, shielding, hardening, etc.).

Conductive floors, static grounding system, lightning protection system, blast viewports/shields, explosive blast walls.

7. State any environmental control requirements for the facility/equipment (i.e., temperature, humidity, air scrubbing).

Temperature and Humidity Control, exhaust ventilation (some with scrubbers), containment systems for wastewater. The temperature and humidity limits for those buildings where primary explosives are handled are very strict (nominally 50% humidity); special HVAC systems are required for these buildings.

8. Indicate if this facility/equipment would be extremely difficult or impossible to replicate or relocate at another site and the impact to the Department of the Navy if this facility/equipment were lost. Consider existing Government-wide and commercial capabilities as the replication and impact statements are formulated.

a. This facility is fixed and therefore would be difficult to relocate for the following reasons:

- Cost to construct large number of buildings with specialized operating requirements would be prohibitive
- Some of the equipment is large, heavy and complex, and would require dismantled to be moved
- Rebuilding infrastructure to house and support this type of capability would be very costly

b. Loss to Navy and DoD:

Our acquisition management role and full spectrum capability has allowed Indian Head to act as a "smart buyer" for our customers. Hands-on engineering and production experience has enabled us to correct design and production deficiencies to ensure the

delivery of reliable and cost effective products. When the government loses a supplier or when additional sources are required but not immediately available, the government must qualify a new supplier. To ensure the qualification of a competent and cost effective source, the government must provide an experienced team of engineers, technicians, and quality specialists to work directly with the prospective contractor. Because of reduced profits, increased environmental regulation, and the risks associated with product liability, Indian Head is the sole source producer of several critical components and is second source for many other CADs, PADs and AEPS. When DoD's primary producer of man-rated percussion primers chose to cease production because of product liability issues, Indian Head developed the capability to produce these items and remains a sole source producer for many of them today. We are also sole source for propellant curing and bonding agents used in PAD production which are not available from industry.

Indian Head's rapid delivery of stores ejection and countermeasure cartridges to meet Desert Storm requirements is a prime example of our ability to meet rapid response and surge requirements. Our fleet support function enables us to interact directly with the fleet users of our products. The expertise gained through this day-to-day interaction is applied in the introduction of new technologies and products and ensuring the safety, reliability, and maintainability of products already in service. **Because Indian Head establishes and validates safety and technical requirements through the development of design and product specifications,** we are often called upon to provide assistance to industry. Losing the facility would severely impair the DoD's resident expertise in performing private contractor assists and malfunction investigations. Without the hands-on experience, the ability to identify pitfalls in processing techniques, evaluate and assess contractor facilities and processes, and perform malfunction investigations on fleet failures would be lost.

c. Other government: Indian Head also provides support to many other countries through Foreign Military Sales. Many of the items produced at Indian Head are low rate of production items used in Foreign Aircraft which are no longer in U.S. service. The quantities produced and difficulties experienced with these items does not interest Private Industry. These aircraft would be unsupportable if it were not for Indian Head. Nonsupport would sour relationships and affect some treaty agreements (our allies could not maintain their flights).

9. Indicate how and when the facility/equipment was transported and or constructed at the site.

Facilities were originally constructed between 1910 and 1953. Most buildings have been renovated in the 1960's or 1970's, and all have state-of-the-art equipment.

10. List the functional support areas (previously provided in Tab A) that this facility/equipment support. Refer to Appendix A for the list of functional support areas.

2.12 Weapons Propulsion
2.13 Other Ordnance

This facility supports the following NSWC Technical Capability:

Cartridge/Propellant Actuated Devices/Aircrew Escape Propulsion Systems

11. Provide the historical utilization average for the past five fiscal years (1989-1993). Define the unit of measure used. To retain the required organic expertise, we perform approximately 10% in-house production.

1989 - 48 different items totalling 95,494 units
1990 - 56 different items totalling 168,129 units
1991 - 78 different items totaling 127,373 units
1992 - 107 different items totaling 126,593 units
1993 - approximately 126,000 units

NOTE: The above numbers include only normal scheduled production programs. Unscheduled programs in support of special jobs are not included. The following is a list of these special programs for the past year.

-Loaded 20 different development items
-Performed disassembly/inspection for Level Of Rework Analysis (LORA) on 2 items
-Screened 7 different contractor items for problems
-Downloaded 8 different contractor items for engineering investigations
-Loaded 2 different items for test prior to contractor delivery
-Repaired 3 different contractor items
-Loaded 3 different items for engineering investigations
-Produced 6 different inert items for training
-Loaded 9 different items for qualification
-Loaded 1 item for private industry development/testing

12. Provide the projected utilization data out to FY1997.

1994 - 1997 = approximately 280,000 units per year (includes estimates of 200,000 primers per year).

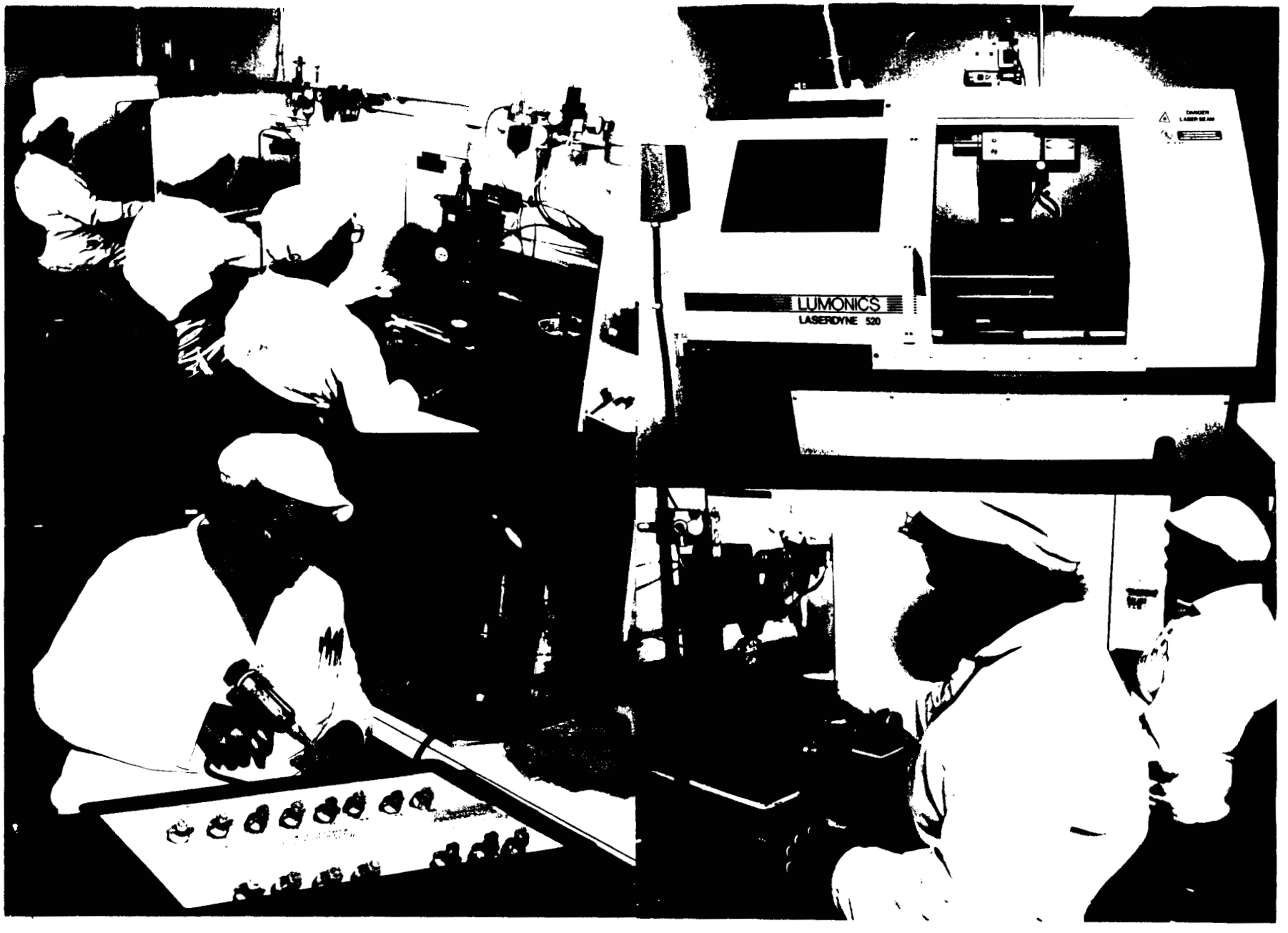
13. What is the approximate number of personnel used to operate the facility/equipment?

The prototype and production facilities are operated by approximately 45 operators (one shift). The skills mix necessary to carry out this function is composed of engineers, technicians, production and test specialists, and support personnel. The R&D engineering and in fleet support, functions are performed by 150 engineers, technicians, and logistical specialists. Extensive experience and advanced training are required in explosives and industrial safety, environmental effects, combustion of materials, manufacturing processes, thermodynamics, explosives tool design, computer simulation, flight modeling, and diagnostic evaluation of explosive items. The level of expertise required is developed and maintained through hands-on experience; there are no academic programs which graduate engineers or scientists with majors in this area. Our integrated engineering, manufacturing, and test capabilities allow the extensive on-the-job training necessary to develop these skills. Because of the complexity of the work, it takes a minimum of 5 years to develop engineers and specialists to the full performance level. Many are recognized experts in CAD/PAD design and evaluation, propellant formulation, manufacturing processes, and destructive/nondestructive test.

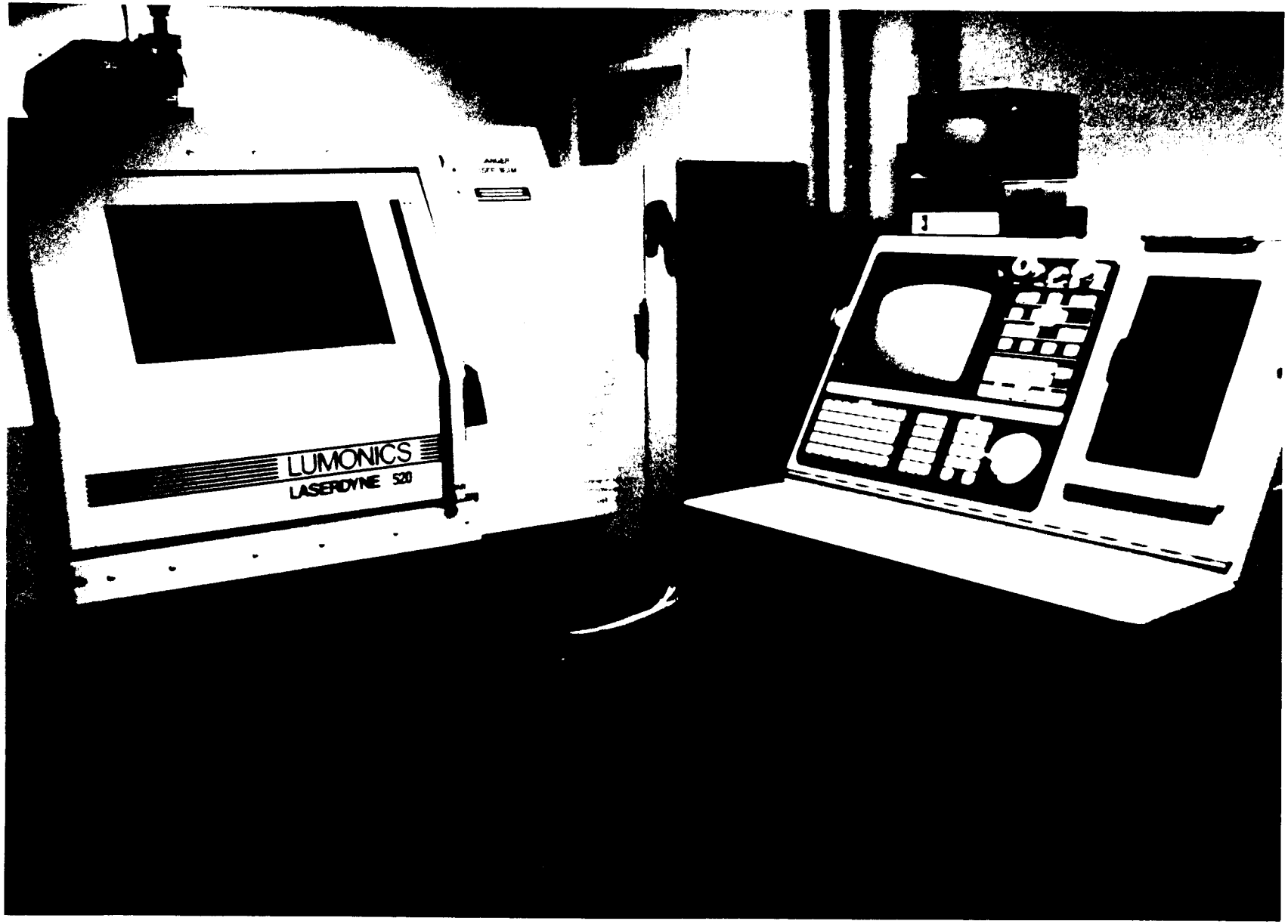
14. What is the approximate number of personnel needed to maintain the equipment?

The facility requires services from an electrician, pipe fitter, and a production machinery mechanic.

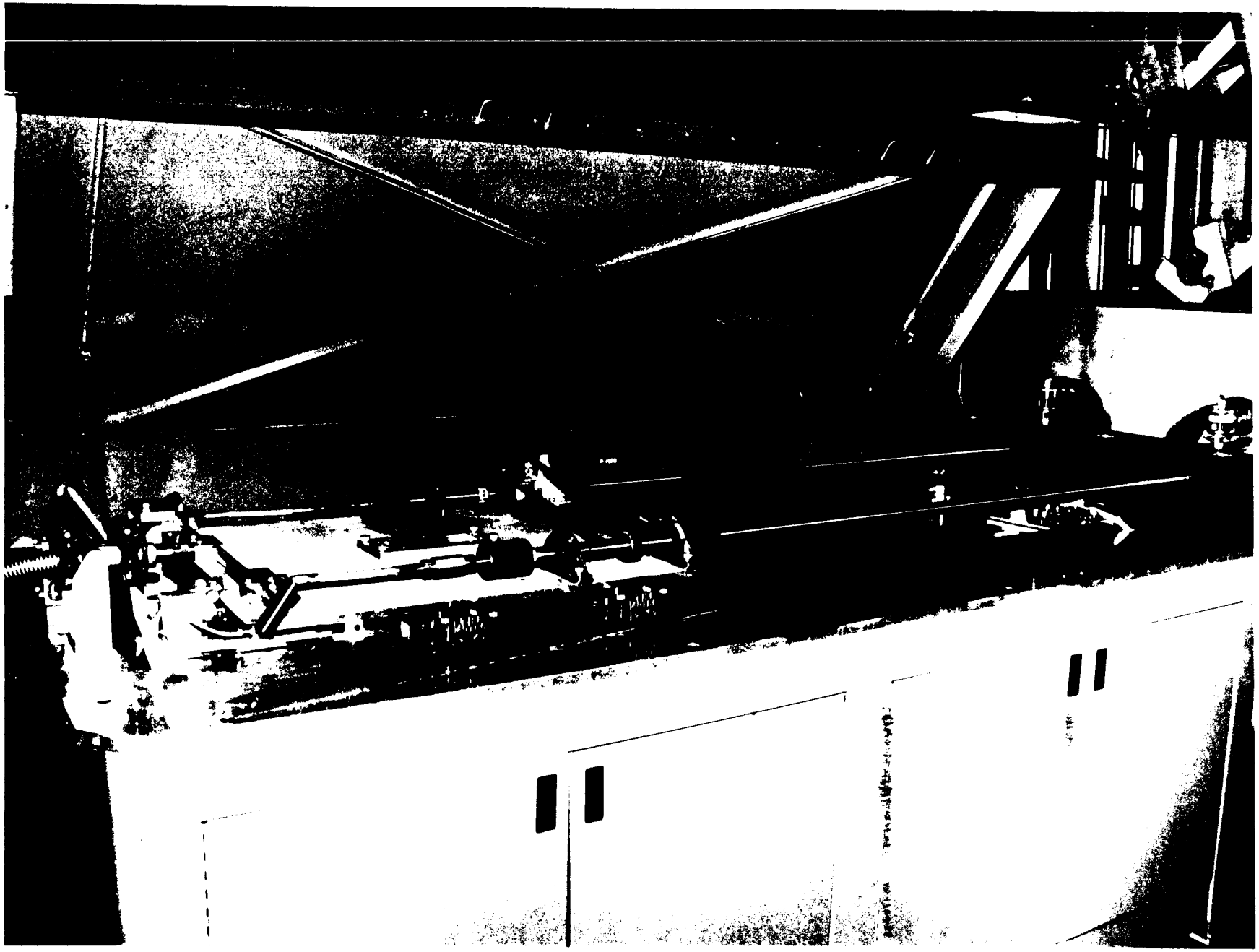
15. Provide one 8 1/2 x 11 black and white photo of the facility/equipment.



The CAD/PAD Manufacturing facility provides the only DOD in-house capability to manufacture, load, assemble, dissemble, and rework cartridges, ballistic power systems, Cartridge Actuated Devices (CADs), Propellant Actuated Devices (PADs), Aircrew Escape Propulsion Systems (AEPS), and pyrotechnics such as delay and ignition compositions for all services and Foreign Military Sales.

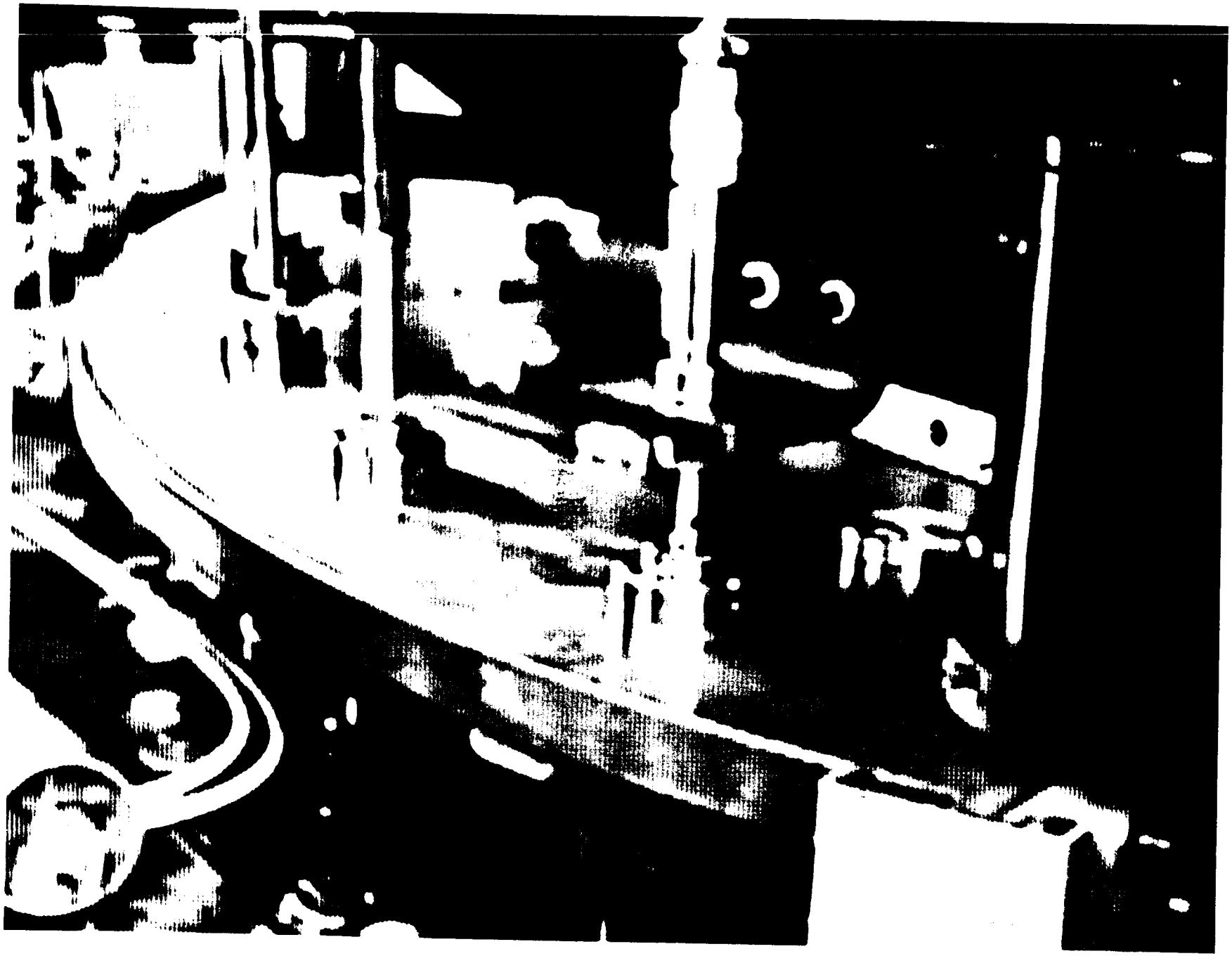


Laser Welder



Propellant Actuated Devices (PAD) Reclamation Equipment

Cartridge Actuated Device (CAD) Automated Thread Chaser



Iowa Loader

SPECIAL FACILITIES AND EQUIPMENT
FACILITIES/EQUIPMENT CAPABILITY FORM

Technical Center Site	Indian Head Division, NSWC
Facility/Equipment Nomenclature or Title	Composite Propellant/PBX Processing

1. State the primary purpose(s) of the facility/equipment.

The primary purpose of the composite propellant and plastic bonded explosive (PBX) ordnance materials manufacturing plant complex is to:

- Mix and cast solid propellants and PBX explosives.
- Assemble rocket motors, warheads, igniters and land/water mine countermeasure systems.
- Perform depot level maintenance, regrain, retrofit and rework on rocket motors and warheads.

This facility provides the flexibility to accomplish workload ranging from:

- Process development
- Scale-up
- Technical Data Package Validation
- Low Rate Initial Production
- Full Production

State-of-the-Art processing equipment has the capability to produce all cast propellants and explosives currently used by the Department of Defense. Some of the products produced at this facility for use by the Navy, Army , Air Force and private industry include:

Mk 107 Torpedo Warhead
Mk 103 Torpedo Warhead
Mk 122 Torpedo Warhead
Mk 115 Standard Missile Warhead
Mk 125 Standard Missile Warhead
Sidewinder Warhead

Phoenix Warhead
Maverick Warhead
Mk 14 Explosive Device
5 INCH/54 Projectile

Anti-Personnel Obstacle Breaching System (APOBS)
Distributed Explosive Technology (DET) Arrays
Distributed Explosive Mine Neutralization System (DEMNS)

SR121-NP-1/2 Jet Assisted Take-Off (JATO) Propulsion System
Mk 23 JATO
Mk 128 JATO
Medium Range Unmanned Aerial Vehicle Booster

Smokey Sam Simulator
Saggar Sam Simulator

In addition to producing new products, these facilities are used to download, regrain, and perform rework/maintenance. This work is performed to return overage, defective or damaged systems to a ready-for issue condition. This type of work is routinely performed on the following items:

- Sidewinder Missile
- Phoenix Missile
- Sparrow Missile
- Mk 56, 70, and 104 Standard Missiles

This facility also produces propellant and explosive items to meet short term emergency requirements. The flexibility and diversity of this facility allows for rapid response to emerging and quickly changing requirements. These capabilities include rapid process development, prototyping and fielding of propellant and explosive systems/subsystems. During Operation Desert Storm we accelerated development, manufactured and fielded APOBS and the Mk 14 Explosive Devices to defeat new enemy threats.

This facility is designated as the mobilization base producer for warheads for the Navy and Jet-Assisted-Take-Off (JATO) Propulsion Systems for the Single Manager for Conventional Weapons (SMCA). Our warm manufacturing lines provide additional manufacturing capacity to meet surge wartime requirements when private industry cannot meet the demand

or ramp-up quickly enough to satisfy mission requirements. **As an example of the advantages of having a warm manufacturing line for quick turn around,** the inventory of MK 6 JATOs used by the Navy in the Antarctic were becoming overage and unsafe for use. This JATO was a 1950's development and the ingredients were not available to manufacture new ones. Indian Head Division quickly developed and qualified a replacement propellant with the same performance and without changes to the external configuration of the JATO or aircraft. This propellant has to withstand -75 degrees F, a requirement not normally found in the services.

This facility is used to manufacture cast composite/PBX systems as they transition from development to low rate production, such as DEMNS, DET , MK 128 JATO and APOBS. New manufacturing process technologies developed by the IHDIV's Pilot Plant are incorporated and optimized during the developmental phase to ensure a smooth transition from development to production. This transition involves scaling-up from 5, 30 or 150 gallon development mixes to 300 or 420 gallon production sized mixes. Once the production process is fully defined and optimized, low rate initial production verifies the adequacy of the technical data package for full scale production. R

Our facilities modernization program has allowed this facility to be continually outfitted with emerging technologies. New S-O-T-A facilities include:

- Mix, cast and cure facility for warheads and JATOs
- Ammonium Perchlorate grinding facility R
- Solid Waste Recycler for thermal treatment of explosive contaminated waste
- Spray Lining facility for tactical rocket motor inert preparation

Equipment integral to this facility with a replacement value ≥ $500,000:

a. Vented Suppressive Shield: This piece of equipment is designed to contain and suppress a detonation equivalent to 100 pounds of TNT. The equipment is installed in a secure (clearance required) facility. The purpose of the equipment is to house explosive operations that would otherwise have to be done in a remote location. It is a fixed asset with a cost of $516,000. It weighs 80,000 lbs and takes up 2,100 cubic feet.

This piece of equipment is the largest of its type in the world. No similar piece of equipment exists that would be capable of processing tactical warheads in the 25 to 100 pound range. It was purchased in 1991.

or ramp-up quickly enough to satisfy mission requirements. **As an example of the advantages of having a warm manufacturing line for quick turn around,** the inventory of MK 6 JATOs used by the Navy in the Antarctic were becoming overage and unsafe for use. This JATO was a 1950's development and the ingredients were not available to manufacture new ones. Indian Head Division quickly developed and qualified a replacement propellant with the same performance and without changes to the external configuration of the JATO or aircraft. This propellant has to withstand -75 degrees F, a requirement not normally found in the services.

This facility is used to manufacture cast composite/PBX systems as they transition from development to low rate production, such as DEMNS, DET , MK 128 JATO and APOBS. New manufacturing processes technologies developed by the IHDIV's Pilot Plant are incorporated and optimized during phase to ensure a smooth transition from development to production. This transition involves scaling-up from 30 or 150 gallon development mixes to 420 gallon production sized mixes. Once the production process is fully defined and optimized, low rate initial production verifies the adequacy of the technical data package for full scale production.

Our facilities modernization program has allowed this facility to be continually outfitted with emerging technologies. New S-O-T-A facilities include:

- Mix, cast and cure facility for warheads
- Ammonium Perchlorate grinding facility
- Solid Waste Recycler
- Spray Lining facility

Equipment integral to this facility with a replacement value ≥ $500,000:

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This piece of equipment is the largest of its type in the world. No similar piece of equipment exists that would be capable of processing tactical warheads in the 25 to 100 pound range. It was purchased in 1991.

b. Vacuum Casting System: This system is specifically designed to vacuum cast any composite explosive or propellant product up to six feet in length and 2,000 pounds. The system is designed to be as flexible as possible, thereby minimizing or eliminating the complete tooling redesign that has always been necessary in the past for a new product. This is a fixed asset with a replacement cost of $1,349,000. It weighs 100,000 lbs and takes up 27,000 cubic feet. No similar system exists that would be capable of processing as wide of range of tactical warheads and rocket motors. It was purchased in 1992.

c. Spray Lining Machine: This equipment consists of a computer controlled spray lining machine designed to spray single or multicomponent liners onto the inside diameter of rocket motor cases ranging in size from 5 inches to 18 inches in diameter and from 3 feet to 12 feet long. This is a fixed asset with a replacement cost of $750,000. It weighs 20,000 lbs and takes up 2,000 cubic feet. It was bought in 1990.

d. 300 Gallon Baker Perkins Vertical Planetary Mixer: It is used to mix plastic bonded explosives and composite propellants for programs such as the MK 122 Torpedo Warhead, the MK 125 Standard Missile Warhead, the MK 14 Mine Clearing Warhead, the MK 107 Torpedo Warhead, the MK 64 511 Projectile Warhead, SR121-NP JATO, MK 128 JATO, MK 23 JATO, Javelin Rocket Motor, DEMNS Rocket Motor, Smokey Sam Simulator, and Sagger Sam Simulator. The explosives and propellants can only be made in this type of equipment due to the high viscosity of the materials being mixed. This is a fixed asset with a replacement value of $1,000,000. It weighs 75,000 lbs. and it takes up 2,500 cubic feet of space.

e. 420 Gallon Baker Perkins Vertical Planetary Mixer: The 420 gallon mixer is now being installed. When complete, it will be used for the mixing of propellants and explosives in support of the same type of programs now supported by the 300 gallon mixer. Its use will provide greater economy in the casting of motors and warheads by permitting more units to be cast from each mix (reduced labor cost/unit). This is an asset with a replacement value of $1,500,000. It weighs 100,000 lbs., takes up 3,000 cubic feet and was bought in 1981.

In addition to the 300 gallon and 420 gallon mixers, Indian Head has a full array of smaller mixers which are necessary to provide adequate information to scale up operations. Indian Head has the full spectrum of equipment to support vertical mixing operations and the capability to respond quickly to new requirements.

f. Solid Feed System: This equipment consists of a solids feed system designed to feed ammonium perchlorate, RDX, HMX, and other solid components into explosive and

propellent mixes. This is a fixed asset with a replacement value of $800,000. It weighs 20,000 lbs, takes up 2,000 cubic feet and was bought in 1990.

g. Dust Collection System: This piece of equipment consists of five baghouses designed and built to collect ground Ammonium Perchlorate (A.P.) from an air transport stream after it had been ground to the required particle size in a jet mill. This is a fixed asset with a replacement value of $1,000,000. It weighs 40,000 lbs, takes up 15,000 cubic feet of space, and was bought in 1990.

h. Abrasive Blasting System: This piece of equipment was designed and built to use grit (steel, sand, glass beads, etc) to remove corrosion from the interior of rocket motor chambers prior to further processing. It is a one of a kind system designed to handle rocket motor cases from 5 inches to 18 inches in diameter and from 3 to 12 feet in length. This is a fixed asset with a replacement value of $600,000. It weighs 420,000 lbs, takes up 3,000 cubic feet of space, and was bought in 1989.

i. Radiographic Inspection System: This equipment consists of radiographic equipment installed in a secure (clearance required) facility. The system is configured to radiographically inspect warheads. This is a fixed asset with a replacement value of $600,000. It weighs 20,000 lbs. and takes up 1,000 cubic feet of space. Similar equipment of this type exists at several government and commercial activities but is not configured to specifically handle classified warheads.

2. Indicate whether the facility/equipment is portable, moveable or fixed as defined by paragraph 6, page 12 of this data call.

The facility is considered a "fixed asset" since it consists of more than 30 principal processing buildings containing more than 160,000 square feet of processing space. Most of the principal processing buildings are surrounded by earthen barricades. There are numerous equipments sheds, explosive scrap sheds, hazardous waste storage sheds, etc. supporting these buildings.

3. Provide the replacement value of the facility/equipment. Report the facility/equipment cost separate from any building and utilities that may be integral to the facility/equipment.

This facility consists of over 30 major processing buildings. The cost of replacing these buildings and the "fixed equipment" contained therein would be in excess of $130,000,000.

4. Provide the gross weight and cube of the facility/equipment.

N/A

5. Indicate any "special" utility support required by this facility/equipment other than normal electrical power.

Along with standard electrical power, the facility requires steam, clean filtered water, high pressure river water and compressed air.

6. Indicate any special budget requirements for the facility/equipment (i.e., special foundations, non-ferrous materials, shielding, hardening, etc.).

Since the facility handles large amounts of sensitive high explosives and propellants, contingency blast containment measures must be met such as thickened walls and barriers. As stated above, many of the buildings are surrounded by earthen barricades. Lightning protection for processing buildings is required and must be tied to grounding girdle separate from the processing buildings. Processing buildings have conductive floors which are tied into the building's grounding girdle.

7. State any environmental control requirements for the facility/equipment (i.e., temperature, humidity, air scrubbing).

The facility processes large quantities of hazardous materials including powdered high explosives and volatile organic compounds. This requires that many of the buildings in the facility have treatment capabilities such as vacuum condensation of solvents, carbon columns on both process air streams and wastewater streams, and scrubbing of process air to meet environmental regulations. Since most of the materials we process are hygroscopic, most of the processing buildings require humidity and temperature controls. Humidity conditioning of large quantities of air requires special heating and ventilation systems utilizing desiccant drying systems.

8. Indicate if this facility/equipment would be extremely difficult or impossible to replicate or relocate at another site and the impact to the Department of the Navy if this facility/equipment were lost. Consider existing Government-wide and commercial capabilities as the replication and impact statements are formulated.

a. This facility is fixed and therefore would be difficult to relocate for the following reasons:

- Quantity of buildings is high and specialized nature of operations makes construction costs prohibitive.

- **Equipment removal would require the dismantling of many of the buildings.**

- Most of the equipment is large and heavy.

- Rebuilding the infrastructure to house and support this type of equipment would be very costly.

b. The facility loss impact to the Department of Defense would be:

- Loss of warm composite propellant/explosives production base to meet surge requirements.

- Loss of DoD expertise in the production of composite propellants/explosives would negatively impact our acquisition role.

c. No other DoD facility has any capability for the processing of composite propellants or explosives beyond the pilot scale. There is no question that the private sector has a very strong role and capability in all aspects of composite propellants and rocket motors, from research through large scale production. There are several companies (i.e., Hercules, Thiokol, ARC, Aerojet, CSD) with significant roles in this area. Even so, the Navy's expertise in composite propellants at Indian Head continues to be vital in resolving problems for these companies during development and production. As discussed elsewhere in this data call, Indian Head is used by virtually all program managers to resolve production and Fleet support problems with propulsion and warhead components of weapon systems. Having a continuing production role provides the large scale, hands-on experience needed; combined with the research and development and Fleet support engineering functions at Indian Head, it is possible to provide this vital service to the Navy.

Finally, the point needs to be made again that the processing of propellants, explosives and energetic chemicals is not something which has a market outside the DoD. Even though the private sector does currently provide virtually all of the large composite rocket motors for DoD, there is not incentive for these companies to maintain this capability as the market declines. Without Indian Head, the Navy and DoD has no resource to provide such units if the marketplace should cause the private sector capability to be shut down. If the need to maintain a knowledgeable technical base to support the units in the Fleet is combined with this need to have at least some production capability, Indian Head's composite

propellant/PBX facility is vital.

9. Indicate how and when the facility/equipment was transported and or constructed at the site.

Most of the original plant was built during the 1950 to 1960 era. Since 1980 the Division has been involved in modernizing the plant. All of the major processing buildings/capabilities have undergone renovation/upgrade and are environmentally compliant.

10. List the functional support areas (previously provided in Tab A) that this facility/equipment support. Refer to Appendix A for the list of functional support areas.

2.7 Explosives
2.12 Weapons Propulsion
8.2 Countermeasures

This facility supports the following NSWC Technical Capabilities:

Rocket/Missile/Gun Propulsion
Energetics Manufacturing/Manufacturing Technology
Cartridge/Propellant Actuated Devices/Aircrew Escape Propulsion Systems
Explosives

11. Provide the historical utilization average for the past five fiscal years (1989-1993). Define the unit of measure used.

If one assumes that full capacity is one (1) shift per day, five (5) days per week, fifty (50) weeks per year as the basis then during the past five (89-93) years we have operated at 100% of capacity.

The facility is a very flexible composite propellant and plastic bonded explosive manufacturing plant and can change products to meet changing needs within the DoD with short lead times. The very flexibility of the facility makes evaluating facility capability and capacity on any basis very difficult.

12. Provide the projected utilization data out to FY 97.

Using the same basis as in question 11 above we expect our projected utilization of FY 95, 96, and 97 to be 70%.

13. What is the approximate number of personnel used to operate the facility/equipment?

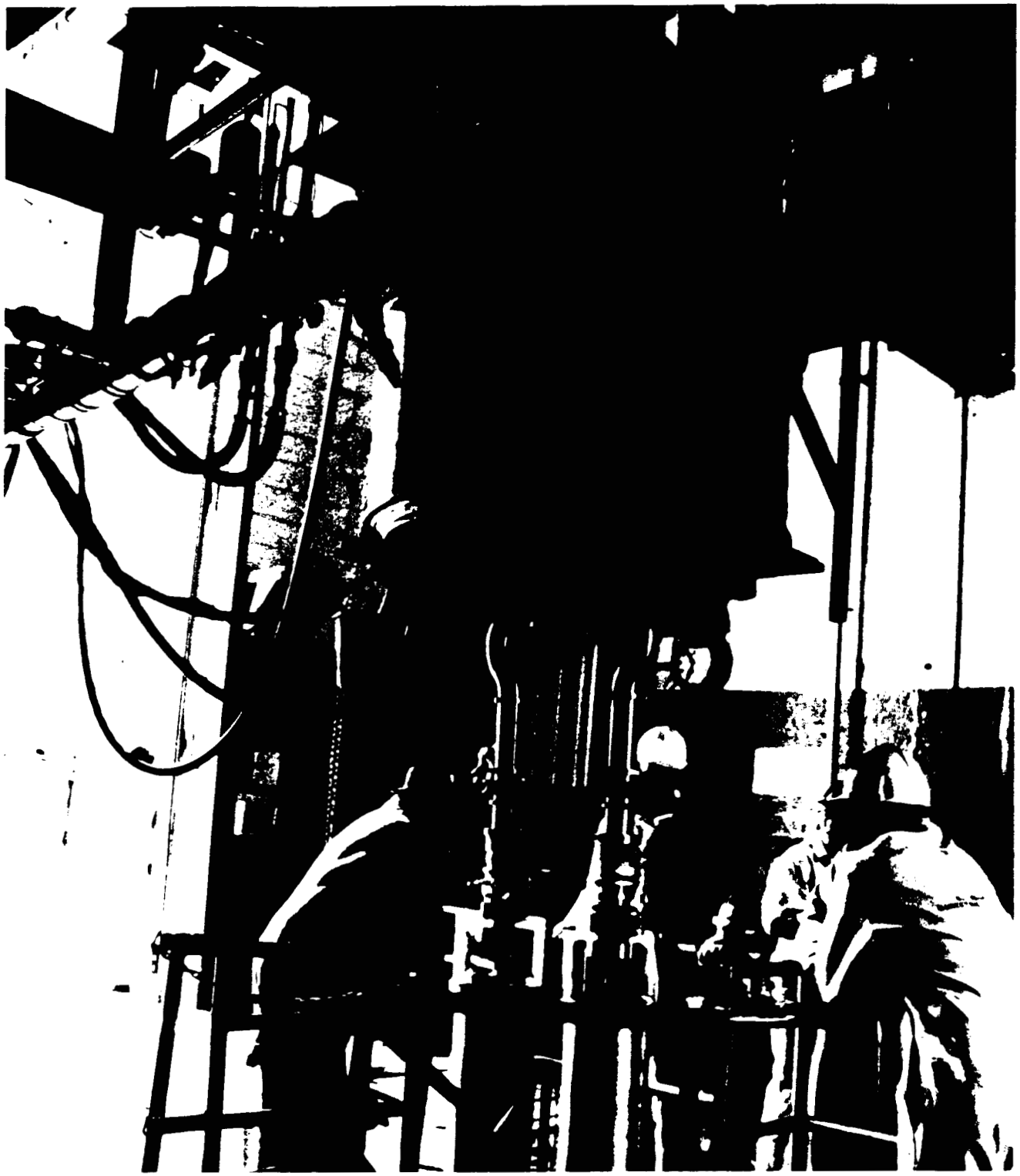
To operate at a 70% utilization of capacity requires a combined personnel level of about one hundred fifteen (115).

14. What is the approximate number of personnel needed to maintain the equipment?

Specialized maintenance of process related equipment requires three (3) work years of effort.

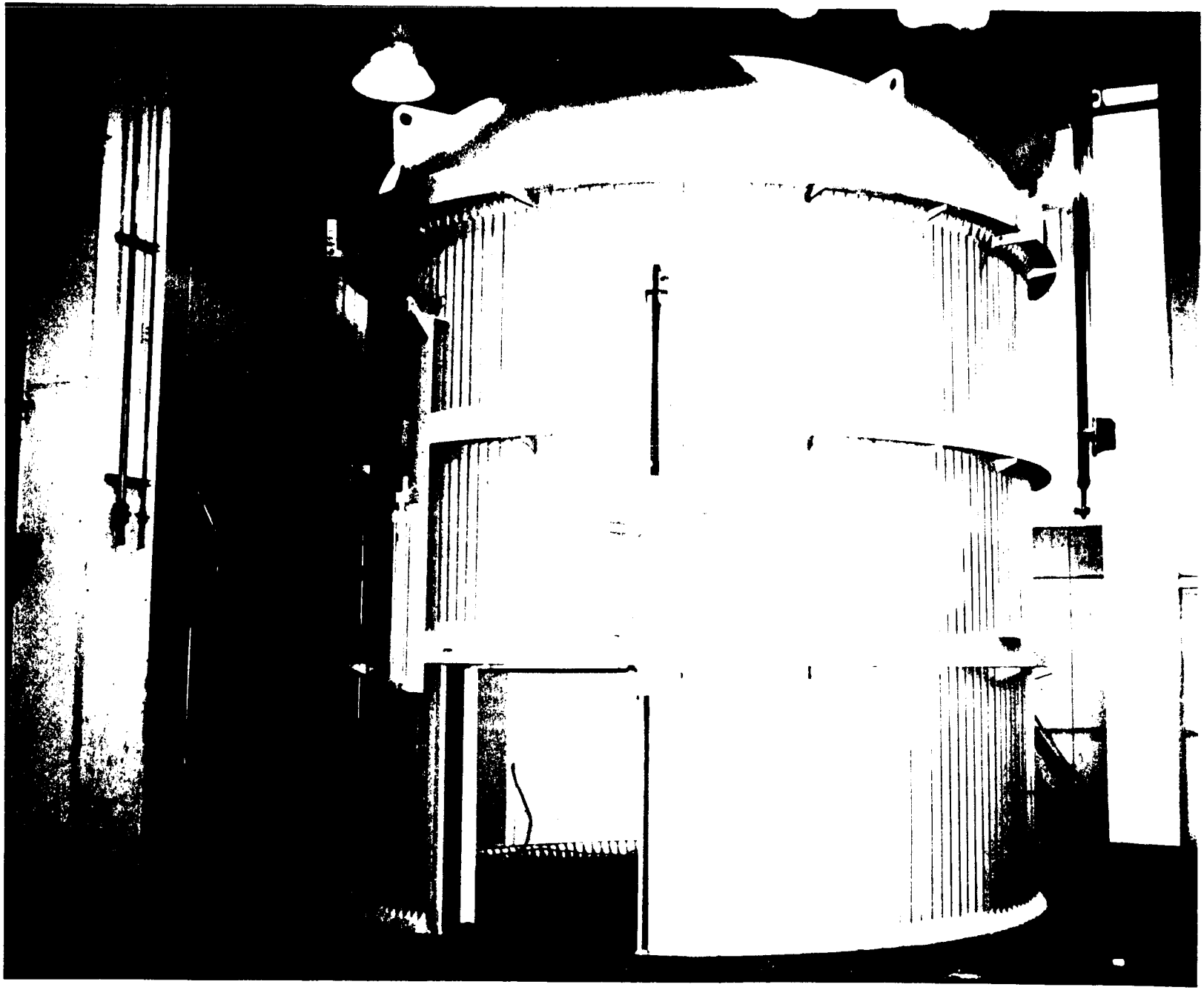
15. Provide one 8 1/2 x 11 black and white photo of the facility/equipment.

Composite propellant and plastic bonded explosives (PBX) are manufactured in the Cast Plant. Within these facilities operations range from ingredient preparation, mixing, casting, curing, disassembling, assembling of composite rocket motors and all currently approved PBX explosives used in Navy munitions.

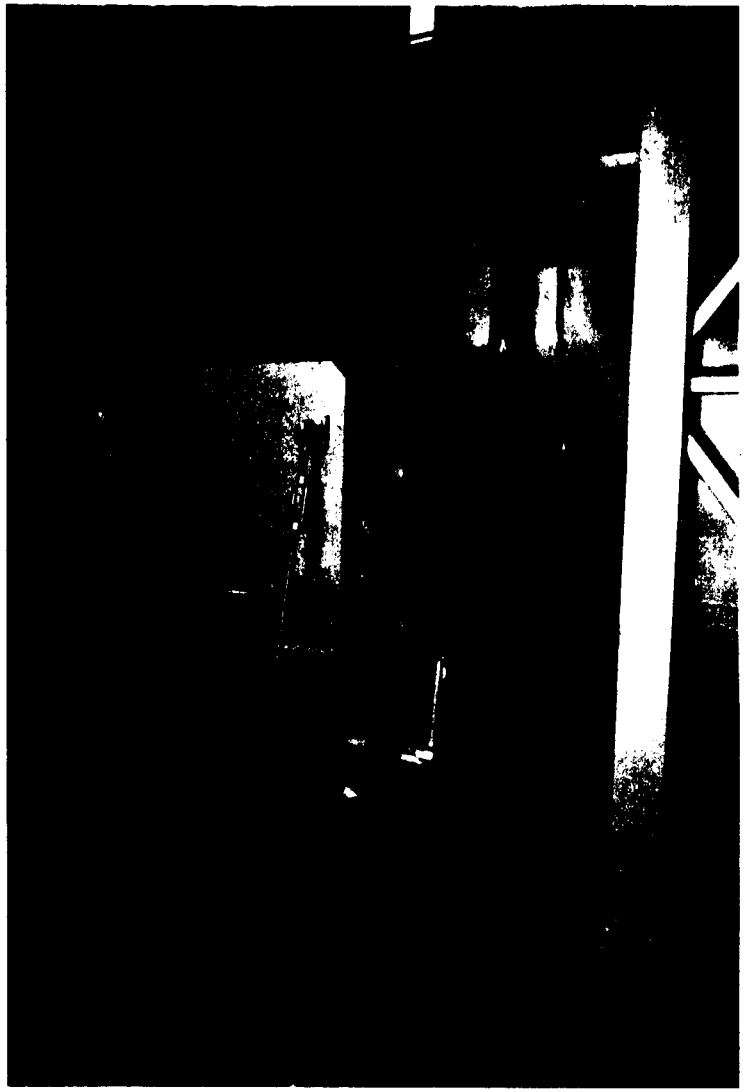


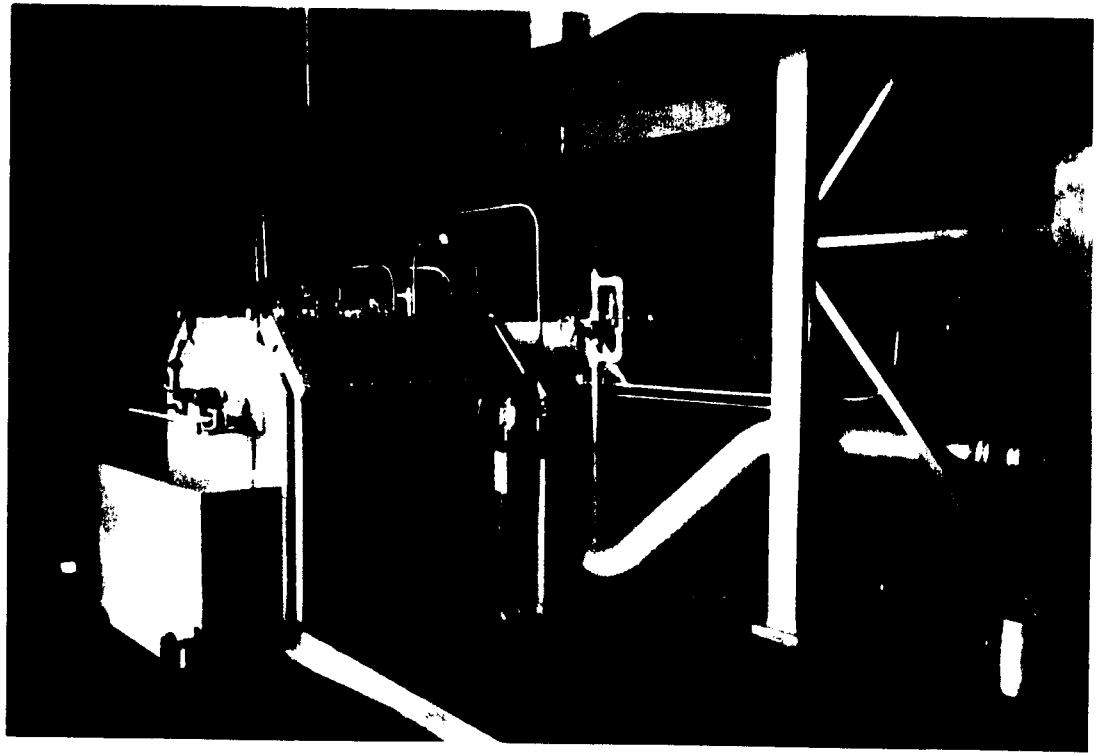
This is a composite propellant being vacuum cast from the 300 gallon vertical mixer into a javelin motor chamber.

Certified operators are casting PBX explosive into warhead chambers using a vacuum bell.



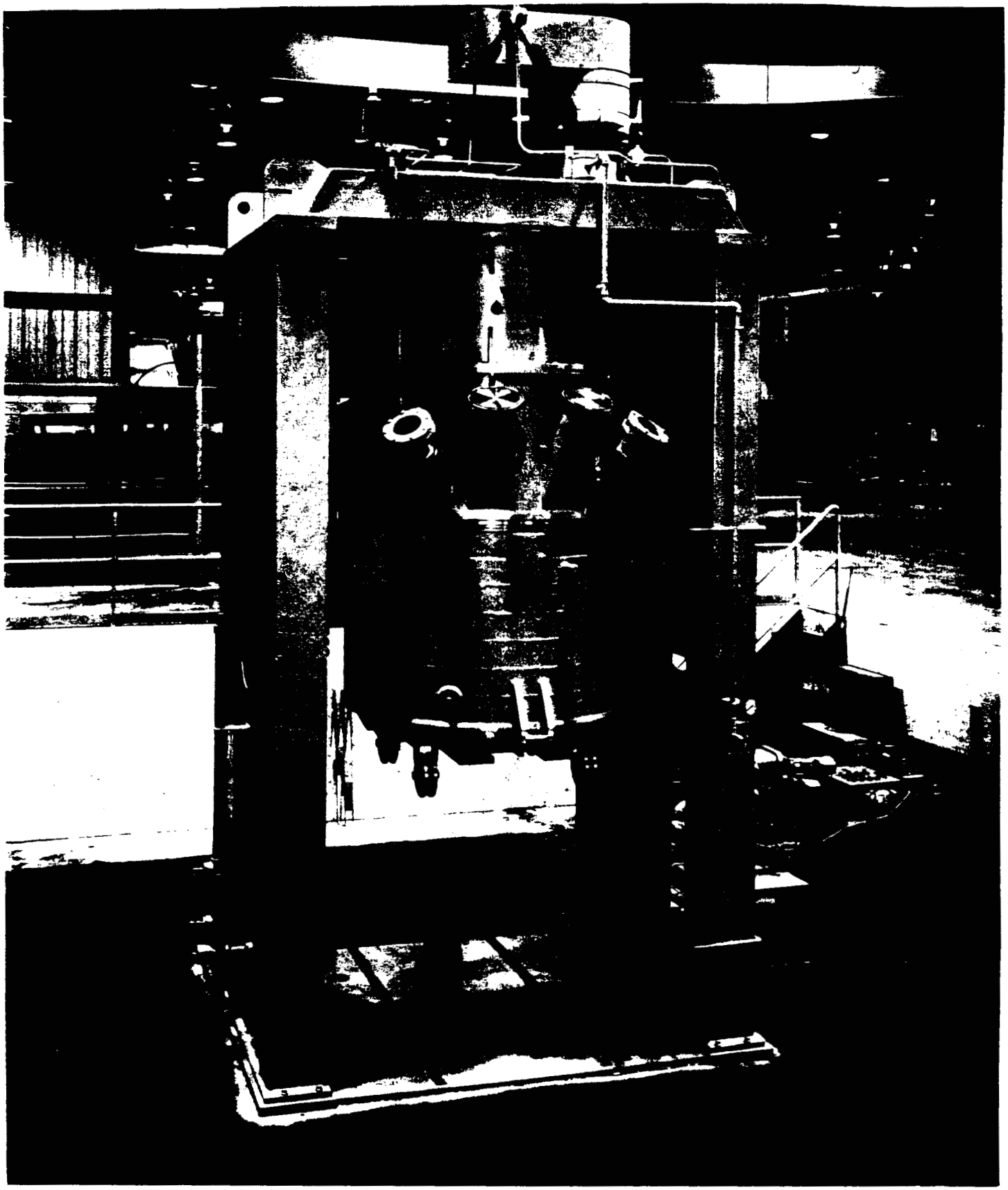
Vented Suppressive Shield



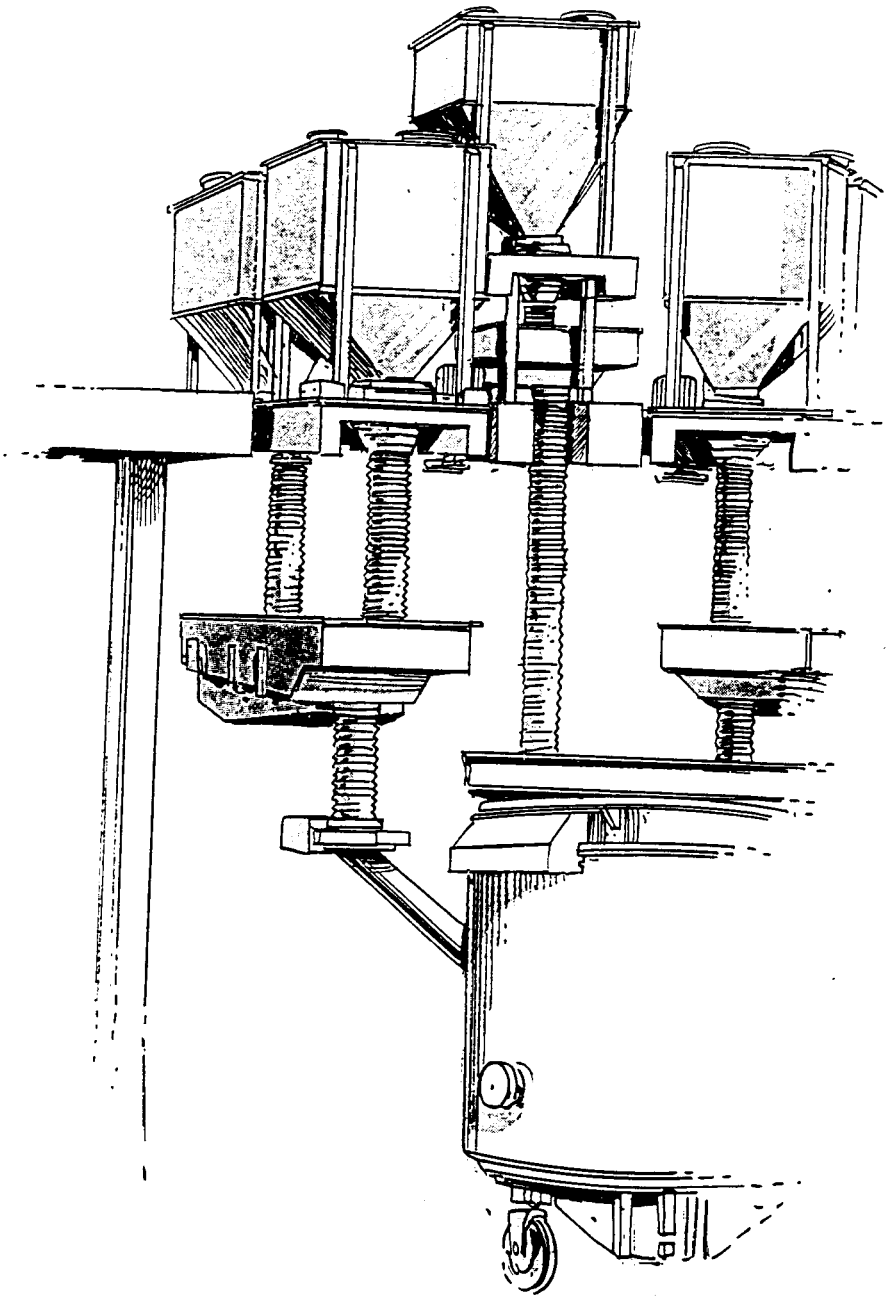


Vacuum Casting System

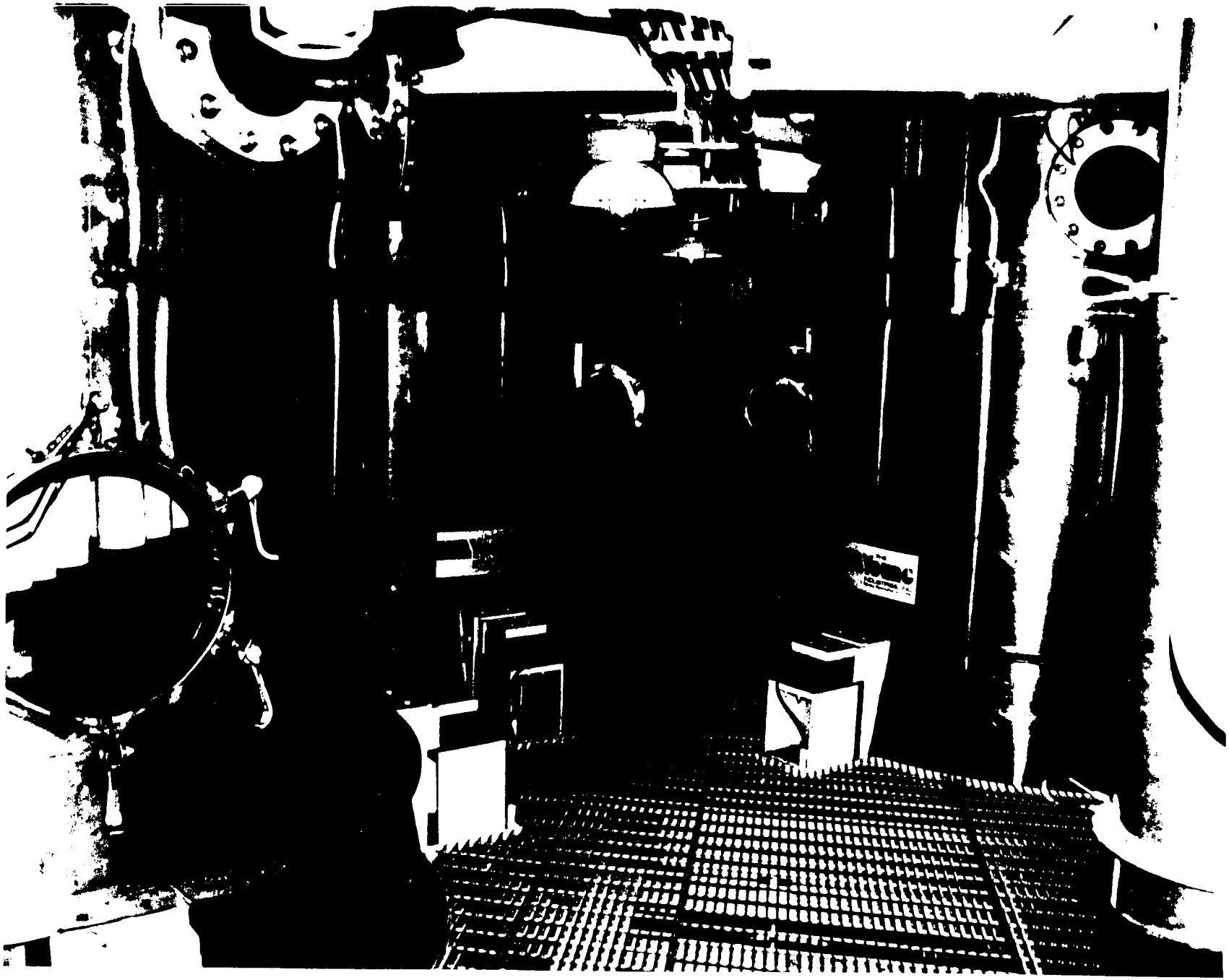
Spray Lining Machine



420 Gallon Baker Perkins
Vertical Planetary Mixer

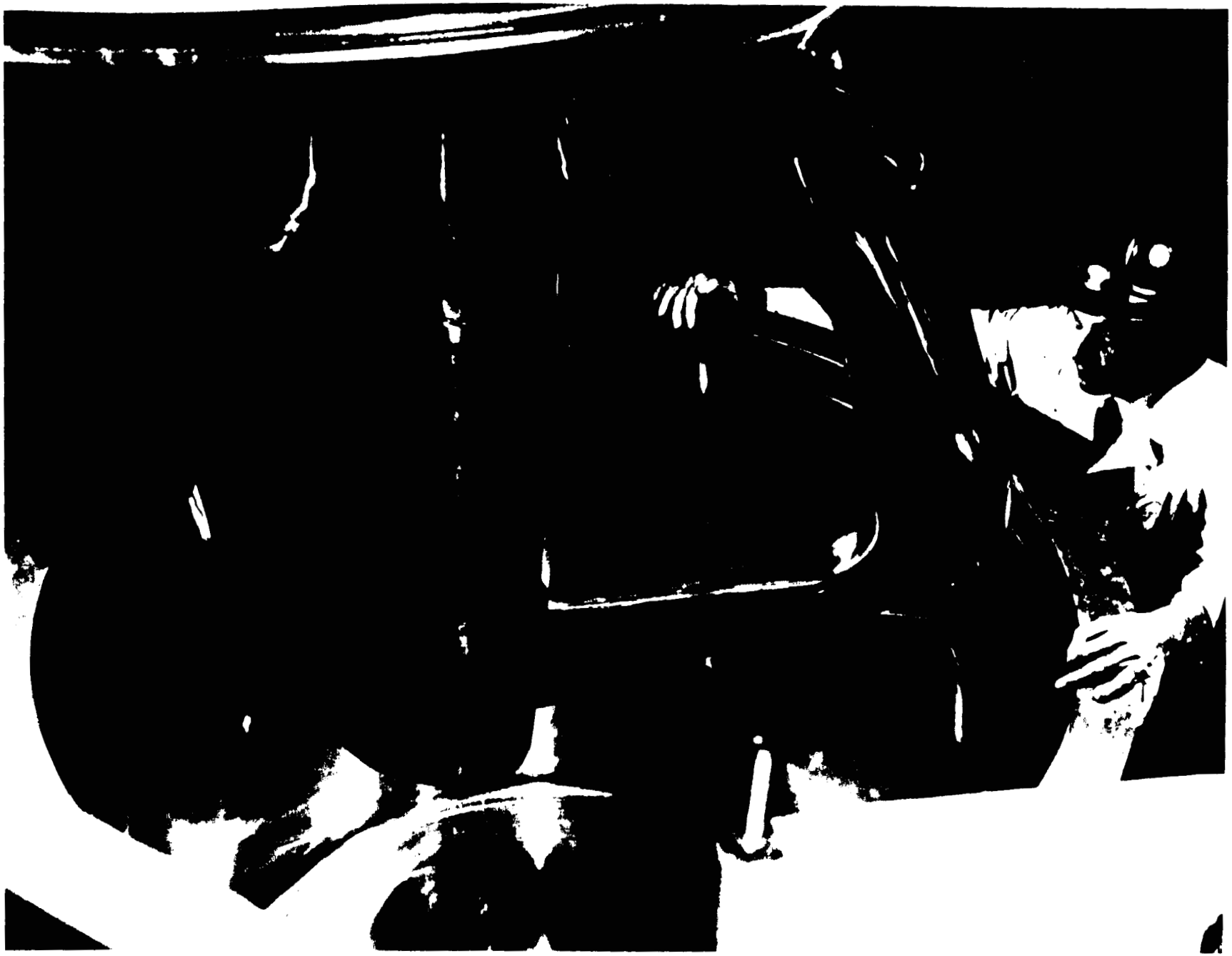


Solid Feed System



Dust Collection System

Abrasive Blasting System



300 Gallon Baker Perkins Vertical Planetary Mixer

Radiographic Inspection System

SPECIAL FACILITIES AND EQUIPMENT
FACILITIES/EQUIPMENT CAPABILITY FORM

Technical Center Site	Indian Head Division, NSWC
Facility/Equipment Nomenclature or Title	Explosive Safety and Ordnance Environmental Support

1. State the primary purpose(s) of the facility/equipment.

The primary purpose of the Technical Center for Explosives Safety is to provide the explosives safety capability for the Navy and Marine Corps ordnance communities. The Technical Center is responsible for recommending policies and procedures for explosive safety, conducting Navy training, and coordinating command level explosive safety inspections. It establishes explosive safety engineering standards, which include explosive hazard characterization testing, assigning interim hazard classifications for explosive shipments, assessing current and future explosive safety needs for facility designs and operator guidance, and interpreting explosive safety siting criteria for Navy and Marine Corps activities. The Center also investigates and analyzes accidents related to explosive safety at Army and Navy facilities, formulating remedial measures, and provides technical support to the Weapons Systems Explosives Safety Review Board.

The Technical Center is supported by a safety testing laboratory for the hazard characterization of new explosives. This laboratory provides the capability to do the necessary tests (impact, sliding friction, and electrostatic discharge) on new energetic materials in order to obtain an interim hazard classification. Larger scale tests in the field are also conducted as the materials are scaled up. These tests include card gap, cap, deflagration to detonation, drop, and bonfire. The latest test capability which has been added for the testing of weapon system components is the 300,000 volt electrostatic discharge (ESD) facility. There are three other ESD test facilities in the country, but this one is unique in design and capability. The facility was designed with the energy transmission lines between the voltage generator and the test cell so that the energy is actually and accurately transmitted to the test unit. It also is unique in the ability to measure voltage and current during testing and to condition the test items at temperature extremes during testing.

The function of the Ordnance Environmental Support Office (OESO) is to provide the Navy's source of expertise on the intersection between use of energetic materials and Federal, State, and local environmental regulations. OESO is charged with evaluating, assessing, developing, and maintaining solutions to ordnance environmental problems. As such, OESO supports all Navy and Marine Corps activities with environmental issues and problems. The office evaluates and coordinates environmental technology proposals, determines critical technologies, maintains the Navy's ordnance environmental database, and recommends Navy policies and procedures for environmental compliance. OESO is provided technical support by the personnel and facilities devoted to environmental research and development which were described under the Energetic Materials Research Laboratory.

2. Indicate whether the facility/equipment is portable, moveable, or fixed as defined by paragraph 6, page 12 of this data call.

The office and test buildings are fixed.

3. Provide the replacement value of the facility/equipment. Report the facility/equipment cost separate from any building and utilities that may be integral to the facility/equipment.

The facility includes offices for the Technical Center for Explosive Safety, OESO, the safety testing laboratory and equipment, and the 300,000 ESD test facility. The estimated replacement value for these facilities is $2450K.

4. Provide the gross weight and cube of the facility/equipment. N/A

5. Indicate any "special" utility support required by this facility/equipment other than normal electrical power.

The ESD test facility requires 3-phase, 460 volt electrical power.

6. Indicate any special budget requirements for the facility/equipment (i.e., special foundations, non-ferrous materials, shielding, hardening, etc.).

All buildings in which energetic materials are handled require electrical grounding systems, lightning protection, sprinkler or deluge systems with automatic sensing equipment, special conductive floors, special construction to minimize propagation from one area to another, explosion proof electrical equipment, etc. All buildings must be sited in accordance with the quantity-distance requirements of OP-5.

7. State any environmental control requirements for the facility/equipment (i.e., temperature, humidity, air scrubbing).

Testing of the energetic materials must be done in a controlled atmosphere, requiring an HVAC system for the safety laboratory.

8. Indicate if this facility/equipment would be extremely difficult or impossible to replicate or relocate at another site and the impact to the Department of the Navy if this facility/equipment were lost. Consider existing Government-wide and commercial capabilities as the replication and impact statements are formulated.

The Technical Center for Explosive Safety and OESO were placed at Indian Head by the Navy because we are the only Navy activity with long term, hands on experience with all phases (research, development, testing, production, storage, and fleet use) of explosive materials (propellants, explosives, pyrotechnics, and chemicals). As such, Indian Head was and is the only activity with the expertise to perform these vital functions. Moving the Technical Center or OESO away from the technical base provided by the broad spectrum of work done at Indian Head would, in time, result in both groups no longer having the expertise necessary to perform their missions.

The Explosive Safety Technical Center and OESO are charged with making decisions about Navy and Marine Corps explosive safety and environmental policies, providing oversight of contractor efforts, and performing inspections and investigations of Navy and Marine Corps activities involving potential litigation and/or EPA fines and violations. These are inherently governmental functions and cannot be done by the private sector.

9. Indicate how and when the facility/equipment was transported and/or constructed at the site.

The office buildings and the facility in which the safety testing laboratory is located was built in the 1950's. The ESD facility was only completed in 1994.

10. List the functional support areas (previously provided in Tab A) that this facility/equipment support. Refer to Appendix A for the list of functional support areas.

2.1 Gun Systems
2.2 Guided Missiles
2.3 Free Fall Weapons and Rockets
2.5 Mines
2.7 Explosives
2.8 Launchers
2.12 Weapons Propulsion
2.13 Other Ordnance
2.14 Explosive Ordnance Disposal
8.2 Countermeasures

This facility supports the following NSWC Technical Capabilities:

Rocket/Missile/Gun Propulsion
Energetics Manufacturing/Manufacturing Technology
Cartridge/Propellant Actuated Devices/Aircrew Escape Propulsion Systems
Explosives
Ordnance Environmental Support Navy-Wide
Explosives Safety Engineering

11. Provide the historical utilization average for the past five fiscal years (1989-1993). Define the unit of measure used.

FY	Workyear Utilization Average
89	16
90	22
91	38
92	36
93	34

12. Provide the projected utilization data out to FY 1997.

FY	Projected Workyear Utilization Data
94	35
95	43
96	39
97	41

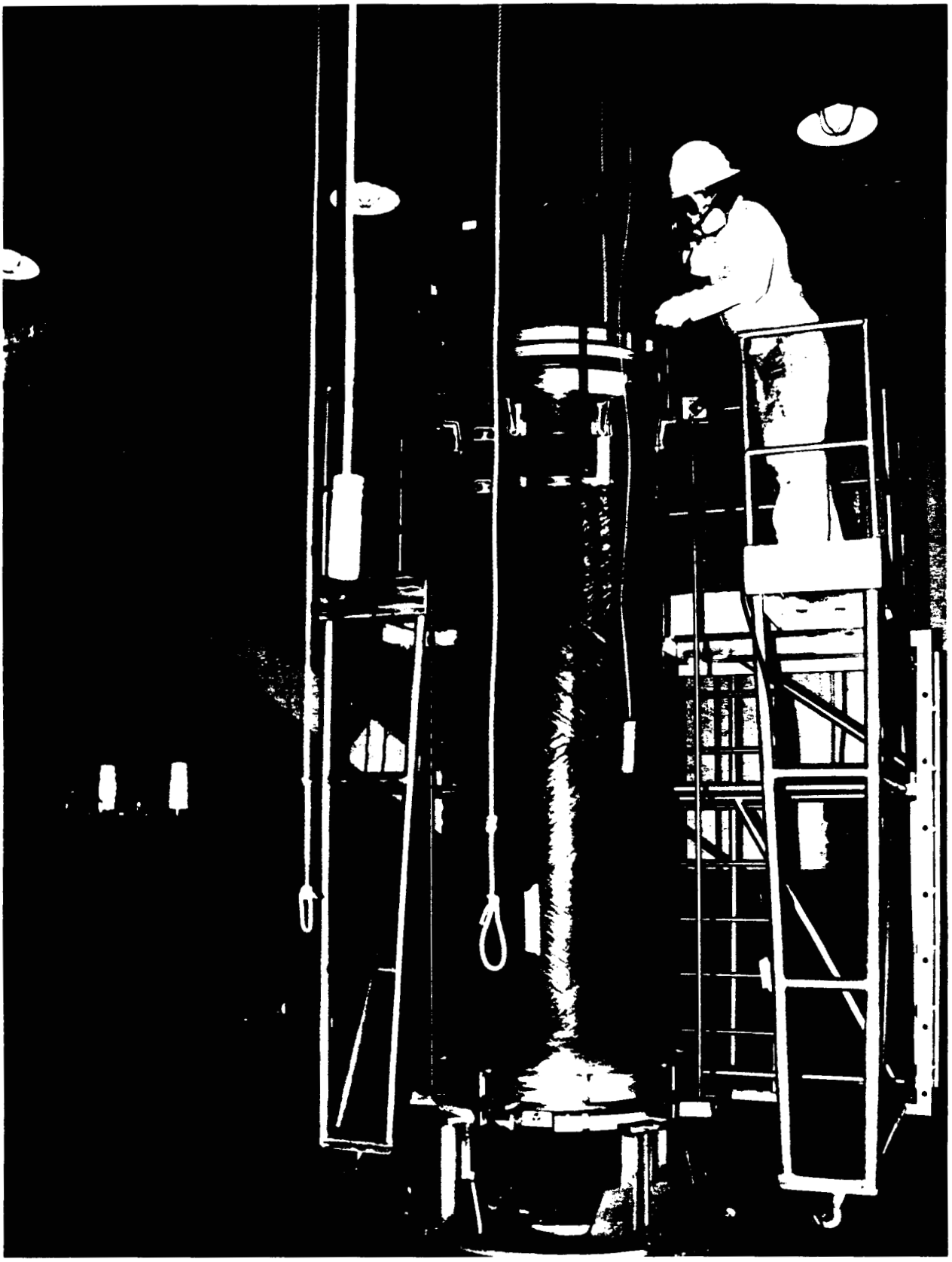
13. What is the approximate number of personnel used to operate the facilities/equipment?

33

14. What is the approximate number of personnel needed to maintain the equipment?

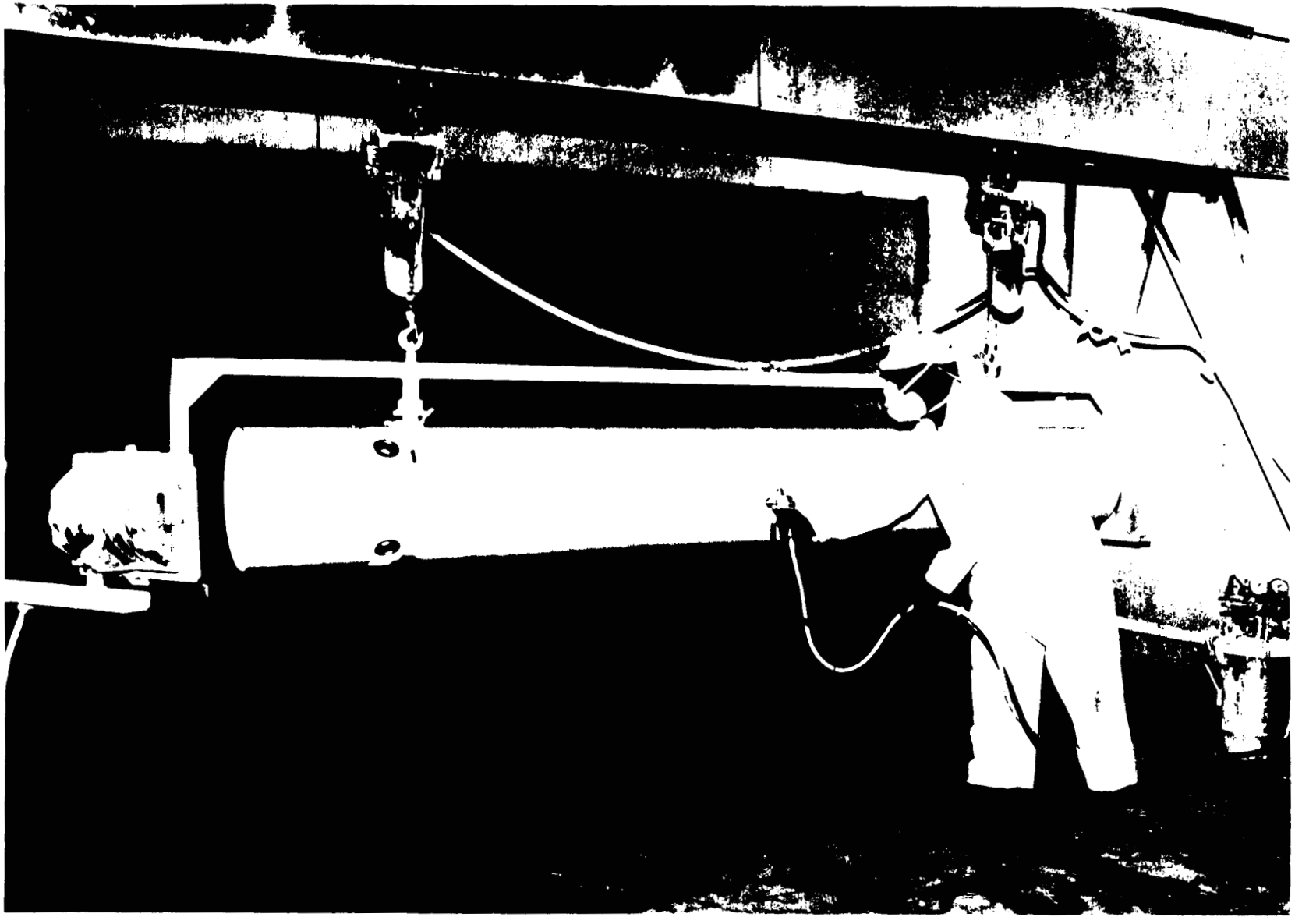
General support provided by Public Works Department is less than one workyear.

15. Provide one 8 1/2 x 11 black and white photo of the facility/equipment.



Certified operators and engineers disassemble VANDAL grains after casting and curing operations.

Certified ordnance workers are installing a hanger for a rail loaded standard missile booster.



An ordnance worker is applying enamel paint on the outside surface of a standard missile booster.

SPECIAL FACILITIES AND EQUIPMENT
FACILITIES/EQUIPMENT CAPABILITY FORM

Technical Center Site	Indian Head Division, NSWC
Facility/Equipment Nomenclature or Title	Ordnance Test & Evaluation Facility

1. State the primary purpose(s) of the facility/equipment.

The ordnance test and evaluation capability at the Indian Head Division is made up of five major components:

Rocket motor ballistic test facility
Tomahawk functional ground test facility
Cartridge Actuated Device (CAD) test facility
Environmental test facility
Non-destructive test facility.

The rocket motor ballistic test facility is used to static fire rocket motors in support of development, lot acceptance, quality evaluation, and malfunction investigation programs. The facility provides the capability to environmentally condition and fire the motors to simulate the real conditions which will be experienced in the fleet. Real-time data analysis and reduction, video coverage, and high speed photography ensure complete characterization of the performance of the rocket motor. These tests are performed for those units developed or produced at Indian Head and by private contractors. Typical programs supported include all aircrew escape propulsion units, all JATO units, Standard Missile, HARM, Sidewinder, and AMRAAM. Approximately 5040 test firings are conducted each year.

The Tomahawk Functional Ground Test (FGT) system is unique within DOD, providing a system level approach to validating a missile's operational reliability and quality. Using a specially constructed component thrust vector test stand, the FGT system permits complete evaluation of the missile's performance: rocket motor firing and separation; separation of all jettisoned items; deployment of fins and wings; operation of thrust vector control tabs, fins, engine, and guidance system. This system has now been enhanced so that a real-time vehicle/environment model with guidance direct memory access is connected to the missile

during firing, thus simulating a complete mission and realistically testing all missile hardware and software interfaces.

Indian Head has tri-service responsibility for cartridges and CAD'S. The CAD test facility is required for the qualification, lot acceptance, quality evaluation, and malfunction testing of the more than 700 cartridge and CAD units used by DOD. The facilities, test stands, instrumentation, and data acquisition equipment have been developed to permit testing of all these units while simulating environments from deep ocean to the upper atmosphere. These tests are done in support of in-house programs as well as private contractors. The cartridges and CADs are used for a multitude of purposes in DOD aircraft as well as some weapon systems, including energy transfer, fire extinguishing, flotation device actuation, and ordnance release. We test nearly 17,212 cartridges and CADs per year.

All new ordnance items must be evaluated at the environmental extremes to which they may be exposed in order to ensure reliable and safe performance during service use. The environmental test facility is designed to provide this capability for rocket motors, warheads, aircrew escape propulsion units, and CADS. The facilities provide the capability to evaluate the response of ordnance items when exposed to mechanical stimuli (shock, drop, vibration, hydrostatic pressure, and acceleration) and climatic extremes (altitude, temperature, humidity, thermal shock, salt-fog, wind and rain, and sand and dust). Units are tested in the environmental facilities as part of qualification, surveillance, lot acceptance, and malfunction programs. After undergoing a series of environmental tests, the ordnance items are usually then test fired in one of our ballistic test facilities to determine the effects of the environmental cycling on performance. Typical units tested include Standard Missile, Sidewinder, Harm, various JATOS, and CAD/PADs. 17,095 separate environmental tests are conducted per year.

The non-destructive test (NDT) facility is required in order to inspect ordnance items and metal parts for flaws, improper assembly, foreign materials, and any other anomalies which may have occurred during manufacture, storage, or service use. There are five primary techniques which are utilized: radiography, dye penetrant, magnetic particle, eddy current, and ultrasonic. Indian Head has two radiographic (x-ray) sites, with a total of eight x-ray units. Ordnance items up to five feet in diameter, 18 feet long, and 4,000 pounds of Class 1.1 explosive weight can be x-rayed. A separate building is used for the other four techniques. The NDT techniques are used to inspect units after manufacture, environmental testing, or a malfunction. Approximately 24,684 x-rays and other NDT tests are done each year.

The combination of these facilities provides Indian Head with the total capability to support development, production, quality evaluation, and malfunction programs for ordnance items.

Equipment integral to this facility with a replacement value ≥ $500,000:

a. Tomahawk Functional Ground Test (FGT) System: The primary purpose of this equipment is to interface and gather data during Tomahawk Missile FGT. This asset is moveable with a replacement value of $6-7 million. It weighs approximately 12-15 tons. This is the only government owned Tomahawk FGT capability. If this capability is lost the Navy could not perform special test on the Tomahawk and would have to rely on expensive flight tests for data (more than 30 times more expensive).

b. Rocket Motor Thrust Vector Control Test Stand (Ormond Inc.): This equipment is a multi-component test stand with six-degrees-of-freedom capability used in testing the MK 106/MK 111 booster to determine serviceability. This is a one of a kind test stand. This is a fixed asset with a replacement value of $750,000 - $1,000,000. It weighs approximately 20,000 lbs.

This is the only government owned multi-component test stand for the Tomahawk Booster (MK 106/MK 111). If this capability were lost, the Navy could not perform quality evaluation (service life evaluation) on the Tomahawk Booster. To replicate or relocate this test stand the receiving activity must have a sophisticated data acquisition system (40 plus channel capability), temperature conditioning chambers for the boosters (-20°F to 110°F), facility to perform remote explosive operations (1000 foot explosive arc) and a control room to house the fire control/servo controller/data acquisition system (20' x 20' building).

c. Multi-Component ROCAT Thrust Stand: This equipment is used to test Navy and Air Force rocket catapults for aircrew escape from aircraft. This is a fixed asset with a replacement value of $700,000. It weighs 8,000 lbs, and takes up 750 cubic feet.

This is a one of a kind test stand. If this capability is lost the Navy will lose it's only state-of-the-art multi-component test system for testing rocket catapults which are man rated unit.

d. Large Motor Test Digital Data Acquisition System (HP-1000): This equipment is used to acquire digital data from rocket motor static-fire operations. It supports lot acceptance testing of production items, quality evaluation for fleet returns and special tests. This asset is moveable with a replacement value of $2,000,000. It weighs 2,000 lbs, and takes up 144 cubic feet.

Without this equipment the Navy would lose the capability of testing a wide range of rocket motors (sidewinder, Tomahawk, Phoenix, JATOs, MK 70, MK 104 MK 66, Harm and etc.).

This equipment would be difficult to replicate since it is configured for specific firing operations at the present location.

e. Small Motor Test Digital Data Acquisition System (HP-1000): This equipment is used to acquire digital data from rocket motor static-fire operations. It supports lot acceptance testing of production items, quality evaluation for fleet returns and special tests. This asset is moveable with a replacement value of $2,000,000. It weighs 2,000 lbs, and take up 144 cubic feet of space.

Without this equipment the Navy would lose the capability of testing a wide range of ordnance (rocket catapults, Underseat rocket motors, Gas Generators, and other propellant actuated devices). This equipment would be difficult to replicate since it is configured for specific firing operations at the present location.

f. Large Motor Test Automatic Data Acquisition Equipment: This equipment is used to acquire digital data from rocket motor static-fire operations. It supports lot acceptance testing of production items, quality evaluation for fleet returns and special tests. This asset is moveable with a replacement value of $1,200,000. It weighs 2,000 lbs, and take up 384 cubic feet of space.

Without this equipment the Navy would lose the capability of testing a wide range of rocket motors (sidewinder, Tomahawk, Phoenix, JATOs, MK 70, MK 104 MK 66, Harm and etc.). This equipment would be difficult to replicate since it is configured for specific firing operations at the present location.

g. Small Motor Test Automatic Data Recording Equipment: This equipment is used to acquire digital data from rocket motor static-fire operations. It supports lot acceptance testing of production items, quality evaluation for fleet returns and special tests. This asset is moveable with a replacement value of $1,000,000. It weighs 6,000 lbs, and take up 336 cubic feet of space.

Without this equipment the Navy would lose the capability of testing a wide range of ordnance (rocket catapults, Underseat rocket motors, Gas Generators, and other propellant actuated devices). This equipment would be difficult to replicate since it is configured for specific firing operations at the present location.

h. High Energy Real-Time Radiographic Inspection System: The high energy real-time radiographic inspection system is composed of four different x-ray sources, up to 4 million-electron-volts (4 MeV), including a 200kV microfocus source, and three manipulator systems

located in two different buildings. The primary purpose for this equipment is to non-destructively inspect energetic and non-energetic materials for flaw detection, signs of aging, improper assembly, foreign materials in the raw materials or manufactured propellants, or any other anomalies that might occur. These energetic materials can be up to 5 feet in diameter and up to 18 feet in length with a maximum explosive weight of 4,000 pounds of Class 1.1 or 10,000 pounds of Class 1.3. This asset is movable with a replacement value of $3,300,000. This equipment occupies approximately 5,000 cubic feet of space and weighs an estimated 25,000 pounds.

i. Digital/Analog Vibration Control System includes 20,000 Lb-F Electromagnetic Shaker: The vibration system is used to conduct environmental vibration tests on a wide array of ordnance and inert items to simulate adverse environmental conditions that the item will be exposed to during its normal service life. The equipment is moveable with a replacement value of $575,000.

2. Indicate whether the facility/equipment is portable, moveable or fixed as defined by paragraph 6, page 12 of this data call.

The facility/equipment is fixed as defined by paragraph 6, page 12 of this data call.

3. Provide the replacement value of the facility/equipment. Report the facility/equipment cost separate from any building and utilities that may be integral to the facility/equipment.

There are 39 main buildings which comprise the ordnance test & evaluation facility. Their estimated replacement values is $ 17,700 K. The equipment used in this facility has an estimated replacement value of $ 27,300 K.

4. Provide the gross weight and cube of the facility/equipment. N/A.

5. Indicate any "special" utility support required by this facility/equipment other than normal electrical power.

Facility requires special instrumentation grounding, AC line conditioning, filtering and surge protection. Normal 110/220 electrical power. 440 - 3 phase required for component thrust vector test stand. 3000-5000 psi clean air and distilled water for some test bays. Cooling tower for environmental test area.

6. Indicate any special budget requirements for the facility/equipment (i.e., special foundations, non-ferrous materials, shielding, hardening, etc.).

A solid foundation is required for the test stands. Primary ground girdle and lightening protection are required. Good grounding bus is also required for instrumentation grounding. Buildings must be hardened for close proximity to explosive operations. Deflector shields are also required for test stands if they are within 1000 feet of personnel. There are also blast walls and lightning protection systems required for this facility. The shock and vibration facility requires a solid foundation of reinforced concrete and a sound dampening room. The facility must also maintains other safety requirements as required by OP-5.

The radiography facilities have the following unique requirements:

- Radiation safety shielding, such as lead or thick concrete or perimeter fencing, to control personnel exposure to ionizing radiation.
- Overhead gantry crane with minimum 10 ton capacity for movement of materials and to support the x-ray source in the exposure area. Special training is required to operate this piece of equipment.
- Special medical examinations required for personnel exposed to explosive materials and ionizing radiation on a regular and recurring basis.
- Certification of NDT personnel.

7. State any environmental control requirements for the facility/equipment (i.e., temperature, humidity, air scrubbing).

Equipment in facility requires temperature and humidity controls. The facility should be covered for protection from the elements.

8. Indicate if this facility/equipment would be extremely difficult or impossible to replicate or relocate at another site and the impact to the Department of the Navy if this facility/equipment were lost. Consider existing Government-wide and commercial capabilities as the replication and impact statements are formulated.

The facilities are fixed and therefore would be very difficult to relocate. Several of the test capabilities at Indian Head cannot be found elsewhere in DOD or private industry. Assuming that the capability were to be moved elsewhere, these facilities would have to be replaced. They include the Tomahawk functional ground test system, the entire CAD test facility, and the aircrew escape propulsion test stands.

Indian Head provides for the Navy and DOD a combination of research, development, engineering, production, and test capablity for energetic materials and therefore for the weapon systems for which the energetic materials are essential. The production function needs the research and development people to understand and resolve problems during manufacture. The research groups need the experience of the engineering people to determine what new work is needed and to assess the success of past developments. Each separate function is dependent on the other. When they are located together, the opportunities for synergy and maximizing people and facility investment are increased. The ability to test ordnance items in support of development, production, quality evaluation, malfunction, and fleet support programs is a critical part of the complete technical capability provided by Indian Head. On an annual basis, over 60,991 units are subjected to ballistic, environmental, and NDT tests in these facilities. Many of the test and evaluation functions provided by this facility could be obtained from private contractors or from other DOD facilities. Doing so, however, would result in an important loss for the technical base in energetic materials.

9. Indicate how and when the facility/equipment was transported and or constructed at the site.

The facilities were constructed between 1944 and 1991 and have been continuously updated and modernized to meet current and anticipated testing requirements.

10. List the functional support areas (previously provided in Tab A) that this facility/equipment support. Refer to Appendix A for the list of functional support areas.

2.5 Mines
2.7 Explosives
2.12 Weapons Propulsion
2.13 Other Ordnance
8.2 Countermeasures

This facility supports the following NSWC Technical Capability:

Rocket/Missile/Gun Propulsion
Energetics Manufacturing/Manufacturing Technology
Cartridge/Propellant Actuated Devices/Aircrew Escape Propulsion Systems
Explosives
Weapons Simulation/Emulation
Explosives Safety Engineering

11. Provide the historical utilization average for the past five fiscal years (1989-1993). Define the unit of measure used.

The historical utilization average is 250 days/year FY 89-93.

12. Provide the projected utilization data out to FY 1997.

The projected utilization data is 250 days/year for FY 94-97. Environmental testing occurs 365 days a year. Several operations conducted at the facility can run on a 24 hours basis.

13. What is the approximate number of personnel used to operate the facility/equipment?

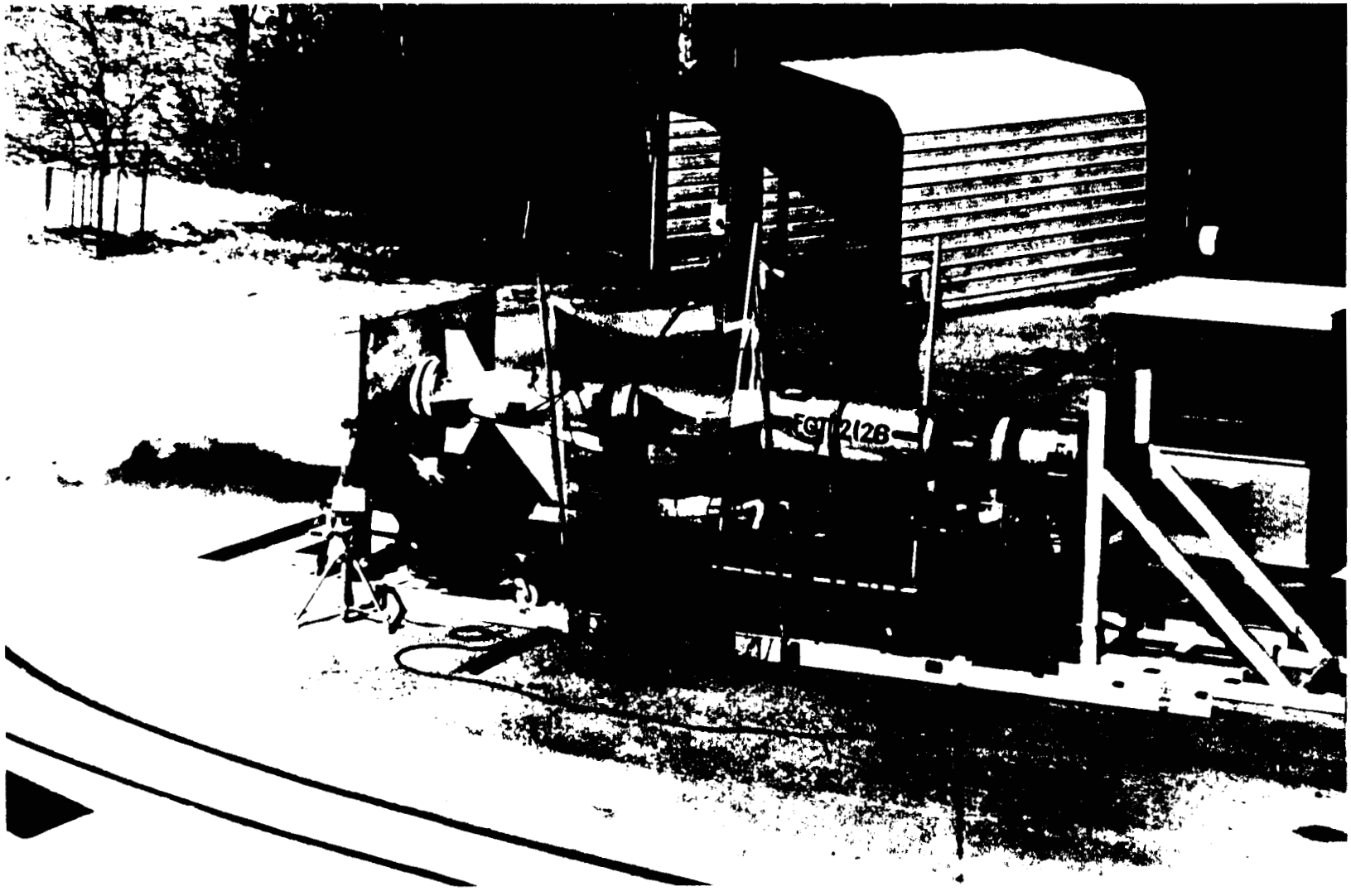
The approximate number of personnel to operate this facility is 60.

14. What is the approximate number of personnel needed to maintain the equipment?

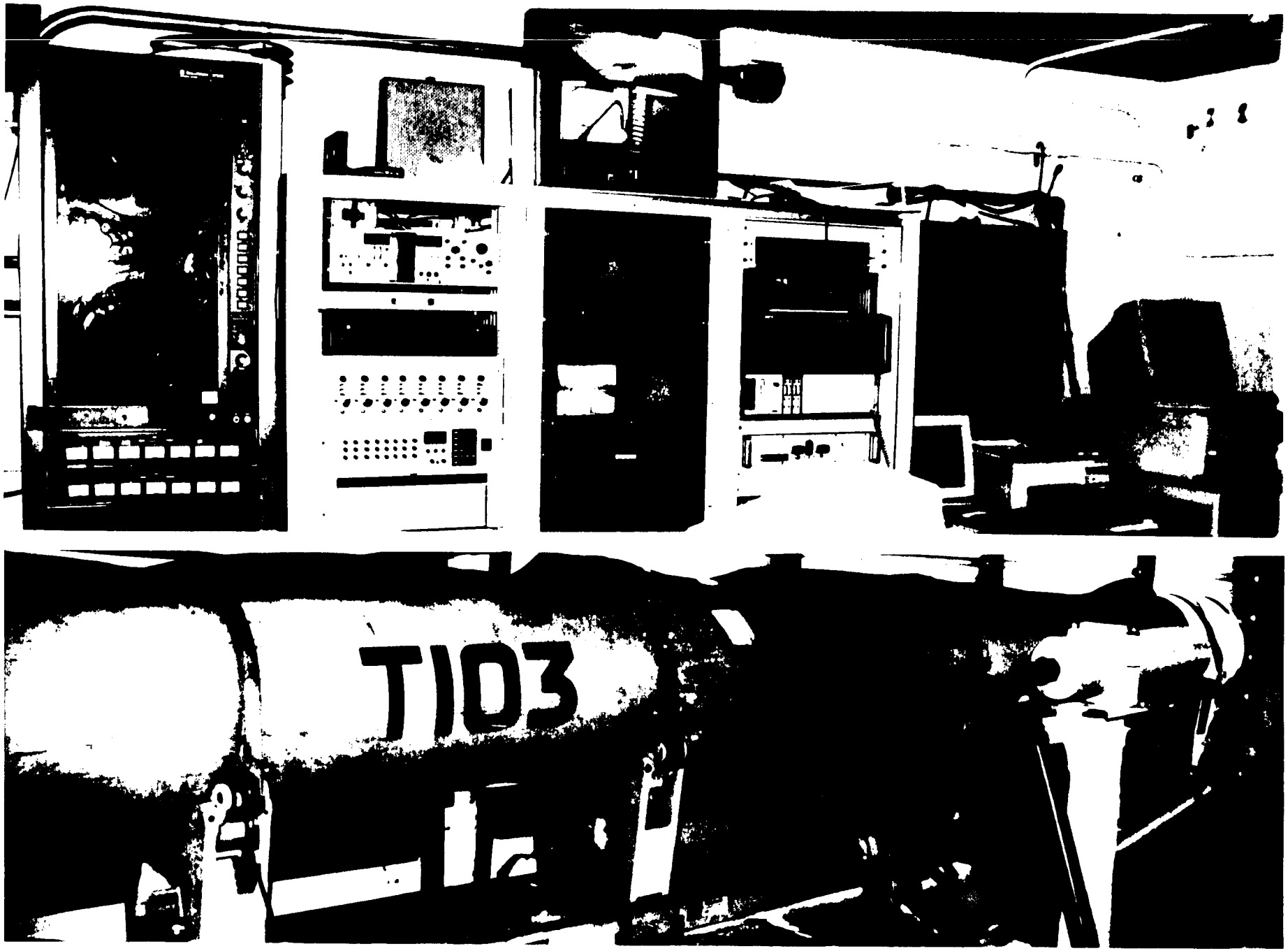
The approximate number of personnel needed to maintain the equipment is 5.

15. Provide one 8 1/2 x 11 black and white photo of the facility/equipment.

Our missile and rocket motor test firing facilities are used to determine ballistic parameters during all phases of motor life cycle at temperatures to which the items are likely to be exposed during fleet use.

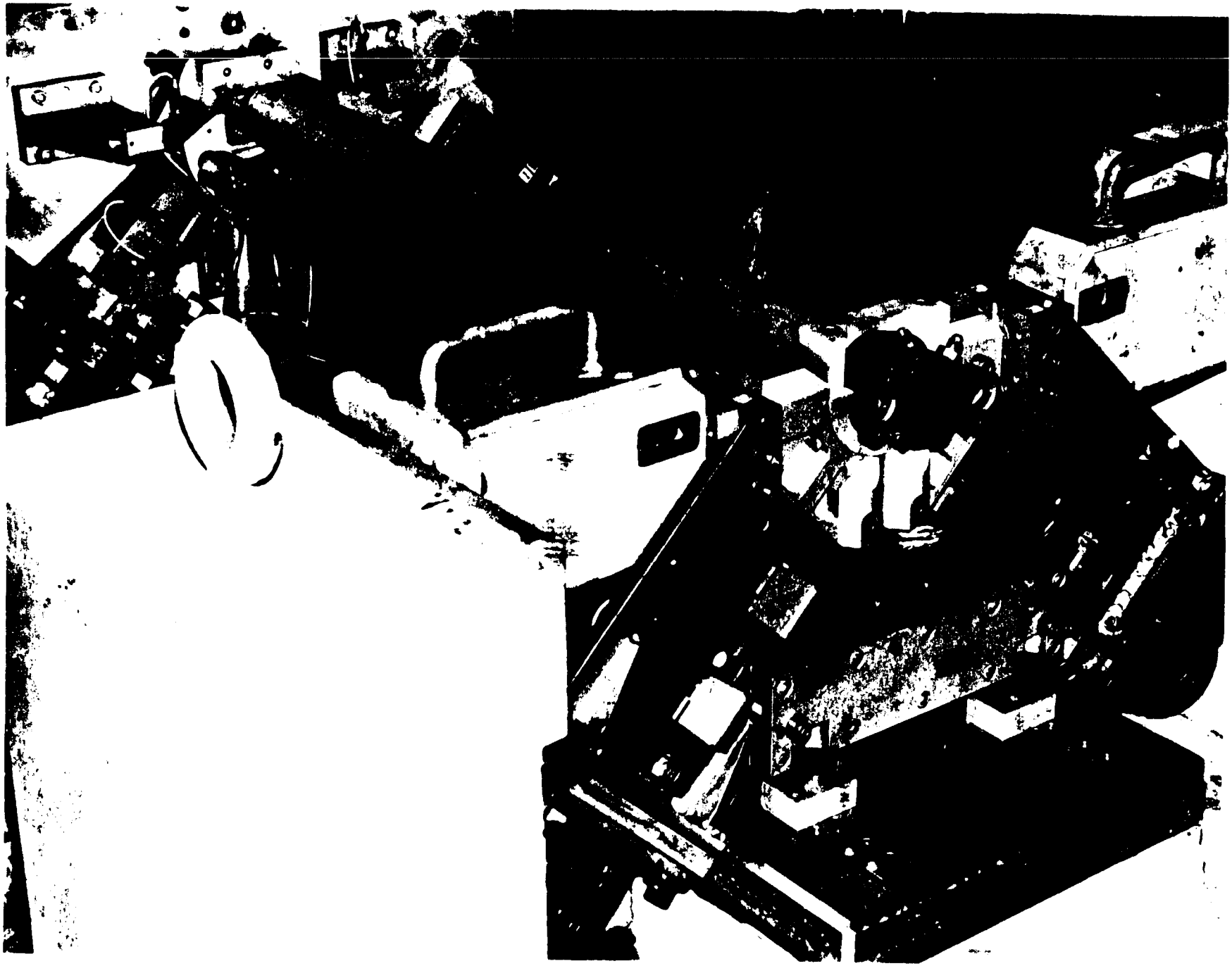


A unique capability, the functional ground test for the Tomahawk cruise missile allows for continued evaluation of program enhancement and fleet inventory analysis.

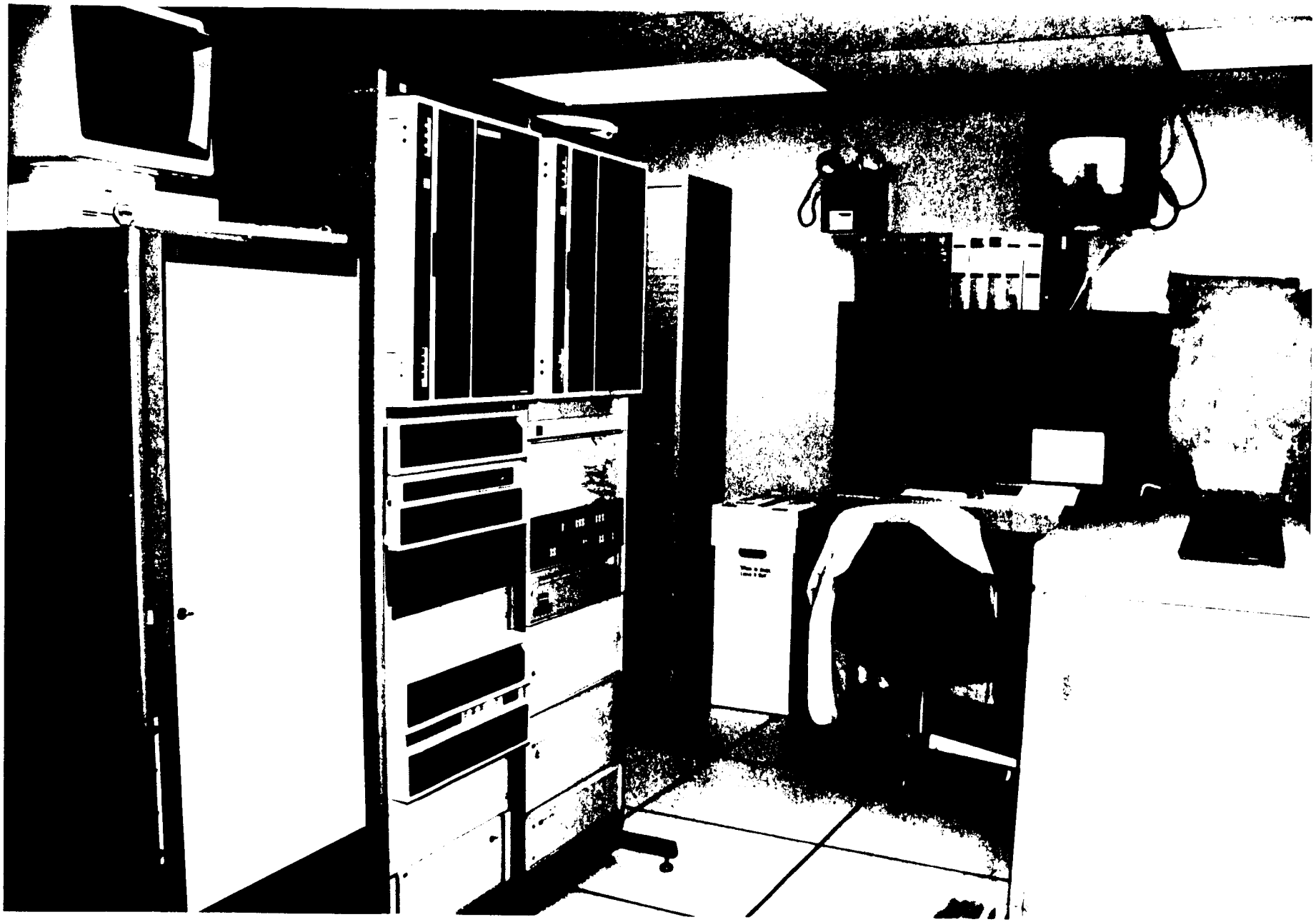


Tomahawk Functional Ground Test (FGT) System

Component Thrust Vector

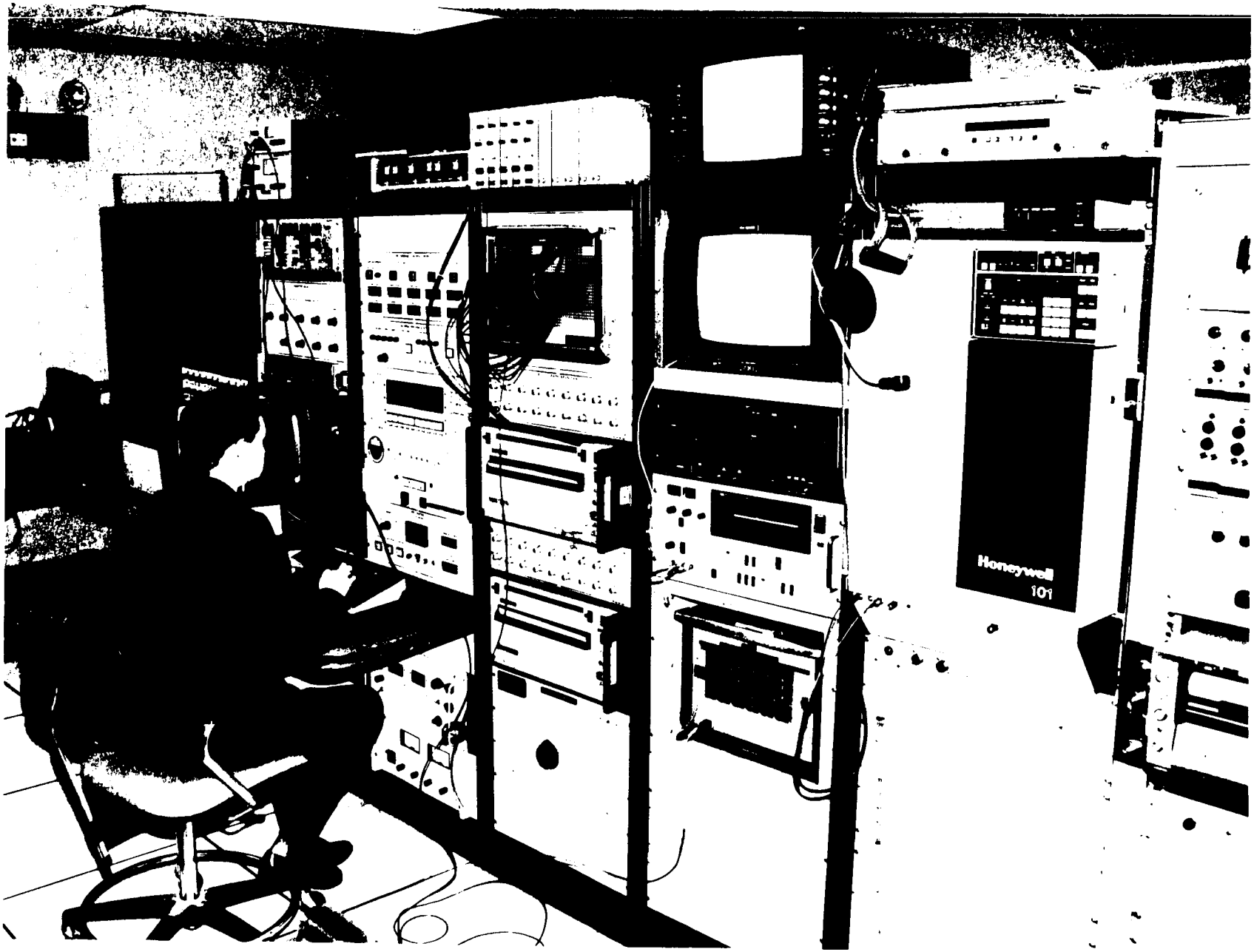


Multi-Component ROCAT Thrust Stand

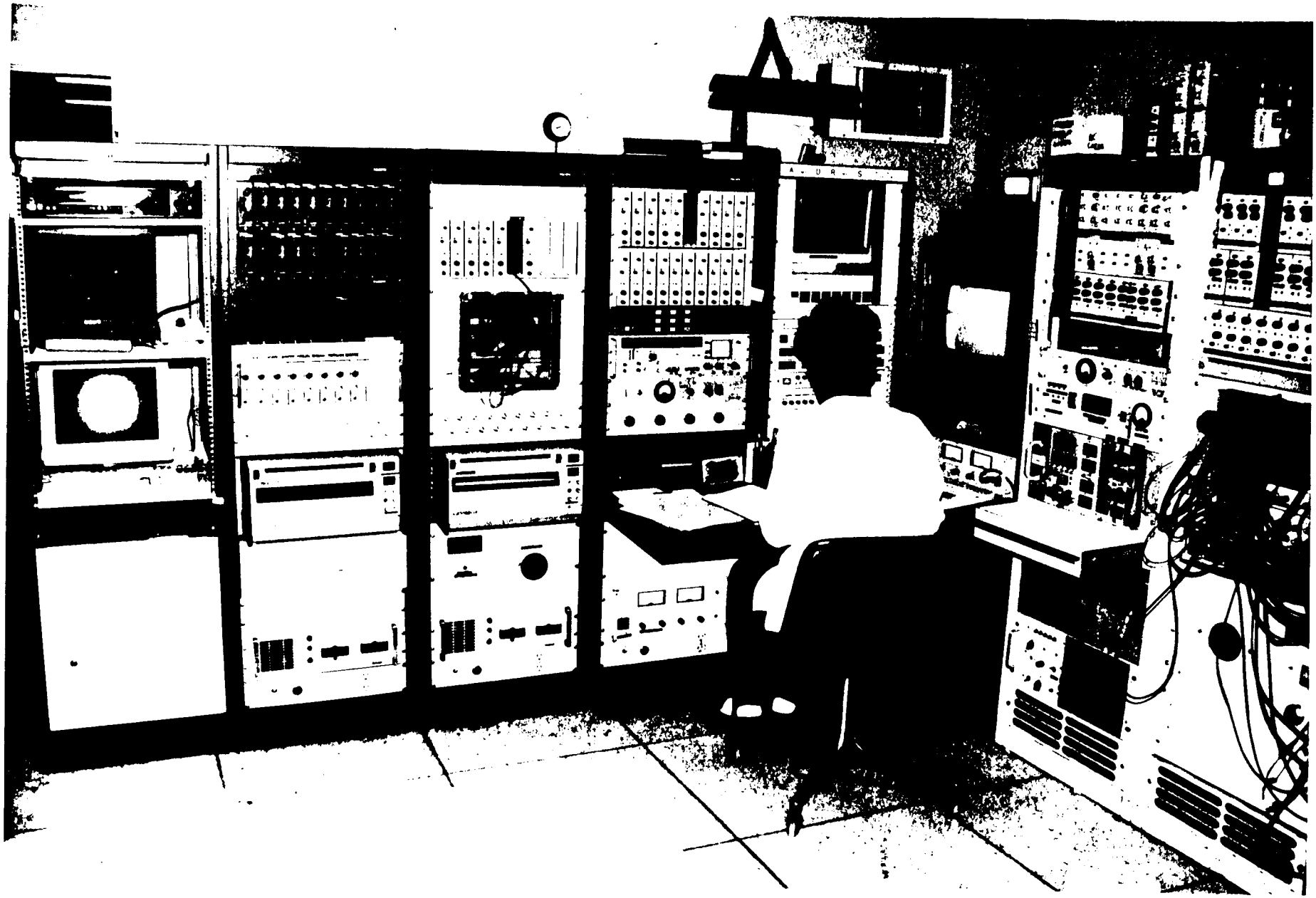


Large Motor Test Digital Data Acquisition System (HP-1000)

Small Motor Test Digital Data Acquisition System (HP-1000)

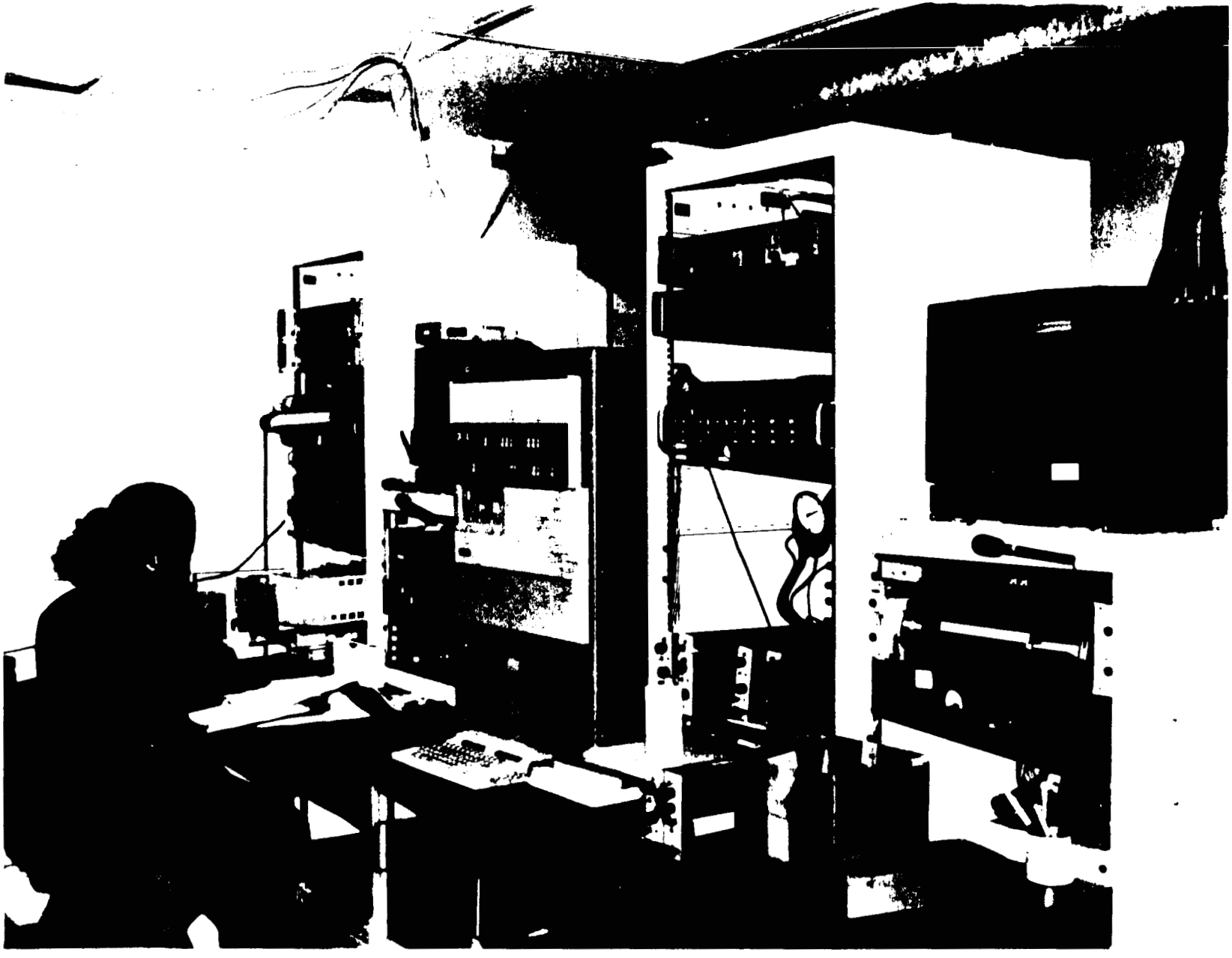


Large Motor Test Automatic Data Acquisition Equipment



Small Motor Test Automatic Data Recording Equipment

This facility is used to not only ballistically test Cartridge Actuated Devices (CADs) produced by Indian Head Division, but also to perform lot acceptance tests on all CADs produced by private industry. Over 700 different types of cartridges are tested in this facility.



Remote control room with data acquisition system for firing Cartridge Actuated Devices (CADs) which records data from time to pressure-max (TPMAX), accelerometers, photocells and breakwires.

Radiographic facilities house real time x-ray equipment to determine in-process defects in manufactured units. Conventional film radiography is used extensively to non-destructively inspect energetic and non-energetic materials for flaw detection, signs of aging, improper assembly and foreign materials.

High Energy Real-Time Radiographic Inspection System

Environmental vibration test system simulates shock and vibration experience during operational use. Test items include electronics related to ordnance, igniters, cartridges, rocket motors, missiles, and warheads.

BRAC DATA CALL NUMBER 64
CONSTRUCTION COST AVOIDANCE

Information on cost avoidance which could be realized as the result of cancellation of on-going or programmed construction projects is provided in Tables 1 (MILCON) and 2 (FAMILY HOUSING). These tables list MILCON/FAMILY HOUSING projects which fall within the following categories:

1. all programmed construction projects included in the FY1996 - 2001 MILCON/FAMILY HOUSING Project List,

2. all programmed projects from FY1995 or earlier for which cost avoidance could still be obtained if the project were to be canceled by 1 OCT 1995, and,

3. all programmed BRAC MILCON/FAMILY HOUSING projects for which cost avoidance could still be obtained if the project were to be canceled by 1 OCT 1995.

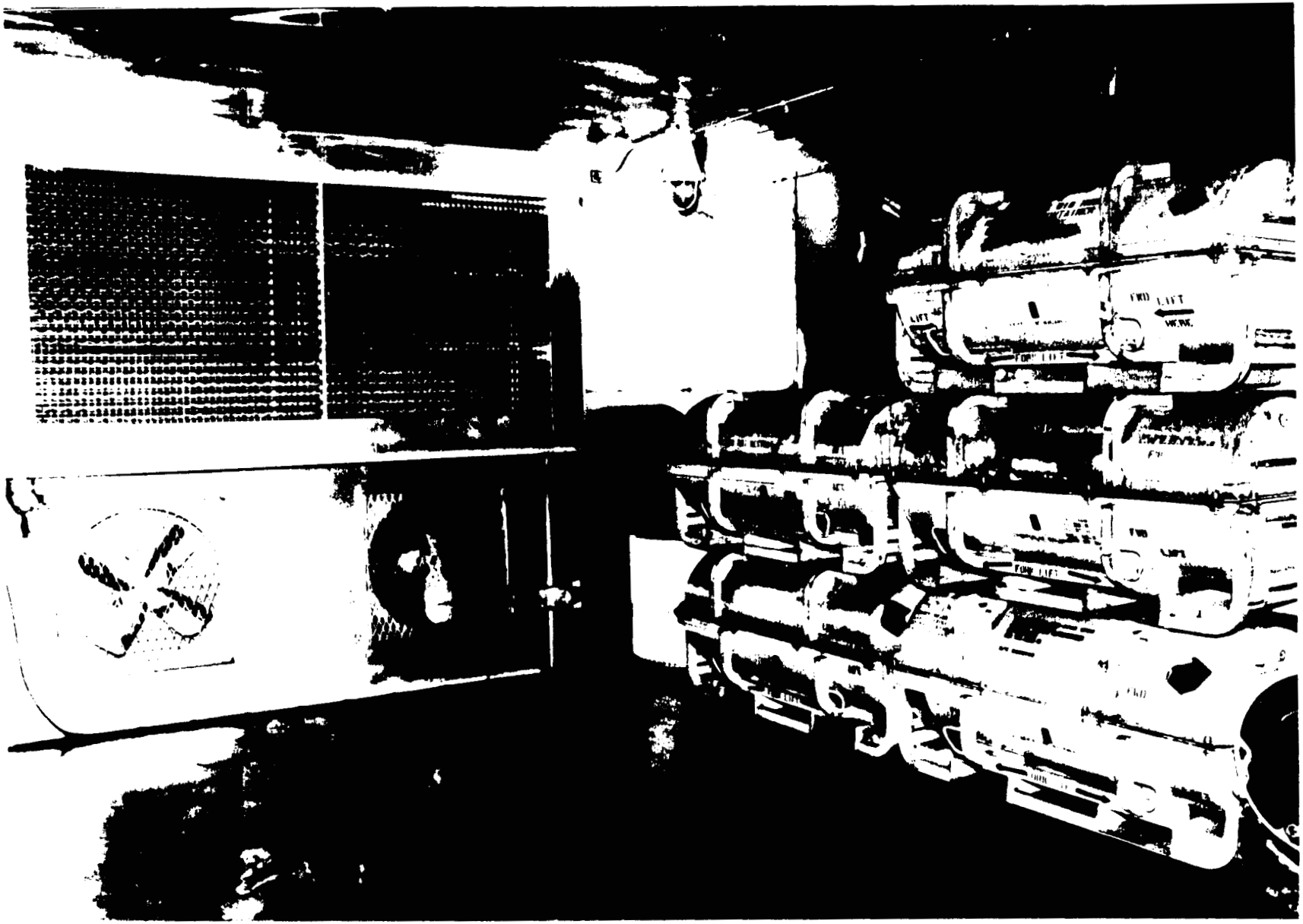
Projects listed in Tables 1 and 2 with potential cost avoidance were determined as meeting any one of the following criteria:

Projects with projected Work in Place (WIP) less than 75% of the Current Working Estimate (CWE) as of 1 OCT 1995 .

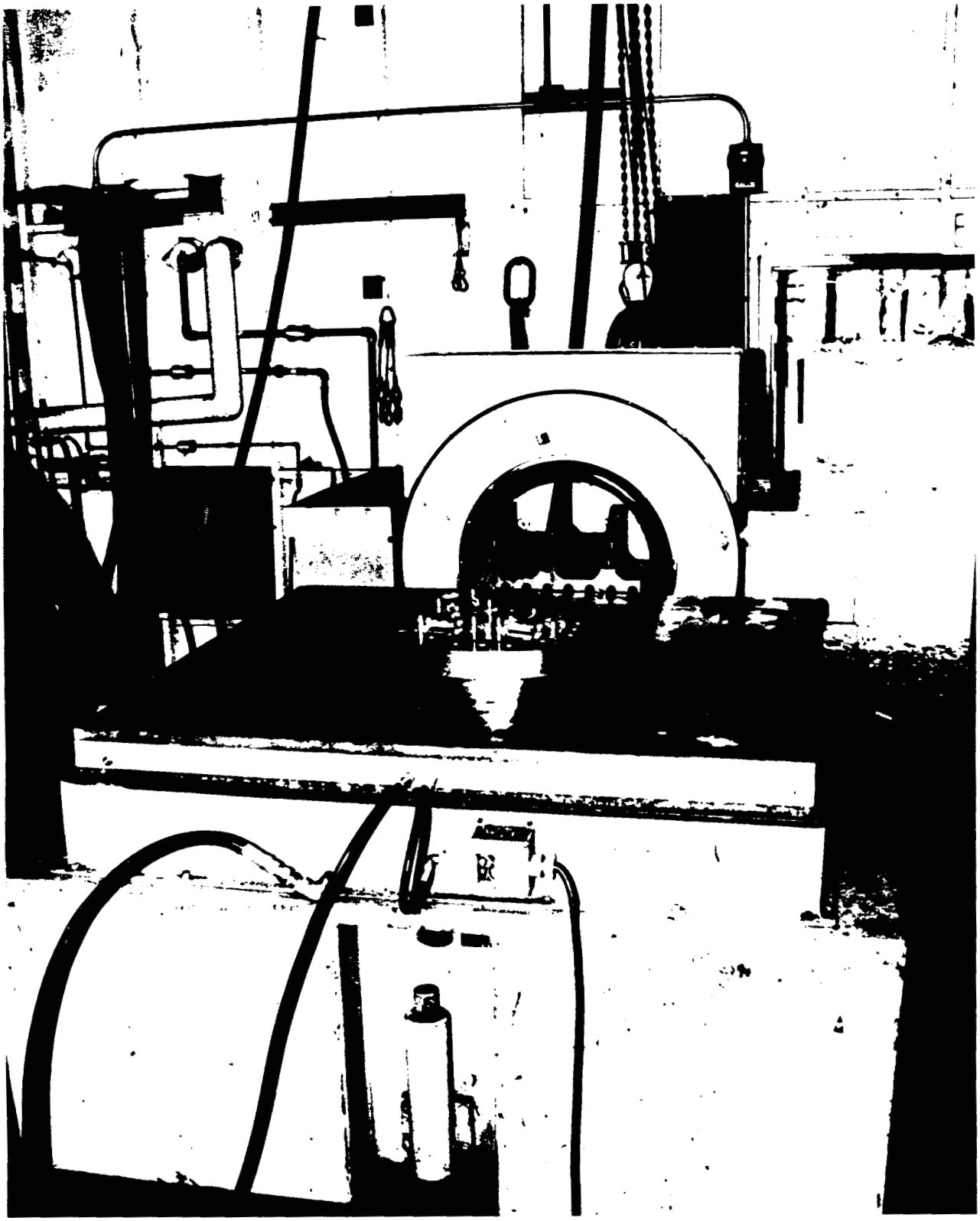
Projects with projected completion dates or Beneficial Occupancy Dates subsequent to 31 March 1996.

Projects with projected CWE amount greater than $15M.

The estimated cost avoidance for projects terminated after construction award would be approximately one-half of the CWE for the remaining work. Close-out, claims and other termination costs can consume the other half.



This temperature and humidity chamber, part of the Enviromental Test Facility is 2300 cubic feet and can control humidity and 1 to 99 percent R.H. IHD is presently running a 6 month temperature and humidity test for a joint US/UK Harpoon program.



Digital/Analog Vibration Control System (includes 20,000 Lb-F Electromagnetic Shaker)

SPECIAL FACILITIES AND EQUIPMENT
FACILITIES/EQUIPMENT CAPABILITY FORM

Technical Center Site	Indian Head Division, NSWC
Facility/Equipment Nomenclature or Title	Chemical/Physical Characterization

1. State the primary purpose(s) of the facility/equipment.

The major function of chemical and physical characterization facilities at Indian Head is the performance of the testing and analysis necessary to determine the properties of the standard energetic materials (propellants, explosives, pyrotechnics, and chemicals) and the raw materials used in their manufacture which are processed on a regular basis, whether for development or production. When raw materials for use in energetics are delivered by a supplier, chemical analyses are performed to determine if the material meets specification requirements. After propellants or explosives are made, the materials are characterized for their chemical and physical properties (i.e., chemical composition, stability, density, mechanical properties, burning rate). These tests are typically performed on each mix of propellant or explosive which is loaded into a motor or warhead to ensure quality and performance.

The facility has extensive chemical laboratories equipped with modern analytical equipment to support the chemical analysis portion of this workload. All mechanical properties testing is also done in this facility, which provides a variety of sophisticated test sets for this purpose. Burning rate tests on propellants, using the closed bomb for gun propellants and the strand burner and/or slab burner for rocket propellants, are also conducted here. The facility, using a scanning electron microscope and other techniques, provides metallurgical analysis for Indian Head.

The facility supports all in-house production programs with characterization of energetic materials. Production programs supported include Otto Fuel (monopropellant for the Navy's torpedos), Standard Missile and MK 50 torpedo warheads, JATO and aircrew escape propulsion units, 2.75" rocket motor grains, and LOVA gun propellant. Where standard propellants or explosives are being used in a development program, this facility also characterizes the energetic material. This facility also performs all of the chemical analyses

on samples taken as part of our monitoring program to ensure compliance with environmental regulations. This facility also provides the explosive and propellant machining capability, which is important to provide test samples and to achieve the final shape needed for some warheads and motors.

Equipment integral to this facility with a replacement value ≥ $500,000:

a. Boring Mill: The boring mill is a machine used to cut propellants and explosives from a remote location. This machine is specially designed to accommodate larger propellant samples and rocket motors. The mill is completely versatile and its capabilities are almost unlimited. The equipment is fixed. The machine is set on a special foundation and machine parts are trued and leveled with respect to each other. Remote control circuitry is run with conduit to the two remote control rooms at the machining facility. The cost to replace the boring mill is $900,000. The boring mill weighs approximately 40,000 pounds. and takes up 2,400 cubic feet.

The boring mill completes our capabilities as a propellant and explosive machining facility. This machine was designed and installed concurrently with the building design that houses it. To remove or relocate would require possible machine redesign and/or facility modifications.

b. High-Rate Tester: The test system is used to perform static tests (tensile, compression) on propellant and other energetic materials to define the mechanical behavior of the materials. The machine was specially designed to simulate the stresses and strains propellants would encounter upon ignition or detonation. This is a fixed asset with many facility support systems that are very difficult to move and relocate. The effort would require extensive facility modifications. Support systems include: hydraulic pump system, compressed gas delivery system, liquid nitrogen delivery system, and video monitoring system. The replacement value of the equipment is $850,000. The equipment's gross weight is approximately 5,000 pounds and it takes up 3,000 cubic feet of space. We receive outside contracts from private industry and other military operations requesting the tests this equipment performs.

2. Indicate whether the facility/equipment is portable, moveable or fixed as defined by paragraph 6, page 12 of this data call.

The facility is fixed as defined by paragraph 6, page 12 of this data call.

3. Provide the replacement value of the facility/equipment. Report the facility/equipment cost separate from any building and utilities that may be integral to the facility/equipment.

There are seventeen main buildings that comprise the Chemical/Physical Characterization test facility. Their estimated replacement value is $ 12,100K. The equipment associated with this facility has an estimated replacement value of $ 16,300K.

4. Provide the gross weight and cube of the facility/equipment.

N/A

5. Indicate any "special" utility support required by this facility/equipment other than normal electrical power.

Facility requires special instrumentation grounding, AC line conditioning, filtering and surge protection. Several buildings also requires 110 AC, 220/440 Volts 3-phase electrical power. Several buildings also require liquid nitrogen, in house vacuum system, and house compressed air.

6. Indicate any special budget requirements for the facility/equipment (i.e., special foundations, non-ferrous materials, shielding, hardening, etc.).

Primary ground girdle is required for grounding. Building must be hardened for close proximity to explosive operations. The are special hardened steel walled rooms in several of the buildings. There are also blasts walls and lightning protection systems required for this facility. Conductive floors and secondary containment for hazardous waste and hazardous material storage is also required. The facility also maintains other safety requirements as required by OP-5.

7. State any environmental control requirements for the facility/equipment (i.e., temperature, humidity, air scrubbing).

Temperature and humidity controls are required. The facility should have ventilation.

8. Indicate if this facility/equipment would be extremely difficult or impossible to replicate or relocate at another site and the impact to the Department of the Navy if this facility/equipment were lost. Consider existing Government-wide and commercial capabilities as the replication and impact statements are formulated.

These facilities are fixed and therefore would be very difficult to relocate. The performance of chemical and physical analysis on the energetic materials processed at Indian Head is integral to the performance of the production, engineering, and fleet support missions of Indian Head. Without an on-site capability to perform this function, it would be impossible to perform the other work in a safe and reliable manner; nor would it be possible to ensure the safety of the ordnance loaded for delivery to the fleet. This capability is an inherent part of operating a facility where energetic materials are processed. Movement of this facility without the other facilities would have no value.

9. Indicate how and when the facility/equipment was transported and or constructed at the site.

The facilities were constructed between 1902 and 1994 and have been continuously updated and modernized to meet current and future test requirements. A new $ 4.4 Million Chemical Laboratory will be in operation on Command during 1994.

10. List the functional support areas (previously provided in Tab A) that this facility/equipment support. Refer to Appendix A for the list of functional support areas.

2.5 Mines
2.7 Explosives
2.12 Weapons Propulsion
2.13 Other Ordnance
8.2 Countermeasures

This facility supports the following NSWC Technical Capabilities:

Rocket/Missile/Gun Propulsion
Energetics Manufacturing/Manufacturing Technology
Cartridge/Propellant Actuated Devices/Aircrew Escape Propulsion Systems
Explosives
Explosives Safety Engineering

11. Provide the historical utilization average for the past five fiscal years (1989-1993). Define the unit of measure used.

The historical utilization average was 250 day/year for FY89-93. A few of the buildings in the facility run on a 24 hours basis.

12. Provide the projected utilization data out to FY1997.

The facilities are projected to be utilized 365 days/year for FY94-97. A few of the buildings in the facility run on a 24 hours basis.

13. What is the approximate number of personnel used to operate the facility/equipment?

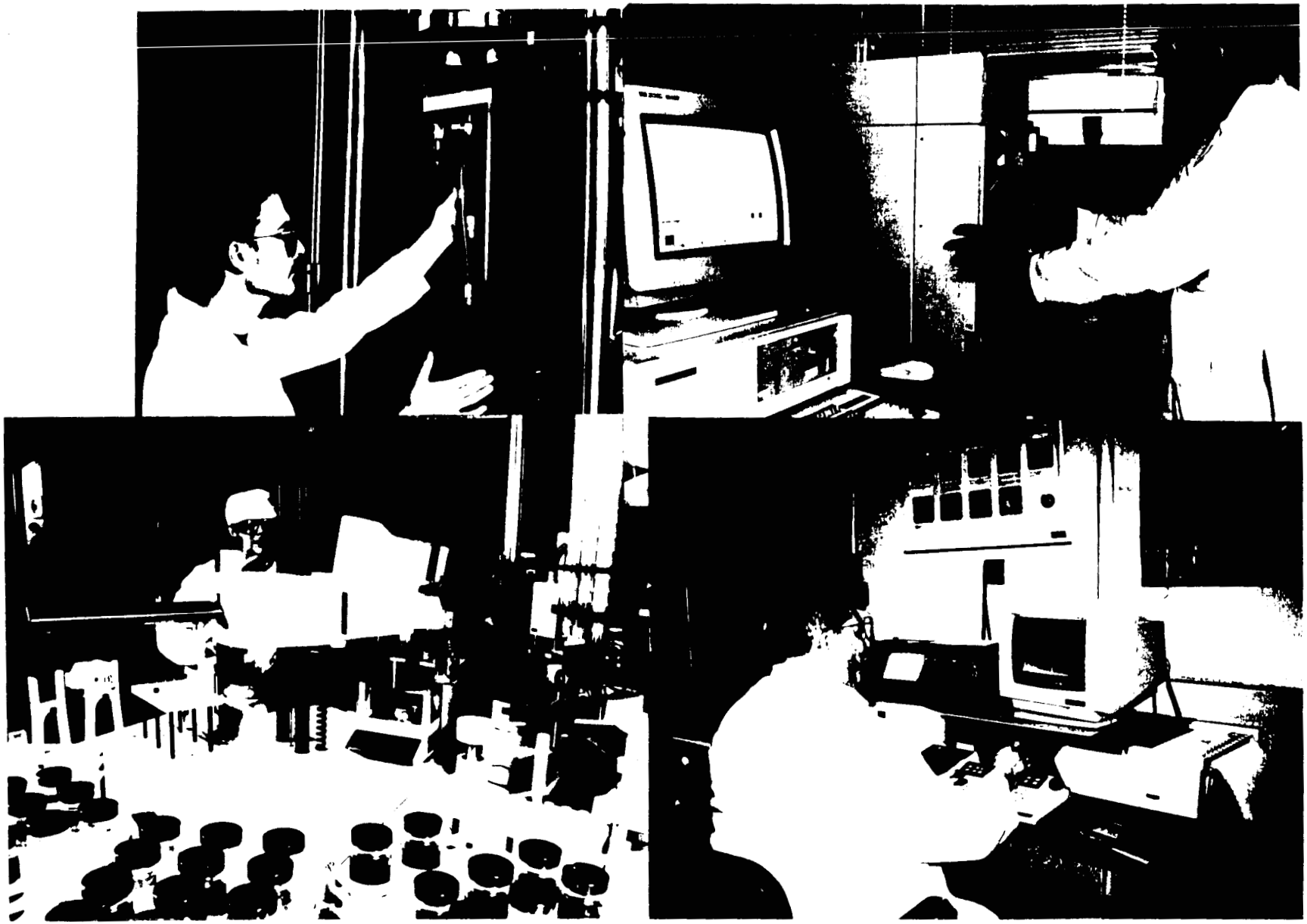
The approximate number of personnel used to operate the facility is 47.

14. What is the approximate number of personnel needed to maintain the equipment?

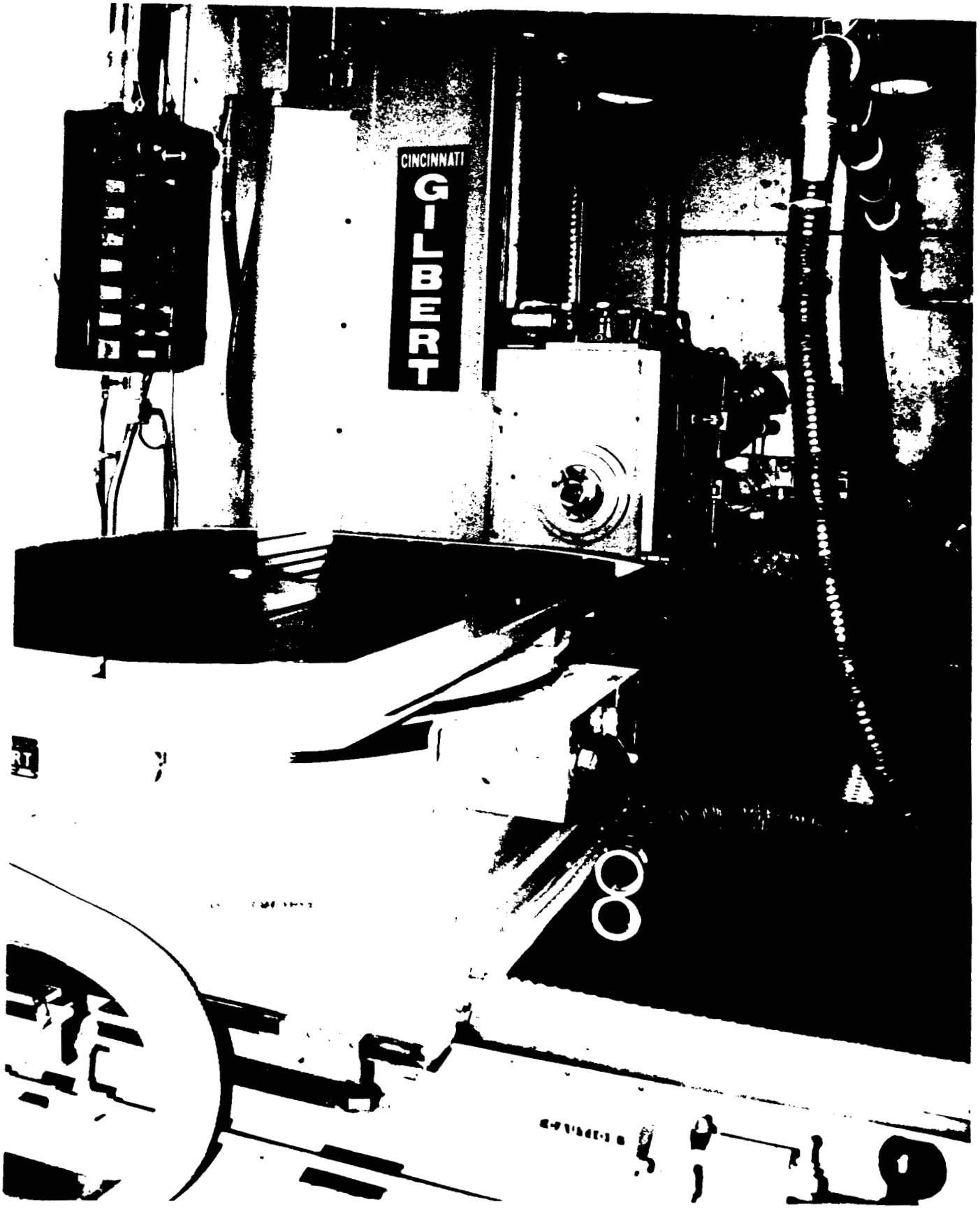
Three people.

15. Provide one 8 1/2 x 11 black and white photo of the facility/equipment.

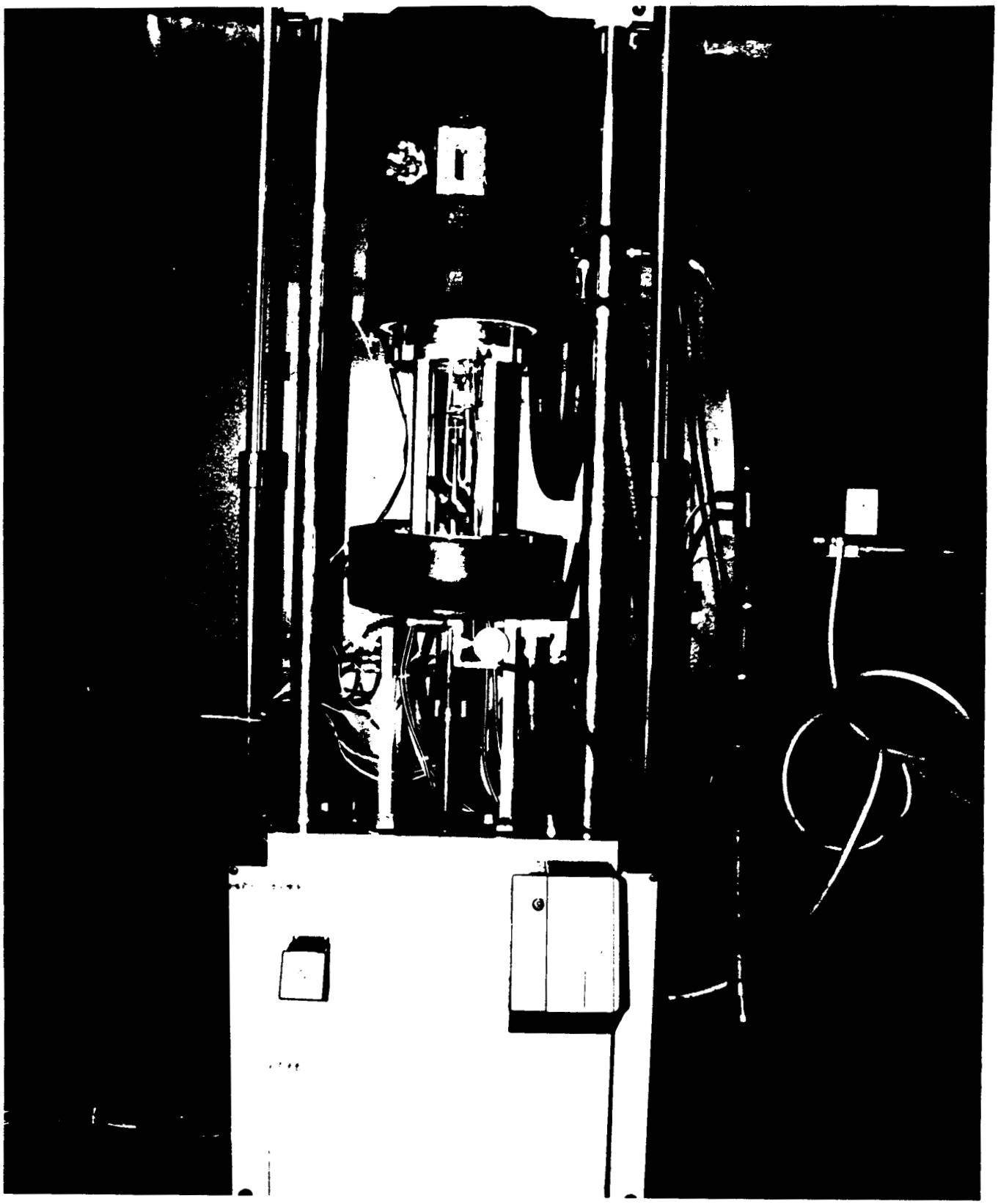
These laboratories perform physical/chemical/material characterization analyses of chemical raw materials, in process materials, and finished products. Material characterization may include determination of plume signature, ballistic performance, smoke generation and mechanical properties.



A sample of Indian Head Division's capabilities. Clockwise from top left: material characterization using the high rate/high pressure tester, the chemical extractors which determines residual propellant stabilizers, automated robotic system for propellant sample preparation, and microspectroscopy analysis of metals.



Boring Mill



High-Rate Tester

SPECIAL FACILITIES AND EQUIPMENT
FACILITIES/EQUIPMENT CAPABILITY FORM

Technical Center Site	Indian Head Division, NSWC
Facility/Equipment Nomenclature or Title	Honeywell/Bull DPS8000 Computer System

Note: This piece of equipment does not reside in any of the Special Facilites highlighted above. It provides support to the entire activity.

1. State the primary purpose(s) of the facility/equipment.

Transaction processing and timesharing system for division financial and supply processing.

2. Indicate whether the facility/equipment is portable, moveable or fixed as defined by paragraph 6, page 12 of this data call.

Moveable (Large mainframe computer system)

3. Provide the replacement value of the facility/equipment. Report the facility/equipment cost separate from any building and utilities that may be integral to the facility/equipment.

Equipment/Hardware $2.5 M, Software $0.5 M

4. Provide the gross weight and cube of the facility/equipment.

Gross weight 27,006 lb., Volume 1406 cu. ft.

5. Indicate any "special" utility support required by this facility/equipment other than normal electrical power.

Power distribution center and Uninterruptable Power Supply (UPS).

6. Indicate any special budget requirements for the facility/equipment (i.e., special foundations, non-ferrous materials, shielding, hardening, etc.).

Raised floor, fire suppression system, and physical security.

7. State any environmental control requirements for the facility/equipment (i.e., temperature, humidity, air scrubbing).

Temperature and humidity controls, 70 degrees with 40% humidity.

8. Indicate if this facility/equipment would be extremely difficult or impossible to replicate or relocate at another site and the impact to the Department of the Navy if this facility/equipment were lost. Consider existing Government-wide and commercial capabilities as the replication and impact statements are formulated.

It can be de-installed and relocated at considerable expense and would need adequate computer facilities with a controlled environment.

9. Indicate how and when the facility/equipment was transported and or constructed at the site.

Equipment was transported from manufacturer to site by commercial carriers. The original/initial equipment was installed in 1983 and is subjected to upgrades every two years.

10. List the functional support areas (previously provided in Tab A) that this facility/equipment support. Refer to Appendix A for the list of functional support areas.

Indirectly supports all FSAs

11. Provide the historical utilization average for the past five fiscal years (1989-1993). Define the unit of measure used.

The system is operational 24 hours/day, 5 days/week.

12. Provide the projected utilization data out to FY1997.

The system will be utilized at current levels until the applications are replaced by their open Systems Environment equivalents in FY 1996.

13. What is the approximate number of personnel used to operate the facility/equipment?

Two workyears to operate.

14. What is the approximate number of personnel needed to maintain the equipment?

One workyear to maintain.

15. Provide one 8 1/2 x 11 black and white photo of the facility/equipment.

Honeywell/Bull DPS8000 Computer System

SPECIAL FACILITIES AND EQUIPMENT
FACILITIES/EQUIPMENT CAPABILITY FORM

Technical Center Site	Indian Head Division, NSWC
Facility/Equipment Nomenclature or Title	Digital Telephone Switch

Note: This piece of equipment does not reside in any of the Special Facilites highlighted above. It provides support to the entire activity.

1. State the primary purpose(s) of the facility/equipment.

System 85 and System 75 digital switches provide routing of all incoming, outgoing, and intercom calls. Trunk lines run to the System 85 switch with a T-1 line running under the Mattawoman Creek to the Stump Neck annex, linking the System 75.

2. Indicate whether the facility/equipment is portable, moveable or fixed as defined by paragraph 6, page 12 of this data call.

This equipment is movable.

3. Provide the replacement value of the facility/equipment. Report the facility/equipment cost separate from any building and utilities that may be integral to the facility/equipment.

$729,362.

4. Provide the gross weight and cube of the facility/equipment.

14,400 pounds, 653.4 cubic feet

5. Indicate any "special" utility support required by this facility/equipment other than normal electrical power.

Conditioned power.

6. Indicate any special budget requirements for the facility/equipment (i.e., special foundations, non-ferrous materials, shielding, hardening, etc.).

Physical security.

7. State any environmental control requirements for the facility/equipment (i.e., temperature, humidity, air scrubbing).

Temperature/ humidity control, 75 degrees Fahrenheit with 40% humidity.

8. Indicate if this facility/equipment would be extremely difficult or impossible to replicate or relocate at another site and the impact to the Department of the Navy if this facility/equipment were lost. Consider existing Government-wide and commercial capabilities as the replication and impact statements are formulated.

It would take considerable effort to deinstall and relocate this equipment. The Indian Head Division could not communicate without the switch.

9. Indicate how and when the facility/equipment was transported and or constructed at the site.

Long haul trucks delivered in 1991.

10. List the functional support areas (previously provided in Tab A) that this facility/equipment support. Refer to Appendix A for the list of functional support areas.

Indirectly supports all FSAs

11. Provide the historical utilization average for the past five fiscal years (1989-1993). Define the unit of measure used.

FY91 124,440 hours
FY92 135,660 hours
FY93 125,540 hours

12. Provide the projected utilization data out to FY1997.

FY94-97 124,440 hours/year

13. What is the approximate number of personnel used to operate the facility/equipment?

There is no need for human intervention, 0 workyears.

14. What is the approximate number of personnel needed to maintain the equipment?

One workyear is spent maintaining this equipment.

15. Provide one 8 1/2 x 11 black and white photo of the facility/equipment.

Digital Telephone Switch

SPECIAL FACILITIES AND EQUIPMENT
FACILITIES/EQUIPMENT CAPABILITY FORM

Technical Center Site	Indian Head Division, NSWC
Facility/Equipment Nomenclature or Title	Local Area Network (LAN)

Note: This piece of equipment does not reside in any of the Special Facilites highlighted above. It provides support to the entire activity.

1. State the primary purpose(s) of the facility/equipment.

The Division Local Area Network (LAN) provide data and video communications. The LAN is the primary means of connectivity to all Division business systems. The LAN also provides backbone connectivity between forty-eight Novell file servers running office automation packages.

2. Indicate whether the facility/equipment is portable, moveable or fixed as defined by paragraph 6, page 12 of this data call.

The LAN is FIXED. It spans several miles and is attached to utility poles or buried.

3. Provide the replacement value of the facility/equipment. Report the facility/equipment cost separate from any building and utilities that may be integral to the facility/equipment.

REPLACEMENT VALUE

Cable Plant

Cable,strand, attachment hardware, amplifiers and power supplies.

(41,600 ft of cable plant * 15/ft) = $624,000. .

Equipment

- Customer premise electronics	=	$225,000
- Headend electronics	=	$ 35,000
- Bridges and routers	=	$112,000
		$372,000

TOTAL **$996,000**

4. Provide the gross weight and cube of the facility/equipment.

The LAN is comprised of cables spanning nearly 8 miles.

5. Indicate any "special" utility support required by this facility/equipment other than normal electrical power.

None

6. Indicate any special budget requirements for the facility/equipment (i.e., special foundations, non-ferrous materials, shielding, hardening, etc.).

There are physical security requirements.

7. State any environmental control requirements for the facility/equipment (i.e., temperature, humidity, air scrubbing).

The Headend electronics must be in a temperature controlled environment (75 degrees fahrenheit, 40% humidity).

8. Indicate if this facility/equipment would be extremely difficult or impossible to replicate or relocate at another site and the impact to the Department of the Navy if this facility/equipment were lost. Consider existing Government-wide and commercial capabilities as the replication and impact statements are formulated.

The LAN would be extremely difficult to relocate. The LAN could be replicated at another site for the cost listed in question three (assuming a site of similar size with similar quantities of buildings).

9. Indicate how and when the facility/equipment was transported and or constructed at the site.

The LAN was delivered by long-haul trucks, constructed on site beginning in 1983.

10. List the functional support areas (previously provided in Tab A) that this facility/equipment support. Refer to Appendix A for the list of functional support areas.

Indirectly supports all FSAs

11. Provide the historical utilization average for the past five fiscal years (1989-1993). Define the unit of measure used.

1989	700 USERS
1990	780 USERS
1991	850 USERS
1992	1,100 USERS
1993	1,300 USERS

12. Provide the projected utilization data out to FY1997.

1994	1,350 USERS
1995	1,400 USERS
1996	1,400 USERS
1997	1,400 USERS

13. What is the approximate number of personnel used to operate the facility/equipment?

No personnel are used to operate the equipment.

14. What is the approximate number of personnel needed to maintain the equipment?

Two people are needed to maintain the equipment.

15. Provide one 8 1/2 x 11 black and white photo of the facility/equipment.

Local Area Network

SPECIAL FACILITIES AND EQUIPMENT
FACILITIES/EQUIPMENT CAPABILITY FORM

Technical Center Site	Indian Head Division, NSWC
Facility/Equipment Nomenclature or Title	Video Teleconferencing (VTC)

Note: This piece of equipment does not reside in any of the Special Facilites highlighted above. It provides support to the entire activity.

1. State the primary purpose(s) of the facility/equipment.

The purpose of this AT&T Modular Video System is to allow video teleconferencing calls with other military installations in either point-to-point or multi-point modes. The Division joined the Defense Commercial Telecommunications Network (DCTN) which is the primary VTC network system within DOD and networks over 150 military installations.

2. Indicate whether the facility/equipment is portable, moveable or fixed as defined by paragraph 6, page 12 of this data call.

The system is called modular system and is considered moveable.

3. Provide the replacement value of the facility/equipment. Report the facility/equipment cost separate from any building and utilities that may be integral to the facility/equipment.

Estimated replacement cost of system is $500,000.

4. Provide the gross weight and cube of the facility/equipment.

The gross weight of the system is estimated at 5150 lbs. This figure is based on the shipping weight recorded by AT&T prior to transport, and includes a nominal amount for the cardboard boxes and containers. The cube of the equipment is approximately 600 cubic feet.

5. Indicate any "special" utility support required by this facility/equipment other than normal electrical power.

None

6. Indicate any special budget requirements for the facility/equipment (i.e., special foundations, non-ferrous materials, shielding, hardening, etc.).

Physical security

7. State any environmental control requirements for the facility/equipment (i.e., temperature, humidity, air scrubbing).

Temperature controls for electronics - 75 degrees F.

8. Indicate if this facility/equipment would be extremely difficult or impossible to replicate or relocate at another site and the impact to the Department of the Navy if this facility/equipment were lost. Consider existing Government-wide and commercial capabilities as the replication and impact statements are formulated.

Although the AT&T Modular Video System is a standard DCTN product, the Indian Head Division added remote VTC capabilities for two auxiliary training bays (teletraining), one in the same facility and one off-site. This required additional systems engineering on the part of AT&T and some standalone equipment. The system would be difficult to relocate and costly to replicate.

9. Indicate how and when the facility/equipment was transported and or constructed at the site.

The Naval Surface Warfare Center, Indian Head Division completed the installation of their VTC system on 6 December 1993. AT&T provided, delivered and installed all equipment.

10. List the functional support areas (previously provided in Tab A) that this facility/equipment support. Refer to Appendix A for the list of functional support areas.

Indirectly supports all FSAs

11. Provide the historical utilization average for the past five fiscal years (1989-1993). Define the unit of measure used.

System installation was completed on 6 December 1993. The remainder of December was then used for operator training and system demonstrations to Indian Head personnel. Utilization data for January - March 1994 is as follows:

January	08.43%
February	19.48%
March	21.00%

The unit of measure used is hours of teleconferencing used over a forty-hour week. Forty hours of usage would be 100% utilization.

12. Provide the projected utilization data out to FY1997.

1994	45%
1995	60%
1996	75%
1997	85%

As noted, NSWC Indian Head VTC is a new site on the DCTN. The above data has been developed based on historical data provided by the Naval Air Systems Command (AIR 7145) regarding the typical utilization growth of other sites, comparable in size to Indian Head.

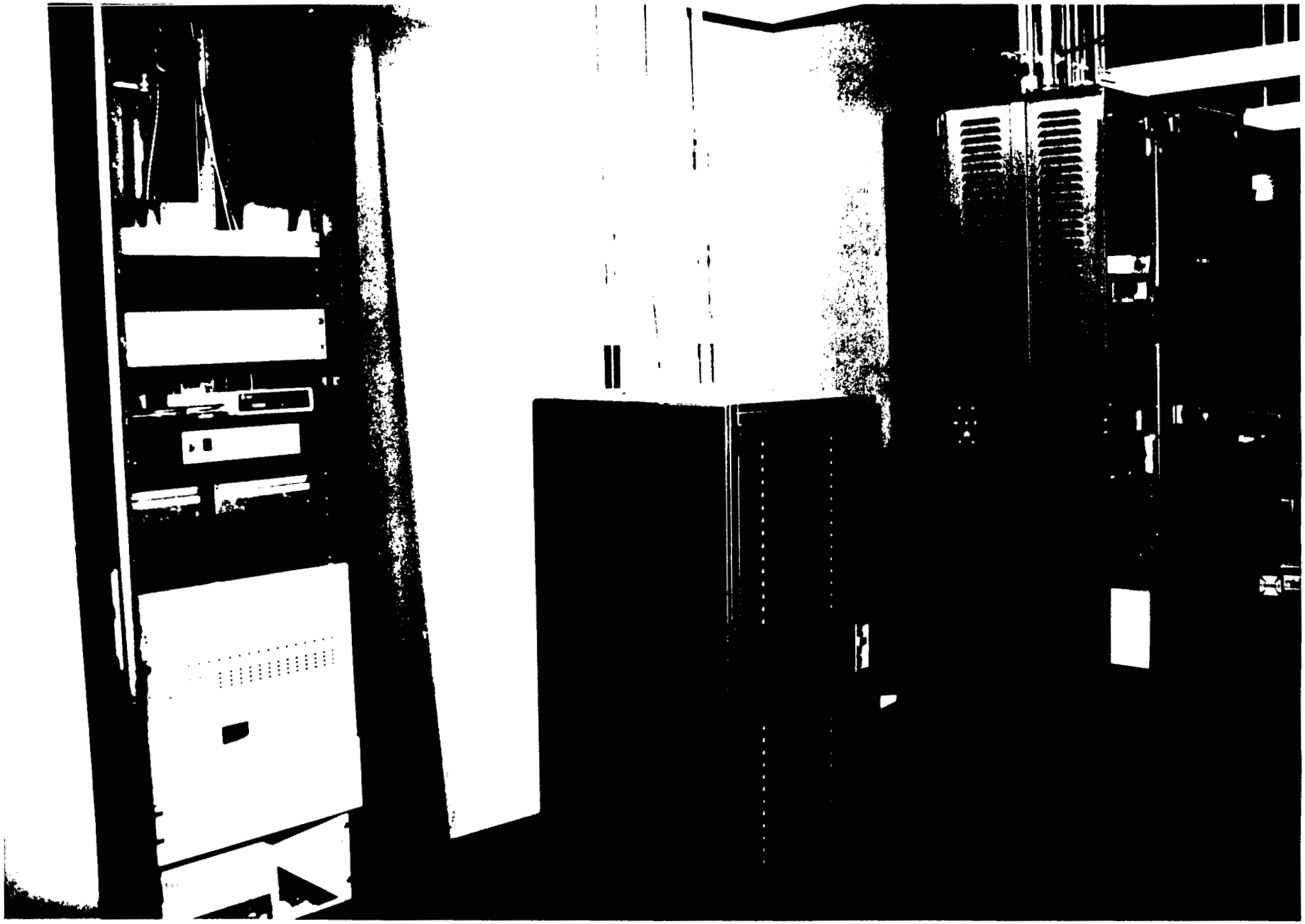
13. What is the approximate number of personnel used to operate the facility/equipment?

Two workyears to operate.

14. What is the approximate number of personnel needed to maintain the equipment?

One workyear to maintain.

15. Provide one 8 1/2 x 11 black and white photo of the facility/equipment.



Video Teleconferencing System

SPECIAL FACILITIES AND EQUIPMENT
FACILITIES/EQUIPMENT CAPABILITY FORM

Technical Center Site	Indian Head Division, NSWC
Facility/Equipment Nomenclature or Title	Prime 9955 Mod II Computer System

Note: This piece of equipment does not reside in any of the Special Facilites highlighted above. It provides support to the entire activity.

1. State the primary purpose(s) of the facility/equipment.

Current Oracle development platform. Used for processing the divisions Automated Training System (ATS), Personnel Certification System and the Budget system.

2. Indicate whether the facility/equipment is portable, moveable or fixed as defined by paragraph 6, page 12 of this data call.

Moveable (Super mini computer system)

3. Provide the replacement value of the facility/equipment. Report the facility/equipment cost separate from any building and utilities that may be integral to the facility/equipment.

$680K

4. Provide the gross weight and cube of the facility/equipment.

Gross weight 7000 lbs.
Volume 450 cu. ft.

5. Indicate any "special" utility support required by this facility/equipment other than normal electrical power.

Power distribution center and Uninterruptable Power Supply (UPS).

6. Indicate any special budget requirements for the facility/equipment (i.e., special foundations, non-ferrous materials, shielding, hardening, etc.).

Raised floor, fire suppression system, and physical security.

7. State any environmental control requirements for the facility/equipment (i.e., temperature, humidity, air scrubbing).

Temperature and humidity controls, 70 degrees with 40% humidity.

8. Indicate if this facility/equipment would be extremely difficult or impossible to replicate or relocate at another site and the impact to the Department of the Navy if this facility/equipment were lost. Consider existing Government-wide and commercial capabilities as the replication and impact statements are formulated.

It can be de-installed and relocated at considerable expense and would need adequate computer facilities with a controlled environment.

9. Indicate how and when the facility/equipment was transported and or constructed at the site.

The equipment was transported from manufacturer to site by commercial carriers. The original/initial equipment was installed in 1987.

10. List the functional support areas (previously provided in Tab A) that this facility/equipment support. Refer to Appendix A for the list of functional support areas.

Indirectly supports all FSAs

11. Provide the historical utilization average for the past five fiscal years (1989-1993). Define the unit of measure used.

The system is operational 24 hours a day, 5 days a week.

12. Provide the projected utilization data out to FY1997.

The system will be utilized at current levels until the applications are ported to the Open Systems Environment using the SUN platform in FY 1996.

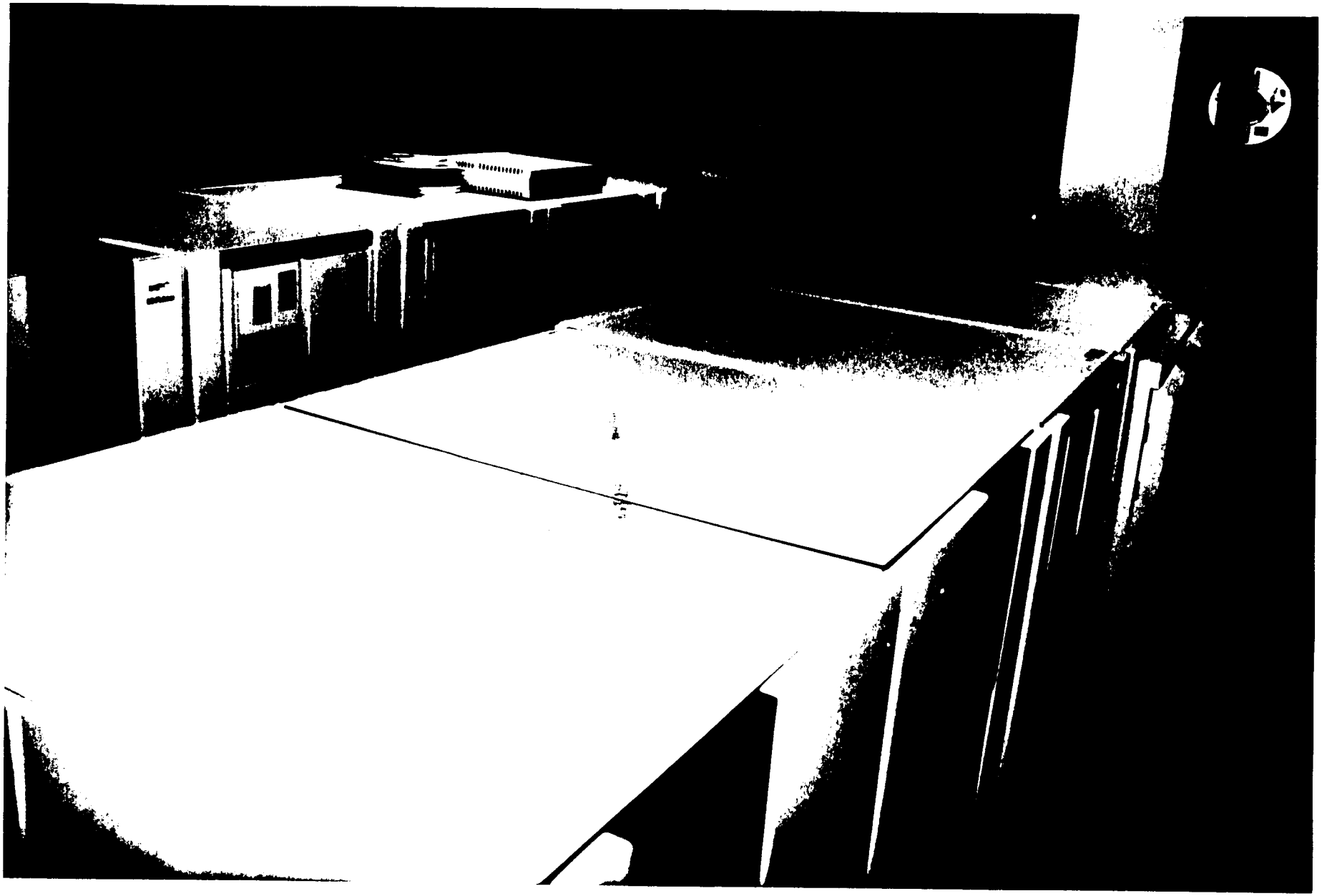
13. What is the approximate number of personnel used to operate the facility/equipment?

One workyear to operate.

14. What is the approximate number of personnel needed to maintain the equipment?

One workyear to maintain.

15. Provide one 8 1/2 x 11 black and white photo of the facility/equipment.



Prime 9955 Mod II Computer System

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205

DATA CALL 64
CONSTRUCTION COST AVOIDANCES

Table 1: Military Construction (MILCON) Projects (Excluding Family Housing Construction Projects)

Installation Name:	**INDIAN HEAD MD NSWCTRDIV**
Unit Identification Code (UIC):	**N00174**
Major Claimant:	**NAVSEA**

Project FY	Project No.	Description	Appn	Project Cost Avoid ($000)
1994	113	HAZARDOUS WASTE TREATMENT FACILITY	MCON	3,400
		Sub-Total - 1994		**3,400**
1995	114	POWER PLANT UPGRADES	MCON	4,000
1995	121	DENITRATION/ACID MIX FACILITY	MCON	6,400
		Sub-Total - 1995		**10,400**
1996	146T	EXPLOSIVE TEST FACILITY	BRAC	10,300
		Sub-Total - 1996		**10,300**
1999	129	VOC RECOVERY EXTRUSION	MCON	850
		Sub-Total - 1999		**850**
2000	132	MOTOR RECLAMATION FACILITY	MCON	3,600
2000	134	VOC RECOVERY MIXER	MCON	1,200
2000	142	VOC RECOVERY	MCON	3,100
2000	143	EXPL COUNTERMSR ASSEM FAC	MCON	6,700
		Sub-Total - 2000		**14,600**
2001	130	HAZ MATERIAL WAREHOUSE	MCON	7,000

R

DATA CALL 64

CONSTRUCTION COST AVOIDANCES

Table 1: Military Construction (MILCON) Projects (Excluding Family Housing Construction Projects)

Installation Name:	**INDIAN HEAD MD NSWCTRDIV**
Unit Identification Code (UIC):	**N00174**
Major Claimant:	**NAVSEA**

Project FY	Project No.	Description	Appn	Project Cost Avoid ($000)
2001	144	CONFINED BURN FACILITY	MCON	9,600
		Sub-Total - 2001		16,600
		Grand Total		56,150

BRAC-95 CERTIFICATION

I certify that the information contained herein is accurate and complete to the best of my knowledge and belief.

MICHAEL D. THORNTON
NAME (Please type or print)

Signature

CDR, CEC, USN
Title

9 Dec 94
Date

MILCON PROGRAMMING DIVISION
Division

NAVAL FACILITIES ENGINEERING COMMAND
Activity

I certify that the information contained herein is accurate and complete to the best of my knowledge and belief.

MAJOR CLAIMANT LEVEL

J. E. BUFFINGTON, RADM, CEC, USN
NAME (Please type or print)

Signature

COMMANDER
Title

12/9/94
Date

NAVAL FACILITIES ENGINEERING COMMAND
Activity

I certify that the information contained herein is accurate and complete to the best of my knowledge and belief.

DEPUTY CHIEF OF NAVAL OPERATIONS (LOGISTICS)
DEPUTY CHIEF OF STAFF (INSTALLATIONS & LOGISTICS)

W. A. EARNER
NAME (Please type or print)

Signature

Title

12/9/94
Date

DATA CALL 64

CONSTRUCTION COST AVOIDANCES

Table 1: Military Construction (MILCON) Projects (Excluding Family Housing Construction Projects)

Installation Name:	**INDIAN HEAD MD NSWCTRDIV**
Unit Identification Code (UIC):	**N00174** #205
Major Claimant:	**NAVSEA**

Project FY	Project No.	Description	Appn	Project Cost Avoid ($000)
1994	113	HAZARDOUS WASTE TREATMENT FACILITY	MCON	2,681
		Sub-Total - 1994		**2,681**
1996	146T	EXPLOSIVE TEST FACILITY	BRAC	4,578
		Sub-Total - 1996		**4,578**
1997	114	POWER PLANT UPGRADES	MCON	7,100
		Sub-Total - 1997		**7,100**
1998	121	DENITRATION/ACID MIX FAC	MCON	6,850
		Sub-Total - 1998		**6,850**
1999	129	VOC RECOVERY EXTRUSION	MCON	850
		Sub-Total - 1999		**850**
2000	132	MOTOR RECLAMATION FACILITY	MCON	3,600
2000	134	VOC RECOVERY MIXER	MCON	1,200
2000	142	VOC RECOVERY	MCON	3,100
2000	143	EXPL COUNTERMSR ASSEM FAC	MCON	6,700
		Sub-Total - 2000		**14,600**

BRAC-95 CERTIFICATION

I certify that the information contained herein is accurate and complete to the best of my knowledge and belief.

MARK E. DONALDSON
NAME (Please type or print)

Signature

CDR, CEC, USN
Title

12 July 1994
Date

MILCON PROGRAMMING DIVISION
Division

FACILITIES PROGRAMMING AND CONSTRUCTION DIRECTORATE
Department

NAVAL FACILITIES ENGINEERING COMMAND
Activity

Enclosure (1)

I certify that the information contained herein is accurate and complete to the best of my knowledge and belief.

MAJOR CLAIMANT LEVEL

J. E. BUFFINGTON, RADM, CEC, USN
NAME (Please type or print)

Signature

COMMANDER
Title

7/13/94
Date

NAVAL FACILITIES ENGINEERING COMMAND
Activity

I certify that the information contained herein is accurate and complete to the best of my knowledge and belief.

DEPUTY CHIEF OF NAVAL OPERATIONS (LOGISTICS)
DEPUTY CHIEF OF STAFF (INSTALLATIONS & LOGISTICS)

W. A. EARNER
NAME (Please type or print)

Signature

Title

2/18/94
Date

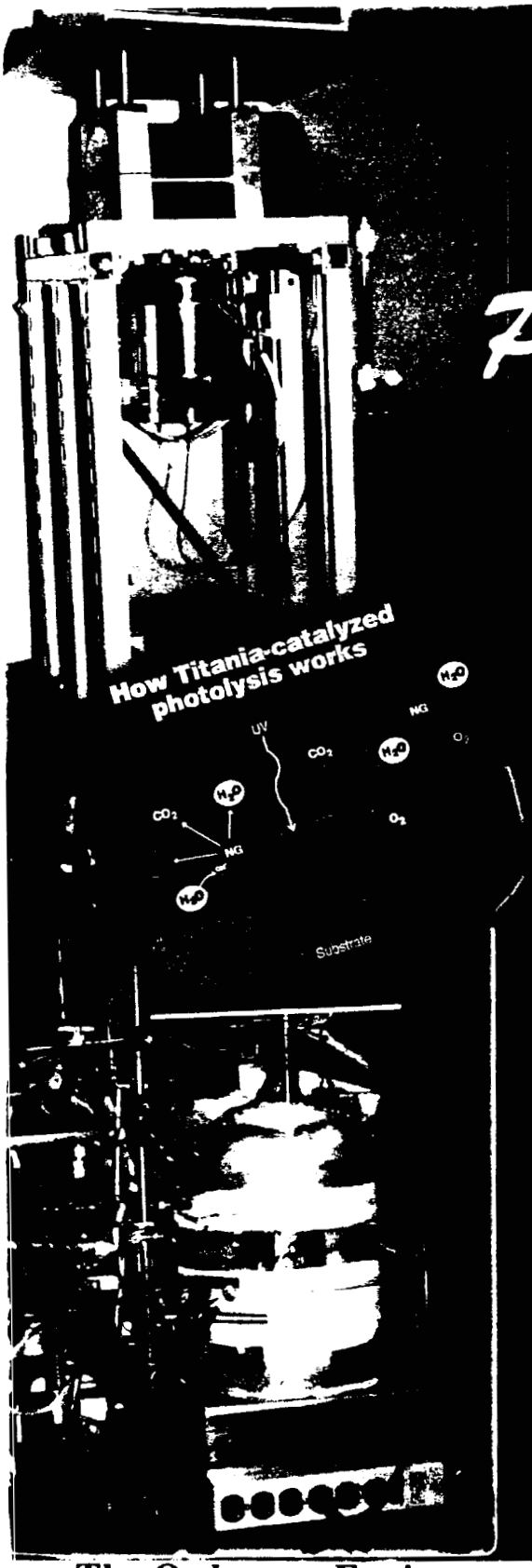
DATA CALL 64

CONSTRUCTION COST AVOIDANCES

Table 1: Military Construction (MILCON) Projects (Excluding Family Housing Construction Projects)

Installation Name:	**INDIAN HEAD MD NSWCTRDIV**
Unit Identification Code (UIC):	**N00174** #205
Major Claimant:	**NAVSEA**

Project FY	Project No.	Description	Appn	Project Cost Avoid ($000)
2001	130	HAZ MATERIAL WAREHOUSE	MCON	7,000
2001	144	ENERGETIC WASTE FACILITY	MCON	9,600
		Sub-Total - 2001		**16,600**
		Grand Total		**53,259**



Photocatalytic Treatment of Air Contaminated With Explosives

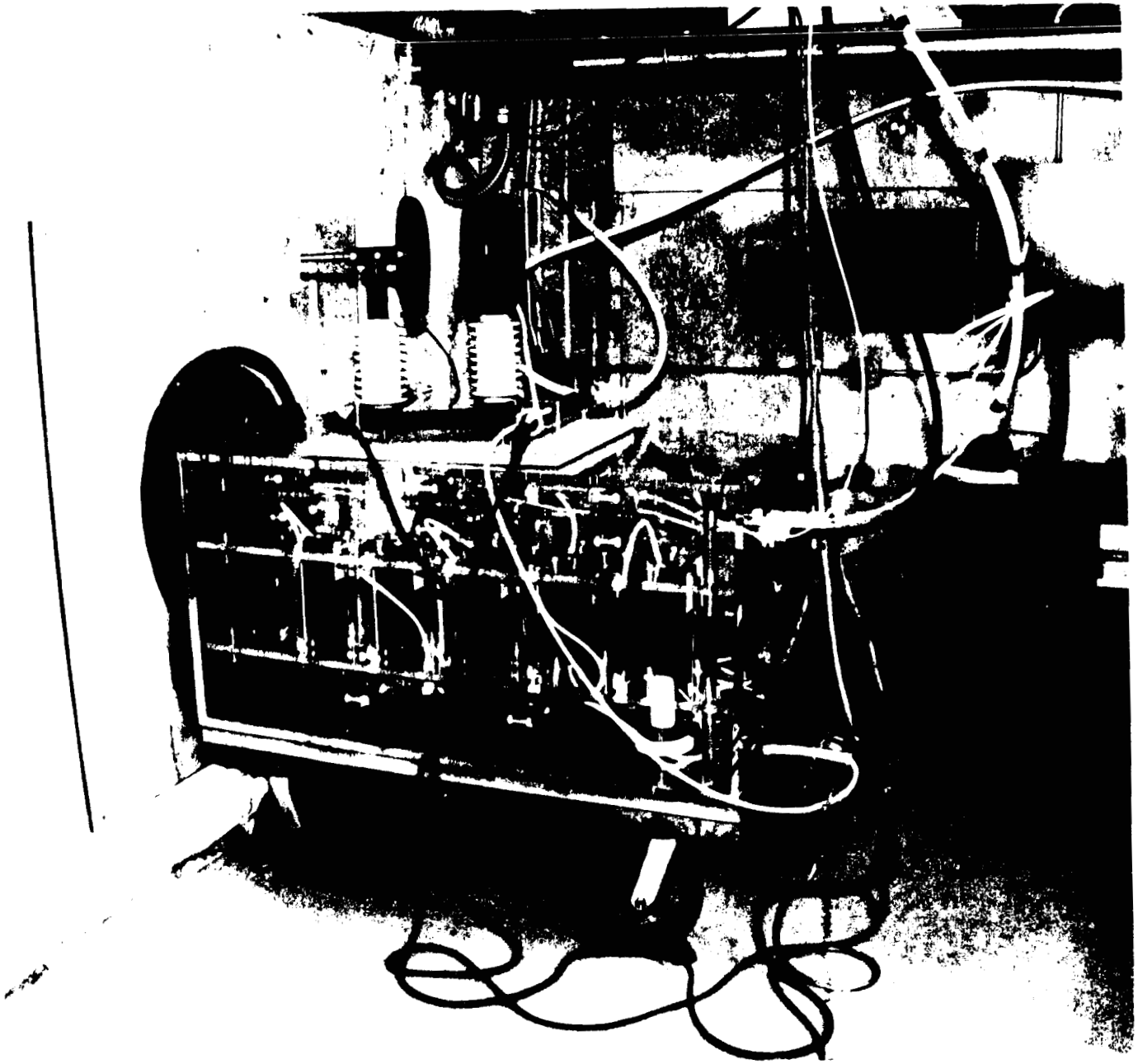
Indian Head engineers are working with Florida Solar Energy Center scientists to develop a photocatalytic oxidation process to treat air streams contaminated with nitroglycerine and solvents.

The photocatalytic process uses ultraviolet light and a titanium dioxide catalyst to convert 99%+ of the contaminants into environmentally benign compounds.

The process has been successfully demonstrated on the bench scale and is currently being scaled up to the pilot scale. The ultimate goal is the full scale implementation of the process at a DoD facility to demonstrate the technology for wide-spread application.

The bench scale and pilot scale units will be used for future feasibility studies on other candidate DoD air streams.

The Ordnance Environmental Support Office (OESO) is responsible for the evaluation and coordination of environmental technology proposals, determination of critical technology, maintenance of ordnance environmental database, and recommendations for Navy policies and procedures for environmental compliance.



The Marx Generator is used to provide 300,000 volt energy source for electrostatic discharge (ESD) test.

SPECIAL FACILITIES AND EQUIPMENT
FACILITIES/EQUIPMENT CAPABILITY FORM

Technical Center Site	Indian Head Division, NSWC
Facility/Equipment Nomenclature or Title	Extruded Products Facility

1. State the primary purpose(s) of the facility/equipment.

This facility is the only government-owned, government-operated extrusion plant in the country for the manufacture of propellant grains for solid rocket motors. The primary purpose of this facility is to manufacture, load, assemble, disassemble, and rework:

- extruded composite and double base propellant grains
- propellant systems,
- ignition devices for rocket igniters,
- safe and arm devices,
- gun primers,
- rocket motors, and
- PAD/AEPS rocket motors and cartridge grains.

Other capabilities provided include:

- Conducting manufacturing methods and technology studies,
- Proving-out production equipment and tooling,
- Developing extrusion processes for new products and identifying facility requirements for production,
- Supporting private industry by transferring new products from preproduction and pilot production to quantity manufacturing,
- Assisting in developing final specifications for products,
- Developing safety guidelines and improving operational methods, and
- Providing a back up capability to private industry production (which was utilized in 1988-92, when Radford Army Ammunition Plant's MK 90 grainline was shutdown due to fatalities) and serving as a mobilization base as seen during Desert Storm for the Mk 22 Mod 4 Rocket Motor.

The facility's production activities include: Mk 117 Jet-Assisted Take-Off (JATO) motors; Mk 22 solid rocket motors for the Mine Clearing Line Charge (MICLIC) system; Mk 90 motors for the Hydra 70 weapons system (2.75" rocket), MK 1 RAPEC, M9 Rocket Catapult, and M37 Rocket Catapult motors for aircraft ejection systems; and production activities for the ASROC and Zuni systems. These facilities are flexible and can be adapted for many other uses to do specialty production or to quickly react to a need.

Equipment integral to this facility with a replacement value ≥ $500,000:

a. Seven 15" Horizontal Extrusion Presses: The primary purpose of the horizontal presses is to process double-base and composite propellants. These presses have supported the 2.75" rocket (used by all services), ASROC, and ZUNI programs, MICLIC's MK22 line throwing rocket system, and various AEPS (Aircrew Escape Propulsion System) programs.

Assets are best considered fixed. The presses must be removed through the top of the building requiring roof removal and heavy duty cranes. Buildings must be specially constructed to house these presses. The hydraulic and control systems are best described as "moveable" assets although the connecting infrastructure would make relocation very expensive.

The replacement value of each press system is estimated at $ 1,000,000.

b. Two 3" Spiral Multi-Wrap Machines: The primary purpose of this machine is to apply a peripheral inhibitor on double-base propellant grains to inhibit the burn during rocket motor firing. Multiple layers of inhibitor tape are applied simultaneously in a spiral pattern on the outside circumference of the propellant. These machines have supported the 2.75" rocket program. This machine is characterized as a "fixed" asset with a replacement value of $500,000.

The manufacturer of this equipment no longer produces this type of machine. Appropriate buildings, utility systems, and environmental control systems would need to be constructed for relocation. Portions of the building would have to be removed in order to access the equipment.

c. 5" Spiral Multi-Wrap Machines: The primary purpose of this machine is to apply a peripheral inhibitor on double-base propellant grains to inhibit the burn during rocket motor firing. Multiple layers of inhibitor tape are applied simultaneously in a spiral pattern on the outside circumference of the propellant. This facility has supported the ZUNI program, MICLIC's MK22 line throwing rocket system and DEMNS system. This machine is

characterized as a fixed asset. The replacement value of this facility is $500,000.

The manufacturer of this equipment no longer produces this type of machine. Appropriate buildings, utility systems, and environmental control systems would need to be constructed for relocation. Portions of the building would have to be removed in order to access the equipment.

d. 3" Dowel Rod Machine: The primary purpose of this machine is to machine the outside diameter of double-base propellant grains. This machine is used to supported the 2.75" weapon system. This is a fixed asset with a replacement value of $900,000.

Replication of this machine would be possible. Appropriate buildings, utility systems, and environmental control systems would need to be constructed for relocation. Relocation of the facility would damage portions of the existing facility. Portions of the building would have to be removed in order to access the equipment.

e. 5" Dowel Rod Machine: The primary purpose of this machine is to machine the outside diameter of double-base propellant grains. This machine has supported the ZUNI weapon system and MICLIC's MK22 line throwing rocket system. The equipment would have to be removed through the top or side of the building requiring roof or wall removal and heavy duty cranes. The replacement value of this machine is $900,000.

Replication of this machine would be possible. Relocation of these facilities would be very difficult. Appropriate buildings, utility systems, and environmental control systems would need to be constructed for relocation. Relocation of the facility would damage portions of the existing facility. Portions of the building would have to be removed in order to access the equipment.

f. Real-Time Radiographic Machine: The primary purpose of the real-time radiographic machine is to inspect the internal characteristics of propellant grains. The machine utilizes non-destructive inspection techniques and is capable of 3600 inspections along the entire length of the grains. This facility has supported the 2.75" weapon system.

The facility is divided into two areas, the X-ray machine and the control bay. The X-ray machine consists of cathode and anode generators, x-ray tube, intensifier, and manipulator. Control system consist of x-ray processing console, grain inspection control, real time video screens, and computer controlled image processor. This equipment is moveable, but because of the sensitive nature of the electronics, it is expected that many components would be damaged in dismantling/shipment and need replacement.

The replacement cost of this equipment is $3,000,000. The gross weight of this equipment is 15,000 lbs.

Exact replication of this facility is extremely difficult. Some of the components used in the facility are no longer manufactured. This facility was custom designed and built to process particular propellant grains only. Relocation of this facility would risk damaging sensitive x-raying equipments. Impact of the Navy would be critical if this facility was lost. This facility is necessary to support important weapon programs.

2. Indicate whether the facility/equipment is portable, moveable or fixed as defined by paragraph 6, page 12 of this data call.

Facilities are fixed.

3. Provide the replacement value of the facility/equipment. Report the facility/equipment cost separate from any building and utilities that may be integral to the facility/equipment.

The Extrusion Plant at Indian Head operates 90 buildings. Replacement cost is estimated at $85M.

4. Provide the gross weight and cube of the facility/equipment. N/A

N/A

5. Indicate any "special" utility support required by this facility/equipment other than normal electrical power.

90 psi compressed air, 220 & 440 volt electricity, fresh water, river water for cooling, explosive deluge sprinkler system, UV sprinkler system, steam for equipment heating.

6. Indicate any special budget requirements for the facility/equipment (i.e., special foundations, non-ferrous materials, shielding, hardening, etc.).

Conductive floors, static grounding system, lightning protection system, blast viewports, explosive shields, explosive blast walls, frangible roofs, and explosion proof electrical service/components.

7. State any environmental control requirements for the facility/equipment (i.e., temperature, humidity, air scrubbing).

The facility processes large amounts of hazardous materials including explosive liquids, powdered high explosives, strong acids/bases and volatile organic compounds (VOC). This requires that many of the buildings have scrubbers, condensers and filtering systems for air emission environmental controls. Wastewater is processed through settling tanks and carbon adsorption systems before being discharged. Acidic waste waters are neutralized to an acceptable pH and then processed through a salt removal facility before being discharged. The Navy has made a large investment (>$12M) in recent years to ensure these processes remain environmentally compliant.

8. Indicate if this facility/equipment would be extremely difficult or impossible to replicate or relocate at another site and the impact to the Department of the Navy if this facility/equipment were lost. Consider existing Government-wide and commercial capabilities as the replication and impact statements are formulated.

Indian Head and Radford Army Ammunition Plant are the only active facilities which have the capability to extrude up to 12 inch diameter propellant grains in the United States. Indian Head is the sole source to machine 5 inch and larger extruded rocket motors.

a. This facility is fixed and therefore would be very difficult to relocate for the following reasons:

- Quantity of buildings is high and the specialized nature of operations makes construction costs prohibitive
- Equipment removal would require the dismantling of many buildings
- Most of the equipment is large and heavy
- Rebuilding the infrastructure to house and support this type of equipment would be very costly

b. The facility loss impact to the Department of Defense would be:

- Non-support of necessary ordnance items during the startup/toolup lead time for another facility to come on line,

- Loss of a quick response "warm line" that can be used to produce small to intermediate quantities of extruded, energetic products, while waiting for the large scale production facility to begin its activities. **In every major conflict, since World War II, the extruded products facility was used to produce products to fill emergency needs, while the GOCO or private, high volume sources were being started.** IHDIV is the second source of certain energetics. There have been several instances where the cost of an energetic product has been reduced as much as half just because Indian Head had the capability to produce the product. Without this capability, the Navy would be held captive to the monopoly of private industry.

- Loss of manufacturing capability of any grain over 2.75" (Radford is only set up to produce stick propellant and 2.75" grains.)

- Loss of the only GOGO extrusion facility which would result in loss of DoD technical expertise in the production of these critical energetic items which supports acquisition and in-Service engineering roles

With the current warfighting scenario of regional conflicts, it is unlikely that large production capabilities will be needed. IHDIV provides the surge capability that will be required with this type of conflict for a variety of energetic products. Without Indian Head's surge capability, the Navy and DoD will suffer the delay and startup costs of large manufacturing facilities.

c. Recent history has demonstrated the value of the Navy having an active double-base extruded facility - the surge requirement during Desert Storm/Desert Shield and to supplement the void created as a result of Radford Army Ammunition Plant being shut down for a prolonged period of time because of an explosive incident.

9. Indicate how and when the facility/equipment was transported and or constructed at the site.

Facilities were originally constructed between 1910 and 1953. Renovations and some new buildings have been recently added.

10. List the functional support areas (previously provided in Tab A) that this facility/equipment support. Refer to Appendix A for the list of functional support areas.

2.12 Weapons Propulsion
2.13 Other Ordnance
8.2 Countermeasures

This facility supports the following NSWC Technical Capabilities:

Rocket/Missile/Gun Propulsion
Energetics Manufacturing/Manufacturing Technology
Cartridge/Propellant Actuated Devices/Aircrew Escape Propulsion Systems

11. Provide the historical utilization average for the past five fiscal years (1989-1993). Define the unit of measure used.

Historical Utilization:

FY89 - 5,244,000 lbs grains and 44,006 ignition devices
FY90 - 3,484,000 lbs grains and 48,692 ignition devices
FY91 - 3,484,000 lbs grains and 40,000 ignition devices
FY92 - 2,208,000 lbs grains and 40,000 ignition devices
FY93 - 1,013,000 lbs grains and 35,000 ignition devices

Note:

(1) FY89 through FY92 demonstrate the surge capabilities of Indian Head to increase production as a result of Radford Army Ammunition Plant being shut down for a prolonged period of time because of an explosive incident and to meet the needs of Desert Storm.

(2) The propellant grains are used in many different items including: Mk 90 Grain (2.75" rocket), Mk 88 ZUNI Rocket Motor, Mk 22 MICLIC, ASROC Rocket Motor, M9 Rocket Catapult, M37 Rocket Catapult, CKU-22/A Cartridge, Under Seat Rocket Motors (USRMs), APOBS, Mk 18 Rocket Motor, and NOSOL Propellant for stores release cartridges and CADs.

(3) The above numbers include only normal scheduled production programs. Unscheduled programs in support of special jobs are not included. The following is a list

of these special programs for the past year.

-disassembled 3 different contractor items for investigation
-loaded/disassembled 9 different items in support of engineering investigations
-loaded 9 different items in support of development
-loaded 9 different items for qualification

12. Provide the projected utilization data out to FY1997.

Projected utilization:

FY94 - 696,300 lbs grains and 30,000 ignition devices
FY95 - 150,000 lbs grains and 30,000 ignition devices
FY96 - 264,000 lbs grains and 30,000 ignition devices
FY97 - 264,000 lbs grains and 30,000 ignition devices

13. What is the approximate number of personnel used to operate the facility/equipment?

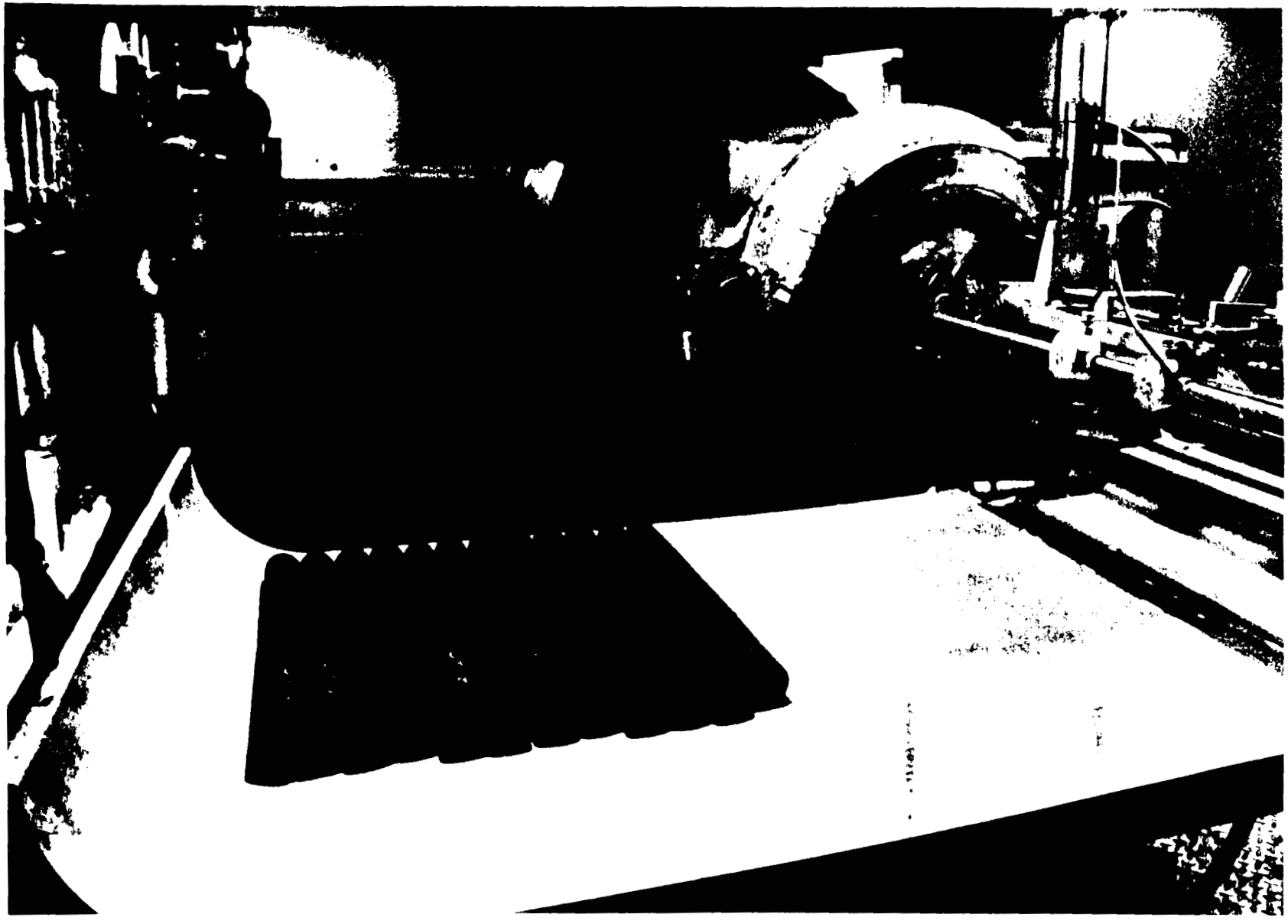
Currently approximately 70 operators on one shift operate this facility.

14. What is the approximate number of personnel needed to maintain the equipment?

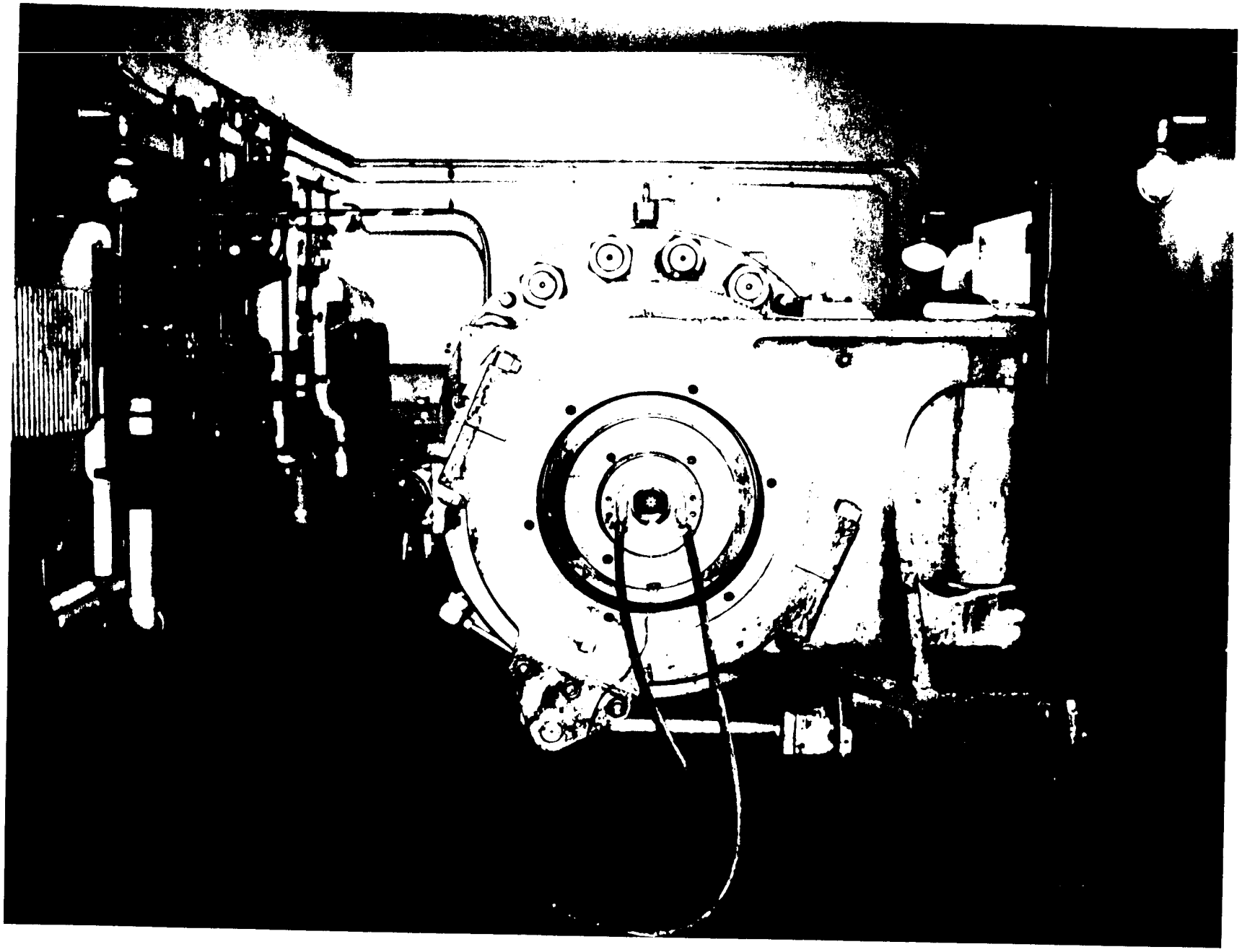
This facility requires services from an electrician, a pipefitter, and two production machinery mechanics.

15. Provide one 8 1/2 x 11 black and white photo of the facility/equipment.

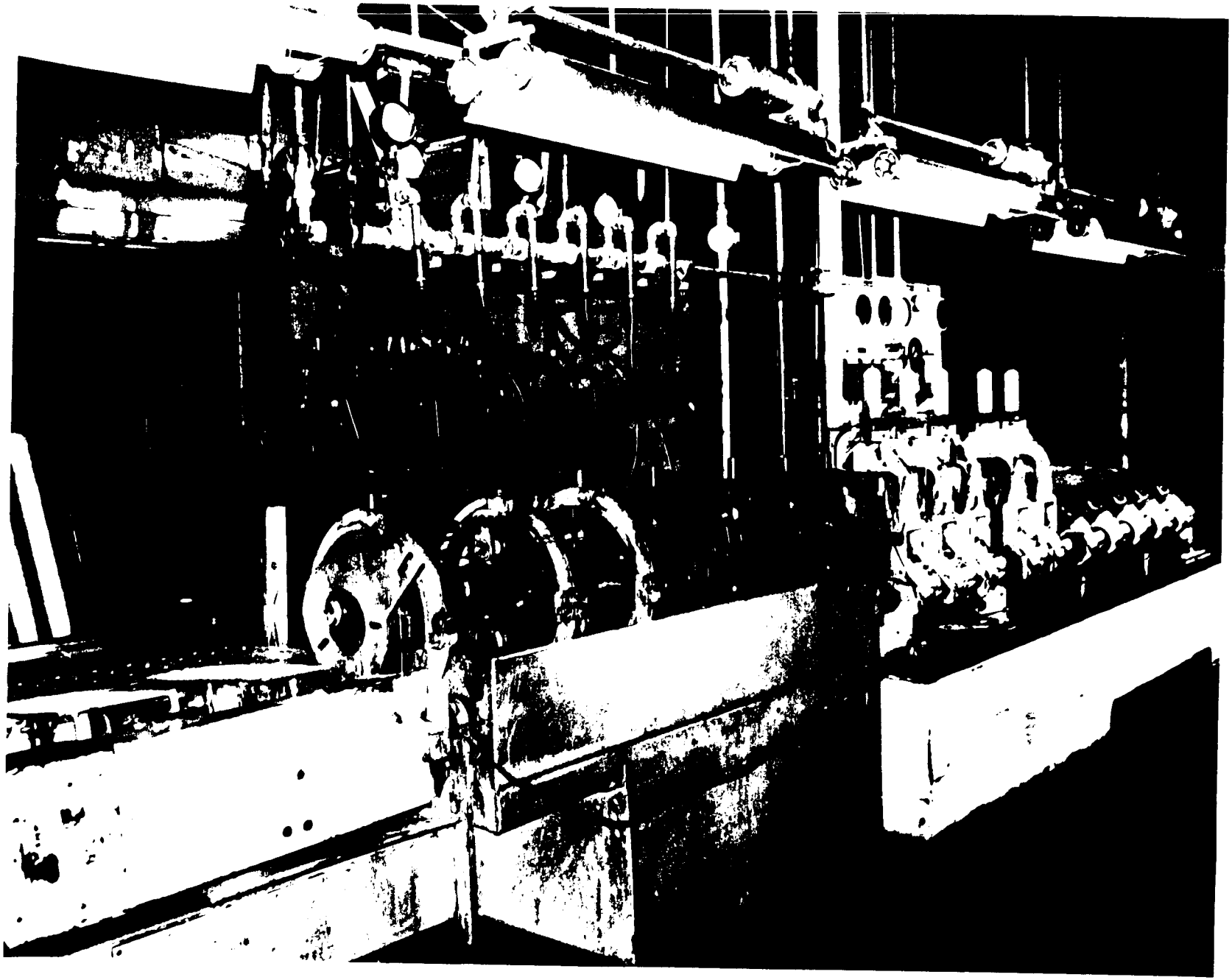
The Extrusion plant is the only government owned government operated facility for the production of solventless propellant grains for solid rocket motors.



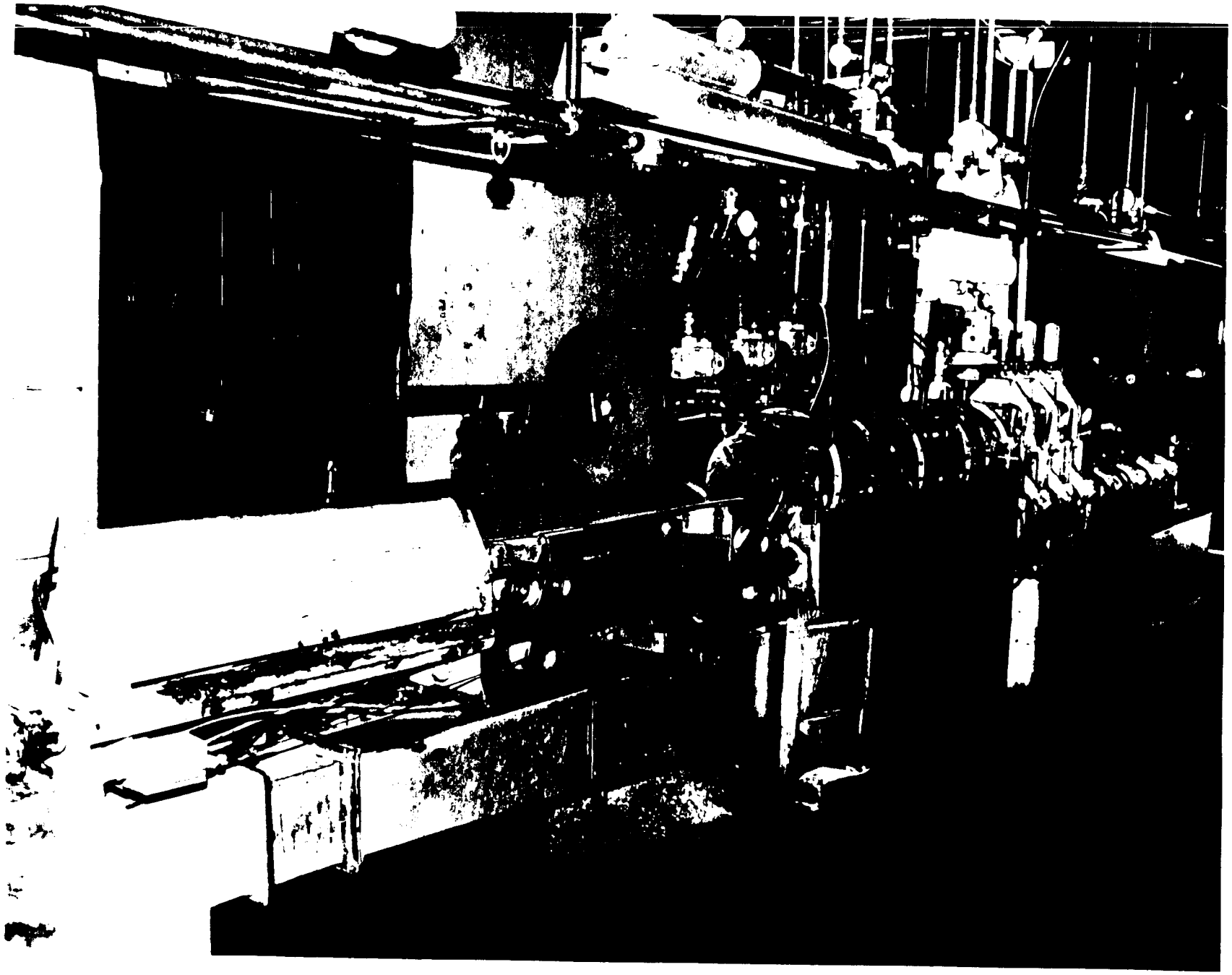
2.75" rocket grains are but one of the many products that are extruded at Indian Head Division. Pictured is one of seven 15" horizontal extrusion presses.



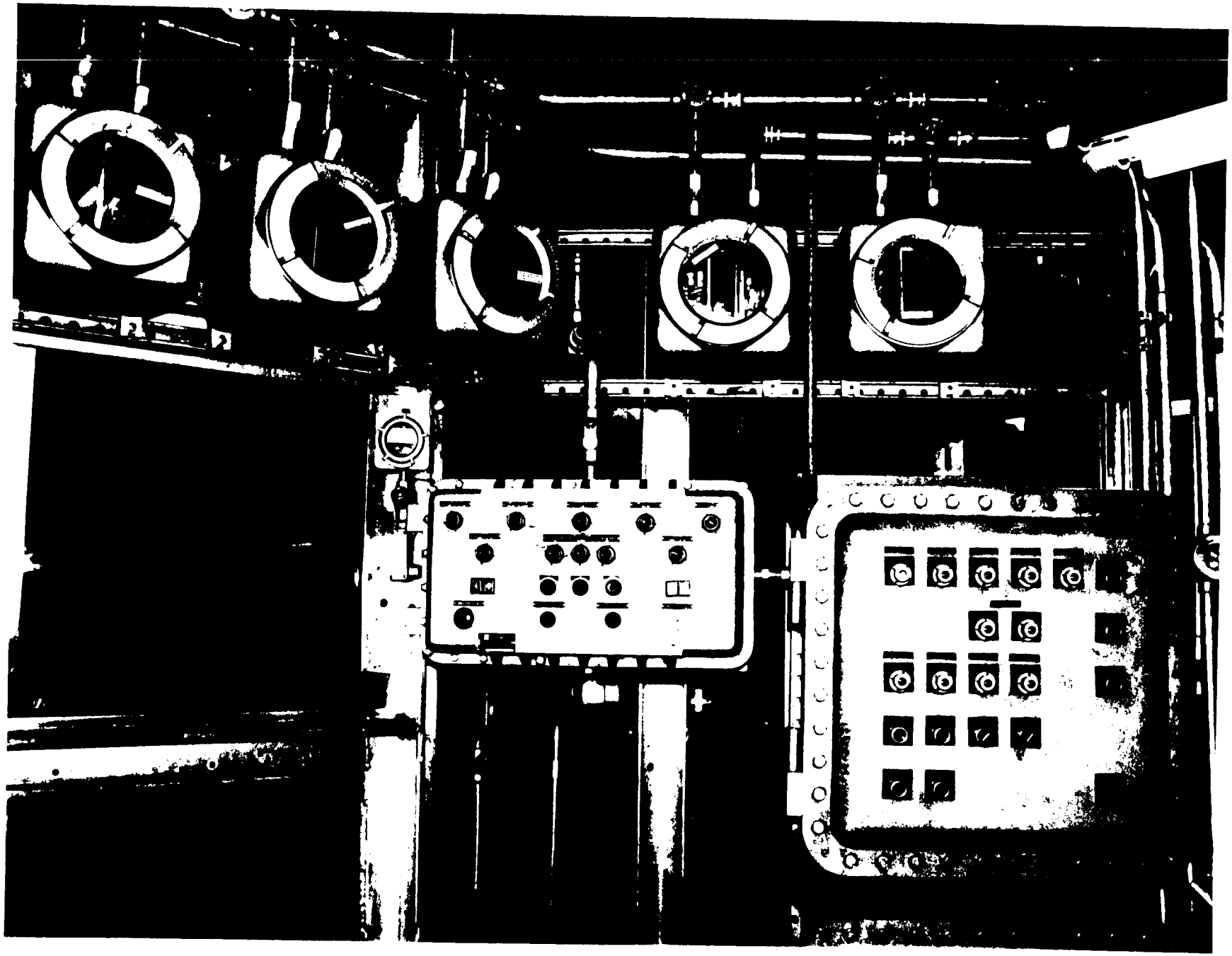
15" Horizontal Extrusion Press
(IHDIV owns seven)



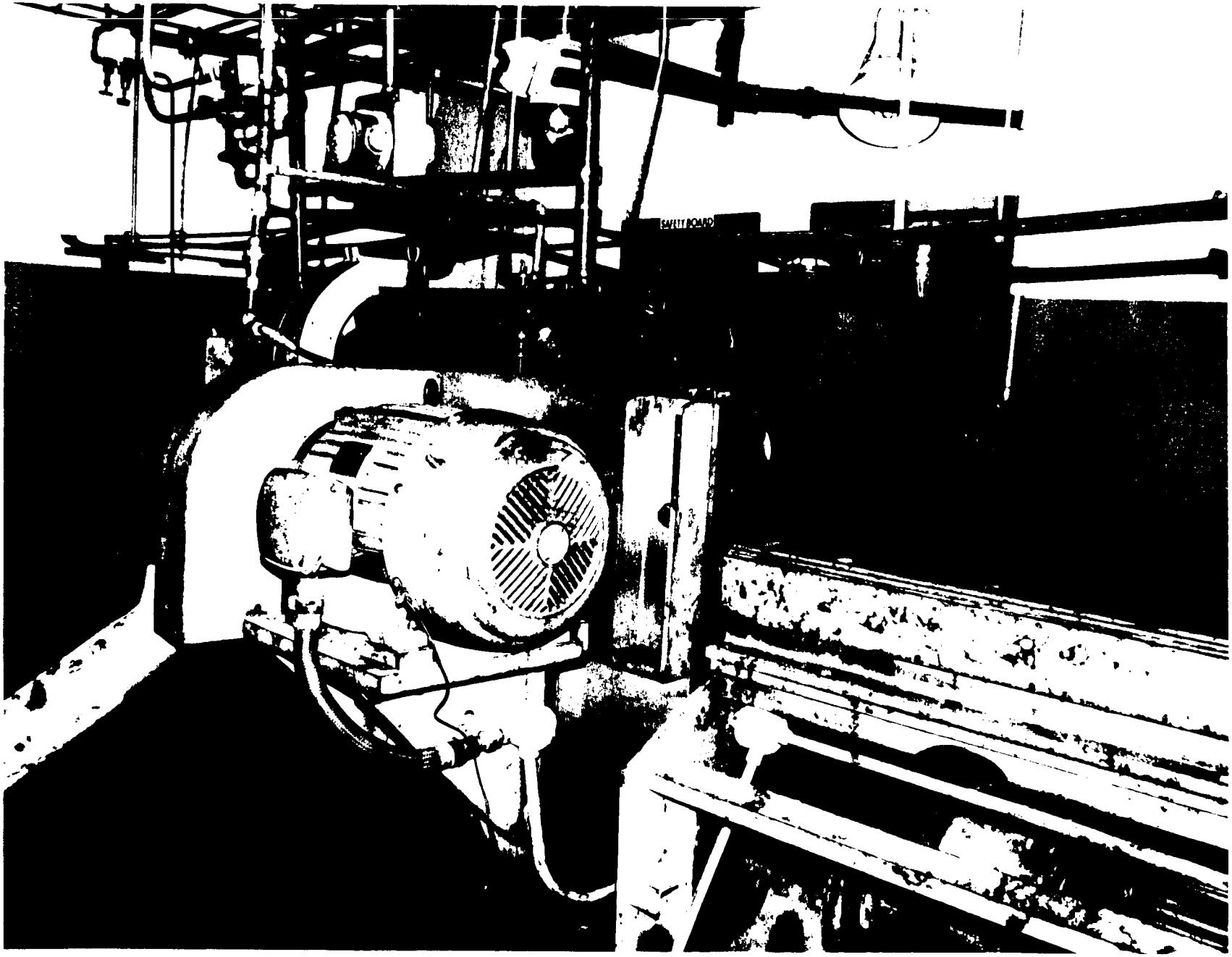
5" Spiral Multi-Wrap Machines



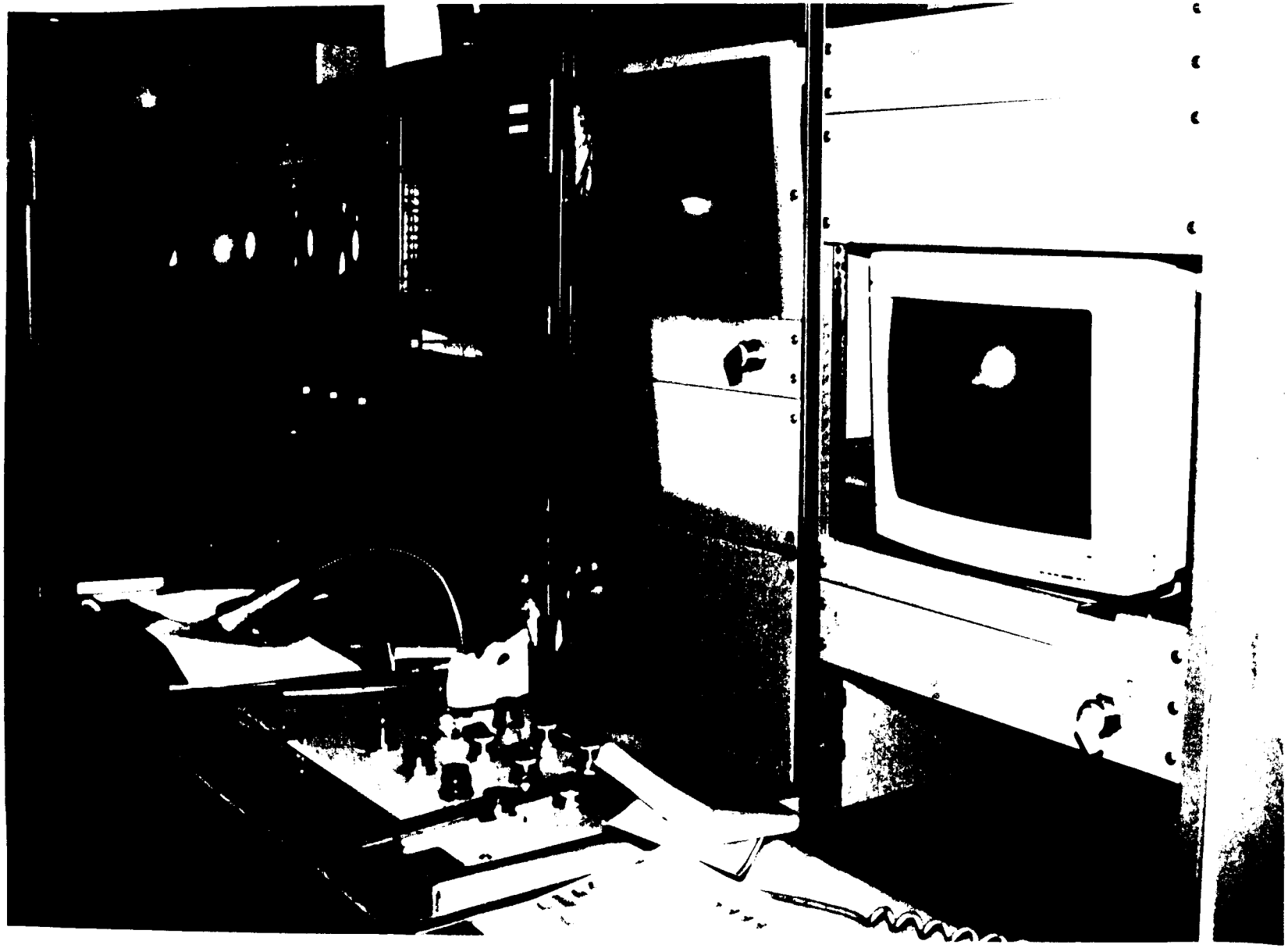
3" Spiral Multi-Wrap Machines



3" Dowell Rod Machine



5" Dowell Rod Machine



Real-Time Radiographic Machine

SPECIAL FACILITIES AND EQUIPMENT
FACILITIES/EQUIPMENT CAPABILITY FORM

Technical Center Site	Indian Head Division, NSWC
Facility/Equipment Nomenclature or Title	Magazine Facility

1. State the primary purpose(s) of the facility/equipment.

The primary use of the magazines is the storage of explosive materials and ordnance items in support of Indian Head's Mission. In addition, this facility provides the East Coast Stock and Issue point for cartridges, CADs, PADs, and AEPS for the Navy and Air Force.

2. Indicate whether the facility/equipment is portable, moveable or fixed as defined by paragraph 6, page 12 of this data call.

Facilities are fixed.

3. Provide the replacement value of the facility/equipment. Report the facility/equipment cost separate from any building and utilities that may be integral to the facility/equipment.

144 ordnance storage facilities, with an estimated replacement value of $35.5M. We are authorized storage of 383,807 pounds of Class 1.1, 50,480 pounds of Class 1.2, 13.4M pounds of Class 1.3, and 1.6M pounds of 1.4.

4. Provide the gross weight and cube of the facility/equipment.

N/A

5. Indicate any "special" utility support required by this facility/equipment other than normal electrical power.

None

6. Indicate any special budget requirements for the facility/equipment (i.e., special foundations, non-ferrous materials, shielding, hardening, etc.).

These buildings are designed in accordance with OP 5 regulations for explosive storage and operating buildings. This includes lightning protection, static grounding systems, earth mounds, reinforced concrete walls, special security hardware, explosion proof electrical service, and ventilation provisions.

7. State any environmental control requirements for the facility/equipment (i.e., temperature, humidity, air scrubbing).

Temperature controls are required for some buildings.

8. Indicate if this facility/equipment would be extremely difficult or impossible to replicate or relocate at another site and the impact to the Department of the Navy if this facility/equipment were lost. Consider existing Government-wide and commercial capabilities as the replication and impact statements are formulated.

Magazine space is at a premium throughout DOD, and relocation possibilities are unknown. This facility supports explosive R&D through reclamation work performed at Indian Head Division. Magazine operations are integral and could not be separated from operations.

9. Indicate how and when the facility/equipment was transported and or constructed at the site.

Facilities were constructed from 1919 to 1953. Renovations have been accomplished.

10. List the functional support areas (previously provided in Tab A) that this facility/equipment support. Refer to Appendix A for the list of functional support areas.

2.2 Guided Missiles
2.5 Mines
2.7 Explosives
2.12 Weapons Propulsion
2.13 Other Ordnance
8.2 Countermeasures
9.1 Navy Strategic Systems
10.3 Facilities Engineering

This facility supports the following NSWC Technical Capabilities:

Rocket/Missile/Gun Propulsion
Energetics Manufacturing/Manufacturing Technology
Cartridge/Propellant Actuated Devices/Aircrew Escape Propulsion Systems
Explosives
Ordnance Environmental Support
Explosives Safety Engineering

11. Provide the historical utilization average for the past five fiscal years (1989-1993). Define the unit of measure used.

Historically, virtually all of the magazines are in use for storage of explosives and ordnance at all times. This does not mean the magazines are loaded to capacity in terms of explosive limits. Because of the variety of materials developed and produced here, and the Navy's strict limitations on which types of explosives can be stored together, the large number of magazines are regularly needed.

12. Provide the projected utilization data out to FY1997.

The same utilization rate (nearly 100% of magazines in use at all times) is expected to continue during this period.

13. What is the approximate number of personnel used to operate the facility/equipment?

Currently 21 ordnance personnel are used to operate these facilities.

14. What is the approximate number of personnel needed to maintain the equipment?

The facilities require services of an electrician and pipefitter.

15. Provide one 8 1/2 x 11 black and white photo of the facility/equipment.

Energetic materials are stored in one of Indian Head Division's 69 magazines.

11. Provide the historical utilization average for the past five fiscal years (1989-1993). Define the unit of measure used.

Based on an FY 92 all-time total workyear high of 231 workyears for this facility, utilization was as follows:

FY 89 - 82%
FY 90 - 94%
FY 91 - 99%
FY 92 - 100%
FY 93 - 95%

12. Provide the projected utilization data out to FY1997.

Using the same baseline from question 11, expected outyear utilization is as follows:

FY 94 - 91%
FY 95 - 88%
FY 96 - 77%
FY 97 - 72%

13. What is the approximate number of personnel used to operate the facility/equipment?

IHDIV is recognized as the Navy's expert for weapons simulators. The full-spectrum role requires highly trained personnel with extensive Applied Engineering, design, manufacturing, and Fleet support expertise across numerous U.S. and FMS weapon systems platforms and weapon products. Within the Combat Systems Integration FSA, we support such major programs as AEGIS, Vertical Launching System, TOMAHAWK, STANDARD Missile, Extended SeaSparrow Missile, ASROC, and Harpoon. To master their skills our engineers and technicians require a minimum of five to seven years of training and experience. The skills mix includes the following:

Senior Technologists with skill in mastery of advance concepts, principles, and practices of electrical engineering, software engineering, computer science, and extensive field experience with weapon systems that enable the person to serve as expert in the full range of electronic systems for Naval weapon systems and missile/weapon simulation, and the ability to apply advanced technology to design of new simulators.

Electrical, Mechanical, & Aerospace Engineers with intimate knowledge of the weapons systems interface, missile parameter, Fleet training philosophies, and diagnostic/test requirements in order to translate each into functional characteristics for the simulation product line.

This facility is also supported by: (1) **Engineering Technicians** with expertise in prototyping, transition-to-production, production, and maintenance of simulators and special test equipment; (2) **Electronic Mechanics** with expertise in fabrication, modification, and repair of simulator components, and **Production Support Specialist** with expertise in acquisition, quality assurance, logistics required to assure product reliability, maintainability, and quality are met. R

Average of 200 people based on historic and projected workload. R

14. What is the approximate number of personnel needed to maintain the equipment?

12

15. Provide one 8 1/2 x 11 black and white photo of the facility/equipment.

Electrical, Mechanical, & Aerospace Engineers with intimate knowledge of the weapons systems interface, missile parameter, Fleet training philosophies, and diagnostic/test requirements in order to translate each into functional characteristics for the simulation product line.

This FSA is also supported by: (1) **Engineering Technicians** with expertise in prototyping, transition-to-production, production, and maintenance of simulators and special test equipment; (2) **Electronic Mechanics** with expertise in fabrication, modification, and repair of simulator components, and **Production Support Specialist** with expertise in acquisition, quality assurance, logistics required to assure product reliability, maintainability, and quality are met.

14. What is the approximate number of personnel needed to maintain the equipment?

12

15. Provide one 8 1/2 x 11 black and white photo of the facility/equipment.

SPECIAL FACILITIES AND EQUIPMENT
FACILITIES/EQUIPMENT CAPABILITY FORM

Technical Center Site	Indian Head Division, NSWC
Facility/Equipment Nomenclature or Title	Weapons Simulator/Emulator Facility

1. State the primary purpose(s) of the facility/equipment.

The facilities/equipment are used to provide a core capability in engineering design, development, manufacture, integration, maintenance and fleet support of missile simulators, weapon console emulators, training shapes and weapons system test/diagnostic equipment for the fleet. These facilities/equipment also support the design, development, and installation of manufacturing process control equipment, rocket motor test sets, and closed-loop simulators specifically designed for use in the manufacture and testing of energetics and the weapons/weapons components that employ these energetics. Our weapon simulator/emulator facilities and equipment include engineering offices, hardware and software design/development laboratories, electronic/mechanical manufacturing, testing and maintenance areas representing 16 buildings, approximately 98,800 sq. ft., and over $17.3M in facility/equipment investment.

Our modern development equipment allows us to develop the most advanced, reliable, and maintainable products in the least amount of time. We design and develop our simulators and interface test sets using state-of-the-art 32-bit microprocessors and VMEbus technology. We also design and develop the Test Consoles and test equipment required to test these simulators, Interface Test Sets, their subassemblies and interface cables. Our ATE's are based on state-of-the-art VXI technology, powered by HP engines. Our advanced emulators, analyzers, lab equipment, and ATE's provide the environment required to completely control the development and testing of new devices.

2. Indicate whether the facility/equipment is portable, moveable or fixed as defined by paragraph 6, page 12 of this data call.

Fixed facilities.

3. Provide the replacement value of the facility/equipment. Report the facility/equipment cost separate from any building and utilities that may be integral to the facility/equipment.

The facility and equipment investment exceeds $17.3M.

4. Provide the gross weight and cube of the facility/equipment.

N/A

5. Indicate any "special" utility support required by this facility/equipment other than normal electrical power.

440v, 3-phase: Overhead Hoists/Cranes

220v, 3-phase: Sand Blast Enclosure

220v, 3-phase : Printed Circuit Board Cleaner
Test Equipment
Environmental Chamber

6. Indicate any special budget requirements for the facility/equipment (i.e., special foundations, non-ferrous materials, shielding, hardening, etc.).

None

7. State any environmental control requirements for the facility/equipment (i.e., temperature, humidity, air scrubbing).

Standard HVAC.

8. Indicate if this facility/equipment would be extremely difficult or impossible to replicate or relocate at another site and the impact to the Department of the Navy if this facility/equipment were lost. Consider existing Government-wide and commercial capabilities as the replication and impact statements are formulated.

a. This facility is fixed and therefore would be difficult to move. This capability was originally located at IHDIV because there was no commercial or government source to provide fleet support for the simulators. The equipment was procured as a part of the

weapon system, but the prime contractors did not give fleet support a high priority. When new equipment was bought to replace the defective units in the fleet, extremely high prices were paid because the units were purchased as sole source, and in small quantities.

Relocation of this facility would cause the loss of the complementary effect this capability has on our energetics capabilities. Our energetics and propulsion experts are drawing more and more from our weapons simulation capabilities to design and build live-fire, missile-in-the-loop functional ground test software and fixtures. We would also loose much of our organic automated process control capability, which is essential to our ability to develop , test and manufacture energetics and energetics-based systems.

b. Loss Impact - Loss of this technical capability will result in inability of the Navy's weapons platforms to accomplish their primary mission of threat engagement and destruction. Under current Navy warship certification procedures, the weapons platforms cannot be certified to fire live ordnance without the products and services that these facilities provide. These facilities are necessary to provide a safe and cost effective way of keeping the Navy's weapons platforms certified and their personnel trained and ready.

There are in excess of 1,000 pieces of Indian Head designed/ produced simulators, devices, and special equipment deployed on US and FMS surface, air, and underwater platforms as well as shipyards, land-based test sites, and training sites. IHDIV is the only facility which provides full spectrum/life-cycle services across all weapons platforms for Navy missile simulator products. Indian Head's life-cycle expertise associated with this equipment would have to be replicated elsewhere to meet fleet certification and training needs, such as in the case with the Harpoon Guided Missile Simulator, which is necessary for verification and training for Harpoon Ships Command Launch Control Set. Similarly, the U.S. would have to develop alternate sources to adequately support NATO and other U.S. allies with missile simulators, trainers, and other special test equipment that are essential in assuring allied capability and force structure.

c. Private sector missile prime contractors have the capability to provide simulator products and services for specific missile/weapons systems. Historically, use of missile prime contractors has resulted in proprietary products that are missile specific, expensive, and difficult to maintain because they incorporate no common simulation approach. These types of problems have lead to consolidation of this capability at the IHDIV. The result is design, fielding, and fleet support of simulators that can be used for multiple missile/ weapons systems, e.g., all variants of Standard Missile and Harpoon. These designs incorporate a high degree of standardization and there is a strong emphasis on operational level maintenance.

9. Indicate how and when the facility/equipment was transported and or constructed at the site.

The weapons simulation effort at Indian Head involving these facilities began in 1965 and has grown to the extent indicated over the past 30 years. These facilities and equipment have been modernized over that time period to result in the present modern computerized engineering, manufacturing, and test capabilities.

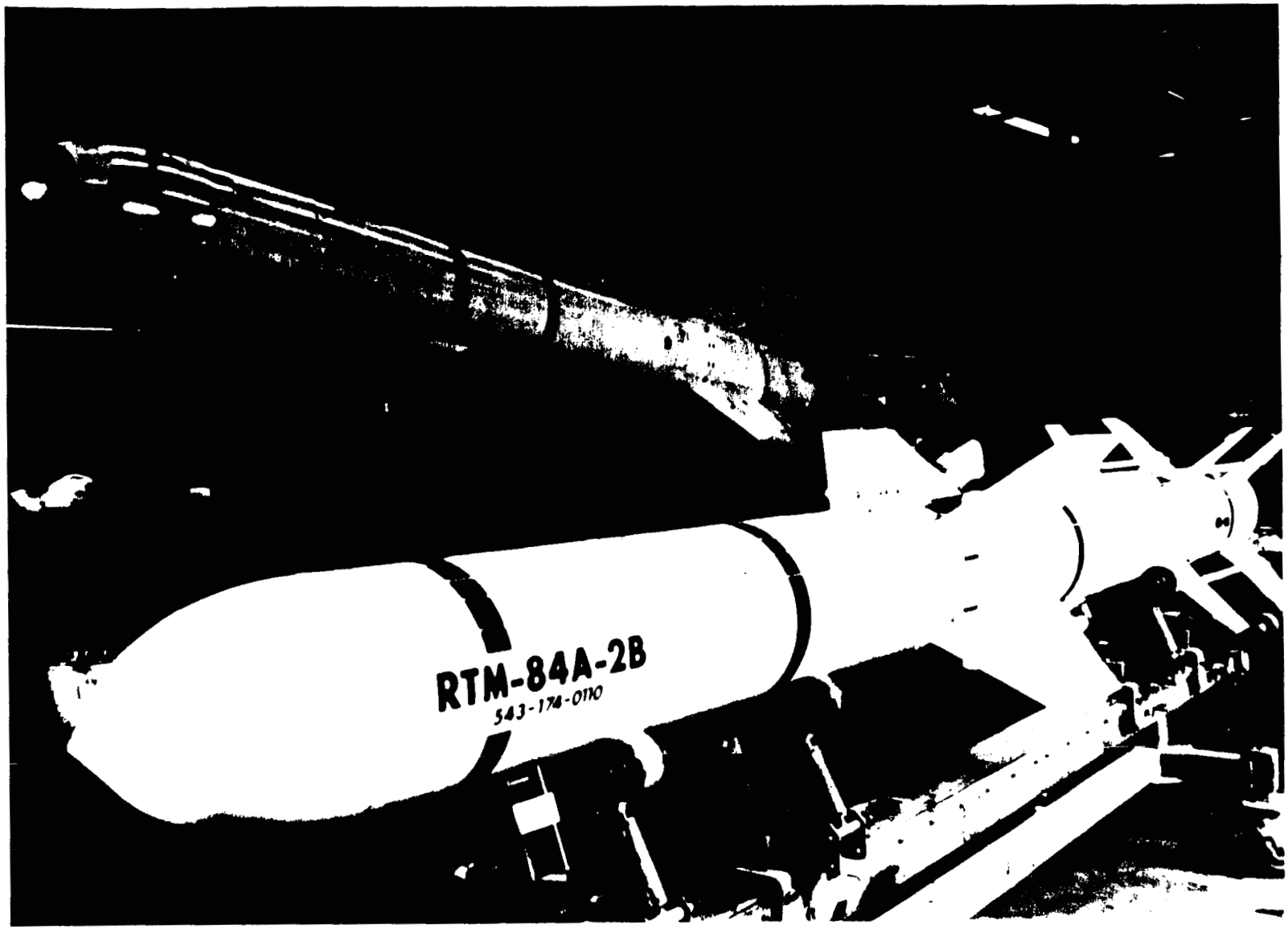
10. List the functional support areas (previously provided in Tab A) that this facility/equipment support. Refer to Appendix A for the list of functional support areas.

Our Simulator/Emulator facilities are an integral part of our Weapons Simulation, Training, Test and Diagnostic Equipment full life-cycle capability. They support the following functional support areas via the design and development of hardware and software for weapon simulators and test/diagnostic equipment.

2.2 Guided Missiles
2.8 Launchers
2.10 Weapons Data Links
2.14 Explosive Ordnance Disposal
6.3 Surface Ship Navigation Systems
6.4 Weapons Navigation Systems
8.2 Countermeasures
10.1.4 Weapons-Related Training Systems
11.1 Generic Technology Base - Computers
11.2 Generic Technology Base - Software

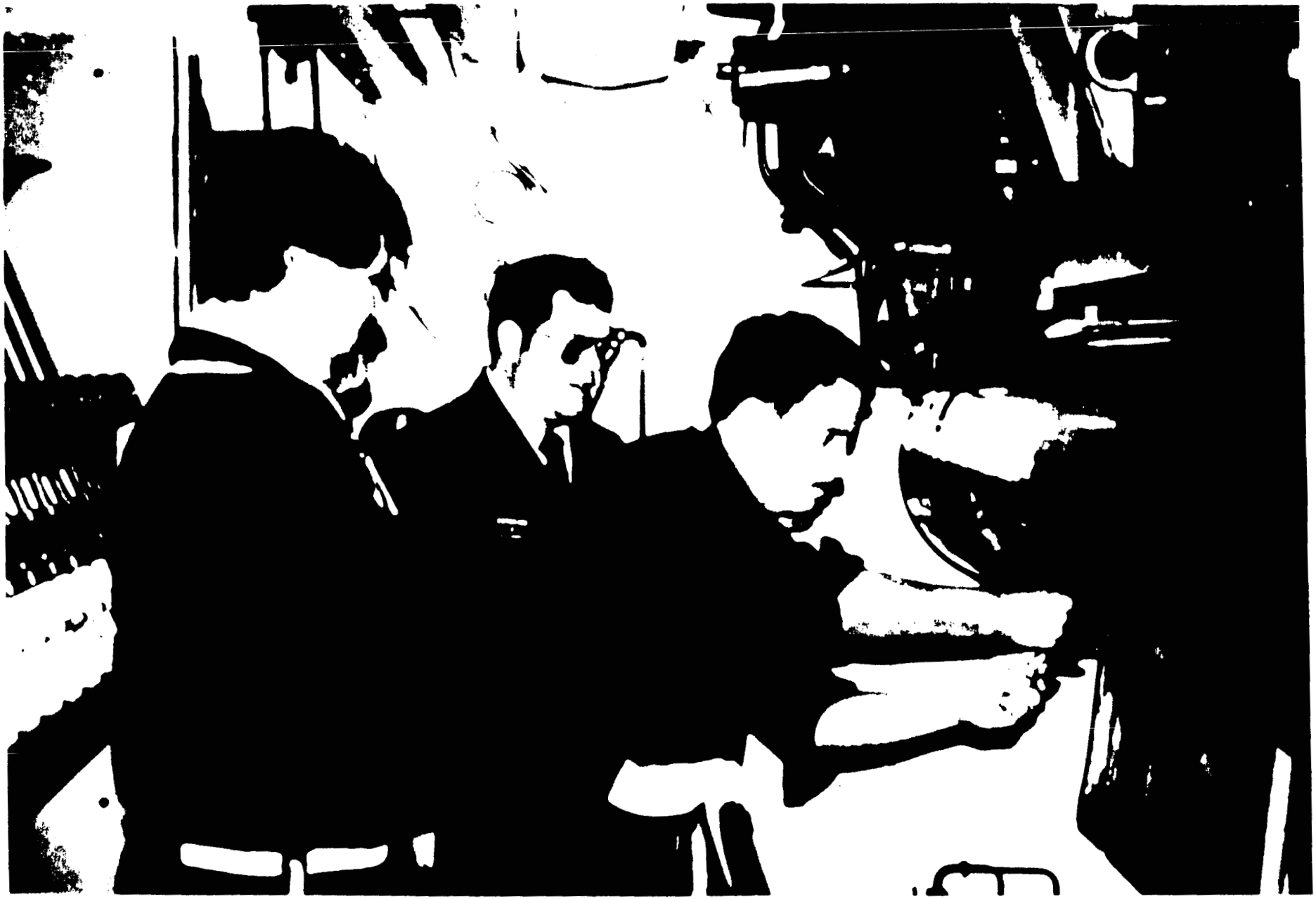
This facility supports the following NSWC Technical Capabilities:

Rocket/Missile/Gun Propulsion
Energetics Manufacturing/Manufacturing Technology
Missile Simulator/Trainers/Test and Diagnostic Equipment



Training shapes, designed and produced at Indian Head Division, are used aboard Navy ships to simulate shipboard response of missiles and to test fire control systems.

Used for weight, handling, diagnostics, and training, an ordnance equipment mechanic completes installation of simulator black box for Mk 66 guided missile training round.



Indian Head Division technical representatives perform field service on a Mk 18 Training Surface to Air Missile (TSAM)) trainer for shipboard personnel.

SPECIAL FACILITIES AND EQUIPMENT
FACILITIES/EQUIPMENT CAPABILITY FORM

Technical Center Site	Indian Head Division, NSWC
Facility/Equipment Nomenclature or Title	Multibase Propellant Production Facility (MPPF)

1. State the primary purpose(s) of the facility/equipment.

The primary purpose of the Multibase Propellant Production Facility (MPPF) is to manufacture double base casting powders for use in rocket motors such as the Terrier, Talos, Bullpup missile systems and most recently in the Vandal Target booster. This plant is also used to manufacture casting powder for the Trident II launch gas generators that are manufactured in the private sector.

Casting powder was widely used in the 1960s and 1970s for rocket motors, and there were several production facilities, both commercial and government. With the replacement of double base propellant by composite propellants (i.e., ammonium perchlorate/rubber binder) in the 1970s, the need for these facilities went away. The MPPF is the only one of these which was/is properly sized for the requirements seen in the 1980's and into the future. The regraining of Vandal boosters is a prime example of this. In 1989, the Navy found it necessary to regrain its aging Vandal Target booster inventory or face not being able to meet its Aegis training needs in the future. They came to Indian Head for the regraining of their overage assets. We were able to reactivate the MPPF and produce the casting powder necessary for the qualification **and** production grains. This was a small production quantity, approximately 50,000 pounds, which a private sector facility could not consider producing because of the high start-up costs and small, if any, return on investment.

The plant has also aided the private sector by providing casting powder for gas generators. When Hercules, Inc. had to produce Trident II launch gas generators they came to Indian Head for the casting powder needed. This is particularly significant because Hercules could have used its own resources but again realized that the costs to start up their large facilities made Indian Head the economically advantageous alternative. We also were the only facility that had the technical expertise to manufacture the powder as a result of our previous experience.

This will be our role in the future for these and any new double base casting powder requirements throughout the DoD. When new systems require the use of new casting

powders, our R&D groups have the facilities and expertise to design formulations and prove out production methods. This would be followed by the MPPF producing qualification powders lots and subsequent small production lots. This facility is the only one in DoD which has a capability to produce small quantities of casting powder at reasonable cost. If the project resulted in a significant production effort, we could transfer the technology to the private sector.

The facility has also been used to manufacture double base gun propellants during qualification programs. Recently, the capability to do water drying of single-base propellants was added to this facility, making it more versatile and able to support qualification programs requiring these types of propellants.

2. Indicate whether the facility/equipment is portable, moveable or fixed as defined by paragraph 6, page 12 of this data call.

This facility is considered fixed because it consists of more than 30 buildings with most of the main processing buildings having walls which are two-foot thick steel-reinforced concrete. Most of the equipment housed in these buildings is large, steel machinery which would be costly to extricate and relocate.

3. Provide the replacement value of the facility/equipment. Report the facility/equipment cost separate from any building and utilities that may be integral to the facility/equipment.

The cost to replace the facility is estimated to be $40 million. Some buildings have unique designs that accommodate the processing equipment inside and would have to be duplicated at a new site. The costs include equipment, structures, and environmental/safety infrastructure necessary to run explosive operations. However, the technical and configuration management costs are not included.

4. Provide the gross weight and cube of the facility/equipment. N/A

5. Indicate any "special" utility support required by this facility/equipment other than normal electrical power.

Along with standard electrical power, the facility requires steam, clean filtered water, high pressure river water and compressed air.

The facility is connected to the Activity's waste water management system. This waste

water management system includes secondary and tertiary treatments. This system was designed to minimize and eventually eliminate explosive waste emissions.

6. Indicate any special budget requirements for the facility/equipment (i.e., special foundations, non-ferrous materials, shielding, hardening, etc.).

The equipment is used to process energetics and therefore must follow the directives provided in safety regulations for storing, producing, handling, and shipping explosives. Guidelines for building separation and the thickness of walls for processing buildings are also provided in these safety regulations. The operating buildings contain at least one to two feet of reinforced concrete walls. There are some buildings that are covered and surrounded by earthen mounds for blast containment. All of the operating buildings contain conductive floors. The equipment in those buildings is bonded so they maintain the same electrical potential. Some processing buildings contain frangible roofs.

Each operating building contains a fire protection deluge and sprinkler system. The operating buildings are protected by lightning rods that are tied to grounding girdles separate from the processing building.

The electrical equipment used in those buildings is explosion-proof equipment which is usually two to three times more costly than non explosion-proof equipment.

Since the equipment handles large amounts of sensitive high explosives, contingency blast containment measures must be met such as thickened walls and barriers. Lightning protection for processing buildings is required and must be tied to grounding girdle separate from the processing buildings. Processing buildings have conductive floors which are tied into the building's grounding girdle.

7. State any environmental control requirements for the facility/equipment (i.e., temperature, humidity, air scrubbing).

The facility processes large amounts of hazardous materials including powdered high explosives and volatile organic compounds (VOC). This requires that many of the buildings have scrubbers, condensers, and filtering systems for water and air emission environmental controls. Wastewater is processed through settling tanks and carbon adsorption systems before being discharged. Oil/water separators are also present throughout the facility at process waste streams. Explosive dust collection systems are used in the powder handling facilities. Wet/dry separators are present to separate solid materials from process liquids.

8. Indicate if this facility/equipment would be extremely difficult or impossible to replicate or relocate at another site and the impact to the Department of the Navy if this facility/equipment were lost. Consider existing Government-wide and commercial capabilities as the replication and impact statements are formulated.

This facility is fixed and therefore would be very difficult to relocate due to the large number of buildings and the massive infrastructure present to support the facility. **Equipment removal would require the dismantling of many concrete hardened buildings, most of which are buried beneath earthen mounds. Removal and transportation of sensitive explosive handling equipment handling equipment could jeopardize the safe use of this equipment due to possible cracking and misaligned clearances.** The equipment is uniquely dependent on the facilities in which it is housed regarding structural layout and necessary safety and environmental protection accessories such as blast barriers, grounding girdles, air emission, and waste stream controls and safety egresses.

The facility loss impact to the Department of Defense would be:

- loss of the only low rate production propellant casting powder production facility within the DOD which would necessitate the start-up of large, private facilities for any future casing powder requirement

- loss of industry watchdog/price controlling second source

- loss of the only qualified producer of Trident II gas generator propellant

- loss of warm propellant production base to meet surge requirements

- loss of DOD technical expertise in the production of double base propellants

The Indian Head Division is the one remaining location where double base casting powder production expertise still exists in both the technical and operational areas. This includes both commercial and government activities. When the British recently had a requirement for double base casting powders, they came to Indian Head.

9. Indicate how and when the facility/equipment was transported and or constructed at the site.

The facility was constructed in the early 1950s. It supported the MK 11 Talos and MK 12

Terrier booster programs until the late 1980s. It has also produced the Trident II launch gas generator work throughout the 1980s. Throughout this time period, the plant has been upgraded to meet new safety and environmental regulations. The plant was most recently reactivated to produce casting powder for the Vandal Target booster.

10. List the functional support areas (previously provided in Tab A) that this facility/equipment support. Refer to Appendix A for the list of functional support areas.

2.12 Weapons Propulsion
9.1 Navy Strategic Systems

This facility supports the following NSWC Technical Capability:

Energetics Manufacturing/Manufacturing Technology

11. Provide the historical utilization average for the past five fiscal years (1989-1993). Define the unit of measure used.

The annual production rates for the last five years are as follows:

1989 - 10,000 pounds (Completion of Trident II casting powder)
1990 - 50,000 pounds (Production of Vandal Target casting powder)
1991 - No production
1992 - No production
1993 - No production

12. Provide the projected utilization data out to FY1997.

There is projected workload for this facility if the efforts to regrain the Honest John rocket for NASA and the Air Force materialize. This plant would be the only source for the casting powder used in manufacturing the propellant sections. If the Navy were to require additional Vandal boosters, this again would be the sole source for the propellant. The quantities would probably be in the 50,000 pounds per year range. It should also be noted that this plant has been considered as a location for the manufacture of composite propellant meal that would be extruded into propellant grains for use on the Advanced Rocket System.

13. What is the approximate number of personnel used to operate the facility/equipment?

The plant requires 25 operators to manufacture at a rate of 20,000 pounds per month. These operators would require an expertise in the manufacturing of casting powder in that they would need to understand the processing parameters to be monitored and what action to be taken if the process requires adjustment. A chemical engineer would be required to oversee the technical aspects of raw material procurement, process equipment maintenance, manufacturing procedure development and propellant quality inspection. A plant manager with experience in managing explosives production facilities is also required.

14. What is the approximate number of personnel needed to maintain the equipment?

Two full-time personnel are needed to maintain the facility when it is operating.

15. Provide one 8 1/2 x 11 black and white photo of the facility/equipment.