DCN 591

1. SPACE AND NAVAL WARFARE SYSTEMS COMMAND, ARLINGTON, VA

Certified copy of the C4I data call response dated 13 October 1994.

2. NAVY MANAGEMENT SYSTEMS SUPPORT OFFICE, CHESAPEAKE, VA.

Certified copy of the C4Idata call response dated 11 October 1994.

3. NAVAL COMMAND, CONTROL AND OCEAN SURVEILLANCE CENTER, SAN DIEGO, CA.

Certified copy of the C4I data call response dated 20 October 1994.

4. NAVAL COMMAND, CONTROL AND OCEAN SURVEILLANCE CENTER, RDT&E DIVISION, SAN DIEGO, CA.

Certified copy of the C4I data call response dated 20 October 1994.

5. NAVAL COMMAND, CONTROL AND OCEAN SURVEILLANCE CENTER, ISE WEST COAST DIVISION, SAN DIEGO, CA.

Certified copy of the C4I data call response dated 18 October 1994.

6. NAVAL COMMAND, CONTROL AND OCEAN SURVEILLANCE CENTER, ISE EAST COAST DIVISION, CHARLESTON, SC.

Certified copy of the C4I data call response dated 18 October 1994.

7. DEPARTMENT OF THE NAVY

Certified copy of the "Navy Energetics Presentation to the Laboratory Joint Cross-Service Group" on 20 October 1994 presented by Dr. Ira Blatstein.

8. NAVAL AIR WARFARE CENTER, WEAPONS DIVISION, CHINA LAKE, CA.

Certified copy of the Energetics data call response dated 16 October 1994.

Certified copy of the NAWC China Lake Energetics Presentation to the Laboratory Joint Cross-Servive Group on 20 October 1994.

9. NAVAL SURFACE WARFARE CENTER, CRANE DIVISION, CRANE, IN.

Certified copy of the Energetics data call response dated 17 October 1994.

Certified copy of the NSWC Crane Energetics Presentation to the Laboratory Joint Cross-Service Group on 20 October 1994.

Certified copy of NSWC Crane response to questions raised by the Laboratory Joint Cross-Service Group during the 20 October 1994 Energetics Presentation

10. NAVAL SURFACE WARFARE CENTER, DAHLGREN DIVISION, DAHLGREN, VA.

Certified copy of the Energetics data call response dated 18 October 1994.

Certified copy of the NSWC Dahlgren Energetics Presentation to the Laboratory Joint Cross-Service Group on 20 October 1994.

Certified copy of NSWC Dahlgren response to questions raised by the Laboratory Joint Cross-Service Group during the 20 October 1994 Energetics Presentation

11. NAVAL SURFACE WARFARE CENTER, INDIAN HEAD DIVISION, INDIAN HEAD, MD.

Certified copy of the Energetics data call response dated 18 October 1994.

Certified copy of the NSWC Indian Head Energetics Presentation to the Laboratory Joint Cross-Service Group on 20 October 1994.

Certified copy of NSWC Indian Head response to questions raised by the Laboratory Joint Cross-Service Group during the 20 October 1994 Energetics Presentation

12. NAVAL ORDNANCE CENTER, NAVAL EXPLOSIVE ORDNANCE DISPOSAL TECHNOLOGY DIVISION, INDIAN HEAD, MD.

Certified copy of the Energetics data call response dated 18 October 1994.

13. NAVAL UNDERSEA WARFARE CENTER HEADQUARTERS, NEWPORT, RI.

Certified copy of the Energetics data call response dated 17 October 1994.

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BRAC 95

DATA CALL #12
AMENDMENT #1

"ENERGETICS"

26 OCTOBER 1994

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WC

DATA CALL #12
AMENDMENT 1
NAWCHQ

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

NEXT ECHELON LEVEL (if applicable)

W. E. Newman, RADM, USN
NAME (Please type or print)

Signature

Commander
Title

10/26/94
Date

Naval Air Warfare Center
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

W. C. Bowes, VADM, USN
NAME (please type or print)

Signature

Commander
Title

1 NOV 94
Date

Naval Air 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

Title

11/7/94
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.

Each individual in you 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 the information contained herein is accurate and complete to the best of my knowledge and belief.

ACTIVITY COMMANDER

D. B. McKinney, RADM, USN
Name (Please type or print)

Signature

Commander
Title

10/16/94
Date

Naval Air Warfare Center Weapons Division China Lake Site
Activity

Data Call #12 Amendment #1 of 16 October 1994

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ACTIVITY UIC: 60530

BRAC 95 DATA CALL #12
AMENDMENT #1
ENERGETICS

26 OCTOBER 1994

NAWC

NAVAL AIR WARFARE CENTER

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26 October 1994

ENERGETICS CROSS-SERVICE ANALYSIS

This document, BRAC Data Call #12 Amendment #1, is in response to the Department of the Navy Base Structure Analysis Team (BSAT) call for BRAC certified data to perform a cross-service analysis of energetic materials. It provides detailed data as specified under the Energetics Cross-Service Analysis Data Call. In addition, it provides a recommendation and justification for establishing NAWCWPNS China Lake as a DOD focus site for full-spectrum RDT&E activities associated with energetic materials used in conventional and strategic weapons.

INTRODUCTION

The Naval Air Warfare Center Weapons Division (NAWCWPNS) has the expert people, equipment, facilities, and physical space to provide a full-spectrum capability in energetics. China Lake energetics facilities were first developed in 1948. Over the past 46 years, these facilities have been maintained and systematically modernized to meet the needs of the Fleet. The facilities/equipment and the highly skilled professionals in energetics may be viewed as a core capability having a capacity that can be increased through the use of existing facilities/equipment with little or no modification or through expansion to include those energetics capabilities that do not presently exist at China Lake.

China Lake's existing energetics capability is world class. It participates in tri-service and involves multinational programs. Its potential for growth is very good because of its vast land area for expansion without encroachment problems from neighboring communities, without the need for building bomb-proofs for explosive testing, without problems associated with inclement weather in the winter, and without new environmental impact need statements. Additionally, China Lake provides a full-spectrum capability where work includes energetic materials synthesis, development, and qualification for service use, coupled to design and development of weapons and weapon components that use energetic material (e.g., ordnance, propulsion), testing, and the full life-cycle support of the weapons and components. Within this full-spectrum activity, R&D, T&E, and in-service engineering are seamlessly integrated. China Lake management has invested many millions of dollars of its discretionary funds over several decades to maintain its energetics facilities and provide a location for future consolidations if other sites are closed due to encroachment or reductions in DOD funds. Along these same lines, China Lake has designated Energetic Materials, Ordnance and Propulsion as one of its major strategic thrusts, as well as one of its core Science and Technology areas represented under a Science and Technology Network.

In the future, as the defense budget draws down, some areas of S&T covered by the government laboratories will have to be dropped or substantially reduced. These areas will be transferred to academia or private industry or simply abandoned. In the case of energetics, a strong in-house DOD S&T must be maintained with academic or private industry. In addition, international collaboration and interactions must be maintained.

If consolidation of energetics work is undertaken under BRAC-95, DOD could build on NAWCWPNS China Lake basic attributes (space, remoteness, full-spectrum RDT&E, and in-service engineering for energetics, which are integrated into all-up weapon systems and components) and possibly join with industrial partners to form a DOD focus site for energetic materials for conventional and strategic weapons. In recent years, NAWCWPNS China Lake has entered into a significant number of partnerships with other DOD activities, universities, and

industry. In the area of energetic materials, examples of these partnerships in industry include the following:

1. Cooperative Research and Development Agreement (CRDA) with Alliant Technologies for injection loading of explosives .

2. Team effort with Texas Instruments (TI) for the assembly and checkout of the first Joint Standoff Weapons (JSOWs).

3. CRDA with Thiokol for manufacture of CL-20 and S&T to transition this material to civilian explosives.

4. Team effort with Lockheed/Bechtel to develop the design for an environmentally acceptable large solid rocket motor disposal facility for Trident motors.

Examples of partnerships with other DOD activities include:

1. Cooperation Propulsion R&D activities with AF at Phillips Laboratory

2. Joint propellant technology activity with Army at Micom

3. Joint Air Breathing Propulsion Technology effort with Air Force Wright Laboratory

4. Joint development program with Air Force (JSOW, JDAM)

Examples of collaboration with universities include:

1. Propulsion Combustion Instability Research with CALTECH

2. Propulsion Steady-State Combustion with Brigham Young

In the future, as the capability in both the government and industry continues to be reduced due to the defense draw down, it may be advantageous (and necessary) to do more industrial teaming. More specifically, in anticipation of energetics work being consolidated at a single site, China Lake is exploring the feasibility of entering into Public Private Ventures that would have industrial firms locate and build energetics facilities at China Lake to replace those that would be closed at other government sites. This concept is outlined in more detail in the Summary section of this report.

DETAILED RESPONSE TO DATA CALL

1. *Organization Chart (as of 30 September 1994):*

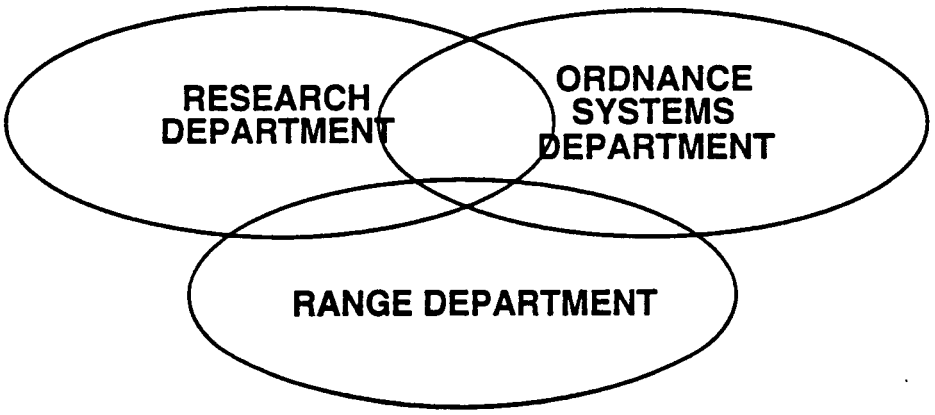
   a. Show organizational elements (those which report directly to the activity commander).

   b. Describe organizational relationships especially between support organizations and any other organizations located on the Installation/Base.

RESPONSE

Figure 1 shows the entire NAWCWPNS organizations as of 30 September 1994. Energetics RDT&E is very much a team effort at NAWCWPNS with participation from a number of major organizational elements. Figure 2 is a repeat of the Figure 1 organizational chart showing the major participants in energetics with those organizations shaded. Figure 3 is a simplified chart of these organizations with a brief summary of their energetics related functions.

The primary capability in energetics RDT&E is provided by the Research Department, the Ordnance Systems Department, and the Range Department. As shown below, these Departments form a team for the full-spectrum, full-life-cycle support of energetics (energetic materials, ordnance, and propulsion). They rely on the other Departments identified in Figure 3 for significant support to provide this complete capability.



This team provides a capability in energetic materials, ordnance, and propulsion that ranges from basic research into energetic molecules through the technology advancement of materials and components to the design and development of weapons and weapon components, including test and evaluation at every phase.

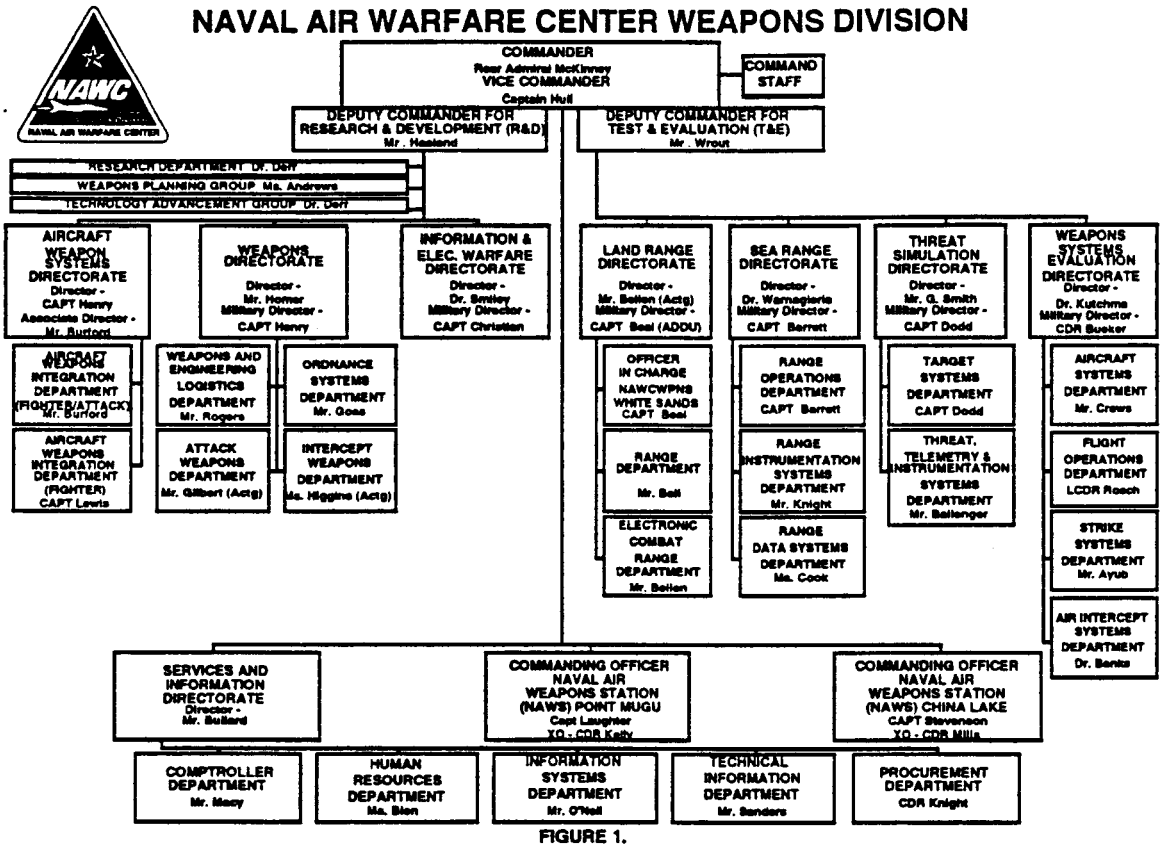
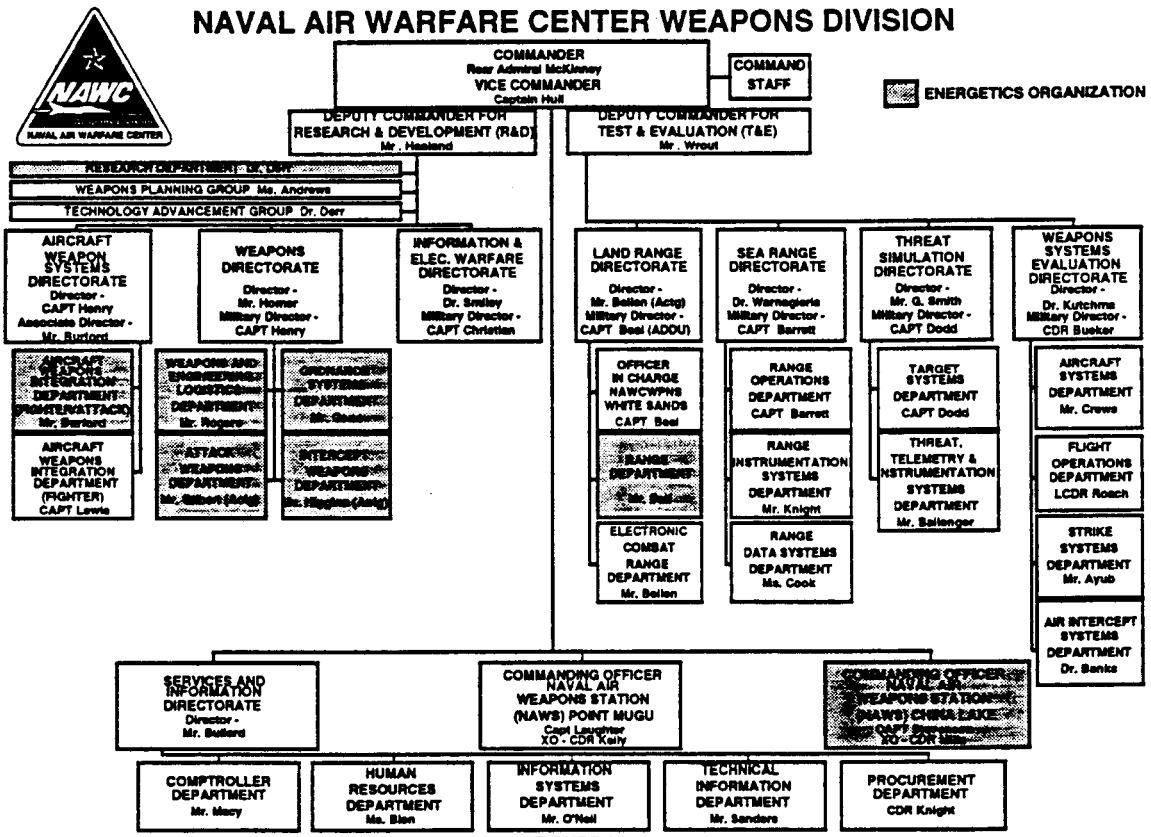

NAVAL AIR WARFARE CENTER WEAPONS DIVISION
NAWC
NAVAL AIR WARFARE CENTER
COMMANDER
Rear Admiral McKinney
VICE COMMANDER
Captain Hull
COMMAND STAFF
DEPUTY COMMANDER FOR RESEARCH & DEVELOPMENT (R&D)
Mr. Haaland
DEPUTY COMMANDER FOR TEST & EVALUATION (T&E)
Mr. Wrout
RESEARCH DEPARTMENT Dr. Daw
WEAPONS PLANNING GROUP Ms. Andrews
TECHNOLOGY ADVANCEMENT GROUP Dr. Dell
AIRCRAFT WEAPON SYSTEMS DIRECTORATE
Director - CAPT Henry
Associate Director - Mr. Burford
AIRCRAFT WEAPONS INTEGRATION DEPARTMENT (FIGHTER/ATTACK)
Mr. Burford
AIRCRAFT WEAPONS INTEGRATION DEPARTMENT (FIGHTER)
CAPT Lewis
WEAPONS DIRECTORATE
Director - Mr. Horner
Military Director - CAPT Henry
WEAPONS AND ENGINEERING LOGISTICS DEPARTMENT
Mr. Rogers
ATTACK WEAPONS DEPARTMENT
Mr. Gilbert (Actg)
ORDNANCE SYSTEMS DEPARTMENT
Mr. Goss
INTERCEPT WEAPONS DEPARTMENT
Ms. Higgins (Actg)
INFORMATION & ELEC. WARFARE DIRECTORATE
Director - Dr. Smiley
Military Director - CAPT Christian
LAND RANGE DIRECTORATE
Director - Mr. Bellon (Actg)
Military Director - CAPT Beal (ADDU)
OFFICER IN CHARGE NAWCWPNS WHITE SANDS
CAPT Beal
RANGE DEPARTMENT
Mr. Bell
ELECTRONIC COMBAT RANGE DEPARTMENT
Mr. Bellon
SEA RANGE DIRECTORATE
Director - Dr. Warnagiris
Military Director - CAPT Barrett
RANGE OPERATIONS DEPARTMENT
CAPT Barrett
RANGE INSTRUMENTATION SYSTEMS DEPARTMENT
Mr. Knight
RANGE DATA SYSTEMS DEPARTMENT
Ms. Cook
THREAT SIMULATION DIRECTORATE
Director - Mr. G. Smith
Military Director - CAPT Dodd
TARGET SYSTEMS DEPARTMENT
CAPT Dodd
THREAT, TELEMETRY & INSTRUMENTATION SYSTEMS DEPARTMENT
Mr. Bellenger
WEAPONS SYSTEMS EVALUATION DIRECTORATE
Director - Dr. Kutchma
Military Director - CDR Bueker
AIRCRAFT SYSTEMS DEPARTMENT
Mr. Crews
FLIGHT OPERATIONS DEPARTMENT
LCDR Roach
STRIKE SYSTEMS DEPARTMENT
Mr. Ayub
AIR INTERCEPT SYSTEMS DEPARTMENT
Dr. Banks
SERVICES AND INFORMATION DIRECTORATE
Director - Mr. Bullard
COMMANDING OFFICER NAVAL AIR WEAPONS STATION (NAWS) POINT MUGU
Capt Laughter
XO - CDR Kelly
COMMANDING OFFICER NAVAL AIR WEAPONS STATION (NAWS) CHINA LAKE
CAPT Stevenson
XO - CDR Mills
COMPTROLLER DEPARTMENT
Mr. Macy
HUMAN RESOURCES DEPARTMENT
Ms. Blen
INFORMATION SYSTEMS DEPARTMENT
Mr. O'Neil
TECHNICAL INFORMATION DEPARTMENT
Mr. Sanders
PROCUREMENT DEPARTMENT
CDR Knight

FIGURE 1.


NAVAL AIR WARFARE CENTER WEAPONS DIVISION
NAWC
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Rear Admiral McKinney
VICE COMMANDER
Captain Hull
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DEPUTY COMMANDER FOR TEST & EVALUATION (T&E)
Mr. Wrout
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WEAPONS PLANNING GROUP Ms. Andrews
TECHNOLOGY ADVANCEMENT GROUP Dr. Derr
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Associate Director - Mr. Burford
AIRCRAFT WEAPONS INTEGRATION DEPARTMENT (INTERVATTACK)
Mr. Burford
AIRCRAFT WEAPONS INTEGRATION DEPARTMENT (FIGHTER)
CAPT Lewis
WEAPONS DIRECTORATE
Director - Mr. Homer
Military Director - CAPT Henry
WEAPONS AND ENGINEERING LOGISTICS DEPARTMENT
Mr. Rogers
ORDNANCE SYSTEMS DEPARTMENT
Mr. Gibson
ATTACK WEAPONS DEPARTMENT
Mr. Gilbert (Actg)
INTERCEPT WEAPONS DEPARTMENT
Mr. Hughes (Actg)
INFORMATION & ELEC. WARFARE DIRECTORATE
Director - Dr. Smiley
Military Director - CAPT Christian
LAND RANGE DIRECTORATE
Director - Mr. Bellen (Actg)
Military Director - CAPT Beal (ADOU)
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Mr. Bell
ELECTRONIC COMBAT RANGE DEPARTMENT
Mr. Bellen
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XO - CDR Kelly
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XO - CDR May
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Mr. Macy
HUMAN RESOURCES DEPARTMENT
Ms. Blen
INFORMATION SYSTEMS DEPARTMENT
Mr. O'Neil
TECHNICAL INFORMATION DEPARTMENT
Mr. Sanders
PROCUREMENT DEPARTMENT
CDR Knight

FIGURE 2.

NAVAL AIR WARFARE CENTER WEAPONS DIVISION

ENERGETICS ORGANIZATION

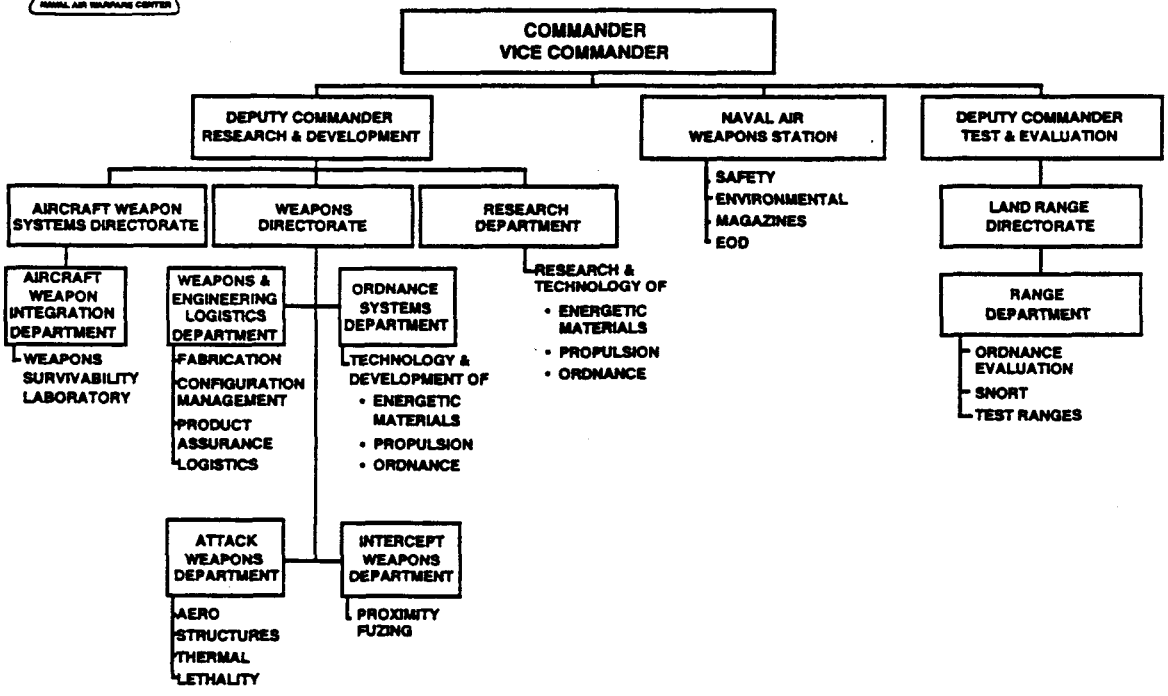


FIGURE 3.

Fundamental research into new energetic materials and physical phenomena associated with energetic materials and weapon components is performed in the Research Department. Because of their expertise in the physical sciences, members of the Research Department are often called on as consultants to help solve problems in all stages of development and Fleet support. Technology advancement of materials and components is typically a joint effort between the Research Department and the Ordnance Systems Department. This partnership forms the bridge between research and early technology work and the technology demonstrations and design and development of weapons and weapon components that are primarily supported in the Ordnance Systems Department.

The Ordnance Systems Department provides the expertise for ordnance systems, including explosives, warheads, safe-arm devices, initiators, etc.; and for propulsion systems, including propellants, rocket motors, arm-fire devices, thrust vector control technology, initiators, etc. Aircraft gun and ammunition expertise also reside here. Because of this expertise, the Department is able to provide ordnance and propulsion acquisition support for weapons and weapon components. The department does in-service engineering and provides the expertise to solve fleet problems in these areas. The Ordnance Systems Department also manages the Ordnance Plant that provides a complete, full-spectrum fabrication, assembly, and evaluation capability in energetic materials, ordnance, and propulsion.

The Range Department provides test and evaluation capability at every step of the way. This capability ranges from small-scale evaluation of experimental ordnance and propulsion items to the environmental, safety, and performance testing and evaluation of weapon components and complete weapons. The ranges are so vast that China Lake has often been selected for conduct of very large-scale explosive tests for customers, such as NATO, the DDESB, and the other services. These operations have included, for example, confined detonations inside tunnels and the detonation of a simulated maritime pre-positioned ship involving 500,000 pounds net explosive weight of ordnance.

Significant support is provided by the other organizations identified in Figure 3. The Weapons and Engineering Logistics Department (WELD) provides in-service engineering of tactical weapon systems, and the metal and composite fabrication capability for experimental weapon components, as well as special-purpose apparatus needed for research and technology development. This Department also provides the expertise in data and configuration management, as well as product assurance. Aerodynamics, structures, and thermal expertise are provided by the Attack Weapons Department, as well as the lethality analysis in support of weapon design. Proximity fuzing expertise for ordnance resides in the Intercept Weapons Department. The Aircraft Weapons Department manages the Weapons Survivability Laboratory. This facility provides the capability to determine the survivability of military hardware, including weapons, in realistic live-fire scenarios, including simulated flight conditions.

The Naval Air Weapons Station (NAWS) China Lake provides important support by providing safety and environmental expertise. The first class safety program they manage has contributed to our excellent safety record in the RDT&E of energetics. In the environmental area, our philosophy has been to cooperate fully with the regulatory agencies and to be a partner with them. As a result, we have been able to fully comply with the environmental regulations with minimal impact to our operations. The Weapons Department in the NAWS maintains the magazines and provides the inventory, handling, and shipping support necessary for our operations, as well as the EOD functions we need. The magazines are sited for 9 million pounds with a total storage capacity of 117,000 square feet.

A number of mechanisms, both formal and informal, serve to facilitate this team effort in energetics at NAWCWPNS. These range from information exchanges and technology symposia to the concentrated efforts in support of a specific project. Examples are the Science and Technology Network for Energetic Materials, Ordnance, and Propulsion; the Strategic Thrust in Energetic Materials, Ordnance, and Propulsion; and Integrated Program Teams for specific programs and projects. The capabilities this team effort provides will be described more fully in terms of functions and products in the following sections that respond to the specific requirements in this data call.

2. *For each organizational element:*

a. Breakout five types of FY93 workyears (government, FFRDC on-site, FFRDC off-site, contract support on-site and contract support off-site) by the following seven job categories: S&T Engineering Development, Production, In-Service Engineering, and other (describe).

b. Number of square feet of space occupied broken out by laboratory specific space, general office space, and other space (describe). Note if government owned or leased.

c. List total FY93 funds and list main programs and customers.

Note: Energetic work was defined as : Any work associated with ordnance, propulsion, energetic materials, propellants, explosives formulations; testing of the above; production of any item that contains an energetic material; in-service engineering of weapons, storage, transportation, and build-up of weapons; aero structures; thermal and lethality work; all fuzing that contains a safety-arming (S-A) device with explosively loaded detonators, leads, and boosters; configuration management of data; fabrication shops (metal and composites); product assurance and logistics; safety and environmental tasks that are directly in support of energetic materials or energetic work.

Also included in a separate section are data on proximity fuzing, or target detection devices (TDDs). Some TDDs contain energetic materials in the form of thermal batteries that are Class C explosive. However, TDDs are also included in this data call because their design and performance characteristics must be intimately linked to the design and performance characteristics of the warhead to achieve the desired performance of the integrated ordnance section.

WORKYEARS

Environmental Code C8305	Government	FFRDC On-Site	FFRDC Off-Site	Contract Support On-Site	Contract Support Off-Site
S&T		0	0		
Engineering Development		0	0		
Production		0	0		
In-Service Engineering		0	0		
Other (G&A) Environmental	1.6	0	0		
TOTALS	1.6	0	0	0	0

WORKYEARS

Safety Code C8403	Government	FFRDC On-Site	FFRDC Off-Site	Contract Support On-Site	Contract Support Off-Site
S&T		0	0		
Engineering Development		0	0		
Production		0	0		
In-Service Engineering		0	0		
Other (G&A) Safety	4.3	0	0		
TOTALS	4.3	0	0	0	0

WORKYEARS

Aircraft Weapons Code C21	Government	FFRDC On-Site	FFRDC Off-Site	Contract Support On-Site	Contract Support Off-Site
S&T	2	0	0	4	0
Engineering Development	8	0	0	20	0
Production		0	0		
In-Service Engineering		0	0		
Other (Describe)		0	0		
TOTALS	10	0	0	24	0

WORKYEARS

Research Dept Code C023	Government	FFRDC On-Site	FFRDC Off-Site	Contract Support On-Site	Contract Support Off-Site
S&T	85	0	0	1.5	
Engineering Development		0	0		
Production		0	0		
In-Service Engineering		0	0		
OTHER (DESCRIBE)		0	0		
TOTALS	85	0	0	1.5	0

WORKYEARS

Weapons, Engineering & Logistics Dept Code C26	Government	FFRDC On-Site	FFRDC Off-Site	Contract Support On-Site	Contract Support Off-Site
S&T	0.8	0	0	1.5	0
Engineering Development	39.7	0	0	2	2
Production	41.4	0	0	30	7.5
In-Service Engineering	371.4	0	0	0.75	356
Other (Describe)	0	0	0	0	0
Work Details	0	0	0	0	0
Engineering Support Services	0	0	0	0	0
TOTALS * INCLUDES ALL-UP ROUNDS	453.3	0	0	34.25	365.5

WORKYEARS

Range Dept T&E	Government	FFRDC On-Site	FFRDC Off-Site	Contract Support On-Site	Contract Support Off-Site
S&T	17.12	0	0	0.1	0
Engineering Development	38.92	0	0	3.5	0
Production	76.4	0	0	1.1	0
In-Service Engineering	11.51	0	0	0.95	0
Other (Describe)	35.3	0	0	14.35	0
TOTALS	179.25	0	0	20	0

WORKYEARS

Attack Weapons Code C28	Government	FFRDC On-Site	FFRDC Off-Site	Contract Support On-Site	Contract Support Off-Site
S&T	5	0	0	0	0
Engineering Development	24	0	0	0	0
Production	8	0	0	0	0
In-Service Engineering	2	0	0	0	0
Other (Describe)	0	0	0	0	0
TOTALS	39	0	0	0	0

WORKYEARS

Ordnance Systems Dept Code C27	Government	FFRDC On-Site	FFRDC Off-Site	Contract Support On-Site	Contract Support Off-Site
S&T	52.5	0	0	2.8	11.4
Engineering Development	89.4	0	0	4.5	57.2
Production	5.1	0	0		1
In-Service Engineering	3.6	0	0		
Other (Describe) WPN	37.3	0	0	0.3	0.4
OMN	10			0.1	
Misc (APN, OPN, FMS, Prprty)	7.9			0.4	
Maint/Oper Supt To T&E	6				
Bids & Proposals (O/H)	9.6				
Facil Related (O/H)	18.9				
Envir Related (O/H)	2				
Training Related (O/H)	1.7				
Other Support (O/H)	63.5				
TOTALS	307.5	0	0	8.1	70

WORKYEARS

Weapons Dept Code C85	Government	FFRDC On-Site	FFRDC Off-Site	Contract Support On-Site	Contract Support Off-Site
S&T	8.3	0	0		
Engineering Development	6.7	0	0		
Production		0	0		
In-Service Engineering	0.7	0	0		
Other (T & E)	14.7	0	0		
Other (FME)	0.6				
TOTALS	31	0	0	0	0
WORK YEAR GRAND TOTALS	1,110.95	0	0	87.85	435.5

2. B. Number of square feet of space occupied broken out by: laboratory specific space, general office space, and other space (describe). Note if government owned or leased.

Environmental Code C8305	Lab Space, Sq. Ft.	Office Space, Sq. Ft.	Other, Sq. Ft.	Owned or Leased
TOTALS	5,000	2,600	1,500	Owned

Safety Code C8403	Lab Space, Sq. Ft.	Office Space, Sq. Ft.	Other, Sq. Ft.	Owned or Leased
TOTALS	0	5,888	0	Owned

Range Dept T&E Code C32	Lab Space, Sq. Ft.	Office Space, Sq. Ft.	Other, Sq. Ft.	Owned or Leased
TOTALS	9,9175	14,665	369,187	Owned

Research Dept Code C023	Lab Space, Sq. Ft.	Office Space, Sq. Ft.	Other, Sq. Ft.	Owned or Leased
TOTALS	37,300	8,280	6,974	Owned

Weapons, Engineering & Logistics Dept. Code C26	Lab Space, Sq. Ft.	Office Space, Sq. Ft.	Other, Sq. Ft.	Owned or Leased
TOTALS	28,200	77,813	600	Owned

Aircraft Weapons Code C21	Lab Space, Sq. Ft.	Office Space, Sq. Ft.	Other, Sq. Ft.	Owned or Leased
TOTALS	53,281	5,070	17,019	Owned

Attack Weapons Code C28	Lab Space, Sq. Ft.	Office Space, Sq. Ft.	Other, Sq. Ft.	Owned or Leased
TOTALS	13,000	7,800	0	Owned

Ordnance Systems Dept Code C27	Lab Space, Sq. Ft.	Office Space, Sq. Ft.	Other, Sq. Ft.	Owned or Leased
TOTALS	126,399	93,199	0	Owned

Weapons Dept Code C85	Lab Space, Sq. Ft.	Office Space, Sq. Ft.	Other, Sq. Ft.	Owned or Leased
Totals	141,112	19,640	0	Owned

SPACE GRAND TOTALS	503,467	234,955	395,280

2.C. List total FY93 funds and list main programs and customers. Summarize the total energetics funding for each department.

Environmental	Program	FY 93 Funding, $K	Customer
C8305	Environmental Permits	160	C27 Overhead
	TOTALS	160	

Safety	Program	FY 93 Funding, $K	Customer
C8403	Safety Inspections	260	C27
	OP-5 Regulation Assistance		
	TOTAL	260	

Research Dept	Program	FY 93 Funding, $K	Customer
C0235	Various Energetics Chemistry	1,043	Office of Naval Research
C02391	IR Laser Interactions	23	Office of Naval Research
C02394	IR Advanced Materials	137	Office of Naval Research
C02392	IR Combustion Control	95	Office of Naval Research
C02392	IR Plume Signature Control	91	Office of Naval Research
C02394	IR Hydrocode	83	Office of Naval Research
C02391	IR Energetic Materials	126	Office of Naval Research
C02392	IR Combustion Instability	94	Office of Naval Research
C02391	IR Hexastar Polymers	66	Office of Naval Research
C02391	CSD Special Deposit	6	United Technologies
C02391	Dilatometry Testing	14	United Technologies
C023903	Shaped Charge Jet	30	Naval Surface Warfare Center
C023903	SCJFT Warhead Eval	49	Naval Sea Systems Command
C023903	Martest Trials	11	Naval Surface Warfare Center
C023903	Weapon Effect Tests	44	Naval Surface Warfare Center
C023903	Blast Hardened Thrml Inst	110	DDBF
C023903	Shaped Charge Jet	36	Naval Research Laboratory
C02391	Ignition Tests	15	Air Force
C02392	Minimum Signature	36	Office of Naval Research
C02392	Active Control	115	Office of Naval Research
C02392	Control of Soot Formation	110	Office of Naval Research
C02392	Pressure Oscillations	50	Army Research Lab, Aberdeen*
C02392	Missile Plumes	120	Office of Naval Research
C023903	Trident Admin	1,705	Strategic Systems Proj Office
C02392	Space Shuttle	65	NASA
C023903	Trident	1,598	Strategic Systems Programs
C023903	Trident	4,314	Strategic Systems Programs
C023903	Trident	263	Strategic Systems Programs
C02394	ADN Detonation	63	Office of Naval Research**
C02394	ADN Detonation	63	Office of Naval Research**
C02394	Wedge Tests	30	Army Missile CMD, Picatinney
C02394	A/C Survivability	101	Air Force, Wright Patterson AFB
C02392	Gun Instabilities	5	Army Missile CMD, Picatinney
C02392	Pressure Oscillations	50	Army Research Lab, Aberdeen*
C02392	Heat Flux	170	Office of Naval Research
C02391	Insensitive Propulsion	148	Naval Sea Systems Command
C02391	IMAD/Propulsion	686	Naval Sea Systems Command
C02394	IMAD/ALOS	62	Naval Surface Warfare Center
C02391	Explosives Technology	247	Naval Surface Warfare Center
C02391	Explosives Technology	100	Naval Surface Warfare Center

*These are not duplications
**These are not duplications, but represent matching funding from two sources.

Research Dept	Program	FY 93 Funding, $K	Customer
C02391	Propulsion	149	Office of Naval Research
C02391	Propulsion	429	Office of Naval Research
C02392	Airframe	39	Office of Naval Research
C02392	Guilder Dormouse Dc	141	Nelo
C02394	SDIO-Millimeter	10	Office of Naval Research
C02390	Core B&P	21	Nawc Overhead
C02392	Plume Sig B&P	25	Nawc Overhead
	TOTALS	12,988	

Weapons Engineering & Logistics Dept	Program	FY 93 Funding, $K	Customer
C264	Machine Shop Support	400	C27
35B3	AIWS	140	PMA-201
35B5	JDAM	80	PMA-201
35B4	ARS	95	PMA-201
39B2	AMRAAM	20	PMA-201
35B1	GBU-24	200	PMA-201
35B1	Maverick	42	PMA-242
35A	HARM	140	PMA-242
39B12	Sidewinder	75	PMA-259
39B8	Sparrow	300	PMA-259
3609	Phoenix	28	PMA-259
35E	Special Projects	140	NELO
35C	Tomahawk/Cruise	137	PMA-280
35A	HARM	420	NAVAIR PMAs
39B12	Sidewinder	490	NAVAIR PMAs
35B4	ARS	70	NAVAIR PMAs
39B8	RAM	140	NAVAIR PED
39B8	A6E	70	NAVAIR PED
39B8	Sparrow	280	NAVAIR PMAs
3609	Phoenix	140	NAVAIR PMAs
36/39	Misc	350	NAVAIR PMAs
35C	Cruise Msl	420	NAVAIR PMAs
39B11	Standard Missile	280	NAVSEA
3609	Phoenix	300	NAVAIR PMAs
35B4	ARS	80	NAVAIR PMAs
39B8	RAM	160	NAVAIR PMAs
39B	Cruise	400	NAVAIR PMAs
35A	HARM	150	NAVAIR PMAs

Weapons Engineering & Logistics Dept	Program	FY 93 Funding, $K	Customer
39B12	Sidewinder	450	NAVAIR PMAs
39B8	Sparrow	450	NAVAIR PMAs
3267	20mm Guns	70	NAVAIR PMAs
35B5	ABF	140	NAVAIR PMAs
35B5	JDAM	140	NAVAIR PMAs
P2611	AMRAAM - PRAT	2,349	USAF
P2611	AMRAAM - PRAT	189	USN
P2611	AMRAAM - TM	18	USAF
P2611	Phoenix Msl SPT	218	USN
P2611	Phoenix - GLAT	661	USN
P2613	Phoenix - TM	219	USN
P2611	HARM - PRT	114	USAF
P2611	HARM BLK3	1	USN
P2611	Harpoon/SLAM	487	USN
P261	Various In-Service Weapon Systems	116,805	AIR 418
C265	Various CM/DM Weapons Systems	2,040	NAWC-Various
	TOTALS	129,899	

Code	Aircraft Weapons Dept	FY 93 Funding, $K	Customer
C2182	Shaped Charge Jet	63	NAVSEA
C2182	Mk83 FAB	25	NAVAIR
C2182	Ammo Research	3	OUSD
C2182	MIKES Air Gun	20	OUSD
C2182	Rocket Motor Impact	85	OUSD
C2182	Weapons Bay Vulnerability	31	OUSD
C2182	Expendables Test	92	OUSD
C2182	Internal Bay	152	OUSD
C2182	V-22 NBC Filter	2	OUSD
C2182	F-18 E/F Dry Bay	292	OUSD
C2182	BECJRM Panel Shots	19	NAVAIR
C2182	Thermoplastic Wing	68	MC AIR IRAD
C2182	V-22 Support	36	OUSD
C2182	Fuel Ingesiton Tolerance Spec	245	OUSD
C2182	F-18 Full-Up Ammo Drum	40	OUSD
C2182	Ullage Suppression	135	NAVAIR
C2182	F-18 Dry Bay Follow-On	40	OUSD
C2182	V-22 Dry Bay	46	OUSD

Code	Aircraft Weapons Dept	FY 93 Funding, $K	Customer
C2182	F-18 E/F Fuel Cube	65	OUSD
C2182	BSU 85 &86	27	NAVAIR
C2182	Missile Mod	7	NAVAIR
C2182	25mm Evaluation	4	C32C2
C2182	Directed Energy Laser Support	41	SPAWAR 232
C2182	Rocket Research Dry Bay	71	OLIN/Rocket Research Corp.
C2182	SNORT	73	C3222
C2182	TDU 34	36	C3243
	TOTALS	1,718	

Range Dept	Program	FY 93 Funding, $K	Customer
C321	Trident Aging/Motor Disposal Support	1,892	NSSP
C321	Trident Motor Disposal Support	1,014	NSSP
C321	Plume Measurement CTEIP	1,616	NAWC-HQ/OSD
C321	Institutional Support (M&O/I&M/FAC)	2,648	NASC
C321	START Treaty Comp	65	NSSP
C321	Polaris Stars Testing	70	SD - SANDIA Natl Lab
C321	5"/54 Ammo Arena Test	154	NOSI
C321	2.75 IMAD Testing	152	NOSI
C321	Minuteman Motor CT/Firing Support	190	Norton AFB
C321	XM-46 Liquid Prop IM Testing Support	446	Picatinney Arsenal (Army)
C321	M830A1 Round IM Test	110	Picatinney Arsenal
C321	NASA RTR Firing Support	88	SD-THIOKOL
C321	TALOS Motor CT Support	35	Norton AFB
C322	Air/Ground Range Testing (*)	10,876	PEOs, PMAs, Proj Offices
C322	*F/A-18, F-14D, F-16, AND AV-8 Weapons Integration		PEOs, PMAs, Proj Offices
C322	*AC-130 Fire Control Verification		PEOs, PMAs, Proj Offices
C322	*Sidewinder		PEOs, PMAs, Proj Offices
C322	*AMRAAM		PEOs, PMAs, Proj Offices
C322	*HARM		PEOs, PMAs, Proj Offices
C322	*Tomahawk		PEOs, PMAs, Proj Offices
C322	*GBU-24		PEOs, PMAs, Proj Offices
C322	*Rockeye		PEOs, PMAs, Proj Offices
C322	*Fleet Training (Walleye, Maverick, Guns, LGBs, Etc.)		PEOs, PMAs, Proj Offices
C322	*Predator		PEOs, PMAs, Proj Offices
C322	*20MM, 25MM, 105MM, 120MM, AND 5" Ammunition		Marine Corps/Army
C322	*Light Assault Vehicle - Air Defense (LAV-AD)		Marine Corps
SNORT	NACES	29	NAWC-AD
SNORT	NACES	37	NAWC-AD
SNORT	Sidewinder Wing	41	NAWCWPNS

Range Dept	Program	FY 93 Funding, $K	Customer
SNORT	PHTAP	3400	NAWCWPNS
SNORT	Warhead Impact	114	NAWCWPNS
SNORT	Warhead Impact	323	NAWCWPNS
SNORT	20-mm Rainfield	44	AIR FORCE
SNORT	Dual-Mode Seat	29	NAWCWPNS
SNORT	BOA-1SC	15	NAWCWPNS
SNORT	Rkt Mtr IR Study	30	NAWCWPNS
SNORT	SLAM	139	NAWCWPNS
SNORT	AATC Ang Fly-By	73	AIR FORCE
SNORT	BLU-109	120	NAWCWPNS
SNORT	Tomahawk	69	NAWCWPNS
SNORT	AMRAAM	147	NAWCWPNS
SNORT	AAR-44 Fly-By	44	
SNORT	MRTFB	607	NAWCWPNS
	TOTALS	24,617	

Ordnance Systems Department	Program	FY 93 Funding, $K	Customer
C27	Misc Guided Wpns	600.0	NSEA
C27	Misc Guided Wpns	156.4	NASC
C27	Misc Guided Wpns	85.0	MCRD-Mar Corps Sys Cmd
C27	Misc Guided Wpns	110.0	NSWC-Crane
C27	Misc Guided Wpns	10.0	NSWC-Panama City
C27	Misc Guided Wpns	44.0	NSWC-Dahlgren
C27	Misc Guided Wpns	35.0	NSWC-White Oak
C27	Standard Missile	60.0	NSWC-Dahlgren
C27	Trident/Polaris/Poseiden	270.0	Strat Sys Proj Office
C27	Misc Unguided Wpns	75.0	NASC
C27	GP Bomb Systems	226.0	NASC
C27	Gun Systems	90.3	AF-Eglin
C27	Gun Systems	7.0	Army-Picatinny Arsenal
C27	Gun Systems	289.1	Army-Rock Island Arsenal
C27	Gun Systems	489.7	MCRD-Mar Corps Sys Cmd
C27	Gun Systems	2.5	NAV AV Depot-Alameda
C27	Gun Systems	33.0	NONR-Off of Navy Research
C27	Gun Systems	214.0	NSEA
C27	Gun Systems	50.0	NSWC-White Oak
C27	Gun Systems	305.0	NSWC-Indian Head
C27	Gun Systems	259.0	NASC (Via Pt Mugu)
C27	Gun Systems	1,235.0	NASC (Directly)
C27	Aircraft Survivability	750.0	DNA-Def Nuclear Agency
C27	Aircraft Survivability	150.0	NASC

Ordnance Systems Department	Program	FY 93 Funding, $K	Customer
C27	Misc R&T	52.0	DOE-Dept of Energy
C27	Misc R&T	95.0	NONR-Off of Navy Research
C27	Misc R&T (TBMD)	3,750.0	Strat Sys Proj Office
C27	Misc R&T	74.1	NAV WPN SPT CNTR-Crane
C27	Guidance & Control R&T	337.0	MCRD-Mar Corps Sys Cmd
C27	Fuze R&T	185.0	AF-Eglin
C27	Fuze R&T	20.0	Army-Redstone Arsenal
C27	Fuze R&T	5.0	NAV WPN SPT CNTR-Crane
C27	Propulsion R&T (MMPT ATD)	3,816.5	NASC (Directly)
C27	Propulsion R&T (TOW TRGTS)	264.3	NASC (Via Pt Mugu)
C27	Propulsion R&T	3,220.0	NONR-Off Navy Research
C27	Propulsion R&T	392.0	AF-Holloman
C27	Warheads R&T	33.0	Army-US WTRWYS ENGIN
C27	Warheads R&T	875.0	NONR-Off Navy Research
C27	Warheads R&T	219.0	NSWC-Dahlgren
C27	Warheads R&T	30.0	NAV WPNS STN-Earle
C27	Explosives R&T	47.6	Army-US WTRWYS ENGIN
C27	Explosives R&T	65.0	DNA-Def Nuclear Agency
C27	Explosives R&T	34.0	DOE-Dept of Energy
C27	Explosives R&T	1,138.1	NSWC-White Oak
C27	Wpns Matls R&T	50.0	Army-Aberdeen Pr Ground
C27	Wpns Matls R&T	200.0	Army-Tank Automotive Cmd
C27	Wpns Matls R&T	25.0	NSWC-White Oak
C27	Insensitive Munitions	50.0	AF-Wright Patterson
C27	Insensitive Munitions (A/C ORD SFTY)	3,317.0	NASC
C27	Insensitive Munitions (IMAD/PROP)	12,602.0	NSEA
C27	Insensitive Munitions (IMAD/ALOS)	1,015.0	NSWC-Dahlgren
C27	Insensitive Munitions	967.0	NSWC-White Oak
C27	Insensitive Munitions	25.0	NAV WPNS STN-Earle
C27	Energ Matls R&T	110.0	Asst Sec of Defense
C27	Energ Matls R&T	15.5	MCRD-Mar Corps Sys Cmd
C27	Special Projects (Munit Storage)	366.5	AF-Eglin
C27	Special Projects (Project E)	325.0	AF-Patrick AFB
C27	Special Projects	6.0	Army-Redstone Arsenal
C27	Special Projects	260.0	Army-Tank Automotive Cmd
C27	Special Projects (High-Perf Mag)	951.0	Nav Civil Engr Lab
C27	Special Projects	17.0	CMDR-Mid East Forces
C27	Special Projects	9.6	Nav Intl Prog Office

Ordnance Systems Department	Program	FY 93 Funding, $K	Customer
C27	Special Projects	60.0	NSEA
C27	Special Projects	20.0	Asst Dep Undersec of Navy
C27	Special Projects	22.0	NSWC-White Oak
C27	Misc Aircraft & Avionics	72.0	AF-Eglin
C27	Aerial Targets & RPVS (SSST)	1,229.2	NASC
C27	Misc Support	165.0	NAVAIR Devel Cntr-Warminster
C27	Misc Support	60.0	NASC
C27	Misc Support	16.5	Nav Research Lab
	TOTALS	42,155	

Attack Weapons Dept	Program	FY 93 Funding, $K	Customer
289	Sidewinder	500	NAVAIR
289	SLAM/Harpoon	400	NAVAIR
289	Standard Missile	400	NAVSEA
289	Sparrow	400	NAVAIR/NAVSEA
289	AMRAAM	300	NAVAIR
289	High Perf. Magazine	300	NAVFAC
289	Maverick Booster	150	NAVAIR
289	MMPT	100	NAVAIR
289	IMAD	150k	NAVAIR
289	Air Weaponry Block	150	ONR
C281	JTCG/ME	800	DOD/JTCG/ME
C281	JSOW	70	NAVAIR PMA-201
C281	JDAM	400	NAVAIR PMA-201
C281	ARS	35	NAVAIR PMA-201
C281	HARM	350	NAVAIR PMA-242
C281	Tomahawk	160	NAVAIR PMA-CMPO
C281	SLAM	200	NAVAIR PMA-SLAM
C281	AX	200	NAVAIR PMA-AX
	TOTALS	4,915	

Code	Weapons Dept	FY 93 Funding, $K	Customer
C8500	Wpns Dept	397.4	G&A
C8503	Eod Suppt	42.3	G&A
C8510	Mag Ops	174.9	Misc G&A Funds
	Mag Ops Div	183.8	Misc Dir Projects
C8520	Ord Admin Div	193.7	Misc G&A Funds
	Ord Admin Div	42	Misc Dir Projects
C8530	Wpns Assembly Div	129.2	Misc G&A Funds
		112.9	Misc Dir Projects
	TOTALS	1,276.2	
GRAND TOTAL ENERGETIC DOLLARS K		217,988	

WORKYEARS FOR TDDs (PROXIMITY FUZES)

Intercept Weapons Code C293	Government	FFRDC On-Site	FFRDC Off-Site	Contract Support On-Site	Contract Support Off-Site
S&T	25.2	0	0		2
Engineering Development	28.1	0	0		
Production	11.5	0	0	1.9	0.2
In-Service Engineering	5.2	0	0		
Other (Describe)		0	0		
Work Details	7.3				
Engineering Support Services				1	
TOTALS for TDDs	77.3	0	0	2.9	2.2

SPACE FOR TDDs (PROXIMITY FUZES)

Intercept Weapons Code C293	Lab Space, Sq. Ft.	Office Space, Sq. Ft.	Other, Sq. Ft.	Owned or Leased
Totals for TDDs (Proximity Fuzes)	12,681	11,967	32,181	Owned

PROJECTS/FUNDING FOR TDDs (PROXIMITY FUZING)

Intercept Weapons	Program NR/Title	FY 93 Funding, $K	Customer/Sponsor
C2932	008/RAM	409	NAVSEA/PEO (TAD) DR
C2932	016/Sidewinder	642	NAVAIR/PMA-259
C2932	JDAM	68	NAVAIR/PMA-201
C2932	ARS	68	NAVAIR/PMA-201(PEO)
C2932	022/HARM	150	NAVAIR/PMA-242
C2934	020/Standard Msl	3,137	NAVSEA/PMS-422
C2935	Ordnance Project	450	Office of Naval Research
C2935	Counter Low Observables Project	350	Office of Naval Research
C2935	Advanced Threat Fuze	2,660	NAVSEA/PMS-422-1
C2935	Guid Integrated Fuzing	1,630	NAVSEA/PMS-422-1
C2935	Special Projects	320	Various
C293/C29C	Special Projects	680	Various
C2933	014/AMRAAM	80	YA, JSPO AMRAAM
C2933	034/MHIP	12	PMA 259, NAVAIR
C2933	023/Sparrow	152	PMA 259, NAVAIR
C2933	Special Projects	1,367	Various
C2933	015/Phoenix	69	PMA 259, NAVAIR
	TOTALS	12,244	

3. *Describe by major functional and product lines, the capabilities of your activity to perform energetic functions in terms of manpower, intellectual/skill capability and capacity, and major facilities and equipment.*

3.A. INTRODUCTION AND OVERVIEW

The Naval Air Warfare Center Weapons Division (NAWCWPNS) has the expert people, equipment, and facilities to provide a full-spectrum, full-life-cycle capability in energetics (energetic materials, ordnance, and propulsion). Additionally, we have a very important asset for this kind of work—physical space. With over a million acres of land space at the China Lake site, NAWCWPNS has the room to perform the full-spectrum of energetics work and to do it efficiently. Because we are able to provide the proper physical separation for our operations, we are able to conduct concurrent operations in our facilities without regard for other ongoing operations. In addition to efficiency and flexibility, this gives NAWCWPNS the capacity to accommodate additional workload without significant modifications or additions. Also, because the current operations occupy such a small percentage of the available land, NAWCWPNS has an excellent ability to efficiently accommodate additional workload by constructing additional facilities.

Currently, ongoing work at NAWCWPNS ranges from basic research to energetic molecules, through technology advancement of materials and components to the design and development of weapons and weapon components, to the integration into the all-up round weapon, and the integration of the weapon into the weapon system. Test and evaluation is conducted at every step of the process. This expertise also gives us the important ability to provide support to the Fleet and to solve its problems. These activities are carried out at a variety of locations at China Lake ranging from the well-equipped laboratories in Michelson Laboratory where the new (breakthrough) energetic molecule CL-20 was recently synthesized, to the remote areas of our ranges where we have conducted large-scale energetic material experiments involving 500,000-pound net explosive weight of ordnance. In between these extremes are a wide variety of well-equipped, capable facilities manned by experienced people with demonstrated expertise.

NAWCWPNS provides a full life-cycle capability in energetics. Its scientists and engineers are directly involved in all the acquisition phases of energetic materials, ordnance, and propulsion from fundamental research in the physical sciences to the support of weapons in the Fleet. Because of this, they are able to identify technical needs at all acquisition stages and to find appropriate solutions to these needs using the full range of resources resident in NAWCWPNS. Conversely, they are in a unique position to feed "lessons learned" and technical shortcomings back into the research and technology cycles to provide solutions for future weapons and upgrades of existing weapons.

NAWCWPNS routinely teams with industry to provide a combined expertise that is greater than either can provide separately. This teaming ranges from technology CRDAs, such as the injection loading CRDA with Alliant Technologies to the teaming arrangement with Texas Instruments for the assembly and checkout of the first JSOW weapons. It will be advantageous to do more and more of this teaming in the future as the capability in both the government and industry continues to be reduced because of the defense drawdown. We will need to combine all our capability to provide the needed expertise.

Another characteristic of NAWCWPNS that provides a real strength in energetics is the capability to do full-spectrum research and development and conduct test and evaluation at the same site. For example, a full range of energetic materials processing capability exists in the China Lake

Propulsion Laboratory complex located five miles east of Michelson Laboratory. This capability ranges from laboratories that can handle larger quantities of material than is safe to do in Michelson Laboratory (up to 150-gallon size mixes, or more than 2000 pounds of explosive or propellant). This complex also has a complete capability for casting rocket motors or warheads and assembling them into complete weapon systems.

Ten miles further to the east is the Skytop complex with its seven test bays that have the capability to static test rocket motors up to first-stage Trident size (1.5 million pounds of thrust). Tests can be conducted horizontally or vertically and performance characterized using a number of techniques, including thrust measurement and real-time X-ray technology where engineers and scientists can actually observe the propellant inside the rocket motor during the combustion process.

Either of these complexes is an outstanding and almost irreplaceable asset by itself, but the colocation of these capabilities gives NAWCWPNS a unique and comprehensive capability. Experimental propulsion systems using new propellants and novel design features can be fabricated in the CLPL complex, inspected and tested nondestructively, and then performance tested at Skytop or safety tested at adjacent test sites, all without ever leaving the China Lake site—indeed without even leaving the same secure restricted area. This is, of course, only one example. This same advantage applies to all our areas of energetics RDT&E.

The next sections describe our capabilities by major functional and product lines. The description is organized by the major product categories of Energetic Materials, Ordnance, Propulsion, Weapon Integration, and Guns and Ammunition. For ease of reading, the functional areas of Test and Evaluation, Ordnance Plant capability, and Support Functions are described separately. Because these are applicable to all the product lines, they would otherwise be repeated in each product line discussion. The following section provides a summary of the facilities in one location for the reader's convenience, with their applicability to the product lines indicated in a matrix. The last section provides a summary of the personnel skills that are integral to our capability in energetics. This is summarized in one section rather than dispersed throughout the product line discussions, again for the convenience of the reader.

The lists of buildings and facilities used for each category of capabilities in the following sections is not exclusive, i.e., many of the buildings are used for multiple purposes.

3.B. CAPABILITIES DESCRIPTION

3.B.1. Energetic Materials

NAWCWPNS China Lake has full-spectrum, full-life-cycle capability in energetic materials RDT&E. Work includes synthesis of new energetic molecules to be used in propellants and explosives, characterization of these new ingredients (primarily safety and compatibility studies), scale-up of these ingredients so that sufficient material is available to formulate research propellants and explosives, the actual formulation work, and characterization of these formulations (performance, hazards, signature, combustion stability, mechanical behavior/aging, and environmental considerations). The successful candidates that emerge from this formulation and characterization process are transitioned to the Propulsion or Ordnance product lines. An example of China Lake's success in these largely research and technology endeavors is CL-20. This high-energy ingredient was first synthesized in the Research Department in 1987 and was scaled up in joint efforts between the Ordnance Systems Department and the Research Department . The characteristics of this new ingredient were determined by these two departments working together. The material was used to formulate propellants and explosives with outstanding success in each

area. High-performance, minimum-signature propellants having low hazards have been successfully formulated and demonstrated in the Insensitive Munitions Advanced Development Propulsion program. Work using CL-20 in explosive formulations has demonstrated the highest performance ever achieved while having acceptable hazards. These successes at China Lake have led to a Cooperative Research and Development Agreement (CRADA) proposal linking China Lake with Thiokol Corporation, which is producing this material. This material is also finding potential technology transfer in application of CL-20 based explosives for the oil industry, primarily in liner penetration technology.

While there have been many successes in the research and technology functional lines, there have also been many joint successes with the test and evaluation functional area as well. For example, test and evaluation facilities are being used by a team of Range and Research Department people working with Lockheed Missiles and Space Corp., Thiokol Corp., Hercules Corp., and the Chemical Systems Division of United Technologies to determine the hazards of strategic missiles. These impact studies involve laboratory scale tests, tests with 10 pounds of propellant, 100 pounds of propellant, and third-stage motors loaded with inert propellant simulant.. These studies show not only the prompt shock to detonation transition but a delayed detonation. This delayed detonation is of interest because, although it occurs at lower velocity thresholds, it is more violent than the conventional shock to detonation.

An additional linkage between the Research, Ordnance Systems, and the Range Departments is in the research and development programs developing technology to dispose of excess Fleet ballistic missile motors in a safe, cost-effective, and environmentally clean method. These research data obtained from laboratory to 40,000-pound scale tests are being used to design the full-scale facility. China Lake is one of several candidate sites for the location of the full-scale system. These data may also be used to design a system that is being proposed for construction in Eastern Europe to dispose of strategic missiles from the former USSR.

Other examples of China Lake teaming with industry include the CRADA with Alliant Techsystems to develop injection loading of explosive, the frequent use of China Lake's unique facilities, equipment and personnel by industry, and the participation and leadership activities of China Lake personnel in Joint Army Navy NASA Air Force (JANNAF) Interagency Propulsion Committee.

Results of China Lake's RDT&E activity in energetic materials are found in many weapons.

CHINA LAKE'S CONTRIBUTION TO THE FLEET	
EXPLOSIVE	APPLICATION *
PBXN-1	Polaris A-3 Poseidon
PBXN-3	Sidewinder Sparrow
PBXN-4	Sparrow
PBXN-5	Sidewinder FAE Weapons Mk 1 Destructor Standard Missile 2 Tarter APOBS HEI-T Projectile
PBXN-6	APAM
PBXN-101	Shrike Standard Arm
PBXN-104	Phoenix
PBXN-107	HARM Tacit Rainbow Tomahawk IW/ER Tomahawk CEB Advanced HARM
PBXN-201	FAE
PBXN-202	Smoke Rocket Warheads
PBXN-301	Sidewinder

* "List of Explosives for Navy Munitions (U), SW010-AG-ORD-010.

China Lake has played a significant role in the development of propellant and pyrotechnics for the following missiles/applications. In some instances it was a joint effort with industrial contractor.

CHINA LAKE'S CONTRIBUTION TO THE FLEET
Reduced Smoke Sidewinder
Shrike
HARM
Chaparral
ASROC
Vertical Launch ASROC
BOMROC
Mk111 Tomahawk
Zuni
2.75 inch rocket
Insensitive Munition Hellfire
CATFAE
Poseidon
Trident C-4, D-5
Vertical Seeking Seat
Harpoon
5" GP
8" GP
5" Rocket Assisted Projectile
9" High Performance Test Track Booster
Tiger Sled Track Motor
Castable Gas Generator
Helicopter Hand Fired Flare
Soft Parachute Extraction Motor
Infrared Flare (several)
Silver Iodate for weather modification

China Lake's expertise in energetic materials RDT&E not only results in propellants, pyrotechnics, and explosives for missile motors, warheads, and flares, but is also used in problem solving as illustrated in the following example. Ammonium perchlorate (AP) is the principal ingredient in many propellants China Lake has had a strong research program in the decomposition, ignition, and combustion of AP. When PEPCON, one of the two manufacturers of AP in the U.S. had a major explosion that destroyed their plant at Henderson, Nevada, a large-scale tri-service and NASA program was initiated. The purpose of the program was to understand the reactivity of AP and show that it was safe to manufacture, ship, and use. There was a threatened moratorium on AP use. China Lake's expertise was called on technically as well as to chair one of the major teams. This work, much of it conducted at China Lake such as the large-scale testing, helped prove that it was safe to ship and use AP, thus avoiding a shutdown that would have had major impact on missile motor manufacturing. Less than a year later, Kerr-McGee, the other major producer of AP

and at that time the only producer, had a serious fire at their Henderson plant. Once again, China Lake was called on. The results convinced the Clark County fire department that although an accident occurred, Kerr-McGee had done everything properly. As a result Kerr-McGee was allowed to continue operation. Thus China Lake's expertise helped keep the qualification of AP, helped PEPCON become reconstituted as WECCO, and kept Kerr-McGee in operation. As a result the U.S. missile propulsion industry hardly missed a beat. This is just one example of the application of China Lake's expertise to solve significant problems.

These are just a few of the examples of the research, development, test, and evaluation being conducted in the Energetic Materials Product Line. This work, much of it unique in the U.S. and the world, is possible because of the outstanding people, equipment ,and facilities available at China Lake. In the Energetic Material Product Lines, there are approximately 120 scientists, engineers, and skilled technicians. Many of these people have advanced degrees, many years experience, and are recognized worldwide. China Lake is unique in the facilities used to support this product line; facilities that range from state-of-the-art research laboratories to large-scale testing (e.g., detonation of 500,000 pounds of explosive in one test) that can be done in only a few locations in the world. The testing is fully instrumented to determine data essential to research and development programs; the testing is not only unique in scale, but in instrumentation capability. As an indicator of this unique investment, China Lake has over $49.65M in facilities to formulate and test up to 10 pounds of explosives and propellant. The facilities to test the larger amounts of explosive are described in the Test and Evaluation area.

The primary facilities used in support of the laboratory and small-scale development and testing of energetic materials are

Chemical Analysis Research Facility
Propulsion and Energy Conversion Research
Energetic Materials Synthesis and Scale-Up Laboratory
Propellants and Explosives Formulation Laboratories
Energetic Materials Properties Analysis Laboratory
Detonation Physics Laboratory

As the scale of the material being processed or evaluated increases, the list of facilities utilized expands to include

China Lake Ordnance and Propulsion Pilot Plant
Cactus Flats Ordnance Test Area
Ordnance Test Complex
Tactical Propulsion Test Facility

In addition to the facilities dedicated specifically to Energetic Materials Product Line, there are many support facilities needed. These include the machine shops, welding shops, photographic and instrumentation groups, energetic materials handling and transportation personnel. See section 3.C for a more detailed discussion of the facilities that support the Energetic Materials product line.

3.B.2. Propulsion

Capabilities

The China Lake Propulsion Laboratories (CLPL) possess the technical expertise, skills, equipment, and facilities to provide full-spectrum, cradle-to-grave research and development, production/production support/in-service engineering, test and evaluation, and demilitarization for solid rocket and airbreathing propulsion. China Lake has the land space, infrastructure, hazardous operation sitings, and environmental permits to conduct any conceivable propulsion RDT&E or production operation within the scope of government laboratory and field activity purview.

Since the beginning of rocketry in the U.S., China Lake has been the leader in its application to the military and the development of new technologies. The first forward-fired aircraft rockets and barrage rockets used in the Pacific theater during World War II were developed and produced at China Lake. Through the subsequent decades China Lake continued to provide rocket propulsion for each succeeding generation of weaponry. The rocket motors for 2.75" rocket, Zuni rocket, Sidewinder, ASROC, HARM, Chaparral, Skipper, Vertical Launch ASROC, and many others were designed, developed, and qualified at China Lake.

The Propulsion Laboratories have also led the way in development of cutting-edge technology. The first extruded double-base propellants, reduced smoke propellants, fluorocarbon propellants, magnesium-teflon, magnesium-teflon-viton, the Universal Arming-Firing Device, the first consumable igniter, pioneering work in integral rocket ramjets, the first vertical launch missile, the first thrust vector controlled air-to-air missile, advanced liquid fuels (including RJ-4I, JP-10, and RJ-7), every thrust vector control scheme—jet tabs (Tomahawk Mk 106), jet vanes (Seasparrow, Vertical Launch ASROC), trapped-ball movable nozzle (Tomahawk Mk 111, SM-2 Mk 72)--now in-service, and many advanced propellant processing innovations were developed and demonstrated at China Lake and transitioned to industry for systems application. Today, China Lake leads the nation in synthesis of new energetic materials (CL-20), reduced/minimum signature technologies, insensitive munitions, integral aero-thrust vector control, combustion stability, composite cases for tactical missiles, liquid fuel ramjet technology, and advanced processing technology. The breadth of current work extends from basic research to production, and demilitarization. Some examples of current work in various phases of the acquisition cycle are given in the following paragraphs.

CL-20 is a new energetic molecule and was first formulated at China Lake. China Lake has developed synthesis and manufacturing methods and has transferred these to industry. CL-20 propellants have been formulated and scaled-up at China Lake to demonstrate processability, and good ballistic and physical properties. Full-scale tactical rocket motors have been made and static firing and insensitive munitions testing are in process. This ability to move from research to hardware demonstration in a rapid fashion is a well recognized China Lake specialty.

China Lake is the national leader in technology for the reduction of rocket motor plume signatures. This technology offers significant tactical advantage in air-to-air combat by delaying enemy alertment, thus reducing his response time. The technology advancements involve development of new ingredients, new propellant formulations, innovative nozzle design, novel grain and blast tube design, and development of new plume prediction codes. An overall propulsion "systems" approach is utilized to incorporate the various technologies to best advantage.

China Lake, in partnership with industry, is currently developing and demonstrating under an Advanced Technology Demonstration breakthrough technologies in propulsion. Incorporated into the rocket motor and control system demonstration are pulse motor energy management, integral-

aero-thrust vector control, composite case, and laser ignition system. This is the first time that these technologies have been demonstrated, and the first time that a vertical launch missile has been successfully launched without roll control. Several projects—AMRAAM, Evolved Seasparrow, CORPSAM—have indicated a high degree of interest in transition of this ATD technology as a product improvement.

China Lake is the recognized national leader in insensitive munitions (IM). China Lake's contributions to IM include work in composite cases, insensitive propellants, mitigation devices, and rocket motor and all-up-round container design. It is important to recognize that IM must be attacked from a systems viewpoint. The rocket motor design and configuration play a critical role in its response to hazard stimuli. China Lake has developed models for the prediction of hazard response (burn to violent response test, slow cookoff visualization test, cookoff test bomb, case design tool/fragment impact model, FRAGMAP code), which are now widely used in industry. China Lake has awarded numerous IM technology development and system demonstration contracts to the propulsion industry over the last 4 years and continues to work closely with industry and the other services to coordinate IM activities in the propulsion community. China Lake leads to NATO IM Information Council, which was established to exchange information and coordinate requirements among member nations.

In full-scale development, China Lake has served multiple roles. For Vertical Launch ASROC China Lake designed, developed, and qualified the rocket motor and thrust vector control (TVC) systems. A full-disclosure technical data package was delivered to the contractor for production. The motor and TVC are currently in production. For Tomahawk, China Lake was the Navy's technical direction agent, working with the contractor to assure compliance with Navy requirements. When problems arose in the propellant formulation, China Lake chemists assisted in its reformulation; when the contractor ignition system failed in developmental testing, China Lake designed a replacement; when problems developed in the hot-ball movable nozzle TVC, China Lake's experience in TVC and in particular with the cold-trapped ball nozzle came into play; and all through the long arduous qualification process, China Lake personnel worked cooperatively with the contractor to assure success. On HARM China Lake developed and demonstrated the technology and transitioned it to private industry for full-scale development. The HARM reduced smoke propellant and the nonsmoky, hard insulator were the result of this successful technology transfer. Another role filled by China Lake is risk mitigation. On SRAM II for the Air Force and on Sea Lance for the Navy, the contractor designs were deemed so technically risky or so costly that the sponsor elected to have China Lake execute an independent design effort. In the case of Sea Lance, the China Lake case and nozzle design were accepted into the production baseline in lieu of the contractor's designs.

After the successful develoment of HARM and its entry into production, China Lake's role in the program ended. In 1991 China Lake became involved with HARM production support at the request of NAVAIR because of a dispute with the contractor over whether the government should buy on waivers 170 reject rocket motors. China Lake developed a failure scenario showing a potential for a motor blow-up on ignition (which could result in the loss of the firing aircraft). This led to a more thorough look at the contractor's production process and to our conclusion that the contractor had some serious processing difficulties. At this time a violent explosion of a lot acceptance test motor occurred. The failure mode was identified as that previously predicted by China Lake. The existence of a serious problem could no longer be debated and production was shut down. Several thousand motors have been recalled from the Fleet as a result. China Lake has taken the lead in efforts to define the processing problems, institute acceptable fixes, instill new quality assurance provisions making use of statistical process control and continuous improvement, define and direct a requalification program, and resume production and continue to assist the contractor so that further problems do not develop.

An indication of the respect accorded China Lake within the propulsion community is the fact that China Lake personnel are often called in by all three military services to support failure investigations, as troubleshooters, and as a backup design or risk mitigation source. Examples of such activities include HARM, Tomahawk, and Trident for the Navy, SRAM II and Sidewinder MK 36 for the USAF, and Viper for the Army.

China Lake is currently conducting research on solid motor disposal utilizing low-pressure confined burning with exhaust scrubbers to determine low-pressure combustion mechanisms, analyze combustion products, and demonstrate that these products can be treated in an environmentally correct way.

The propulsion product line includes solid rocket motors, liquid divert propulsion and fuels, airbreathing propulsion (including ordnance rated turbines, liquid fuel and solid fuel ramjets, and combined cycle engines), and on-board power (thermal batteries, gas generators), and control and actuation systems (electromechanical, pneumatic, hydraulic). The work at China Lake in propulsion extends from research and technology, design and development, test and evaluation, production/production support/in-service support, to demilitarization and disposal. Functions supporting the propulsion product line include analysis and modeling (aerodynamics, thermal, structural, internal ballistics, cycle analysis, and flight performance); basic research in chemistry, materials, and combustion; formulation and scale-up of propellants; environmental qualification and testing; safety and environmental compliance; insensitive munitions and hazard testing; and range testing of both propulsion systems and all-up-round weapons. This colocation with the supporting technical organizations, with the cognizant weapons integration activities, and with the test ranges facilitates efficient transition of technology into systems demonstration and evaluation. Propulsion systems may be developed, fabricated, qualified, and integrated into the all-up-round, and flight tested at a single site.

Manpower

Two hundred eighty-six (286) scientist, engineer, and technician workyears are devoted to propulsion at China Lake. Their work and expertise extends from basic research in the chemistry of energetic materials and study of the combustion process, through advanced development of new technologies and engineering development of new systems, to test and evaluation, production support, in-service support, and demilitarization. One hundred thirty-six (136) workyears are in research and technology (6.1 to 6.3a), 68 workyears are in development (6.3b to 6.4), and 82 workyears are in production/production support and in-service engineering.

Intellectual/Skill Capability & Capacity

Intellectual/skill capability and capacity of China Lake personnel involved in solid rocket and airbreathing propulsion is indicated in the "Personnel Skill Summary" section in a number of ways: advanced degrees, patents and inventions, publications, awards, national and international professional leadership positions, and years of experience in various specialized fields of propulsion. Current on-board personnel represent 4,232 total years of experience in propulsion. For scientists and engineers the figure is 2,982 years of experience; for technicians and wage grade employees it is 1,250 years. The bulk of experience is in the research and development phase; 3 1 years total, with 2,415 amongst scientists and engineers.

Skills mix includes disciplines integral to the propulsion design process, as well as those necessary to support acquisition programs: requirements analysis and definition; conceptual design; flight performance analysis; cost and operational effectiveness trade studies; aerodynamics; thermal analysis; structures; propellant formulation and scale-up; case design, fabrication, and preparation;

nozzle design and fabrication; insulation and liner design and fabrication; solid rocket motor grain design; ignition systems; thrust vector control; control-actuator characterization, integration, and checkout; propellant processing; motor casting and assembly; quality control; static firing; hazard testing; internal ballistics; technical documentation (engineering drawings and specifications); product assurance; system safety; reliability and maintainability; acquisition and procurement support; production process engineering; technology and design transition to industry; and surveillance of contractor production. Additional areas of expertise unique to airbreathing propulsion are inlet design, combustor design, fuel management systems, and fuels.

Contributions to the Military Services

Listed below are propulsion systems, components systems, and technologies that China Lake propulsion employees invented, designed, or contributed to the development.

Solid Rocket Motors for Missiles, Rockets, and Projectiles
- 2.75" Rocket
- Zuni Rocket
- Sidewinder
- ASROC
- HARM
- Chaparral
- Vertical Launch ASROC
- Rocket Assisted Projectiles
- 5" Guided Projectile
- 5" Bombardment Rocket

Other Solid Rocket Applications
- Rocket Assisted Personnel Ejection Catapult
- Vertical Seeking Ejection Seat
- Smoky SAM Simulator
- High-Performance Test Track Booster (World land-speed record holder, on Hollomon AFB test track)
- Tiger Test Track Motor
- Vertical Launching System Gas Management Test Motor
- Extruded Magnesium-Fluorocarbon Infrared Flares

Airbreathing Propulsion
- Advanced Liquid Fuels (including RJ-4, JP-10 (Harpoon, SLAM, Tomahawk, ALCM) and RJ-7)
- Advanced Low-Volume Integral Rocket Ramjet
- Advanced Common Intercept Missile Demonstration (transitioned to AAAM, and SLAT)
- Solid Ramjet (HTPB) Fuels
- Aero-Grid Fuel Distribution System
- Expendable Ordnance-Grade Turbine (with NASA, Condor)
- Prop-Fan Missile Demonstration (with NASA, Long-Range Cruise Standoff Weapon)

Subsystems & Components (all are China Lake-developed products, *items are firsts in the propulsion field)
- *Extruded double-base propellants (applied to Zuni, ASROC, Sidewinder, 2.75" rocket, and many others)
- *Reduced smoke propellants (applied to Sidewinder, HARM, VLA, AMRAAM, Hellfire, and Maverick)
- *Fluorocarbon propellants (applied to flares and igniters)

X-61 propellant
HARM propellant
Vertical Launch ASROC propellant N-63
Mk 111 Tomahawk propellant
*Minimum signature, nondetonable propellants
*Magnesium-teflon
*Magnesium-teflon-viton
*Triphenyl bismuth cure catalyst
*Dimethylbitetrazole energetic fuel additive
*Insensitive propellants
*Universal Arming-Firing Device (RAM, SM-2, Tomahawk, VLA, Seasparrow, Harpoon)
*Consumable igniter Mk 305 (Tomahawk)
Sidewinder gas generator Mk 6
High-temperature insulation (for both rockets and ramjets)
*Composite case overwrap damage protection

Technology (*items are firsts in the propulsion field)
*Vertical Launching System demonstration
*Vertical Launch Missiles (Chaparral, Sparrow, Harpoon, ASROC)
*Thrust vector controlled air to air missile (first controlled high angle of attack guided missile)
Jet tab thrust vector control (Tomahawk MK 106)
Jet vane thrust vector control (Seasparrow, Vertical Launch ASROC)
*Trapped-ball movable nozzle (Agile, Tomahawk Mk 111, SM-2 Mk 72)
*Insensitive Munitions (IM) preferential insulation technique (PIT, used on HARM)
*Thermite linear shaped charge case penetrator mitigation device
*IM intermetallic thermal cookoff sensor
*IM hybrid composite/slotted steel case
*Droppable thrust vector control unit
Thrust-cutoff range control (ASROC, VLA)
Energy management (pulse motor)
Integral aero-thrust vector control
Composite cases (demonstrated on Sea Lance, NAAWS, Phoenix, Shrike, Maverick, 2.75" Rocket, Predator)
*CL-20 tactical rocket propellant formulation
PSAN/Zinc Sulfate/Ammonium Nitrate phase stabilizer
*Low drag ramjet demonstration
Stable, high efficiency ramjet combustor

Processing Technology (*items are China Lake firsts)
*Injection loading of propellants and explosives
*Consumable igniter processing
*Low cost plastic motor case molding
*High shear mixing of composite explosives
*Processing of explosives and propellants utilizing dry RDX and HMX
*Delayed action cure catalyst for solid propellants
*Introduction of isostatic p sing of explosives
*Application of coatings to solid propellants and explosive ingredients using fluid bed suspension
*Manufacture of propellant, explosive, pyrotechnic molding powder by shock gel suspension
*Grinding of CL-20 to consistent, controllable particle size

Major Facilities & Equipment

The China Lake Propulsion Plant consists of 43 square miles and 288 buildings. This Plant includes facilities for processing of cast composite and extruded propellants. Cast composite mixing capacity extends from gram quantities to 2200 pounds. Four extrusion presses range from 1 inch to 15 inch. There are three casting areas, capable of casting rocket motors up to 6 feet diameter and 30 feet long. Motor and missile assembly buildings, inert and energetic storage magazines, grinding facilities, machining buildings, and motor preparation facilities all exist within this Plant. Laboratories for the synthesis of new energetic materials, propellant formulation, propellant characterization and scale-up, quality control, case fabrication (metal and composite), composites/plastics/rubber parts(including a filament winder) design and fabrication, case cleaning and lining, arm-fire device, and safe-arm device laboratories, igniter and gas generator test bays, actuation and control characterization and test, and all-up-round integration and checkout are resident within the Plant. Facilities have been adapted to and developed for the demilitarization and disposal of rocket motors. The Large Rocket Motor Disposal Facility (LRMDF) conducts research on disposal of solid rocket propellants through confined low pressure burning. Unique and dedicated facilities for special access and foreign material exploitation also exist.

The Air Breathing Propulsion Laboratory specializes in research, proof of concept, development and testing of airbreathing engines and their components, including inlets, ramjet combustors, turbine engines, fuel management systems, fuels, and insulators. The facility can also test liquid propellant rocket engines. RDT&E is supported by a research scale (2" dia) test facility located at Michelson Lab, a small-scale (7" dia) propulsion test laboratory and a large-scale (21" dia) facility located in within the China Lake Propulsion Laboratories complex. These are the only facilities in the Navy for ramjet and component testing.

The Ordnance Test Area, located adjacent to CLPL can test rocket motors from subscale to Trident size (1.5 million pounds thrust). The facility includes two fully independent control rooms and seven static test bays. All test bays are equipped for multiaxis test stands for resolving side forces of thrust vector control systems or those resulting from nozzle malalignment. Test stands can fire motors vertically, horizontally, or at an intermediate angle. Real-time radiography provides visible data on rocket motor grain burnback and propellant/insulator performance. Plume measurement capability exists for measurement of infrared signature and radar cross section. The high energy automated computed tomography (Cat Scan) X-Ray facility provides unique capability to scan a motor, as large as a Trident or Minuteman, to inspect for unbonds, voids, or other defects undetectable by conventional means. The Aeroheat Test Facility provides capability for test of ramjet components and connected-pipe tests of ramjet engines at air flow rates, temperatures, and pressure simulating supersonic flight. The Division also possesses full capability for environmental testing for qualification of rocket motors. Capabilities include vibration, shock, temperature, humidity, salt spray. This is the only government site capable of full DOD STD 2105 insensitive munitions/hazard testing, including 40-foot drop, fast cookoff, slow cookoff, bullet impact, fragment impact, and sympathetic detonation. China Lake's Ordnance Hazard Evaluation Board is the only such body recognized by the Weapon Systems Explosive Safety Review Board (WSESRB) to review and interpret IM test results and advise the WSESRB.

In Michelson Laboratory reside research facilities involved in energetics. The Propulsion and Energy Conversion Research Facility consists of several major laboratories. Energetic Material Synthesis Laboratory, Energetic Materials Formulation R&D Facility, Small-Scale Test Facilities, Propulsion Research Laboratory, and the Combustion Diagnostics and Plume Signature Laboratory support propulsion research and technology. This collection of laboratories and facilities represents a unique capability to take a new energetic molecule from first conception through formulation and scale-up, to initial performance and hazard assessment in weapon

application. The facility is the only experimental laboratory for the study of combustion instability. The Propulsion Research Lab conducts basic and applied research in solid rocket propellants, airbreathing propulsion, and advanced gas dynamics. The composites filament winding machine located in the Composites Development Lab is an advanced state of the art laboratory capable of fabricating composite motor cases to 4 feet diameter and 17 feet in length.

Also, in the Michelson Lab complex is the Engineering Prototype Facility. The shop is capable of fabricating from CAD/CAM all metal parts needed for rocket motor development or production.

Proximity to the missile and systems offices at NAWCWPNS, and to the test ranges at China Lake and Pt Mugu facilitate ease in assembly, integration of rocket motors and control systems into the missile all-up-round, systems checkout in existing 6-degree of freedom simulation labs, and test and evaluation. The close interface afforded between systems and propulsion personnel, and the reduced cost and quick turnaround afforded by collocation with the Ranges are essential to successful execution of full rocket motor qualification, which includes pre-flight rating tests, and aircraft integration tests.

Major facilities and laboratories for solid rocket propulsion are listed below. More detailed information on each is presented in Sections 2.b. and 4.b.

Facilities Supporting Propulsion

- Actuator And Power Systems Lab
- Aeroheat Test Facility
- Air / Ground Range
- Air-Breathing Propulsion Lab
- C27 Explosive and Ordnance Modeling
- Chemical Analysis Research Facility
- China Lake Ordnance and Propulsion Pilot Plant
- Composites Development Lab
- Detonation Physics Lab
- Development Projects Laboratory
- Energetic Materials Properties Analysis Lab
- Energetic Materials Synthesis and Scale-up Lab
- Engineering Prototype Facility
- Environmental Test Complex
- High Hazard Propulsion Test Facility
- Large Rocket Motor Disposal Facility
- Materials Engineering/Failure Analysis Facility
- Missile/Rocket Motor Assembly Facility
- Non-Destructive Ordnance Test Facility
- Ordnance and Propulsion FME Lab
- Ordnance and Propulsion Plant Support Shops
- Ordnance Assembly Facility
- Ordnance Breakdown Facility
- Ordnance Packaging Facility
- Ordnance Stowage Facility
- Ordnance Test Complex
- Propellants and Explosive Formulation Labs
- Propulsion and Energy Conversion Research
- Sled Tracks
- Strategic Propulsion Test Complex
- Tactical Propulsion Test Facility

Ordnance Assembly Facility
Ordnance Breakdown Facility
Ordnance Packaging Facility
Ordnance Stowage Facility
Ordnance Test Complex
Propellants and Explosive Formulation Labs
Propulsion and Energy Conversion Research
Sled Tracks
Strategic Propulsion Test Complex
Tactical Propulsion Test Facility
Weapons Survivability Lab

3.B.3. ORDNANCE

Overview

China Lake has a full-spectrum capability in the support of ordnance systems and components. Ordnance systems are made from warheads, high explosives, safe-arm devices, initiation systems, and target detecting devices. The life-cycle of the Ordnance product line goes from basic research to in-service engineering support. The Ordnance product line begins with scientific studies and experimentation to increase knowledge and understanding of the technology associated with energetic systems. This basic understanding is then applied to the solving of specific military problems so that advanced ordnance concepts are developed. China Lake has played a major role in developing these advanced concepts into ordnance systems that meet or exceed the performance requirements for the military application.

Because of a close working relationship and the in-house capabilities for ordnance component design, energetic material development, energetic material processing, hardware fabrication, product assurance, and ordnance test and evaluation, the transfer of technology and new products to our industry partners is smooth and complete. Additionally these same factors make China Lake highly suited to perform in-service engineering of systems in the Fleet. In times of war this capability has been called on to provide quick response modifications to weapons to attack targets of opportunity.

China Lake not only has a broad range of expertise working in the ordnance product line, but additionally has the facilities required to compliment this talent in-house. These facilities are discussed in more detail in a later section of this document. Some of the highlights of these facilities are the ability to develop, scale-up, and process new energetic materials that can be used in the development of new ordnance components. The facilities and equipment exist to allow engineering analysis and evaluation of ordnance components as they are being designed. This includes the effects of environmental stimuli to exploring the detonation physics of a particular energetic phenomena. A networked system of personal computers and workstations provides the engineers and scientists the most modern tools available for modeling explosives and ordnance performance. The development of new technology for warhead cases has been greatly aided by the ability to do composites in-house. In the area of Target Detector Device (TDD) design, a national asset is available at China Lake in the Missile Engagement Simulation Arena (MESA). In this facility, the performance of tactical missile TDD's is evaluated against threat systems. The T&E capability at China Lake provides the facilities necessary to engineer and qualify an ordnance product in-house, including all Insensitive Munitions requirements and performance tests.

Research and Technology

China Lake has a broad involvement in research and technology for Ordnance Items. This span of technology includes adapting new insensitive explosives into ordnance systems with equivalent or improved performance, as well as new technologies to improve the performance of existing ordnance systems. The following is an example of the technology being advanced today at China Lake.

Reactive Case

A concept to utilize the high combustion energy found in metals/metal alloys. This was investigated for warhead case application to determine what increases in performance (compared to steel cases) could be gained from their use. This technology was transitioned into the Tomahawk Block III warhead and is under development for the SLAM-ER missile.

Aimable Ordnance

A concept to focus warhead fragmentation into a very narrow azimuthal direction by first deforming the warhead, circumferentially, and then initiating the explosive on the diametrically opposite side. This concept involved advancing technology in the areas of explosive formulation, warhead structure and fragmentation, initiation, case deformation, and target azimuthal acquisition. This concept is currently in advanced development as the Deformable Ordnance Section Project for NAVSEA.

Fuel Air Explosion (FAE)

A concept that dispersed liquid fuel into air and detonated the resulting cloud of gaseous mixture to provide over pressure (blast) of a much greater magnitude than was available from solid explosives. Several concepts were generated, evaluated, and produced. Current status is looking at solid fuels, vice liquids, and combining the mixing and detonation into a single event.

Insensitive Munitions (IM)

An approach to solving fast cook-off of ordnance was investigated which involved implementing a stress riser in the warhead case to rupture it and allow the main explosive fill to burn, an out-gassing liner to pressurize the case to the rupture point, a fuze booster design which would vent the booster explosive pressures to allow it to burn, and a less sensitive main explosive fill. This technology was transitioned to the development of the Harpoon warhead and subsequently to the Penguin and Tomahawk warhead developments.

Explosive Response Modeling

Modeling of explosive detonations, including metal acceleration, and explosive response to fragmentation impact shock, was initiated in 1986. These investigations were in response to the insensitive munitions issue and to provide a predictive capability before, and sometimes in lieu of, conducting testing. This technology is in use today (SMERF program) to predict explosive response to unplanned stimuli and to evaluate configurations to mitigate the resulting shock levels to one which is tolerable to the warhead/ weapon.

Incendiary Effects

Investigations into incendiary materials, how they might be used in warhead applications, and the effects/potential pay-off from their use were initiated in 1968 and again in 1989-1993. The long term effects on the targets (surface targets) from these materials is slowly being recognized. Early technology was transitioned in one of the Zuni rocket warheads. Current efforts are oriented toward bi-metallic systems for optimum synergism between materials.

Micro-Machined Accelerometer

This effort investigated the feasibility of using micro-machining technology to fabricate an accelerometer concept for safe-arm applications. This late 1980's technology was successfully developed (via SBIR) and is currently transitioned into various applications (several electronic safe-arm devices (ESAD)) programs and automobile industry) for detecting impacts to initiate air bags.

In-Line ESAD

This technology focused on the design and demonstration of a completely electronic safe-arm device (ESAD), with no mechanical parts and an in-line explosive train. The concept included electronic sensors, signal processing, high voltage firing sets, and slapper detonators. This technology is based on slapper detonator technology that was transitioned from the National Labs to address DOD weapon system requirements, such as producibility, cost, and improved performance.

Laser Initiation

This 1990's technology is investigating the use of laser initiation to fire pyros and explosives for application to arm-fire and safe-arm devices. The technology for arm-fire devices has been demonstrated for propulsion, while the initiation of explosives for safe-arm application is still being worked on by DOD and DOE.

The following applies to TDDs (proximity fuzes)

Active-Optical Fuzing

China Lake developed the first active-optical fuzes using solid-state lasers—the DSU-10 for the Standard ARM (developed in 90 days during 1968 to meet a Vietnam War requirement), the DSU-15 for Sidewinder, and the DSU-19 for HARM. The active-optical fuze provides a proximity sensor that is immune to electronic countermeasures.

Passive IR TDD Technology

China Lake has been at the forefront in the development and characterization of Passive Infrared Technology as applied to TDD's. One project called EX-412 investigated the utility of operating in the mid-IR region for RAM. Performance was excellent, however it was not finished for political reasons. Investigations are ongoing in the long wavelength IR region and one project successfully demonstrated Passive Ranging in 1992.

Artificial Neural Network Fuze

China Lake has been developing a TDD concept that will use both the CW Active Optical technology combined with Neural Network Processing to detect a cruise missile target flying very close to the sea surface in spite of high levels of sea surface clutter. This effort began in 1992 and is ongoing.

Guidance Integrated Fuzing (GIF) Technology

The idea of Guidance Integrated fuzing (not Guided Aided Fuzing) evolved at China Lake during the mid 1970's. These concepts were shared widely with the Army, Air Force, Raytheon, Hughes, Texas Instruments, and other manufacturers between 1989 and 1992 through direct presentations and other forums such as TTCP's. The concepts are being widely adapted in missiles such as Standard and AMRAAM.

Pseudo Noise Fuze Technology

Initial work determining the capabilities and characteristics of pseudo noise (PN) modulation techniques applied to fuzing was investigated in 1967 to 1970. This work led to the development of the Correlation Radar Fuze, Phase I and II advanced development models. Laboratory and field tests of these units demonstrated PN fuzing capabilities as well as demonstrating techniques for azimuth sensing and sea surface tracking. This technology is currently in service use on several multiservice missile systems.

Other Examples of Ordnance Technology

Linear Shaped Charge
Variable Charge To Metal Ratio (VCMR)
Multi-Frag Effects
Shear Fragmentation Control
Continuous Rod
Supersonic Penetrator
Explosive Driven Generator
Dual Rotor Mechanical Arming
"Balanced Rotor" System
Electronic Timer

Microprocessor/Microcomputer
Clock Frequency Verification
Gate Array
Mechanical Interrupter
In-Line Electronic Arm-Fire Device
Explosive Logic and Hydras
Inertia Switches
Crush Switches
Piezo-Electric Switches

Examples of TDDs (Proximity Fuzes)

Sensors
Signal Processing
Neural Network and Fuzzy Logic
Dynamic Encounter Testing
Multi-Sensor
Millimeter-Wave Solid-State Technology
Low-Altitude Guidance Algorithm
Millimeter-Wave Solid-State Technology

Void and Breakup Sensing
Aerosol Backscatter Modeling
CO-2 Laser Technology
CO-2 Laser Ranger
CW Active Optical Fuzing
Advanced Threat Fuze
Passive IR Modeling and Analysis
Optical Guidance Integrated Fuzing (OGIF)
Dual Beam RF Fuze Technology

Ordnance System Design

Because of the in-house capabilities in energetic materials, warheads, proximity sensors, safe-arm devices, explosive and ordnance modeling, initiation systems, insensitive munitions, lethality, and test and evaluation, China Lake has been able to use a system approach to the design of ordnance sections for weapon systems. This unique capability allows for the weapons system requirements to be addressed uniformly by the ordnance section components. An example of this might be a requirement to reduce the amount of explosive fill in the warhead without degrading performance. Instead of putting the full requirement on the explosive to meet this new requirement, the use of new technology in warhead case design such as reactive materials can be used along with a new explosive so that a system solution to the problem is achieved. The ability to do this type of system design would be greatly hampered if any of the in-house capabilities were missing.

A recent example of this Ordnance System approach to ordnance design was the Tomahawk BGM-109-C Block III upgrade. This project took a system approach to developing a lower weight Reactive Case Warhead, that met IM requirements, and provided a longer fuze delay. Had this task been done as individual component upgrades, the desired results may have been unachievable. This project was successful and a product that met the requirements for the weapons system was delivered because a close teaming arrangement was possible between all the required disciplines in-house at China Lake.

Ordnance Hazard Evaluation Board

Insensitive Munitions (IM) technology development is a major effort at China Lake. As a result of IM expertise residing at China Lake, a service is able to be provided to the Navy Safety Community by bringing together the senior level experts to give consistent evaluations of testing performed in support of qualifying weapon systems in the IM environment. This unique capability to bring together this expertise has facilitated the development of improved testing processes and has provided a stable baseline for ordnance designers to determine the needed IM improvements.

China Lake's Ordnance Contribution To The Military

China Lake has fifty plus years of involvement in providing ordnance systems and ordnance components to the fleet. The following charts are a list of weapon systems in which the ordnance section and/or ordnance components were developed at China Lake and are now in use by the fleet. Of particular importance is that China Lake has been responsible for all of the Missile and Free-Fall Weapons Fuzing Systems currently in use by the Navy. Also, a majority of the Missile Warheads and all of the Free-Fall Weapons Systems have been developed by or with the involvement of China Lake.

Antisurface Weapons

Weapon System	Comments	Warhead	S-A	TDD
Harpoon	•Meets today's IM requirements •Items currently in limited production and deployed on all Harpoon weapons, including the Standoff Land Attack Missile (SLAM), AGM-894E.	X	X	N/A
Tomahawk BGM 109-C (land attack)	•Combination of China Lake using an NDI warhead and modifying existing fuze.	X	X	N/A
Tomahawk BGM 109-C Block III	•Introduced lower weight Reactive Case Warhead, met IM, and provided longer fuze delay.	X	X	N/A
Penguin, MK 2 Mod 7	•China Lake modification to existing ordnance items to meet IM requirements	X	X	N/A
Maverick, AGM-65	•China Lake monitored ordnance contractor's effort to assure specification compliance	X	X	N/A
Shrike, AGM-45	•Items no longer in production but currently deployed on Navy carriers	X	X	X
HARM, AGM-88	•Production procurement completed and deployed by Navy and Air Force	X	X	X
SLAM ER, AGM-84H	•China Lake ordnance development, just started	X	X	N/A
Hellfire, AGM-114/K	•Contractor electronic safe & arm device (ESAD) being developed •Monitored two contractor's efforts to assure spec compliance		X	N/A
ZUNI 5.0 Inch Rocket	•Out of production, but still in service use	X		

Free-Fall Weapons

Weapon System	Comments	Warhead	S-A	TDD
Mk 82/83/84 Bombs	•In production; has been improved to meet IM; several upgrades starts and stops; incorporated into Joint Direct Attack Munitions (JDAM) family of weapons.	X	N/A	N/A
FMU-139A/B Bomb Fuze	•Microprocessor controlled joint service GP bomb fuze	N/A	X	N/A
Skipper	•Was a weaponization of the Mk 80 series Bomb family to provide greater terminal accuracy. Out of production, but currently deployed.	X	X	N/A
Joint Programmable Fuze	•Joint service development under JDAM Program; may have wide usage. •China Lake monitoring of contractor development effort.	N/A	X	N/A
Walleye	•Not in production, deployed with Navy carriers	X	X	N/A
GBU-24A/B	•China Lake IM modification of existing ordnance •In production, deployed with Navy carriers	X	X	N/A
"EYE" WEAPONS (DENEYE, BRITEYE, APAM, BIGEYE, ROCKEYE)	•This family of dispensed weapons had mixed development and production success and most are out of production.	X	X	N/A
FAE II [BLU-95/B (500 lb) & BLU-96/B (2,000 lb)]	•Second generation 500 lb and 2,000 lb FAE warheads, dispersed above ground by integral Target Detecting Device (TDD).	X	X	X
Helicopter Trap Weapon (HTW)	•Air delivered continuous rod warhead used to clear helicopter landing zones of vegetation and booby traps. Rapid Action Development Program received Approval for Service Use in 1970.	X	N/A	N/A
FMU-140 Dispenser Proximity Fuze	ROCKEYE, APAM, GATOR, BIGEYE	N/A	X	X

Antiair Weapons

Weapon System	Comments	Warhead	S-A	TDD
Phoenix AIM-54	•China Lake developed S-A fuzing and initiation		X	X
Standard Missile	•China Lake developed S-A fuzing and initiation		X	X
Rolling Airframe Missile (RAM) RIM-116	•China Lake developed Sidewinder ordnance (see Sidewinder)	X	X	X
Sparrow, AIM - 7	•China Lake developed ordnance	X	X	X
Sidewinder AIM-9	•China Lake developed ordnance •Still in production; used by Navy and Air Force	X	X	X
AMRAAM, AIM - 120	•China Lake Monitored contractor's efforts	X	X	X

Production Support and In-Service Engineering

China Lake has a unique capability for production support and in-service engineering of its ordnance product line. Because most of the ordnance technology used in Navy missiles and free-fall weapons was developed at China Lake, an excellent pool of technical talent is available to deal with technical problem that occur during production or Fleet use. This talent coupled with a strong capability in product assurance, logistics, and test and evaluation establishes an unmatched capability to perform production support and in-service engineering. This same strength in production and Fleet support provides an important reality input to the technologists and ordnance system developers working on future advancements to existing weapon systems.

Teaming With Industry

Because of China Lake's broad span of experience in energetics and particularly ordnance components development, a unique capability to provide expertise capability to industry exists. A team example was recently experienced with Texas Instruments. The Texas Instruments Fuze (S-A device with explosive detonators, leads, and booster.) Team celebrated a successful milestone by manufacturing and shipping its 5000th FMU-111/B fuze on time. This fuze is used on the AGM-88 Harm missile to maintain the warhead in the safe condition during assembly, storage, and captive-carry of the missile, and to arm the warhead after the missile has been launched and has traveled a safe separation distance from the launcher. The previous suppliers of the FMU-111/B had an unacceptable LAT of 32%. Since the teaming of China Lake and Texas Instruments in 1991 to qualify them to produce the FMU-111/B, their LAT success rate has been exceptional. Texas Instruments has achieved a 5 sigma quality on the production of this device and should achieve 6 sigma before production has been completed.

China Lake brought to this team the knowledge and experience of how and why a fuze works, and Texas Instruments brought the knowledge and experience of how to manufacture a device in a production environment. This combination permitted qualification for the FMU-111/B fuze in 11 months compared to almost 24 months experienced by all other producers. This is an example of the type of industry teaming that will be required in the future on most ordnance developments and how China Lake is uniquely qualified to work in this type of environment.

Manpower

There are 118 people involved in the research, design, testing, and production support of ordnance systems at China Lake. 68% of these people have bachelor-level degrees in engineering and sciences with 14% holding graduate level degrees. These 118 people represent a combined total of 1,931 years experience work with energetics/ordnance systems. There are 74 TDD people, who represent 1,057 years of experience. Several of the people at China Lake involved in the ordnance product line represent the Navy and United States Government on National and international committees such as the JOCG, DOD/DOE Joint Program, TTCP, and NATO. These people are dedicated to excellence and have been recognized both locally at China Lake and nationally for their contributions.

3.B.4. All-Up Weapon Integration

As part of its full-spectrum capability in the area of energetics, NAWCWPNS has the facilities, equipment and personnel necessary to design and develop, assemble and integrate, evaluate, test, store and disassemble all-up weapon systems containing energetic components. For the purposes of this datacall, all-up weapon systems will include all ordnance items that include an energetic device such as a warhead, rocket motor, pyrotechnic actuator, gas generator or thermal battery, and are at the highest level of integration possible for that system. The specific capabilities in the areas of the major subsystems such as rocket motors and warheads will be considered in separate sections. However, capabilities in the areas of the other major subsystems such as guidance, control, airframe and telemetry will be discussed in this section to the extent that these subsystems contain energetic components.

Throughout the years that China Lake has been providing service to the fleet, its capability in the area of missile system development has been well documented, though not necessarily well publicized. During his tenure as Secretary of Defense, Robert McNamara commented that China Lake "designed 85 percent of the Free World's air weapons." In extensive peer rating surveys conducted by the Office of Naval Materiel in the 1970s, China Lake was rated the top Navy laboratory. Some years later David Packard, in his role as chairman of the Packard Commission, declared that China Lake "is one of the two or three best federal laboratories." Though in recent years, China Lake's role in weapon development has evolved from that of design agent to technical direction agent/lead laboratory, many of the more recently fielded weapon systems can trace their origins from concepts and technology demonstrations at China Lake. China Lake has either been the developer, the lead laboratory, or has provided necessary technology for such systems as Sidewinder, Sparrow, 2.75 Aircraft Rockets, Walleye, Shrike, HARM, Skipper, Polaris, SEASPARROW, Standard Missile, Tomahawk, RAM, and Vertical Launch ASROC. China Lake has also been recognized for its quick response to emergency need situations during the Korean War, the Cuban Missile Crisis, the Vietnam War, and Desert Storm.

The synergistic effects that result from having a civilian/military team, experts in all areas of a weapon system, and a complete capability in all aspects of a weapon system's life cycle have produced a weaponeering expertise at China Lake that is hard to match. This expertise continues today and leads to research and technology programs in all areas of energetics that support mission needs. Much of this effort is discussed under the rocket motor and warhead sections. However, it should be noted that many weapon systems in service today have resulted from weapon systems conceived and initiated under technology programs at China Lake. Many other systems rely upon technologies that have resulted from system demonstrations. Examples include Vertical Launch ASROC, Tail Control Sparrow, Vertical Seeking Seat, and, of course, Sidewinder. On-going programs that would fall into this category include the Multi-Mission Propulsion Technology (MMPT) Advanced Technology Demonstration (ATD) and the Dual-Mission Advanced Missile Airframe Technology ATD.

Another consequence of China Lake's capabilities in all areas of a missile system is its ability to act as Technical Direction Agent/Lead Laboratory for most Navy missile development and production programs. The systems level approach inherent in the strong matrix organization assures that all

potential issues are investigated at an early stage in the program. In addition, the experience gained by the scientists, engineers and technicians in research and technology programs allows them to lend an authoritative voice to the development process. This "hands-on" and system-level experience has allowed China Lake to effectively correct missile system deficiencies (e.g., Sparrow), re-design critical components (e.g., Tomahawk MK 305 ignitor), develop failure correction scenarios (e.g., STANDARD Missile 2 Block IV Booster Thrust Vector Actuation System), and provide strategic and ready guidance to contractors (e.g., HARM motor unbond failure investigation).

China Lake also has the facilities necessary to provide for the final all-up integration and testing of missile systems including their energetic components. Preparations have recently been completed for the air vehicle integration of the Joint Standoff Weapon (JSOW). The Missile/Rocket Motor Assembly Facility will be used for assembly operations, mass properties measurements, and acceptance testing. This is a cooperative effort between NAWCWPNS and Texas Instruments, the JSOW prime contractor. To support the JSOW program air vehicle integration requirements, a missile integration facility that permitted explosive integration and testing was required. NAWCWPNS was selected to house the facility because much of the developmental and operational testing will be conducted on its ranges, and because appropriate integration assets already existed. The Ordnance Systems Department handles ordnance items on a daily basis and had the necessary trained personnel and properly equipped and certified buildings. The facility selected at NAWCWPNS brings together, in one location, all aspects of missile integration. This includes on-site ready storage of energetic components such as flight termination systems, live payloads and thermal batteries. Mass properties measurement capabilities were relocated to the facility, resulting in a greatly improved turn-around time for missile integration. Additional features of the facility include an un-interruptable power system for use with the sensitive high value test equipment, a closed circuit video system, remote testing capability and a state-of-the-art fire monitoring system. Mass properties testing will include the measurement of roll, pitch and yaw moments of inertia. These measurements will use a state-of-the-art measurement system incorporating new mass properties fixturing equipment. This was another cooperative effort with NAWCWPNS providing the fixture design, and Texas Instruments fabricating the hardware.

Similar, simultaneous operations can take place throughout the Missile/Rocket Motor Assembly Facility. It consists of a group of buildings in the China Lake Propulsion Laboratory (CLPL) area of NAWCWPNS with the capability to handle full assembly and disassembly, inspection , mass properties measurement, and integration, checkout and fitment testing of missiles and their components. This facility is also used to instrument missiles for flight testing, static firing, and safety, hazard, and environmental testing. Because of the facility's proximity to the test ranges and radiographic test areas, and its ability to accommodate live ordnance, pre-test checkout and modifications can be turned around in a very quick, economical manner. Because of the separation of the various components of the facility, multiple concurrent operations are possible. The complex includes a total of 8523 square feet of usable space, of which 160 square feet is office space. Equipment essential to integration activities include the safety equipment resident in the buildings (deluge systems, fire alarms and sensors), power systems including hydraulic and up to 408-volt systems, a mass properties table, cranes and other handling equipment, and specialized missile test equipment. A total of 16 individuals currently work in this facility (7 of them are Texas Instrument personnel), and that total should remain constant through FY97. This is a small percentage of the total capacity for the facility. Because of the simultaneous operations that can occur, it is estimated that the facility could support a total of 520 manhours per day between mass properties testing, integration activities, fitment checks and continuity testing. This assumes a 24-hour day with anticipated maintenance downtime of about 30 minutes per day. That is equivalent to 123 manyears of work. This is in contrast to the projected FY97 usage of 115 manhours per day, or 24 manyears of work. All of the NAWCWPNS employees using this facility are in the Ordnance Systems Department. A summary of their capabilities is found in the Personnel Skills Summary Section.

Other facilities at China Lake also support all-up weapon integration. The Ordnance and Propulsion Foreign Materials Exploitation Lab currently houses the MMPT ATD integration effort. Once again, this is an instance where an existing facility had the equipment, space, separation and location necessary to perform the work efficiently. This facility is a group of buildings in the CLPL area of NAWCWPNS that has the capability to test and evaluate foreign materiel solid and air-breathing motors, warheads, ignition systems, electronics and thrust vector control systems. The facility provides the requisite safety (i.e., isolation, certification, process control) and security (i.e., isolation, perimeter fence, process control) for the exploitation of hardware up to the Secret level including both class 1.1 and class 1.3 explosives. Ordnance operation facility equipment includes deluge systems, and fire sensing and alarm systems. Safety interlock systems are provided on strategic doors to prevent inadvertent interruptions. Like the Missile/Rocket Motor Assembly Facility, the Ordnance and Propulsion Foreign Materials Exploitation Lab is certified for ordnance operations and is in close proximity to other functional, safety and radiographic test areas. The laboratory includes 17,550 square feet of space, of which 9,651 is office space. About 5,390 square feet could be devoted to all-up integration efforts. A total of 20 individuals currently work in this facility (one of which is a contractor), of which 5 support all-up integration efforts. The total for integration work is anticipated to be about three for FY97, with about an average of 2 manhours per day, or 0.4 manyears of work. This is a small percentage of the total capacity for the facility. Because of the simultaneous operations that can occur, it is estimated that the facility could support a total of 672 manhours per day between integration activities, fitment checks, system electronics testing and continuity testing. This assumes a 24-hour day with anticipated maintenance downtime of about 1.5 hours per day. This is equivalent to 140 manyears of work. All of the NAWCWPNS employees using this facility are in the Ordnance Systems Department. A summary of their capabilities is found in the Personnel Skills Summary Section.

Another All-Up Weapon integration facility at NAWCWPNS is the Ordnance Assembly Facility, operated by the Weapons Department. This facility is covered under the Support Section and includes assembly operations prior to flight testing.

All-up Weapon Integration is also conducted by the Anti-Radiation Missile (ARM) Integration Complex. The purpose of the complex is to do laboratory-based research and development, and to perform developmental testing of static and dynamic hardware. The facility occupies 16800 cubic feet of space, and includes overhead bridge cranes and ordnance certification. The multisite facility conducts weapon assembly and integration, all-up round checkout, flight performance prediction, and production hardware verification on loaded rounds with live ordnanace. Currently, two personnel support the facility in the area of missile integration This number should remain constant through FY97. It is estimated that the facility could support a total of 184 manhours per day between various integration activities. This assumes a 24-hour day with anticipated maintenance downtime of about 1 hour per day. This is equivalent to 38 manyears of work.

All-up weapon integration also includes the capability to receive, disassemble, store, package and ship weapons containing energetic materials. At NAWCWPNS, this is the responsibility of the Weapons Department. Their facilities, the Ordnance Breakdown Facility, the Ordnance Packaging Facility, and the Ordnance Stowage Facility provide this capability. These operations support the other energetic capabilities and are discussed in the Support Section. However, some further

mention of two items of special importance to all-up weapon integration is necessary. First, these facilities have the capability to handle Category 1 items. These are small, portable weapons such as shoulder-fired anti-tank weapons, and their handling and storage requires special security and safety precautions including security perimeters, guards, and alarm systems. Second, the Breakdown Facility has the capability to remotely disassemble weapons of unknown or questionable safety. This is of primary importance in Foreign Materiel Exploitation.

Another aspect of all-up weapon integration is the capability to test developmental or production ordnance items. This is primarily the responsibility of the Range Department and a description is included in the Test and Evaluation Section. Facilities that test all-up weapons include the Environmental Test Complex, the Sled Tracks, the Air, Ground and Sea Ranges, the Weapons Survivability Laboratory, the Non-Destructive Ordnance Test Facility, and the Test Complexes at White Sands. These facilities allow for a weapon with energetic materials to be heated, cooled, shaken, dropped, fired upon, cooked off, fired at a target and electronically measured. Again, the proximity of these test areas to China Lake allows for an efficient use of resources and allows for the test personnel to participate in developmental planning.

All-up weapon integration and testing also occurs at the Ready Missile Test Facility (RMTF), located at NAWCWPNS Point Mugu. This facility provides the capability to conduct functional testing, acoustic/dynamic testing, thermal conditioning, real time radiography and assembly/ disassembly of all-up-round weapons containing warheads and rocket motors. The facility consists of four vibro-acoustic tests cells rated at 650 lbs or more of class 1.1 explosives. These cells are capable of combining shaped acoustic to 457+ dB and mechanical shakers to cover a frequency range of 5 to 2000 Hz. There is a thermal capacity in each cell for a temperature range of -70°F to +170°F with a liquid nitrogen boost for high cooling ramps. Functional test cells provide the complete functional check-out of each missile in a live all-up configuration. The real-time radiography capability provides an evaluation of missile rocket motor integrity before and after being subjected to test environments. An assembly building is also part of the facility. This is the only facility that can reproduce the stresses of captive flight environments on live all-up weapons, both dynamically and thermally. Inducing field stresses in this manner is essential to measuring the production reliability of tactical missiles prior to field usage. The facility occupies 15,100 square feet, of which 1,000 square feet is office space. A total of 19 individuals currently work in this facility (11 of which are contractors), with the total expected to remain the same through FY97. This is a small percentage of the total capacity for the facility. Because of the simultaneous operations that can occur, it is estimated that the facility could support a total of 429 manhours per day between the four cells. This assumes a 24-hour day with anticipated downtime of about 6.1 hours per day for weather and maintenance. That is equivalent to 89 manyears of work.

All-up weapon integration also depends upon other support functions, such as provided by Public Works, the Engineering Prototype Facility, the safety and environmental organizations, and the Ordnance and Propulsion Plant Support Shops.

Energetic materials, as noted earlier, are also found in other sections of the missile other than the warhead and rocket motor. Thermal batteries are used to power the guidance and control section, destruct systems, and actuation systems. The Guidance Components Test and Analysis Complex supports thermal battery work at NAWCWPNS. The Complex has the equipment and capabilities to perform destructive analysis, diagnose design and construction defects, perform engineering and production support functions, analyze system designs, a test combined system components to determine or validate their respective performance parameters and interfaces. The Complex also assists programs by demilitarizing and properly disposing of batteries. Depending upon the system requirements, the Complex can provide a new battery design, or recommend an existing design. Recently, it fabricated non-lithium battery packs for the A6 backup computer and the

F/A18 MODSUM pack, and developed a lithium thermal battery for the hydrostatic mine fuse. They have also assisted many Navy programs develop, qualify and safety certify thermal batteries for missile applications (e.g., AMRAAM, Sparrow, Phoenix, RAM, JSOW, JDAM). The facility consists of 600 square feet of laboratory and test space dedicated to the test and evaluation of thermal batteries. Equipment includes a computer-controlled electrical load bank and multichannel data gathering system they designed that can be adapted to test any battery form 1-volt DC to 500-volt DC and control currents form 0.1 to 120 amps while recording 12 voltage/current channels and 18 thermocouples each second. There is also a remote firing bay certified for the safety/abuse testing of thermal batteries, an x-ray unit, pressure chamber, temperature chambers, and ceramic heaters capable of sustaining in excess of 600°C. The four personnel assigned to the complex have a combined total of 23 years of experience with thermal batteries (42 years of experience with ordnance items), and have made significant contributions to the Navy's battery technical and design manuals. This facility is currently at capacity for a normal work day since no simultaneous operations can occur. However, by going to 24 hour operations, it could support a total of about 12 manyears of work. Additional capacity is possible by utilizing facilities from other areas. Personnel from the Ordnance Department also have experience in thermal battery design, development and testing and portions of the Actuator and Power Systems Laboratory can be used for thermal battery testing.

Gas generators are another source of power in a missile. They are generally used to provide power for actuation systems and can be used to operate the missile control system, wing deployment, fin release, and for other functions. A gas generator is like a small solid rocket motor that produces gas to provide pressurization into a system. Because of this similarity to rocket motors, capabilities in this area can be found under the Propulsion Section. In addition, gas generator testing can also be conducted at the Guidance Components Test and Analysis Complex.

Missile systems can contain other actuation or release devices known as Cartridge Activated Devices (CADs) and Pressure Activated Devices (PADs). These contain small amounts of energetic materials and can be found in most missile systems. Most of the expertise in this area resides in the Energetic Materials competency and a description of that capability can be found in that section.

Energetics Facilities
Actuator and Power Systems Lab
Air/Ground Range
Anti-Radiation Missile Integration Complex
Environmental Test Complex
Guidance Components Test and Analysis Complex
Missile/Rocket Motor Assembly Facility
Ordnance and Propulsion Foreign Materials Exploitation Lab
Ordnance and Propulsion Plant Support Shops
Ordnance Assembly Facility
Ordnance Breakdown Facility
Ordnance Packaging Facility
Ordnance Stowage Facilities
Ready Missile Test Facility
Sea Range
Sled Tracks
White Sands Test Complexes

3.B.5. Guns and Ammunition

Capabilities Description

General Discussion

The NAWCWPNS has the responsibility for the Research, Development, Test and Evaluation (RDT&E), as well as the In-Service Engineering (ISE) of Gun and Ammunition (G&A) efforts for the USN and USMC aviation community. In addition, the NAWCWPNS G&A Team continues to perform production related testing on both guns and ammunition. In the near future, the Gun Rework Capability currently located at NADEP Alameda will be relocated to the NAWCWPNS China Lake facility. This will provide even better opportunities to provide full-spectrum, "One Stop Shopping" support to the Naval aviation G&A community.

Research and Technology

NAWCWPNS Research and Technology efforts in the G&A area have resulted in the identification successful evaluation of some novel and innovative concepts and technologies in both the gun and ammunition areas. The Armor Piercing Tubular Sabot (APTS) and Multi-Purpose Tubular Sabot (MPTS) ammunition concepts being two of the examples holding great promise for future development. The Laser Ignited Caseless Ammunition (LICA) gun and ammunition program has likewise successfully demonstrated some very unique hardware implementations that offer improved performance, reduced size/weight, lower life cycle costs, improved environmental features, and also promises to resolve current and future operational/safety deficiencies. The G&A Team is also involved in working with a Norwegian technical team to better understand the phenomenology of the pyrotechnically initiated explosives variety of ammunition. The end result of this effort will be a computer model of this type of ammunition that will serve as a valuable tool for study of anomalous behavior as well as an important design tool for future development and production efforts. Much of this work is made possible through the availability of the Ballistics Test Laboratory (BTL) which is located at the NAWCWPNS China Lake site. Additional information on this facility is included in Section C (Facilities Summary) below. The Team has also been actively involved in the development of a "Roadmap" that is being prepared through the Joint Service Medium Caliber Automatic Cannon Technology (JMAT) Master Plan program. This "Roadmap" will be used to provide direction to the development of improved gun systems through the coordinated efforts of each of the Services.

Design and Development

The G&A work group has, for such a small number of personnel, a significant number of ongoing development efforts. These development efforts are funded using either RDT&E (6.4) or Product Improvement Program - Weapon Procurement Navy (PIP-WPN) funds. Currently managed programs include the 25mm PGU-32/U (Semi-Armor Piercing High Explosive-Incendiary) and PGU-33/U (Target Practice Frangible-Traced) ammunition PIP's, the Percussion/Electric Gun System (PEGS) PIP, the 20mm PGU-39/B Dummy cartridge (PIP) and the 20mm Cartridge Sealant PIP. The PGU-32/U program is designed to provide the USMC with a very high performance combat round that can effectively engage the majority of the typical battlefield targets. The PGU-33/U round is designed to provide the USMC AV-8B community with a target practice round that can be used to perform realistic training without the risk of having projectiles or projectile fragments ricochet into the path of the firing aircraft. The PGU-39/B dummy cartridge satisfies a serious need for a dummy round that simulates the shape of the current combat rounds

dummy cartridge satisfies a serious need for a dummy round that simulates the shape of the current combat rounds of ammunition. The 20mm Sealant program is to provide a significantly improved environmental seal between the projectile and the cartridge case. This more robust design will provide more reliable and safer ammunition to the Fleet. The PEGS PIP is designed to significantly reduce the risk of inadvertent initiation of 20mm electrically primed ammunition through indirect contact with the high levels of Electromagnetic Fields that are present on Fleet ships. Resolution of this shortcoming will respond to a deficiency previously identified by NAVSEA as a major Fleet safety and operational readiness problem. Beginning in FY95, the G&A Team will begin the initial investigation of a major weight savings program through the introduction of aluminum cased 20mm ammunition. This effort will reduce the combat ready weight of both fixed wing and rotary wing aircraft and at the same time extend the useful range, performance and survivability of the total aircraft weapon system. The NAWCWPNS G&A Team also provides technical consultation on Development programs being managed by the other Services. Examples of this include: the U.S. Army Cased Telescoped Gun and Ammunition Technology (CTAGT) Program, the U.S. Air Force Ballistic Sight Technology Improving Night/Day Gunnery (BSTING) Program and the U.S. Air Force AC-130/U Aircraft Gunship Program. The G&A Team is arranging to perform compatibility tests on behalf of the Norwegian Company, Raufoss A/S during the first quarter of FY95. These tests are designed to verify the compatibility of the Raufoss version of the 20mm PGU-28/B round of ammunition, developed in the 1980's by the NAWCWPNS G&A Team, with the Lightweight version of the M61A2 gatling gun system being integrated into the Swiss F/A-18 aircraft.

In-Service Engineering/Production Engineering Support

The NAWCWPNS G&A Team has a broad spectrum of responsibilities in the ISE and Production Engineering Support (PES) area. The Gun System ISE/PES programs currently being managed by the Team include: the F-14 Aircraft, the AV-8B Aircraft, the F/A-18 Aircraft, the UH-1N Helicopter, the HH-60H Helicopter, the AH-1W Helicopter as well as the Common Aircraft gun systems such as the M60D, the GAU-2B/A, the GAU-17, the XM-218 and peripheral items such as cleaners and lubricants. Ongoing Ammunition ISE/PES efforts include the engineering investigation of the behavior of various ammunition items, including: 20mm PGU-series Chamber Pressure as well as various production and operational related mishaps. The U.S. Army, NAVAIR and NAVSEA also depend upon the NAWCWPNS to use the various gun systems integrated into the Ballistics Test Laboratory to perform critically important production related Function and casualty tests on production ammunition. Although not organizationally merged with the G&A Team, the NAWCWPNS, nonetheless, provides logistics support to the overall aviation G&A community in the USN and USMC. The two communities are in close proximity at NAWCWPNS-Point Mugu and enjoy an excellent and well coordinated working relationship.

Intellectual Skill Capability

The NAWCWPNS G&A Team is currently composed of 13 civil servants. The combined experience in the area G&A is 107 years. The total experience in the weapons development or hands-on usage of military weapons through civil service, private sector or military experience is 261 years. Some of these employee's are viewed by both the internal and external communities as national and even international experts in their fields. A number of patents and other awards have been garnered by these employees. For additional information on this area, see Section D (Personnel Skills Summary) below.

Contributions To The Military Services

There have been a significant number of very effective systems introduced into the Navy weapons inventory as a direct result of the efforts of the NAWCWPNS G&A Team. These include the following: GPU-2/A 20mm Lightweight Gun Pod, 25mm PGU-20/U Armor Piercing-Incendiary (API) ammunition, 25mm PGU-22/U High Explosive-Incendiary (HEI) ammunition, 25mm PGU-23/U Target Practice (TP) ammunition, 25mm PGU-25/U HEI ammunition, 25mm MK 210 HEI ammunition, A/A49E-10 25mm Gun System for the AV-8B aircraft, 20mm PGU-27/B TP ammunition, 20mm PGU-28/B Semi-Armor Piercing High Explosive-Incendiary (SAPHEI) ammunition and 20mm PGU-30/B TP-Traced (TP-T) ammunition. The 25mm PGU-32/U SAPHEI ammunition, 25mm PGU-33/U TP Frangible-Traced (TPF-T) ammunition, the 20mm PGU-39/B Dummy cartridge and the improved case sealant used in the 20mm PGU-series of ammunition will be released to the Fleet in the next few months. The excellent day to day support of Fleet assets is an unheralded but critically vital part of the "Cradle to Grave" support provided by the NAWCWPNS G&A Team.

Major Facilities And Equipment

As previously stated, the Ballistics Test Laboratory (BTL) is a central factor in the Team's ability to successfully perform their broad and varied mission. This facility includes two 150-foot underground firing tunnels that can fire up to 20mm rounds in single-shot fully instrumented Mann barrel test firings. The BTL also has a 230-foot outdoor firing range capable of high rate of fire automatic gun firings up to 30mm using all-up aircraft gun systems. Specially instrumented and fully complete AV-8B and F/A-18 aircraft gun systems have been integrated into the BTL in support of a wide variety of tests, including acceptance related tests on production ammunition. All of the firing stations have a broad spectrum of instrumentation. The instrumented Mann barrels provide a wide range of test data relative to interior ballistics. Exterior ballistics are likewise measured, stored and processed using relatively sophisticated computer driven data gathering and analysis processes.

The transfer of the Gun Rework function from NADEP Alameda to the NAWCWPNS will further expand the facilities of the Team. The majority of the specialized equipment will be relocated to the China Lake site. Although most of this equipment will be used solely for the rework and gun test firing function, some of it is generic in nature and will be available for the use of other gun related programs.

In addition to the BTL and Gun Rework facilities, the Team has an excellent full-range shop facility that is used to maintain the test guns used at the BTL. This shop is not only used to perform maintenance on the Team's guns, but is also used to provide I-level maintenance for the AV-8B gun systems used by the USN and USMC in their T&E aircraft located at the China Lake Airfield.

For additional information on Facilities and Equipment, see Section C (Facilities Summary) below.

3.B.6 Test and Evaluation

Test and evaluation is an integral part of the RDT&E of energetics at the Naval Air Weapons Center Weapons Division. The elements support a full-spectrum T&E capability that supports all phases of research, development, production, and in-service engineering. The facilities that provide this extensive capability are discussed in the following paragraphs.

The energetic T&E facilities at China Lake consist of Air/Ground Ranges, a supersonic ordnance research track (SNORT) element, and an Ordnance T&E Division. The capability of the activity to perform energetic functions in terms of manpower, intellectual/skill capability and capacity, and major facility and equipment is described per element below:

Air Ground Ranges

The China Lake Air / Ground ranges provide test and evaluation resources in support of a wide range of weapons and weapons systems. Tests include component level - fuzes, sensors, propellants, warhead; to full up system level performance tests and span the range of air-to-air, air-to-surface, surface-to-air, and surface-to-surface. The North and South range complexes are greater than 1.1 million acres of land in the Southwestern Mojave desert, and is an invaluable asset for large-scale testing of all weapon systems and delivery means.

A total of 196 personnel make up this resource, with the following intellectual/skill capability and capacity:

Doctorate	2
MS/MA	10
BS/BA	40
Assoc Degree	42
Some college:	39

SNORT Track

The SNORT test facility participates in Material Characterization, Physics Measurements, Environmental Testing, Safety Evaluation, and Performance Evaluation of live weapon systems and energetic materials utilizing rocket powered vehicles transiting a track at up to supersonic speeds (maximum of Mach 3.5). This emulates flight or movement within the test constraints, and allows a better evaluation of energetic activities during testing. Currently the SNORT facility is supporting a major effort for the Trident PHTAP Program (Propellant Hazards Test and Analysis Program). The capability of the activity to perform energetic functions in terms of manpower, intellectual/skill capability and capacity, and major facility and equipment is described as follows.

The Branch is staffed with 35 persons, full time. The skills mix includes mechanical and electronics engineers, electronics technicians, photographers, computer technicians, engineering technicians, ordnance specialists, metal craftsmen, customer interface personnel, and an administrative support staff. Additional personnel and skills are make available on an as-needed basis from other areas of NAWCWPNS or from local contractors.

Intellectual/skill capability and capacity:

BS/BA	7
2-yrs college:	8

Facilities: Assembly and fabrication shops for preparation and checkout of sleds and ordnance hardware. Magazine storage for ordnance. A fully equipped machine shop is staffed and operated to expedite sled fabrication and to create/modify test hardware. Limited office facilities are also available.

Equipment: Photographic capability from still cameras to frame rates up to 16,000 pictures per second; additionally, tracking cameras are available, as is time-space-position coverage and video coverage. Both PCM and FM/FM telemetry systems are routinely used for sled tests, with sledborne and ground station capability available on site; a calibration laboratory is operated in support of the instrumentation systems. An on-site ground station is fully equipped with antennas,

receivers, discriminators, recorders, etc. "Quick look" data review is provided, as is computer processing for most data collected. Additional capability is provided with respect to blast overpressure measurements, analog-digital data conversion, and velocity measurement systems. Branch communications encompass the standard radio and telephone capabilities, as well as a computer link which connects the Branch to mainside NAWCWPNS activities. On-site mechanical engineering design is accomplished using AUTOCAD

Ordnance T&E Division

The Ordnance T&E Division consists of seven complexes within the China Lake boundaries which conduct distinct testing of live ordnance items. These are Strategic, High Hazard and Tactical propulsion facilities, Aeroheat test facility. Environmental test complex, Non-Destructive ordnance test facility, and the Ordnance Explosive test complexes. The Division is chartered to conduct Propulsion, Warhead, and Environmental testing in support of weapons systems RDT&E.

The Strategic, High Hazard and Tactical propulsion facilities and the Aeroheat test facility are located in the Skytop propulsion test area, which is chartered to specifically provide the open air range (free space) resources (people, land, airspace, facilities, instrumentation, and data reduction) required to support customers who need to test propulsion systems or related sub-systems. Total range size is approximately 11.6 square miles.

Personnel support for these functions is 40 personnel, tasked to perform T&E duties on multiple test stands as the workload dictates. Educational levels are: 3 MS, 14 BS, 9 Associate Degrees, 9 some college, and 5 high school. Formal education and directed technical training are sufficient in the personnel talent pool to accommodate all present work, with growth capability inherent due to the overall corporate technical talent of the personnel in performing ordnance motor test functions.

The Environmental Test Complex is principally located in the Skyline test area, with two large environmental chambers located in the Salt Wells area of China Lake. These facilities consist of six vibration and one shock test fixture with associated control room functions located in three separate buildings and eight environmental chamber test elements (7 temperature/humidity and one salt fog) at the Skyline and Salt Wells area.

The 15 personnel who support these functions are tasked with conducting MIL-STD and insensitive munitions (IM) vibration, shock and temperature/humidity exposure tests on all classes of tactical ordnance items, including bombs, missiles, and subsystem components containing explosive materials. The personnel mix in this area includes test engineers, test conductors, firing officers, and ordnance qualified technicians. Personnel educational levels are: 1 MS, 7 BS, 2 Associate degrees, 4 some college, and 1 high school. All ordnance handlers are skilled and certified.

The Non-Destructive Ordnance Test Facility is physically located in two areas whose primary functions are computed tomography and film X-ray functions respectively. These facilities are utilized for inspection and recording of construction anomalies, etc by X-ray exposure.

Personnel support for these functions is 10 personnel, tasked to perform all pretest and stand-alone X-ray inspection of motors and other energetic components. An average work year is 700-900 tests total for both facilities. When additional assistance is required for large test item handling, etc., personnel from the environmental test complex normally assist on an as needed basis. The force level for conduct of testing by and of itself is sufficient for present levels, and an estimated growth of 25% test load could be absorbed without personnel or equipment increase. Educational levels are: 1 MS, 2 BS, 4 some college, and 3 high school. There are five qualified radiographers on this staff.

The Ordnance Explosive test complexes consists of five major geographic test areas consisting of 22 separate test sites or bays tasked to perform a full spectrum of ordnance activation tests, including fast and slow cookoff, propane fire, bullet impact, fragment impact, drop, sympathetic detonation, liquid fuel and fuel-air explosive mixtures, and large scale arena detonations. The facilities are geographically separated (22 miles maximum road distance) and range in explosive siting from 200 lbs explosive, classes 1.1 thru 1.3 (Area R) to Burro Canyon which can test to 140,000 lbs of classes 1.1 and 1.2, and 200,000 lbs of 1.3. The CT sites are capable of testing up to 3,000 lbs of all classes. Twenty-two personnel support these functions. The personnel mix in this area includes test engineers, test conductors, firing officers, and ordnance qualified technicians. Personnel educational levels are: 4 BS, 6 Associate degrees, 8 some college, and 4 high school. All ordnance handlers are skilled and certified. The attached information delineates the facilities and equipment of this resource. (* Note: from Data Call 12)

3.B.7 Ordnance and Propulsion Pilot Plant

The China Lake Ordnance and Propulsion Pilot Plant possesses full-spectrum capability to conduct research and development, test and evaluation, pilot production, and demilitarization for all energetics, including propellants, explosives, pyrotechnics, ordnance devices, solid rocket motors, airbreathing propulsion, ordnance and ammunition, warheads, and fuzes.

The China Lake Plant covers an area of 43 square miles and consists of 288 buildings. This Plant includes facilities for processing of cast composite and extruded propellants, and melt-cast, mixed, pressed and injection loaded explosives, as well as assembly and integration facilities for ordnance, propulsion systems, warheads, and all-up weapon systems. The Plant has hazardous operation siting approvals in-place for all operating buildings. The large land spaces available at China Lake permit multiple, simultaneous operations, and room for expansion to accommodate emerging requirements. Operating buildings are positioned according to quantity-distance tables to ensure that unrelated operations are outside the hazard arc. No current or projected encroachment from residential, commercial, or recreational development threatens the continued operation or expansion of the energetics functions of the Plant. All necessary environmental permits are in place to allow energetic operations from RDT&E through pilot production to demilitarization. Industrial waste water, and hazardous material handling and disposal systems are in full compliance with DOD, EPA, and State of California requirements.

Mixing capacity starts at the gram quantity level and extends to 2200 pounds. The Plant has state of the art vertical high shear mixers ranging in size from 50 grams to 150 gallons for the processing of energetic materials, both propellants and explosives. Propellant extrusion capability ranges from 1" to 15" diameter. There are three casting areas, capable of casting rocket motors up to 6 feet diameter and 30 feet long. Explosive processing capability includes melt-cast from 1 to 40 gallon slurry kettles, utilization of the high shear mixers mentioned above, hydraulic presses up to 300 ton, 16 inch isostatic press, two Stokes tablet presses for explosive pellets, and both laboratory and production scale injection loaders. These injection loaders, invented, designed, and developed at China Lake, represent the cutting edge of technology for loading of high viscosity PBX explosives. The production scale injection loader is the result of a Cooperative Research and Development Agreement (CRADA) between China Lake and Alliant Technologies. It will be used by both parties for R&D and production.

Material synthesis and propellant and explosive formulation efforts are conducted in dedicated laboratories, the Formulation Laboratories, and the Energetic Materials and Scale-up Laboratories. Facilities for particle size reduction of energetic materials and raw ingredients include Sweco mills, micropulverizer, two fluid energy mills, and a Raymond hammer mill. Curing ovens (32 total) range from small sample size to walk-in ovens (8), which can accommodate full-up weapon

systems. Laboratory and 50-liter solvent stripping facilities are available for stripping solvent from liquid energetic materials, or for preparation of lacquer premixes for energetic formulations. Facilities for remote machining include a variety of lathes and mills for both propellants and explosives, Class 1.1 and 1.3.

Laboratories and shops for propellant characterization, properties analysis, quality control, composites parts design and fabrication, case fabrication (both metal and composite), motor preparation and lining facilities, arm-fire device, and safe-arm devices, igniter and gas generator loading and testing, thrust vector control and actuation characterization and test, and inert and energetic storage magazines are resident to support the function of the Plant.

The Airbreathing Propulsion Laboratory affords the capability for test and evaluation of liquid and solid fuel ramjets, expendable turbine engines, liquid propellant rocket engines, and advanced liquid fuels. These are the only facilities in the Navy for ramjet and component testing.

Rocket motor, ordnance, warhead, and missile assembly and integration buildings in the Plant permit the energetic components to be installed in the all-up-round (AUR), and for the AUR to be checked out prior to shipment or test. The utility of this capability is recognized by the weapons prime contractors and has led to a teaming relationship between China Lake and Texas Instruments for the Joint Standoff Weapon (JSOW). An integrated team of China Lake personnel, bringing their energetics and ordnance expertise, and Texas Instruments personnel, bringing JSOW weapon system expertise, will integrate, checkout , and conduct mass properties testing on each JSOW prior to its shipment to the Range for flight test.

Facilities for the decontamination and disposal of rocket motors and warheads exist currently, and advanced facilities for the environmentally safe disposal of large rocket motors are planned (these are discussed in the environmental section of this data call).

Unique and dedicated facilities for special access and foreign material exploitation also exist within the Plant.

Facilities, buildings, and equipment are delineated in detail in the appropriate section of this data call. Below is a summary of capacity for propellant and explosive processing, and ordnance, propulsion, and weapon system integration. It should be acknowledged that modern explosives are becoming very much like propellants as far as processability is concerned. As a result, much synergy is possible both in equipment and in personnel. China Lake ordnance workers are cross-trained in all processing operations, and in both explosives and propellants. Likewise the vertical mixers, casting pits, curing ovens, and particle size reduction mills and grinders are used for explosive and propellants alike.

<u>Mixers</u>
1 50 gram
1 1/4 pint
7 pint
5 1 gallon
1 5 gallon
1 25 gallon
1 30 gallon
1 50 gallon
2 150 gallon
<u>Extrusion</u>
1 inch extrusion press
3 inch extrusion press

12 inch vertical extrusion press
15 inch horizontal extrusion press
Melt-Cast
3 liter slurry kettle
1 gallon slurry kettle
10 liter slurry kettle
5 gallon slurry kettle
2 25 gallon slurry kettles
2 40 gallon slurry kettles
Casting Facilities
Rocket Motor Assembly Building(15951)
Casting Pit(15721)
Casting Pit(15811)
Presses
10 ton
15 ton
20 ton
50 ton
300 ton
2 tablet presses
16" isostatic press
Injection Loading
laboratory injection loader
production injection loader
Assembly and Integration Facilities
Actuator and Power Systems Lab
Fuze Test and Assembly Lab
Rocket Motor Assembly Building
Warhead/Bomb Assembly and Integration Facility
Missile Assembly Facility
Foreign Materials Exploitation Lab

3.B.8. Support Functions

The energetics programs require the handling and storage of hazardous materials. Several functions have been established to support these operations. The need for these support functions is not limited to one or a few operations but applies to all the operations across the Division where energetic materials are involved, therefore these functions have been established in organizations that are independent of the developing or operating organizations. They include Safety, Environmental, and the Weapons Department, as well as an Explosive Ordnance Disposal Detachment. In addition significant support for energetics is obtained from the Weapons Engineering and Logistics Department for all-up rounds in the Fleet as well as engineering services during energetics development.

Safety

Energetic materials safety is a particularly critical component at research, development, test and evaluation activities. This is due to research and development of unique, one-of-a-kind, experimental weapons systems; prototype weapons systems; pilot plant operations; and/or "quick response, fast turnaround" projects.

Navy energetic materials safety requirements--promulgated primarily for production process facilities and routine operations--must be interpreted, with intent determined and implemented, for application to RDT&E activities. In many cases, new safety requirements must be determined and published for RDT&E energetic materials operations.

Energetic materials safety support activities are provided by Weapons Officer, Command-appointed Explosives Safety Officer and Command-appointed Assistant Explosives Safety Officer. The latter two are assigned to the Safety and Physical Security Department. Approximately 7500 man-hours per year are provided for energetic materials safety support activities by the Safety and Physical Security Department (Explosives Safety Officer, Assistant Explosives Safety Officer and other Safety and Occupational Health Specialists). In addition, approximately 15,000 man-hours per year are provided by line organization personnel for energetic materials safety support activities (inspections, particularly those by higher authorities; safety meetings; operations safety review; Standard Operating Procedures preparation and review; etc.).

Energetic materials safety support activities include annual inspections (more frequent inspections of some energetic materials facilities) of 130 energetic materials operating buildings, 350 storage facilities (magazines, service magazines, ready service magazines, ready service lockers, etc.), 15 environmental control conditioning facilities, test ranges, pistol and rifle ranges; and documentation of inspection results; performing preliminary hazard analyses, risk assessments, and operations safety analyses; Standard Operating Procedures review (approx. 700 SOPs), explosives safety qualification and certification program review (approx. 700 energetic materials operating personnel in this program), Site Approval documentation review, exemptions, and waivers preparation and review (no exemptions and one waiver currently in effect); energetic materials facilities constructions, renovation, maintenance and repair work review; energetic materials mishap investigation, documentation and reporting (approx. 5 reportable energetic materials mishaps per year); maintaining energetic materials safety chapter in safety manual (preparation, publication and issuance of revisions as necessary); preparation and issuance of energetic materials safety instructions; and providing energetic materials safety training courses (basic explosives safety training class, managers/supervisors explosives safety training class, explosives drivers safety training class, energetic materials safety training class:, including periodic refresher safety training courses.

Other safety functions provided by the Safety and Physical Security Department (824000D) contribute, supplement and support energetic materials safety functions. These functions include (but not necessarily limited to) industrial safety, traffic safety, industrial hygiene, occupational health, respiratory protection, confined space entry safety, gas free engineering, electromagnetic radiation (ionizing, laser, microwave) safety, personal protection programs, sight conservation, hearing conservation, hazardous materials safety.

These energetic materials safety functions are mandated by higher authority directive (e.g., NAVSEA OP-5).

Environmental

Air Emission Permits

All of the necessary air emission permits have been obtained, and are maintained in compliance with applicable requirements. California has a reputation for having the most aggressive air emission permitting program in the country. The 1990 amendments to the Federal Clean Air Act require all States to develop similar permitting programs. Many of the facilities, equipment, and operations at NAWCWPNS require air emission permits. Examples include drying and curing

ovens for propellants and explosives, large mixers, and explosive synthesis equipment. Air emission permits typically take about a month to obtain, but in complex or controversial matters can take over a year. Air emission permit fees are currently about $300 a year each.

Industrial Wastewater

Industrial wastewater (IWW) contaminated with energetic residues and hazardous solvents is generated during the R&D of energetic materials, propulsion systems, and ordnance items. NAWCWPNS is in the process of constructing IWW collection systems which are in compliance with all current and anticipated Federal, State, and local environmental regulations. Approximately 50% of the collection systems are completed and in use. Completion of the remainder is anticipated by the end of FY95. In addition, a MILCON is planned for FY96 to construct an IWW treatment plant. This treatment plant will tremendously reduce the quantity of hazardous waste shipped off-site, and enable NAWCWPNS to operate more efficiently and economically. Current operations generate about 300,000 gallons of IWW annually. The treatment system will be able to treat over 600,000 gallons annually if necessary.

Energetic Hazardous Waste Disposal

NAWCWPNS, China Lake has an energetic hazardous waste disposal range which has an interim RCRA Part B Permit for both open burning and open detonation (OB/OD). This asset enables us to quickly, economically, and safely dispose of energetic wastes generated during the RDT&E of energetic materials, propulsion systems, and ordnance items. The China Lake OB/OD site is currently operating under interim permit status, as are virtually all OB/OD hazardous waste disposal sites across the country. In addition, the OB/OD site at China Lake has specific written approval from the State to continue its interim status. The China Lake OB/OD site is operating well within the limits set by the permit, which is presently for open burning/detonation of up to 300,000 pounds annually of energetic materials/ordnance with a pending increase to 500,00 pounds. While rumors about the EPA banning OB/OD disposal operations are rampant, there is nothing official to indicate that this will occur in the foreseeable future.

Encroachment

China Lake has extensive land holdings and all energetic R&D facilities were originally located to prevent encroachment and protect civilian populations, facilities and property from hazardous situations. China Lake has managed to maintain more than adequate explosive safety arcs and encroachment is not an issue. In addition, energetic R&D facilities are located in areas which do not have prohibitive wildlife and archaeological protection issues.

Environmental Documentation Support

NAWCWPNS has cultivated interagency relationships with Federal, State, and Local agencies and developed the general processes necessary to generate appropriate environmental documentation and approvals. Proper environmental documentation has become an important precursor to many RDT&E operations involving energetics. Even with the on-going changes in the environmental documentation and approval requirements, the specific processes may change, but our basic procedures and experience will prove invaluable.

Hazardous Waste Generation, Accumulation, and Disposal

NAWCWPNS has well defined and managed generation, accumulation, and disposal procedures and facilities for both energetic and non-energetic hazardous waste. Adequate training for personnel is provided.

Weapons Department

The Weapons Department supports RDT&E programs assigned to the installation by procuring all standard energetic materials and ordnance in support of those programs and receives all energetic materials and ordnance shipped to the installation. The Department provides storage space for energetic materials and ordnance and insures that physical security standards are complied with for all magazines and AA&E storage areas. It is responsible for the administration and maintenance of 260 explosive magazines and ready service lockers. Advice is provided on facility design, location and construction to insure Naval Ordnance Center (NOC) or DOD Explosive Safety Board (DDESB) approval for all energetic material/ordnance facilities or operations. The Weapons Department prepares and submits site approvals to document facility locations and operations as a requirement for obtaining formal approval from NOC or DDESB. It maintains computerized inventory of all standard energetic materials and ordnance. The Department also transports materials as needed by users to test sites, prepares material for off Station shipment, and provides weapons assembly and inspection of items to be flown from aircraft. Support is provided to Foreign Military Exploitation (FME) programs by conducting ordnance breakdown and evaluation. The facilities operated by the Weapons Department in support of the Energetics programs of the installation include the Ordnance Assembly Facility, the Ordnance Breakdown Facility, the Ordnance Packaging Facility, and the Ordnance Stowage Facility.

Explosive Ordnance Disposal (EOD) Detachment

The EOD Detachment is responsible for disposal of all energetic material and ordnance in support of activities of the installation. Standard operating procedures (SOP) state that in the event of dud ordnance, or problems arise in which energetic materials/ordnance are damaged and/or hazardous, that EOD be contacted. The EOD Detachment is on call for "Bomb Disposal" in support of the community and local area. The Detachment operates Burro Canyon Disposal Site, disposing of locally generated energetic materials/ordnance and an increasing percentage from outside of the Division. The Burro Canyon Disposal Site is presently permitted for open burning/detonation of up to 300,000 pounds annually of energetic materials/ordnance with a pending increase to 500,00 pounds. EOD also does failure analysis and assembly of ordnance, and it provides diving service in support of testing programs. FME programs are supported by providing ordnance breakdown and evaluation services.

Weapons Engineering and Logistics Department

The Weapons Engineering and Logistics Department (WELD), headquartered at China Lake, provides functional engineering, logistics development and support, manufacturing development, product support and technical documentation for all air-launched weapons, weapon systems and related equipment.

WELD provides/operates:

1. Functional life-cycle support in the areas of reliability, maintainability, production engineering, quality assurance, environmental engineering, system safety, materials analysis and te ng.

2. Specialized facilities that include reliability and environmental testing, materials testing, prototype production, microminature electronic repair, and weapon system functional testing.

3. All NAWCWPNS engineering prototype model shops and electronic prototype model fabrication facilities.

4. Technical consultation, planning, analysis, and design in areas of reliability and durability including statistical analysis, fault analysis, structural dynamic and aerodynamic loads, acoustics, vibration, shock and acceleration.

5. Acquisition and logistics support including maintenance planning, support equipment, logistics management, supply support, training systems, facilities, technical documentation and weapons-related information systems.

6. Maintenance engineering support and engineering and technical services to the Fleet, other filed activities and foreign military sales cases as assigned.

7. Coordination for the planning, programming, budgeting and allocation of funding for maintenance and overhaul of air-launched weapons as required to achieve asset readiness objectives.

8. On-site and on-call technical advisors to deployed and shore-based maintenance activities world wide.

9. Production engineering, reverse engineering and concurrent engineering team support for weapons, weapon systems, and related equipment.

10. Product assurance and process improvements based on a foundation of quality control, quality assurance, and software quality assurance expertise from the concept exploration phase through the total life cycle.

11. Configuration and data management and technical documentation services for the life cycle of air-launched weapons, armament, and support equipment and special programs.

PRODUCT LINES

AMRAAM
HARM
Harpoon
Hellfire
JSOW
Maverick
Penguin
Phoenix
Sidearm
Sidewinder
SLAM
Sparrow
TOW
Walleye
AEPS
Ammunition
CADS
Gun systems
GP bombs
Pryotechnics
Rockets

3.C. FACILITIES SUMMARY

Facility	Organization	Energetic Materials	Propulsion	Ordnance	All-Up Weapon Integration	Guns & Ammunition	Test & Evaluation
Actuator and Power Systems Lab	Ordnance Systems Department		X		X		
Aeroheat Test Facility	Range Department		X				X
Air / Ground Range	Range Department		X	X	X	X	X
Airbreathing Propulsion Lab	Ordnance Systems Department	X	X				X
Antiradiation Missile Integration Complex	Attack Weapons Department				X		
C27 Explosive and Ordnance Modeling	Ordnance Systems Department	X	X	X		X	
Cactus Flats Ordnance Test Area	Range Department	X		X		X	X
Chemical Analysis Research Facility	Research Department	X	X				
China Lake Ordnance and Propulsion Pilot Plant	Ordnance Systems Department	X	X	X			
Composites Development Lab	Ordnance Systems Department		X	X		X	
Detonation Physics Lab	Ordnance Systems Department	X		X			
Development Projects Laboratory	Ordnance Systems Department		X				
Energetic Materials Properties Analysis Lab	Ordnance Systems Department	X	X	X		X	
Energetic Materials Synthesis and Scale-Up Lab	Ordnance Systems Department	X	X	X			
Engineering Prototype Facility	Wpns & Eng Logistics Department	X	X	X	X	X	X
Environmental Test Complex	Range Department		X	X	X	X	X
Fuze Development Lab	Ordnance Systems Department			X			
Guidance Components Test & Analysis Complex	Wpns & Eng Logistics Department				X		
High Hazard Propulsion Test Facility	Range Department	X	X				X
Large Rocket Motor Disposal Facility (Prototype)	Range Department	X	X				X
Materials Engi-neering/Failure Analysis Facility	Research Department		X	X			

NOTE: The Environmental Test Complex supports the Guns and Ammunition category. Such items have been subjected to environmental tests or qualification.

(Contd.)

Facility	Organization	Energetic Materials	Propulsion	Ordnance	All-Up Weapon Integration	Guns & Ammunition	Test & Evaluation
Medium-Caliber Gun and Ammo Ballistics Test Lab	Ordnance Systems Department					X	
Missile/Rocket Motor Assembly Facility	Ordnance Systems Department		X		X		
Non-Destructive Ordnance Test Facility	Range Department	X	X	X	X	X	X
Ordnance and Propulsion FME Lab	Ordnance Systems Department	X	X	X	X		X
Ordnance and Propulsion Plant Support Shops	Ordnance Systems Department	X	X	X	X	X	
Ordnance Assembly Facility	Naval Air Weapons Station		X	X	X		X
Ordnance Breakdown Facility	Naval Air Weapons Station	X	X	X	X	X	
Ordnance Packaging Facility	Naval Air Weapons Station	X	X	X	X	X	X
Ordnance Stowage Facility	Naval Air Weapons Station	X	X	X	X	X	X
Ordnance Test Complex	Range Department	X	X	X		X	X
Propellants and Explosive Formulation Labs	Ordnance Systems Department	X	X	X		X	
Propulsion and Energy Conversion Research	Research Department	X	X	X		X	X
Ready Missile Test Facility	Wpns & Eng Logistics Department				X		
Sled Tracks	Range Department	X	X	X	X	X	X
Strategic Propulsion Test Complex	Range Department	X	X				X
Tactical Propulsion Test Facility	Range Department	X	X				X
TDD DDT&E Complex	Intercept Weapons Department			X			
Warhead/Bomb Assembly/Integration Facility	Ordnance Systems Department			X			
Weapons Survivability Lab	Aircraft Weapons Integration Dept	X	X	X			X
China Lake Ordnance and Propulsion Pilot Plant Reserve Capacity	Ordnance Systems Department	X	X	X			

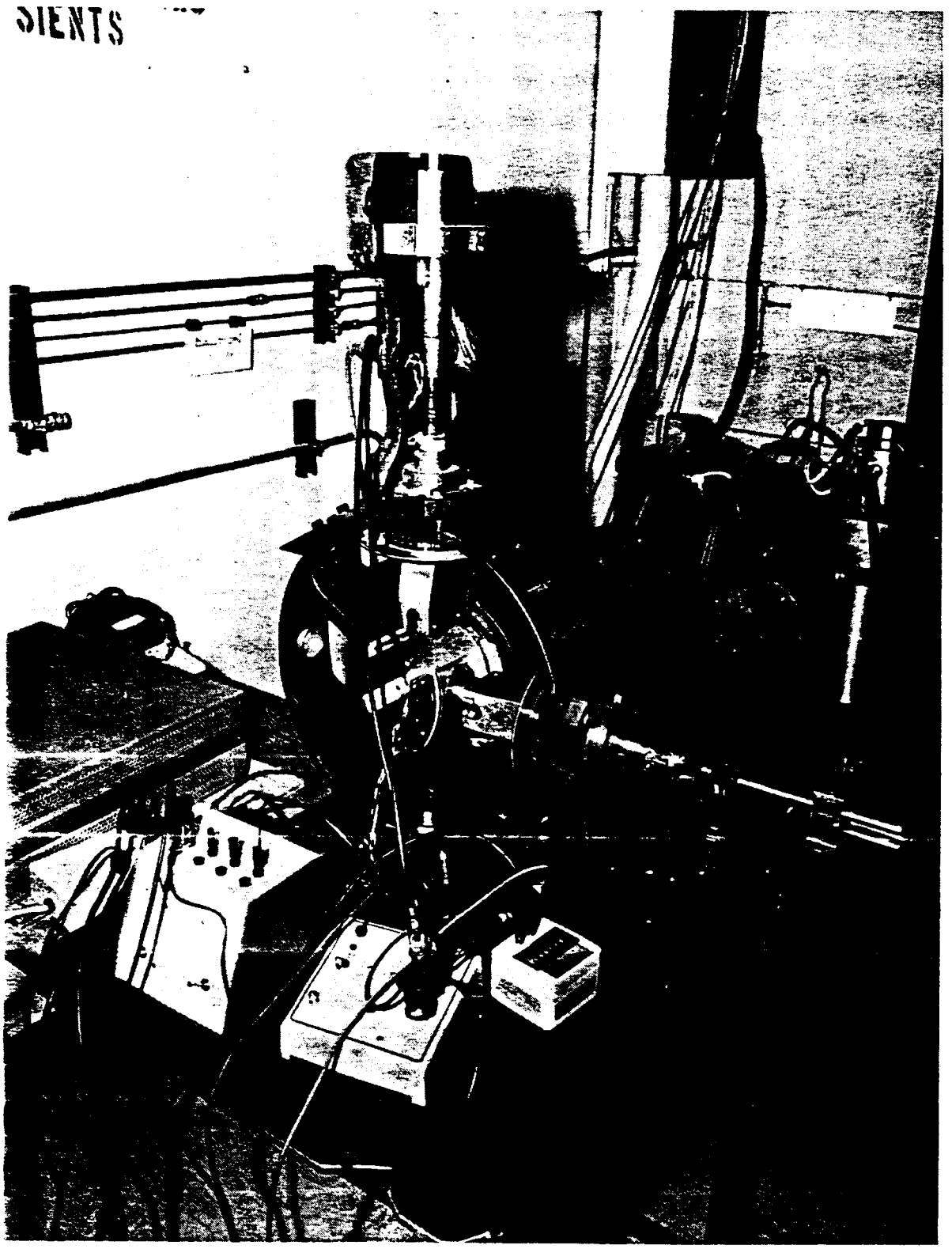
TDDs (PROXIMITY FUZE)

Facility	Organization	Energetic Materials	Propulsion	Ordnance	All-Up Weapon Integration	Guns & Ammunition	Test & Evaluation
Missile Engagement Simulation Arena	Intercept Weapons Department			X	X		
TDD Exploratory Development Facility	Intercept Weapons Department			X			
TDD Performance Evaluation Laboratory	Intercept Weapons Department			X			

Actuator and Power Systems Lab

Facility Description: The Actuator and Power Systems Laboratories are a group of buildings in the China Lake Propulsion Laboratory (CLPL) area of NAWCWPNS that has the capacity to conduct developmental evaluation and test of actuation and power system components of missiles and related equipment, and the capacity to pressure-test and hydroburst-test motor cases, igniter housings, and other pressure vessels. Missile on-board energetic power systems can be assembled and tested within the facility. The full range of actuation systems, including electromechanical, hydraulic and pneumatic, and energy storage systems, can be evaluated at the component level or as part of a larger control assembly. The laboratory can test actuator and control systems with live thermal batteries or gas generators. Checkout of full-up missiles with rocket motor integrated can be conducted prior to flight testing. The laboratory can conduct load testing, performance characterization, and acceptance testing of missile and air-vehicle flight-control actuators, separately or as an integral part of the missile flight control autopilot.

When the planned improvement in FY95 is completed, this equipment will be the only known facility capable of simulating full dynamic loads on actuators and thrust vector control units.

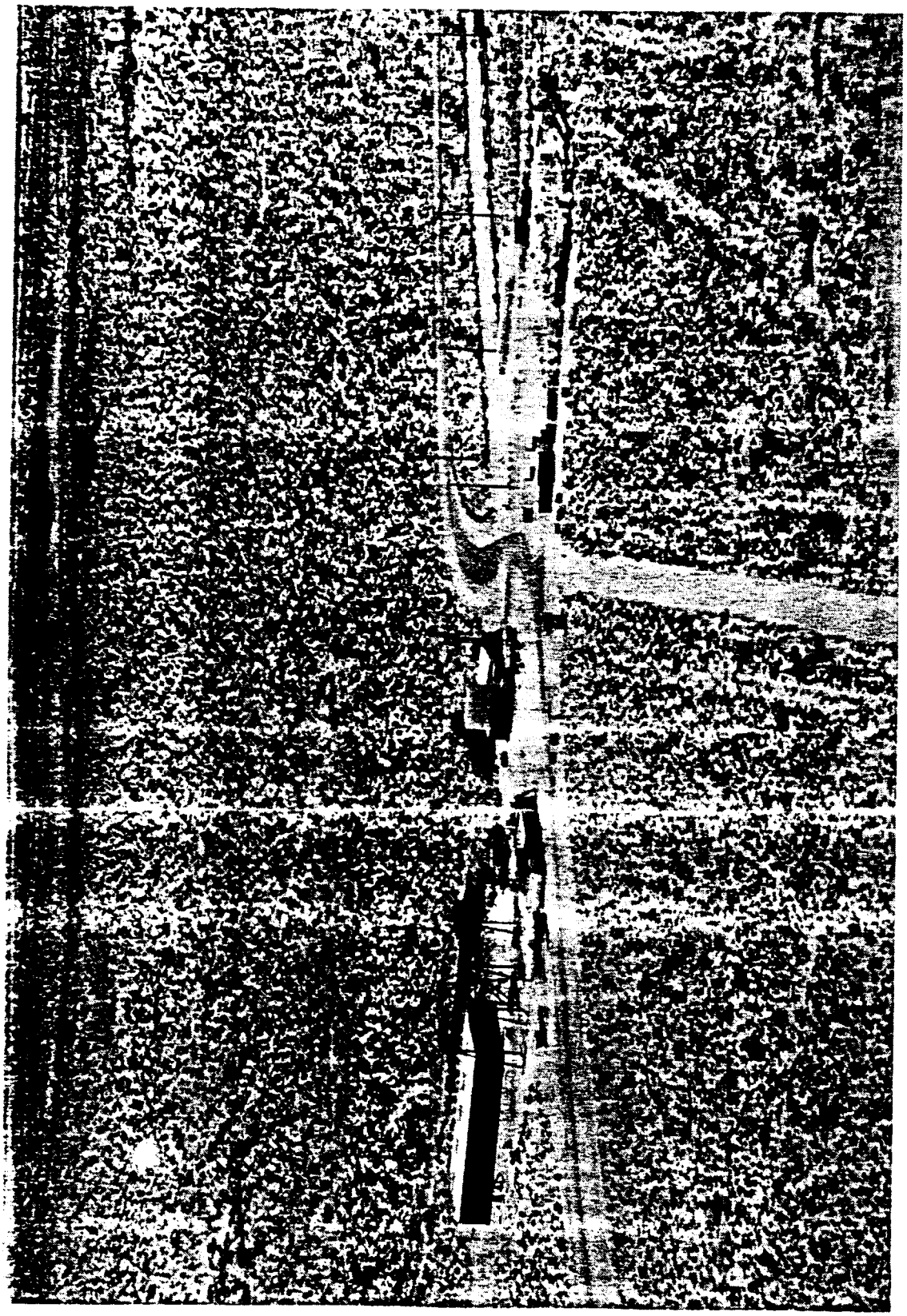


Actuator and Power System Laboratory

Aeroheat Test Facility

Facility Description: The Aeroheat Facility at NAWCWPNS China Lake is used to simulate supersonic flight conditions for materials survivability and to test ramjet propulsion systems, and is capable of testing a variety of tactical-sized missiles, both all-up rounds and components. Test stand capabilities include air velocities to Mach 2.9, temperature elevation of blowdown gasses to 2200°F, a maximum mass flow of 150 lb/sec, and a range of surface heat flux from 0 to 300 BTU/ft2/sec. The workload currently experienced and envisioned into the near future is directed at supporting both China Lake and other government and contractor programs. This test support currently is made to all phases of acquisition development—RDT&E on new or emerging products through production follow-on tests supporting product improvements. Approximately 55% of tasking effort is China Lake programs, 15% is other government programs, and 30% is done for contractors that have active government weapons-development contracts. The T-Range facility already supports nearly the full Navy integrated RDT&E process for all aeroheat tasks generated within the Navy T&E community for small tactical missile material testing. The facility is also part of China Lake's core competency level regarding missile RDT&E. The facility is sited for 200 pounds Class 1.1, 1.3, and 1.4 materials. The facility consists of Buildings/Test Pad 16178, 12143, 16020, 16059, 16060, 16061, and 16101.

This equipment is unique because the facility provides a range of heat flux and mass flows. This facility was included in the recent BOD studies and was not found to be duplicative of any other facility.

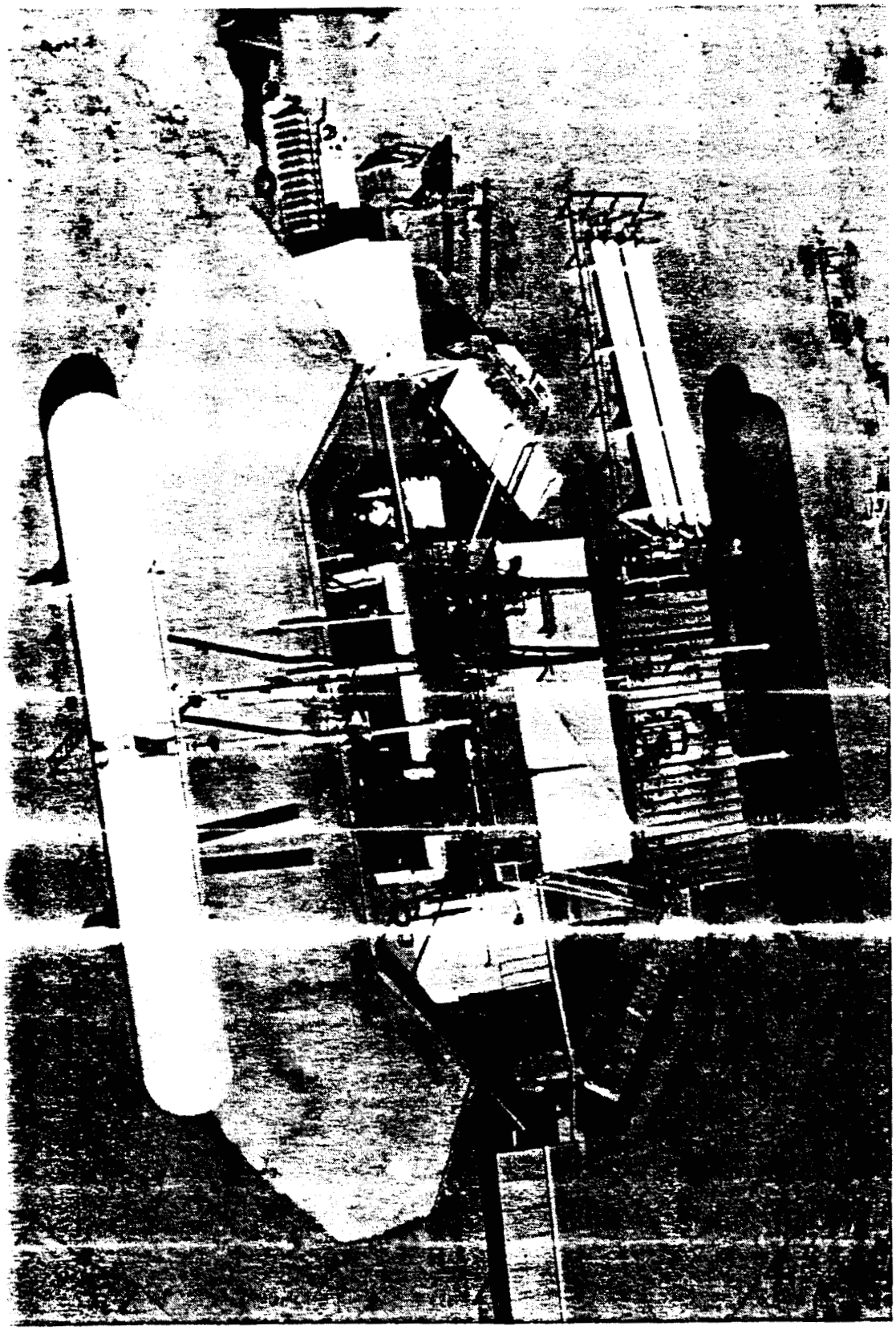


Aeroheat Test Facility

Airbreathing Propulsion Lab

Facility Description: This facility is an open-air facility to static-fire and test airbreathing engines and engine components, including fuels, inlets, insulators, combustors, and fuel management systems. This facility can also static-fire instrumented rocket motors and pyrotechnic devices up to 20 pounds Class 1.3 or 100 mg Class 1.1. The facility can simulate flight conditions up to Mach 5 from sea level to 80,000 feet altitude in operational environments of -65 to 200°F with engine sizes less than 8 inches in diameter direct-connected to the air supply. The facility has test bays for cold flow and hot firing of liquid and solid fuel ramjets and for expendable turbine engine testing. A liquid fuels formulation and development and evaluation laboratory also exists within the facility.

This equipment is unique because the remote location, coupled with the equipment, provides safety and security measures not matched by any other DOD facility with a high population surrounding it.



Air-Breathing Propulsion Laboratory

Air/Ground Range

Elements
- RF Target Array
- G-6 Point Defense Site
- Randsburg Wash Towers and Fuze Range
- Cruise Impact Testing
- G-4 Test Track
- G Range
- B/C Range
- Coso Range
- Airport Lake
- G-2 Range
- G-6 Range
- Redeye Range
- Randsburg Wash Gun Range
- Mojave B North

Facility Description: The North Range is a fully instrumented MRTFB facility supporting T&E for both air and ground testing of conventional weapons, including cruise missiles, air vehicle tests, training and tactics development, and parachute systems.

The range includes over 1.1 million acres of land and over 20,000 square miles of restricted airspace. The primary range can be subdivided into smaller ranges that are used independently or collectively, depending on test scenarios.

The climate and geography of these lands are typical of the arid regions of the U.S. Southwest. The weather is usually clear, with very little precipitation and practically unlimited visibility throughout most of the year. The land is barren, consisting mainly of flat dry lake beds, large dry washes, alluvial fans, and rugged mountains. Nearly all the land is used exclusively for test and evaluation or as a buffer between sensitive/hazardous tests and the surrounding civilian lands.

Outside NAWCWPNS boundaries the land is sparsely populated; equally as diverse in topography and ground cover; and, within a radius of 50 miles, mainly in the public domain. The airspace over the test ranges is restricted from surface to infinity; the surrounding lands are overlain by the R-2508 complex of restricted airspaces (20,000 feet above sea level to infinity), which center on NAWCWPNS and cover an area larger than the state of Maryland. These restricted airspaces combine with the surrounding desert to provide safe and secure air and ground range operational areas.

This equipment is unique because the range contains several facilities and features that are "one-of-a-kind," including

1. The RF Target Array - A large array, 60 plus, of RF targets that live all-up-weapons systems can be launched against. These targets are constructed and geographically positioned to simulate real-world threat scenarios. Additionally, many of the targets are capable of replicating multiple threats.

2. G-6 Point Defense Site - A hardened test site approximately 700 feet above the valley floor allowing for launch/testing of weapons, at co-altitude with test site, where there is a significant risk of either launch item or target impacting the test site. The site is designed to safely sustain impact from a full-scale aerial target.

2. G-6 Point Defense Site - A hardened test site approximately 700 feet above the valley floor allowing for launch/testing of live weapons systems and all-up missiles, at co-altitude with test site, where there is a significant risk of either launch item or target impacting the test site. The site is designed to safely sustain impact from a full-scale aerial target. The G-6 site is also commonly used to evaluate the Phalanx Point Defense System against full-scale targets.

3. Randsburg Wash Towers and Fuze Range - Two wooden towers capable of suspending full-scale targets 250 feet above the ground, allowing gun fuze testing to be performed in a realistic environment. Gun projectiles are fired past the suspended targets from a nearby gun line. Ordnance breakdown/assembly facilities are also located here to support gun munitions preparation.

4. Cruise Impact Testing - The only range that allows impact test and dispensing of submunitions of U/RGM-109 D and C (surface and subsurface launch of Tomahawk) after having flown an operationally realistic track from launch at sea to impact (IR-200 route).

5. G-4 Track - Allows test item to be launched off the end of a track, which looks out over a valley floor several hundred feet below. The facility allows cost-effective, free-flight testing of all-up weapons and retardation devices prior to aircraft flight testing.

6. Colocation with one of DOD's primary weapons RDT&E laboratories. This provides for a convenient and effective interchange between T&E and R&D, including

- Test conducted without travel time and expense
- The ability to test experimental ordnance without off-site shipping expense and coordination
- Quick turnaround of data, data analyses, and re-test

7. Electronic link between China Lake, Edwards AFB, Vandenburg AFB, and Point Mugu - Allows for interchange of data and interrange testing of systems requiring capabilities beyond those of one range—for example, cruise missile testing.

8. Good weather and visibility (>260 clear days per year) providing excellent photo-optical data coverage and test conditions.

Air/Ground Range Control Center Facility Complex

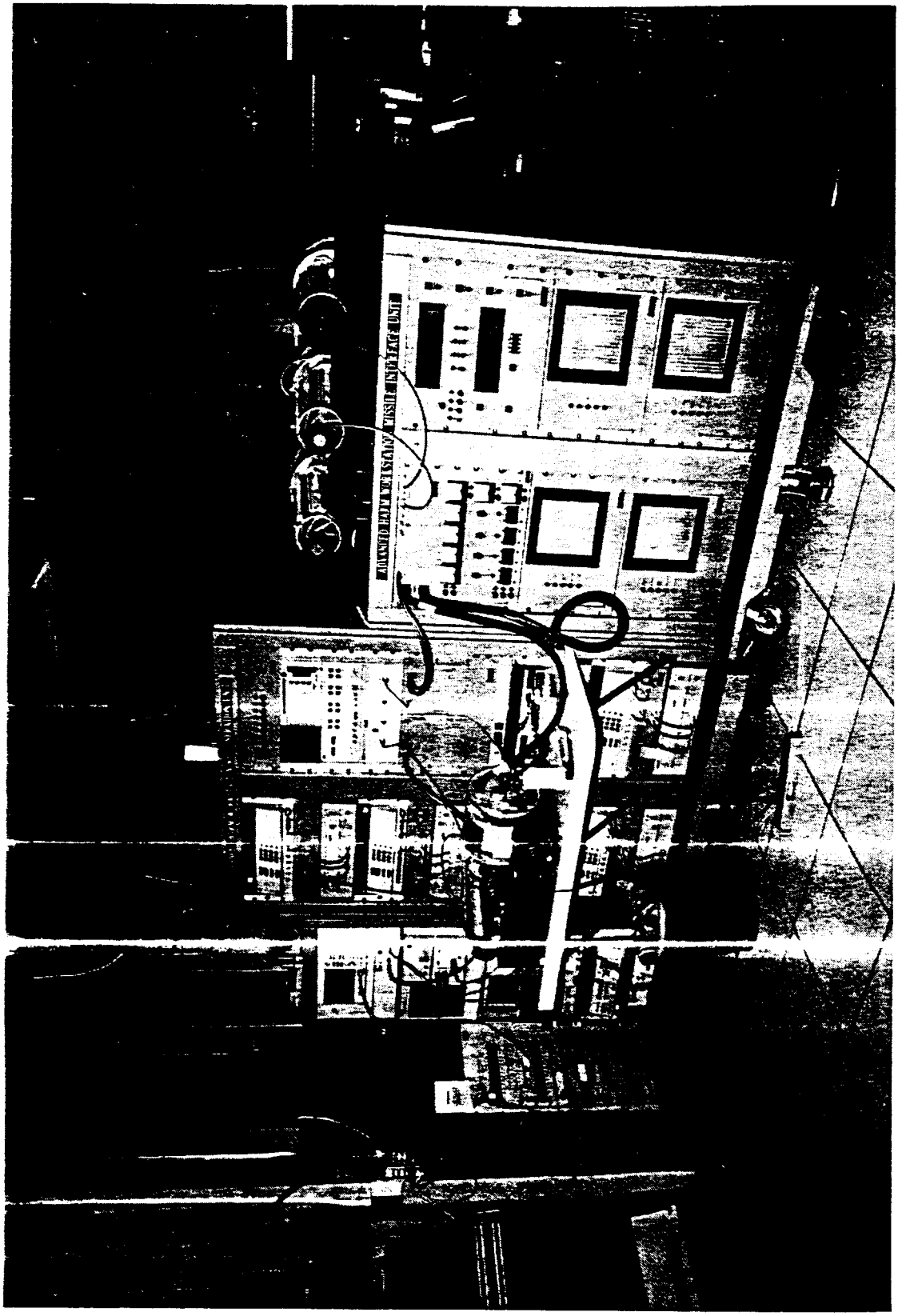
Antiradiation Missile Integration Complex

Elements
- HARM Data Reduction Fac
- HARM Mission Planning Module
- Harm Test Fac
- HARM HEA Integ Fac
- HARM Missile Buildup Fac
- HARM Wpn Sys Integ Console Fac
- Adv HARM Workstation
- Wpn Sys Verification

Facility Description: This capability is a multisite organization including a 6-degree of freedom (DOF) analysis computer laboratory, mission planning module development, data reduction facility, advanced HARM workstation, weapon system integration facility, and weapon system verification facility. The purpose of the complex is to do laboratory-based research, development, and development testing (DT) of static and dynamic hardware; ELINT test and verification; electronic warfare suite integration; production hardware verification, assembly and electrical test of antiradiation missiles (ARMs) for the multiple services/foreign governments, electrical test and repair of ARM avionics, ARM integration with Navy aircraft (OFPs), dynamic missile computer simulation, mission-planning software development (TAMPS), test and debugging of ARM ground-support equipment, and ARM software debugging for live-fire mission scenario testing.

This equipment is unique because it is the only facility in the world that provides unique full-cycle testing of ARM weapons capability, from laboratory-based research, DT, and operational testing (OT) to Fleet test and evaluation. This includes fundamental laboratory-based hardware and software development, instrumented aircraft flight/missile firing, and actual measurement of missile impact in relationship to the required impact target (land or sea base) to access probability of kill (P_k) using complex models of warhead pattern on each target.

The Antiradiation Missile Integration Complex is currently used for all-up weapon integration. The facility includes the necessary ordnance certifications and handling equipment (including overhead bridge cranes) for ordnance operations.



Anti-Radiation Missile Integration Complex

C27 Explosive and Ordnance Modeling

Facility Description: C27 uses a networked system of personal computers and workstations to model various ordnance performance characteristics. These characteristics include ordnance and propulsion sections' responses to shock waves (sympathetic detonation), hard target penetration of warheads, and solid modeling for design studies.

Explosive and Ordnance Modeling Facility

Cactus Flats Ordnance Test Area

Facility Description: This facility is a 15-square-mile test arena for conducting large- and small-scale high-explosive tests, as well as gun testing. The test site can handle tests up to 200,000-pounds net explosive weight. Tests supported include survivability of improved magazine designs, quantity-distance/hazard zone safety tests, sympathetic detonation tests, gun testing (up to 120 mm), and testing of underground explosive storage facilities. Capabilities include high-speed photography, video, pressure measurements, and debris mapping.

Mission statement: Engineering and development of ordnance programs to determine safety, performance, and storage properties.

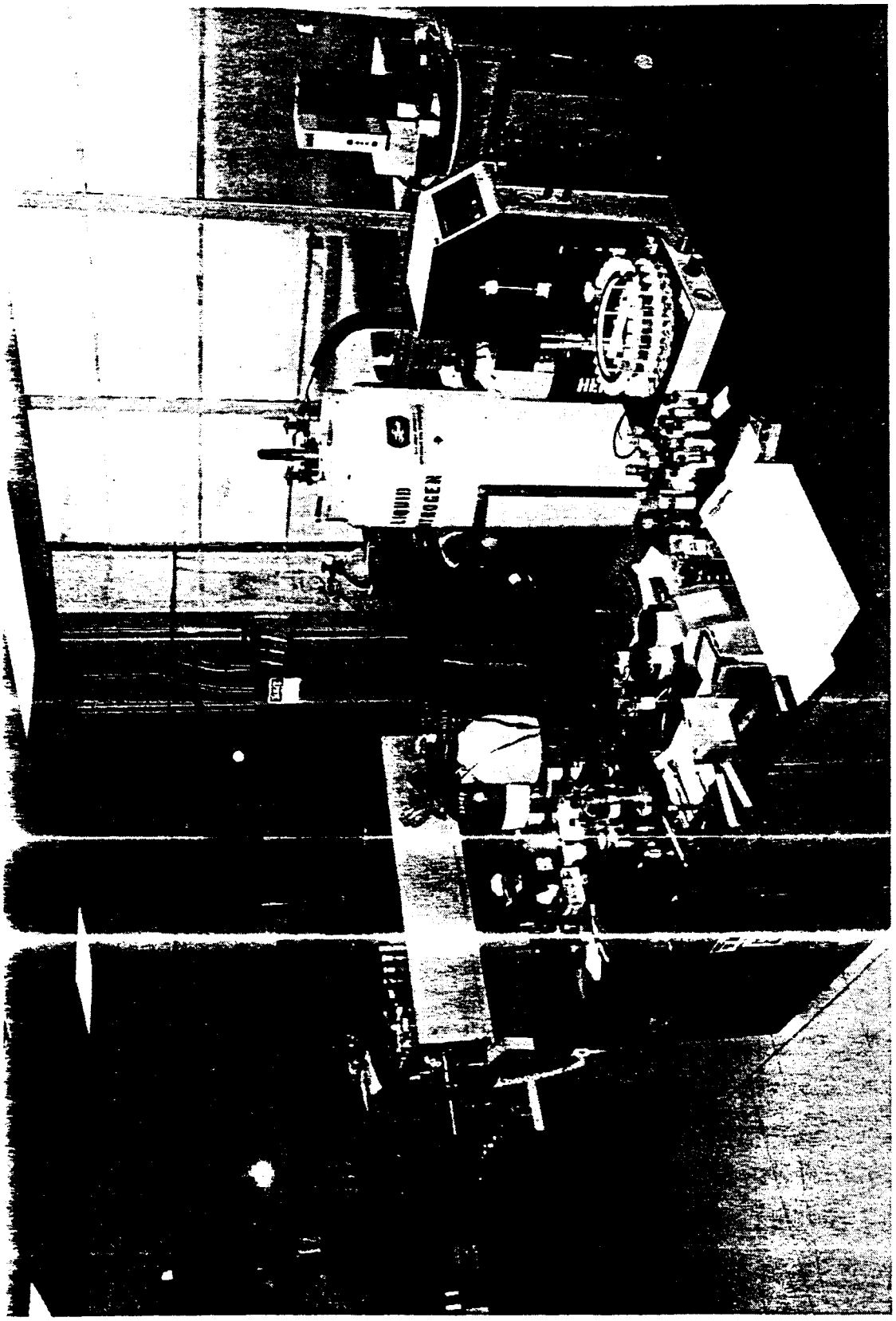
Cactus Flats Ordnance Test Area

Chemical Analysis Research Facility

Elements
- Nuclear Magnetic Resonance Fac
- FT-IR/Raman Fac
- Chem Analysis Lab
- Polymer Characterization Fac

Facility Description: This facility provides analytical services, including materials characterization, to a large number of in-house and out-house activities, including SSPO (Trident) and Chemistry Division research programs in the areas of energetic materials, electronic materials, polymer precursors, foreign materials characterization, failure analyses, and general "unknown" determinations. Analytical environmental and hazardous waste samples are critical to the operations of the Environmental Projects Office. Support is also provided to programs engaged in seeking substitutes for ozone-depleting substances. This includes mass spectrometry and chromatography laboratory, NMR laboratory, infrared spectroscopy laboratory, polymer characterization laboratory, and X-ray diffraction laboratory.

This equipment is unique because it supports a broad range of activities from basic research to advanced development. It is not only state-of-the-art in instrumentation but is partially accredited to do EPA-certified analyses and is certified to do analyses/testing of energetic materials.

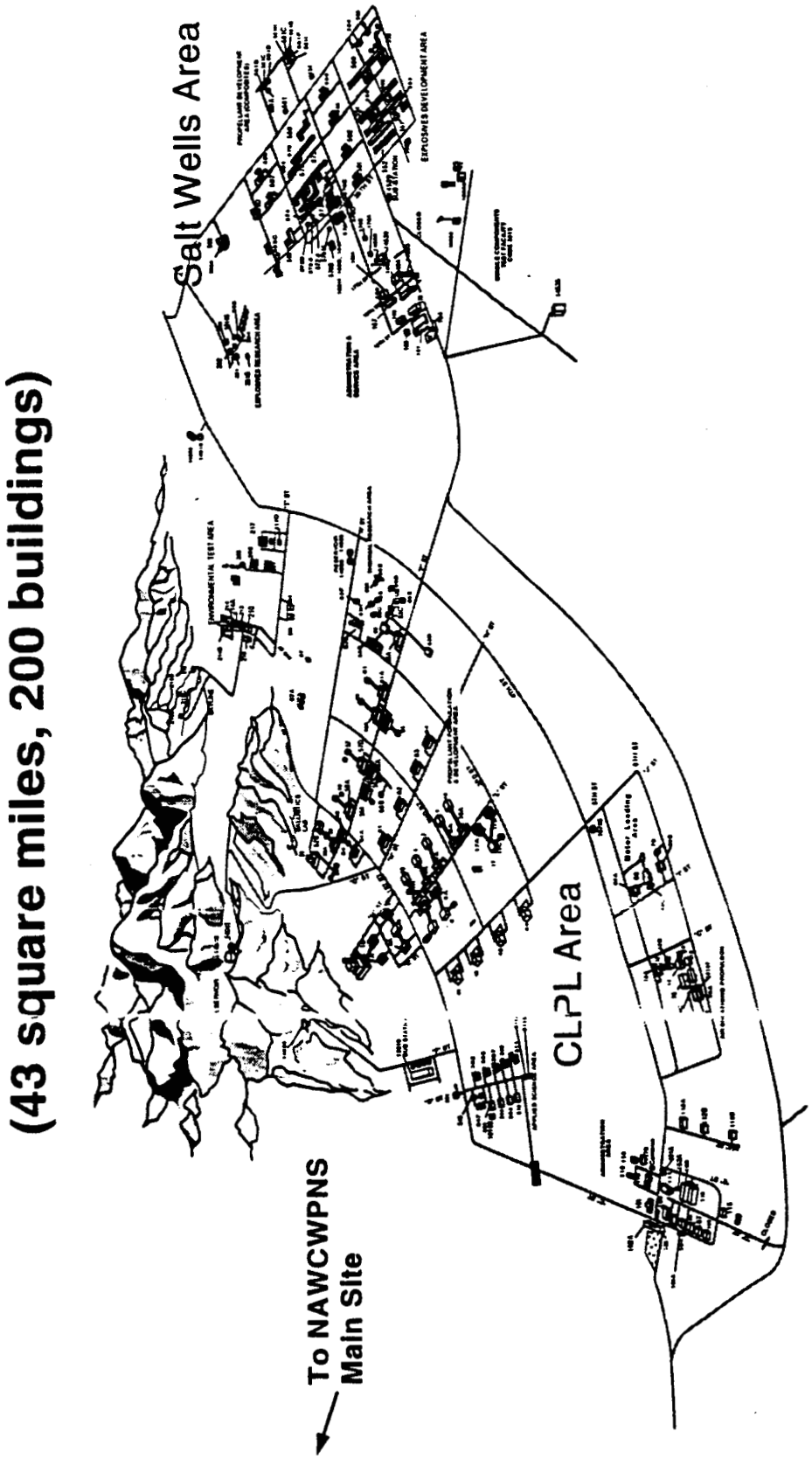


Chemical Analysis Research Facility

China Lake Ordnance and Propulsion Pilot Plant

Facility Description: The mission of the China Lake Ordnance and Propulsion Pilot Plant is to advance ordnance-related technology (i.e., energetic materials, propulsion, warheads, bombs, and fuzing), and to design and develop weapons and weapon components that contain energetic materials. As part of its mission, the Pilot Plant is responsible for the design and development of warheads and propulsion systems, and for the development and application of Insensitive Munitions technology. Its uniqueness is in having the capability to go from hand-mixes and synthesis of new energetic materials and new formulations through large-scale processing of propellants and explosives. Processing equipment includes high-shear mixers from 1 to 150 gallons in size for mixing propellants and explosives; up to 40-gallon slurry kettles for mixing melt cast and other explosives; pellet presses; 20-, 50-, and 300-ton explosive presses; complete raw material preparation in hammer mill; Sweco grinders and fluid energy mills; injection loaders for explosives; casting facilities; ovens for curing explosives and propellants; and complete machining capability for rocket motors, warheads, bombs, explosives, and propellants. Availability of on-site disposal for all explosive and propellant scrap and other excess ordnance components is invaluable. This facility is composed of 56 buildings designed exclusively for proper handling of energetic materials. These buildings are positioned according to quantity distance tables to handle propellants and explosives up to several thousand pounds, with no current or anticipated encroachment from residential, commercial, or recreational development that could compromise the S&T mission. Construction is of reinforced concrete or designed with earth-filled barricades. Safety measures in place include conductive floors and static grounding systems to prevent ignition of energetics through electric discharge. An atmospheric warning system is installed and encompasses the area. Personnel barricades to prevent unauthorized intrusion to process equipment during remote operations are equipped with electrical interlocks. Explosion-proof electrical fixtures and equipment prevent ignition of flammable dusts or vapors, and water-deluge fire-suppression systems are installed to protect the facilities investment. A regulatory approved hazardous waste treatment system that allows for effluent collection, treatment, and disposal of explosive hazardous waste is installed.

This equipment is unique because this is a one-of-a-kind facility within the DOD, DOE, and the U.S. Its uniqueness is in having the capability to go from hand-mixes and synthesis of new energetic materials and new formulations through large-scale processing of both propellants and explosives. Availability of on-site disposal for all explosive and propellant scrap and other excess ordnance components is invaluable. There are no encroachment problems and no possibility of encroachment in the future. There is virtually unlimited room for expansion.

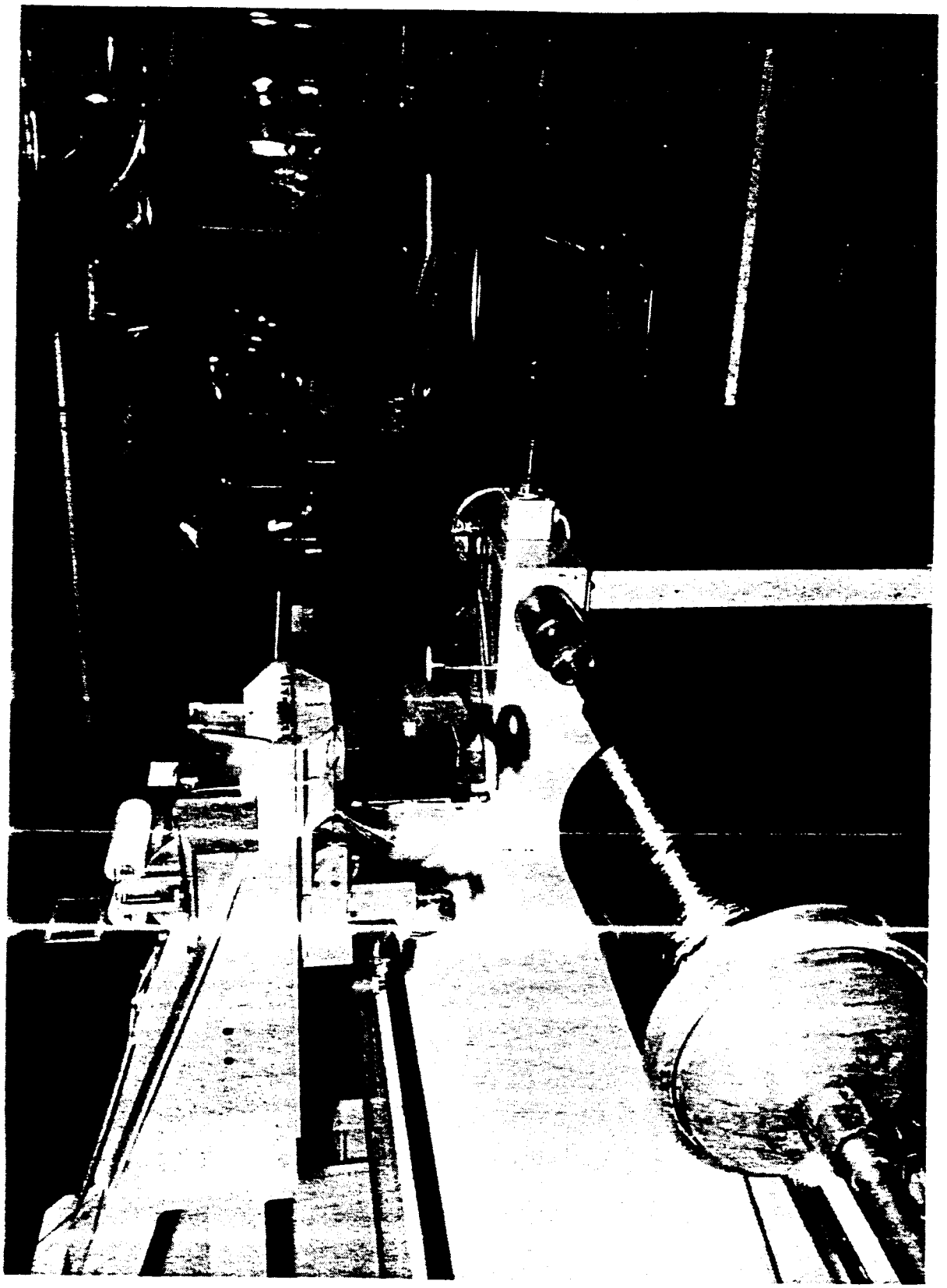


China Lake Ordnance and Propulsion Laboratories

Composites Development Lab

Facility Description: The primary purpose of this S&T laboratory is to provide advanced composite development from design/analysis methodology, materials development and characterization, and fabrication methods through testing for tactical missile airframes and propulsion systems. This laboratory function is located at three primary sites. Plastic and composite parts are developed from bulkheads to complete airframes and nozzles, liners/insulators to rocket motor cases. The laboratory includes unique design, fabrication, and test equipment that are integrated together. The laboratory provides quick-turnaround and special one-of-a-kind solutions to S&T projects. Layup tables, presses up to 720 tons, autoclaves, and curing ovens afford a self-contained capability to meet all manner of non-metallic parts fabrication requirements. The composite winding equipment can fabricate solid rocket motor cases and complete airframes for any size tactical missile. Design and analysis tools are integrated into the fabrication and test facility to form a full-spectrum composite development laboratory.

This equipment is unique because no other facility within DOD possesses the capability to support the entire developmental process, from design of new methodologies and processes through fabrication. No other site has the amount or breadth of equipment and resident capability in the composites design, analysis, fabrication, and testing areas. This is the only facility capable of molding large and complex rocket nozzles and manifolds.

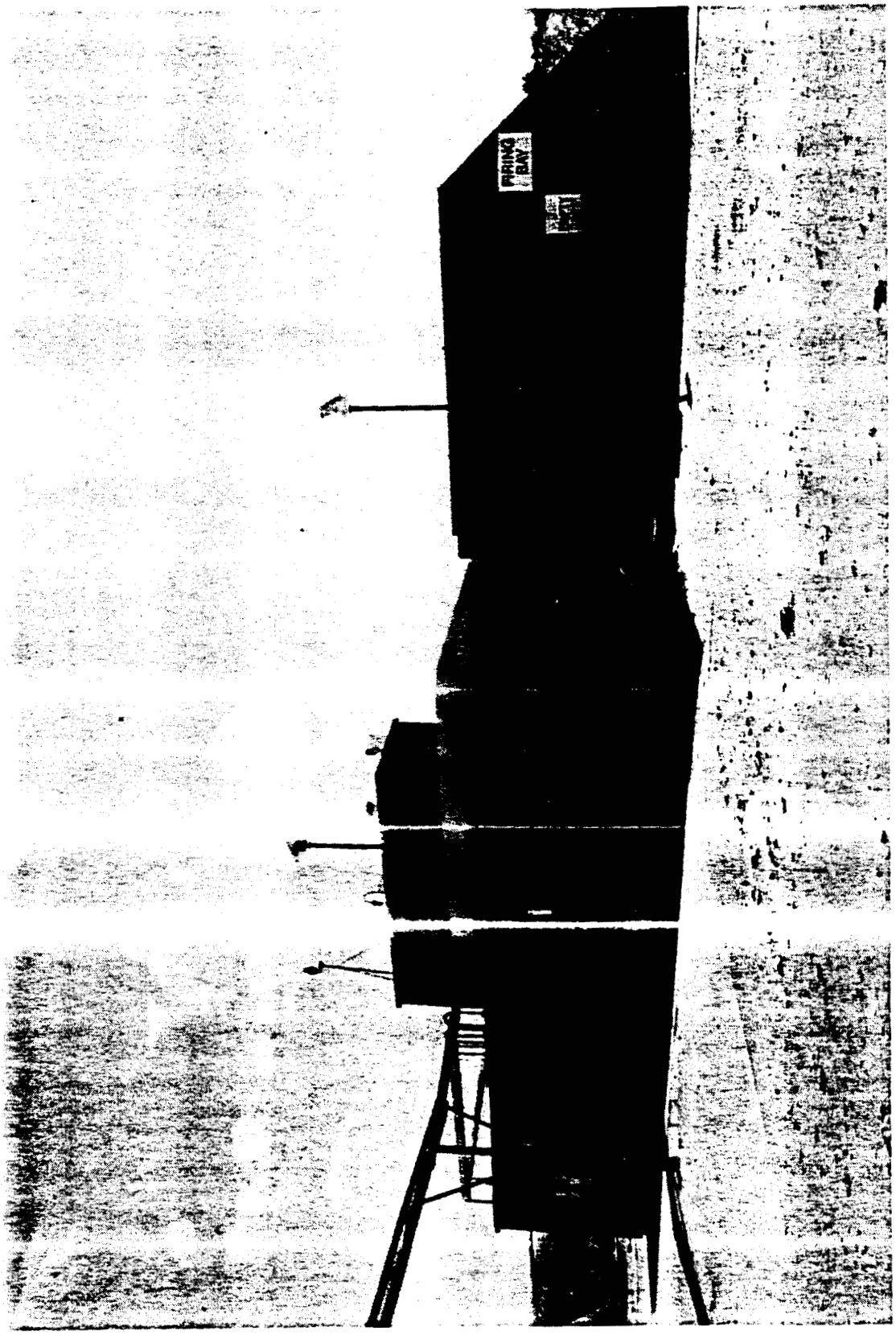


Composites Development Lab

Detonation Physics Lab

Facility Description: This facility consists of three test bays: an enclosed test chamber with separate control room, an indoor firing bay, and an outdoor firing bay with a common control room. All three bays are instrumented, and the ultra-high-speed framing and streak cameras may be used for the indoor and outdoor bays. Precise timing and pressure measurements can also be made. All bays are heavily constructed for work with energetic materials, and control rooms are heated/air conditioned for instrumentation. Support for test facilities includes office space, machine shop, wood working shop, electronics laboratory, chemical laboratory with fume hoods, and photo laboratory. The facility has the capability to be totally self-sufficient: make test fixtures, build stands, instrumentation, test, gather data, evaluate data, report results, and develop film. Tests supported are detonation velocity, detonation pressure, fragment velocity, penetration performance, cap sensitivity, shock sensitivity, sympathetic detonation, critical diameter, failure thickness, and fuel-air-explosive characterization.

Mission statement: To determine the quality, safety, and operational characteristics of energetic materials through detonation physics testing.

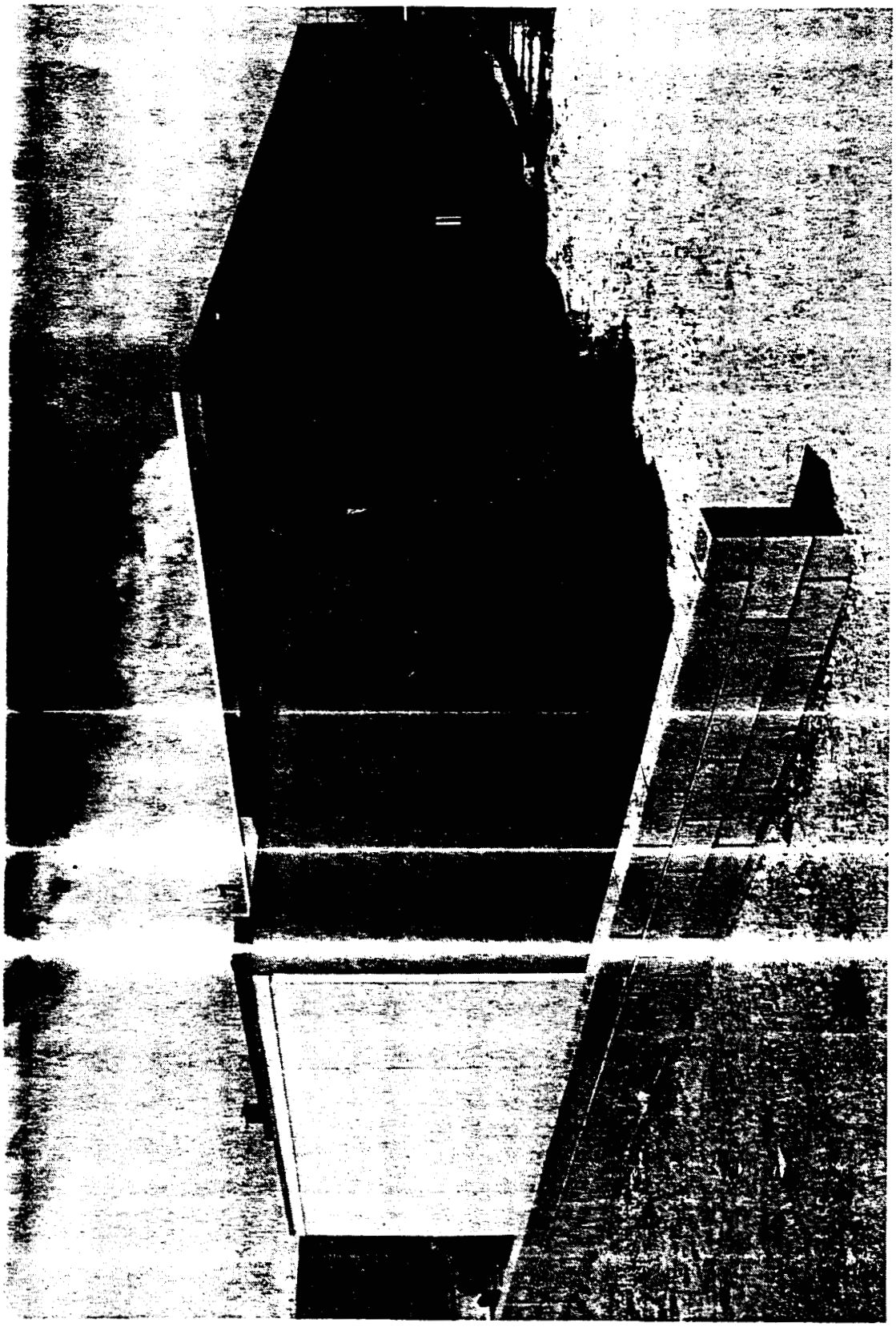


Detonation Physics Laboratory

Development Projects Lab

Facility Description: The facility includes office space, laboratory, and hardware storage/assembly areas for advanced propulsion technology programs..

Mission statement: To provide work space for special projects at NAWCWPNS China Lake, including design, analysis, data reduction, and hardware storage and assembly activities activities in support of development of advanced propulsion technologies. The facility provides a unique capability because of its ability to handle information and hardware, and because of its proximity to specialized rocket motor hardware fabrication, assembly, and instrumentation test areas.



Development Projects Lab

Energetic Materials Properties Analysis Lab

Facility Description: These facilities are a combination of laboratories and field test sites. The total square footage of the laboratory spaces is 12,345. These spaces are configured in a typical laboratory setup for wet and dry chemical analyses and physical properties analysis. This includes proper fume hoods; electrical outlets; uninterrupted power supplies; nonconductive surfaces; inert gas plumbing throughout; and chemical, energetic material, and hazardous waste storage. All laboratory facilities are heavily constructed for the explosive environment and are air condition/ heated for the instrumentation. Instrumentation includes particle size analysis, differential scanning calorimetry, vacuum thermal stability, HPLC, gas chromatograph-mass/spectroscope, reaction rate calorimeter, combustion bomb, thermal gravimetric analysis, IR spectrophotometer, differential thermal analysis, friction sensitivity, electrostatic sensitivity, impact sensitivity, propellant strand burning rate, tensile testing, and cure shrinkage measurement. The combined field test sites buildings square footage is 679. The field test sites are converted battleship gun turrets and are configured into control rooms and enclosed firing bays. The field test sites are instrumented for the thermal characterization of fast cookoff (open-air flame), small-scale cookoff bomb (1 lb), and large-scale cookoff bomb (25 lb) of energetic materials. Steady- and non-steady-state thermal cookoff tests as well as open-flame fast cookoff tests are conducted.

Mission statement: To determine the quality, safe handling, and operational characteristics of energetic materials through state-of-the-art thermal, chemical, and physical analysis.

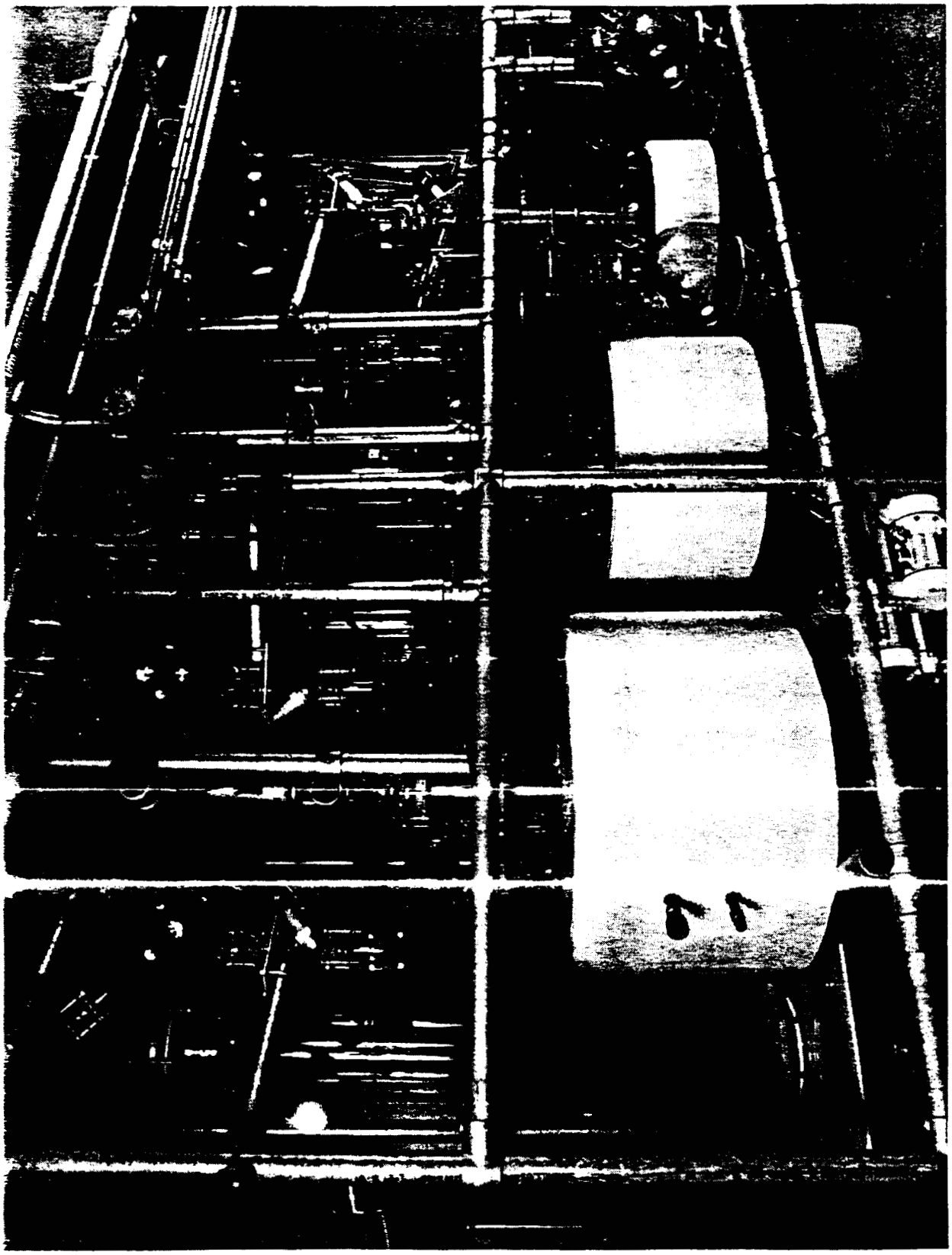
Energetic Materials Properties Analysis Laboratory

***Energetic Materials Synthesis and Scaleup Lab**

Facility Description: The mission is to develop scale-up procedures for the chemical synthesis of new explosive materials.

Facility Description: This facility consists of an energetic materials synthesis laboratory (Bldg. 15700) and a scale-up facility (Bldg. 15702). The facility is devoted to explosives synthesis and ingredient preparation. Solid explosive materials are ingredients for both propellant and explosive formulations. Bldg. 15702 is devoted to the intermediate scale-up of explosives synthesis and ingredient preparation; this facility is capable of scaling up new ingredients to the 10- to 20-pound-per-batch level, enough new material to support exploratory development efforts. The facility consists of a control room and two remote operations laboratories behind a barricade. Remote operations include several chemical reactors, up to 150-liter capacity, and pilot plant scale materials handling equipment. Operations in Bldg. 15700 include formulation (weighing, mixing, casting, curing), and one 1-pint Baker Perkins mixer with control room is located there. The building also contains three energetic materials laboratories, three steam ovens, and a field office.

This equipment is unique because it is an all-glass system that enables the handling of strong acids without contamination caused by leaching ions from metal systems.



Energetic Materials Synthesis and Scaleup Laboratory

Engineering Prototype Facility

Facility Description: This facility is an engineering prototype facility that provides quality technical and industrial manufacturing support to S&T, development, and test and evaluation projects through continuous improvements using comprehensive prototyping/ manufacturing technologies that satisfy customer requirements. This is accomplished using concurrent engineering and manufacturing best practices principles.

This facility provides the prototyping of rocket motor and warhead cases and other components. Both reactive and conventional warhead cases can be fabricated, as well as rocket motor cases of aluminum steel, and composite materials. CAD/CAM permits designs for these propulsion and ordnance systems components to be manufactured directly from the engineers' computer-generated design drawings. Rocket motor blast tubes and nozzle parts of metallic, phenolic, and graphite may be fabricated by molding, lay-up, or machining means. A satellite facility is located within the Ordnance and Propulsion Plant and is fully dedicated to the support of propulsion and ordnance systems.

Engineering Prototype Facility

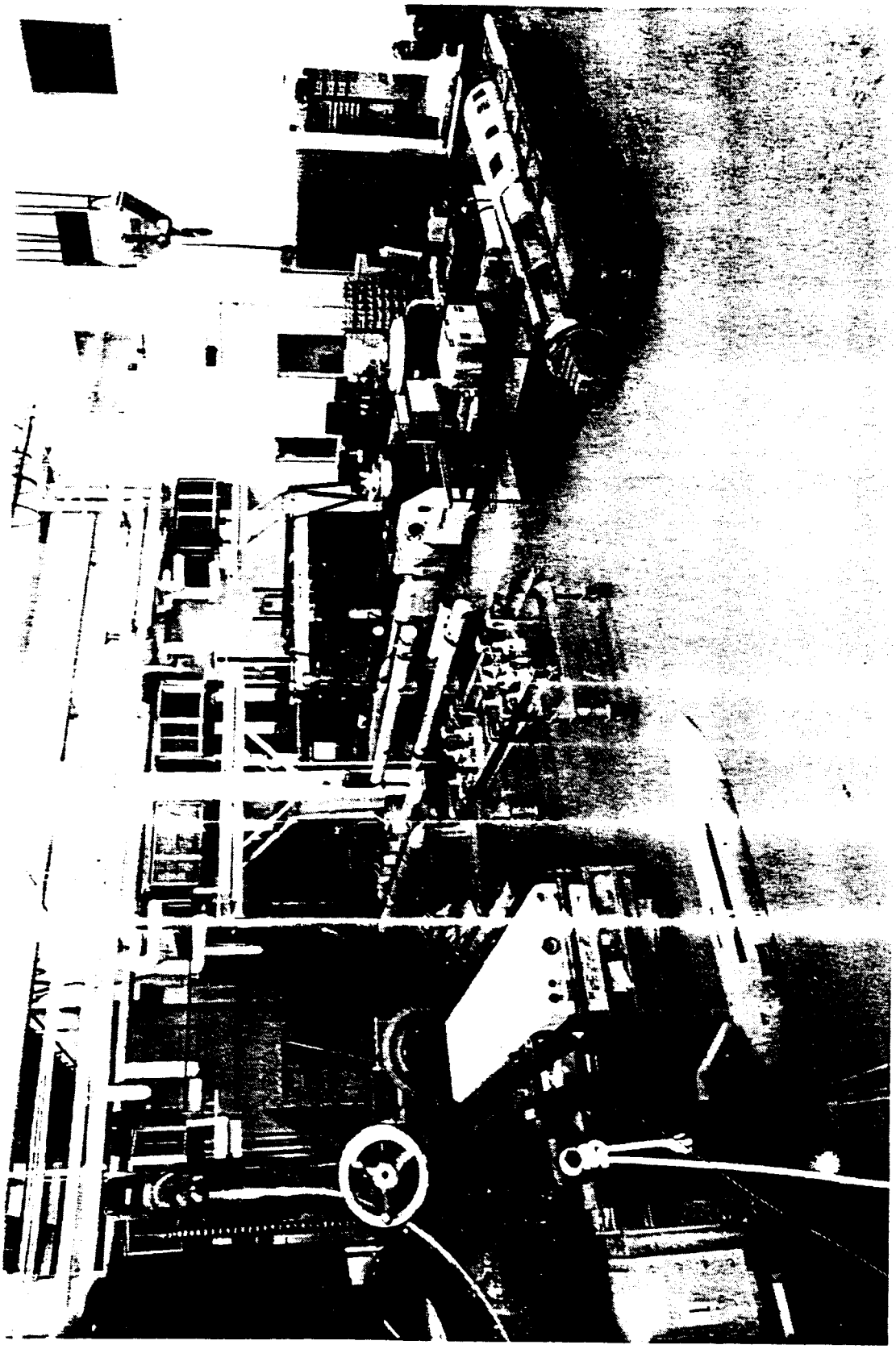
Environmental Test Complex

Elements
- Envir Test Lab
- Envir Test/Climatic Fac
- Envir Test Vibration Fac
- Electromagnetic Environment

Facility Description: The Environmental Test Complex consists of 36,000 square feet of indoor laboratory (Michelson Laboratory) for testing inert test items; four remote sites separated by the appropriate explosives quantity distances utilized for climatic and dynamic explosives testing with siting limits up to 30,000 pounds Class 1.1 and 100,000 pounds Class 1.3; a complex of three steel-shielded enclosures (two each 13- by 20- by 12-foot and one each 25- by 25- by 12-foot enclosures) NVLAP accredited for MIL-STD 461/462 testing; and a bounded wave pulse facility providing a peak field strength of 50,000 volts/meter over a test area of 125 cubic meters.

This equipment is unique because of the 2-inch stroke capability of two 36,000 force pound electrodynamic shakers and slip table to test 8,000 pound Class 1.1, 5,000 pound Class 1.2, or 100,000 pound Class 1.3 explosives.

Mission statement: To support NAWCWPNS and other military programs in all matters, including gathering environmental data; analyzing, interpreting, and reporting environmental data; developing environmental specifications and test methods; performing environmental tests; and evaluating test procedures, methods, and equipment.

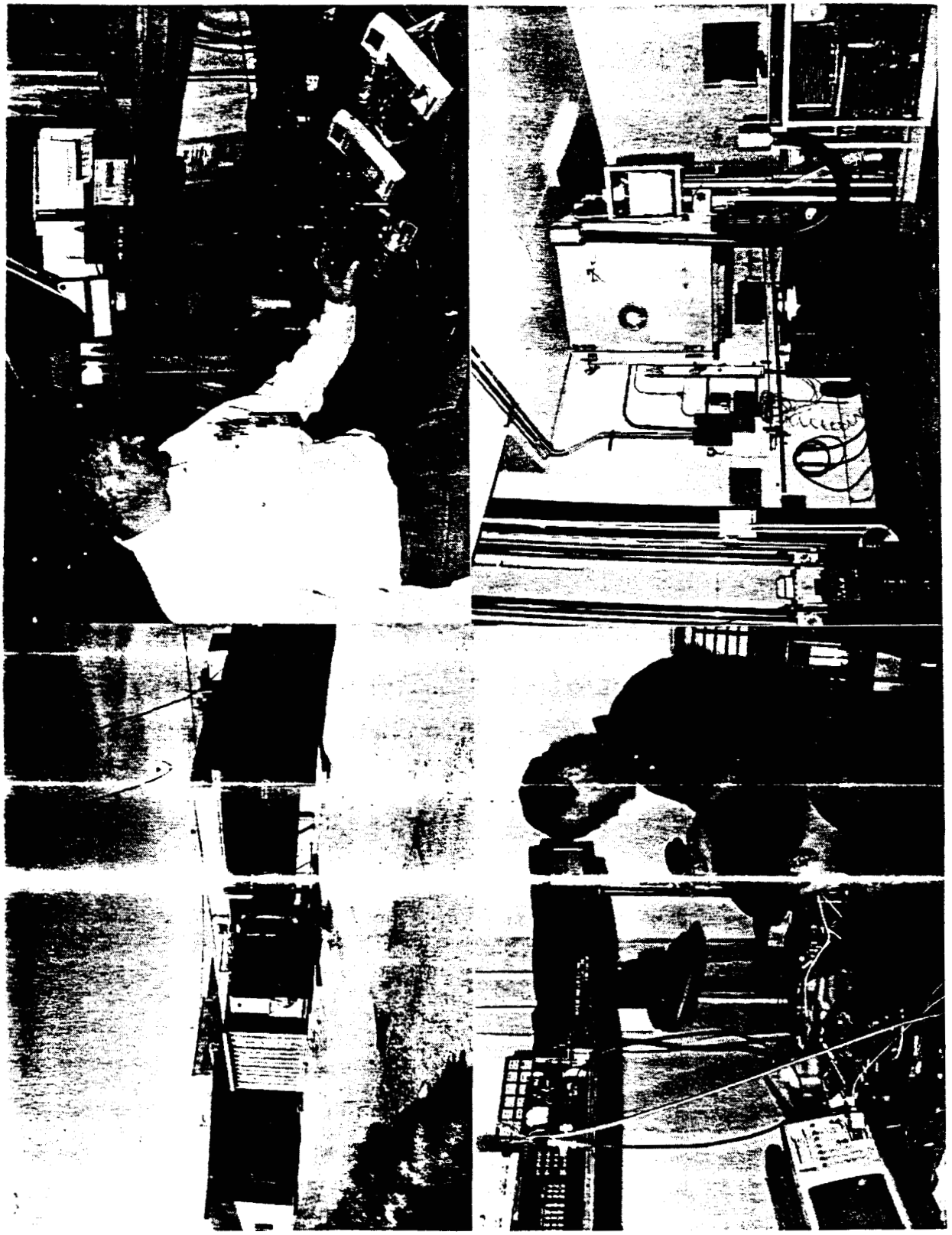


Environmental Test Complex

Fuze Development Lab

Facility Description: The C274 Fuze Development Laboratories are made up of six buildings, three specialty test docks, two storage areas, five explosive magazines, and four magazettes, all with limited access. Altogether the facilities provide approximately 11,500 square feet of office space and 13,800 square feet of laboratory and explosive operations space. The facility's primary mission is S&T and development engineering (DE) on safety and arming devices, contact fuzes, and explosive components used in missiles and free-fall weapons. The Fuze Development Lab's primary capabilities include the design, test, and evaluation of inert and explosively loaded arming and firing devices, safety and arming devices, and fuzes. Evaluations are performed on the devices in exploratory development, demonstration and validation, engineering, or production support phases. The facility, with the associated equipment, has the capability of subjecting test items to a range of electrical environmental stimuli, including acceleration, shock, vibration, temperature, and humidity. The facilities and equipment provide for design, design modeling, computer analysis, data analysis, environmental testing, explosive output, and performance testing.

This equipment is unique because the C274 Fuze Development/T&E laboratories can provide connections for a full range of safety and arming devices, contact fuzing devices, and explosive components T&E from S&T through integration and in-service testing. The colocated facilities are occupied by 80 ordnance engineers and technicians, which is unique within the U.S. The facilities are connected to the NAWC network via a T1 link, which permits communication with the remainder of NAWCWPNS and any site in the world with Internet access capability. This integrated evaluation facility is invaluable in the development and maintenance of the technical expertise of the personnel. The impact of losing this facility would involve degradation, over time, of the personnel technical skills and ultimately lower quality fuzing devices in the Fleet.



Fuze Development Laboratory

Guidance Components T&A Complex

Elements
- Actuator Test and Analysis
- Inertial Component Test and Analysis
- Thermal Battery Test and Analysis
- Electronics Assembly Test and Analysis
- Inertial Test Lab

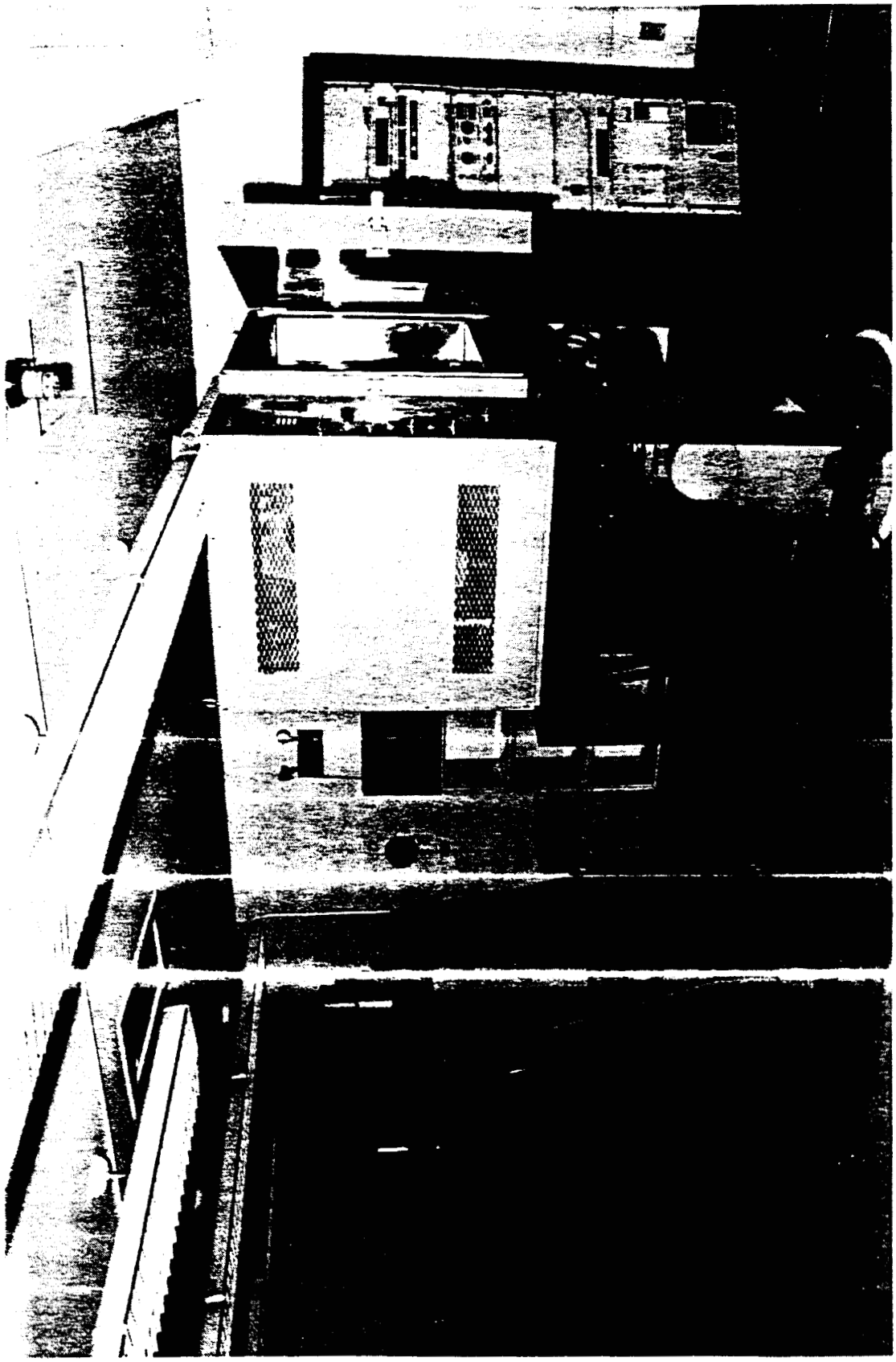
Facility Description: The Guidance Components Test and Analysis (T&A) Complex includes the Actuator, Inertial Component, Thermal Battery, and Electronics Assembly T&As, and the Inertial Test Laboratory.

Mission statement: To evaluate and characterize the design and performance of pneumatic, hydraulic, and electro-mechanical missile actuation systems. Performance evaluation of inertial components being considered for application to tactical missile guidance/seeker stabilization. Provide weapons integration support for inertial and GPS navigation systems in Navy air-launched weapons, and support of developmental engineering of new inertial and GPS sensors and to support integration of aircraft inertial and inertial/GPS navigation systems. Functional and safety testing of thermal batteries. Provide a quick-turnaround test capability for testing electronic components and subsystems.

Descriptions of Energetic Facilities:

Actuator T&A: Approximately 1,400 square feet of laboratory and test facility space equipped with multiaxis actuator test stands, power/pneumatic/hydraulic supplies, assembly/disassembly tools, and workspace dedicated to the T&E of missile control actuators and gas generators. This equipment is unique because the Actuator T&A facility is uniquely certified to conduct gas generator actuator tests.

Thermal Battery T&A: Approximately 600 square feet of laboratory and test space dedicated to the T&E of thermal batteries used in tactical missiles, bombs, and aircraft. Thermal batteries are classified as class C explosives. Battery technologies currently under T&E are primarily lithium chemistry, silver-zinc, and calcium chromate technologies. Precisely controlled loads and heating elements are also used to simulate worst-case environments for safety tests of batteries. The facility is dedicated to performance test and evaluation and disposal of thermal batteries, and includes a remote firing bay for safety and abuse testing of thermal batteries.



Guidance Components T&A Complex

High Hazard Propulsion Test Facility

Facility Description: Bay III consists of nine test pads for conducting high hazard of high-energy systems. Motors can be fired in a variety of attitudes. The CBAT chamber at MS-3 is currently supporting technology development for rocket motor disposal studies. The facility is permitted through the Mojave Air Quality Control District for air emissions. No permits are necessary for use of cooling or quench water.

TMDI pads 1 through 4: nozzle-up, 300,000-lb thrust, sited for 60,000-lb 1.1 and 1.3.

MS-0: horizontal, 50,000-lb thrust, sited for 60,000-lb 1.1 and 1.3.

MS-1: horizontal, 300,000-lb thrust, sited for 60,000-lb 1.1 and 1.3.

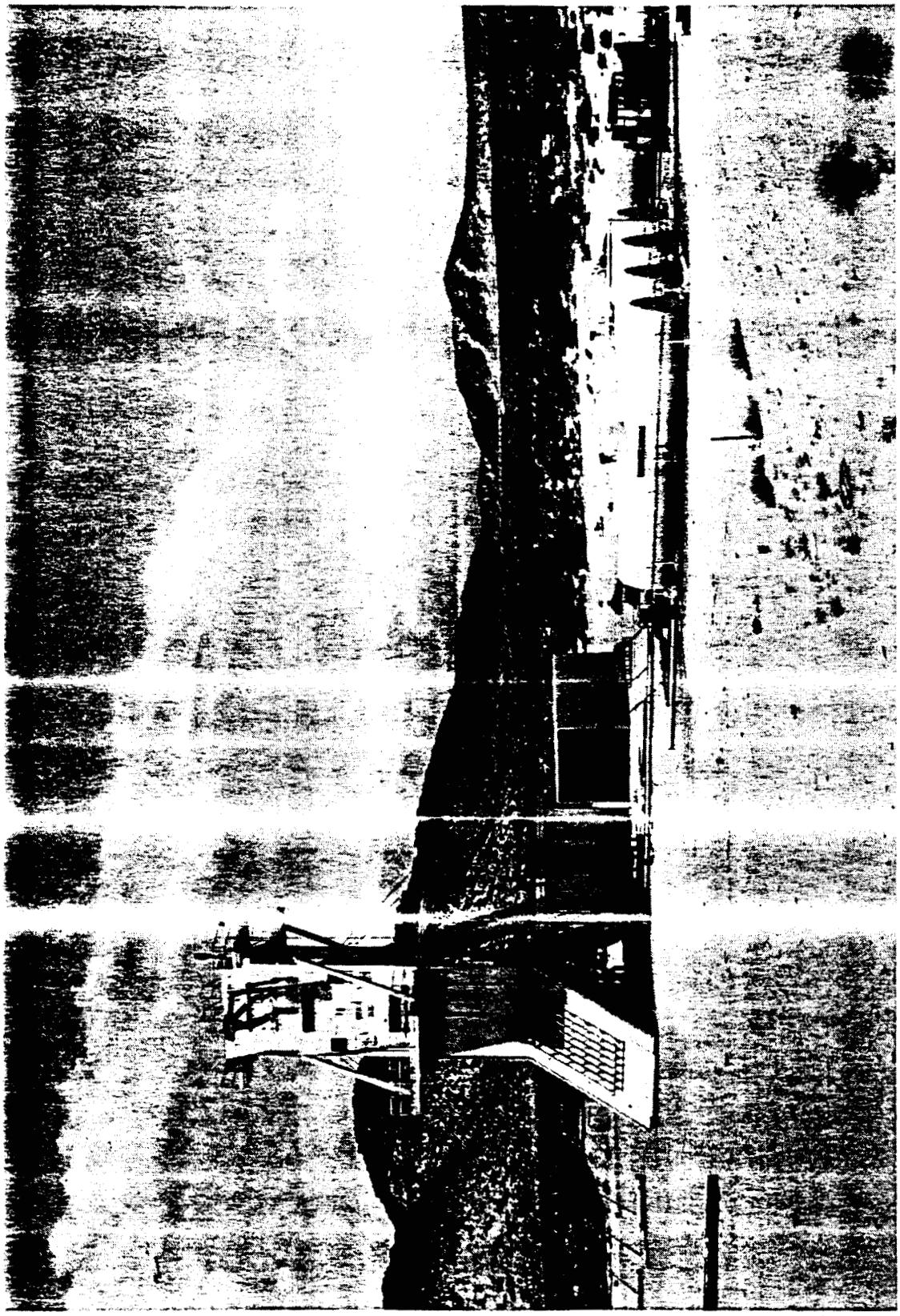
MS-2: Horizontal and 50-degree nozzle down, 300,000-lb thrust, sited for 60,000-lb 1.1 and 1.3.

MS-3: vertical, horizontal, confined burn chamber (SS and TS motors only), 300,000-lb thrust, sited for 60,000-lb 1.1 and 1.3.

MS-4: motor detonation site, sited for 130, 000-lb 1.1.

The facility numbers for this test area are 16132, 16144, 16147, 16147, 16148, 16152, 16153, 16154.

Although there is one other facility capable of conducting high-hazard motor testing, the Bay III facility is unique in its ability to fire motors at any attitude, the availability of any instrumentation requirement, the high flexibility to configuration requirements, and the explosive limits. The facility can be used for sympathetic detonations, static firings, thrust cut-off studies, command destruct, or partial burns for flight termination and internal ballistic studies.



High Hazard Propulsion Test Facility

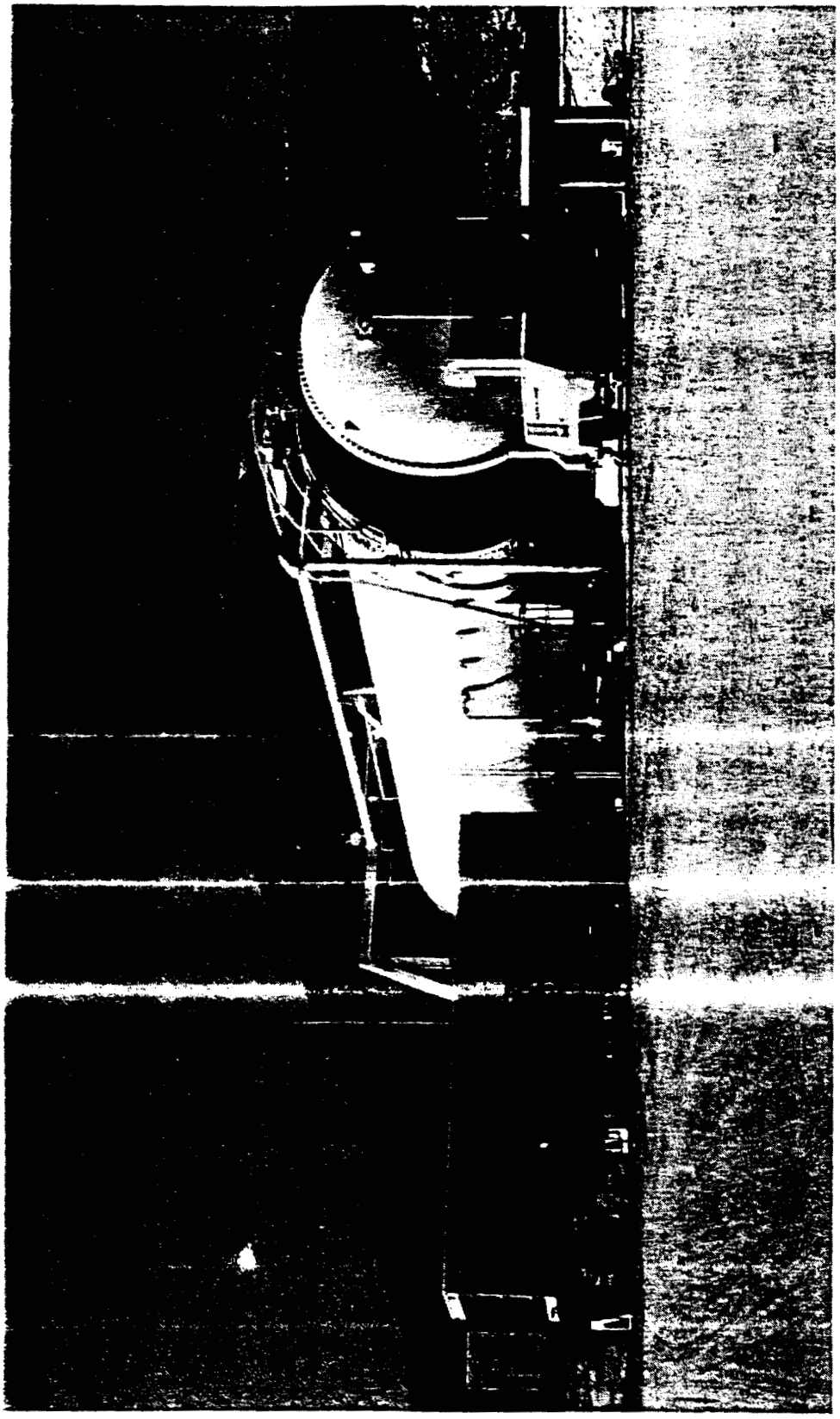
Large Rocket Motor Disposal Facility (Prototype)

Facility Description: The Trident II missile made some earlier Fleet ballistic missiles (FBMs) obsolete. The START treaty has made some FBMs excess. These obsolete or excess missiles must be disposed of in an environmentally acceptable process. The disposal of the large rocket motors is a significant problem because some of the motors contain approximately 100,000 pounds of hazard class 1.1 propellant. The most economical method of disposing of these motors is by low-pressure burn, capture of the exhaust products, and subsequent treatment. The technology has been demonstrated at China Lake in several facilities ranging from a small-scale S&T facility to T&E facilities capable of burning 40,000 pounds of propellant.

The prototype facility is located within the high hazard propulsion test area and consists of a large chamber Confined Burn Assessment Test (CBAT) chamber, and instrumentation trailers containing the sampling and gas analysis equipment. The prototype facility is provided with control functions, data acquisition, and utilities from existing propulsion test infrastructure. The prototype facility has fired full-scale second stage Poseidon; second and third stage Trident I motors in the CBAT chamber; and numerous open-air firings to characterize combustion products, burn times, pressure transients, thermal loads, mass flow conditions, and to identify any instability phenomena caused by firing motors in a nondesigned mode. Currently, the scrubber and gas treatment systems are being added to the CBAT chamber to complete the LRMDF prototype configuration. Firings will be continued through FY 95 to collect all the data necessary to design the full-scale disposal facility.

The full-scale Large Rocket Motor Disposal Facility will be capable of disposing of outdated or surplus ballistic missile motors (up to 100,000 pounds of propellant/motor) in an environmentally clean method. The LRMDF will dispose of two motors a day, 7 days a week, 45 weeks a year. China Lake is currently being considered as one of the candidate locations for siting the full-scale LRMDF. While the facility has not been finally designed, the projected cost is estimated to be approximately $80 to 120M and would add approximately 50 work years to the overall workload.

Mission statement: To conduct research on solid propellant disposal techniques on full-scale motors (up to 40,000 lb) to determine low-pressure combustion mechanisms, to analyze the combustion products, and to demonstrate that these products can be treated in an environmentally correct manner; to validate results obtained from the Sub-Scale S&T Facility used to burn small motors (<200 lb); and to provide the data necessary to design and operate a full-scale Large Rocket Motor Disposal Facility (LRMDF) capable of disposing of outdated or surplus ballistic missile motors in an environmentally clean method. The Joint Ordnance Commanders Group (JOCG) established a subgroup (Large Rocket Motor Disposal) to coordinate tri-service disposal of rocket motors, which sanctioned and funded, in part, this facility. The LRMDF (prototype) will be the only facility capable of controlled confined burns with subsequent scrubbing of rocket motor exhaust.

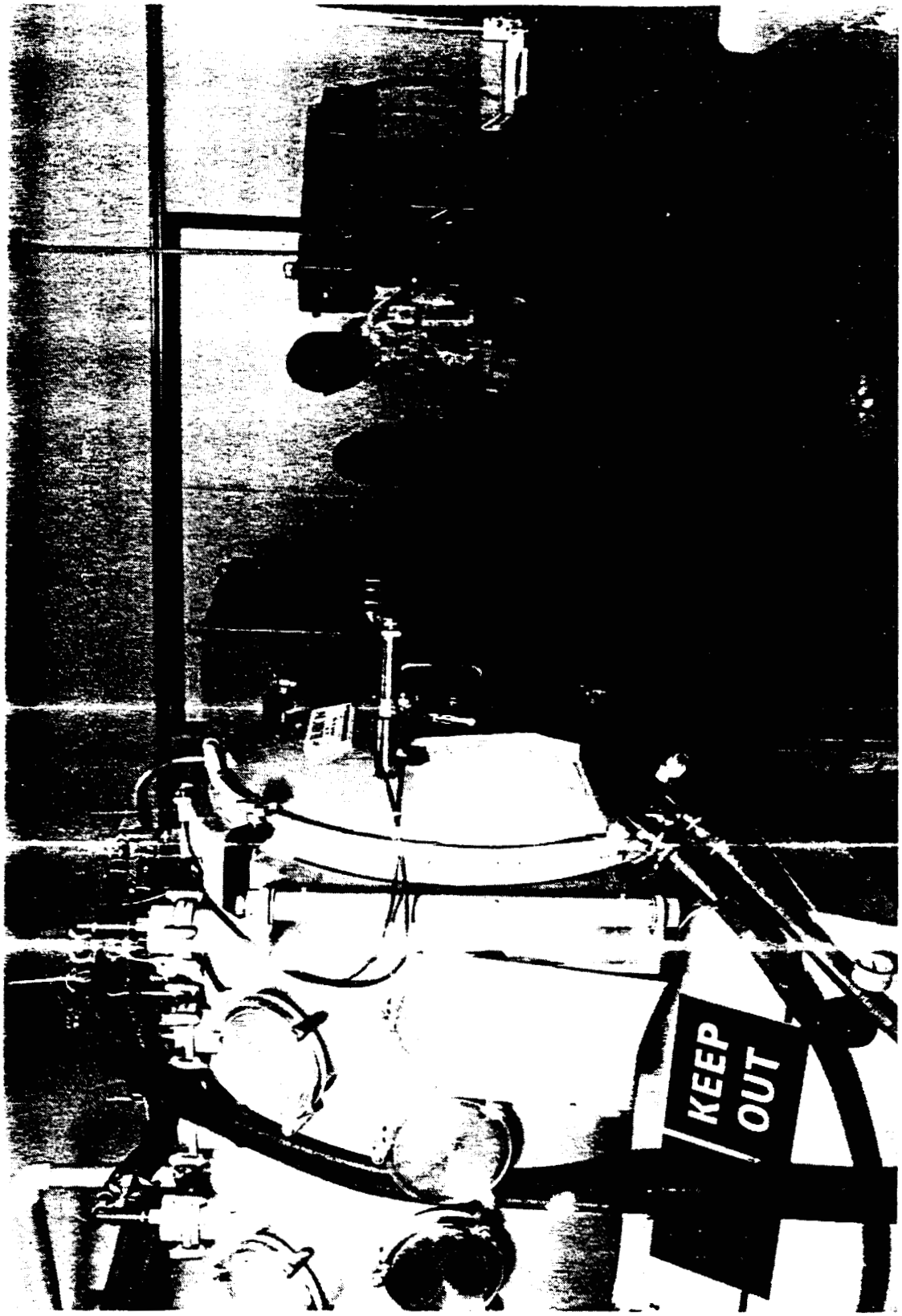


Large Rocket Motor Disposal Facility

Materials Engineering/Failure Analysis Facility

Facility Description: Laboratory equipment and facilities include capabilities for analysis and characterization of materials, specifically metal and metal alloys, polymer-based composites, and semiconductor materials. Facilities are tailored to accommodate component scale units for initial failure analysis assessment and extend into molecular and subgrain regions to determine root causes. Facilities determine bulk properties, molecular structure, and interfacial boundary layer composition. Resources characterize mechanical, electrical, electro-optical, and thermal properties or materials used in the fabrication of avionic and missile components.

Mission statement: To provide materials engineering technical support and consultation; conduct applied research to develop materials and processes for systems applications; and provide materials engineering support and failure analysis in the fields of corrosion control, ceramics, composite structures, metallurgy, polymers, nondestructive and destructive testing, and plastics applications.



Materials Engineering/Failure Analysis Laboratory

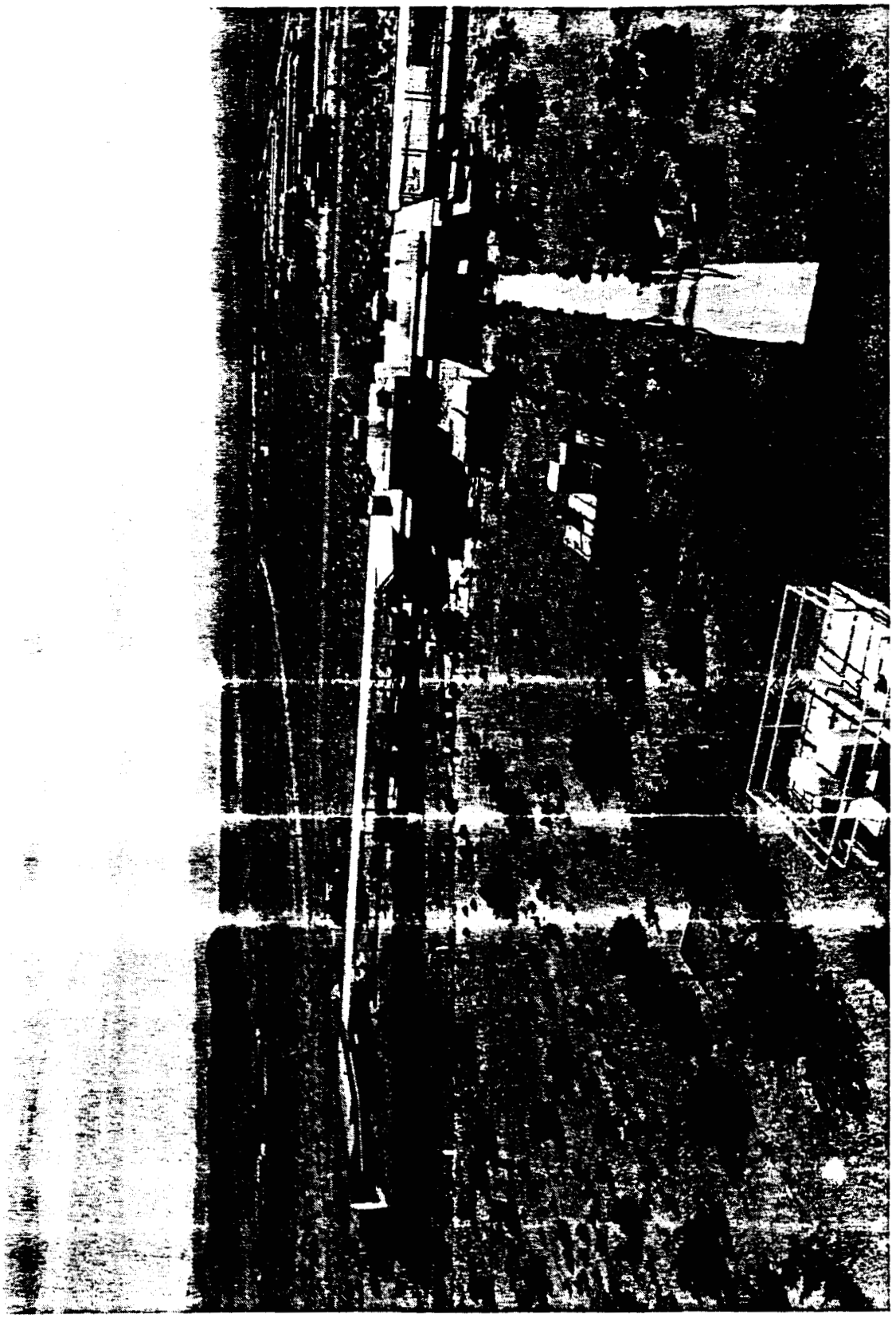
Medium-Caliber Gun and Ammo Ballistics Test Lab

Facility Description: The Ballistics Test Laboratory (BTL) has two 150-foot underground firing tunnels that can fire up to 20-mm caliber rounds in single-shot firings. The BTL also has a 230-foot medium caliber (up to 30-mm) outdoor firing range capable of high-rate automatic gun firing using all-up aircraft gun systems. All firing stations have a broad spectrum of instrumentation. The BTL has a full-range shop facility for maintenance of gun systems, including intermediate-level maintenance for selected systems. Capability exists for small rocket motor and combustion bomb tests.

The BTL is used to perform testing and evaluation of energetics materials, such as primers, gun propellants, and projectile high explosive and incendiary mixes.

This equipment is unique because of its facility to perform ammunition lot-acceptance testing for 25-mm ammunition purchased for the Navy.

Mission statement: To perform test and evaluation on aircraft gun systems and related ammunition for safety, performance, and reliability.



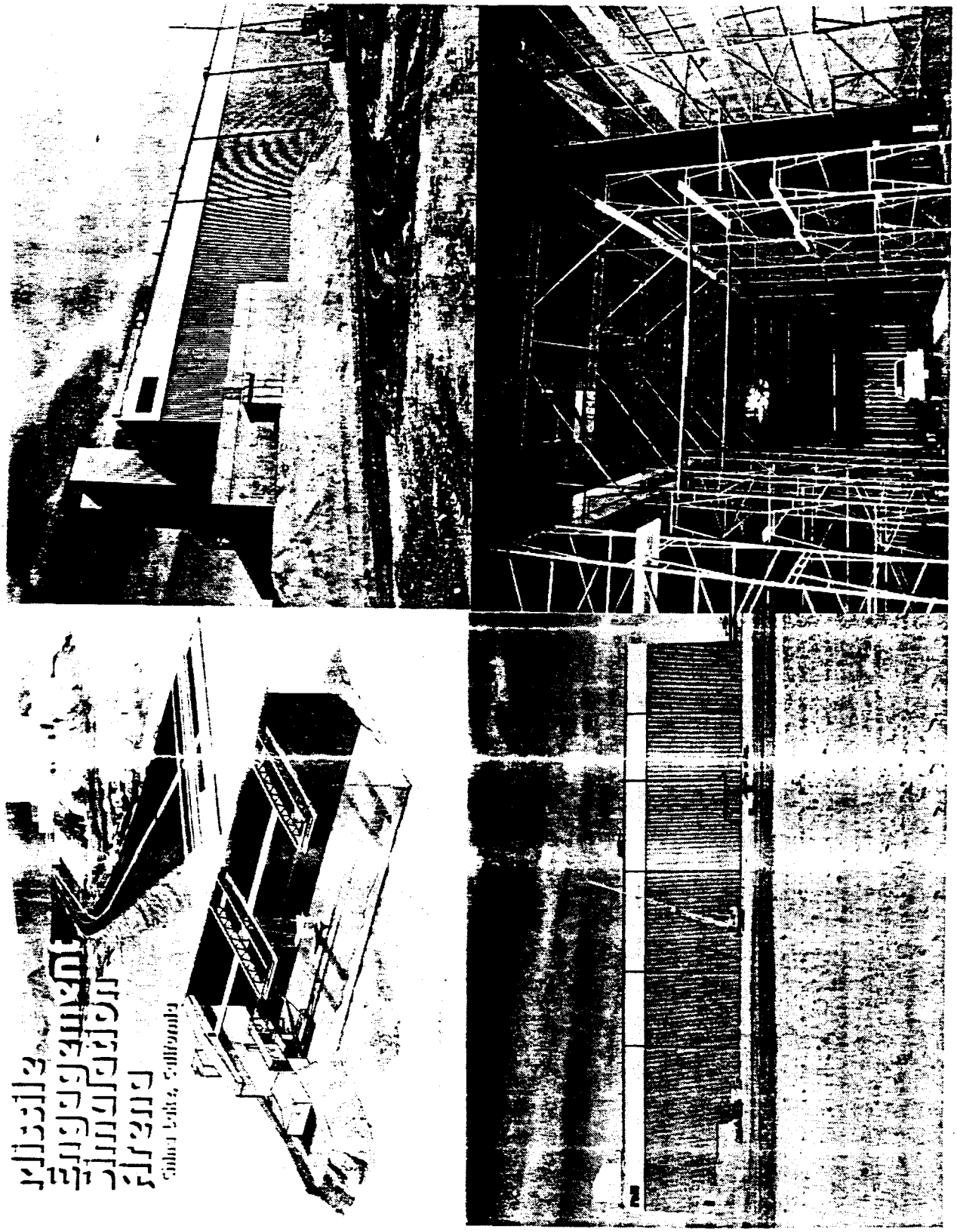
Medium Caliber Gun & Ammo Ballistics Test Lab

Missile Engagement Simulation Arena (MESA)

Facility Description: The MESA, currently under construction, will be a unique test facility used for RDT&E of target detection devices (TDDs). The MESA facility will replace the Encounter Simulation Laboratory (ESL), Norco, California, in February 1995. The performance of tactical missile TDDs will be evaluated against threat systems in this facility. The facility is used to gather TDD target signature and perform post-processing of the signature to determine the warhead burst point. The results of the testing are used to assess the effectiveness of the missile and investigate upgrades to enhance the performance of the tactical systems. Additionally, the facility will be used to gather data for missile and aircraft survivability analysis.

This equipment is unique because the MESA facility will be used for RDT&E of TDDs. The performance of tactical missile TDDs is evaluated against threat systems. The results of the testing are used to assess the effectiveness of the missile and investigate upgrades to enhance the performance of the tactical systems. Additionally, the facility will be used to gather data for missile and aircraft survivability analysis.

Although energetics other than thermal batteries are not used in this facility, it has been included in this section because the performance characteristics of the TDD are critical to the design of an ordnance system and particularly the warhead. By knowing how and when the TDD will sense the target, a particular warhead design can be adjusted to improve its kill capability. This is particularly true when an aimable or directed ordnance concept is being used.

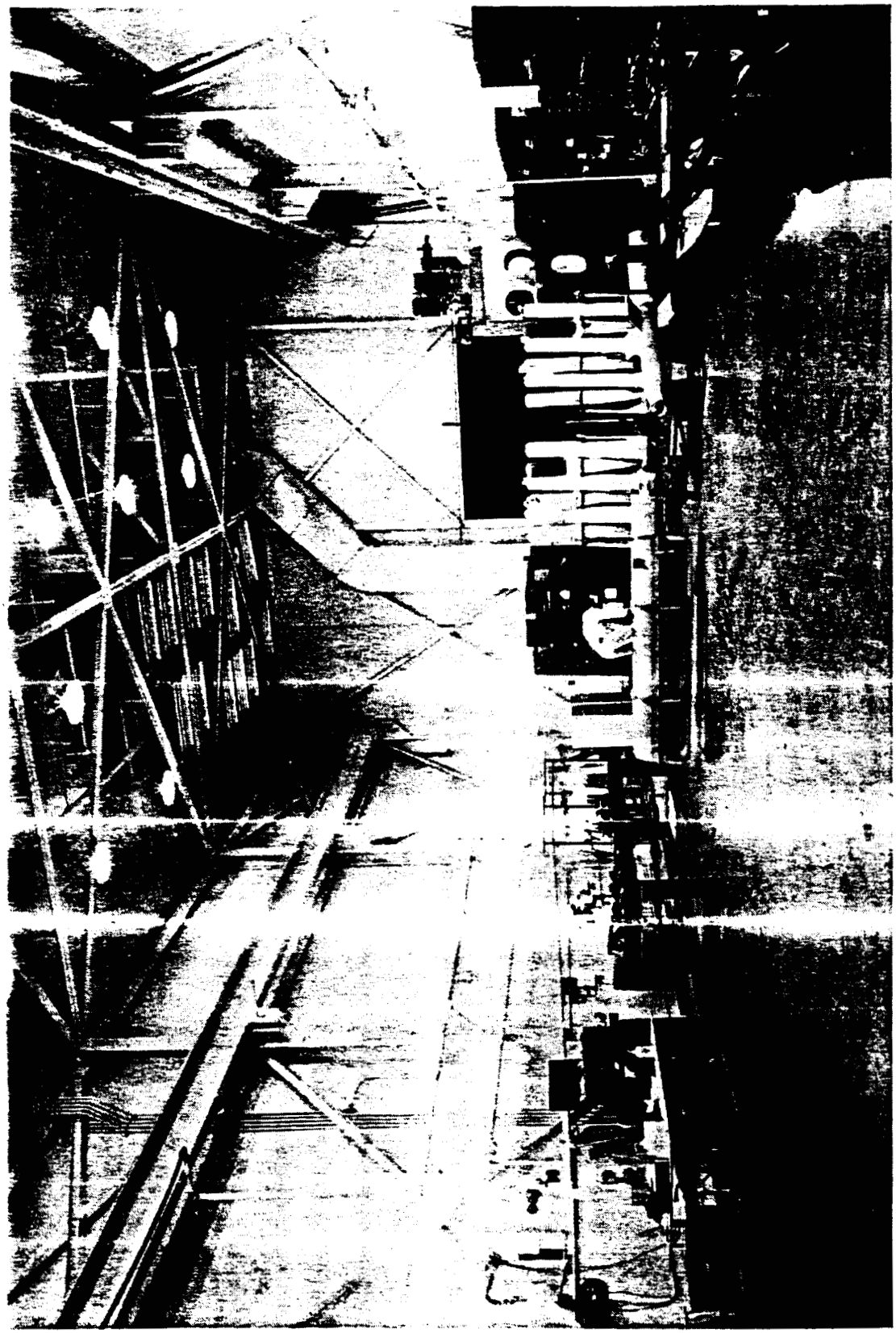


Missile Engagement Simulation Arena

Missile/Rocket Motor Assembly Facility

Facility Description: Missile/Rocket Motor Assembly Facility consists of a group of buildings in the CLPL area of NAWCWPNS with the capacity to handle full assembly and disassembly, inspection, mass properties measurement, and integration, checkout and fitment testing of missiles and their components, including rocket motors, warheads, igniters, and safing/arming devices. Missiles and components are also instrumented for flight testing, static firing, safety, hazard, and environmental testing. The facilities are unique in that their proximity to the test ranges and their ability to accommodate live ordnance permit pretest checkout and modifications for R&D tests to be turned around in a very quick, economical manner.

This equipment is unique because it is the only facility capable of handling all-up-round integration and integration testing of JSOW.



Missile / Rocket Motor Assembly Facility

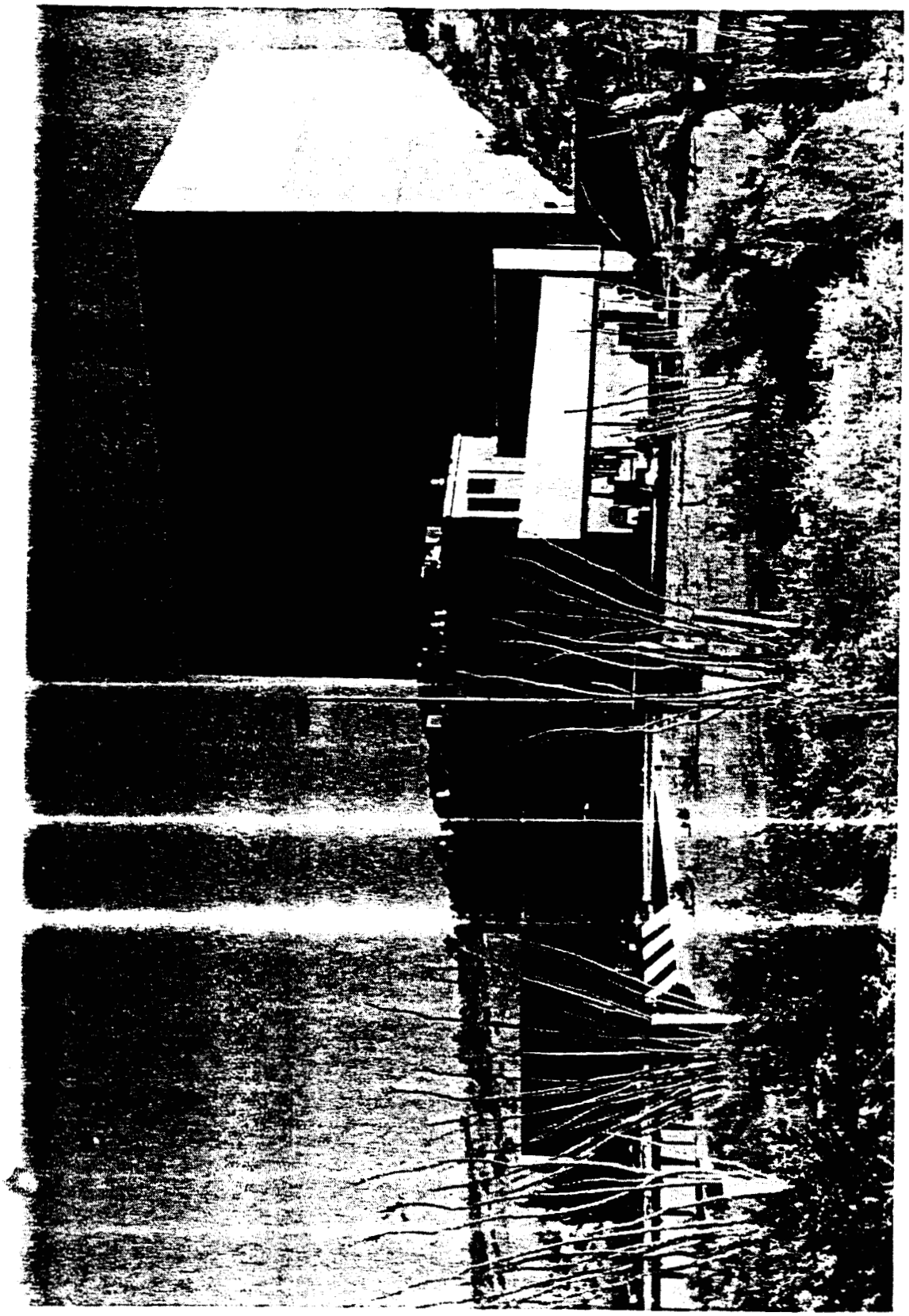
Non-Destructive Ordnance Test Facility

Facility Description: Building 15988 contains a large high-energy computed tomography (CT) inspection system. This system can inspect items up to 86 inches in diameter and 24 feet long. The system consists of an L-6000 high-rad output linear accelerator that provides a 13,500 rad, 16 Mev energy source, detectors, and an elevator system in a 3-foot-deep pit capable of supporting rocket motors weighing up to 130,000 pounds. In addition to providing two-dimensional digital video data, the facility is capable of producing conventional film X-rays. Although this facility was constructed to support mainly the Trident program, it has also conducted CT inspections of systems such as the SICBM and Minuteman motors, and is currently supporting the Army STARS Polaris program.

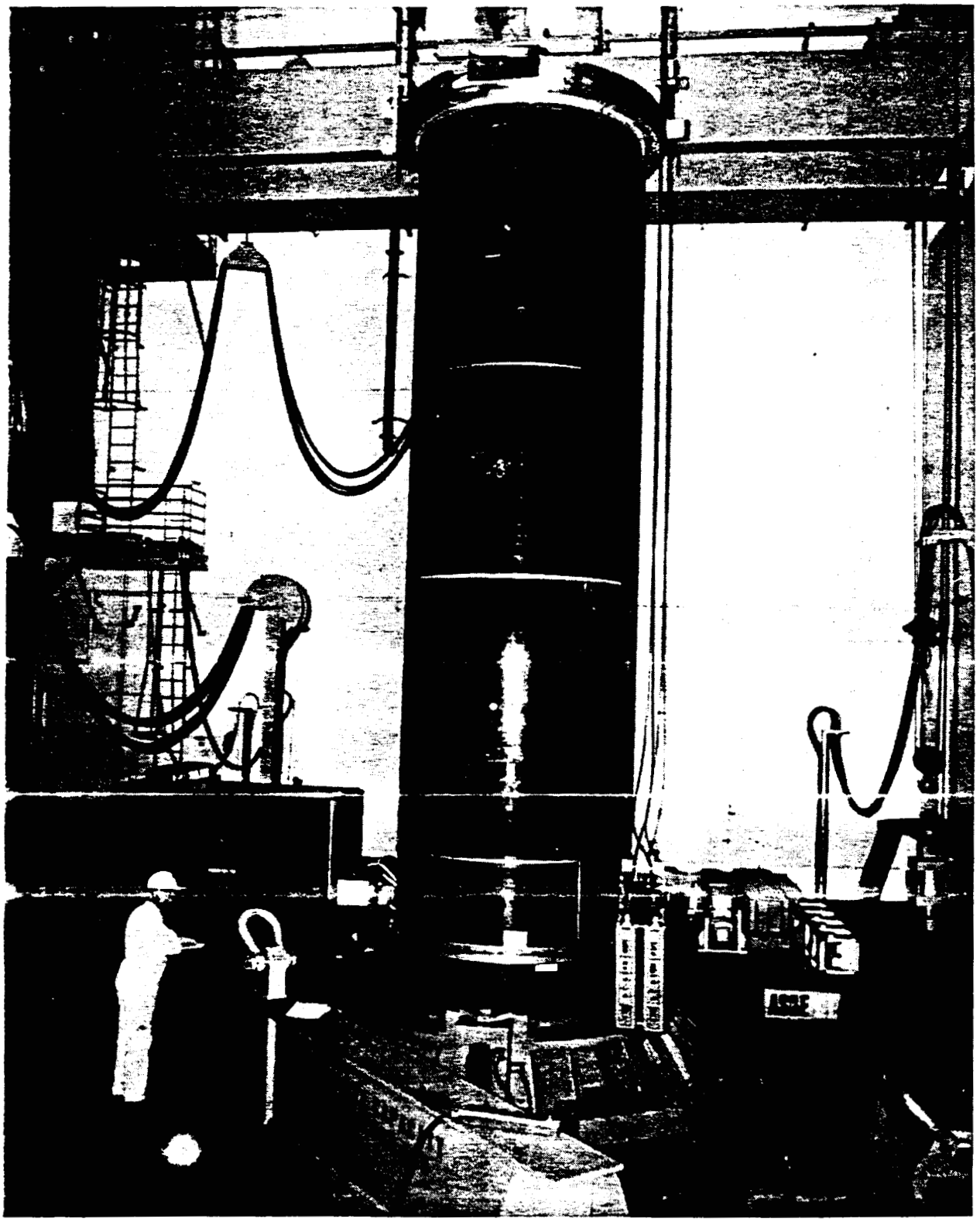
Buildings 15790 and 15800 are standard film X-ray facilities equipped with various X-ray machines and associated film processing and support capabilities. The facilities can handle a wide range of items from small ordnance items and components to first-stage Polaris motors. Other non-destructive test capabilities exist at these facilities, such as helium leak testing or boroscopic inspections.

Facilities are sited as follows:
Bldg 15988: 225,000 lbs 1.1, 5,000 1.2, 300,000 1.3, 225, 1.4;
Bldg 15790: 50,000 1.1, 5,000 1.2, 60,000 1.3;
Bldg 15800: 50,000 1.1, 60,000 1.3.

Other facilities that support these operations are 15794, 15804, and 15987.



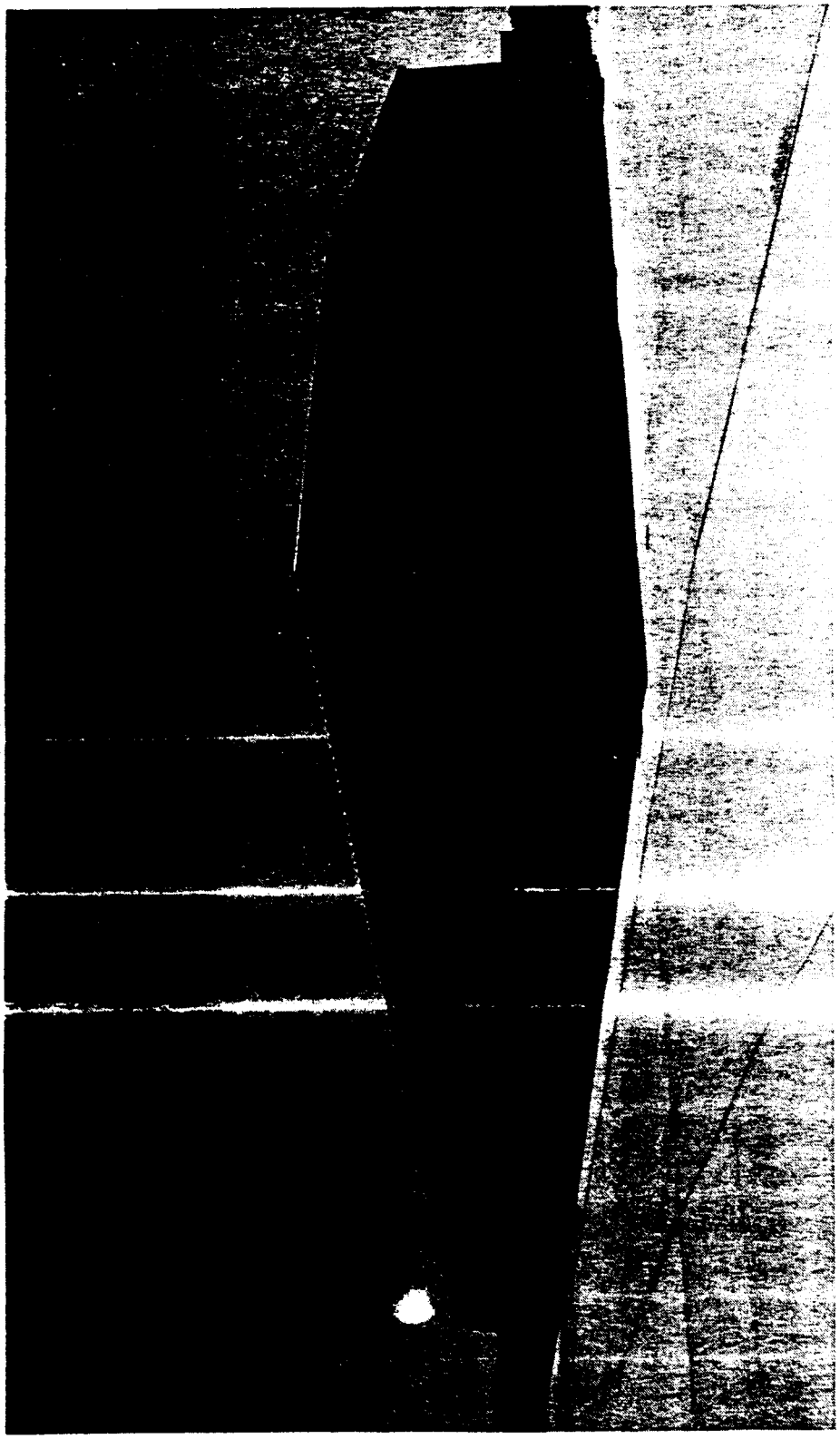
Non-Destructive Ordnance Test Facility



Non-Destructive Ordnance Test Facility—High Energy Computer Automated Tomography

Ordnance Assembly Facility

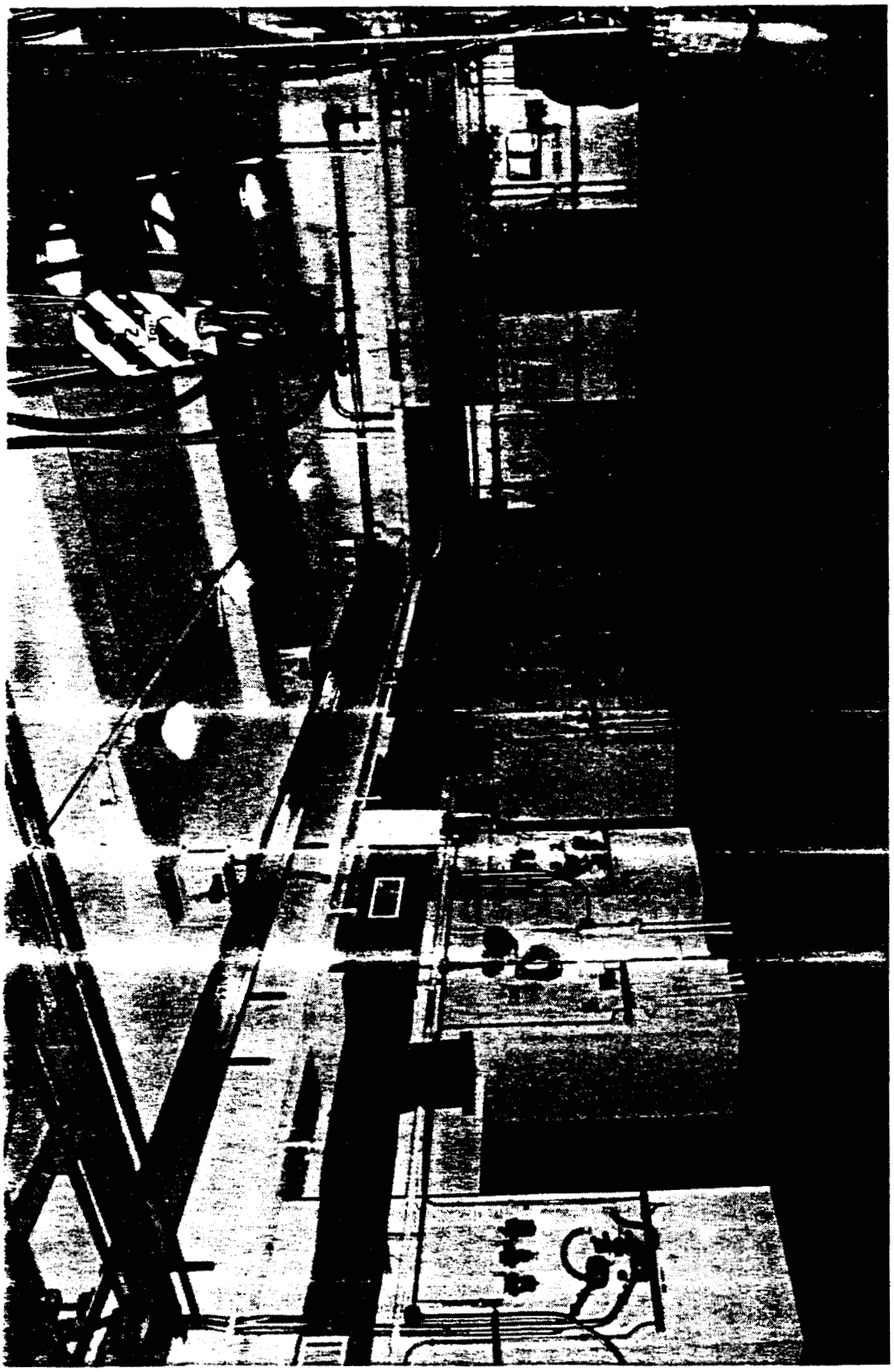
Facility Description: This facility supports the flight tests of weapons, guns, and other ordnance items by assembling the item and performing preflight checkout. From this facility the item is loaded on the aircraft for flight test. This facility has the capability to conduct weapons continuity and electrical test of weapons. This facility can support pre-flight operational checkout of weapon systems.



Ordnance Assembly Facility

Ordnance Breakdown Facility

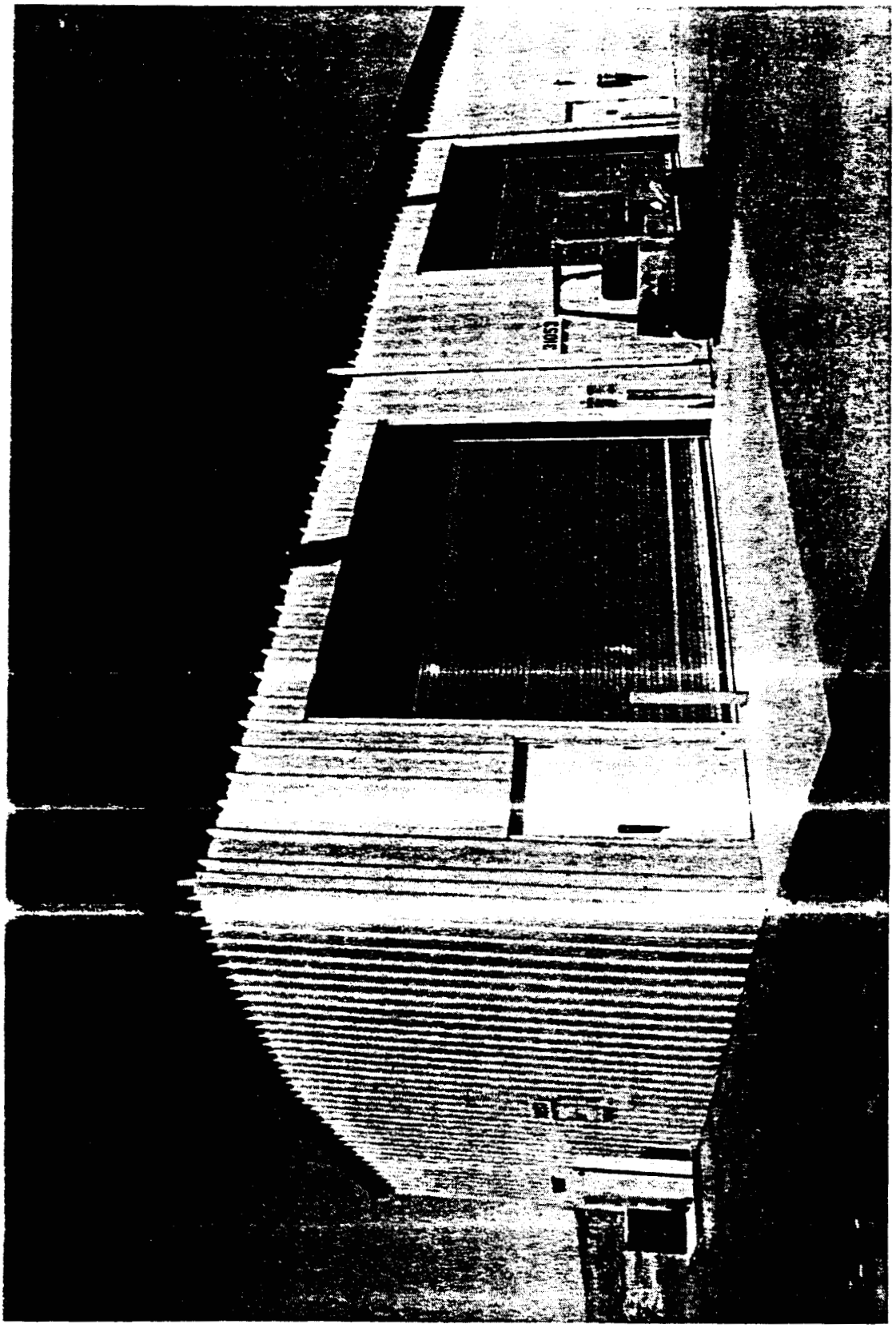
Facility Description: This facility performs breakdown of ordnance items and components for failure analysis and foreign military exploitation. The facility also includes an RCRA-authorized State of California permitted open burn/open detonation disposal area for disposing of scrap propellant, explosive, excess weapons, excess ordnance components, and other energetic materials. This facility supports weapons pre-flight/pre-condition inspection and electrical and continuity checkout.



Ordnance Breakdown Facility

Ordnance Packaging Facility

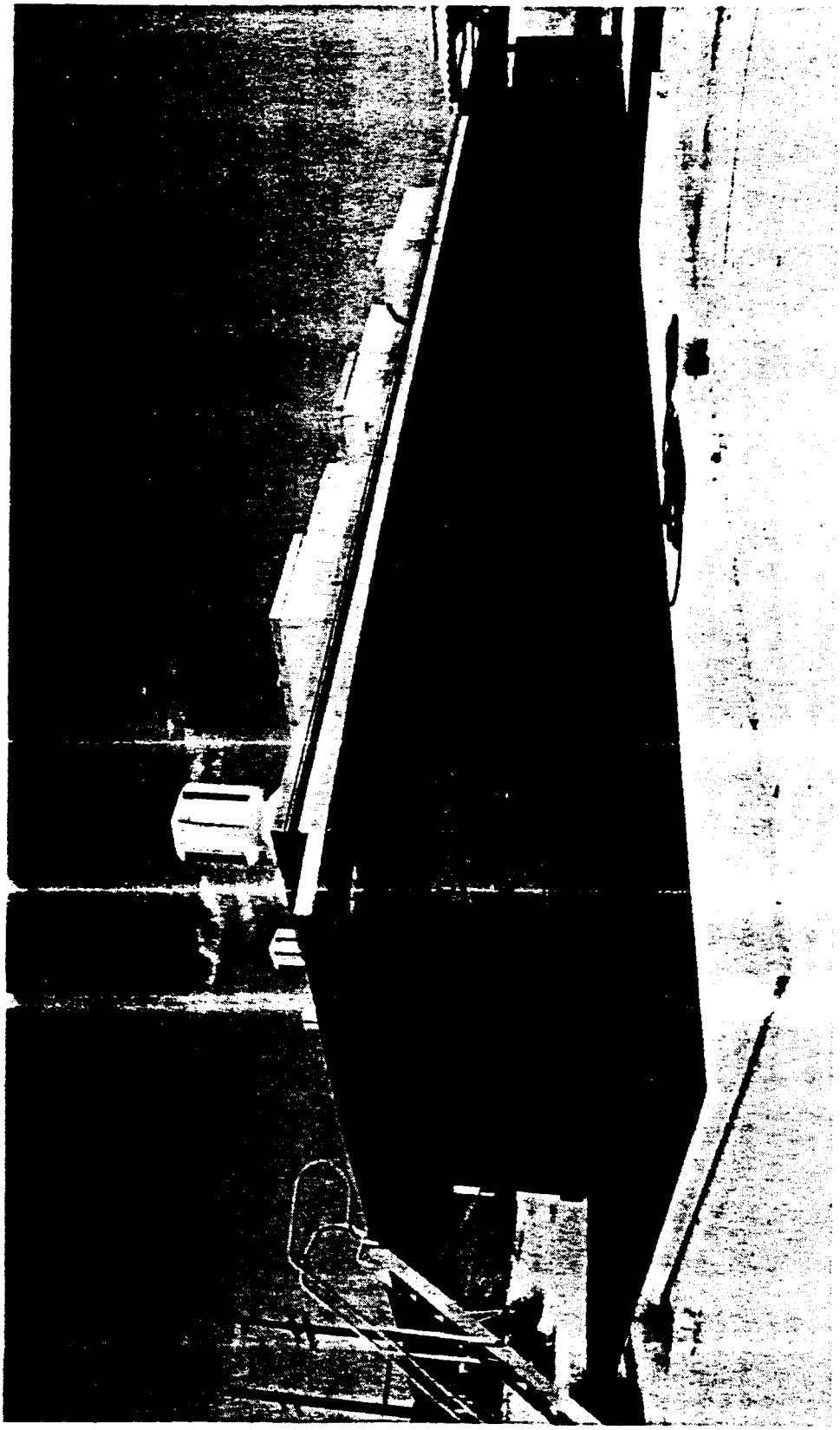
Facility Description: This facility has the shipping and receiving, packaging, and document preparation responsibility for all ordnance items and energetic material arriving at or leaving the Station.



Ordnance Packaging Facility

Ordnance and Propulsion Foreign Materials Exploitation Lab

Facility Description: This facility consists of a group of buildings in the CLPL area of NAWCWPNS that has the capacity to test and evaluate foreign materiel solid and airbreathing motors, warheads, ignition systems, electronics, and thrust vector control systems. The facility provides the requisite safety (isolation, certification, process control) and security (isolation, perimeter fence, process control) for the exploitation of hardware up to the Secret level, including both Class 1.1 and 1.3 explosives. The facility meets ordnance operation facility requirements including deluge systems, static grounding systems, explosive-proof electrical systems, and blow-out panels. Building construction permits simultaneous operations in adjacent test cells. Doors have safety interlock systems. Special security devices are required for some projects.

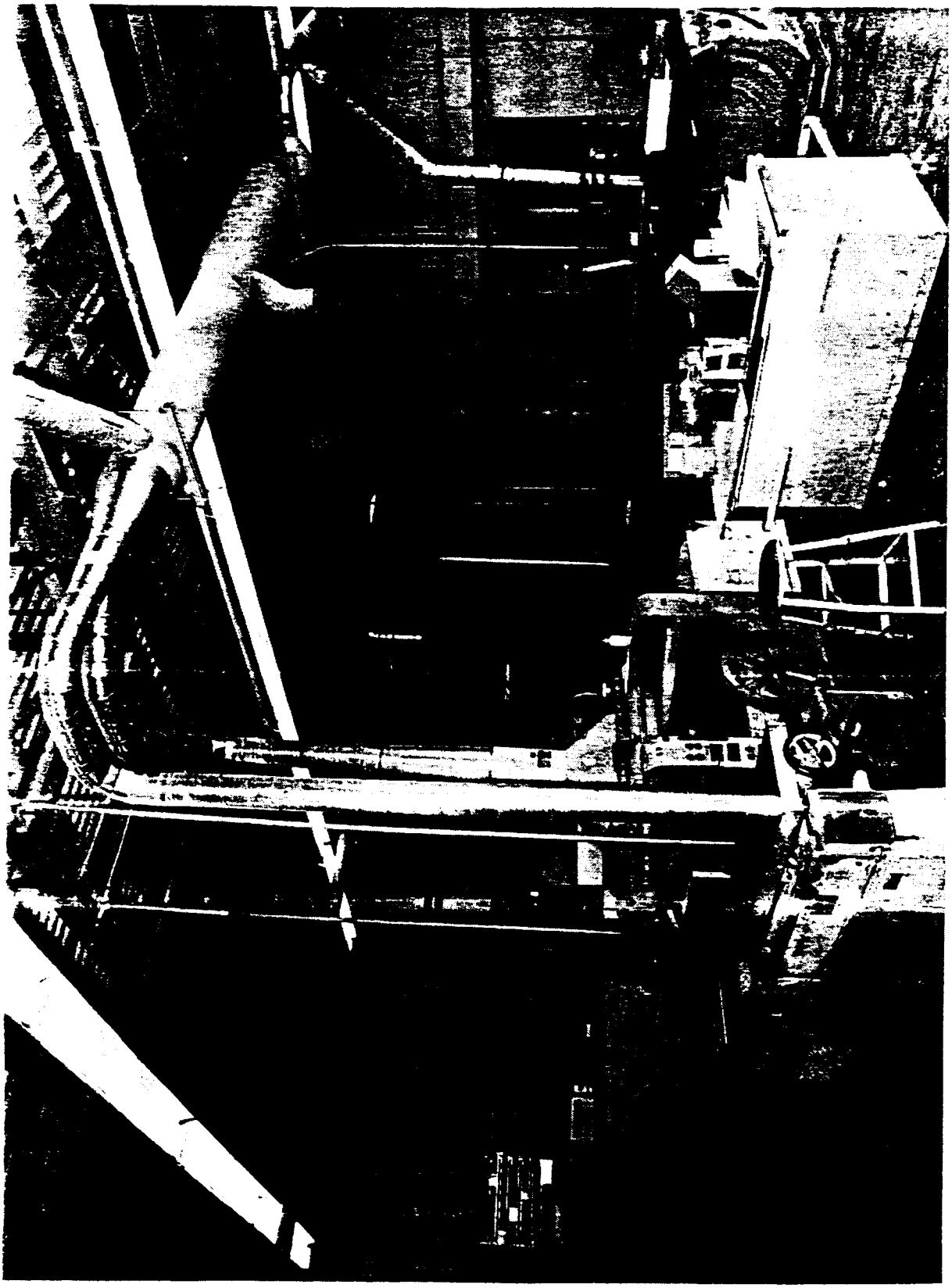


Ordnance & Propulsion FME Lab

Ordnance and Propulsion Plant Support Shops

Facility Description: This facility contains maintenance shops providing a home base and work space for a full spectrum of industrial maintenance craftsmen. Shops contain tools, machinery, and parts storage to support craftsmen activities. The facility includes mobile equipment for excavation and lifting and transport of machinery, materials, and equipment.

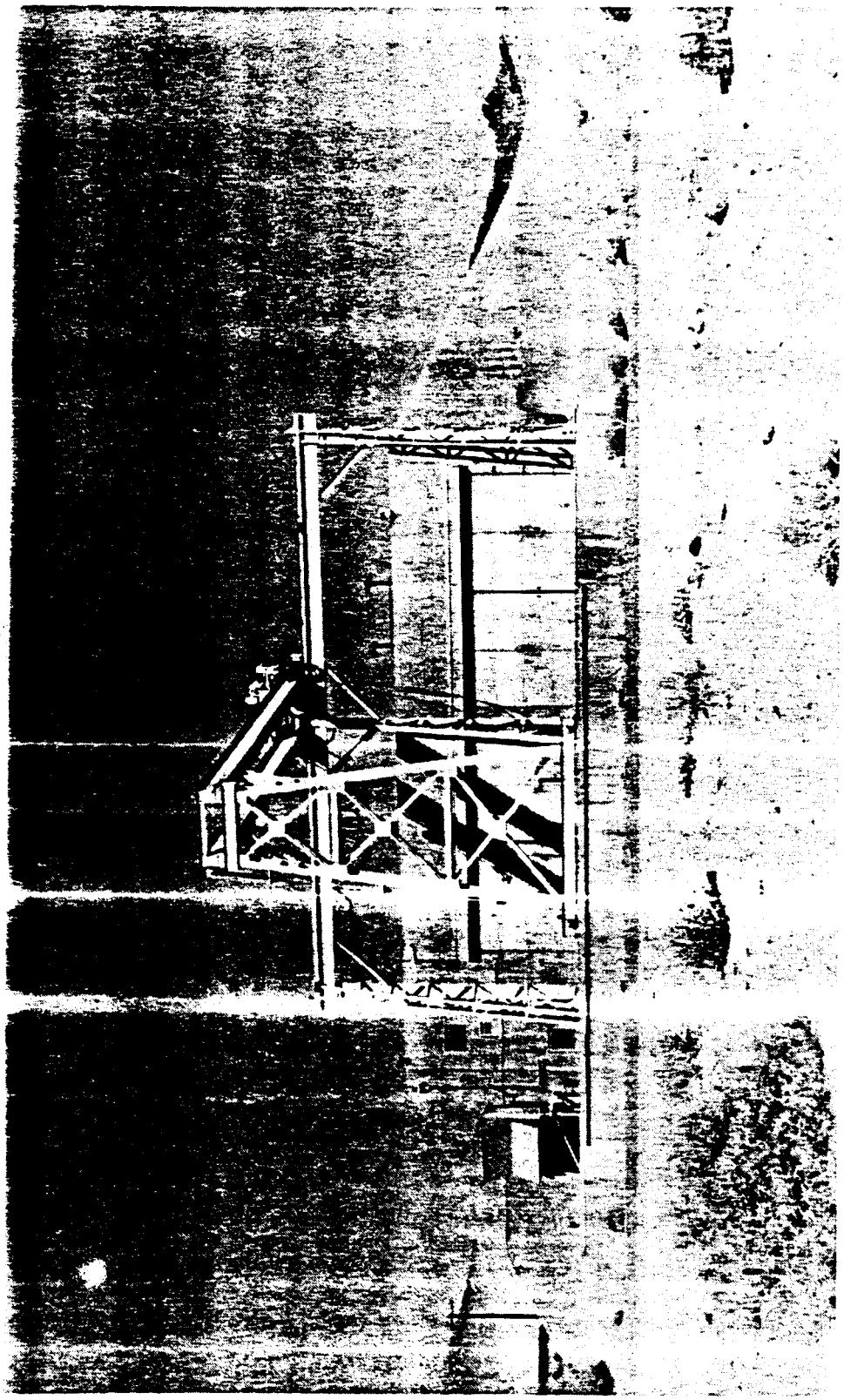
Mission statement: To maintain and develop energetic materials, ordnance, and propulsion operating buildings and processing systems for research, development, testing, and evaluation of ordnance devices, propellants, and explosives. Conduct liaison activities with the Public Works Department on behalf of Code C27. Provide environmental controls for personnel and for hazardous operations by design, installation, and maintenance of environmental control systems.



Ordnance and Propulsion Plant Support Shops

Ordnance Stowage Facilities

Facility Description: These facilities are earth-covered ammunition storage sites and ready service magazines that meet DOD explosive safety requirements. These facilities are capable of providing secure ammunition and energetic storage space. The materials stored in these facilities are in direct support of the mission for RDT&E endeavors.



Ordnance Stowage Facilities

Ordnance Test Complex

Facility Description: The Ordnance Test Complex consists of five major geographic test areas consisting of 22 separate test sites or bays to perform a full spectrum of ordnance activation tests, including fast and slow cookoff, bullet impact, fragment impact, drop, sympathetic detonation, liquid fuel and fuel-air explosive mixtures, and large-scale arena detonations. There are 33 structures, including six control rooms supporting these test areas and with associated assembly and storage buildings. The facilities are geographically separated (22 miles maximum road distance), and all have expansion capabilities for future growth if necessary. Area R has the smallest ordnance siting of 200 pounds explosive, Classes 1.1 through 1.3 inclusive. Burro Canyon can test to 14,000 pounds of Classes 1.1 and 1.2 and 200,000 pounds of Class 1.3. The CT sites are capable of testing up to 3,000 pounds of all classes. All sites have sensors for test support (pressure, temperature, velocity, etc.) and photo coverage. High-speed photography up to 10,000,000 frames per second is available at Area R.

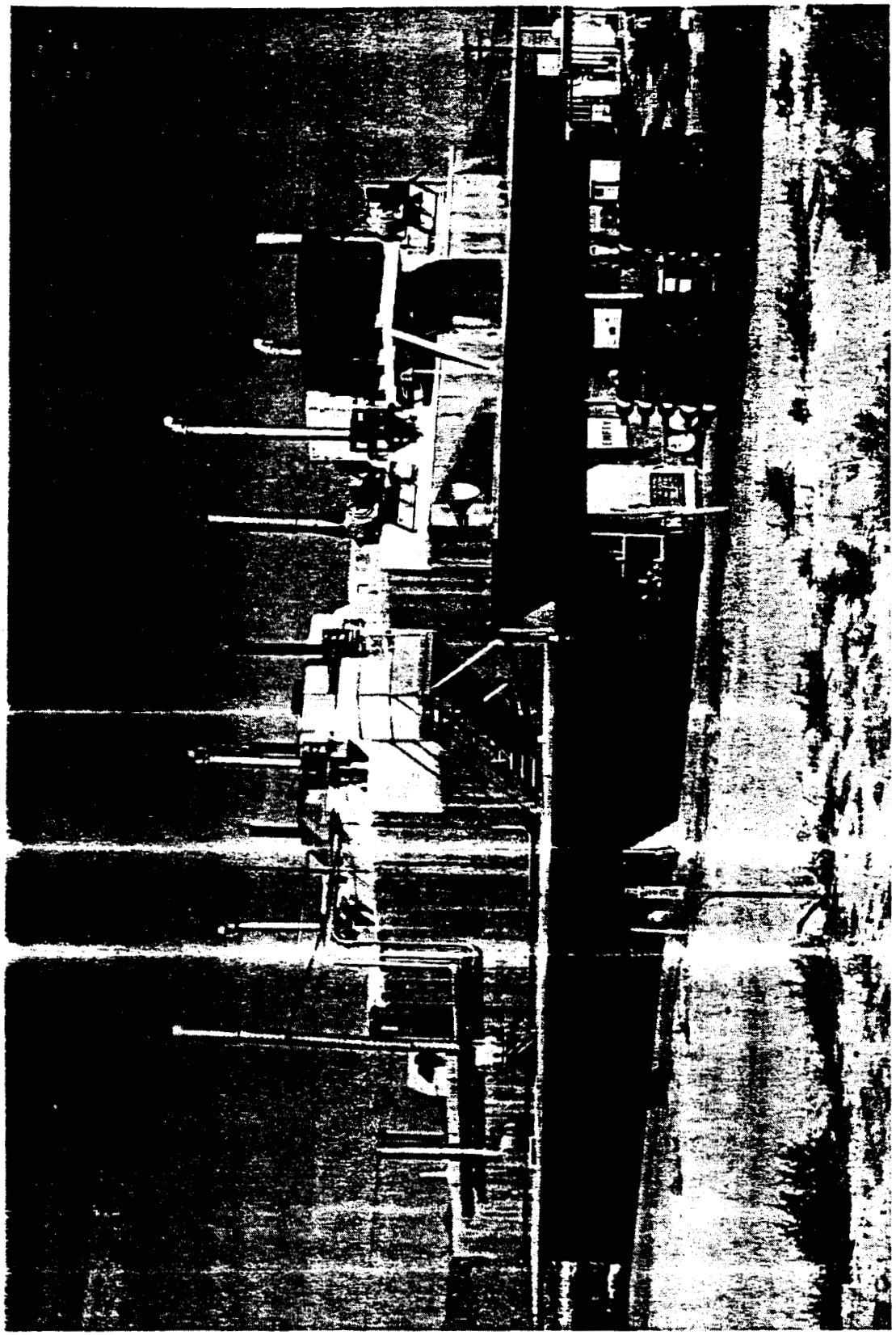
This equipment is unique because, with the test arenas at Burro Canyon fully operational, there are no other government facilities specifically sited for this type of large static firing arena test capability. There are other activation sites, sited at lower explosive limits at other government agencies; however, encroachment is rapidly taking them over. Burro Canyon and the CT test sites are still capable of expansion for test growth if required.

Ordnance Test Complex

Propellants and Explosive Formulation Labs

Facility Description: The facility is devoted to propellant and explosives formulation (weighing, mixing, casting, curing) and ingredient preparation; and consists of three major laboratory buildings (13100, 10560, 15510), a fuels laboratory (13470), and a general chemistry laboratory (13060). The facility includes associated chemical storage buildings, magazines, shop, office building totaling some 60 structures spread over about 8 square miles. Six 1-pint, one 1-gallon, one 50-gram (1/10 pint), and one 1/4-pint Baker Perkins propellant/explosives mixers in eight mix bays, two explosives presses, three slurry kettles, a horizontal mixer/extruder, and other equipment are housed and operated in the three major laboratory buildings.

Mission statement: To develop technology in new areas of propellant formulation and explosive formulation and assist in the application of these new propellants and explosives to current and future Navy tactical weapons, and to develop technology in new areas of high-temperature ordnance materials.

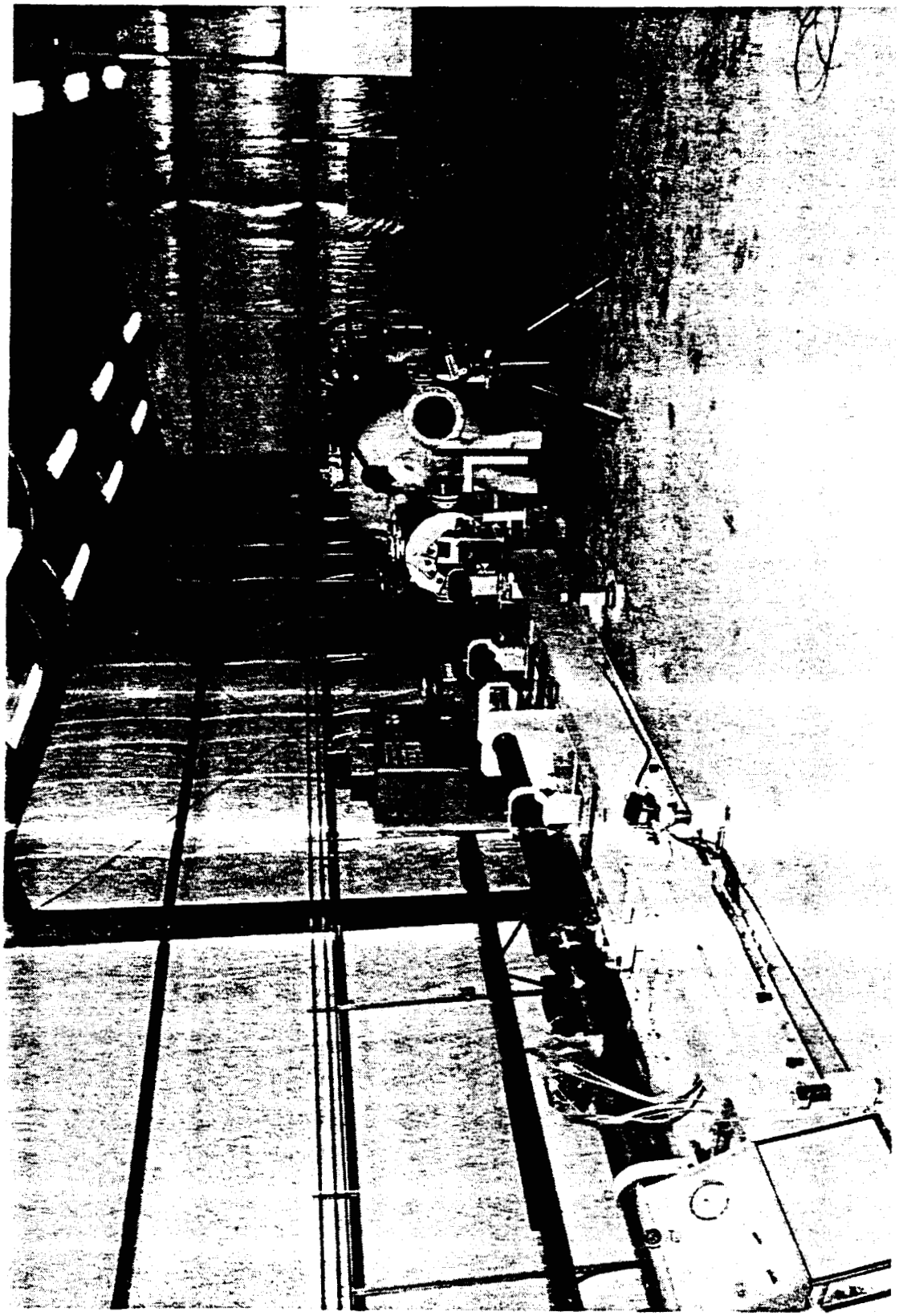


Propellants and Explosive Formulation Labs

Propulsion and Energy Conversion Research Facility

Facility Description: This facility consists of seven major individual laboratory sites: (1) Energetic Material Synthesis; (2) Energetic Materials Formulation R&D Facility; (3) Small-Scale Test Facilities; (4) Detonation Sciences Research Laboratories; (5) Fire Research Test Facility; (6) Propulsion Research Laboratory; and (7) Combustion Diagnostics and Plume Signature Laboratory. In this agglomerate of unique facilities, you can take a new energetic molecule from first conception and formulate and evaluate its performance and hazards for utilization in an all-up weapon. For example, CL-20 was recently evaluated in this fashion in a period of 3 to 5 years.

This equipment is unique because it is the only experimental combustion instability facility; the only airbreathing facility with integral diagnostic tools; the only shock diagnostic and detonation physics facility that can study up to 2 pounds of energetic material; and the only turn-to-violent reaction facility that can conduct full motor testing. This is the only facility capable of scaling up a new energetic ingredient and performing a complete evaluation of its hazards and performance as a propellant or explosive complete hazards evaluation of energetic materials, as well as real motors, and unique 3-D imaging of plume and flow fields time resolved imaging.



Propulsion and Energy Conversion Research Facility

Ready Missile Test Facility

Facility Description: This facility consists of 14 buildings of which 8 are unique and specially constructed ordnance-certified cells used to perform functional, environmental, reliability testing, and preparation of all-up-round weapon systems. The facility performs production reliability acceptance testing, government lot-acceptance testing, and production verification testing. The facility totals 15,100 square feet that is owned and operated by the government. The facility supports all-up-round guided missiles, free-fall weapons, rockets, and weapons propulsion.

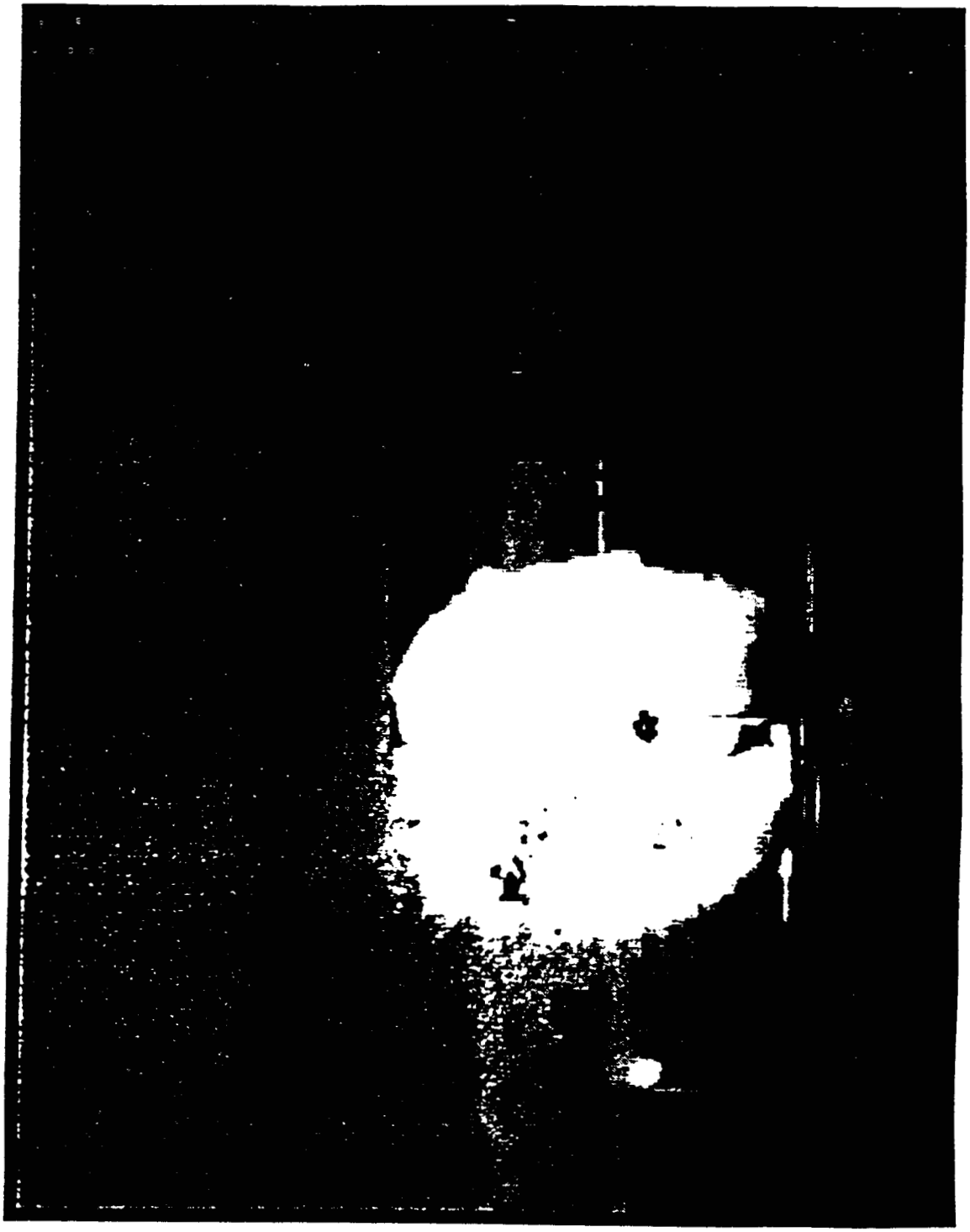
Ready Missile Test Facility (RMTF)

Sled Tracks

Facility Description: The 4-mile-long dual-rail Supersonic Naval Ordnance Research Track (SNORT) is the second-longest DOD sled track. In track testing, payloads and instrumentation are propelled by rocket-powered sleds along a set of straight, heavy-duty crane rails at speeds of up to 4,000 feet per second (Mach 3.5). Payloads typically including warheads or other live ordnance items, normally weigh up to 25,000 pounds; however, depending on mission requirements, heavier payloads are possible. The length of the tracks allows support of relatively long-duration runs. A water brake is used to decelerate and recover sleds. A pair of 225-foot-tall steel towers are in place at trackside to suspend items over the track. The muzzle is readily reconfigured as an arena for warhead tests. Currently the SNORT facility is supporting a major effort for the Trident Propellant Hazards Test and Analysis Program (PHTAP).

Several colocated facilities are operated by the track operations workforce and are available for on-demand service. These non-maintained facilities include the G-4 track, accidental bomb release track, a vehicle barrier facility, a ramp launch facility, and a stationary test facility. The 3,000-foot-long dual-rail G-4 track is especially significant because it has the unique-in-the-nation capability of launching free-flight vehicles over a 500-foot-deep dry lake bed.

Major land areas available at all facilities can support detonations and/or free-flight release of weapons. Environmental concerns have not been a significant factor in operations.

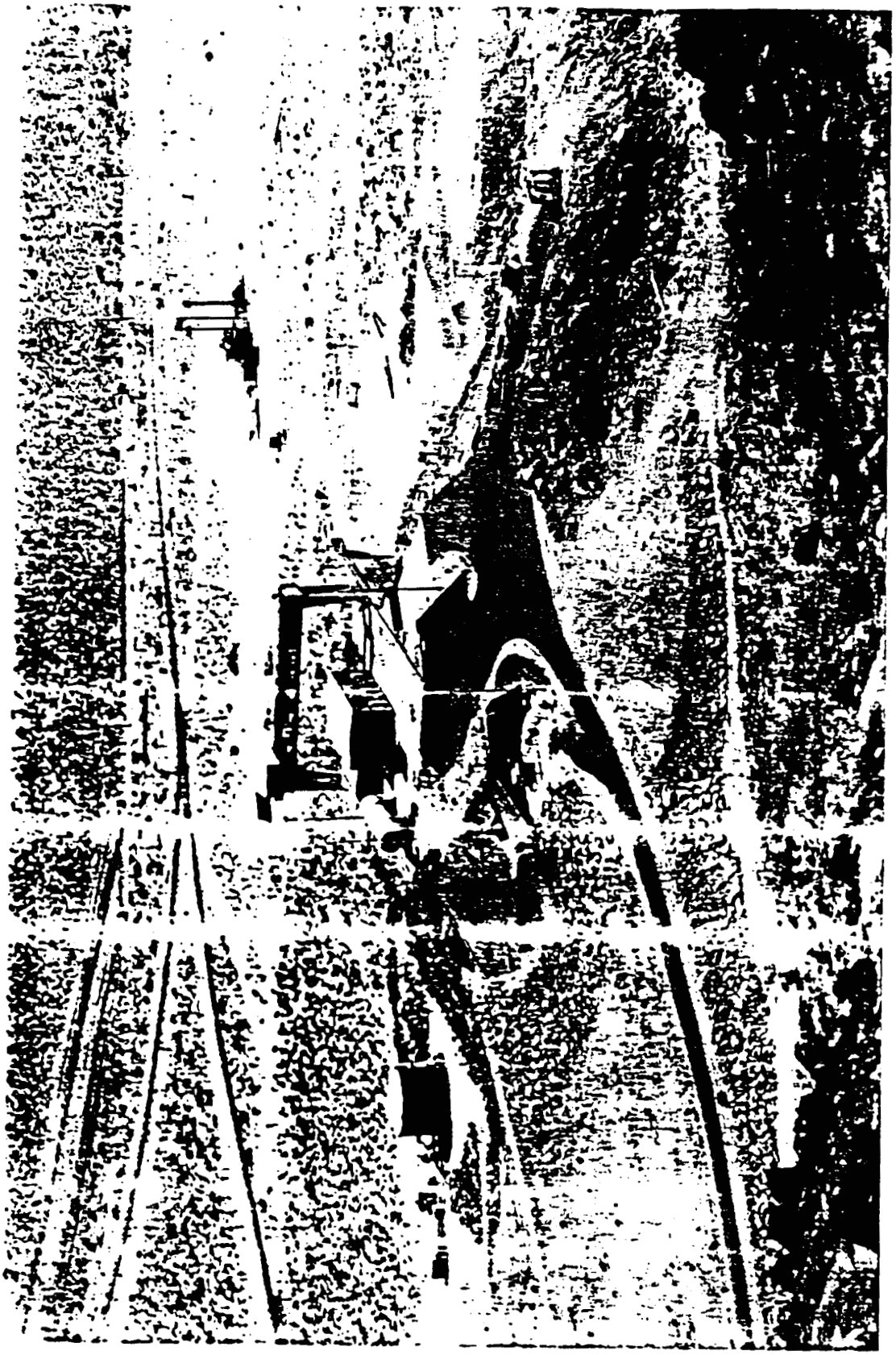


Propellant Hazard Test Assessment Program (PHTAP) Conducted At SNORT

Strategic Propulsion Test Complex

Facility Description: This test complex consists of a series of rocket motor test bays with supporting buildings, work pads, and flame chutes with quenching capability, each having a unique capability for test of solid rocket motors. Bay I, constructed in 1959, is a horizontal test facility that can test motors up to 1 million pounds of thrust. Bay II, built in 1961, tests rocket motors nozzle down, and with an integral Ormond stand, measures six-component thrusts. Bay IIA is a horizontal multistage pad with temperature conditioning capability. Bay VI is a strategic motor vertical test bay with tiltable firing platform, handling motors up to 1 million pounds of thrust, and has a movable service building and gantry crane for motor handling. A water deluge system and real-time radiography are capabilities. Bay VII is a horizontal strategic motor test bay capable of 1.5 million pounds of thrust and provides a movable temperature conditioning building; Bay VII also uniquely provides the ability to test missile stage electronics and transition ordnance. Ordnance siting ranges to 300,000 pounds, Class 1.3. This test complex has supported numerous strategic systems, including Trident I & II, SICBM, Minuteman, Polaris, and Poseidon.

This equipment is unique because Bay VI is the only facility of its kind in the U.S. Once installed on the tilt table, a motor can be fired horizontally or at 45, 85, or 90 attitudes.



Strategic Propulsion Test Complex

Tactical Propulsion Test Facility

Facility Description: The mission of this eight-facility test site is to conduct static firings of rocket motors in support of DOD RDT&E programs.

Bay IV provides the capability to static-fire tactical-sized rockets up to 80,000 pounds of thrust. Bay IV has test pads for firing in both the horizontal and vertical nozzle-down attitudes. A wide variety of thrust stands are available, or can be designed and fabricated on site, to handle any DOD tactical-sized motor. Temperature conditioning is provided by portable chambers and conditioning equipment providing a range of -65 to 185°F. A real-time radiography (RTR) capability is permanently installed in the facility. This bay is currently used for solid rocket motors only. Liquid motors have been fired in the past in Bay IV. The facility is sited for 18,000 pounds of 1.1 or 30,000 pounds of 1.3 materials. The facility is permitted through the Mojave Air Quality Control District for air emissions. No permits are necessary for use of cooling or quench water. The Bay IV control room is scheduled to be upgraded to support the Plume Measurement Facility scheduled for completion in FY97.

Tactical Propulsion Test Facility

TDD DDT&E Complex

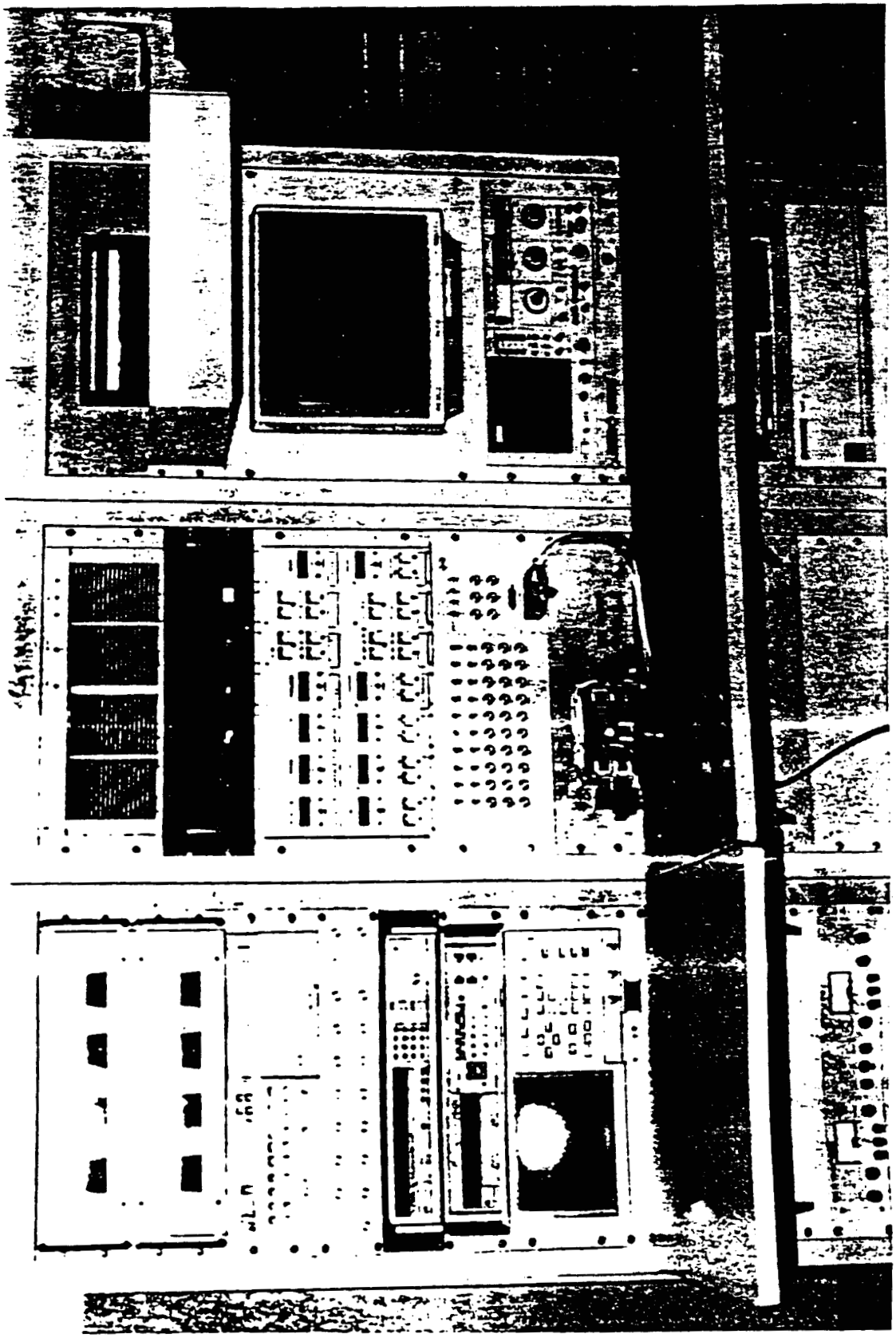
Elements
- TDD Backscatter/Pole Range
- Over-Water Target Detector Measurement
- TDD Data Acquisition System
- Portable Outdoor TDD Test and Dev Station

Facility Description: This capability consists of five facilities designed to perform/support field testing of TDDs or proximity fuzes. The facilities include an indoor pool that is used to measure target detector response to the water surface, two open-air TDD ranges for testing TDD performance against full-size targets suspended in the air, a portable TDD test laboratory for measurement of fuze performance against aircraft in free flight, and a data acquisition and logging system for waveform analysis.

This equipment is unique because one of the five facilities, the portable outdoor TDD development laboratory, represents the only portable capability of its type for measuring TDD capabilities against free-flying aircraft. The other four facilities have duplicates or substitutes elsewhere.

Mission statement: To support exploratory, advanced, and EMD development of TDDs to support intercept weapon development.

Although energetics other than thermal batteries are not used in this facility, it has been included in this section because the performance characteristics of the TDD are critical to the design of an ordnance system, and particularly the warhead. This facility is used for field testing of TDDs to collect actual performance data against simulated targets.



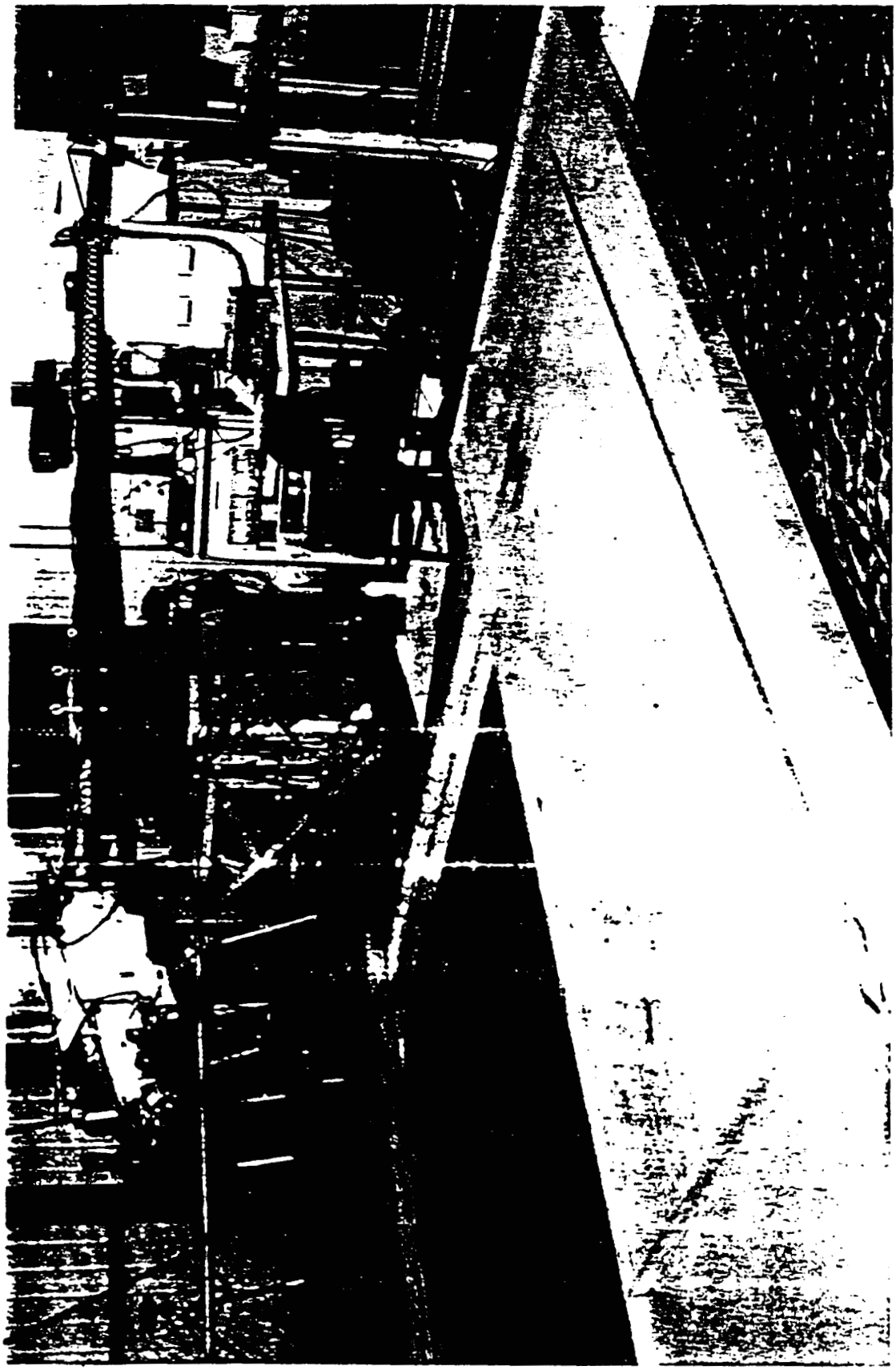
TDD Development, Design, Test, and Evaluation Complex—TDD Test Set

TDD Exploratory Development Facility (IR)

Facility Description: This facility is composed of five laboratory areas, including secure spaces for classified development, an optical tunnel with an external access door, an optical table room with calibration and measurement equipment, a test and data reduction laboratory area, and a general-purpose electronic and signal-processing test area.

Mission statement: To create, design, analyze, and test state-of-the-art technological solutions to enhance the performance of TDDs for U.S. missiles. This is accomplished through the creation of critical experiments, analysis, and test of new technologies, sensors, and signal-processing methods.

Although energetics other than thermal batteries are not used in this facility, it has been included in this section because the performance characteristics of the TDD are critical to the design of an ordnance system, and particularly the warhead. This facility is used to develop state-of-the-art technology for TDDs.



TDD Exploratory Development Facility—Over Water Test Apparatus

TDD Performance Evaluation Laboratory

Facility Description: The TDD Performance Evaluation Laboratory utilizes several individual RF and active optical test sets designed to test the TDD or proximity fuze used on the Sparrow, AMRAAM, Phoenix, Sidewinder, and RAM missiles. The test sets provide a diagnostic tool to analyze the performance of the TDD in the laboratory. The test sets can do production acceptance testing along with specialized engineering tests to ensure that the TDD will meet its specified performance. The test set is designed as an engineering tool for use in the development of the TDDs. The TDD model used for generating missile lethality is based on the performance data taken from the test set.

This equipment is unique because the Sparrow and AMRAAM TDD test sets were designed and built for the in-house development and/or evaluation of the TDDs. The test sets were used as a design development tool and as the tool to measure the end-item performance. They are one-of-a-kind sets within the government.

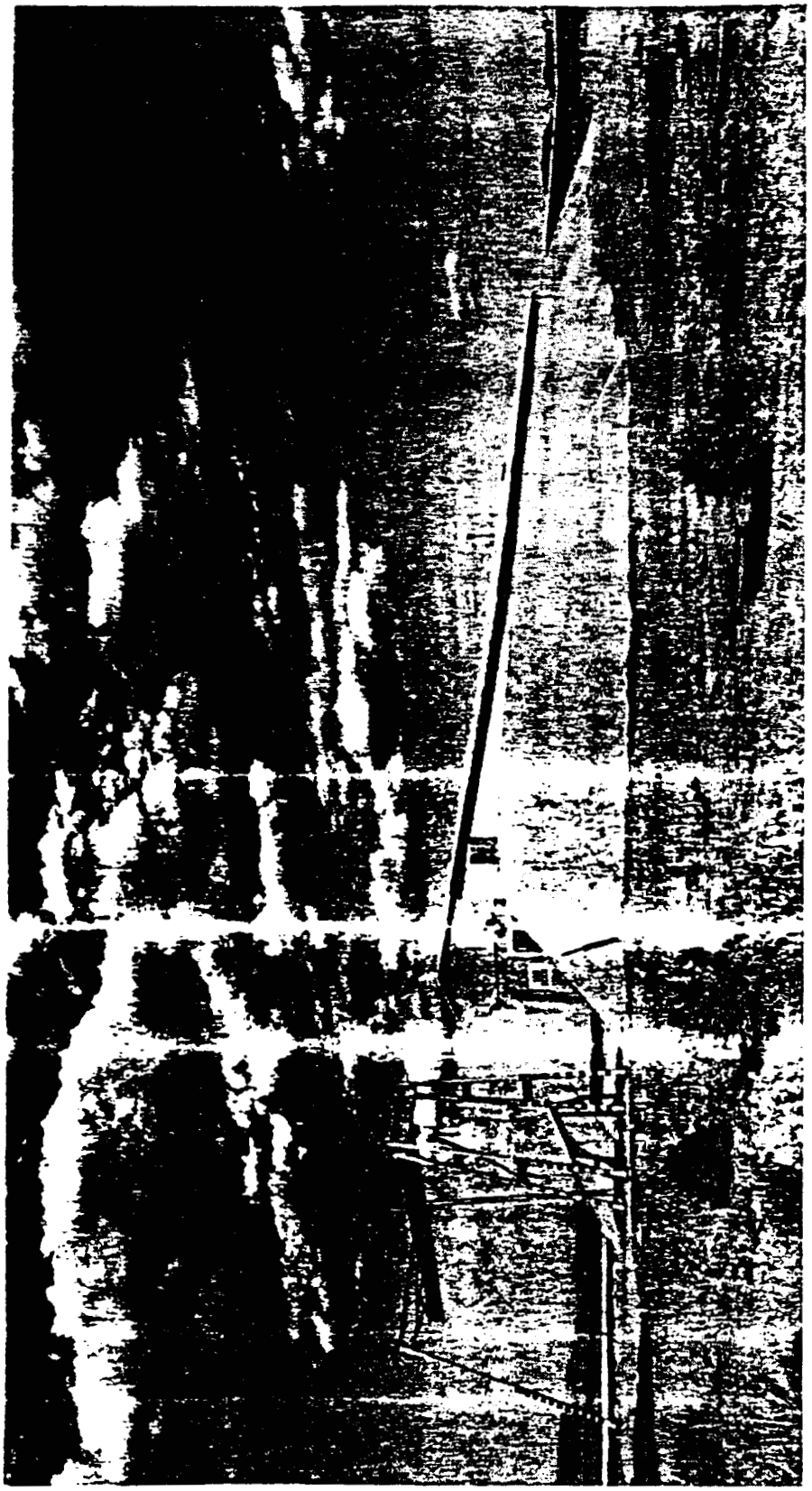
Mission statement: To provide each missile's technical management (NAVAIR/NAVSEA) with accurate, independent performance evaluations to support the development of the optimum TDD within the missile's operational envelope.

Although energetics other than thermal batteries are not used in this facility, it has been included in this section because the performance characteristics of the TDD are critical to the design of an ordnance system, and particularly the warhead. This facility is used to test and evaluate TDD performance for several weapon systems.

TDD Performance Evaluation Laboratory

Warhead/Bomb Assembly/Integration Facilities

Facility Description: These facilities are composed of three assembly buildings (Explosives/ Weapon/Hardware), four large explosive storage docks, four explosive storage magazines, three small magazettes for less than 50 pounds of explosive storage, and one large concrete explosive component assembly building with access to four explosive magazines and three magazettes with 50-pound explosive capacities. These facilities have in the past been used for T&E support; however, the current mission is S&T and DE for explosive devices, warheads, various munitions, and weapon systems and subsystems. Classified materials are accommodated. This facility supports warhead, explosive component, and munitions assembly and checkout without explosive detonation tests. Explosive components and munitions test hardware handling and storage are accommodated. Modifications are limited to removal/replacement of components and subassemblies. Modifications to explosive devices/hardware requires removal to remote control/handling areas. The facilities and equipment provide for design, design modeling, computer analysis, and data analysis in support of its weapon integration mission.



Warhead / Bomb Assembly/Integration Facilities

Weapons Survivability Laboratory (WSL)

Facility Description: The WSL is a complex of test facilities that provides realistic vulnerability and lethality testing of operational aircraft and weapon systems and weapons under simulated dynamic conditions. Used primarily for aircraft vulnerability measurements, aircraft flights are simulated with the High-Velocity Airflow System (HIVAS), and ballistic threats from small arms to missile warheads are evaluated against operational test items. The facility also conducts warhead performance testing, including fragmentation measurements, lethality measurements, penetration measurements, impact tests, and preliminary stores separation tests. The facility includes office spaces, a machine shop, a full range of instrumentation and recording devices, closed-circuit television, high-speed photography, and facilities for storing classified test items.

This equipment is unique because the WSL is a unique resource. Full-scale aircraft and weapons can be tested in dynamic scenarios. The WSL is a one-of-a-kind facility within DOD due to the size and complexity of tests that can be supported. Test results produced are used to update databases and computer simulations used by all three services and the aerospace industry. The WSL facilities are routinely used by all three services to conduct large-scale tests. Industry Independent Research and Development programs also utilize the WSL. The FAA and foreign nationals are expected to utilize the WSL in future joint-test programs. In addition to weapons lethality and weapon system survivability testing, the WSL's HIVAS facility is used for weapon separation tests and parachute deployment testing.

Weapons Survivability Laboratory Complex

China Lake Ordnance And Propulsion Pilot Plant Reserve Capacity

There are five currently unused buildings in the China Lake Ordnance Plant, totaling some 9,800 square feet of available floor space. These buildings could be readily re-activated to their original energetic material processing function, or could be readily activated to accommodate the installation of other energetic material processing/handling capabilities.

Building 10010 has 7,200 square feet of floor space, and contains a 12-inch vertical press used for the extrusion of double-base propellant and other energetic materials up to 12 inches in diameter and 48 inches in length. Activation of this energetic materials processing facility, consisting of this building and associated support building (Building 10040, 420 square feet), would require a minimal effort to re-activate the utilities and check out the presses. Once re-activated, this facility could support 5.25 man-years of effort (based on a single shift, 40-hour work week). This work load could be increased by operating with additional shifts, working weekends, etc.

Building 10530, with 493 square feet of floor space and a 15-inch horizontal extrusion press, could be re-activated with minimal effort. Once re-activated, this facility could support 2.75 man-years of effort (based on a single shift, 40-hour work week). This work load could be increased by adding additional shifts, working weekends, etc.

Building 13010, with 718 square feet of floor space, and containing both 3-inch and 1-inch extrusion presses, could also be readily re-activated at minimal cost. Cost and personnel are cover in another facility.

Building 10050 has 1,128 square feet and was previously used as a machining room for the 12-inch press. It has three bays or rooms available for operations. This building has been modified and all the machinery has been removed. This building has been used as a motor assembly building. This building is now closed for operations. This building could be utilized for water jet demil. system. Estimate it would require 2 man-years to operate a facility of this type.

Building 10610 is comprised of heavy concrete with instrumentation/control room and office/work room. Approximately 560 square feet of floor space is available. This facility has been used for T&E support; however, is used primarily for technology and development engineering for small devices, various munitions, and weapon systems and subsystems intended for air launch. Presently equipped with structure and ejection rack equipment to accommodate 2000-pound class stores. Classified materials can be accommodated. This multiuse facility can be utilized for small devices through AURs for store ejection testing or ejection equipment testing and is capable of accommodating explosive actuated devices and inert test hardware assemblies. Functional testing would be limited to mechanical and/or explosive actuated ejection rack equipment for inert weapon/component test hardware. No instrumentation/test equipment or shop tools are available. Basic structures are in place for ejection rack equipment and instrumentation mounting. The facility has temporary storage areas, small office space, secure areas, and is situated in remote area for safety. Estimate 2 man-years to operate this type of facility.

3.D PERSONNEL SKILL SUMMARY

MANPOWER, INTELLECTUAL/SKILL CAPABILITY

There are in excess of 1,100 people working with Energetics at NAWCWPNS. These numbers do not include support functions such as Public Works, Procurement and Contrt acts, Environmental Projects Office, nor some other groups of people that support the Energetics area, even though they are essential in accomplishing the Energetics mission.

While a complete characterization of all personnel working in energetics is not currently available (because of time constraints and organizational changes), the following data based on 760 people is indicative. This sample of 760 (includes technicians, specialists, and wage grade) is characterized by education and discipline as follows:

Discipline	Number of Ph. D.	M.S.	B.S.
Chemists, Chemical Engineer	37	9	26
Physicists	3	13	18
Mechanical, Aerospace, General Engineers	7	36	136
Electrical, Electronic Engineers	0	20	73
Mathematics, Computer Sciences	0	1	5
Other	0	2	5

There are 290 technicians and specialists, and 69 wage grade machinists and ordnance workers.

One measure of the productivity of an RDT&E facility is the output in terms of publications and patents. For the time period FY91-93 the scientists and engineers working in Energetics published 30 papers in peer reviewed open literature scientific journals. Table 3.D.1 is the listing of these open literature publications. Because much of the work in the Energetics area is sensitive, refereed open literature publications are not the only measure of output. Much of the work is presented at Joint Army Navy NASA Air Force (JANNAF) meetings as classified or restricted publications. In addition much of the work is published in the proceedings of international symposia. In these forums, the selection of papers to be included in the meeting is determined by peer review but the papers often are not. Examples of these publications are proceedings of the International Combustion Symposium, the International Detonation Symposium, the International Symposium on Energetic Materials Technology, the International Colloquium on Dynamics of Explosions and Reactive Systems, and the International Pyrotechnics Seminar. Table 3.D.2 presents 140 publications presented at JANNAF and other meetings for the period FY91-93.

For the FY91-93 time period China Lake Energetics had 70 patent actions, with 39 patents issued, 10 under secrecy order and 21 disclosures still pending (many from FY93). These are listed in Table 3.D.3.

Papers Published: *How many papers were published (FY 91–93)?)*

There were 30 publications in peer-reviewed journals (Table 3.D.1) and 140 sensitive and unique technology publications (Table 3.D.2) (e.g., Joint Army Navy NASA Air Force/CPIA, International Combustion Symposium International Colloquium on Dynamics of Explosions and Reactive Systems, International Pyrotechnics Seminar International Detonation Symposium). These numbers do not include the many publications such as pre-prints for the American Institute of Aeronautics and Astronautic meetings such as the Aerospace Sciences Meeting.

TABLE 3.D.1. Open Literature Publication (FY91–93)

CSF	Paper Titles	Published
Weapons, ICBMs/SLBMs	Current Assessment Methodology for Electrostatic Discharge Hazards of Energetic Materials	Journal of Propulsion and Power **7**, No. 6
Weapons, Conventional Missiles/Rockets	Mitigation of Pressure Oscillations Induced by Supersonic Flow Over Slender Cavities	Journal of Aircraft **29**, No. 6, Nov-Dec 1992
	Mixing and Combustion in a Spinning Circular Combustor	Journal of Propulsion and Power **8**, No. 4, July-August 1992
	Spatial Fragment Mass and Velocity Distributions for Ordnance and Ultra-Ordnance Speed Impacts	International Journal of Impact Engineering **10**, No. 1-4,1990
	Stabilization of a Premixed Flame by Shear Flow Excitation	Combustion Science & Technology **73**, pp. 521-535, 1990
	Noncircular Inlet Duct Cross-Section to Reduce Combustion Instabilities	Combustion Science & Technology **73**, pp. 537-553, 1990
	Coherent and Random Structures in Reacting Jets	Experiments in Fluids **10**, pp. 147-156, 1990
	Compressible Spreading Rates of Supersonic Coaxial Jets	Experiments in Fluids **10**, pp. 161-169, 1990
	Effect of Convective Mach Number on Mixing of Coaxial Circular and Rectangular Jets	Physics of Fluids A, January 1991
	Interaction Between Fluid-Dynamic and Acoustic Instabilities in Combusting Flow Within Ducts	Combustion Science & Technology **79**, pp. 161-166, 1991

TABLE 3.D.1. (contd.)

CSF	Paper Titles	Published
	Subsonic and Supersonic Combustion Using Noncircular Injectors	Journal of Propulsion and Power, March-April 1991
	Low Frequency Pressure Oscillations in a Model Ramjet Combustor	Journal of Fluid Mechanics, **232**, pp. 47-72, 1991.
	Thermal Imaging of Afterburning Plumes	Journal of Propulsion and Power, Nov.-Dec. 1991
	Closed-Loop Amplitude Modulation Control of Reacting Premixed Turbulent Jet	AIAA Journal **29**, No. 12, pp. 2155-2162, December 1991
	Simultaneous OH and Schlieren Visualization of Premixed Flames at the Lean Blow-Out Limit	Experiments in Fluids, No. 12, pp. 10-16, 1991
	Combustion Instability Related to Vortex Shedding in Dump Combustors and Their Passive Control	Progress in Energy and Combustion Science **18**
	Flow and Acoustic Features of a Supersonic Tapered Nozzle	Experiments in Fluids **13**, 1992
	Active Combustion Control in a Coaxial Dump Combustor	Combustion, Science & Technology **81**, 1992
Weapons, Conventional Missiles/Rockets (contd.)	Structure of a Controlled Ducted Flame	Combustion Science & Technology **87**., pp. 217-239, 1992
	Transmittance and Mechanical Properties of PMMA-Fumed Silica Composites	Journal of Applied Polymer Science, Dec 1992
	Pressure Oscillations in Post-Challenger Space Shuttle Redesigned Solid Rocket Motors	Journal of Propulsion and Power, March-April 1993
	A Review of Rijke Tubes, Rijke Burners and Related Devices	Progress in Energy and Combustion Science, Pergamon Press **19**, No. 4, pp. 313-364, 1993
	Study of Combustion Dynamics for Passive and Active Control	Progress in Astronautics and Aeronautics **151**, p. 365, 1993
	Feedback Control of an Unstable Ducted Flame	Journal of Propulsion and Power, July-August 1993
Weapons, Conventional Missiles/Rockets (contd.)	Impact Sensitivity of Polynitroaromatics	J. Energetic Mater., 9 (4), November 1991
	Powder Diffraction Data for Two Energetic Materials and a Proposed Intensity Figure of Merit	Powder Diffraction **6** (1), pp. 31-35, March 1991
Advanced Materials (contd.)	Mass Spectroscopy Study of Products From Exposure of RDX Single Crystals to KrF Excimer	J. Appl. Phys. **69**, pp 3651-3691, 1990
Advanced Materials (contd.)	A Solid-State ^{15}N NMR Study of the Phase Transitions in Ammonium Nitrate	J. Phys. Chem. 97, pp. 11096-11102, 1993
	Synthesis and Explosive Properties of Benzotriazoles	Australia J. Chem. **45**, pp. 513-524, 1992
	Synthesis and Explosive Properties of Dinitropicrylbenz-imidazoles, and the "Trigger Linkage" in Dinitropicrylbenzotriazoles	Australian J. Chem. **45**, pp. 525-539, 1992

TABLE 3.D.2. Sensitive and Unique Technology*

CSF	Paper Titles	Published
Weapons, ICBMs/SLBMs	Pressure Oscillations in Post-Challenger SRMs	CPIA Pub. No. 557, November 1990.
	Intermetallic Thermal Sensor for Full-spectrum Cookoff Mitigation	CPIA Pub. No. May 1993
Weapons, Conventional Missiles/Rockets	Cook-off Workshop Summary: Mechanistic Understanding and Predictive Capabilities	CPIA Pub. No. 582, April 1992
	Absorption Measurements in Propellant Flames	CPIA Pub. No. 573, November 1991
	Acoustic Motor Data Reduction and Analysis	CPIA Pub. No. 593, October 1992 Proc.
	Active Control of Organized Oscillations in a Dump Combustor Shear Layer	International Symposium on Pulsating Combustion, August 1991
	ADN Combustion Studies (U)	CPIA Pub. No. 606, November 1993.
	ADN Propellant Diffusion Flame Structure	CPIA Pub. No. 593, October 1992.
	Combustion of Propellants Containing a High Density, Inert Additive	CPIA Pub. No. 606, November 1993.
	A Comparison of Radiant Ignition and Ballistic Impact Chamber Results	CPIA Publ. No. 582, April 1992.
	Diagnostic Measurements of 2 by 2 Motor Plumes (U)	CPIA Pub. No. 595, February 1993
	Distributed Combustion Response Mechanisms	CPIA Pub. No. 550, October 1990
	The Effect of Impact Damage on Solid Propellant Sensitivity to Electrostatic Discharge	CPIA Pub. No. 582, April 1992
	Factors Influencing Mechanical Properties of Propellants	Proceedings of International Symposium Compatibility of Plastics and Other Materials with Explosives, Propellants and Pyrotechnics, April 1991
	Flame Response in Oscillatory Solid Propellant Combustion	CPIA Pub. No. 593, October 1992
	Fluid Dynamic/Combustion Interaction as Driving Mechanism of Pressure Oscillations in a Regenerative Liquid Propellant Gun	CPIA Pub. No. 550, October 1990
	High Burning Rate High Pressure Non-Aluminized Solid Propellant Combustion	CPIA Pub. No. 606, November 1993.
	High Pressure Pulsed Motor Firing Combustion Instability Investigation	CPIA Pub. No. 606, November 1993.

*This is a listing of significant papers presented at Joint Army Navy NASA Air Force meetings and at international symposia. It covers FY91–93. Not included are the many publications such as pre-prints for meetings such as the Aerospace Sciences Meeting.

TABLE 3.D.2. (contd.)

CSF	Paper Titles	Published
Weapons, Conventional Missiles/Rockets (contd.)	Aerogrid Fuel Injector Demonstration in A Liquid Fueled RAMJET	CPIA Pub. No. 580, February 1992
	Combustion Stability of Side-Dump RAMJET Combustors	CPIA Pub. No., November 1993
	Degradable and Hydrolyzable Binder Explosives	International Symposium on Energetic Materials Technology, October 1992
	Development and Testing of Insensitive Energetic Reduced-Smoke (IERS) Propellants	CPIA Pub. No. 602, November 1993
	Phoenix Propulsion Improvement Investigations	CPIA Pub. No. 602, November 1993
	Plastic Rocket Motor Case	CPIA Pub. No. 602, November 1993
	Plume Energy Change for Airbreathing Engines Using a Low Cost Fuel Additive	CPIA Pub. 602, November 1993
	Seven- and Eight-Inch Liquid Fueled RAMJET Configuration Study for AIR-TO-AIR MISSILES	CPIA Pub. 602, November 1993
	Prediction and Application of Small-Scale Techniques to Cook-Off of Full-Scale Motors	CPIA Pub., April, 1990
	Reliable Determinations for Thermal Stability of Explosives	CPIA Pub., April 1993
	Requirements for Future Airbreathing Propulsion Systems and Components	CPIA Pub. 602, November 1993
	Solid Fuel RAMJET Tests with Single Bypass	CPIA Pub. 602, November 1993
	Suppression of Combustion-Induced Pressure Oscillations in a Liquid-Fueled RAMJET	CPIA Pub., October 1992
	Suppression of Ignition Rise Rate in Solid Propellant Rocket Motor	CPIA Pub. 602, November 1993
	A Survey of Barrier Materials for Mitigating Sympathetic Detonation	CPIA Pub., May 1993
	Testing and Analysis of Heat Transfer in Materials Exposed to Non-Metalized HTPB Propellant	CPIA Pub., December 1992
	Update on the AQM-127A Supersonic Low Altitude Target (SLAT) Program	CPIA Pub. 602, November 1993
	High-Performance, Reduced-Smoke Propellant	CPIA Pub. No. 550, October 1990
	High-Rate Flywheel Tensile Tester for Viscoelastic Materials	CPIA Pub. 582, April 1992
	Ignition Modeling Program	CPIA Pub. No. 593, October 1992
	Impact-Induced Delayed Reactions in Rocket Motors: Further Studies With a Planar Model	CPIA Pub. 582, April 1992
	Insensitive Minimum-Signature Propellants (IMAD-301 Propellants)	CPIA Pub. No. 550, October 1990
	Laser Recoil Combustion Response of HMX/GAP, and CL-20/GAP Propellants at Atmospheric Pressure	CPIA Pub. No. 606, November 1993.

TABLE 3.D.2. (contd.)

CSF	Paper Titles	Published
Weapons, Conventional Missiles/Rockets (contd.)	Measurement of Propellant Combustion Response to Sinusoidal Radiant Hear Flux	CPIA Pub. No. 557, November 1990
	Non-Linear Characteristics of Solid Propellant Combustion Instability	CPIA Pub. No. 593, October 1992
	Nonlinear Instability Test Results of Full Scale Rocket Motors	CPIA Pub. No. 550, October 1990
	Non-Linear Stability Testing and Pulsing of Full-Scale Tactical Motors	CPIA Pub. No. 568, May 1991
	Plume Signature Predictions and Their Comparison With Data for Tactical Rocket Motors (U)	CPIA Pub. No. 595, February 1993
	A Porous Bed (DDT) Evaluation of UTP19.360B Propellant	CPIA Pub., May 1993
	Radiant Heat Flux Combustion Response of Oxidizers ADN, HMX, and RDX at One Atmosphere	CPIA Pub. No. 593, October 1992
	The Relationship Between Ballistic Impact Damage and Violent Reaction in Cased Propellant	CPIA Pub. No. 562, March 1991
	Solid Propellant Combustion Instability Mechanisms Investigation Using Active Control	CPIA Pub. No. 593, October 1992
	Lauryl Methacrylate Propellants	CPIA Pub. No. 606, November 1993.
	The Effect of Ballistic Impact Damage on Violent Reaction in Cased Propellant	Proc. 12th International Symposium on Ballistics, Vol. III, 1990
	Plate Curvature Effects on Ballistic Limit and Fragmentation	Proc. 12th International Symposium on Ballistics, Vol. III, 1990
	Performance Characteristics of Shrouded Supersonic Rectangular and Tapered Elliptic Jets	CPIA Pub. No. 550, October 1990
	Aging Properties of Propellants Containing GAP and AN	CPIA Pub. No. 550, October 1990
	Distributed Combustion Response Mechanisms	CPIA Pub. No. 557, November 1990
	Combustion Enhancement Through Axial Vorticity	CPIA Pub. No. 557, November 1990
	The Thermal Decomposition of Beta CL-20	CPIA Pub. No. 557, November 1990
	Microexplosion of Highly Loaded Slurries	CPIA Pub. No. 557, November 1990
	Microexplosion of Highly Loaded Slurries	CPIA Pub. No. 557, November 1990
	CL-20 and CL-20/Energetic Binder Combustion Chemistry (U).	CPIA Pub. No. 557, November 1990
	CBRED II A Versatile Tool for the Characterization of Damaged Propellants	CPIA Pub. 562, March 1991
	Recent Utilization of the Porous Bed (DDT) Code at the Naval Weapons Center	CPIA Pub. 562, March 1991
	Comparison of Damage-Created Voids With Other Void Types in Energetic Materials	CPIA Pub. 562, March 1991
	Modeling Sympathetic Detonation	CPIA Pub. 562, March 1991

TABLE 3.D.2. (contd.)

CSF	Paper Titles	Published
Weapons, Conventional Missiles/Rockets (contd.)	Wedge Test Results of Minimum Signature Propellants and the Effect of Formulation Parameters on Their Shock Sensitivity.	CPIA Pub. 562, March 1991
	Applying 'FRAGMAP' to Sympathetic Detonation Analyses	CPIA Pub. 562, March 1991
	A Measure of Propellant Damage Due to Fragment Impact	CPIA Pub. 562, March 1991
	Fluorine-Containing Binders	Proc. International Symposium Compatibility of Plastics and Other Materials with Explosives, Propellants and Pyrotechnics, April 1991
	An Evaluation of CL-20 Propellant Formulations (U)	CPIA Pub. 563, April 1991
	Electrostatic Discharge (ESD) Hazards Evaluation of CL-20	CPIA Pub. 563, April 1991
	Combustion Instability Measurements of CL-20 Propellants	CPIA Pub. 563, April 1991
	The Calculated Performance of CL-20 in High-Energy Gun Propellants and in Ball Powder (U)	CPIA Pub. 563, April 1991
	Energetic Compositions Containing CL-20 (U)	CPIA Pub. 563, April 1991
	The Effect of Nozzle Geometry on the IR Emission of Particle-Laden Plumes	CPIA Pub. No. 568, May 1991
	Thermal Imaging of Ramjet Plumes (U)	CPIA Pub. No. 568, May 1991
	Rocket Motor Scale Effects on IR Signature	CPIA Pub. No. 568, May 1991
	Use of Chemiluminescence and Neural Networks in Active Combustion Control	Proceedings of the 23rd International Symposium on Combustion/The Combustion Institute, pp. 1101-1106, 1991
	Effect of Gaseous Fuel Mixing on Boron Combustion in Ducted Rocket With Side Dump	Proceedings of the Second International Symposium on Special Topics in Chemical Propulsion: Combustion of Boron-Based Solid Propellants and Solid Fuels, March 1991.
	Hazards of Energetic Materials and Their Relation to Munitions Survivability	Proceedings of the 22nd International Annual Conference of ICT, July 1991
	Ignitability Measurements of Solid Propellants	Proceedings of the 22nd International Annual Conference of ICT, July 1991
	Study of Combustion Dynamics For Passive and Active Control	Proceedings of the 13th International Colloquium on Dynamics of Explosions and Reactive Systems, July-August 1991
	Wavelet Analysis of a Controlled Pulsating Flame	Proceedings of the International Symposium on Pulsating Combustion, August 1991
	Three-Dimensional Vortical Structure of a Turbulent Flame	Proceedings of the 8th Symposium Turbulent Shear Flows, September 1991.

TABLE 3.D.2. (contd.)

CSF	Paper Titles	Published
Weapons, Conventional Missiles/Rockets (contd.)	Suppression of Combustion Instabilities by Active Shear-Flow/Combustion Control	Proceedings of the 10th International Symposium on Air Breathing Engines, September 1991
	Aluminum Combustion Effects on Combustion Instability of High Burn Rate Propellants	CPIA Pub. No. 573, October 1991
	The Role of External Radiation in the NWC Combustion Model	CPIA Pub. No. 573, October 1991
	The Effect of Propellant Ingredients on the Combustion of CL-20 and Its Residue (U)	CPIA Pub. No. 573, October 1991
	Temperature Sensitivity of CL-20 Deflagration (U)	CPIA Pub. No. 573, October 1991
	Propellant Development: From Idea to Motor	CPIA Pub. No. 573, October 1991
	Combined Active-Passive Control of a Dump Combustor	CPIA Pub. No. 573, October 1991
	Propellant Diffusion Flame Structure	CPIA Pub. No. 573, October 1991
	Measurement of Propellant Combustion Response To Sinusoidal Radiant Heat Flux at 150 psi: Current Experimental Status	CPIA Pub. No. 573, October 1991
	Aluminum Combustion Effects on Combustion Instability of High Burn Rate Propellants	CPIA Pub. No. 573, October 1991
	An Assessment of Cookoff Modeling and Codes	CPIA Pub. No. 586, April-May 1992
	Wavelet Representation of the Multifractal Nature of a Premixed Flame	Proceedings of the 24th International Symposium on Combustion, July 1992
	Wavelet Analysis of the Nonlinear Transition from Actively Stabilized Combustion to Limit Cycle Instability	Proceedings of the 24th International Symposium on Combustion, July 1992
	The Chemistry of Extinguishable Propellants	Proceedings of the 18th International Pyrotechnics Seminar, July 1992
	Fire Extinguishing Pyrotechnics	Proceedings of the 18th International Pyrotechnics Seminar, July 1992
	Combustion Characteristics and Passive Control of an Annular Dump Combustor	CPIA Pub. No. 593, October 1992
	Mixing Enhancement in Particle-Laden Flows	CPIA Pub. No. 593, October 1992
	Combustion Characteristics and Passive Control of an Annular Dump Combustor	CPIA Pub. No. 593, October 1992
	The Reaction of Ammonium Dinitramide Under Thermal Load	CPIA Pub. No. 593, October 1992
	Ammonium Dinitramide Combustion Studies (U)	CPIA Pub. No. 593, October 1992
	High Pressure CL-20 Combustion Studies (U)	CPIA Pub. No. 593, October 1992

TABLE 3.D.2. (contd.)

CSF	Paper Titles	Published
Weapons, Conventional Missiles/Rockets (contd.)	Materials Characterization of Ablative Insulators	CPIA Pub. No. 593, October 1992
	Lessons Learned in Combustion Instability	CPIA Pub. No. 593, October 1992
	Combustion Response of Double Base Ammonium Nitrate Propellants at 1000, 2000, and 3000 psi	CPIA Pub. No. 593, October 1992
	Radiant Heat Flux Combustion Response of Oxidizers HMX, RDX, and ADN at One Atmosphere	CPIA Pub. No. 593, October 1992
	Flame Response in Oscillating Solid Propellant Combustion	CPIA Pub. No. 593, October 1992
	Supersonic Mixing Studies Using Flow Visualization (U)	CPIA Pub. No. 595, February 1993
	Closed-Loop Control of Combustion in a Flame and a Dump Combustor	IEEE Control Systems Magazine, April 1993
	Processing Aspects of Minimum-Signature Propellants	CPIA Pub. No. 597, April 1993
	Planar Mie Scattering Visualization of Reacting and Nonreacting Supersonic Coaxial Jets	Third International Symposium on Special Topics in Chemical Propulsion: Non-Intrusive Combustion Diagnostics, May 1993 (Begell House, New York, NY)
	Factors Controlling the Sensitivity of HTPB/AP/Al Propellant	1993 JANNAF Propulsion Systems Hazards Subcommittee Meeting, CPIA Pub. May 1993
	An Inert Simulant for a High-Elongation Class 1.1 Propellant	1993 JANNAF Propulsion Systems Hazards Subcommittee Meeting, CPIA Publication, May 1993
	Thermal Characterizations of Solid Propellant Formulations	1993 JANNAF Propulsion Systems Hazards Subcommittee Meeting, CPIA Pub., May 1993
	Electrostatic Discharge (ESD) Hazards of Energetic Materials	Proceedings of the Tenth International Detonation Symposium, July 1993
	Comparison of Damage-Created Voids With Other Void Types in Energetic Materials	Proceedings of the Tenth International Detonation Symposium, July 1993.
	The Application of Ballistic Impact and Radiant Ignition Techniques for Characterization of Violent Reaction in Cased Propellant	Proceedings of the Tenth International Detonation Symposium, July 1993.
	Actively Controlled Compact Waste Incinerator	1993 JANNAF Safety and Environ. Protection, August 1993
	Enhancement of Combustion Properties by Control of Air/Fuel Mixing in Turbulent Flames	9th Symposium on Turbulent Shear Flows, Kyoto, Japan, August 16-18, 1993

TABLE 3.D.2. (contd.)

CSF	Paper Titles	Published
Weapons, Conventional Missiles/Rockets (contd.)	Effect of Exothermic Reactions on Coherent Structure Formation in Supersonic Shear Layers	14th International Colloquium on the Dynamics of Explosions and Reactive Systems, University of Coimbra, Portugal, August 1993
	Periodic Chemical Energy Release for Active Combustion Control	XI ISABE, Tokyo, Japan, September 1993
	A Study of Obliquity Effects on Perforation and Ricochet Processes in Thin Plates Impacted by Compact Fragments	14th International Symposium on Ballistics, September 1993
	Mixing Enhancement in Supersonic Free Shear Flows	Review for Annual Review of Fluid Mechanics, 1993
	Ducted-Rocket Combustion Experiments at Low Gas-Generator Combustion Temperatures	CPIA Pub. No. 606, November 1993.
	Interaction Between Fluid Dynamics and Pressure Oscillations in a Simulated Liquid Propellant Gun	CPIA Pub. No. 606, November 1993.
	ADN Diffusion Flame Structures at Elevated Pressure	CPIA Pub. No. 606, November 1993.
	RDX Flame Structure and Chemistry	CPIA Pub. No. 606, November 1993.
	Shock Sensitivity of Minimum Signature Propellants Based on CL-20	Joint JANNAF Development & Characterization of New Energetic Materials, April 1994
	Safety, Aging, and Thermocompatibility Issues of ADN and ADN Propellants	Joint JANNAF Development & Characterization of New Energetic Materials, April 1994
	Lagrangian Hydrocode Modeling of Blunt Projectile Impacts Against Thick Plates at Obliquity	Computational Aspects of Impact and Penetration, Elmepress International, pp. 292-308, 1991
	Actively Controlled Compact Waste Incinerator	Proceedings of The Twenty-Fifth International Symposium on Combustion, The Combustion Institute, July-August 1994.
	RDX Flame Structure	Proceedings of The Twenty-Fifth International Symposium on Combustion, The Combustion Institute, July-August 1994.
	Control of Sooty High Energy Fuel Combustion	Proceedings of The Twenty-Fifth International Symposium on Combustion, The Combustion Institute, July-August 1994.

TABLE 3.D.2. (contd.)

CSF	Paper Titles	Published
Weapons, Conventional Missiles/Rockets (contd.)	Laser Recoil, Emission, and Flame Height Combustion Response of Oxidizers HMX and RDX at Atmospheric Pressure	Proceedings of The Twenty-Fifth International Symposium on Combustion, The Combustion Institute, July-August 1994.
	Electrostatic Discharge (ESD) Hazards of Energetic Materials	Proceedings of Electrostatics '91, April 1991
	Adhesive Development for Fiber Optic Guided Weapons	Proceedings of 3rd Biennial DOD Fiber Optic Conference, pp. 248-252, March 1992
	Synthesis and Characterization of Advanced Materials for Navy Applications	NASA Pub. 3249 Vol. 1 pp. 294-306, 1993

Patents and Disclosures: *How many patents were awarded and patent disclosures were made? (FY91-93)*

There were 70 disclosures, with 39 patents awarded and 10 secrecy orders.

TABLE 3.D.3. Patent Activity FY 91–93.

CSF	Disclosures	Awarded	Patent Titles (List)
Air Vehicles, Fixed Wing, Avionics	73019	Secrecy	(Multiflare Simulator) Infrared Countermeasure Flare Simulation Method (U)
Weapons, Conventional Missiles/Rockets	52370	Issued	Selectively Aimable Warhead Initiation System
	55448	Issued	Improved Shaped Charge
	56370	Issued	Droppable Jet Vane TVC
	57534	Issued	Preparing an Elastomeric Bound Explosive
	58235	Issued	Frequency Obtained Range Definition and Control Proximity Fuze
	58584	Issued	High Energy Case Explosives Based On Dinitropropylacrylate
	59487	Issued	Controlled Fragmentation with Fragment Mix
	59494	Issued	Plastic Bonded Explosives Which Exhibit Mild Cook-Off
	64572	Issued	Insensitive High Density Explosive
	65627	Issued	Inhibitor and Barrier for Use With High Energy Rocket Propellants
	65628	Issued	Insensitive High Energetic Explosive Formulations
	65629	Issued	Additives Which Prevent Gasing of Energetic Binder Containing Propellant
	65763	Issued	Non-Continuous Ignition Train
	65967	Issued	High Nitrogen Smoke Compositions
	66208	Issued	Gas Generant Compositions Containing Energetic High-Nitrogen Binders
	66465	Issued	Shear Type Ordnance Venting Device
	66576	Issued	Bending Type Ordnance Venting Device
	68543	Issued	Thermosensitive Pop-out Device
	68586	Issued	Plastic Bonded Explosives Using Fluorocarbon Binders
	68790	Issued	Spherical Warhead
	69072	Issued	Dump Combustor With Noncoherent Flow
	69360	Secrecy	Stores Storage and Release System (U)
	70166	Issued	Externally Heated Thermal Battery
	70765	Issued	Bonding Agents for Thermite Compositions
	70849	Issued	Castable, Insensitive Energetic Compositions
	71023	Issued	Fire, Temperature and Shock Resistant Explosives
	71172	Secrecy	Multi-Step Fuel Grain
	71413	Secrecy	Multiple Concentric Shaped Charge 9U0
	71713	Issued	Weapons Storage Container to Prevent Sympathetic Detonation
	71764	Issued	Pyrofuze Pin for Ordnance Activation

TABLE 3.D.3. (contd.)

CSF	Disclosures	Awarded	Patent Titles (List)
	71765	Issued	Pyrofuze Aircraft Ordnance Arming System
	72301	Secrecy	Integrated Aerodynamic Fin and Stowable TVC Vane System (U)
	72644	Secrecy	Rocket Having an Arrangement for Internal Ducted Bypass Air Injection (U)
	72786	Secrecy	Safe and Arm Device Using Liquid Explosive (U)
Weapons, Conventional Missiles/ Rockets (contd.)	73212		Reactive Nickel Aluminum Shaped Charge Liner
	73214	Issued	Ordnance Heated Battery Reactor
	73340	Issued	Castable. Insensitive Energetic Compositions
	73362		AGM-136/A Single Hoist Ordnance Loading System (SOLS) Adapter
	73393	Issued	Pyrofuze Pin for Ordnance Device Activation
	73468	Issued	Thermally Activated Case Venting Safety Apparatus
	73470		Explosive Sensitization for Increased Booster Performance
	73575	Issued	Fluidic Laser Calorimeter
	73576		Fire Ram
	73751		Gator Battery Firing Device
	73805		Integrated Roll Control and Power Supply System and Method
	73870	Issued	Safe and Arm Device with Variable Arming Delay By Liquid Explosive
	73871	Issued	Safe and Arm Device with Expansible Element in Liquid Explosive
	73927	Secrecy	Infrared Counter Measure Flare Simulation Apparatus
	74073		Intermetallic Thermal Sensor
	74241		Method of Producing A Controlled Fragmentation Warhead Case
	74289	Issued	Method for Preparing Filler Material for Explosive Round Storage Container
	74293		Method and Apparatus for Active Control of Combustion Devices
	74626		High Rate Flywheel Tensile Testing Apparatus for Viscoelastic Materials
	74646	Secrecy	High-Performance Reduced Smoke Propellant
	74866		Monopropellant for Missile Propulsion
	75028		Charge Amplifier Circuit for Blast Gauges
	75088	Secrecy	Method and Apparatus for Fuel Injection and Controlled Fuel Distribution in A Combustion Device (U)
	75326		Thermally Initiated Venting System
	75673		Flame Extinguishing Pyrotechnic and Explosive Compositions
	75846		Passive Control of Compressible Mixing in High Speed Shear Flows Using Frequency Tunable Cavities
	76054		Method of Producing A Controlled Fragmentation
Weapons, Cruise Missiles (2 disclosures, 2 awards)	69084	Issued	Solid Fuel Ramjet Combustor
	71583	Secrecy	Optical Correlator for Terrain Identification (U)

TABLE 3.D.3. (contd.)

CSF	Disclosures	Awarded	Patent Titles (List)
Weapons, Bombs	73469		Improved Fuel Air Explosive, Hexyl Nitrate/Aluminum Mixture
Weapons, Guns and Ammunition	58224	Issued	Solution Monopropellant for Liquid Propellant Gun
	73640		Rifle, Pistol, Mortar, Barrel Environmental Protector
	73861	Issued	Combustion Instability Suppression in Regenerative Liquid Gun
	74867		Liquid Monopropellant for A Gun
Environmental Quality	75632		Method and Apparatus for the Active Control of A Compact Waste Incinerator
Advanced Materials	75863		Energetic Macromer Thermoplastic Elastomers As Binders for Explosives and Propellants
	75864		Macromer Thermoplastic Elastomers

Other indicators of success include products delivered to the Fleet and other weapons users, awards given to the scientist and engineers, and leadership positions held. Propellants and explosives incorporated into motors and warheads that are incorporated into missiles are described in Sections 3.B.2, 3.B.3, and 3.C. One example of the esteem in which China Lake is held by the users, is that China Lake has twice received the Fleet Ballistic Missile (Trident) flag for excellence in mission support.

Another key element for measuring the intellectual/skill capability of the personnel working in energetics is through awards received and leadership and active participation in national and international technical coordination groups. It is significant that members of the energetics team at China Lake have played an active role in the leadership of energetics S&T on numerous national and international level groups. This activity encompasses essentially all of the capability functions listed in Section 3 and includes personnel from all aspects of the research and development community at China Lake. In the following, a brief summary of past and current activities in leadership areas and major awards are presented.

National Leadership

JANNAF

The Joint Army NASA Air Force (JANNAF) Interagency Propulsion Committee is composed of representatives from the DOD, the military services, the National Aeronautics and Space Administration (NASA), the Department of Energy, and industry whose purpose is to promote and facilitate exchange of technical information; establish standards; effect coordination of research, exploratory development, and advanced development programs in the areas of missile, gun, and space propulsion; and accomplish problem solving in areas of joint interest.

China Lake personnel have played a pivotal role in JANNAF activities over the years as evidenced by the participation of 145 people in roles ranging from subcommitee to executive membership. This figure does not include the thousands of technical presentations contributed by China Lake personnel. The most important areas of participation include: air breathing propulsion, combustion, exhaust plume technology, propellant development and characterization, propulsion sytems hazards, rocket nozzle technology, safety and environmental protection and structures and mechanical behavior. The above participation is as follows:

JANNAF ACTIVITY	NUMBER OF PARTICIPANTS
Executive Committee Member	4
Meeting Chairman	27
Liaison	3
Award Recipient	8
Subcommittee Chairman	17
Technical Steering Group Member	121
Subcommittee Panel Chairman	146
Subcommittee Panel Member	525

American Institute of Aeronautics and Astronautics

The American Institute of Aeronautics and Astronautics is the largest professional society dealing with the title areas of technology for the aerospace industry. NAWCWPNS China Lake activities include:

-Membership and Chairman of Combustion and Propellants Technical Committee
-Membership on Solid Rocket Technical Committee
-Member of Editorial Advisory Board, Journal of Propulsion and Power

Integrated High Payoff Rocket Propulsion Technology (IHPRPT) -

IHPRPT is a technology initiative aimed at significantly increasing the United States investment and capability in rocket propulsion technology. Participants in the initiative are DDR&E, the three services, NASA and the U.S. rocket propulsion industry. The program is based on achieving quantified, time phased propulsion technology goals (e.g., 15% increase in delivered energy by 2010) which will provide significant payoff in military and commercial capability. NAWCWPNS personnel are extensively involved in IHPRPT, including membership on the Government Steering Committee and leadership of both the tactical applications group and the propellant technology area. IHPRPT has been briefed at high levels of government and, by industry, to congressional representatives with extremely favorable response. The Air Force has already received congressionally mandated funding increases to their propulsion technology program as a result of IHPRPT, and there are indications that the Navy and Army will receive similar increases.

-Navy Member, Government Steering Committee
-Lead, Tactical Applications Group
-Lead, Propellants Taxonomy Area

JDL/RELIANCE

Tri-Service Science and Technology Reliance is a set of formal agreements among and implemented by the military departments for joint planning, collocated in-house work or lead service assignment, which cover the bulk of non-service-unique portions of the Service 6.1, 6.2 and 6.3A programs. Responsibility for managing the Reliance implementation process was assigned to the Joint Directors of Laboratories (JDL). Participation by China Lake personnel in Reliance includes:

-Technology Panel for Conventional Air/Surface Weaponry
-Chairman, Missile Propulsion Sub Panel, 91-94

-Chairman, Fuzing/Safe Arm Sub Panel, 94-96
-Active participation in Conventional Gun and Explosives & Warheads Sub Panels

SERDP

The Strategic Environmental Research and Development Program (SERDP) was established to address environmental matters of concern to the DOD and the DOE through support for basic and applied research and development technologies that can enhance the capabilities of the departments to meet their environmental obligations.

-Co-Chair Processing Subtask of CAMPEP
-Member- New PEP Materials and Processes Committee

Other Pollution Prevention Activities

-Chairman-NAWCWPNS Weapon Pollution Prevention Working Group
-Designated NAVAIR Lead for Elimination of ODS from Weapon Systems
-Recipient of 1993 EPA Stratospheric Ozone Layer Protection Award

TCG

The Technology Coordination Group is a DOD tri-service body to oversee and coordinate activities of the Joint DOD/DOE Munitions Technology Development Program. This program was established to take advantage of DOE expertise in munitions technology to help the DOD to solve and/or better understand the issues relating to munitions problems and requirements. Principal technology areas have been subdivided into sections (e.g. TCG I) for which China Lake provides significant guidance.

-Member Technical Advisory Committee
-Leadership and active participation in Technical Coordinating Groups:
- -TCG I - Computational Mechanics and Material Modeling
- -TCG II - Lethality Enhancement
- -TCG III - Energetic Materials (Co-Lead)
- -TCG V -Vulnerability of Energetic Materials (Lead)
- -TCG IX - Demilitarization of Conventional Munitions
- -TCG X - Firing Systems (Lead)
- -TCG XI - Penetration Technology
- -TCG XIII - Sensors and Signal Processing (applies to TDDs)

Joint Service Large Solid Rocket Motor Disposal Group

The Joint Service Large Solid Rocket Motor Disposal Group coordinates the U.S. effort in determining the most effective course of action to take in demilitarization large solid rocket motors. NAWCWPNS China Lake provides the Navy representation on the SES Steering Committee.

Joint Technical Coordinating Group for Aircraft Survivability (JTCG/AS)

-Chairman Vulnerability Reduction Sub Group
-Chairman Fuel Systems Committee
-Chairman Propulsion Committee

International Leadership

NIMIC

NATO Insensitive Munitions Information Center (NIMIC) is a multinational information Center that was created to collect and analyze hazards/safety data on all aspects of munitions components and systems creating a unique NATO data base for Insensitive munitions. At present, Australia, Canada, France, Spain, The Netherlands, United Kingdom, and United States are active participants. Italy, Portugal, and Norway are planning to joining NIMIC in six months. China Lake activities include:

-Chairman of Steering Committee
-U.S. Principal Representative on Steering Committee
-U.S. Focal Point
-Session Co-Chair for Meeting on New Energetic Ingredients

AGARD

NATO Advisory Group for Aerospace Research and Development (AGARD) is an agency whose task is to foster and improve the interchange of information relating to aerospace research and development between the nations in order to ensure that the advances made by one nation are available to the others.

-Propulsion and Energetics Panel
  -U.S. Coordinator and Navy member
  -Chairman Rocket/Ramjet/Gun Standing Committee

NATO CNAD

Under the NATO the Conference for National Armament Group (CNAD) sponsors the Cadre Group AC/310, "Group on the Safety and Suitability for Explosive and Munitions." In recent years, a NAWCWPNS China Lake representative served as the U.S. Principal member for the Main Group.

DATA EXCHANGE AGREEMENT

Data Exchange Agreements (DEA) are primarily bi-lateral data exchanges providing the basis for collaboration between the two nations. Exchanges range from meetings between technical program officers to full technical meetings with active participation of S&E's involved with the technology being exchanged. The following listing of Data Exchange Annexes (DEA's) represents some of NAWCWPNS China Lake's principal areas of international cooperation for energetics.

-DEA N-94-Canada-4500, "Solid Rocket Propulsion Technology"
-DEA N-84-France-5660, "Combustion and Detonation Phenomena in Solid Rocket Motors"
-DEA N-84-The Netherlands-4822, "Combustion and Detonation Phenomena in rocket Motors"
-DEA N-94-Norway-5212, "Missile Technology"

AFSNR for Insensitive Munitions and High Explosives

The Air Force Senior National Representatives (AFSNR) for France, Germany, United Kingdom and the United States have established study programs in areas related to energetic materials. Personnel from NAWCWPNS China Lake, provide the US Navy representation for the (AFSNR) study group on minimum smoke propellants.

TTCP

The Technical Cooperation Program (TTCP) is a collaborative effort by the US, UK, Canada, Australia and New Zealand in combining resources and sharing tasks for the mutual benefit of the partner nations. A large number of technology areas are involved and the following represent principal activities by China Lake personnel:

-WTP-1, Terminal Effects
  -Active participation (focus/KTA officer)

-WTP-3, Fuze Technology
  -Active participation (focus/KTA officer)

-WTP-4, Energetic Materials and Propulsion Technology
  -U.S. National Leader and Chairman, 1991-1994
  -U.S. Navy Representative
  -Lead Focus Office for Airbreathing Propulsion
  -Lead Focus Officer for New Propellant Ingredients
  -Lead KTA-17 "Characterization of New Propellant Ingredients"
  -Participant KTA-12
  -Lead KTA-20 on Cookoff and Delayed Detonation
  -Materials and Hazard Assessment.

-WAG-11, The Hazards of Energetic Material and Their Relation to Munition Survivability
  -Co-chairman and Members
  -Hazard analysis protocols transitioned to NIMIC
  -Recently awarded Group W Recognition Award

AWARDS

Navy Meritorious Civilian Service Award 9

Navy Superior Civilian Service Award 3

JANNAF Award of Recognition 8

American Institute of Aeronautics and Astronautics - Associate Fellow 5

In addition to the above multiple awards, the following represents some of the other awards and distinctions held by the Energetic community at China Lake: AIAA Award, Arthur S. Flemming, Award for Excellence in Technology Transfer, Chemical Rubber Co Award, 1993 EPA Stratospheric Ozone Layer Protection Award, Equal Employment Opportunity (2), Federal Lab Consortium, Fulbright Scholar, G.E.Duvall Shock Science Award, Hispanic Engineer, John A. Ulrich Award, Robert Dexter Conrad Award Nominee(2), and TTCP Achievement Award.

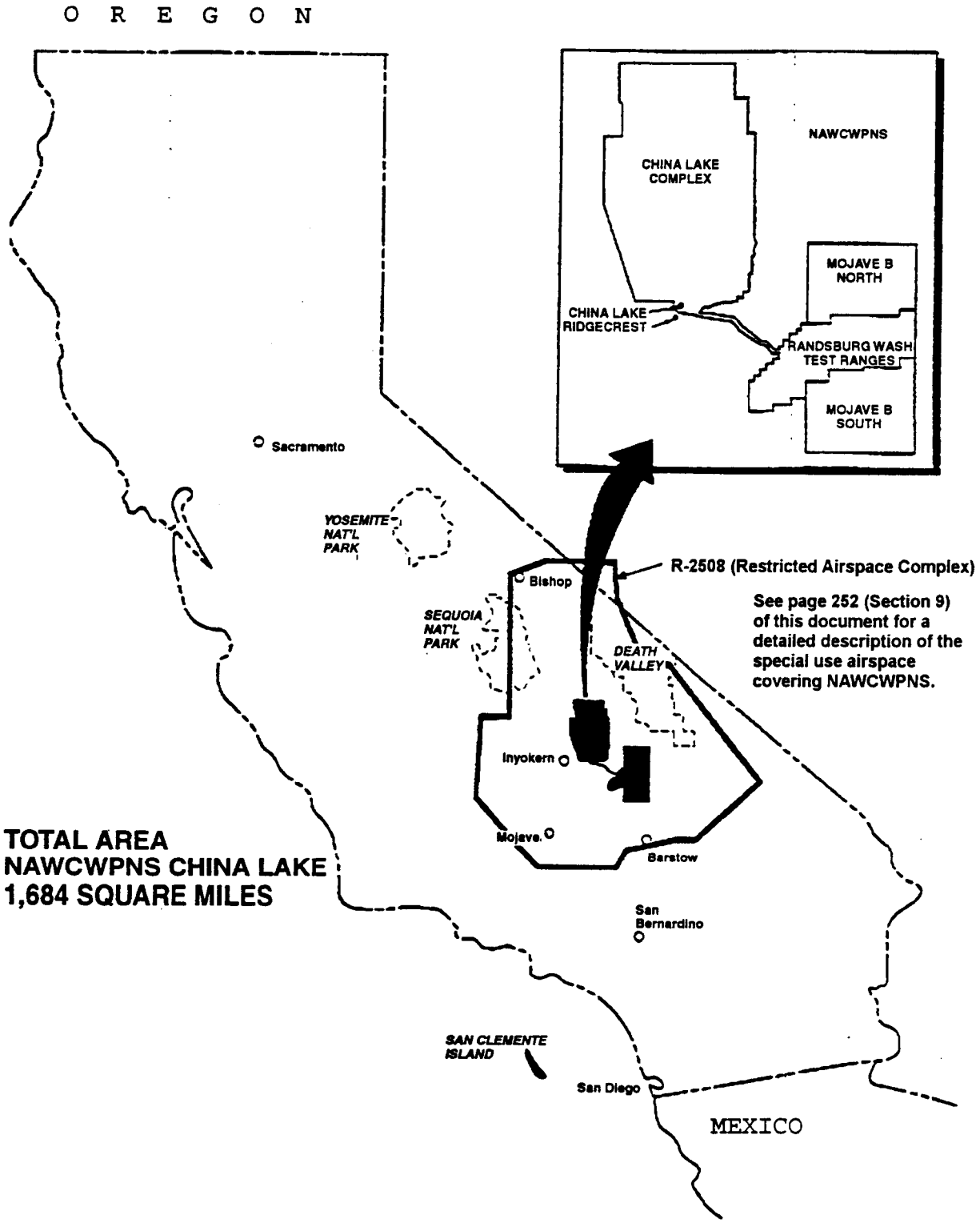
4. *Map of the installation to include elements listed in 2 and 3:*

a. *Annotate buildings to show location of each organizational element.*

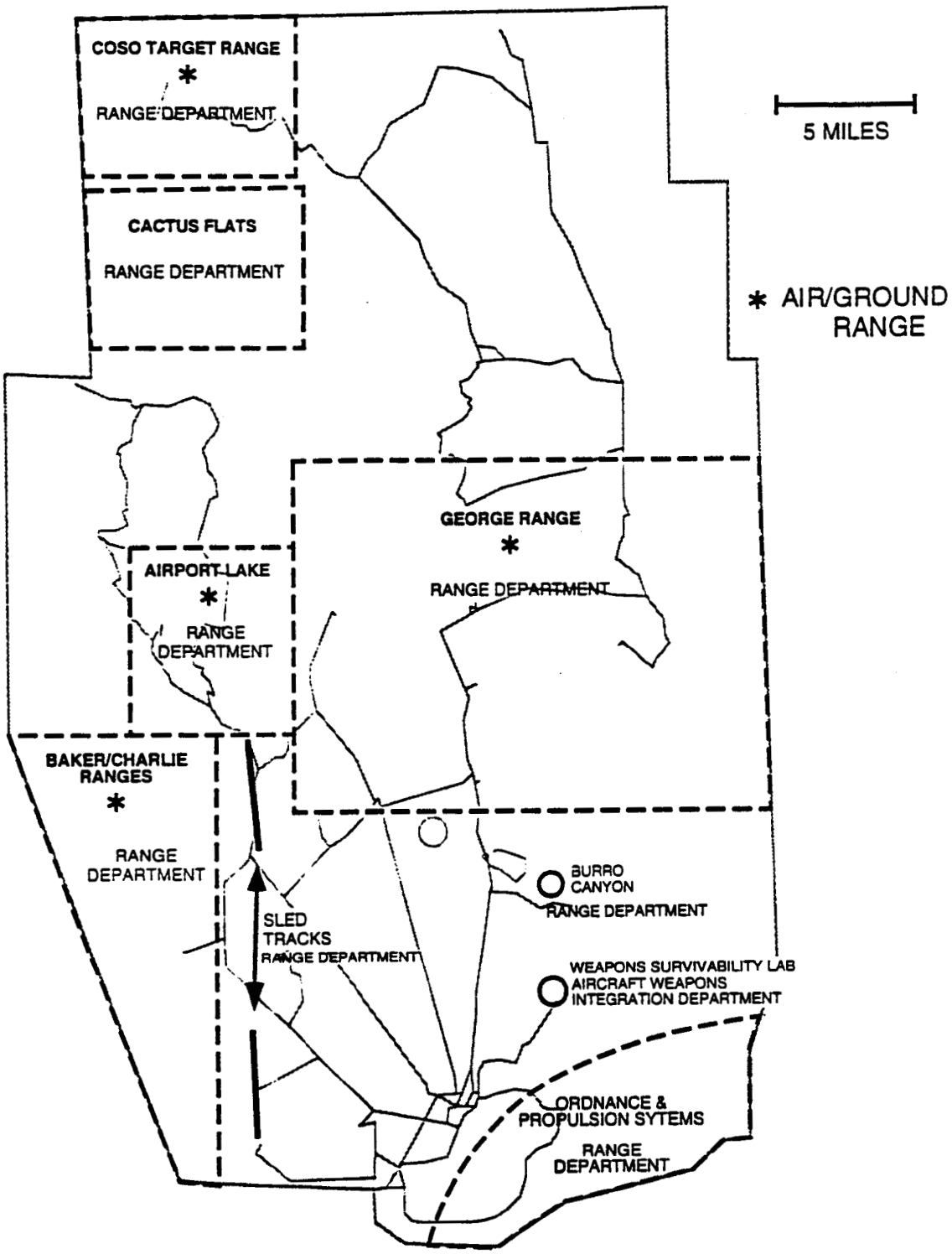
b. *Show buildings with equipment/facilities which would be difficult to move or replicate. List such equipment with initial cost. Provide an estimate of the replacement cost of the facilities.*

c. Summary of the Cost of NAWCWNS China Lake Energetics Complex.

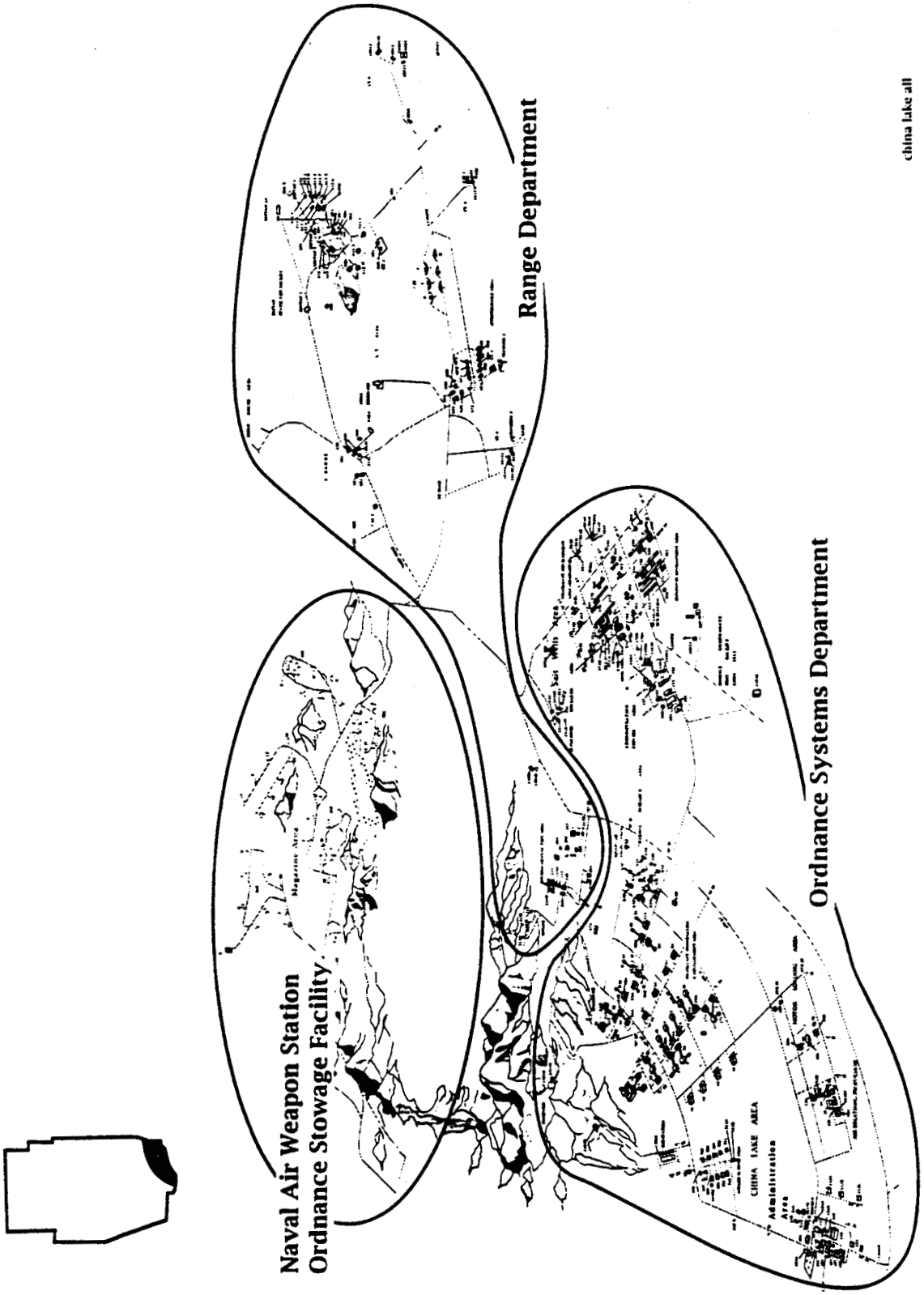
4.A. BUILDING LOCATIONS FOR EACH ORGANIZATIONAL ELEMENT



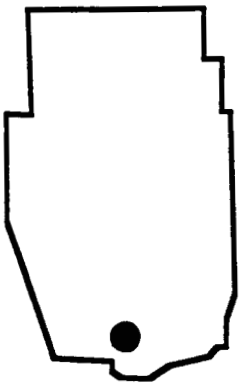
NAVAL AIR WARFARE CENTER WEAPONS DIVISION CHINA LAKE

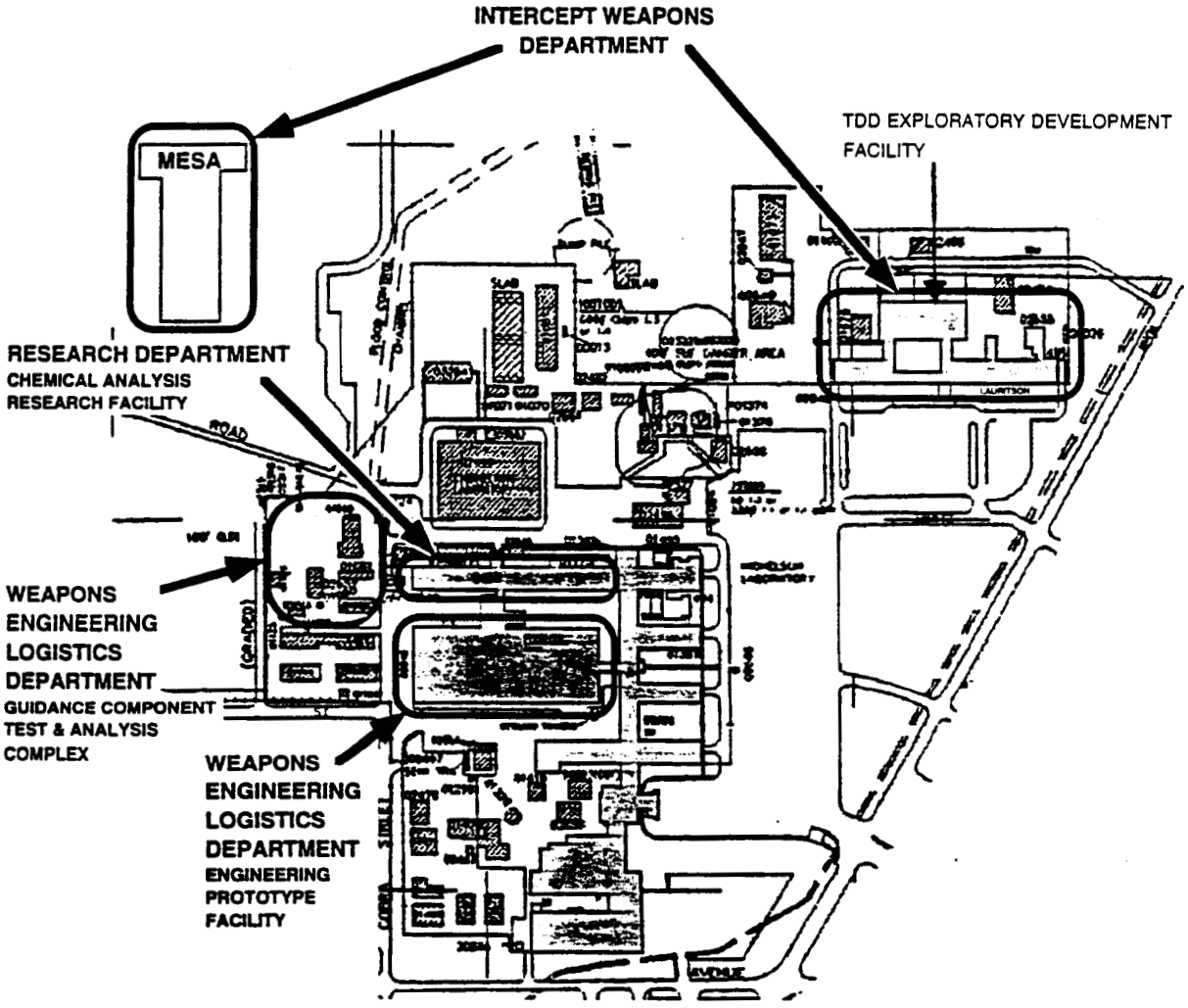


NAVAL AIR WARFARE CENTER WEAPONS DIVISION CHINA LAKE—NORTH RANGES



NAVAL AIR WARFARE CENTER WEAPONS DIVISION CHINA LAKE—
LOCATION OF MAIN ENERGETICS FACILITIES





NAVAL AIR WARFARE CENTER WEAPONS DIVISION CHINA LAKE—
MICHELSON LABORATORY COMPLEX

4.B. SCHEDULE OF BUILDING AND EQUIPMENT FACILITIES

SCHEDULE OF BUILDINGS AND EQUIPMENT/FACILITIES DIFFICULT TO MOVE OR REPLICATE (FACILITY LOCATIONS ON FOLLOWING MAPS)

BUILDINGS	BUILDING INITIAL COST	BUILDING REPLACEMENT COST	EQUIPMENT	EQUIPMENT INITIAL COST	EQUIPMENT REPLACEMENT COST
ACTUATOR AND POWER SYSTEMS LAB					
10050	$218K	$2,381K	Parylene Coater	$52K	$59K
			Glove Box	$25K	$28K
10051	$35K	$391K			
10690	$167K	$1,984K	Hydraulic Power Supply		$75K
			Environmental Chamber	$28K	$38K
10693	$18K	$199K			
11070	$64K	$703K			
11094	$166K	$173K			
AEROHEAT TEST FACILITY					
16020	$15K	DNA	Water Tank	$32K	40K
16059	$219K	$1,240K	Compressor	$400K	500K
			Nitrogen Converter	$240K	300K
16060	$1K	7.8K			
16061	$15K	85.2K	Data Acquisition	$560K	700K
16101	$36K	138K	Proton Accelerator	$2,400K	3,000K
16178	$99K	102K			
AIR/GROUND RANGE		*			
01317	$56K	DNA			
01327	$5K	DNA			
01399	$5K	DNA			
01490	$28K	DNA			
20004	$19K	DNA			
20150	$46K	DNA			
25025	$5K	DNA			
25062	$6K	DNA			
30007	$1K	DNA			
30065	$78K	DNA			
30066	$40K	DNA			
30068	$1K	DNA			
30069	$2K	DNA			
30070	$2K	DNA			
30087	$3K	DNA			
30120	$10K	DNA			
30124	$5K	DNA			
30138	$4K	DNA			
30140	$213K	DNA			
30140	$213K	DNA			
30147	$29K	DNA			
30161	$23K	DNA			
30163	$1K	DNA			
30165	$1K	DNA			
30166	$1K	DNA			
30167	$1K	DNA			
30168	$2K	DNA			
30170	$7K	DNA			
30171	$8K	DNA			
30172	$16K	DNA			

*DNA: Data not available

SCHEDULE OF BUILDINGS AND EQUIPMENT/FACILITIES DIFFICULT TO MOVE OR REPLICATE

BUILDINGS	BUILDING INITIAL COST	BUILDING REPLACEMENT COST	EQUIPMENT	EQUIPMENT INITIAL COST	EQUIPMENT REPLACEMENT COST
30173	$35K	DNA			
30220	$3K	DNA			
30221	$86K	DNA			
30224	$77K	DNA			
30227	$19K	DNA			
30228	$24K	DNA			
30420	$43K	DNA			
30421	$43K	DNA			
30426	$7K	DNA			
30427	$4K	DNA			
30433	$17K	DNA			
30434	$17K	DNA			
30435	$17K	DNA			
30436	$5K	DNA			
30437	$16K	DNA			
30438	$26K	DNA			
30443	$19K	DNA			
30702	$53K	DNA			
30713	$8K	DNA			
30715	$14K	DNA			
30729	$115K	DNA			
30745	$6K	DNA			
30752	$1K	DNA			
30753	$1K	DNA			
30790	$10K	DNA			
30791	$6K	DNA			
30792	$10K	DNA			
30793	$10K	DNA			
30794	$10K	DNA			
30795	$6K	DNA			
30796	$3K	DNA			
30797	$12K	DNA			
30798	$99K	DNA			
30799	$18K	DNA			
30800	$32K	DNA			
30801	$62K	DNA			
30804	$4K	DNA			
30827	$11K	DNA			
30828	$11K	DNA			
30829	$91K	DNA			
30831	$34K	DNA			
30832	$34K	DNA			
30833	$99K	DNA			
30840	$5K	DNA			
30855	$482K	DNA			
30863	$5K	DNA			
30866	$7K	DNA			
30879	$10K	DNA			
30881	$1,285K	DNA			
30882	$9K	DNA			
30885	$12K	DNA			
30886	$28K	DNA			
30888	$90K	DNA			
30889	$51K	DNA			
30892	$22K	DNA			
30893	$10K	DNA			
30895	$49K	DNA			
30898	$25K	DNA			
30918	$28K	DNA			
30929	$62K	DNA			
30932	$7K	DNA			
30954	$183K	DNA			
30955	$17K	DNA			
30958	$33K	DNA			

SCHEDULE OF BUILDINGS AND EQUIPMENT/FACILITIES DIFFICULT TO MOVE OR REPLICATE

BUILDINGS	BUILDING INITIAL COST	BUILDING REPLACEMENT COST	EQUIPMENT	EQUIPMENT INITIAL COST	EQUIPMENT REPLACEMENT COST
30959	$40K	DNA			
30960	$41K	DNA			
30964	$214K	DNA			
30965	$21K	DNA			
30966	$9K	DNA			
30967	$19K	DNA			
30968	$68K	DNA			
30973	$9K	DNA			
30974	$21K	DNA			
30986	$43K	DNA			
30991	$5K	DNA			
30992	$50K	DNA			
30995	$1K	DNA			
30997	$19K	DNA			
30998	$11K	DNA			
31065	$10K	DNA			
31076	$35K	DNA			
31100	$1K	DNA			
31110	$15K	DNA			
31125	$78K	DNA			
31152	$31K	DNA			
31155	$1K	DNA			
31162	$2K	DNA			
31453	$120K	DNA			
31454	$3,585K	DNA			
31455	$3,593K	DNA			
31456	$99K	DNA			
31457	$1,011K	DNA			
32022	$33K	DNA			
32025	$19K	DNA			
32026	$15K	DNA			
32027	$43K	DNA			
32028	$54K	DNA			
32034	$13K	DNA			
32035	$13K	DNA			
32036	$4K	DNA			
32037	$61K	DNA			
32038	$64K	DNA			
32042	$10K	DNA			
32044	$23K	DNA			
32045	$43K	DNA			
32046	$76K	DNA			
32513	$52K	DNA			
32515	$3K	DNA			
32531	$20K	DNA			
32532	$18K	DNA			
32533	$54K	DNA			
32534	$37K	DNA			
32535	$27K	DNA			
32536	$42K	DNA			
32537	$53K	DNA			
32538	$62K	DNA			
32539	$42K	DNA			
32540	$43K	DNA			
32541	$31K	DNA			
32544	$460K	DNA			
32544	$460K	DNA			
32544	$460K	DNA			
32545	$47K	DNA			
32546	$6K	DNA			
32547	$43K	DNA			
32548	$43K	DNA			
32549	$43K	DNA			
32550	$43K	DNA			

SCHEDULE OF BUILDINGS AND EQUIPMENT/FACILITIES DIFFICULT TO MOVE OR REPLICATE

BUILDINGS	BUILDING INITIAL COST	BUILDING REPLACEMENT COST	EQUIPMENT	EQUIPMENT INITIAL COST	EQUIPMENT REPLACEMENT COST
32552	$10K	DNA			
32553	$10K	DNA			
32556	$171K	DNA			
32557	$198K	DNA			
32558	$143K	DNA			
32608	$12K	DNA			
32609	$25K	DNA			
32610	$57K	DNA			
32993	$2K	DNA			
32994	$2K	DNA			
32996	$1K	DNA			
33012	$5K	DNA			
33020	$22K	DNA			
33021	$5K	DNA			
33022	$5K	DNA			
33023	$2K	DNA			
33030	$3K	DNA			
33031	$2K	DNA			
33032	$5K	DNA			
33033	$5K	DNA			
33040	$5K	DNA			
33050	$10K	DNA			
33051	$5K	DNA			
33052	$5K	DNA			
33053	$5K	DNA			
33054	$2K	DNA			
50130	$22K	DNA			
50134	$10K	DNA			
50140	$352K	DNA			
70020	$3K	DNA			
70021	$261K	DNA			
70022	$261K	DNA			
70024	$9K	DNA			
70025	$12K	DNA			
70026	$13K	DNA			
70027	$8K	DNA			
70028	$8K	DNA			
70029	$8K	DNA			
70030	$14K	DNA			
70031	$224K	DNA			
70033	$112K	DNA			
70038	$8K	DNA			
70039	$8K	DNA			
70040	$45K	DNA			
70045	$4K	DNA			
70046	$16K	DNA			
70047	$4K	DNA			
70050	$4K	DNA			
70051	$8K	DNA			
70052	$8K	DNA			
70053	$8K	DNA			
70059	$42K	DNA			
91018	$5K	DNA			
92046	$8K	DNA			
AIRBREATHING PROPULSION LAB					
10180	$114K	$1,243K	Fixed facility equipment	DNA	$4,197K
10181	$43K	$1,057K			
10120	$76K	$829K			
10121	$17K	$183K			
10140	$151K	$1,648K			
10150	$201K	$2,192K			
10160	$97K	$1,057K			

SCHEDULE OF BUILDINGS AND EQUIPMENT/FACILITIES DIFFICULT TO MOVE OR REPLICATE

BUILDINGS	BUILDING INITIAL COST	BUILDING REPLACEMENT COST	EQUIPMENT	EQUIPMENT INITIAL COST	EQUIPMENT REPLACEMENT COST
ANTIRADIATION MISSILE INTEGRATION COMPLEX					
31405	$60K	DNA	Large Overhead Crane	DNA	$10K
31411	$90K	$200K			
31418	$197K	$2,000K	Large Anechoic Chamber	DNA	$550K
			Small Anechoic Chamber	DNA	$420K
			Overhead cranes	DNA	$30K
31433	$659K	$1,000K	Special Raised Flooring	DNA	$450K
			400 Hz Power	DNA	$50K
31462	$182K	$500K	Anechoic Chamber	DNA	$420K
			Special Raised Flooring	DNA	$200K
			400 Hz Power	DNA	$50K
31482	DNA	$20K			
C27 EXPLOSIVE AND ORDNANCE MODELING					
VARIOUS			Networked workstations for Ordnance modeling	$259K	$285K
CACTUS FLATS ORDNANCE TEST AREA					
15 sq. miles test area					
CHEMICAL ANALYSIS RESEARCH FACILITY					
00005			X-ray	600 K	850 K
			NMR	925 K	1350K
			Infrared	925 K	1100 K
			MassSpec/Chromatography	1025 K	1500 K
			Polymer Testing	350 K	450 K
			Thermal Analysis	275 K	350 K
			AA, FIA, ICP, IC	450 K	600 K
			10 lab units	500 K	700 K
01124	DNA	DNA	Solvent Shed	108 K	108 K
02646	DNA	DNA	Chemicals Stockroom	563 K	563 K
92047	DNA	DNA	Refridgerated storage	11 K	DNA
			Glass shop facility	42 K	42 K
			Rm 160 storage	30 K	30 K
CHINA LAKE ORDNANCE AND PROPULSION PILOT PLANT					
11510	$265K	$2,488K			
10530	$288K	$3,145K	15-inch Press	$111K	$2,648K
13010	$115K	$1,077K	Control Room	$12K	$55K
			1" Extrusion Press	DNA	DNA
			3" Extrusion Press	DNA	DNA
15521	$142K	$1,337K	1 Mill	$9K	$176K
			1 Saw	$64K	$189K
15522	$214K	$3,013K	1 Lathe	$21K	$294K
			1 Drill	$7K	$126K
15523	$146K	$1,368K	1 Lathe	$17K	$306K
15530	$301K	$3,293K	300-Ton Press	$182K	$920K
			Production Injection Loader	$168K	$850K
			20-Ton & 50-Ton Press	$38K	$190K
15534	$73K	$80K			
15544	$36K	$384K			
15550	$484K	$5,291K	Ovens	$16K	$82K
15554	$19K	$211K	Small Press	$49K	$250K
			Lab Injection Loader	$39K	$200K
			2 Tablet presses		
			16" Isostatic press		
15590	$391K	$2,824K	Oven	$3K	$35K
			3 Melt pots	$180K	DNA
15594	$31K	$31K	2 40-Gallon Slurry Kettles	$138K	$700K
			2 Portable Slurry Kettles	$12K	$120K

SCHEDULE OF BUILDINGS AND EQUIPMENT/FACILITIES DIFFICULT TO MOVE OR REPLICATE

BUILDINGS	BUILDING INITIAL COST	BUILDING REPLACEMENT COST	EQUIPMENT	EQUIPMENT INITIAL COST	EQUIPMENT REPLACEMENT COST
15596	$15K	$16K			
15720	DNA	DNA	Casting bell oven	$30K	DNA
15707	$18K	$18K	2 Walk-in Ovens	$66K	$335K
15724	$268K	$2,092K			
15730	$761K	$4,695K	Fluid Energy Mill	$210K	DNA
			Micropulverizer	DNA	
			Ovens	$100K	DNA
			2 Twin-shell blenders	DNA	
			2 1-Gal Mixers	$300K	DNA
			Cowles Dissolver	DNA	DNA
			50-liter Rotary Evaporator	DNA	DNA
			Lab-Scale Rotary Evaporator	DNA	DNA
15741	$475K	$5,186K	1- & 5-gallon Mixers	$21K	$640K
15742	$179K	$1,951K	25-Gallon Mixer	$37K	$950K
15743	$171K	$1,872K	30-Gallon Mixer	$198K	$1,000K
15744	$161K	$1,759K	Walk-in Oven	$165K	DNA
15750	$54K	$4,048K	Oven with Spin table	$30K	DNA
			Oven for Freon recovery	$30K	DNA
15754	$54K	$293K	SWECO Grinder	$42K	$340K
15760	$139K	$1,204K	50-Gallon mixer	$341K	$1,800K
10570	$345K	$3,768K	Lathe	$5K	$145K
10571	$14K	$152K	2 Medium Lathes	$57K	$290K
			Large Lathe	$32K	DNA
			2 Mills	$18K	$290K
			2 Drill Presses	$6K	$50K
15810	$87K	$376K	2 Lathes	$85K	$480K
15811	$88K	$383K	1 Mill	$26K	$260K
15813	$87K	$376K	150-Gal Mixer & Support Equip	$83K	$1,550K
15812	$25K	$83K			
15814	$15K	$64K			
15815	$56K	$241K			
15816	$163K	$809K			
15818	$2K	$6K			
15819	$2K	$6K			
15980	$249K	$1,721K	Fluid Energy Mill	$42K	$210K
			Raymond Mill & Support Eqpt.	$23K	$117K
15981	$2K	$8K			
15982	$67K	$67K			
10510	$1,050K	$11,578K			
10562	$48K	$293K			
10610	$55K	$597K			
10040	$69K	$759K			
10041	$38K	$414K			
10550	$82K	$899K			
10551	$30K	$331K			
11010	$238K	$2,454K			
11020	$102K	$1,118K			
11030	$206K	$2,254K			
11040	$69K	$754K			
11070	$64K	$703K			
COMPOSITES DEVELOPMENT LAB					
10690	$167K	$1,984K	720 Ton Press	$89K	$600K
00005			320-Ton Press	$250K	DNA
			125-ton Press	$98K	DNA
			50-Ton Press	$50K	DNA
			70-Ton Arbor Press	$18K	DNA
			10-ton Arbor Press	$10K	DNA
			2 Freezers	$100K	DNA
			4 Ovens	$105K	DNA
			Autoclave	$450K	DNA
			2 Lathes	$200K	DNA
			High Performance Autoclaves	DNA	DNA

SCHEDULE OF BUILDINGS AND EQUIPMENT/FACILITIES DIFFICULT TO MOVE OR REPLICATE

BUILDINGS	BUILDING INITIAL COST	BUILDING REPLACEMENT COST	EQUIPMENT	EQUIPMENT INITIAL COST	EQUIPMENT REPLACEMENT COST
			High Pressure/Temp Presses	DNA	DNA
			6-axis Computer-controlled filament winder	DNA	DNA
			Tape wrap machines	DNA	DNA
			Ovens	DNA	DNA
			Vacuum chambers	DNA	DNA
			Freezers	DNA	DNA
			Mechanical Test Equipment	DNA	DNA
			NDT Equipment	DNA	DNA
			Layup Tables	DNA	DNA
			Mandrel Tooling	DNA	DNA
			Unique Design Tools	DNA	DNA
DETONATION PHYSICS LAB					
12520	$101K	$948K			
12540	$60K	$355K			
16032	$6K	$40K			
12510	$186K	$1,751K			
12511	$1K	$4K			
12512	$14K	$71K			
12514	$29K	$38K			
DEVELOPMENT PROJECTS LABORATORY					
10600	$204K	$2,228K			
10601	$26K	$280K			
10602	$2K	$10K			
11031	$198K	$219K	SKIFF	$100K	$109K
ENERGETIC MATERIALS PROPERTIES ANALYSIS LAB					
10630	$248K	$1,775K			
10636	$7K	$34K			
10637	$3K	$11K			
15560	$465K	$3,185K	Analytical/QA Lab Equipment	$254K	$1,287K
15564	$33K	$364K			
10651	$2K	$8K			
10652	$2K	$10K			
10653	$14K	$70K			
10654	$13K	$64K			
10655	$2K	$10K			
ENERGETIC MATERIALS SYNTHESIS AND SCALE-UP LAB					
15510	$368K	$3,461K			
15514	$60K	$657K			
15700	$157K	$1,471K	1 Pint Mixer	$42K	$210K
			Labs	$36K	$180K
			3 ovens	$27K	$135K
15702	$98K	$168K	Glass Reactor	$101K	$510K
15524	$147K	$1,384K	25-Gal Slurry Kettle	DNA	$60K
ENGINEERING PROTOTYPE FACILITY					
00005	$18,932K	DNA	Scrubber Power	$7K	DNA
			Sweeper Power	$16K	DNA
			Lathe	$26K	DNA
			Lathe	$26K	DNA
			Cut-off Machine	$38K	DNA
			Welder	$16K	DNA
			Bending Machine	$26K	DNA
			Disk Drive	$5K	DNA
			Disk Drive	$5K	DNA

SCHEDULE OF BUILDINGS AND EQUIPMENT/FACILITIES DIFFICULT TO MOVE OR REPLICATE

BUILDINGS	BUILDING INITIAL COST	BUILDING REPLACEMENT COST	EQUIPMENT	EQUIPMENT INITIAL COST	EQUIPMENT REPLACEMENT COST
			Oscilloscope	$13K	DNA
			Measuring Machine	$432K	DNA
			Microscope Zoom	$7K	DNA
			Comparator Projector	$125K	DNA
			Measuring Vertical	$12K	DNA
			Contracer	$10K	DNA
			Control Unit	$21K	DNA
			Finishing Machine	$7K	DNA
			Grinding Machine	$67K	DNA
			Lathe	$26K	DNA
			Index Spanner	$7K	DNA
			Furnace HT TAP	$49K	DNA
			Welding Machine	$6K	DNA
			Oil Quench Cool	$6K	DNA
			Furnace HT TR B	$53K	DNA
			Furnace HT TR B	$20K	DNA
			Washer Load	$37K	DNA
			Pacecar Unidire	$27K	DNA
			Machine Magniti	$19K	DNA
			Welder	$327K	DNA
			X-ray Imaging System	$413K	DNA
			Computer	$13K	DNA
			Plating Unit	$9K	DNA
			Bench Grinding	$9K	DNA
			Ultrasonic Inspection	$401K	DNA
			Imaging Realtime	$6K	DNA
			Fabrication Center	$209K	DNA
			Bending Machine	$8K	DNA
			Mill Vertical	$10K	DNA
			Digital Preset	$16K	DNA
			Lathe Universal	$250K	DNA
			Lathe Bar/Chuck	$121K	DNA
			Milling Machine	$69K	DNA
			5 Axis Machine	$486K	DNA
			Computer	$5K	DNA
			Computer	$5K	DNA
			Printer	$11K	DNA
			Computer	$36K	DNA
			Computer	$36K	DNA
			Tape Drive	$12K	DNA
			Computer	$10K	DNA
			Computer	$5K	DNA
			Computer	$8K	DNA
			Workstation GRA	$23K	DNA
			Workstation GRA	$23K	DNA
			Cutting Equipment	$563K	DNA
			Welding Machine Arc	$306K	DNA
			Rotary Table	$18K	DNA
			General Function	$5K	DNA
			Chamber Environment	$39K	DNA
			X-R Recorder	$4K	DNA
			Boring Heads	$2K	DNA
			Machining Center Hor	$302K	DNA
			Lathe Chucking Hor	$156K	DNA
			Machining Hor	$319K	DNA
			Lathe Chucking Hor	$181K	DNA
			Boring Heads	$2K	DNA
			Terminals & Monitors	$8K	DNA

SCHEDULE OF BUILDINGS AND EQUIPMENT/FACILITIES DIFFICULT TO MOVE OR REPLICATE

BUILDINGS	BUILDING INITIAL COST	BUILDING REPLACEMENT COST	EQUIPMENT	EQUIPMENT INITIAL COST	EQUIPMENT REPLACEMENT COST
ENVIRONMENTAL TEST COMPLEX					
10635	$15K	$35K	Environmental Ovens	$72K	$90K
12030	$7K	$71K	Ejection Shock	$36K	$45K
12100	$122K	$1,205K	Environmental Ovens	$80K	$100K
12140	$294K	$2,900K	Vibration Unit	$200K	$250K
12150	$19K	$184K	Vibration Unit	$200K	$250K
12160	$33K	$277K	Vibration Control	$280K	$350K
12170	$231K	$2,285K	Vibration Unit	$200K	$250K
15954	$56K	$218K	Environmental Test Chambers	$450K	$500K
16000	$5K	$20K	Camera Station	$16K	$20K
16007	$6K	$55K			
16039	$1K	$2K			
16011	$8K	$82K	Data Acquisition/Control Room	$304K	$380K
16012	$5K	$53K	Data Transmission	$144K	$180K
16016	$3K	$25K	Data Transmission	$144K	$180K
16022	$4K	$22K	Camera	$16K	$20K
16046	$1K	$2K			
16109	$255K	$301K	Hoist	$12K	$15K
16166	$81K	$90K	Fuel Tank	$14K	$18K
FUZE S-A DEVELOPMENT LAB					
10095	$10K	$119K			
11530	$535K	$3,545K	Monterey Shock Machine	$102K	$516K
			Centrifuge	$175K	$886K
10060	$141K	$1,546K			
10061	$30K	$327K			
10070	$92K	$1,001K			
10071	$34K	$371K			
10090	$229K	$2,505K			
10091	$47K	$509K			
10100	$165K	$1,167K			
10101	$42K	$459K			
11620	$193K	$1,236K			
GUIDANCE COMPONENTS TEST AND ANALYSIS COMPLEX					
16132	$104K	$137K	Data Acquistion/Control		$900K
16144	$18K	$277K	Termination Vertical Test Stand		DNA
16152	$15K	$32K	Horizontal Test Pad		DNA
16153	$15K	$32K	Horizontal Test Pad		DNA
16146	$8K	$16K	Camera		$20K
16147	$8K	$16K	Camera		$20K
16154	$8K	$16K	Camera		$20K
None	$2,000K	$3,000K	Confined Burn Chamber		
01678	$35K	$50K			
01680	$166K	$373K	Computerized Test System	$61K	$123K
HIGH HAZARD PROPULSION TEST FACILITY					
16132	$104K	$137K	Data Acquisition/Control	$720K	$900K
16144	$18K	$277K			
16152	$15K	$32K			
16153	$15K	$32K			
16146	$8K	$16K	Camera	$16K	$20K
16147	$8K	$16K	Camera	$16K	$20K
16154	$8K	$16K	Camera	$16K	$20K
LARGE ROCKET MOTOR DISPOSAL FACILITY					
98038	$2,000K	3,000K	Main Firing Chamber	$1,000K	$1,000K
			Diesel Water Pump	$100K	$100K
			48-in firing chamber	$125K	$150K
			36-in firing chamber	$50K	$75K
			Mass Spectrometer	$150K	$150K

SCHEDULE OF BUILDINGS AND EQUIPMENT/FACILITIES DIFFICULT TO MOVE OR REPLICATE

BUILDINGS	BUILDING INITIAL COST	BUILDING REPLACEMENT COST	EQUIPMENT	EQUIPMENT INITIAL COST	EQUIPMENT REPLACEMENT COST
			IR Spectrometer	$60K	$60K
			Residual Gas Analyzer	$100K	$120K
			Computer controls	$50K	$50K
			Transformer	$60K	$60K
			Gas mixing system	$70K	$80K
			Large air compressor	$4K	$4K
			Firing Circuit	$3K	$3K
			Video equipment	$7K	$7K
MATERIALS ENGINEERING/FAILURE ANALYSIS FACILITY					
02466	DNA	DNA	Environmental SEM with X-ray	$650K	$700K
			Amray SEM with X-ray	$250K	$325K
			E-Tech SEM	$150K	$200K
			Auger spectrometer	$500K	$800K
			Atomic absorption ICP	$150K	$200K
			Acoustic emission	$25K	$30K
			Vacuum furnace	$80K	$100K
			Metallograph	$80K	$110K
			Dilatometer	$20K	$25K
			Permeometer	$20K	$25K
			Carbon-sulfur analyzer	$40K	$50K
			Instron mechanical tester	$30K	$50K
			Instron servo-mechanical tester	$100K	$150K
			FTIR specrophotometer w/ microscope	$80K	$100K
			Thermal analyzer	$60K	$80K
			High performance liquid chromatograph	$50K	$60K
			Autoclave (1)	$350K	$400K
			Filament winder (1)	$40K	$50K
			Heated lay-up table (1)	$25K	$30K
			Torit dust booth (1)	$25K	$30K
			Hydraulic heated press (1)	$60K	$70K
			Pneumatic heated press (1)	$125K	$150K
			Water jet cutter (1)	$220K	$250K
			Temperature cycling chamber	$30K	$50K
			Temperature humidity chamber	$75K	$150K
			Residual gas analyzer	$20K	$30K
			Leak detector (2)	$40K	$50K
			Ion chromatograph	$40K	$50K
			X-ray radiography	$75K	$100K
			Sirometer	$75K	$150K
			Optical microscopes	$35K	$50K
			Ovens	$50K	$75K
			Hardness testers (2)	$50K	$60K
			Accoustic emission apparatus	$50K	$80K
			Misc. equip for electronics and metal analysis	$150K	$200K
MEDIUM-CALIBER GUN AND AMMO BALLISTICS TEST LAB					
11100	$113K	$1,171K			
10520	$159K	$1,737K			
10521	$36K	$393K			
10522	$36K	$393K			
11091	$163K	$173K			

SCHEDULE OF BUILDINGS AND EQUIPMENT/FACILITIES DIFFICULT TO MOVE OR REPLICATE

BUILDINGS	BUILDING INITIAL COST	BUILDING REPLACEMENT COST	EQUIPMENT	EQUIPMENT INITIAL COST	EQUIPMENT REPLACEMENT COST
MISSILE/ROCKET MOTOR ASSEMBLY FACILITY					
10690	$167K	$1,984K	Explosive Hoists		$30K
			Mass Properties Table	$150K	$200K
			Uninterruptable Power Supply	$20K	$20K
10691	$42K	$458K			
0692	$25K	$273K			
15950	$470K	$2,940K	Spray Liner	$16K	$100K
			Sling Liner	$39K	$197K
			Walk-in Oven w/spin tables	$20K	$100K
			2 Small Ovens	$6K	$60K
			2 Lathes	$11K	$100K
			10-Gallon Blend Pot	$2K	$75K
			"Dunk It" facility	$50K	$255K
			Roll Mill	$36K	DNA
			Drill Press	$24K	DNA
			2 Vacuum Systems	DNA	DNA
			Grinder	DNA	DNA
			Solvent Clean room	DNA	DNA
			Mandrell puller	$25K	DNA
			3-ton Hoist	$42K	DNA
			Grit Blaster	$60K	DNA
			Paint Booth	$18K	DNA
			Heavy Scale	$8K	DNA
			Hydraulic Press	$30K	DNA
			Vapor Degreaser	$70K	DNA
NON-DESTRUCTIVE ORDNANCE TEST FACILITY					
15794	$23K	$227K			
15790	$295K	$2,916K	250KVA X-ray	$320K	$400K
15800	$343K	$1,942K	25MEV Betatron	$1,120K	$1,400K
15804	$38K	$213K	I200 Varian	$480K	$600K
15988	$3,888K	$4,215K	L600 Linatron	DNA	DNA
15987	$118K	$125K		$8K	$10,000K
ORDNANCE AND PROPULSION FME LAB					
10170	$145K	$1,581K			
10171	$38K	$413K			
10172	$34K	$375K			
10173	$13K	$137K			
10200	$163K	$1,781K			
10201	$37K	$401K			
11050	$118K	$1,293K			
11093	$169K	$176K			
11110	$103K	$1,123K			
11150	$322K	$3,521K			
ORDNANCE AND PROPULSION PLANT SUPPORT SHOPS					
11550	$93K	$872K			
11580	$332K	$1,998K			
11680	$154K	$963K			
11690	$115K	$719K			
14540	$39K	$423K			
14550	$26K	$279K			
ORDNANCE ASSEMBLY FACILITY					
20220	$184K	$269K	Explosive Crane	$10K	$12K
20234	$156K	$169K			

SCHEDULE OF BUILDINGS AND EQUIPMENT/FACILITIES DIFFICULT TO MOVE OR REPLICATE

BUILDINGS	BUILDING INITIAL COST	BUILDING REPLACEMENT COST	EQUIPMENT	EQUIPMENT INITIAL COST	EQUIPMENT REPLACEMENT COST
ORDNANCE BREAKDOWN FACILITY					
31616	$336K	$1,043K	Controller	$25K	$29K
30994	$204K	$1,260K			
31617	$1,066K	$1,249K	Remote Breakdown Equipment	$438K	$513K
ORDNANCE PACKAGING FACILITY					
31053	$140K	$192K	Drill Press	$2K	$2K
			2 Table saws	$4K	$4K
			Band Saw	$2K	$2K
			Hoist	$2K	$2K
31060	$177K	$183K			
31064	$183K	$183K			
ORDNANCE STOWAGE FACILITY					
02311	$5K	$7K			
02315	$2K	$9K			
02316	$2K	$9K			
02317	$2K	$9K			
02322	$5K	$10K			
02323	$5K	$10K			
02324	$5K	$10K			
03263	$8K	$14K			
10011	$39K	$428K			
10012	$35K	$380K			
10031	$42K	$456K			
10032	$40K	$432K			
10041	$38K	$414K			
10051	$36K	$391K			
10052	$3K	$9K			
10053	$9K	$15K			
10061	$30K	$327K			
10071	$34K	$371K			
10080	$1K	$7K			
10081	$1K	$7K			
10082	$1K	$7K			
10083	$1K	$7K			
10084	$5K	$11K			
10085	$5K	$11K			
10086	$5K	$11K			
10087	$5K	$11K			
10088	$5K	$11K			
10091	$46K	$509K			
10171	$38K	$416K			
10174	$9K	$14K			
10201	$37K	$401K			
10203	$1K	$7K			
10204	$1K	$7K			
10410	$92K	$1,002K			
10420	$94K	$1,025K			
10430	$73K	$795K			
10440	$68K	$747K			
10525	$5K	$10K			
10526	$3K	$9K			
10528	$3K	$9K			
10529	$5K	$11K			
10541	$38K	$412K			
10542	$28K	$310K			
10551	$30K	$331K			
10561	$27K	$292K			
10563	$7K	$11K			
10564	$6K	$10K			
10565	$4K	$9K			
10566	$4K	$9K			
10571	$14K	$152K			

SCHEDULE OF BUILDINGS AND EQUIPMENT/FACILITIES DIFFICULT TO MOVE OR REPLICATE

BUILDINGS	BUILDING INITIAL COST	BUILDING REPLACEMENT COST	EQUIPMENT	EQUIPMENT INITIAL COST	EQUIPMENT REPLACEMENT COST
10581	$26K	$286K			
10582	$1K	$7K			
10584	$2K	$7K			
10601	$26K	$280K			
10611	$28K	$310K			
10623	$2K	$15K			
10624	$2K	$15K			
10641	$27K	$292K			
10644	$10K	$10K			
10645	$10K	$10K			
10646	$10K	$10K			
10647	$2K	$7K			
10648	$2K	$7K			
10649	$2K	$7K			
10656	$4K	$9K			
10680	$1K	$6K			
10681	$1K	$6K			
10682	$1K	$6K			
10686	$1K	$6K			
10700	$10K	$109K			
10810	$62K	$681K			
10820	$62K	$672K			
10830	$62K	$674K			
10840	$64K	$704K			
10972	$5K	$16K			
10978	$60K	$276K			
12010	$24K	$262K			
12020	$24K	$262K			
12528	$2K	$7K			
12530	$16K	$153K			
12535	$2K	$7K			
12536	$2K	$7K			
12537	$2K	$7K			
12538	$2K	$7K			
12539	$2K	$7K			
12542	$6K	$11K			
13011	$4K	$27K			
13012	$4K	$27K			
13013	$4K	$27K			
13014	$4K	$27K			
13020	$13K	$146K			
13050	$13K	$144K			
13101	$1K	$7K			
13102	$6K	$12K			
15562	$3K	$7K			
15563	$3K	$7K			
15565	$2K	$7K			
15567	$1K	$7K			
15568	$1K	$7K			
15569	$1K	$7K			
15570	$1K	$7K			
15573	$2K	$7K			
15574	$1K	$7K			
15604	$94K	$679K			
15605	$1K	$10K			
15606	$1K	$10K			
15607	$1K	$10K			
15701	$16K	$147K			
15709	$1K	$7K			
15710	$3K	$8K			
15711	$3K	$8K			
15712	$3K	$8K			
15713	$5K	$11K			
15714	$5K	$11K			
15764	$36K	$335K			

SCHEDULE OF BUILDINGS AND EQUIPMENT/FACILITIES DIFFICULT TO MOVE OR REPLICATE

BUILDINGS	BUILDING INITIAL COST	BUILDING REPLACEMENT COST	EQUIPMENT	EQUIPMENT INITIAL COST	EQUIPMENT REPLACEMENT COST
15794	$23K	$251K			
15804	$38K	$235K			
15910	$75K	$705K			
15920	$76K	$713K			
15930	$82K	$594K			
15940	$84K	$602K			
15970	$101K	$698K			
15999	$6K	$11K			
16013	$15K	$164K			
16014	$15K	$164K			
16015	$15K	$164K			
16027	$18K	$122K			
16028	$18K	$122K			
16029	$18K	$122K			
16051	$14K	$109K			
16113	$22K	$91K			
16183	$2K	$7K			
16184	$2K	$7K			
16185	$2K	$7K			
16186	$1K	$7K			
16187	$1K	$7K			
16188	$1K	$7K			
20044	$32K	$385K			
20045	$18K	$209K			
20046	$16K	$187K			
20142	$9K	$53K			
20143	$8K	$50K			
20144	$9K	$53K			
20226	$172K	$202K			
20248	$1K	$7K			
20249	$1K	$10K			
20250	$1K	$10K			
20251	$1K	$13K			
20252	$1K	$13K			
20260	$10K	$15K			
20261	$10K	$15K			
20270	$2K	$7K			
25006	$15K	$92K			
30973	$9K	$53K			
31000	$39K	$187K			
31001	$100K	$1,185K			
31002	$100K	$1,185K			
31003	$100K	$1,185K			
31004	$100K	$1,185K			
31005	$100K	$ 1,185K			
31006	$100K	$ 1,185K			
31007	$100K	$ 1,185K			
31008	$100K	$ 1,185K			
31009	$100K	$ 1,185K			
31010	$100K	$ 1,185K			
31011	$105K	$ 1,182K			
31012	$105K	$ 1,182K			
31013	$110K	$ 1,246K			
31014	$103K	$ 1,164K			
31015	$105K	$ 1,182K			
31016	$105K	$ 1,182K			
31017	$100K	$ 1,175K			
31018	$97K	$ 1,148K			
31019	$99K	$ 929K			
31020	$99K	$ 929K			
31021	$15K	$ 167K			
31022	$15K	$ 167K			
31023	$15K	$ 167K			
31024	$15K	$ 167K			
31025	$15K	$ 167K			

SCHEDULE OF BUILDINGS AND EQUIPMENT/FACILITIES DIFFICULT TO MOVE OR REPLICATE

BUILDINGS	BUILDING INITIAL COST	BUILDING REPLACEMENT COST	EQUIPMENT	EQUIPMENT INITIAL COST	EQUIPMENT REPLACEMENT COST
31026	$15K	$167K			
31027	$15K	$167K			
31028	$15K	$167K			
31029	$32K	$349K			
31030	$32K	$349K			
31031	$32K	$349K			
31032	$32K	$349K			
31033	$32K	$349K			
31034	$32K	$349K			
31035	$32K	$349K			
31036	$32K	$349K			
31037	$12K	$155K			
31038	$12K	$155K			
31039	$12K	$155K			
31040	$100K	$785K			
31041	$100K	$785K			
31042	$100K	$785K			
31043	$100K	$785K			
31049	$100K	$617K			
31050	$100K	$617K			
31051	$100K	$617K			
31052	$100K	$617K			
31055	$11K	$16K			
31056	$11K	$16K			
31057	$11K	$16K			
31067	$9K	$14K			
31096	$1K	$6K			
31126	$21K	$200K			
31127	$21K	$200K			
31212	$2K	$7K			
31213	$4K	$10K			
31214	$1K	$7K			
31375	$8K	$39K			
31481	$2K	$7K			
31484	$8K	$14K			
31485	$6K	$11K			
31486	$5K	$11K			
31487	$2K	$7K			
31488	$2K	$7K			
31489	$1K	$7K			
31490	$3K	$9K			
31492	$3K	$9K			
31493	$3K	$9K			
31494	$1K	$9K			
31495	$1K	$9K			
31496	$1K	$9K			
31506	$2K	$27K			
31623	$4K	$9K			
31982	$2K	$8K			
31983	$2K	$8K			
31984	$2K	$8K			
31985	$2K	$8K			
31986	$2K	$7K			
31987	$2K	$8K			
31988	$2K	$7K			
31989	$2K	$7K			
31997	$5K	$11K			
31998	$2K	$14K			
31999	$2K	$14K			
32000	$2K	$14K			
32001	$2K	$11K			
32004	$2K	$11K			
32005	$1K	$9K			
32008	$5K	$10K			
32009	$5K	$10K			

SCHEDULE OF BUILDINGS AND EQUIPMENT/FACILITIES DIFFICULT TO MOVE OR REPLICATE

BUILDINGS	BUILDING INITIAL COST	BUILDING REPLACEMENT COST	EQUIPMENT	EQUIPMENT INITIAL COST	EQUIPMENT REPLACEMENT COST
32010	$1K	$ 6K			
32011	$1K	$ 6K			
32545	$47K	$ 236K			
70122	$1K	$ 7K			
70144	$4K	$ 10K			
70145	$4K	$ 10K			
91067	$6K	$ 12K			
91068	$6K	$ 12K			
91069	$6K	$ 12K			
92013	$1K	$ 7K			
92014	$1K	$ 7K			
92021	$1K	$ 7K			
92022	$1K	$ 7K			
92048	$5K	$ 10K			
ORDNANCE TEST COMPLEX					
16110	$17K	$71K	Firing Station, Test	$36K	$45K
16129	$640K	$846K		$120K	DNA
16140	$1K	$4K			
16141	$1K	$4K			
16142	$2K	$7K			
31436	$11K	$52K	Data Acquisition/control	$40K	$50K
31546	$1K	$5K	Instrumentation Pad	$7K	$8K
31571	$17K	$73K			
31573	DNA	DNA	Electrical control	$40K	$50K
31589	$1K	$4K	Cordin Compressor	$4K	$5K
31547	$1K	$7K	Generator	$8K	$10K
31548	$1K	$5K			
31549	$2K	$5K			
31563	$2K	$12K			
31550	$119K	$675K	Fire Control	$210K	$300K
31575	$17K	$83K			
31582	$15K	$64K	Oven Test Chamber	$16K	$20K
31587	$8K	$4K	Observation Tower	$16K	$20K
31605	$106K	$399K	Camera/Firing Chamber	$240K	$300K
31611	$16K	$47K			
32526	$4K	$11K			
32527	$5K	$15K			
32528	$1K	$3K			
32529	$8K	$23K	Data Acquisition/Control	$18K	$25K
PROPELLANTS AND EXPLOSIVE FORMULATION LABS					
15510	$368K	$3,461K	1- Pint mixer	$41K	$210K
			1-Gallon Mixer	$51K	$260K
			10-Ton PRess	$18K	$90K
			20-Ton Press	$25K	$125K
			Ovens	$16K	$80K
			3-Liter Slurry Kettle	$6K	$30K
			10-Liter Slurry Kettle	$7K	$35K
			1-gallon Slurry Kettle	$8K	$40K
13040	$140K	$3,461K			
13041	$4K	$22K			
13060	$117K	$1,104K			
13061	$11K	$52K			
13080	$151K	$1,420K			
13100	$257K	$2,417K	50-Gram Mixer	$31K	$155K
			1-Pint Mixer	$41K	$210K
13460	$80K	$869K			
13470	$38K	$417K			
10560	$186K	$2,031K	3 1-Pint Mixers	$123K	$630K
			1/4 Pint Mixer	$35K	$180K
10561	$27K	$292K			

SCHEDULE OF BUILDINGS AND EQUIPMENT/FACILITIES DIFFICULT TO MOVE OR REPLICATE

BUILDINGS	BUILDING INITIAL COST	BUILDING REPLACEMENT COST	EQUIPMENT	EQUIPMENT INITIAL COST	EQUIPMENT REPLACEMENT COST
PROPULSION AND ENERGY CONVERSION RESEARCH					
31098	$175K	$230K	Computer /instrumentation	$48K	$50K
01371	$451.6K	$3,150K	Desktop computers (14)	$48.5K	$32..8K
			Computer terminals	$22K	$6K
			SUN computer system	$57K	$27K
			Color printer	$7K	$4K
			Backup system	$2K	$1.5K
			Scanners	$5K	$4K
			Network hardware	$10K	$10K
			Laser printer	$6K	$5K
			Silicon graphics 2 system	$80K	$65K
			FAX	$4K	$4K
			TV/VCR	$1K	$1K
			Analog tapes (2)	$180K	$130K
			Oscilloscopes (5)	$25K	$25K
			Universal demodulator	$20K	$20K
			Signal generators (2)	$10K	$8K
			Amplifiers (16)	$12K	$10K
			Filters (6)	$18K	$18K
			Spectrum analyzer	$20K	$10K
			IRIG system	$15K	$15K
			Kistler amplifier(22)	$17.6K	$20K
			Visacorder	$15K	$15K
			Patch board system	$20K	$25K
			Program sequencer (2)	$25K	$30K
			Pressure gauges (strain type) (10)	$6K	$6K
			Voltmeter(6)	$10K	$5K
			Interlock system	$10K	$5K
			Misc.	$25K	$25K
			Low pressure T-burner	$100K	$50K
			High pressure T-burner	$250K	$300K
			Particle collector	$30K	$40K
			Miscellaneous from Bay 1	$35K	$35K
			Microwave system	$250K	$250K
			VAX	$120K	$46K
			Data acquisition system for VAX	$50K	$20K
			Racks (9)	$13.5K	$16.2K
			Hotwire anemomenter system	$50K	$38K
			Indictors (24)	$6K	$6.6K
			Piezo driver	$1K	$1K
			486DX33 computer	$3.5K	$3K
			Wavetek 650 syntheszer	$15K	$14K
			Kistler Pressure amps (4)	$10K	$9K
			Audio amps (4)	$2K	$2.2K
			Tektronix instrumentation rack	$4.5K	$4.5K
			Oscilliscopes (4)	$14K	$12K
			Electronic filters (2)	$10K	$6K
			Spectrum analyzer	$65K	$50K
			Graphics terminal	$9K	$3K
			Pressure gauges, mechanical (12)	$12K	$12K
			TV and VCR with video camera	$4.5K	$4.5K
			Amplifiers (20)	$20K	$20K
			Turbine control system	$3K	$3K
			Patch board	$10K	$10K
			Power supplies (2)	$2K	$2K
			Sequencer	$2K	$2.5K
			35mm camera and lenses	$1.5K	$2K
			Microphone system	$20K	$20K
			TSI laser doppler anemometer	$120K	$150K
			Machine shop (mill, lathe, band saw)	$45K	$40K
			Schlieren system	$5K	$15K
			Microscopes (research grade,2; other 2)	$30K	$35K
			XYZ translation table	$10K	$10K
			Workbenchs (16)	$19.2K	$19.2K
			Computers (6)	$18K	$15K
			Water tunnel	$150K	$150K
			Wind tunnel	$50K	$60K
			High pressure plumbing	$100K	$100K
			High pressure tanks (5)	$150K	$150K
			High pressure regulators (2 large, 6 small)	$100K	$100K
			High pressure pump (Mich Lab)	$250K	$250K

SCHEDULE OF BUILDINGS AND EQUIPMENT/FACILITIES DIFFICULT TO MOVE OR REPLICATE

BUILDINGS	BUILDING INITIAL COST	BUILDING REPLACEMENT COST	EQUIPMENT	EQUIPMENT INITIAL COST	EQUIPMENT REPLACEMENT COST
			Microscope	$25K	$10K
			Stereo microscope	$50K	$50K
			Window bomb	$10K	$10K
			Data recording equipment	$20K	$20K
			Fabricated combustors (many)	$200K	$200K
02658	$400K	$716K	Nd-YAG pumped tunable dye laser		
			WEX UV, 20 Hz	$150K	$150K
			CO2 laser, 150W CW, line tunable	$50K	$50K
			XeCl Excimer laser, 50mJ, 200 Hz	$35K	$35K
			Laser dyes	$4.7K	$4.7K
			Window bomb with sapphire windows	$5K	$5K
			Gated intensified diode array camera	$20K	$20K
			High voltage power supply	$.85K	$.85K
			Gated intensified CCD camera	$25K	$25K
			Image intensifier	$15K	$15K
			Nikon lens (UV grade)	$.8K	$.8K
			IR imaging plates	$.5K	$.5K
			Digitizer (LeCroy, 2M sample, 5MHz)	$16.7K	$16.7K
			Digital delay generators (2)	$7K	$7K
			Boxcar integrator	$6K	$6K
			Boxcar integrator (CAMAC rack mount)	$3K	$3K
			IR Acoustic Optic Modulator	$3.5K	$3.5K
			Beam profiler	$3K	$3K
			Power meters (2, IR)	$3K	$3K
			UV-Visible laser power meter	$2.8K	$2.8K
			UV-Visible Acoustic Optic Modulator	$4.5K	$4.5K
			Laser attenuator	$2.7K	$2.7K
			Harmonic Generating crystals	$1.6K	$1.6K
			Neslab heat exchanger	$6K	$6K
			Optical table (5' x 10')	$7K	$7K
			Optical table (4' x 8')	$4K	$4K
			Propellant safe	$2K	$2K
			HEPA filter	$8K	$8K
			CO2 laser, 250W CW, sealed tube, pulse-able	$58K	$58K
			Optical table (4' x 8')	$4K	$4K
			CO2 laser beam integrator	$4K	$4K
			Flashlamp pumped tunable dye laser, 2 Joules	$35K	$35K
			Optical table (4' x 8')	$4K	$4K
			TV monitor	$.3K	$.3K
			Frame grabber board for Zenith	$1.6K	$1.6K
			Digital delay generators (2)	$7K	$7K
			Power supply (hi current)	$2K	$2K
			High speed polygon mirror scanner	$4K	$4K
			Scanning mirrors	$1.5K	$1.5K
			Copper vapor laser, 30 Watts, 8KHz pulse rate	$70K	$70K
			Xenon lamp source	$2.5K	$2.5K
			Quartz Tungsten-Halogen	$2.5K	$2.5K
			Optical Multichannel Analyzer	$28.7K	$28.7K
			3/4 meter double monochrometer	$25K	$25K
			1/4 meter single spectrograph	$4K	$4K
			Digital controlled scanning spectrometer	$15K	$15K
			IBM PC/AT computer	$3K	$3K
			Oscilloscope	$1.5K	$1.5K
			Diode lasers (3 @ 670 nm, 2 @ 1330 nm)	$4.5K	$4.5K
			Flat flame burner	$4K	$4K
			High voltage power supply	$.85K	$.85K
			Photodiode holders	$3K	$3K
			Photodiode amps (3)	$2.4K	$2.4K
			Photomultiplier system with chiller	$3K	$3K
			Laser Doppler Anemometer System	$250K	$250K
			HeNe laser	$2K	$2K
			Zenith 248 computer (with Bernoulli drive)	$3.5K	$3.5K
			Software for PCs (commercial)	$2.4K	$2.5K
			Silicon Graphics Personal Iris 3D workstation	$35K	$35K
			Seiko 5504 color printer	$6.5K	$6.5K
			Texas Instruments PostScript laser printer	$1.6K	$1.6K
			Hewlett Packard 7550 plotter	$3K	$3K
			Pre amp	$1.7K	$1.7K
			300 MHz oscilloscope	$3.5K	$3.5K
			Velocity meter	$1K	$1K
			Power supplies (6 small)	$2.4K	$2.4K
			Flow meters (10)	$1.5K	$1.5K

SCHEDULE OF BUILDINGS AND EQUIPMENT/FACILITIES DIFFICULT TO MOVE OR REPLICATE

BUILDINGS	BUILDING INITIAL COST	BUILDING REPLACEMENT COST	EQUIPMENT	EQUIPMENT INITIAL COST	EQUIPMENT REPLACEMENT COST
			Thermocouple supplies	$2K	$2K
			Laser goggles (safety, 10 pair)	$2K	$2K
			Optical Breadboard	$1K	$1K
			Motorized XY stage	$5K	$5K
			Misc. optics	$32.6K	$32.6K
			Quartz windows	$3.5K	$3.5K
			Misc. optic mounts	$20.5K	$20.5K
			Lab grade optical jacks	$1.5K	$1.5K
			Large X-Y stages	$2.5K	$2.5K
			Gas regulators	$2.5K	$2.5K
			Air filter	$2.5K	$2.5K
			Misc. plumbing fixtures (Swageloks)	$5K	$5K
			High speed focal plane array IR camera	$220K	$220K
			Mass spectral system (portable)	$31.2K	$35K
			Fourier Transform Infrared spectrometer	$52.4K	$60K
			IR Radiometers and data acquisition	$53.7K	$60K
			UV Radiometers and data acquisition	$23K	$31K
			Color printer for false color radiometer images	$6.3K	$6K
			Data acquisition and control computers (3)	$14.5K	$12K
31624	$225K	$250K			
31625	$225K	$250K	Two-Stage Light-Gas Gun	$395K	$500K
			6-inch Powder Gun	$120K	$120K
			Lasers and CCD Detector	$150K	$150K
			High-Speed Digitizers (three)	$140K	$210K
			Cameras	$700K	$700K
			Flash X-ray, Cordon cameras, and other high-speed cameras		
			Hopkinson Bar	$70K	$75K
			Small Light Gas Gun	$20K	$20K
			Small Air Guns (two)	$20K	$20K
			Small Powder Gun	$30K	$30K
			Film reader (two)	$60K	$80K
			computational tools (SGI,HP, Silicon Graphics) (1/3 of SGI system, 1 HP work-- station, 1 Silicon Graphics workstation)	$338K	$338K
31600	$289K	$2,090K	TA Instrumentation		
			TGA	$75K	$110K
			DSC	$75K	$110K
			DTA	$75K	$110K
			Computer system	$10K	$10K
			Microscope system	$25K	$30K
			Cook-off Instrumentation	$30K	$30K
			Pressure DTA	$25K	$30K
			Small high temperature oven	$20K	$25K
			Mass Spectrometer	$40K	$45K
			CO2 laser system	$50K	$100K
			Xenon Arc Image system	$15K	$50K
			Tektronix O'scope	$6K	$5K
			Ignition Chamber	$2K	$5K
			Laser Timers (2)/optics	$5K	$10K
			AIF Timer	$2K	$3K
			Gas system	$2K	$4K
			Power supply	$2K	$3K
			Optical microscope	$3K	$5K
			Heise gage/flowmeters	$2K	$3K
			Propellant safe	$5K	$5K
			Window bomb controller	$2K	$4K
			DC Power supply (2)	$1K	$1K
			Heise/flow/temp system	$2K	$4K
			Locam camera (2)	$30K	$30K
			Window bomb	$5K	$10K
			Photec	$20K	$25K
			Hycam (2)	$20K	$50K
			Propellant safe	$5K	$5K
			Vanguard (2)	$50K	$85K
			Computer terminal	$2K	$8K
			Micro-vu rainbow	$20K	$20K
			Desktop Computers(30)	$135K	$135K
			Printers (10)	$50K	$50K
			VAX 8250 system	$350K	$500K
			Micro VAXII	$25K	$20K

SCHEDULE OF BUILDINGS AND EQUIPMENT/FACILITIES DIFFICULT TO MOVE OR REPLICATE

BUILDINGS	BUILDING INITIAL COST	BUILDING REPLACEMENT COST	EQUIPMENT	EQUIPMENT INITIAL COST	EQUIPMENT REPLACEMENT COST
			Micro VAXII	$35K	$30K
			Avalon processor (3)	$60K	$60K
			VAX monitors(6)	$18K	$24K
			IMAGEN (2)	$18K	$20K
			PHASER Color printer	$15K	$15K
			HP graphics plotter	$5K	$7K
31619	$191K	$191K	Video Monitors/equip.	$10K	$12K
			Nicolet digital O'scope	$25K	$35K
			Firing circuit/control/lockout	$10K	$15K
			Closed bomb controller	$5K	$5K
			Air Compressor	$5K	$8K
16071	$43.5K	$50K	Hydraulic Instron	$1K	$2K
			Hydrostatic Compression App	$5K	$8K
			Tensile Dilatometer	$6K	$10K
			Shear Dilatometer	$3K	$10K
			Computer	$6K	$9K
			Temp controller	$1K	$2K
			Temp Bath	$5K	$7K
16073	$43.5K	$50K	Oven	$6K	$9K
			Circulating bath	$2K	$4K
			Permeability system	$3K	$8K
			Pellet press(50 Ton)	$5K	$7K
			Fume Hood	$10K	$15K
16169	$43.5K	$50K	Explosion proof refridgerator	$50K	$80K
			Balances(2)	$5K	$10K
			Fume Hood	$6K	$9K
			Dog Bone Cutter	$2K	$4K
16087	$43K	$50K	High pressure window bomb	$3K	$8K
			Xenon Lamp	$5K	$7K
			Locam	$10K	$15K
			High Pressure pump accuator system	$50K	$80K
			Gas Manifold	$5K	$10K
16070	$43K	$50K	40kV power supply	$75K	$110K
			ESD conditioning Chaimbers (3)	$150K	$220K
16087	$43K	$50K	Multichannel Oscilloscopes (2)	$60K	$150K
			Dielectric constant system	$78K	$90K
			Volume Resistivity Instrumentation	$8K	$10K
			Computer	$4K	$3K
			ESD discharge apparatus	$8K	$25K
			Special ESD electrical components	$10K	$20K
			Diffusivity System	$5K	$10K
16072	$43K	$50K	Strain Combustion vessel	$20K	$25K
			Nicolet Digital O'scope	$20K	$30K
			Electronic/illumination sys	$5K	$6K
			Gas Manifold	$5K	$8K
16088	$43K	$50K	Jacketed Closed Bomb (144cc)	$15K	$25K
			Std. Closed bomb (200cc)	$20K	$20K
			Transducers/amps/elec.	$2K	$4K
1058	$209K	$209K	Propellant hardness tester	$65K	$70K
			Microscope	$12K	$15K
			Misc. balances	$10K	$15K
			Conditioning chambers	$40K	$50K
			Particle size analyzer	$20K	$25K
			Laboratory bences	$80K	$110K
			Laboratory equipment	$5K	$25K
			Misc tools	$10K	$35K
15573	$10K	$50K	Magazine		
31993	$10K	$50K	Magazine		
31997	$10K	$50K	Magazine		
31998	$10K	$50K	Magazine		
31999	$10K	$50K	Magazine		
32000	$10K	$50K	Magazine		
32001	$10K	$50K	Magazine		
32002	$10K	$50K	Magazine		
32004	$10K	$50K	Magazine		
32008	$10K	$50K	Magazine		
32009	$10K	$50K	Magazine		
31599	$20K	$71K	Propellant cutting/controls	$20K	$50K
CT-1	$43K	$50K	Large Propellant Cutting Facility	$20K	$50K
595B	$60K	$60K			
595C	$60K	$60K			

SCHEDULE OF BUILDINGS AND EQUIPMENT/FACILITIES DIFFICULT TO MOVE OR REPLICATE

BUILDINGS	BUILDING INITIAL COST	BUILDING REPLACEMENT COST	EQUIPMENT	EQUIPMENT INITIAL COST	EQUIPMENT REPLACEMENT COST
READY MISSILE TEST FACILITY					
NAws Pt. Mugu Bldg. Numbers:					
0518	$16K	DNA			
0519	$107K	DNA			
0520	$135K	DNA			
0521	$432K	DNA			
0522	$107K	DNA			
0523	$136K	DNA			
0524	$116K	DNA			
0525	$303K	DNA			
0526	$115K	DNA			
0527	$107K	DNA			
0528	$136K	DNA			
0529	$136K	DNA			
0530	$107K	DNA			
0533	$184K	DNA			
SLED TRACKS					
02451	$1K	DNA			
02452	$1K	DNA			
02453	$1K	DNA			
25000	$2,421K	DNA			
25005	$2K	DNA			
25007	$46K	DNA			
25008	$34K	DNA			
25009	$38K	DNA			
25010	$457K	DNA			
25013	$18K	DNA			
25014	$46K	DNA			
25016	$1K	DNA			
25021	$10K	DNA			
25022	$10K	DNA			
25027	$2K	DNA			
25034	$24K	DNA			
25035	$1K	DNA			
25037	$7K	DNA			
25038	$6K	DNA			
25041	$55K	DNA			
25042	$55K	DNA			
25046	$191K	DNA			
30735	$8K	DNA			
30902	$3K	DNA			
30961	$8K	DNA			
30976	$42K	DNA			
30983	$3K	DNA			
STRATEGIC PROPULSION TEST COMPLEX					
16077	$89K	$387K			
16079	$337K	$1,450K	Data Acquisition/Control	$2,000K	$2,500K
16094	$83K	$354K	Termination	$80K	$100K
16095	$221K	$939K			
16098	$4K	$15K	Pumps	$120K	$150K
16138	$7K	$14K	Hydraulic Pump	$64K	$80K
16139	$32K	$69K			
16157	$7,741K	$8,391K	Firing Pad Table	$2,300K	$3,000K
16158	$300K	$368K	Pump	$200K	$250K
16161	$202K	$223K	Instrumentation	$900K	$1,000K
16160	$2,200K	$2,300K			
16165	$191K	$207K	Instrumentation	$900K	$1,000K
16170	$844K	$915K			

SCHEDULE OF BUILDINGS AND EQUIPMENT/FACILITIES DIFFICULT TO MOVE OR REPLICATE

BUILDINGS	BUILDING INITIAL COST	BUILDING REPLACEMENT COST	EQUIPMENT	EQUIPMENT INITIAL COST	EQUIPMENT REPLACEMENT COST
TACTICAL PROPULSION TEST FACILITY					
16116	$136K	$510K	Data Acquisition /Control	$230K	$300K
16117	$58K	$217K			
16119	$51K	$192K	Diesel Pump	$280K	$350K
16120	$652K	$2,449K	Firing Stand	$200K	$250K
16121	DNA	DNA	Control Cables/Instrumtation	$64K	$80K
16122	$53K	$197K	Oxidizer Distribution	$312K	$390K
16123	$29K	$109K	Nitrogen Distribution	$20K	$25K
16125	$12K	$44K	Centrifuge	$31K	$38K
WARHEAD/BOMB ASSEMBLY/INTEGRATION FACILITY					
10030	$168K	$1,839K			
15540	$180K	$1,970K			
10611	$28K	$310K			
10634	$90K	$533K			
11080	$74K	$813K			
10640	$228K	$2,489K			
10641	$27K	$292K			
11092	$162K	$176K			
11609	$195K	$216K			
15600	$574K	$4,138K			
WEAPONS SURVIVABILITY LAB					
31150	$161K	$200K	Machine Shop Equipment	DNA	$300K
31199	$60K	DNA			
31194	$190K	DNA			
31198	$134K	DNA			
91012					
31174	$13K	DNA			
31192	$37K	$1,400K	Machine Shop Equipment	DNA	$500K
31176					
31197	$180K	DNA			
31166	$3K	DNA			
31151	$8K	$150K	Machine Shop Equipment	DNA	$200K
31196	$181K	$280K	Test Equipment	DNA	$250K
31175	$27K	DNA			
31165	$4K	$50K	Pumps and Piping	DNA	$50K
31193	$3K	DNA			
Fenced Compound	$2,000K	$7,200K	Crane, Fork Lift, Materials	DNA	$800K
Fenced Compound	$5,000K	$13,500K	Test Assets	DNA	$300K
31162	$2K	DNA			
31123	$14K	DNA			
31126	$21K	DNA			
31127	$21K	DNA			
31191	$8K	$200K			
31170	$4K	$480K	Electrical Distribution System	DNA	$200K
31177	$13K	DNA			
31167	$400K	$6,000K	Test Instrumentation	DNA	$750K
31189	$87K	DNA			
31195	$2K	DNA			
31184	$2K	DNA			
31185	$2K	DNA			
31168	$4K	DNA			
31211	$151K	DNA			
31171	$2K	$128K	Water Distribution System	DNA	$60K
31186	$16K	DNA			
31172	$2K	DNA			
31173	$9K	$180K	Fire Fighting System	DNA	$250K
31179	$39K	DNA			
31178	$119K	$300K	Instrumentation	DNA	$600K
31183	$37K	DNA			
31169	$25K	$800K	Turntable	DNA	$800K
31182	$42K	DNA			
31187	$8K	DNA			

SCHEDULE OF BUILDINGS AND EQUIPMENT/FACILITIES DIFFICULT TO MOVE OR REPLICATE

ORDNANCE AND PROPULSION PILOT PLANT RESERVE CAPACITY

10010	$757K	DNA
10530	$288K	$3,145K
10050	$218K	$2,381K
10610	$55K	$597K

TDDs (PROXIMITY FUZE)

MISSILE ENGAGEMENT SIMULATION ARENA (MESA)

02188	$16,850K	$16,850K	Sensor Transporter Subsystem	$2,060K	$2,060K
			2 Overhead target support subsystems	$3,700K	$3,700K
			Calibration sphere positioning subsystem	$340K	$340K

TDD DDT&E COMPLEX

10850	$11K	DNA
10852	$1K	DNA
11693	$38K	$35K

TDD EXPLORATORY DEVELOPMENT FACILITY

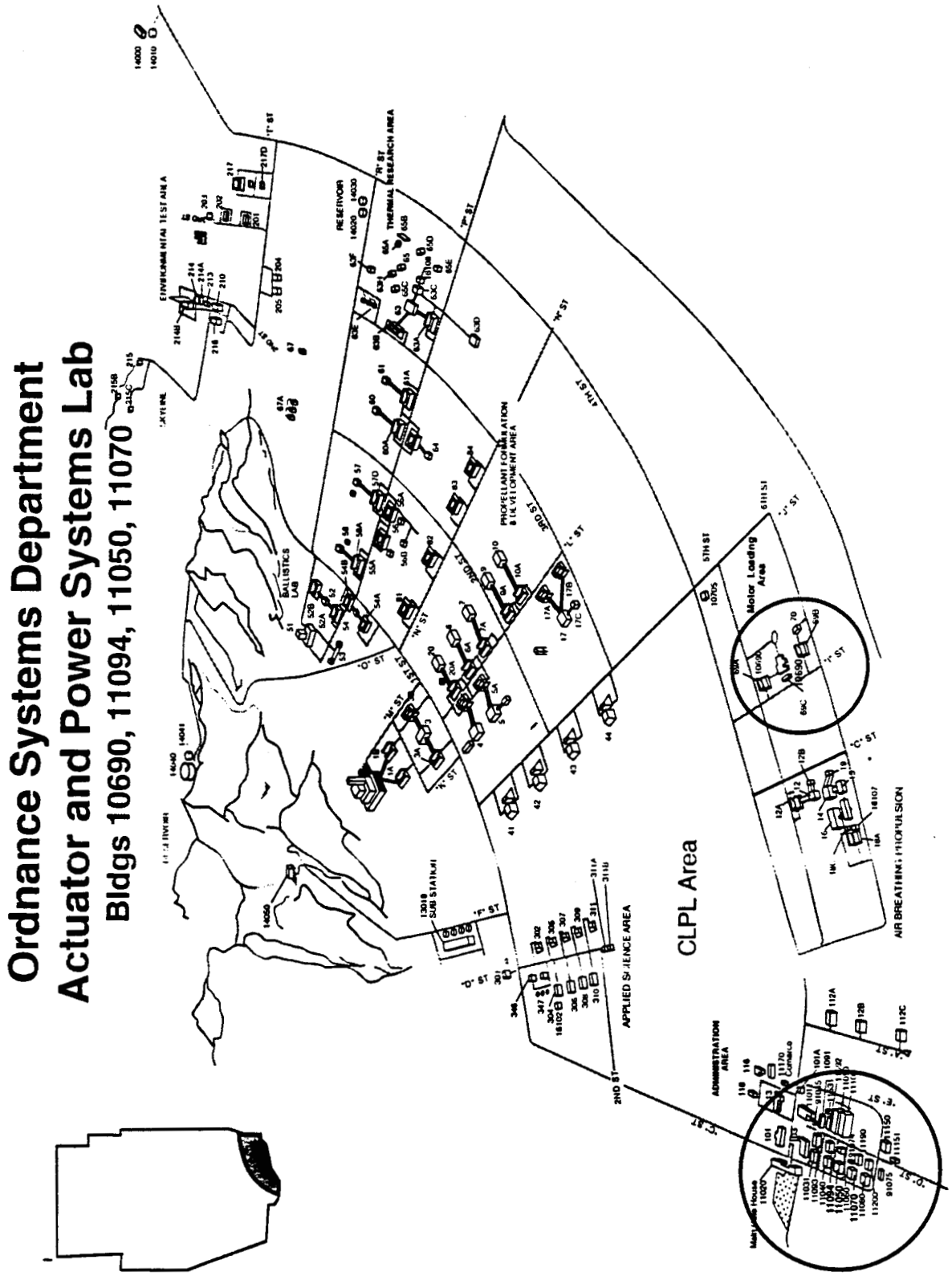
01400	$3,690K	DNA
02655	$142K	DNA
02485	$191K	DNA

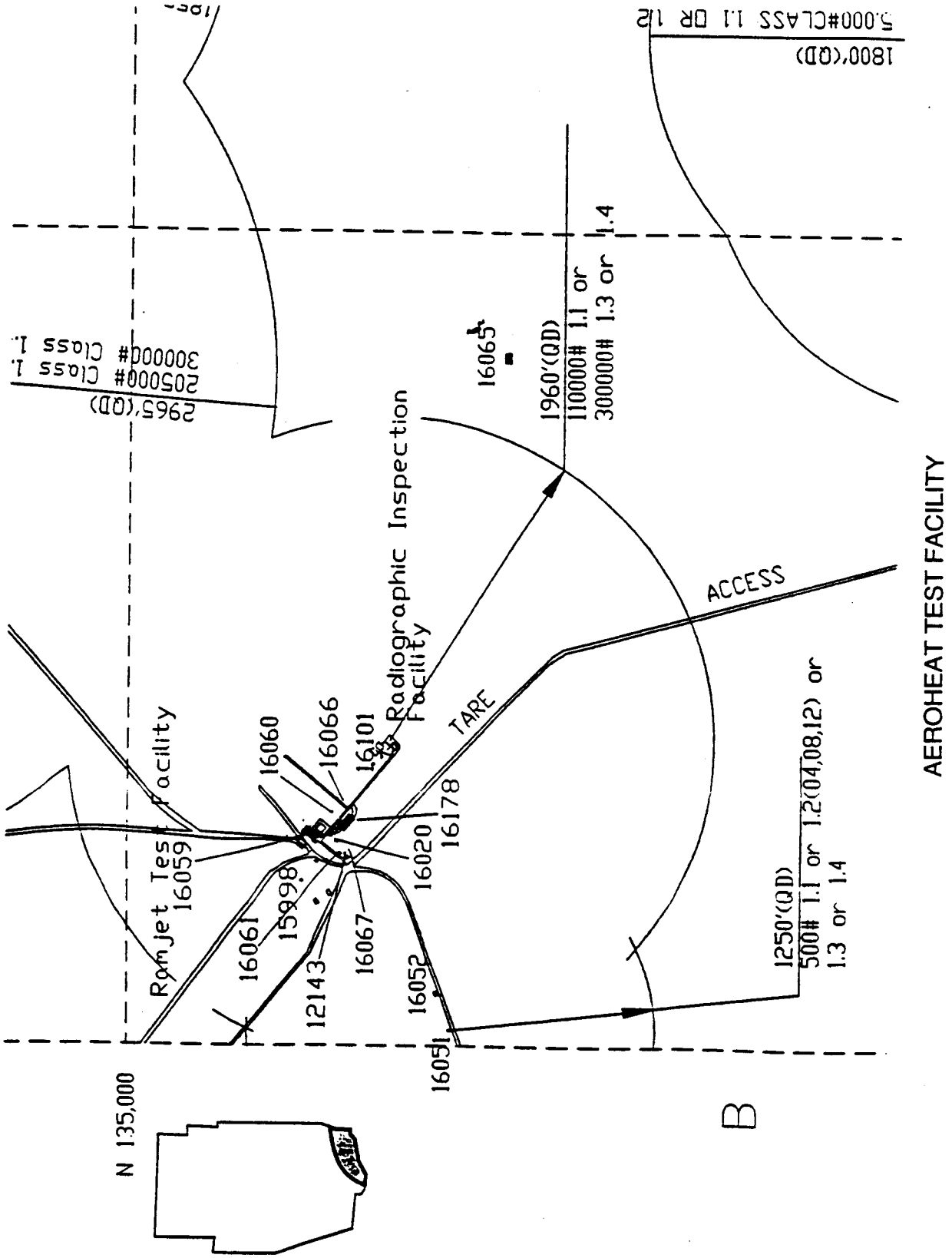
TDD PERFORMANCE EVALUATION LABORATORY

02337	$422K	$275K
02476	$181K	DNA

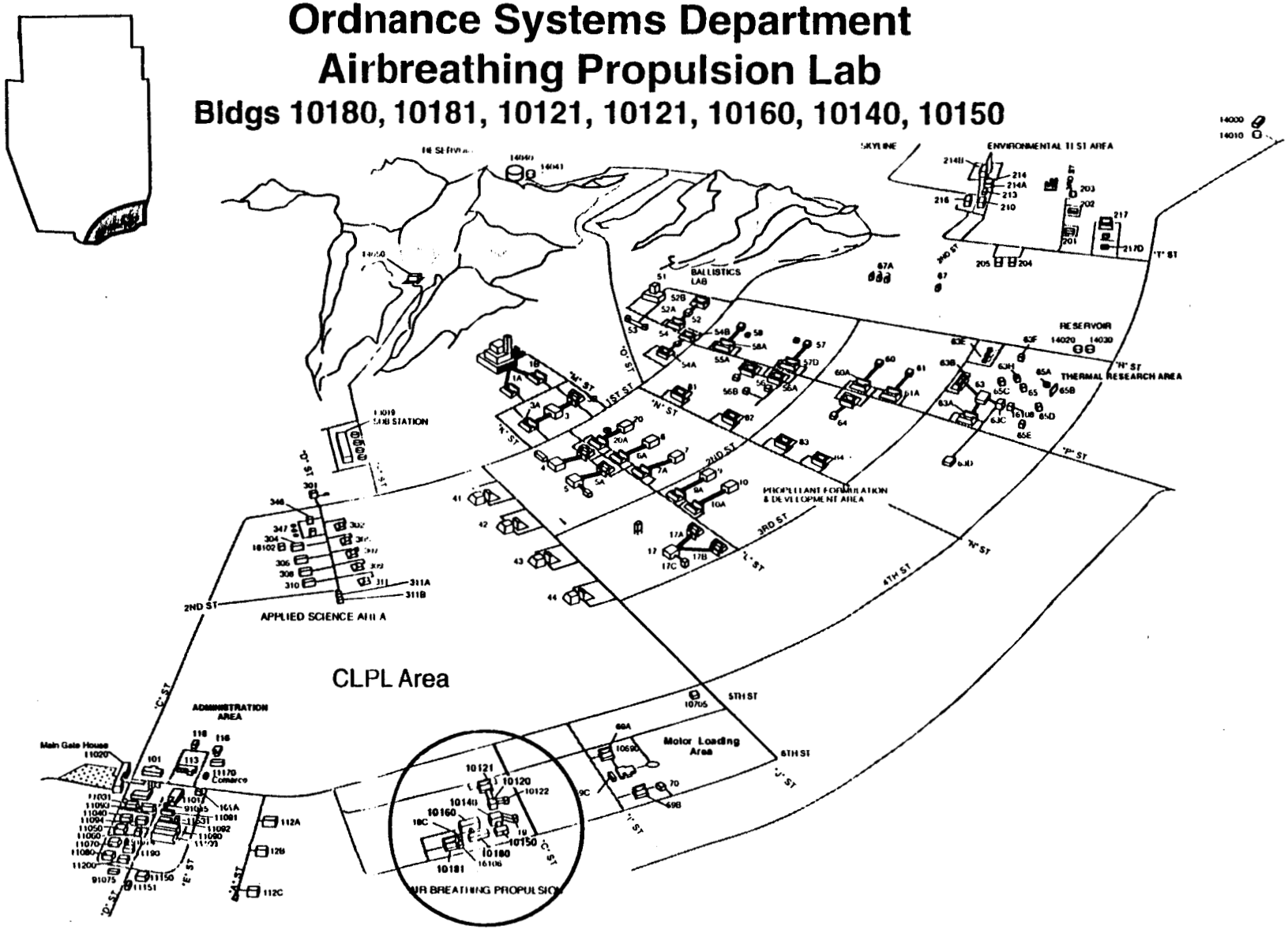
The replacement costs for all buildings listed above was not available.

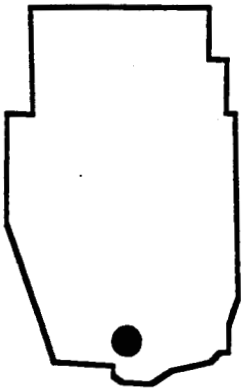
The total replacement value of the buildings on this schedule was estimated by finding the ratio of replacement cost of buildings, where known, and the initial costs of those same buildings. The total known replacement value is $314,265K and the initial cost of those buildings was $52,621K for a ratio of 5.97. If this factor is applied to the total initial cost of all our energetics buildings, which is $101,684K, then the replacement cost is approximately $607,053K (101,684 times 5.97). The known replacement value of equipment is $69,202K. This gives a very conservative total of over $676,255K for buildings and equipment.

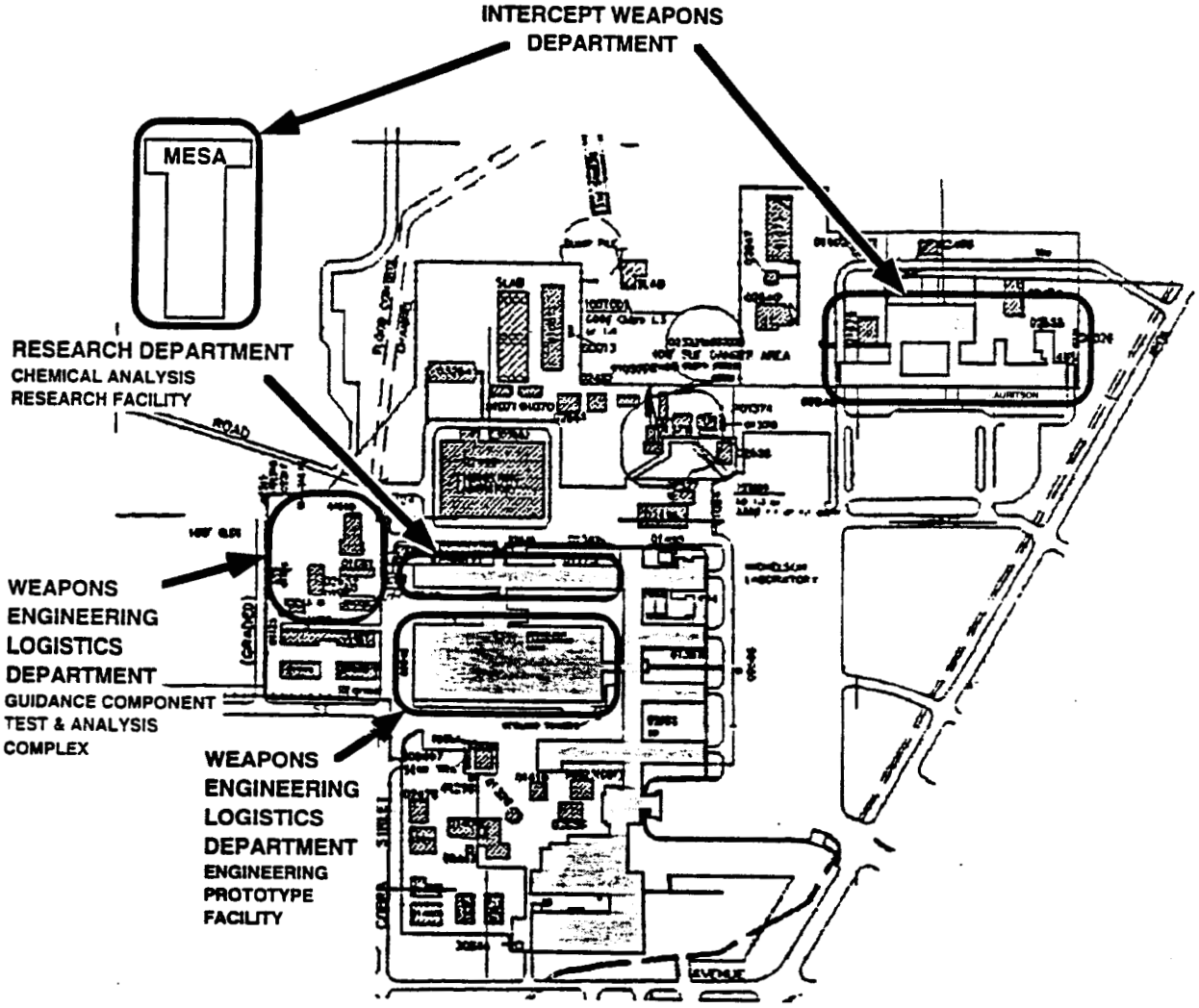

Ordnance Systems Department
Actuator and Power Systems Lab
Bldgs 10690, 11094, 11050, 11070
CLPL Area
Motor Loading Area
APPLIED SCIENCE AREA
ADMINISTRATION AREA
AIR BREATHING PROPULSION
THERMAL RESEARCH AREA
RESERVOIR
BALLISTICS LAB
PROPELLANT FORMULATION & DEVELOPMENT AREA
SUBSTATION
2ND ST
5TH ST
4TH ST
3RD ST


AEROHEAT TEST FACILITY
ACCESS
TARE
Radiographic Inspection Facility
Ramjet Test Facility
16060
16066
16101
16059
16178
16020
15998
16061
12143
16067
16052
16051
16065
1960'(QD)
110000# 1.1 or
300000# 1.3 or 1.4
1250'(QD)
500# 1.1 or 1.2(04,08,12) or
1.3 or 1.4
1800'(QD)
5,000#CLASS 1.1 OR 1.2
2965'(QD)
205000# Class 1.
300000# Class 1.
N 135,000
B

Ordnance Systems Department
Airbreathing Propulsion Lab
Bldgs 10180, 10181, 10121, 10121, 10160, 10140, 10150

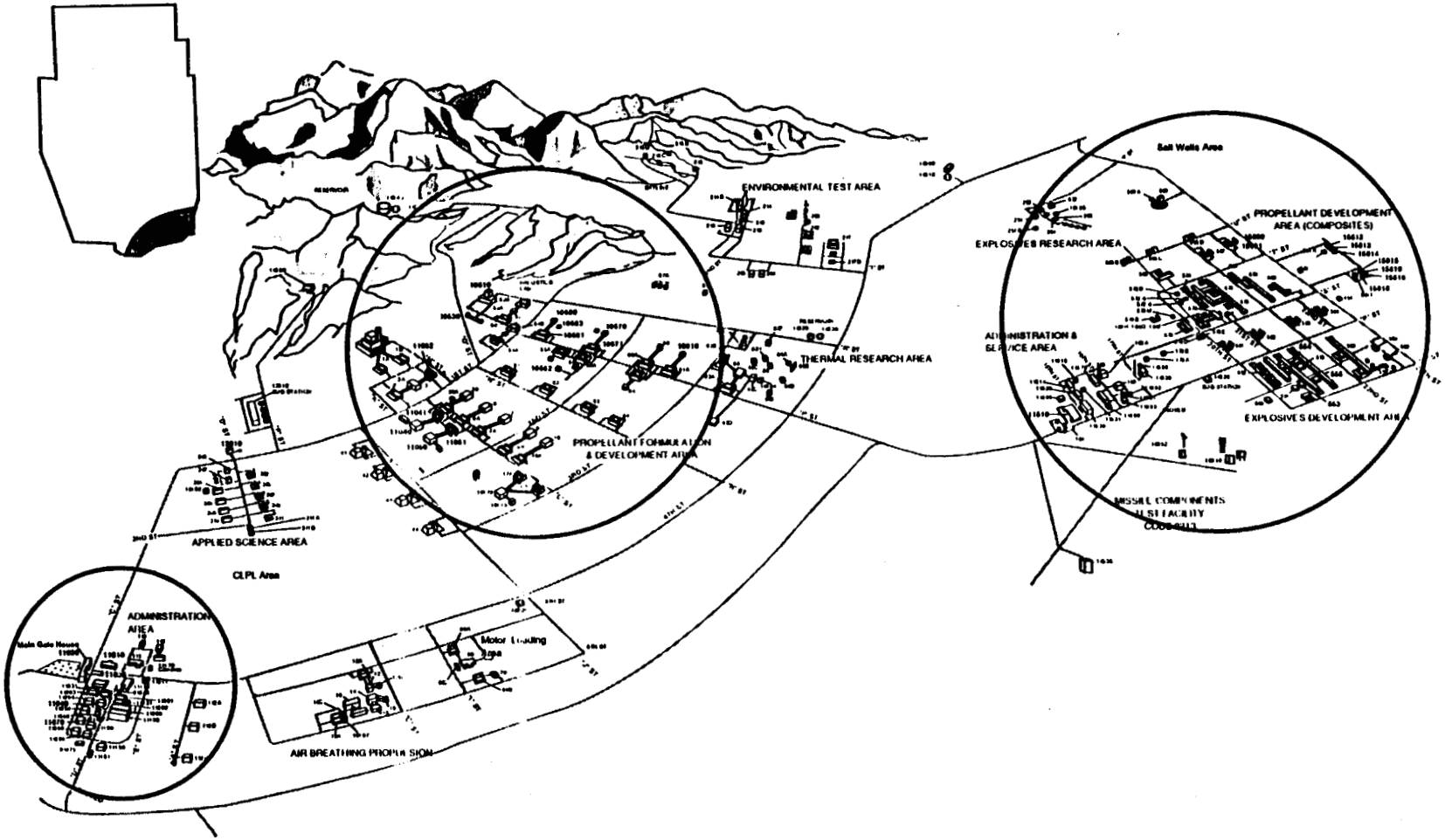




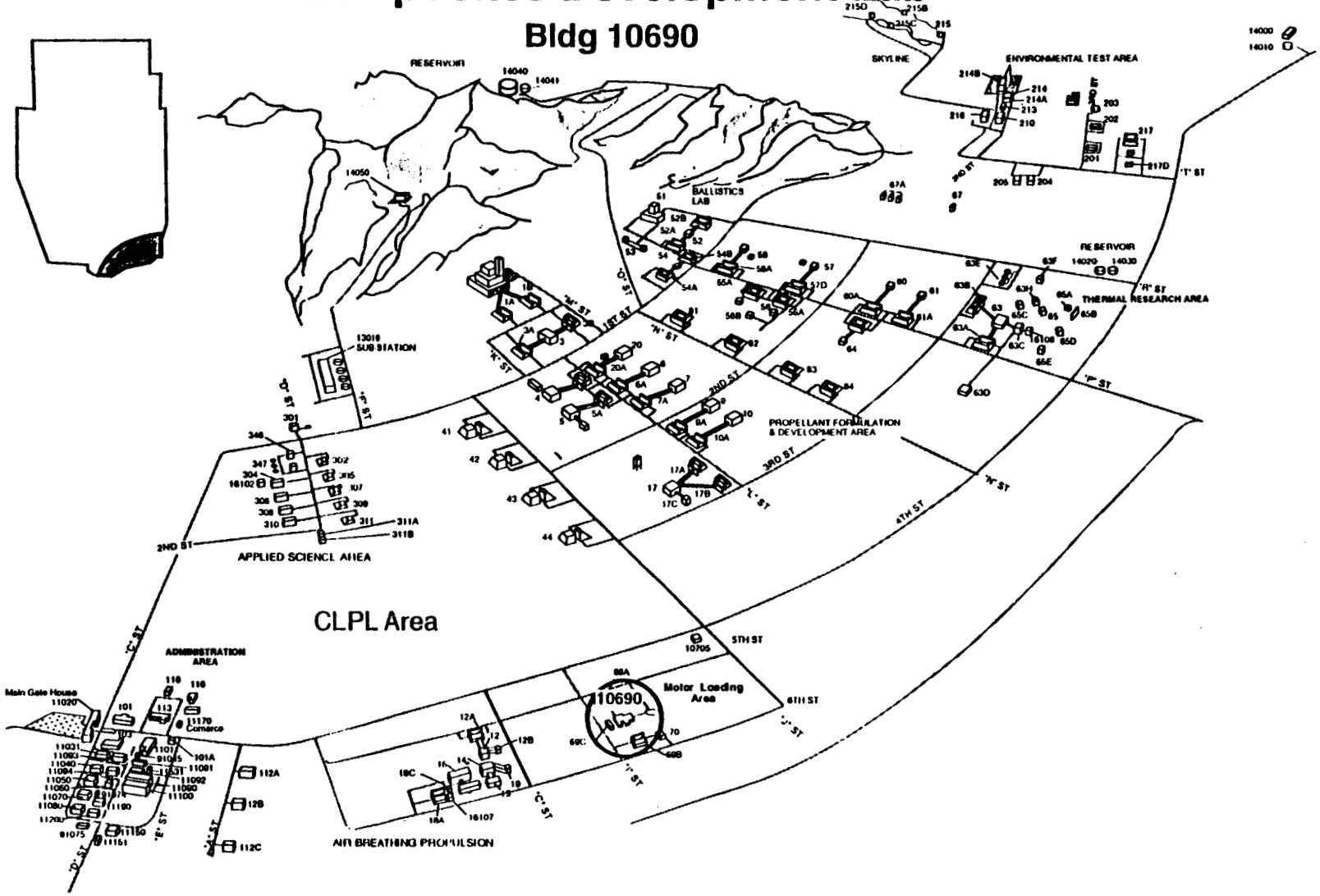

INTERCEPT WEAPONS DEPARTMENT
MESA
RESEARCH DEPARTMENT
CHEMICAL ANALYSIS RESEARCH FACILITY
WEAPONS ENGINEERING LOGISTICS DEPARTMENT
GUIDANCE COMPONENT TEST & ANALYSIS COMPLEX
WEAPONS ENGINEERING LOGISTICS DEPARTMENT
ENGINEERING PROTOTYPE FACILITY

Ordnance Systems Department
China Lake Ordnance & Propulsion Pilot Plant

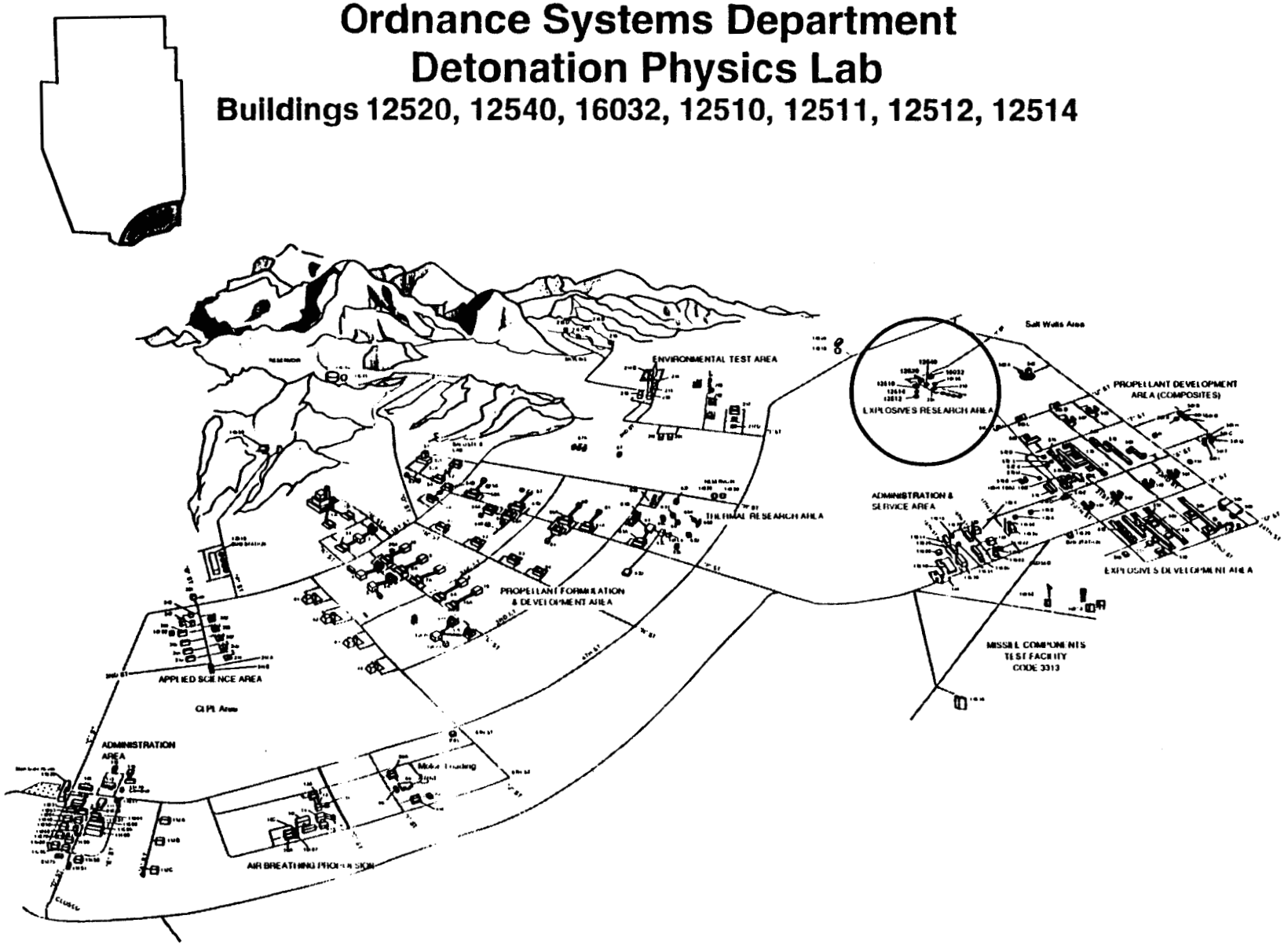
Bldgs 11510, 10530, 13010, 15521, 15522, 15523, 15530, 15534, 15544, 15550, 15554, 15590, 15594, 15596, 15707, 15724, 15742, 15730, 15741, 15750, 15743, 15744, 15754, 15760, 15956, 10032, 10570, 10571, 10580, 10581, 10983, 15720, 15726, 15810, 15811, 15812, 15813, 15814, 15815, 15816, 15818, 15819, 15980, 15981, 10510, 10562, 10610, 10040, 10041, 10550, 10551, 11010, 11020, 11030, 10040, 11070



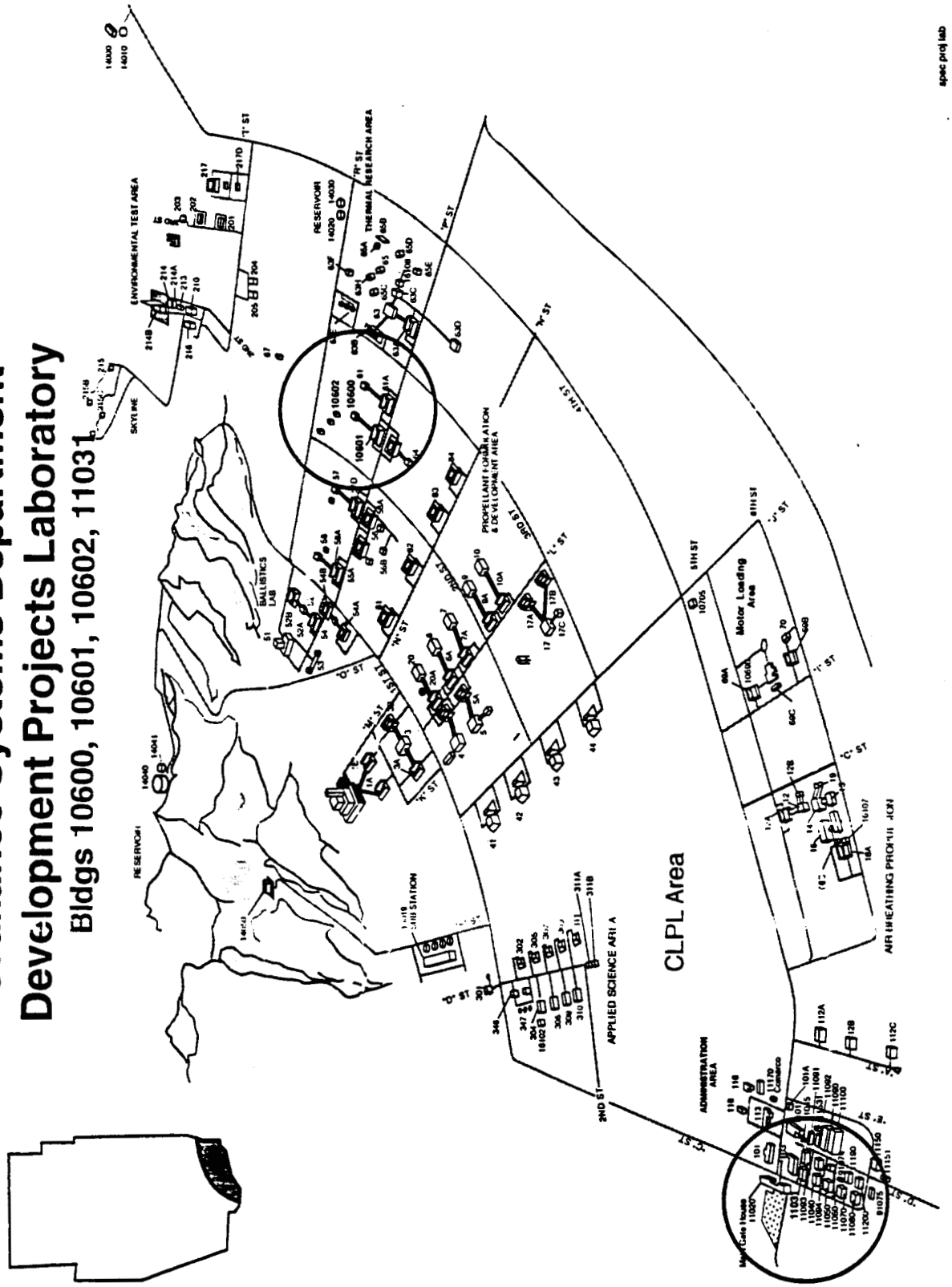
Ordnance Systems Department
Composites Development Lab
Bldg 10690



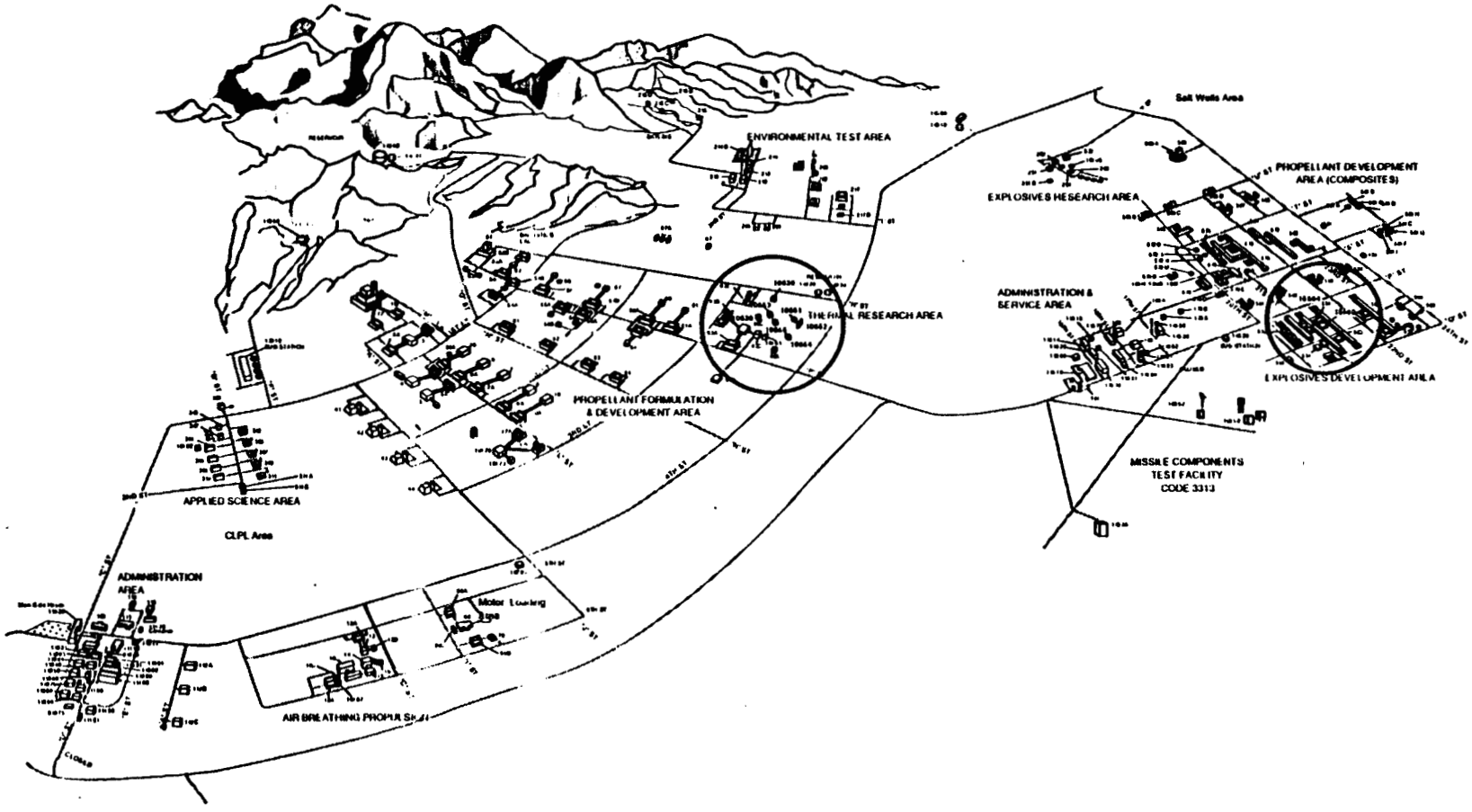
Ordnance Systems Department
Detonation Physics Lab
Buildings 12520, 12540, 16032, 12510, 12511, 12512, 12514



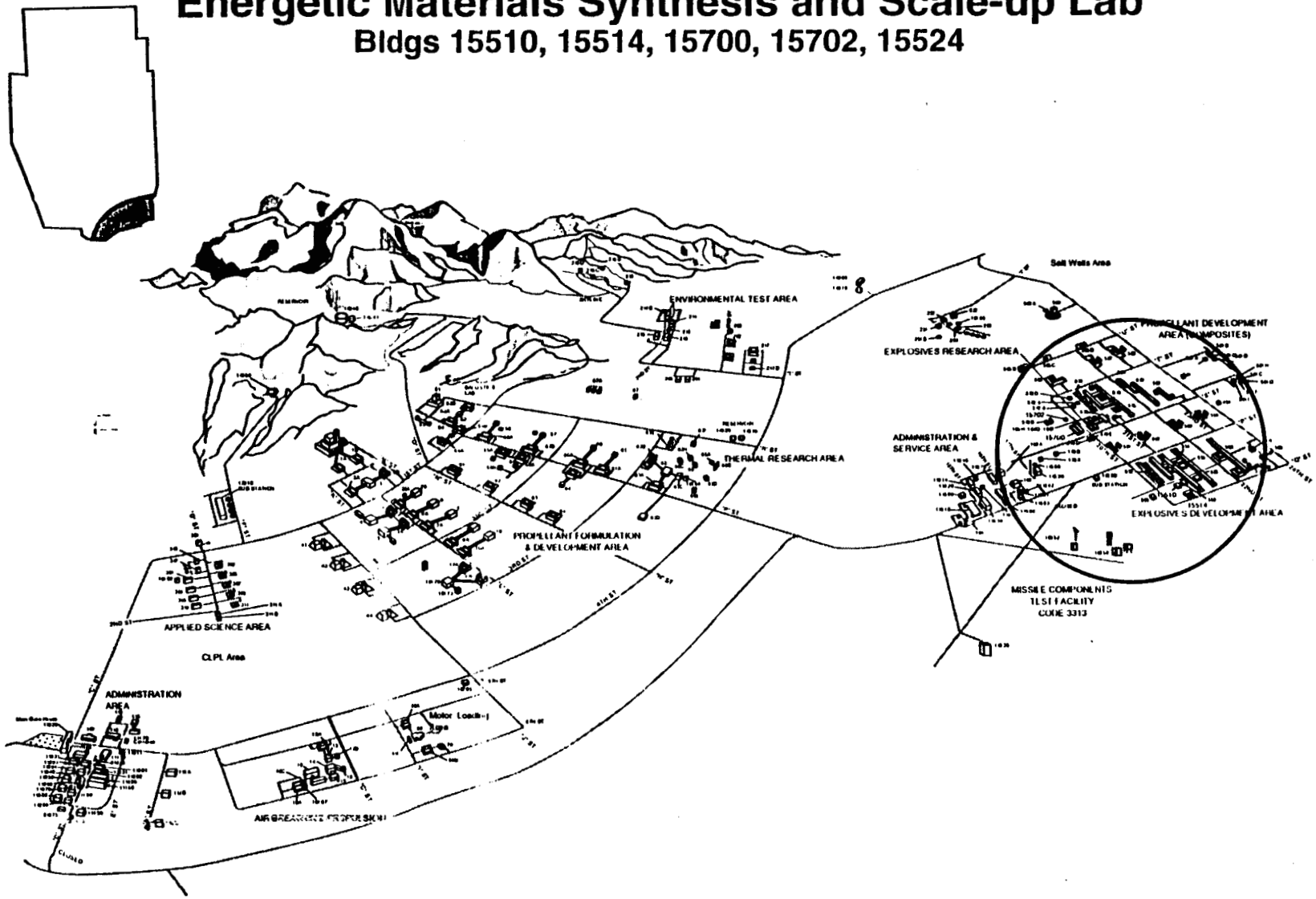
Ordnance Systems Department
Development Projects Laboratory
Bldgs 10600, 10601, 10602, 11031

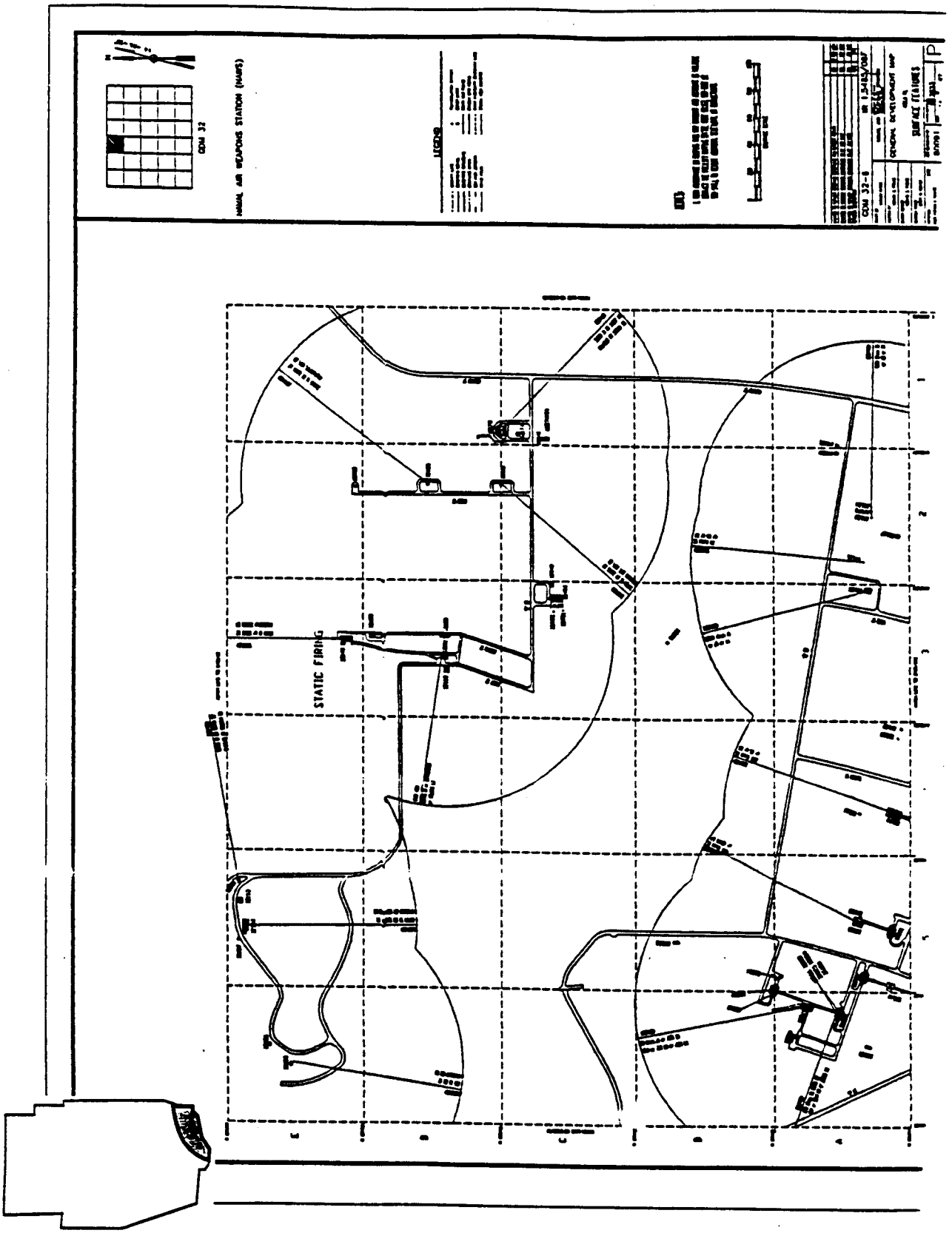


Ordnance Systems Department
Energetic Materials Properties Analysis Lab
Bldgs 10630, 10636, 10637, 15560, 15564, 10651, 10652, 10653, 10654, 10655

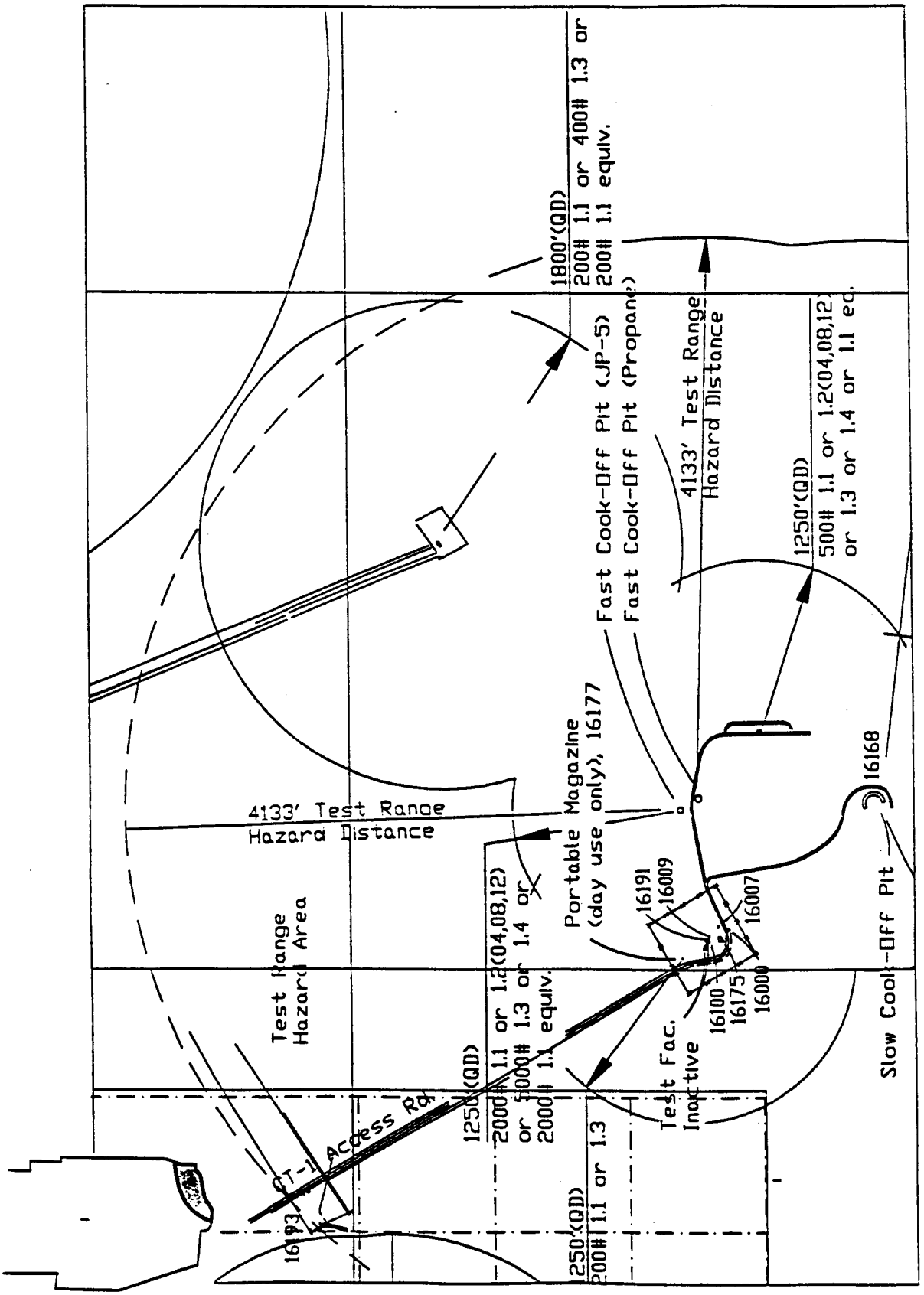


Ordnance Systems Department
Energetic Materials Synthesis and Scale-up Lab
Bldgs 15510, 15514, 15700, 15702, 15524

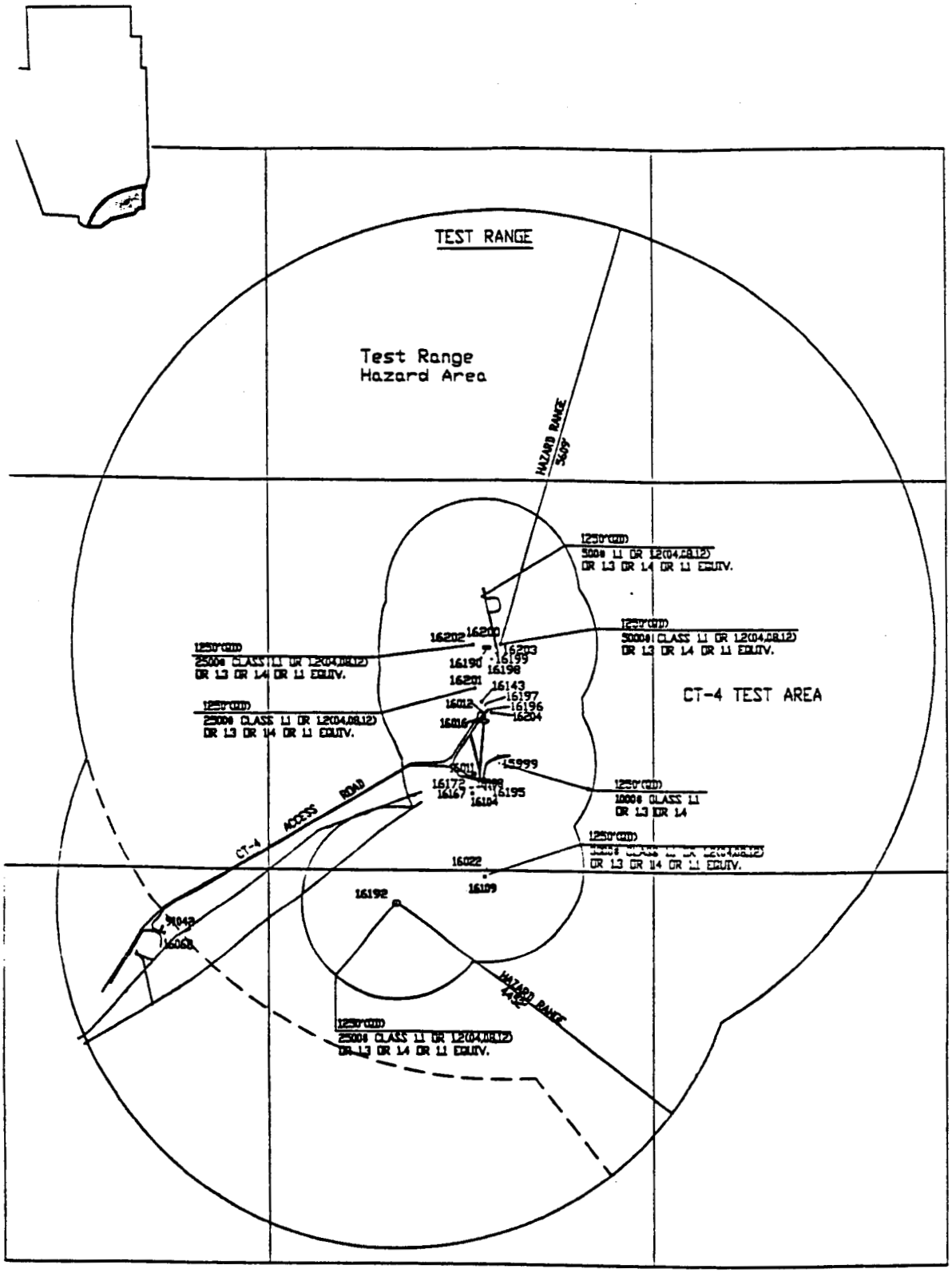




ENVIRONMENTAL TEST COMPLEX (1 OF 3)

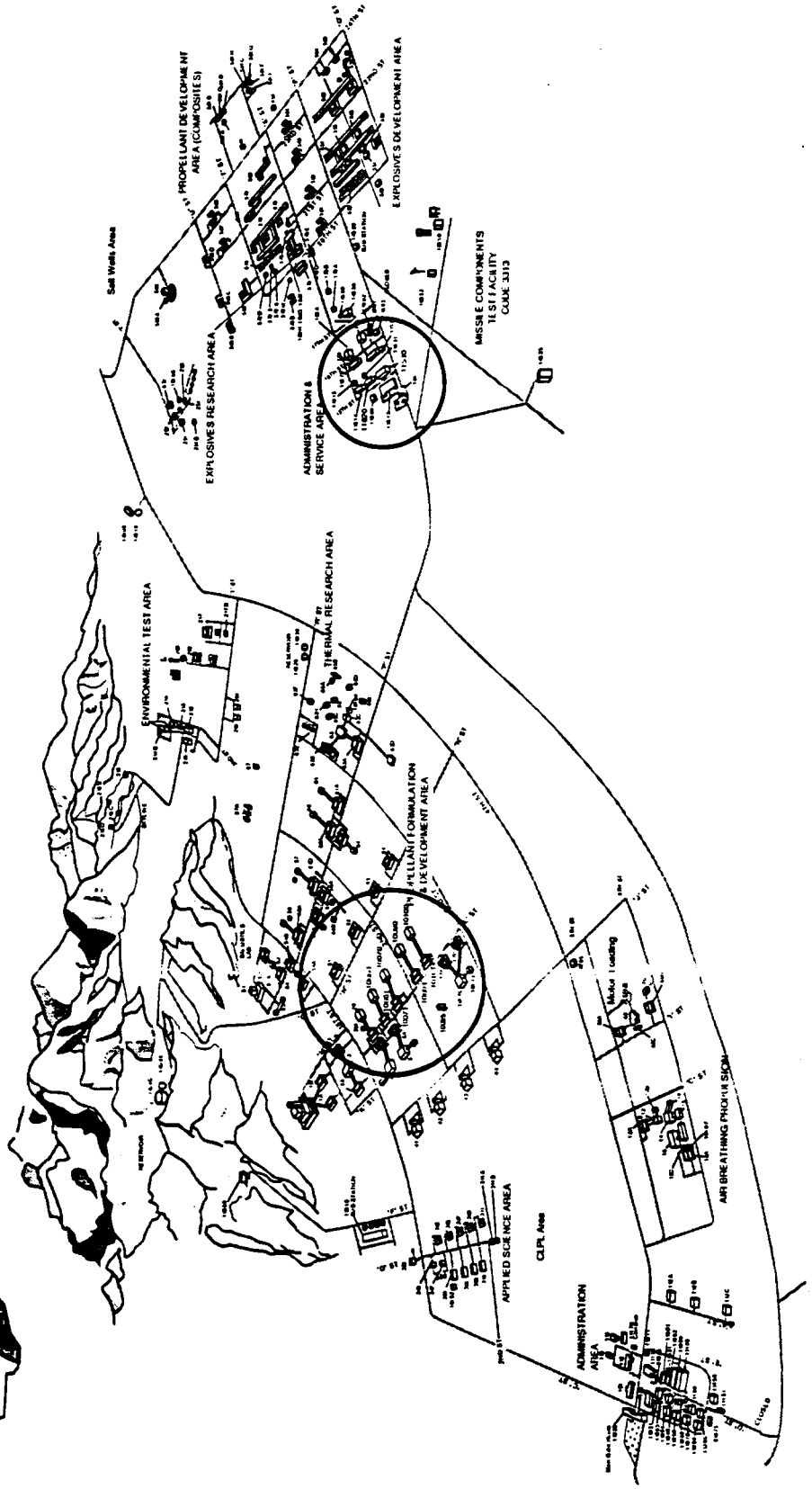


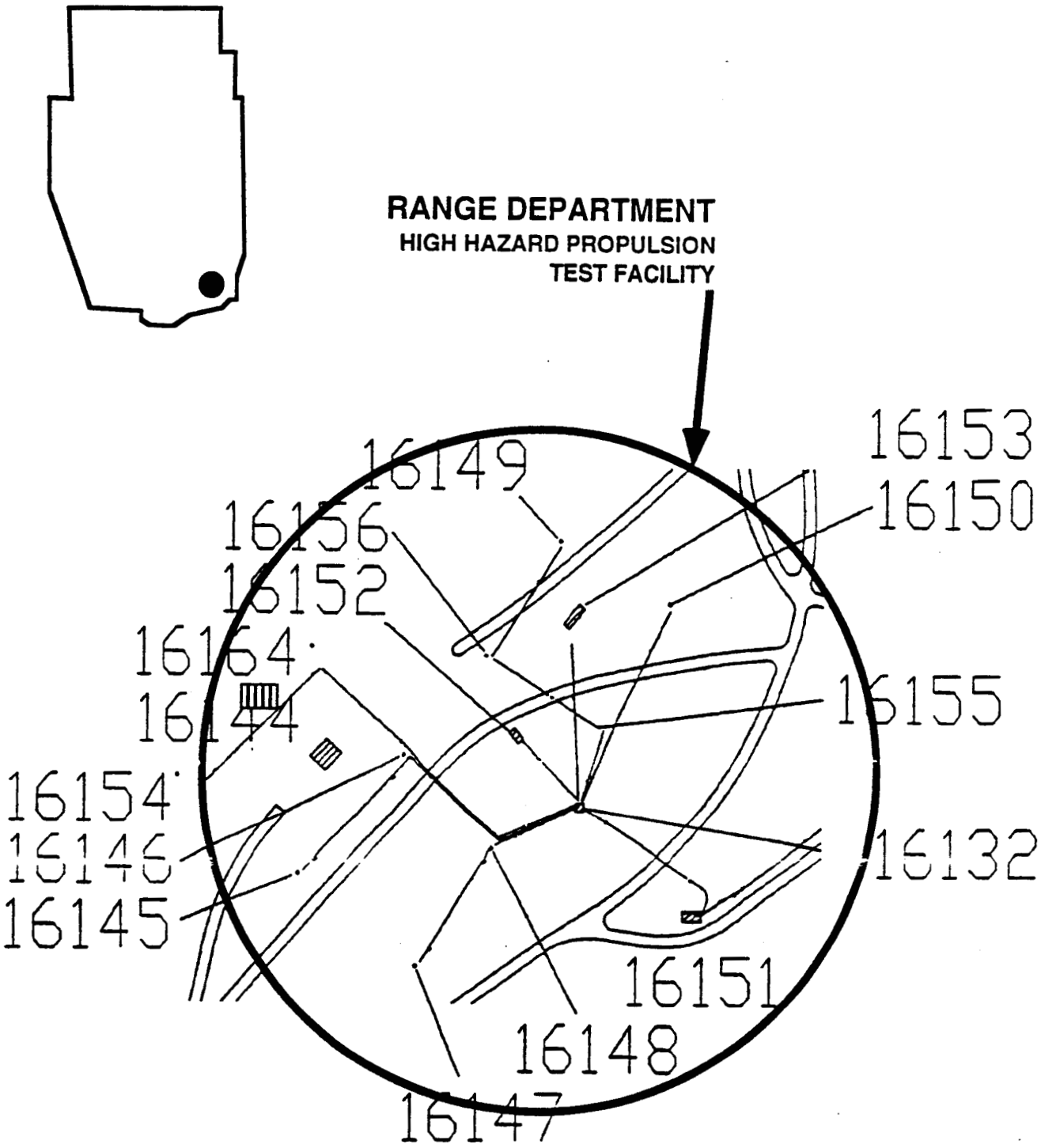
ENVIRONMENTAL TEST COMPLEX (2 OF 3)



ENVIRONMENTAL TEST COMPLEX (3 OF 3)

Ordnance Systems Department
Fuze Development T&E Lab
Bldgs 10095, 11530, 10060, 10061, 10070, 10071, 10090, 10091, 10100, 10101, 11530, 11620




RANGE DEPARTMENT
HIGH HAZARD PROPULSION
TEST FACILITY
16153
16149
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16156
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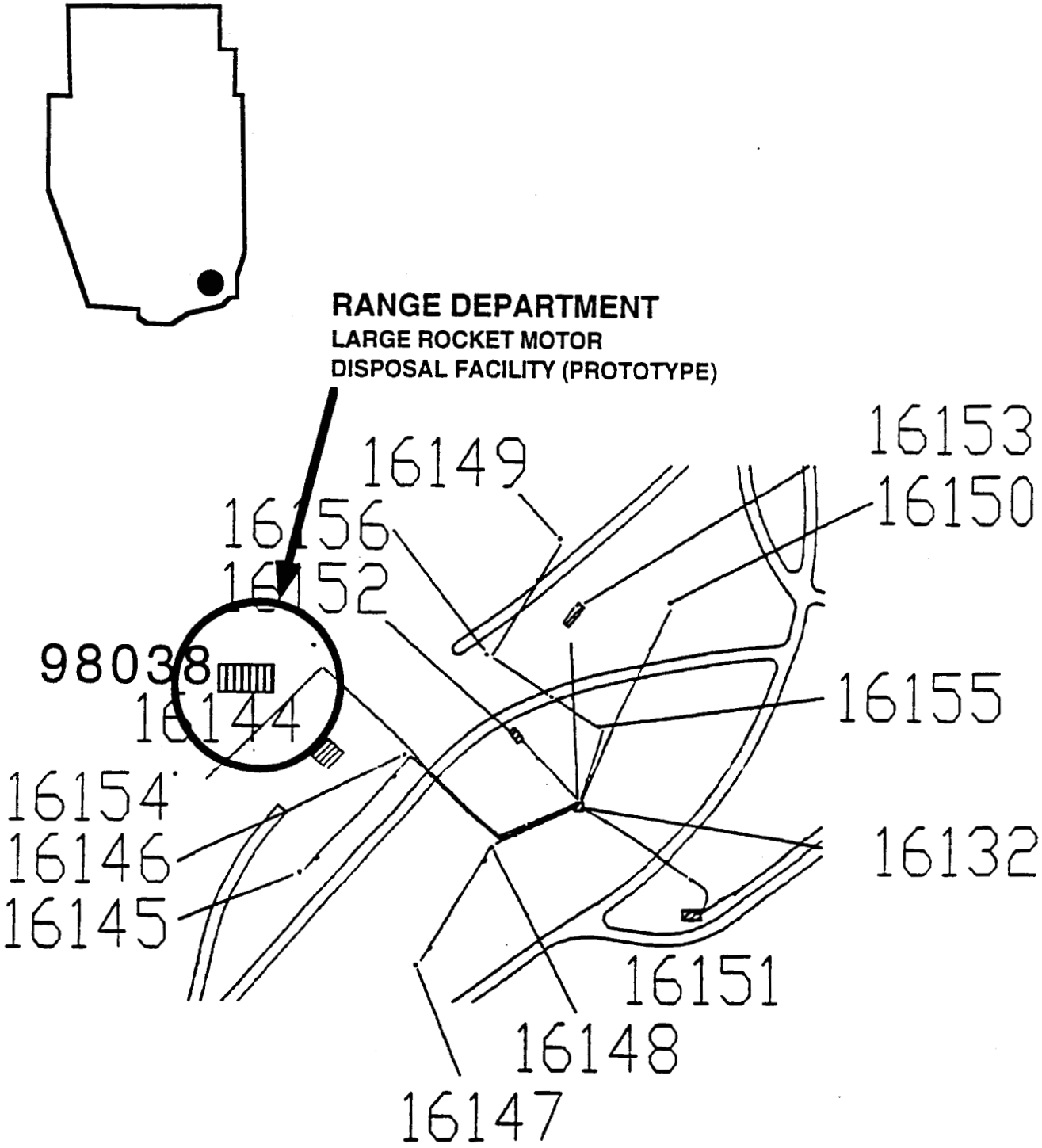
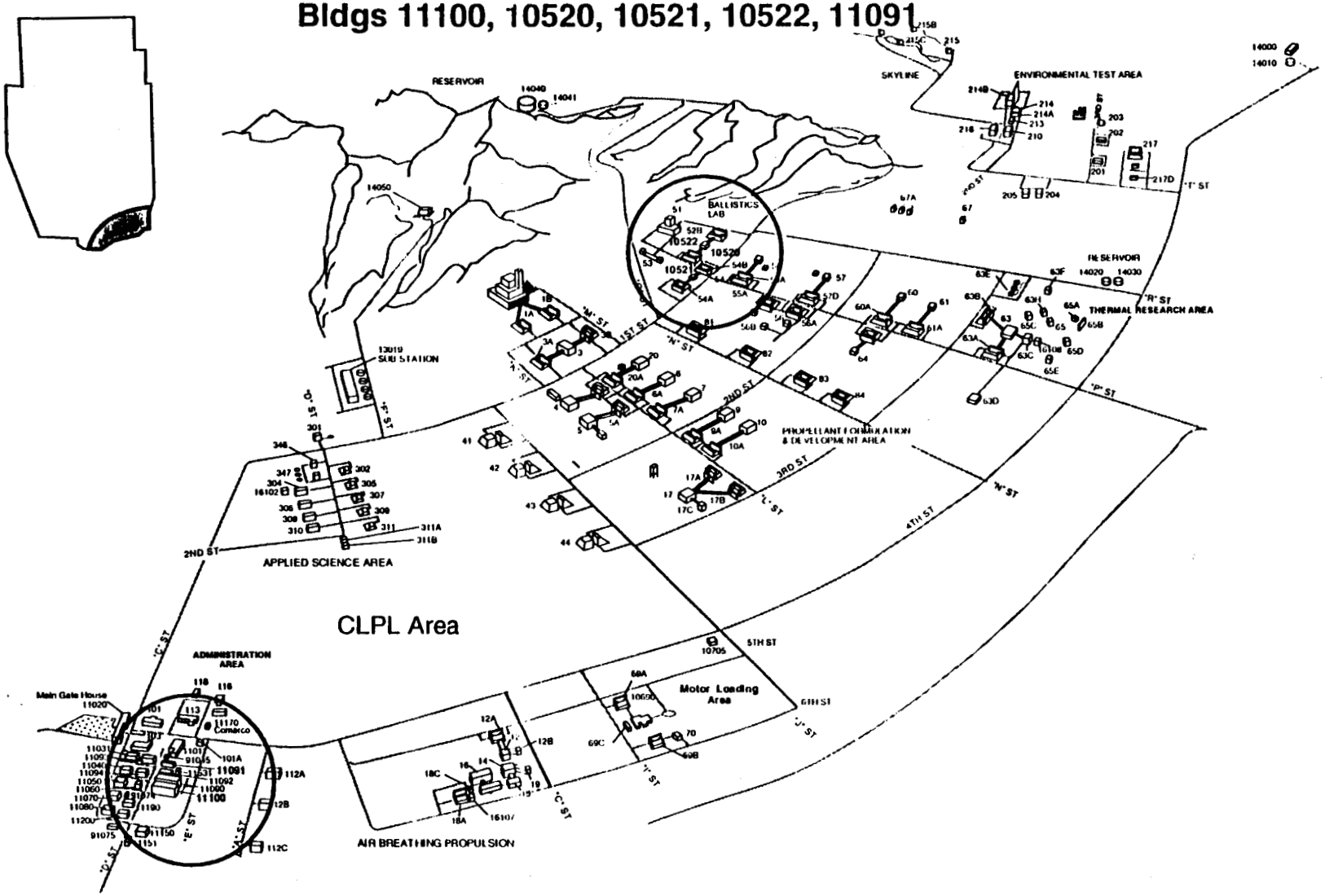
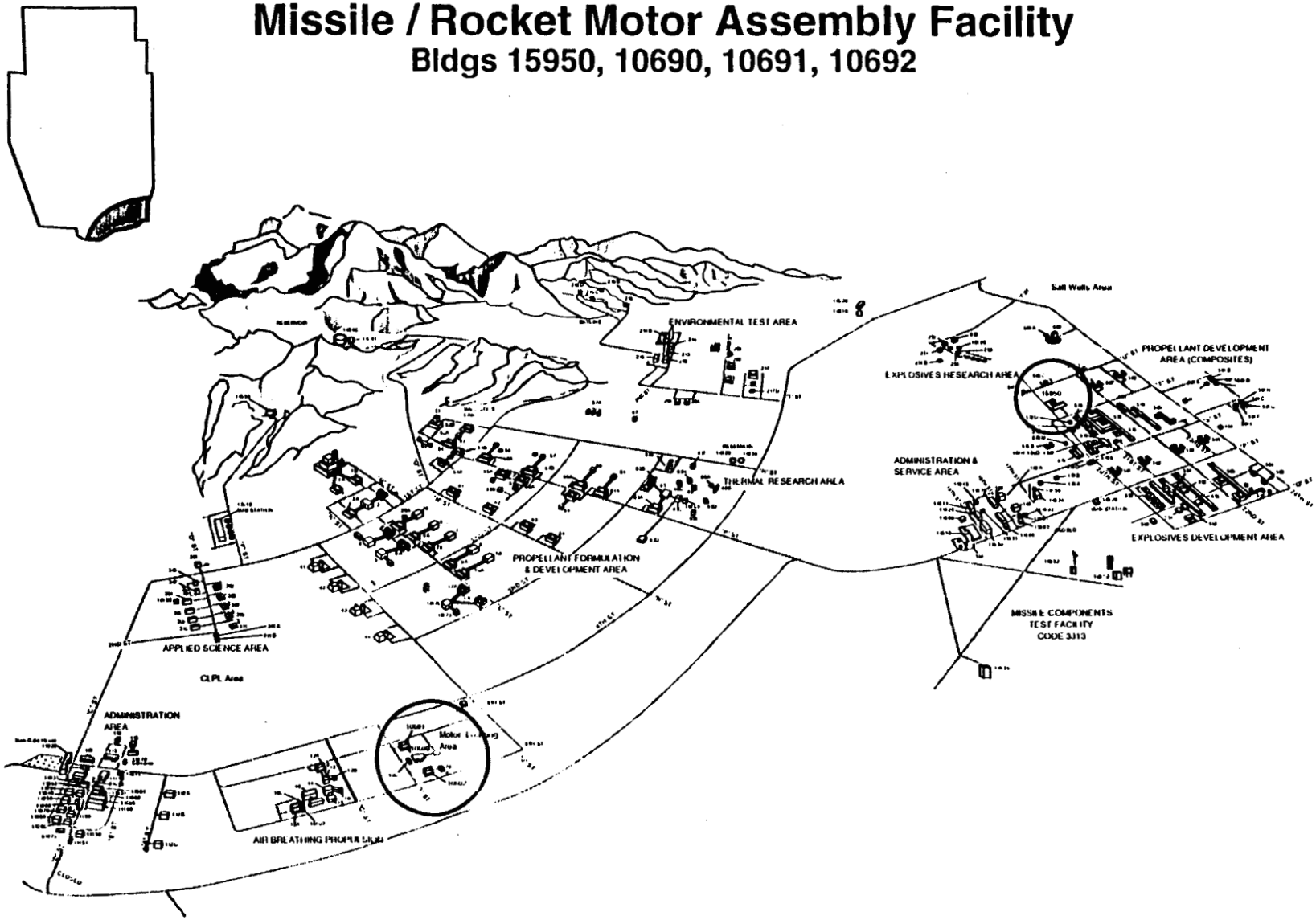
16132
16145
16151
16148
16147

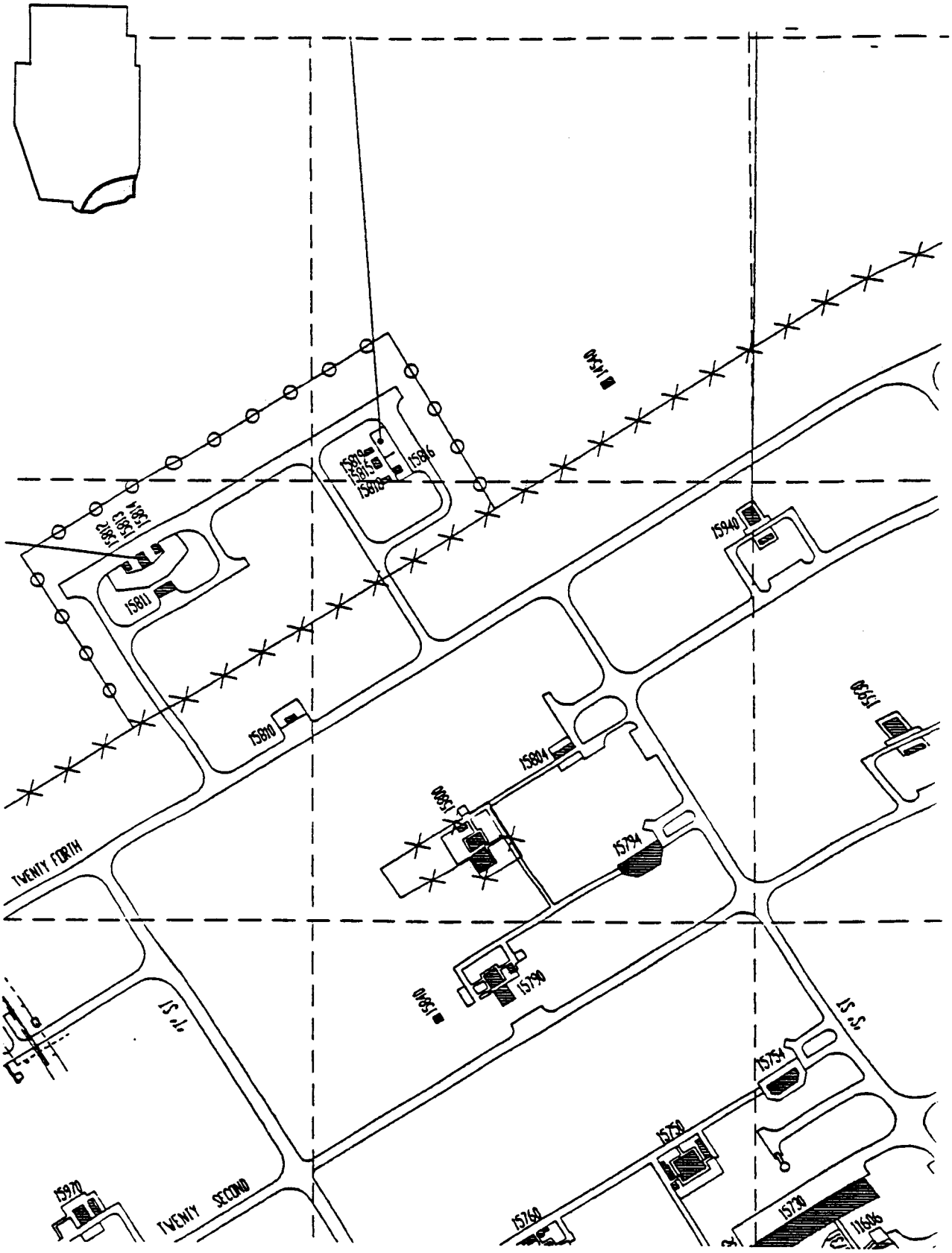

RANGE DEPARTMENT
LARGE ROCKET MOTOR
DISPOSAL FACILITY (PROTOTYPE)
16149
16153
16150
16156
16152
98038
16144
16155
16154
16146
16145
16132
16151
16148
16147

Ordnance Systems Department
Medium Caliber Gun & Ammo Ballistics Test Lab
Bldgs 11100, 10520, 10521, 10522, 11091

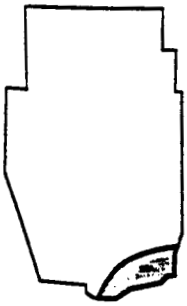


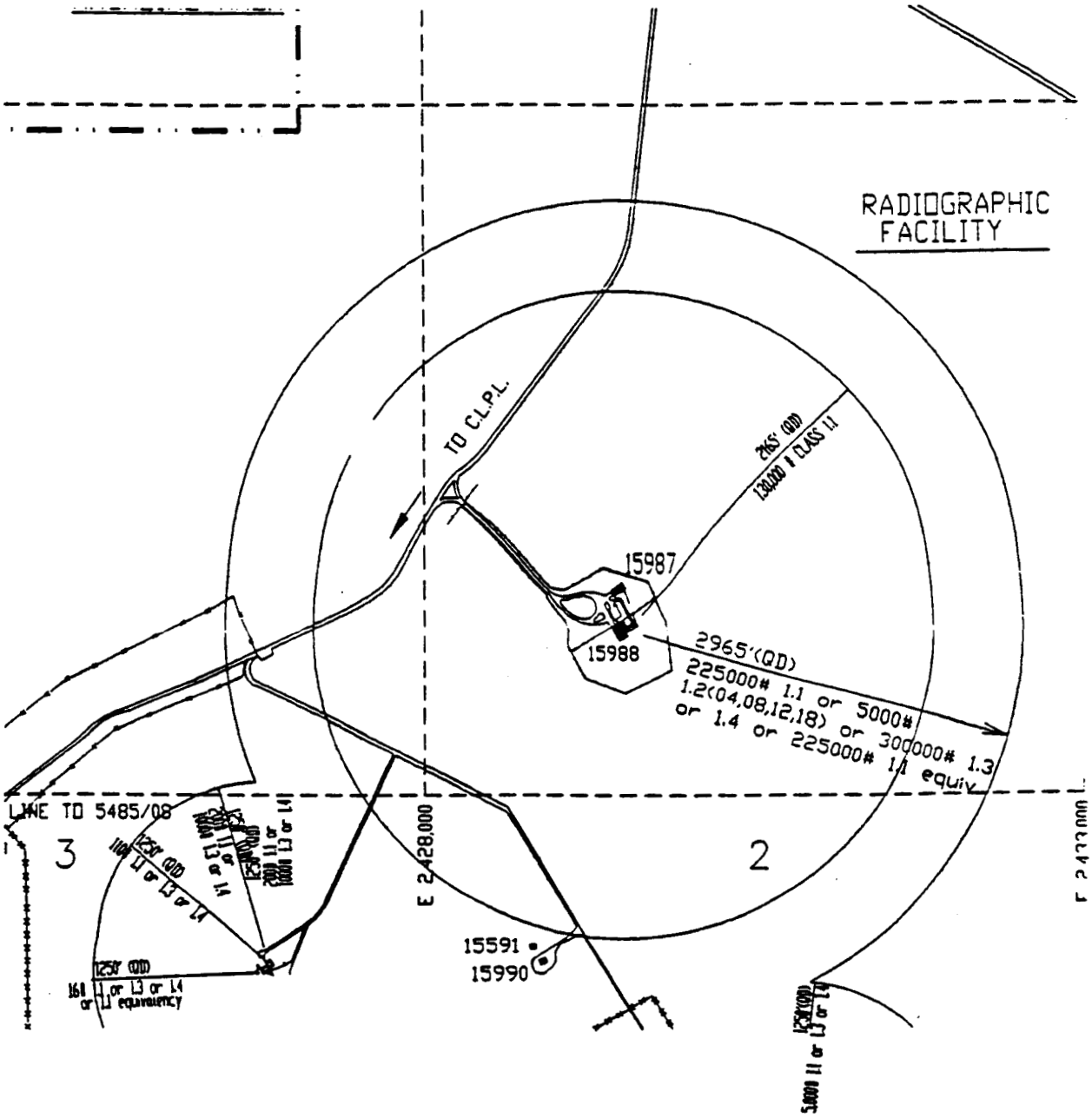
Ordnance Systems Department
Missile / Rocket Motor Assembly Facility
Bldgs 15950, 10690, 10691, 10692





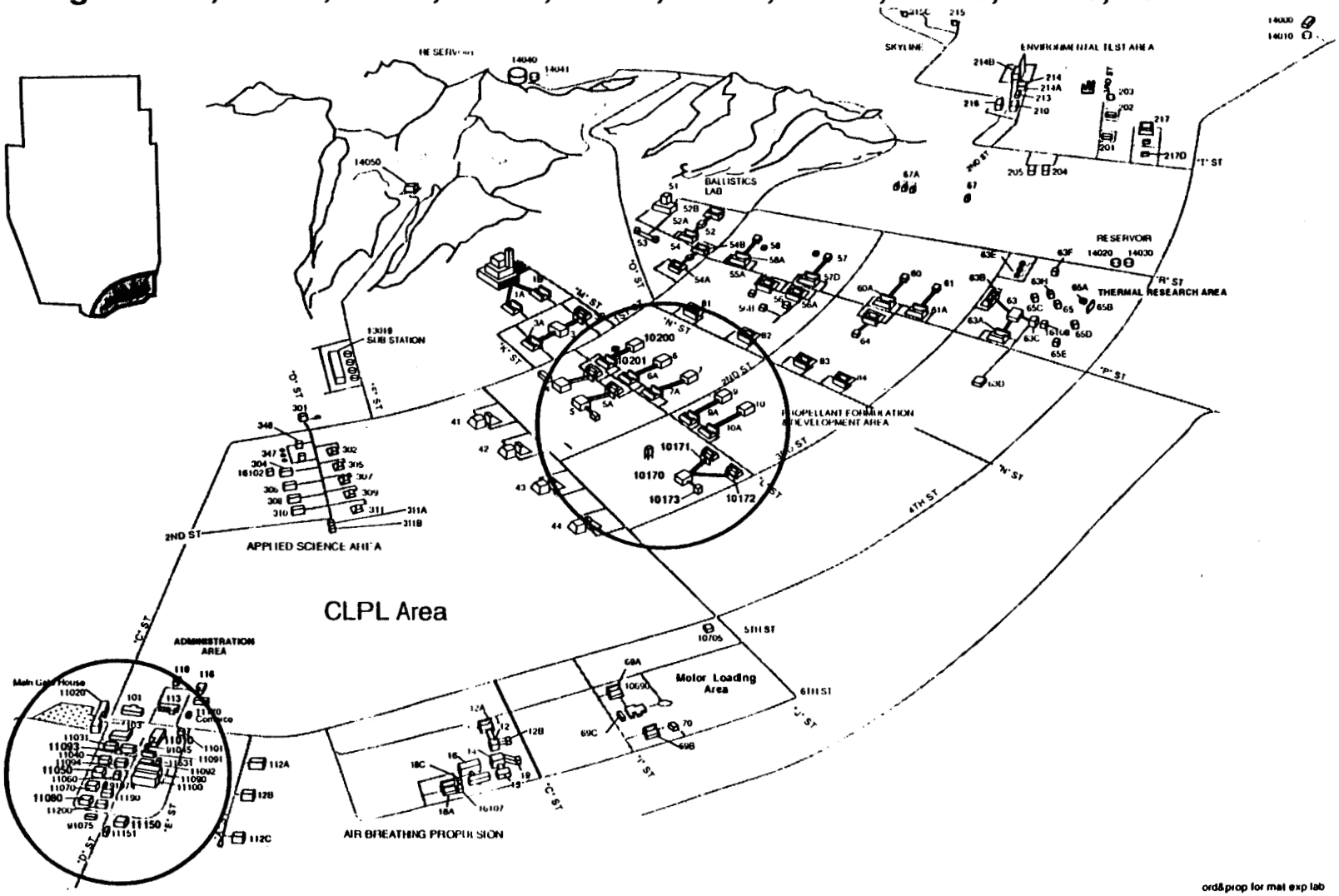
NON-DESTRUCTIVE ORDNANCE TEST FACILITY (1 OF 2)



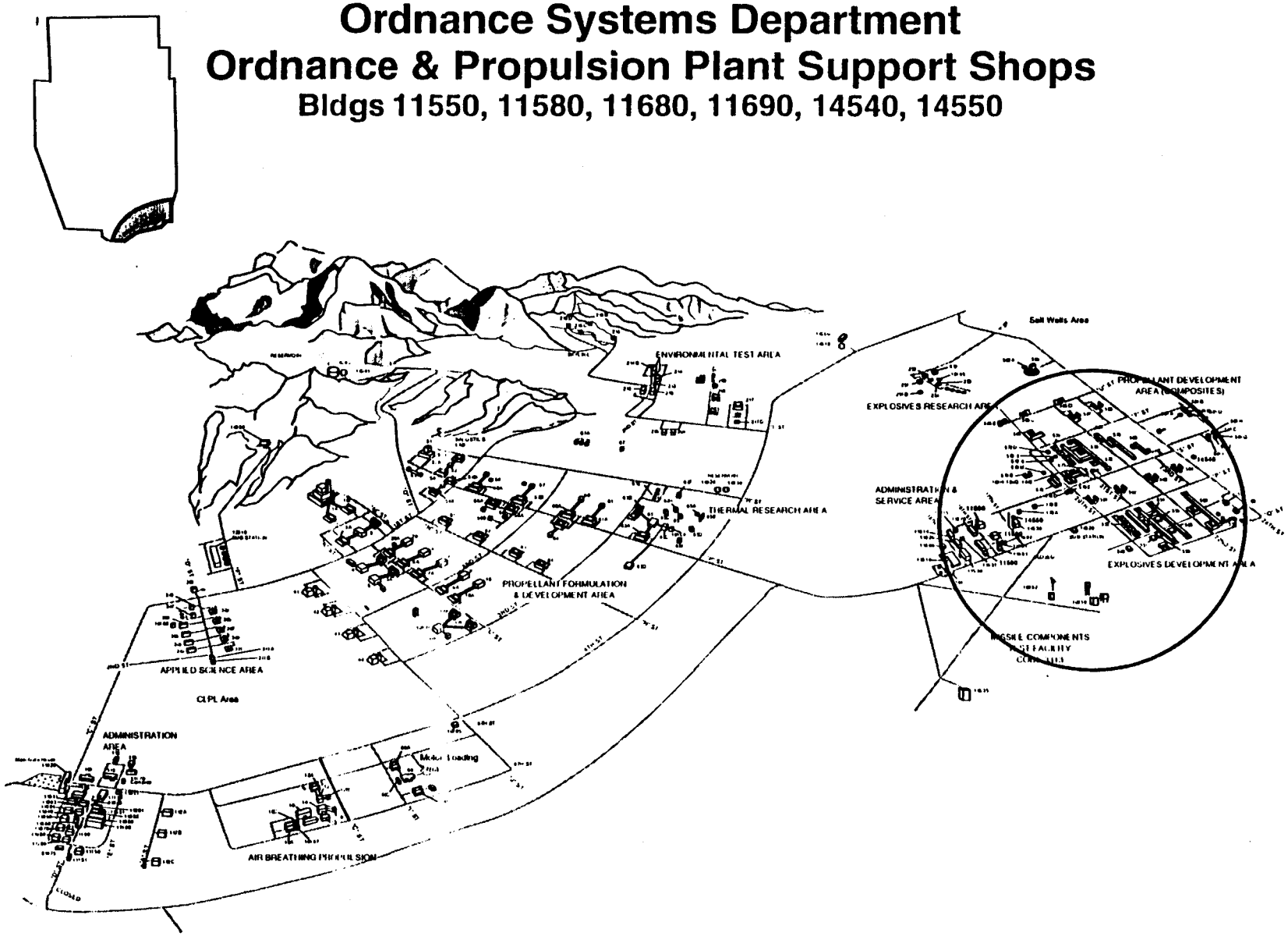


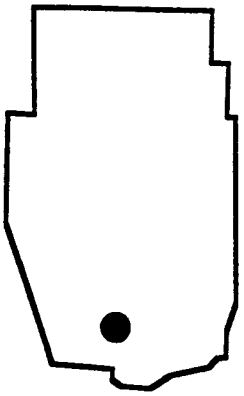
NON-DESTRUCTIVE ORDNANCE TEST FACILITY (2 OF 2)

Ordnance Systems Department
Ordnance & Propulsion Foreign Materials Exploitation Lab
Bldgs 10170, 10171, 10173, 11150, 10200, 10201, 11110, 11093, 11080, 11050

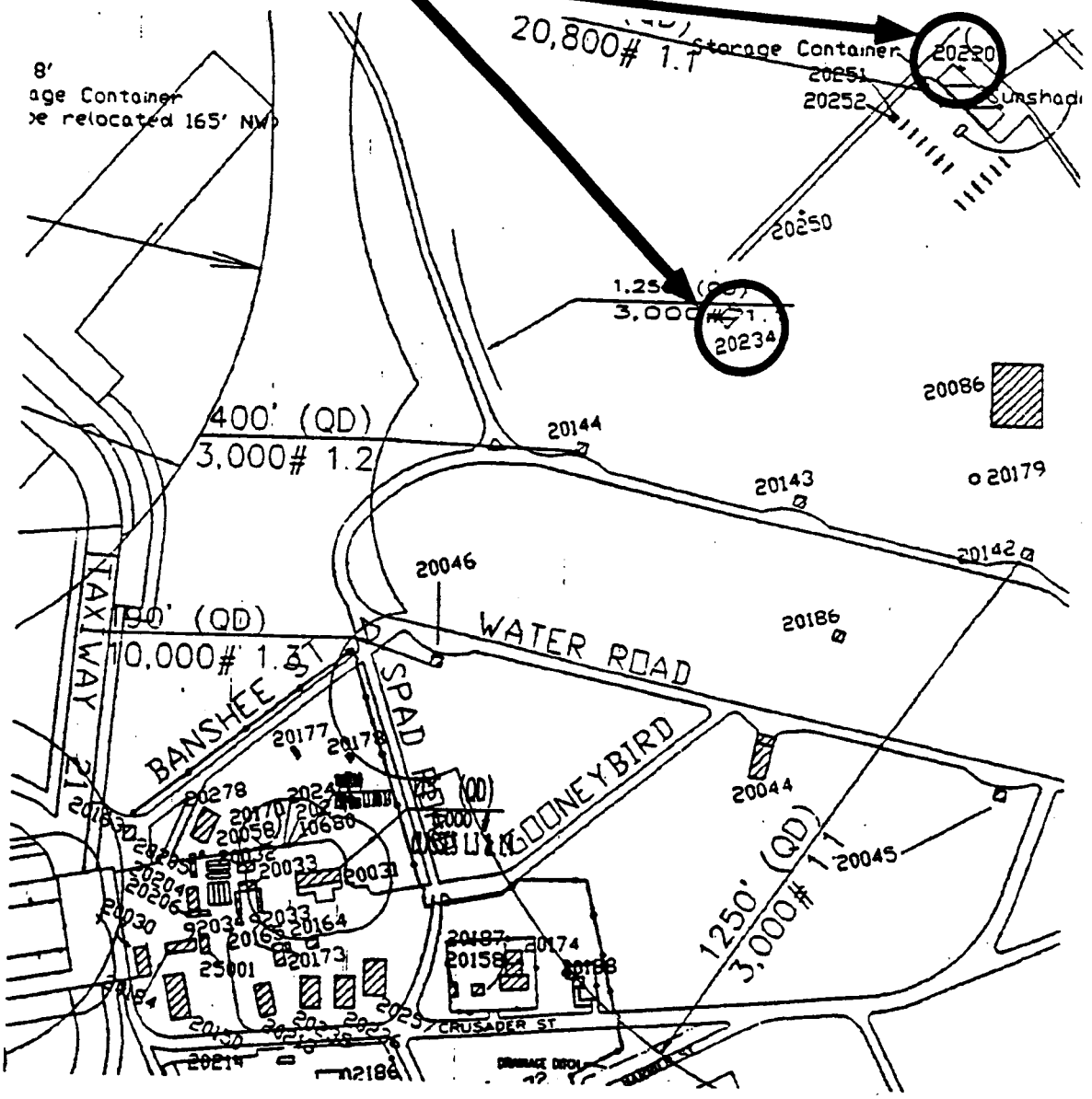


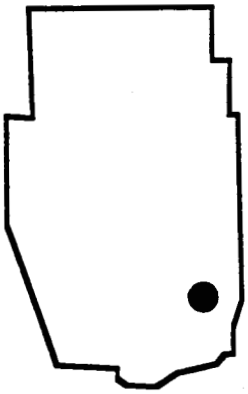
Ordnance Systems Department
Ordnance & Propulsion Plant Support Shops
Bldgs 11550, 11580, 11680, 11690, 14540, 14550





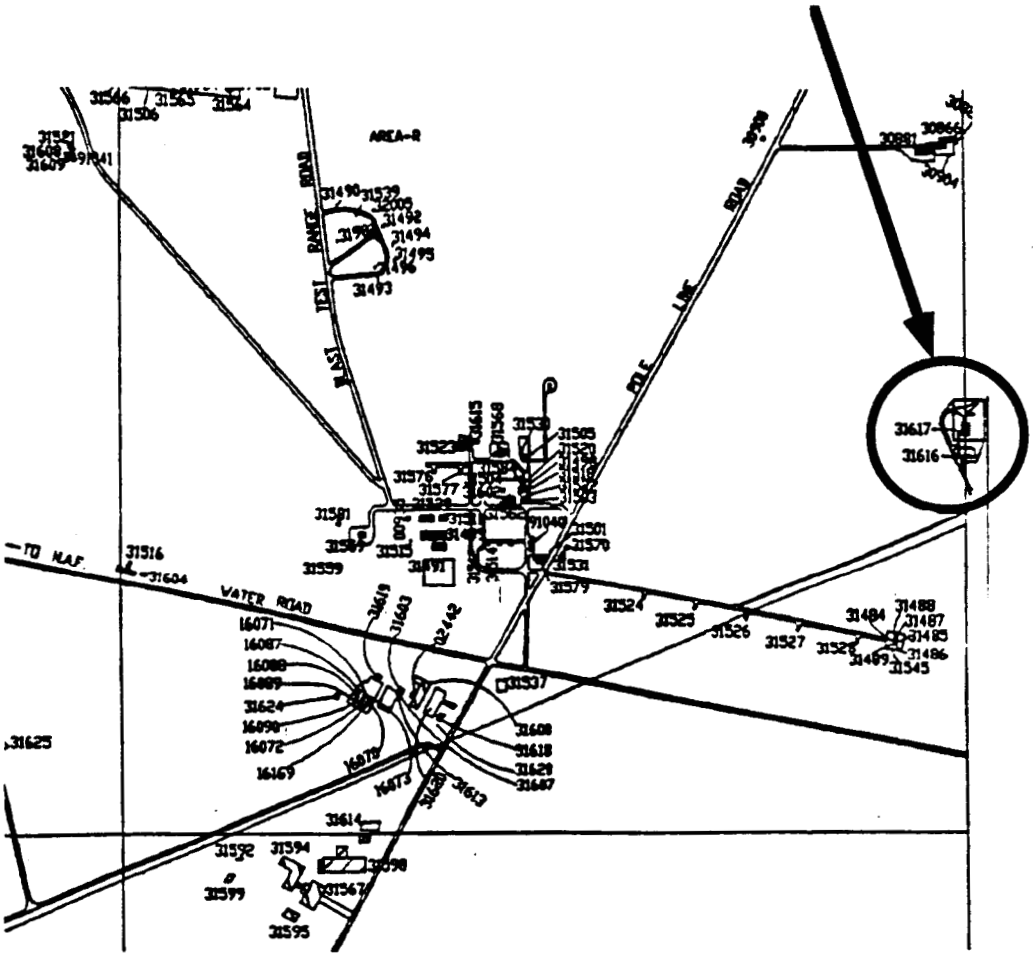
NAVAL AIR WARFARE STATION
ORDNANCE ASSEMBLY FACILITIES

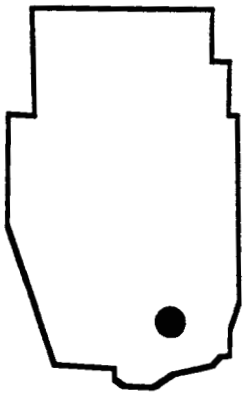


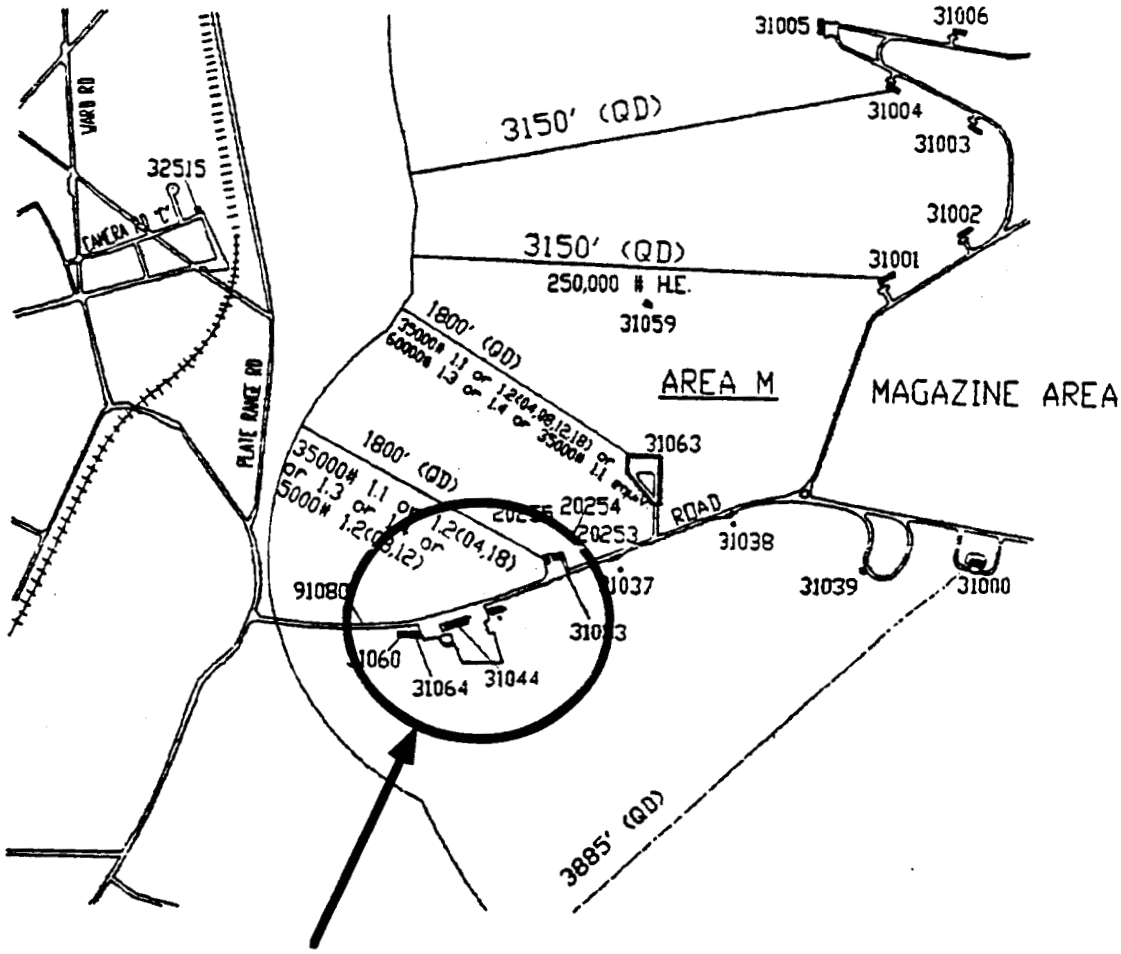


NAVAL AIR WARFARE STATION

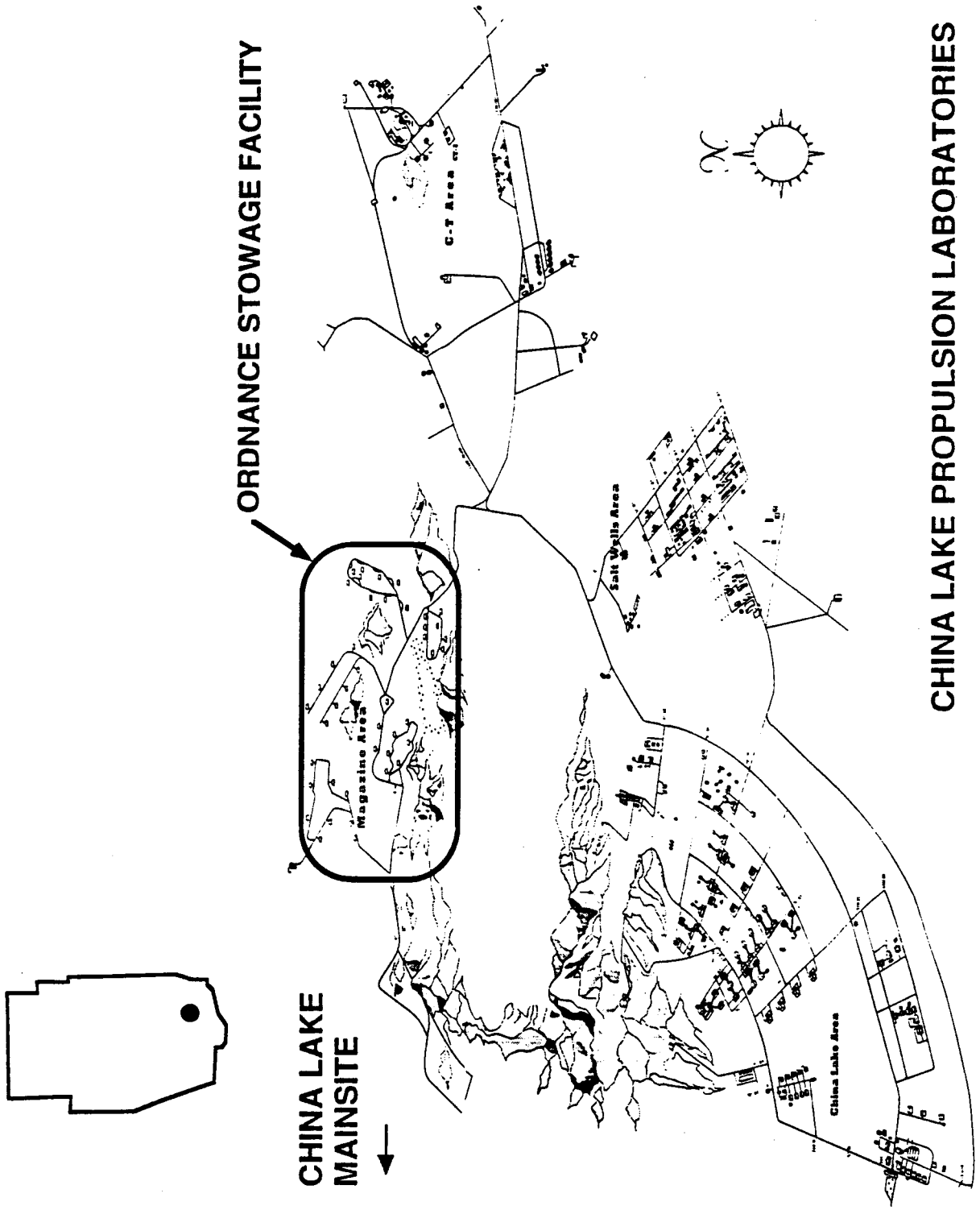
ORDNANCE BREAKDOWN FACILITY

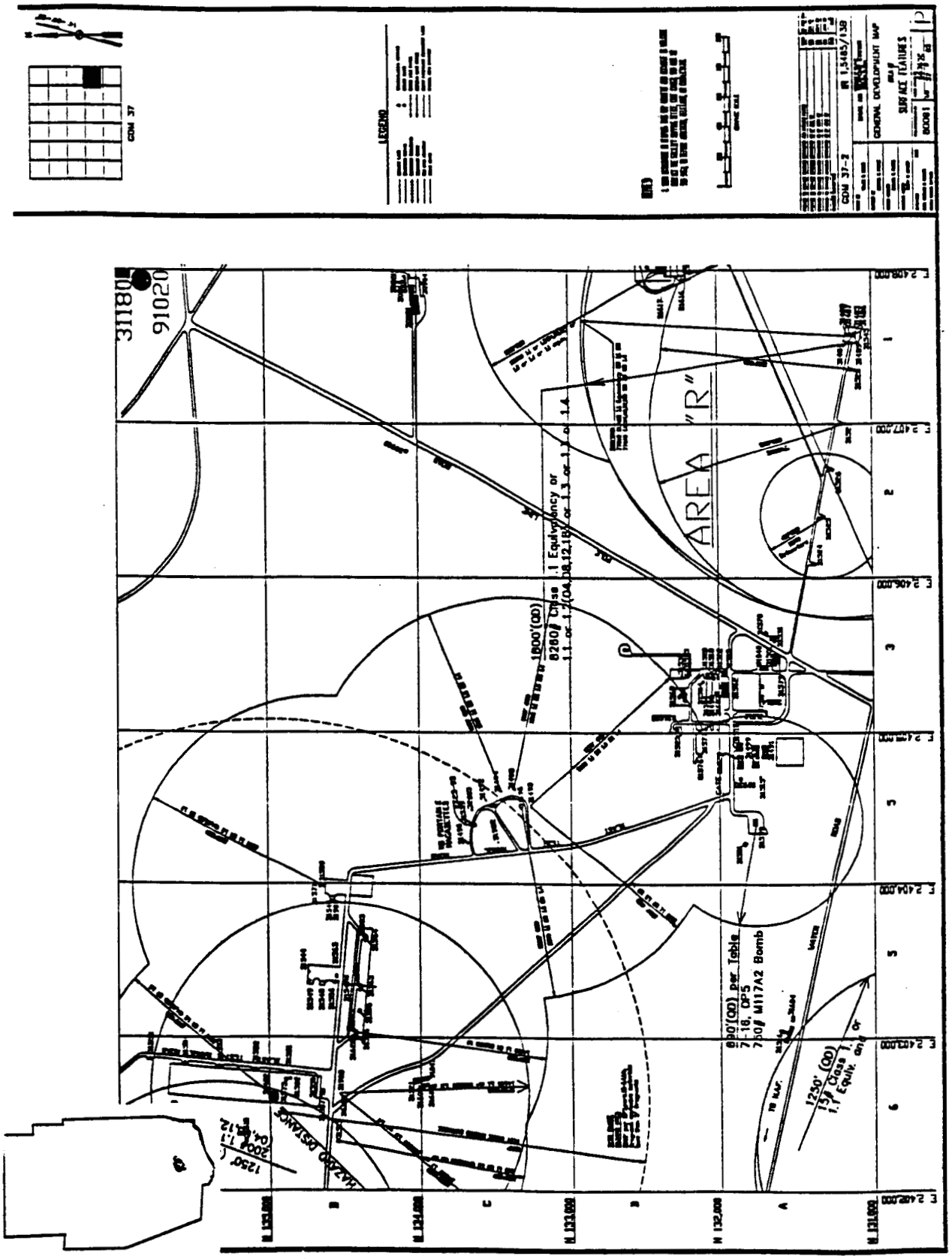




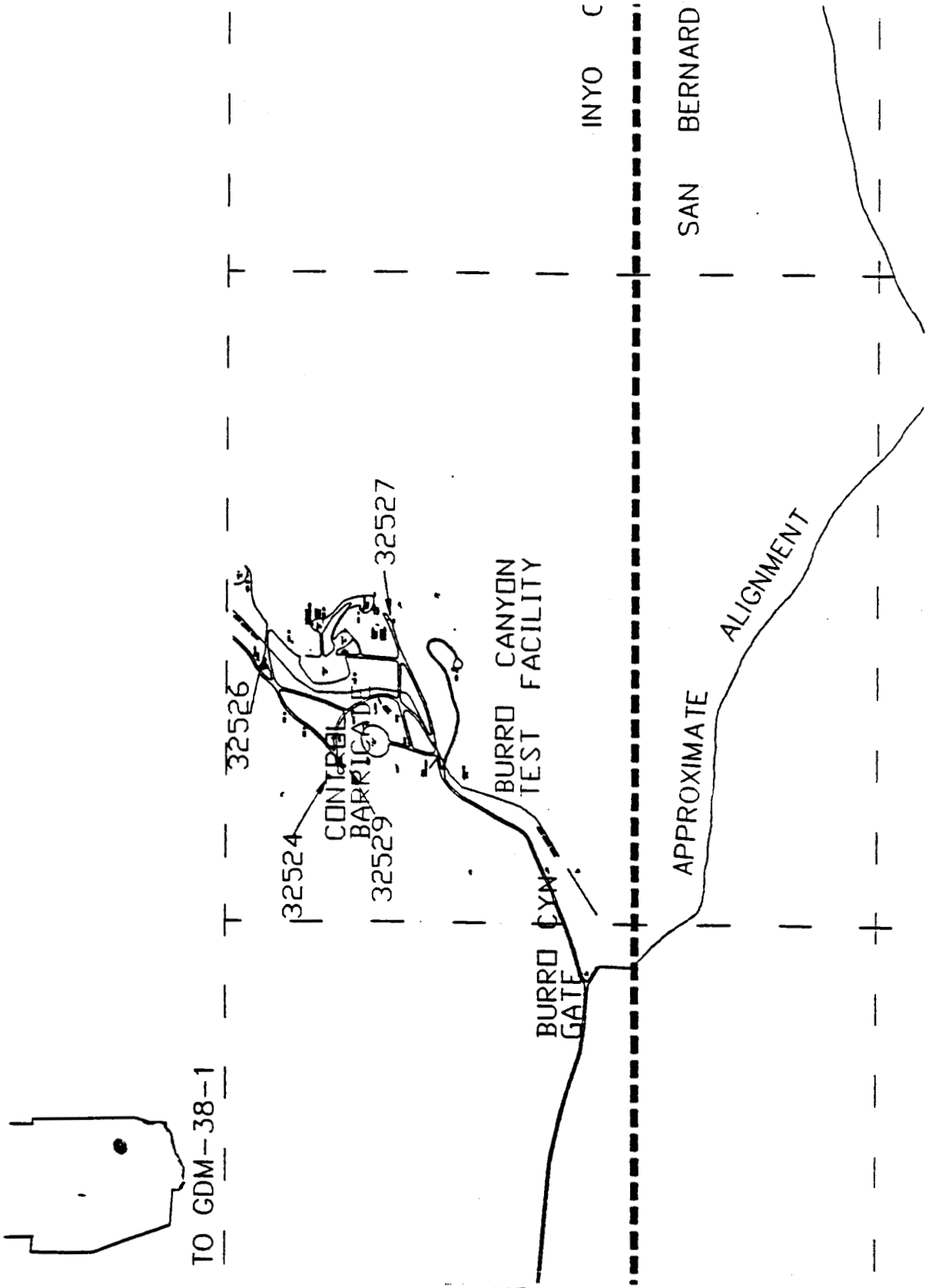


NAVAL AIR WARFARE STATION
ORDNANCE PACKAGING FACILITY


ORDNANCE STOWAGE FACILITY
CHINA LAKE PROPULSION LABORATORIES
CHINA LAKE MAINSITE
Magazine Area
C-T Area
Salt Wells Area
China Lake Area
N

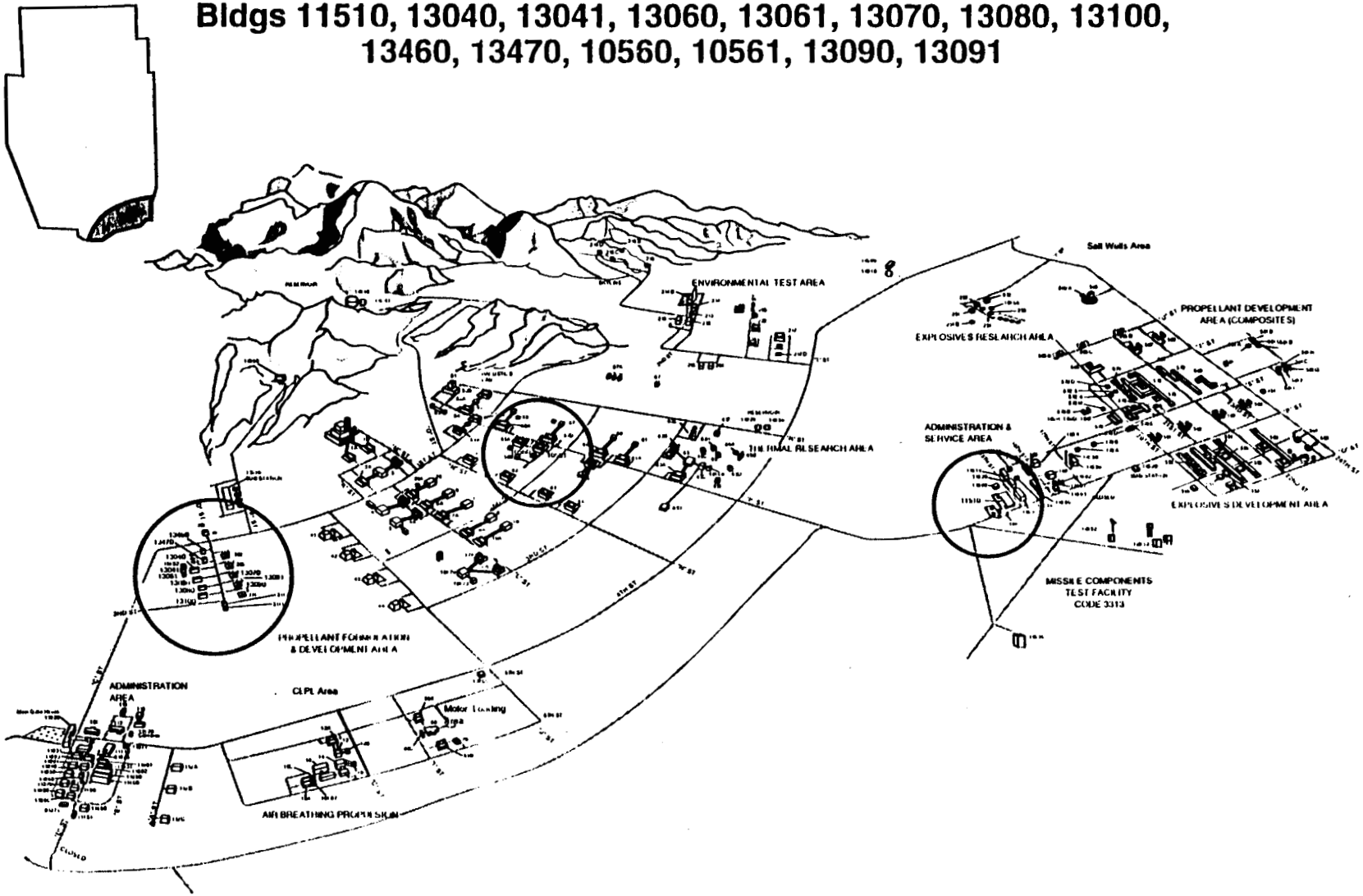


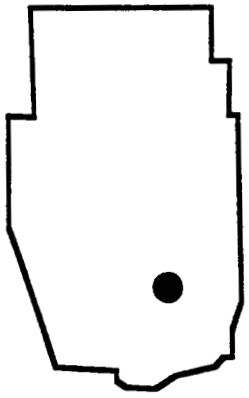
ORDNANCE TEST COMPLEX (1 OF 2)

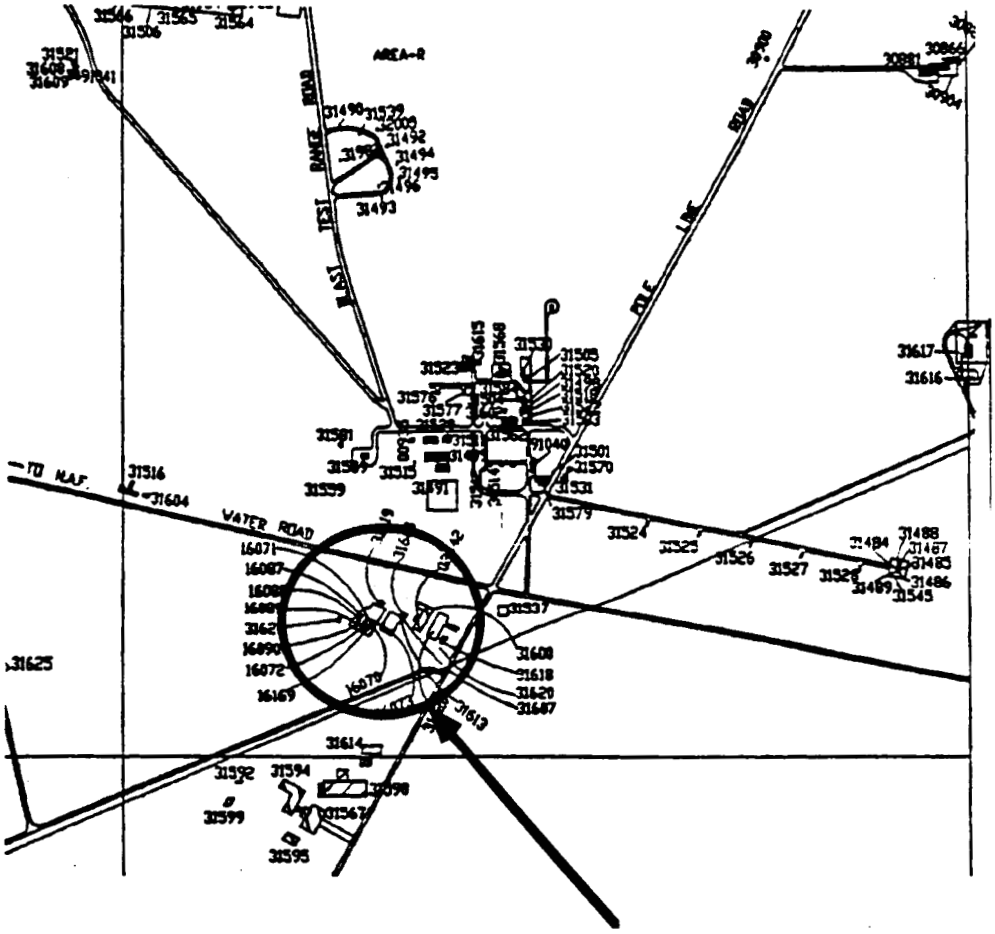


ORDNANCE TEST COMPLEX (2 OF 2)

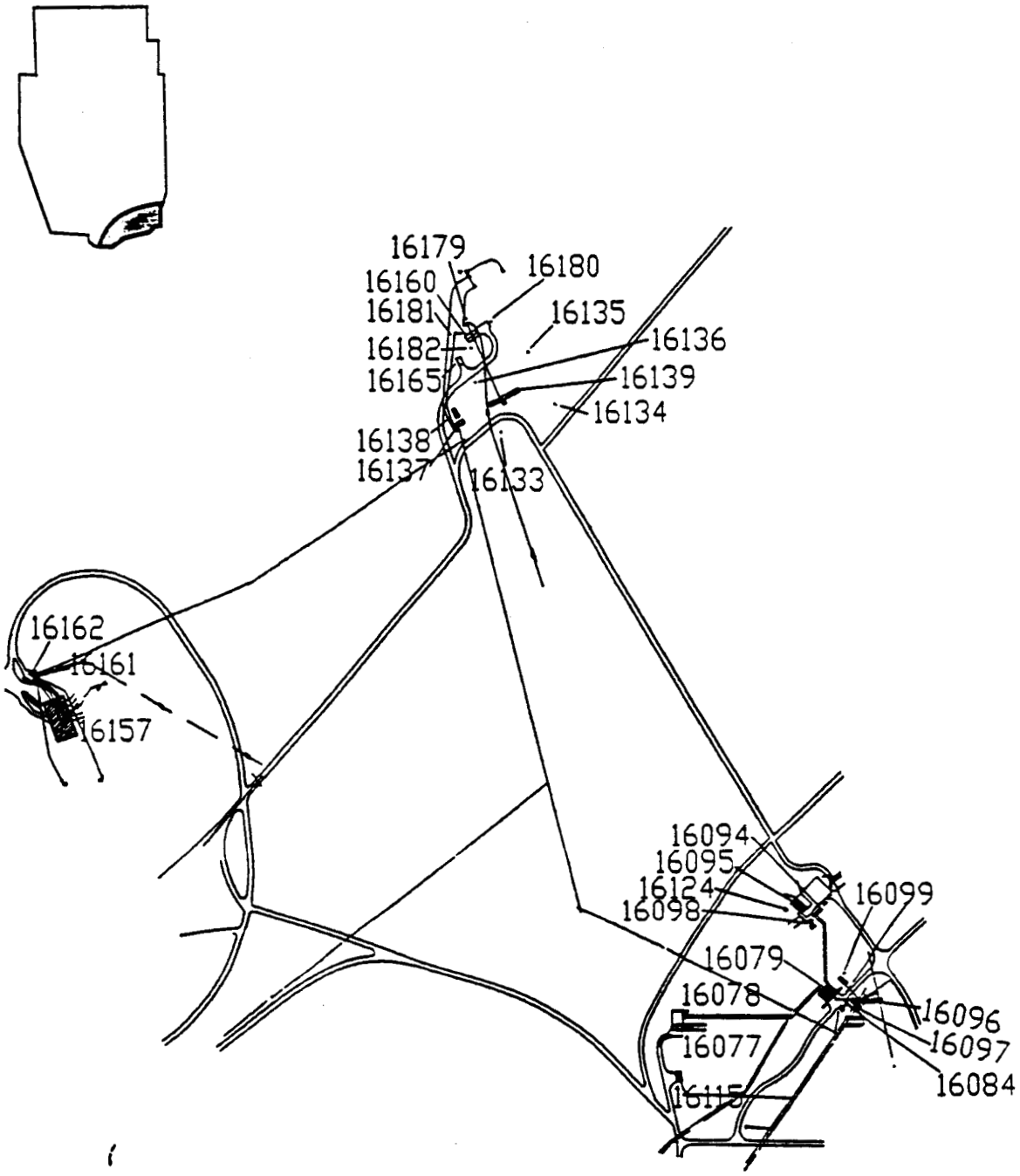
Ordnance Systems Department
Propellants and Explosive Formulation Labs
Bldgs 11510, 13040, 13041, 13060, 13061, 13070, 13080, 13100, 13460, 13470, 10560, 10561, 13090, 13091



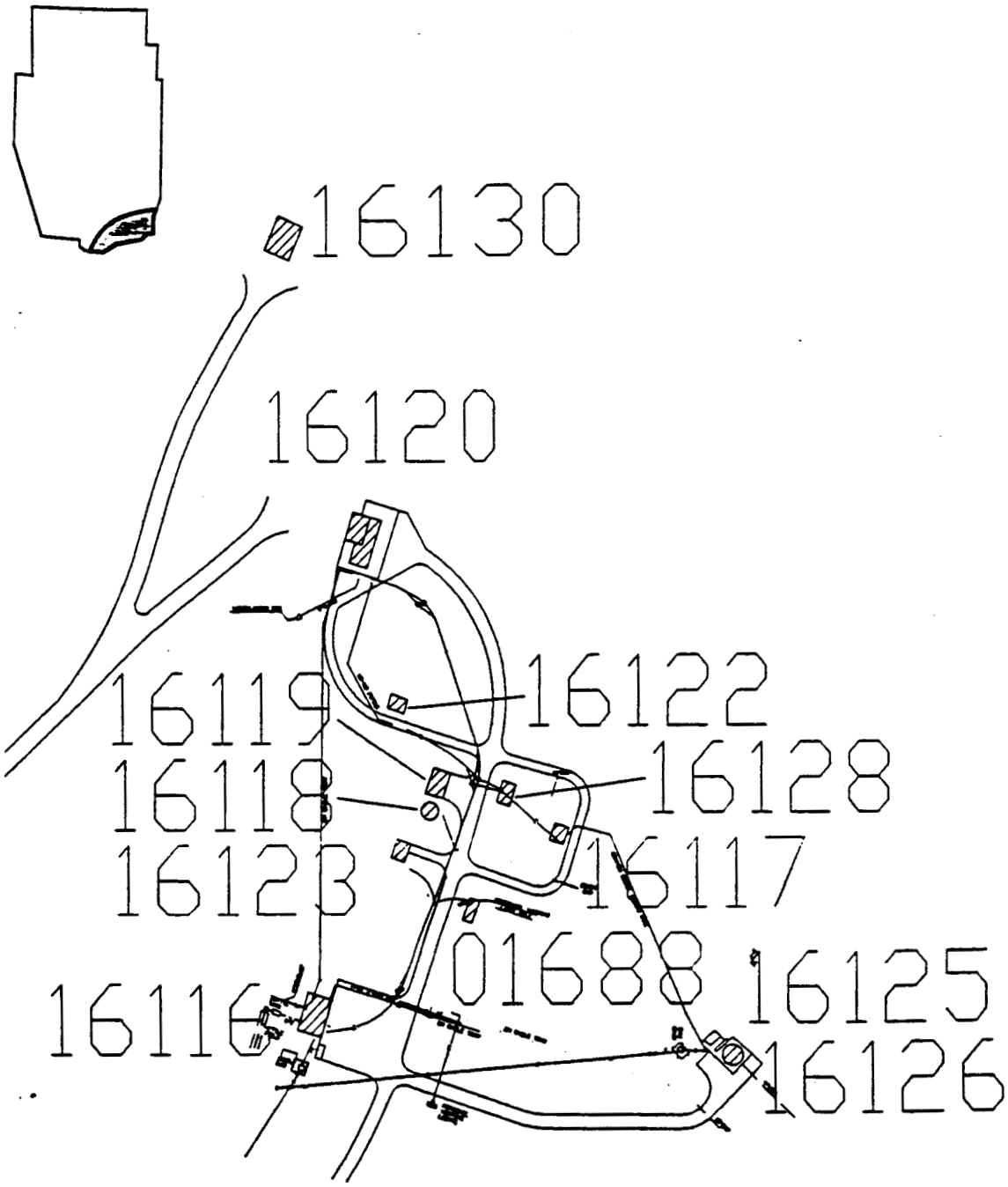




RESEARCH DEPARTMENT
PROPULSION & ENERGY CONVERSION RESEARCH

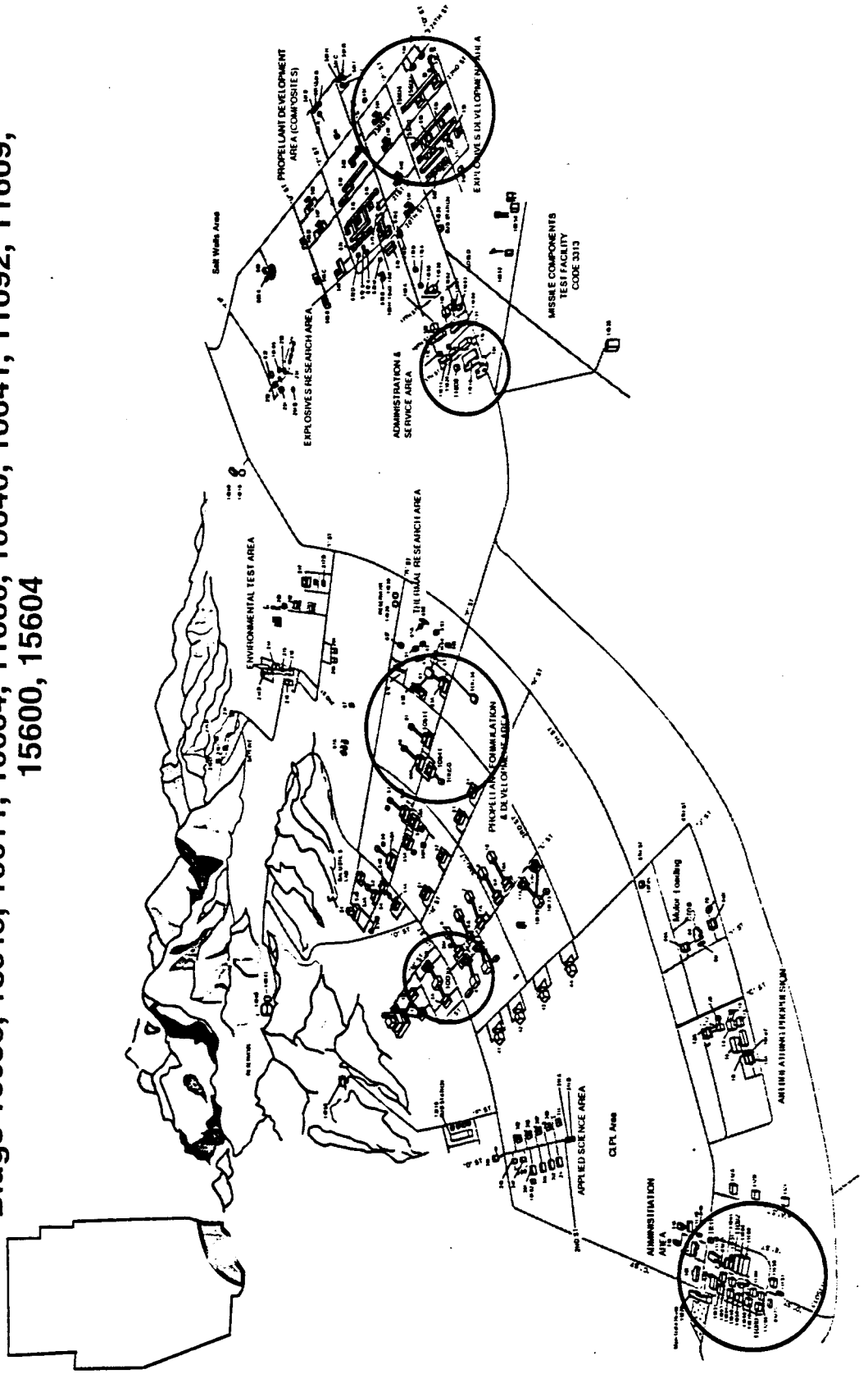


STRATEGIC PROPULSION TEST



TACTICAL PROPULSION TEST

Ordnance Systems Department
Warhead / Bomb Assembly / Integration Facilities
Bldgs 10030, 15540, 10611, 10634, 11080, 10640, 10641, 11092, 11609, 15600, 15604



4.C. SUMMARY OF COSTS OF THE NAWCWPNS CHINA LAKE ENERGETICS COMPLEX

The replacement cost for buildings associated with energetic materials at NAWCWPNS is $542 million and $22 million for TDDs. This amount does not, however, reflect the multiple infrastructure costs required to utilize these buildings. A hidden facility cost is required to perform energetic functions that does not appear in the listed replacement costs of 4.b. This infrastructure can be broken into five categories and will be discussed in the following paragraphs.

Building Infrastructure
The building infrastructure is a combination of the costs associated with roads, utilities, steam heat generation, special air supplies, special hydraulics systems, special fume hoods, etc. The building infrastructure cost associated with energetics at China Lake is determined by multiplying the certified cost for all of China Lake by a percentage that represents the amount of facilities at China Lake being used for energetics.

Vehicle Infrastructure
For an energetics facility to be run efficiently and effectively, vehicles such as truck, fork lifts, cranes, and other handling equipment must be available to the facility. The vehicles used by the organizations supporting energetics make up the vehicle infrastructure.

Computer Network Infrastructure
NAWCWPNS is a modern energetics facility; therefore, a considerable amount of its operation is dependent on a computer network to run efficiently. The computer network infrastructure is made up of a fiber-optic trunk that services local area networks at each facility. It also includes the computer system (both personal and workstations) and software used by the personnel working in energetics. The computer network infrastructure is calculated by doing a detail estimate for 30% of the energetics operations and extrapolating this number to cover the entire operations.

Environmental Infrastructure
NAWCWPNS has spent a considerable amount of money and resources to bring itself into compliance with environmental laws and regulations. This includes the installation of equipment such as waste water tanks and collection systems, acid neutralization system, chemical storage lockers, and HAZMAT accumulation sites. Additionally a complete inventory of hazardous materials must be maintained along with a complete environmental protection program.

Safety Infrastructure
Without a complete, well-organized, and well-run safety program, an energetic facility cannot operate. NAWCWPNS' safety program is made up of safety policy, standard operating procedures (SOP), a certification program, safety equipment, and automated systems that monitor environmental conditions to determine the safety of operations. The safety infrastructure is a combination of the cost to provide all those previously mentioned for the NAWCWPNS energetics facilities.

Actual Facilities Replacement Cost

The following estimates are believed to be conservative.

To get a true amount for the replacement of facilities at NAWCWPNS, the total infrastructure costs ($260 million) must be added to the previously estimated building replacement cost ($564 million) and equipment cost ($70 Million).

Minimum Total Replacement Cost For Energetics Facilities ≈ $900 Million

5. *Estimate the capacity of the activity and installation (separately) to absorb similar workyears with little or no modification of facilities. Estimate the capacity of the activity and installation (separately) to absorb similar workyears with major modifications and describe the nature of those modifications and estimated cost. Use FY97 as the baseline for such estimates.*

CAPACITY TO ABSORB WITH LITTLE OR NO MODIFICATIONS.

The NAWCWPNS energetic facilities have been expanded and modernized over the last 40 years to meet the changing requirements of the Navy. These facilities in FY 97 will have the capacity to absorb a minimum of 480 workyears with little or no modification to the facilities. This capacity estimate is based on

(1) Analysis of the facilities utilization and manpower data from the response to BRAC 95 Data Call # 5 and;

(2) The analysis of out-of-service buildings, which could be put back in service to perform energetic functions.

These analyses are explained in the next two paragraphs.

Each of the facilities/capabilities listed in the data matrix response to question #3 of BRAC 95 Data Call #5 were reviewed. The FY 97 estimated utilization factor and operation and maintenance manpower numbers from this matrix were used to develop under-capacity utilization workyears. The results from these facilities were then summed to provide the total under-utilization workload that could be absorbed with little or no modifications.

Within the China Lake Pilot Plant complex there are 19 buildings that are closed because of various workload reasons. These facilities are qualified ordnance operating buildings that, with some maintenance and/or repair, can easily be utilized to expand the capacity of the NAWCWPNS energetic functions. The following are three examples of energetic functions/capabilities that can be used to absorb similar work years of effort.

(1) A continuous explosive or propellant mixer with a capacity to produce 250,000 pounds of explosive per year could be installed into building 10600. A remote operations control room exists, and power and utilities are in the facility. Minor maintenance and repair would make this building suitable for explosive operation.

(2) Water jet demil equipment could be installed into building 10050. This facility could be used to demil solid propellant rocket motors or warheads for subsequent reuse of the metal parts and possibly the explosive or propellant. Control room, water supply, and power exist to the building.

(3) Double-base propellant presses are located in buildings 10010, 10030, 10040, 10530, and 13010. These facilities were closed when the requirements for double-base propellant processing diminished, but they could be reactivated, providing a useful materials evaluation, pilot production, or production facility for double-base propellants.

The above examples show how 9,800 square feet of floor space could be utilized to perform similar functions with additional manpower.

Similar estimates were made for other inactive facilities and, when combined with the under-utilization data, provided the estimate of about 480 workyears of similar work that could be performed with little or no modifications.

The following groundrules were used in the above analysis:

(1) All buildings meet the siting and safety requirements of NAVSEA OP-5, AMMUNITION AND EXPLOSIVE ASHORE SAFETY REGULATIONS.

(2) All workloads are based on a 5 day, 40-hour work week.

Thus, if additional shifts were utilized for suitable operations, the estimate could be easily doubled and we could accommodate an additional 900 to 1000 workyears of similar work.

CAPACITY TO ABSORB WITH MAJOR MODIFICATION:

The large geographic area, 1,102,682 acres, of the NAWCWPNS China Lake site make it ideal for absorbing almost unlimited energetic functions. Previous studies identified 4,378 unrestricted acres of this space close to the CLPL area available for unconstrained growth. A map, Figure 1, shows these areas where growth to increase capacity of the energetic functions could be provided if funding were available. Approximately 20,000 additional acres are available for further growth with some addition of infrastructure such as roads and utilities.

The answer to the request "estimate the capacity of the activity and installation to absorb similar workyears with major modification" is "several fold above current levels". Since this is not very helpful, three examples are provided with associated scope and cost. These examples, for different types of major modifications with corresponding workyears, at least give some indications of the results of major modifications.

Examples:

(1) Energetic Materials Laboratory: (This would add to our existing capacity to do this type of work.)

Description of Facility—A 42,000-square-foot state-of-the-art laboratory to perform research and development in synthesis, formulation, and characterization of new propellant and explosive materials. The facility has small-scale formulation laboratories, mixer bays, control room, and other support areas to support scientists and chemists using the facility. The facility is designed to meet the safety requirements of NAVSEA INST OP-5, i.e., explosive-proof electrical fixtures, safety alarms, emergency eye washes and showers, 15-inch-thick concrete walls. The facility is also designed to meet EPA requirements for air and waste water emissions, i.e., exhaust scrubbers, double-line plumbing.

Cost of Facility—The building/utilities and equipment are estimated to cost $24,114K

Workyears Absorbed—The facility would require 29 workyears (single-shift basis) to operate and maintain.

(2) Chemical Processing Facility:

Description of Facility—The facility will be comprised of a reactor complex, nitration complex, tank farms, environmental treatment additions and support structures. The facility will be designed to conduct chemical process research and various nitrate-ester reactor development and production. The facility will be designed to meet the necessary safety and environmental requirements.

Cost of Facility—The buildings, utilities, and equipment are estimated to cost $24,045K.

Workyears Absorbed—The facility would utilize twenty nine (29) workyears (single shift basis) to operate and maintain.

(3) Hypervelocity Laboratory (This would add to our existing capacity to do this type of work.)

Description of Facility—The facility will be designed to conduct research on propellants and explosives in the areas of terminal ballistics, fragment impact, shock wave interaction and time resolved spectroscopy. The facility will be approximately 4,000 square feet and will include multiple gun bays, control room and catch basin. The data from such research will be used in energetic materials performance and hazards predictions.

Estimated Cost—Estimated cost of the building, utilities, and equipment is $1,300K.

Workyears Absorbed—It would require an estimated 12 man-years to operate and maintain this facility.

It should be emphasized that these are only examples to indicate the types of workyears that could be absorbed with specific types of major modifications. In the three examples above, an additional 84 man-years of work could be performed for an additional investment of $49.4M. Again, these estimates are for single-shift operation. Thus, if additional shifts were utilized, the estimate could be easily doubled and we could accommodate an additional 168 workyears of similar work. Different types of additional facilities would, of course, yield different workyears and investment numbers. If specific facilities are identified during the BRAC scenario process, the impact of relocating these function to China Lake could then be estimated.

6. *Describe the impact of BRAC 91 and BRAC 93 decisions on the activity and installation.*

NAWCWPNS has been affected as a result of BRAC decisions from 1991 and 1993. BRAC 91 (BRAC II) realigned the Navy's research, development, test, and evaluation (RDT&E) field activities to create the Warfare Centers. Also, Naval Ordnance Missile Test Station (NOMTS) White Sands was realigned as a detachment of NAWCWPNS to perform functions that could not readily be relocated. Naval Weapons Evaluation Facility (NWEF) Albuquerque was ordered closed, and NAWCWPNS received permission to maintain a permanent detachment at Albuquerque. As a result of BRAC 93 (BRAC III), the Navy Systems Commands will vacate the National Capital Region, including Naval Air System Command (NAVAIRSYSCOM) Headquarters and Program Executive Officers (PEOs) and Program Managers Air (PMAs) who will move to Patuxent River, with the exception of a few Naval Air Systems Command (NAVAIRSYSCOM) weapons engineering personnel who are scheduled to move to China Lake. BRAC 91 closed most of NADC Warminster and moved the majority of its functions to Patuxent River. BRAC 93 closed NAWC-AD Trenton and moved its functions largely to Patuxent River or Arnold Engineering Development Center, Tullahoma, Tenn. The details below apply to NAWCWPNS China Lake since that is where the Energetics work is done.

BRAC 91 (BRAC II) UPDATE

As a result of BRAC 91, NAWCWPNS stood up on 1 January 1992 combining Naval Weapons Center (NWC), China Lake; Pacific Missile Test Center (PMTC), Point Mugu; NWEF Albuquerque; and NOMTS White Sands into a single command. Over the past 2 years, continuous organizational consolidations have been ongoing to eliminate duplication of functions and reduce overhead infrastructures. NAWCWPNS closed NWEF Albuquerque and established a detachment on 4 June 1993, and realigned NOMTS to a detachment of the Weapons Division on 12 May 1992.

BRAC 93 (BRAC III) UPDATE

NAWCWPNS is continuing consolidation within its organization. A detachment from NAVAIRSYSCOM Weapons Engineering Division will be moved to China Lake when NAVAIRSYSCOM vacates the National Capital Region.

The Naval Aviation Depot at Naval Air Station (NAS) Alameda is being closed as a result of BRAC 93 and the gun rework activities that have been managed and performed at Alameda for the past several years are being relocated to the NAWCWPNS China Lake site. This offers some unique capabilities to the developer, logistics, and user communities. Included in the advantages of this situation is that it represents complete cradle-to-grave support of a sizable portion of USN/USMC aircraft gun systems. The close physical and organizational relationships of the RDT&E, ISE production support, logistics, and rework efforts will result in significant improvements in the basic design, maintenance, logistics efficiencies, and life-cycle costs related to the Fleet guns.

Initially, there will be approximately 5 to 6 personnel transferred with the workload to the NAWCWPNS China Lake site. In addition to the people, several million dollars worth of equipment will be removed from Alameda and relocated to China Lake. China Lake has identified an appropriate area for the relocation of the Rework Facility in the China Lake Propulsion Laboratory (CLPL)/Salt Wells (SW) areas. The pre-existence of the Ballistics Test Laboratory (BTL) in the CLPL area had a very positive affect on the desirability of relocating this function to China Lake. A complete description of the BTL is included in Section 4 of this document.

The airspace use over China Lake will most probably be affected as a result of the BRAC 93 decision to close U.S. Marine Corps (USMC) Air Station, El Toro. Closing El Toro causes the following chain of events: The Navy is considering a move of the Marine F/A-18s from El Toro to NAS Miramar. This, in turn, will cause the F-14s and E-2s from NAS Miramar to move to NAS Lemoore. As a result, the F-14s and E-2s will increase their use of the R-2508 special-use airspace over NAWCWPNS China Lake. Therefore, a computer-based study on the impact of this modification to the use of R-2508 airspace at China Lake has begun. However, the utilization of the R2508 Joint Use, Special Use Airspace is currently well below its historical peak as shown in the table below. For example, in 1989 (prior to closure of George AFB in Adelanto, Calif.), there were 72,306 sorties in R2508, whereas in 1993, there were 52,399 sorties. Furthermore, the energetics test work that is done at NAWCWPNS is almost exclusively done under the R2505 and R2524 portions of Special Use Airspace, which are directly controlled by NAWCWPNS from the surface of the earth to infinity. The increase in use of R2508 does not adversely affect the ability to accept more energetics work at NAWCWPNS.

Total Sorties By Fiscal Year						
FY87	FY88	FY89	FY90	FY91	FY92	FY93
70,259	72,100	72,306	60,620	54,284	58,005	52,399

As a result of BRAC 93, the Defense Information Systems Agency (DISA) was to consolidate major DOD data-processing facilities and personnel under its command. The DOD BRAC 93 study incorrectly identified 21 government positions at the China Lake data-processing facility. The actual number of government positions is six, as documented in official NAVAIRSYSCOM correspondence to DISA. By 1996, NAWCWPNS expects to have eliminated all mainframe operations. At that time, it will not have any facilities or government positions dedicated to mainframe data-processing operations and thus will not have any facility or government positions to transfer to DISA.

7. Describe military department approved and programmed plans which will impact or have impacted the activity and installation.

INTRODUCTION

Several military plans and programs have started to impact NAWCWPNS installations. The recent military policies dealing with environmental issues has impacted our facilities and methods of operation to meet stated compliance requirements from various environmental legislation. While one side of the coin is compliance, the other side provides increased opportunity to perform research and development to improve the environmental impact resulting from the life cycle of ordnance and energetics. A necessary component of this requirement is institutionalizing continuous improvement and modernization of facilities to meet federal, state, and local regulations.

Several major programs or functions are presently in transition or will be in the near future that will impact our energetic facilities. These include the Large Strategic Rocket Motor Disposal Facility, the transition of the Alameda NAPED Gun Rework Facility, closure of the Jet Propulsion Lab (JPL) Edwards AFB Facility, and USAF Consolidation of Propulsion Research Facilities, the DOD Plume Measurement Facility, and developmental program decisions.

Environmental Energetic R&D Overview

Energetic material development has experienced a major change due to environmental legislation. Energetic materials have historically been associated with use of hazardous materials, such as explosives, propellants, pyrotechnics, and organic volatile compounds. In recent years NAWCWPNS has made great strides in improving the environmental outlook of energetic development. Within our functional and product descriptions, we have indicated the modernization of facilities, the full compliance with federal, state and local regulations, and how this change has impacted NAWCWPNS operations. A further impact can be seen in our outlook on environmental energetic R&D. We have determined that there is a synergistic effect to be gained by having the same S&E staff perform environmental research while continuing to carry out their main mission of providing the Fleet with the best weapons in the world. These experts know the make up and life cycle of our defense weapons, so they are in the best position to help find solutions to environmental concerns. In fact, our S&Es are now including environmental impact in their requirements definitions and are actively pursuing dual-use transitions of these technologies.

Environmental Energetic R&D Projects

Projects at NAWCWPNS that have environmental R&D that include energetic materials activities include the following:

a) Development of compact incinerators using propulsion technology to destroy OVCs and hazardous materials.

b) Basic research in combustion optimization and feedback controls to destroy OVCs and hazardous materials.

c) Development of real-time metallic particulate sensors to monitor air emissions from destruction of ordnance smokes, flares, and dyes.

d) Development of easily demilitarized explosives and propellants with hydrolyzable binder formulations.

e) An active NAWCWPNS support program to encourage innovation in environmental R&D.

f) The modernization of our energetic industrial waste water treatment facility.

Brief Description of Projects

Compact Incinerators: This project aims to develop small compact incinerators for Navy shipboard and small industrial applications. The effort consists of several parts, including the investigation of foreign incinerator technology and systems, the use of airbreathing propulsion technology, and use of novel advanced concepts such as hydrothermal oxidation and steam reforming. Full capability exists to do design development from computer-aided design, prototype, testing, engineering analysis, and documentation. The Airbreathing Propulsion Facility supports this effort and utilizes approximately 5 man-years including approximately eight people with disciplines from chemistry, mechanical engineers, and technicians.

Basic Research on Combustion: This project aims at studying the improvement in flame combustion by utilizing vortex control to increase the dwell time. Additionally, this project is developing control systems to monitor efficiency and provide real-time feedback to change combustion performance. Ultimately, this project supports investigations in compact incinerator designs. This project is located in the only laboratory in the DOD with real-time 3-D flame imaging capabilities. This capability is necessary for the understanding of the complex interaction between fluid dynamics and combustion that relate to the efficiency and stability of combustion systems. It has demonstrated instantaneous multiparameter imaging on turbulent flows. With this knowledge it should be possible to greatly reduce the undesirable outputs that need to be removed to comply with air emission standards. The Propulsion and Energy Conversion Research Facility is used for this work and utilizes approximately 4 man-years, including 10 people with disciplines, including PhD research chemists, aerospace engineers, and technicians.

Real-Time Metal Particulate Air Emissions Monitor: By sensing the flue gas via gas chromatography spectrometry and creating real-time computer readout and control to the combustor or supply lines, it will be possible to prevent occurrences of major nonconforming emissions involving metallic particulates, such as lead, cadmium, and arsenic. The Chemical Analysis Research Facility is used for this work along with support from the Ordnance Test Complex. This work expends approximately 2 man-years of PhD-level research chemists.

Hydrolyzable Binders: Explosives and propellants are difficult to demil because it usually take solvents, high-pressure water, or cutting operations to remove the energetic materials. This usually results in large hazardous waste streams that have high disposal costs. This task aims at creating formulations that can be easily removed by water solutions containing dilute amounts of acids or bases yet have the performance necessary for our modern weapon systems. This technology will readily recover the energetic materials, such as RDX and HMX, intact and make them available for future use. The Propellants and Explosives Formulation Lab supports this effort and utilizes two PhD-level chemists and other chemists and technicians.

Supporting Environmental R&D: NAWCWPNS has established a support project to encourage innovation in developing concepts for better processes, equipment, or substitute technology. Example of this is the development of a pyrotechnic fire extinguisher using modified propellant formulations that produce large volumes of nitrogen gas. This application is intend as a halon

substitute for nonhuman closed compartments with high fire potential, such as engine compartments.

Another task is exploring ways of improving the energetic quality assurance processes by minimizing the use of OVCs used to dissolve propellants and explosives. Super-critical fluid extraction is a new process being incorporated into quality assurance because it uses minute quantities of solvent.

One recent requirement that weapon systems are experiencing is the necessity of describing and qualifying substitute materials for those that will or are no longer produced, particularly the ozone-depleting substances. The issues are long-term compatibility, producibility, and documentation of substitute materials in explosive and propellant formulations and shipping containers. To support this need a NAWCWPNS Weapon Pollution Prevention Working Group was established to coordinate pollution prevention requirements for weapon systems. This group works with NAVAIR, project offices, and other customers, to establish qualification protocols, recommend replacement materials, and prepare for future requirements.

The facilities used for these efforts are those already existing within NAWCWPNS. The personnel skill level will vary depending on the project but typically will include PhD-level for basic research, and engineers, chemists, and technicians for development.

Modernization of our Energetic Industrial Wastewater Treatment Facility: Industrial wastewater (IWW) contaminated with energetic residues and hazardous solvents is generated during the R&D of energetic materials, propulsion systems, and ordnance items. In the past, this IWW flowed through concrete settling sumps and was discharged to lined evaporation ponds. This is no longer acceptable.

We are in the process of upgrading our IWW treatment system. The planned system includes double walled chemically resistant piping with leak detection, double-contained IWW collection tanks with leak detection, and an IWW treatment plant. The treated water will be reused as makeup water for a process water cooling tower. The treatment system is designed to treat 2 gallons per minute over twice our currently needed capacity.

Construction of the total IWW system is planned in three phases. Phase I, which was completed in FY94, included the installation of six IWW collection systems. These collection systems collect IWW from eight buildings and enabled us to close all of the evaporation ponds. Phase II is scheduled for completion in FY95 and includes the installation of five more collection systems and will collect IWW from an additional 12 buildings. The completion of Phases I and II will bring us into compliance with current and anticipated environmental regulations, per our agreement with applicable regulatory agencies. However, IWW will still have to be shipped off-site for treatment. Phase III eliminates off-site transportation and treatment of IWW and includes the construction of an IWW treatment plant and piping system. On-site treatment will enable us to operate more efficiently and economically, as well as minimize the risk and potential liabilities associated with off-site transportation of the IWW. Phase III is a FY96 approved MILCON that has completed the 35% design point and expects 100% design completion by January 1995.

Military Plans, Programs and Consolidations

Closure of the Jet Propulsion Lab (JPL) Edwards Air Force Base: Closure of the JPL Edwards site by JPL/NASA office Pasadena, Calif., has enabled NAWCWPNS to support the Jet Propulsion Laboratory-Pasadena with propellant mixing and casting needs. An agreement with JPL will also transfer excess materials and equipment, including a 150-gallon Baker Perkins mixer and support hardware from Edwards to China Lake. Because this mixer is the same type as the

present China Lake 150-gallon mixer, it should be easily adapted to our operations. This equipment has a current replacement cost of $1.5 million in FY94 dollars. Installation of this equipment is planned in existing buildings and will greatly increase the capacity at China Lake

USAF Plans to Consolidate Laboratories and Field Activities: USAF has consolidation plans to move the propulsion elements of Phillips Lab at Edwards AFB, Calif., to Phillips Headquarters at Kirtland AFB, N. Mex. While the move to Kirtland has been put on hold due to funding, China Lake has assumed a supporting role to Phillips Lab Propulsion Directorate by providing formulation services, plant facilities, and large propellant mixing. The proximity of China Lake and Edwards facilities make for close working relationships in technology, joint development projects, and propellants processing. Our current agreement calls for the China Lake Ordnance and Propulsion Pilot Plant to provide propellant mixes above 2 gallons, and cast these mixes for their research and development efforts.

Alameda NADEP Gun Rework Facility: The Alameda NADEP closure has resulted in relocation of their Gun Rework Facility to China Lake. This move will give a close physical and organizational relationship of the R&T, RDT&E, ISE/PES, logistic, and rework efforts for basic design, maintenance, and logistics related to USN/USMC aircraft guns. With this move will come 5 to 6 people, and several million dollars worth of equipment. The cost of this move has been termed "a bargain" (estimated at $900K at China Lake and $500K at NADEP) and has been accommodated in existing buildings. This new capability was included in the description of functional and product lines.

Large Strategic Rocket Motor Disposal Facility: The Navy's Strategic Systems Program Office (SSPO) has narrowed the potential sites where they will build the plant for full-scale destruction of strategic large rocket motors. The NAWCWPNS China Lake site is included in their planning exercises. This facility at China Lake will occupy several acres located mostly on our eastern boundary adjacent to our present magazine storage area and our Strategic Propulsion Test Complex. Although these will be the closest buildings, they are still 2 to 3 miles away. It will be a major enhancement and extension of our energetic complex. Its location was selected so that it will not interrupt present or future base operations, including test flights, truck passage, and energetic material processing, or require public coordination. The infrastructure requirements for this facility call for rail and road access, large magazines for rocket motor storage, large explosive quantity safety distance arcs, office spaces, as well as the main destruction bays and scrubbing complex. The destruction bays and scrubbing complex are expected to occupy approximately 22 acres and do not include the magazine storage area. SSPO plans to have the facility operational by the year 2002. It is anticipated that they will have a minimum of 2000 Navy strategic motors to dispose of and the potential for other services and foreign country disposal. The facility, which will cost on the order of $100M to construct, will require 50 to 75 people to operate and will require an area approximately 2 miles on a side. Detail designs, environmental assessments, public involvement, and other coordination efforts are expected to start in FY96. When operational it is expected to be a GOCO operation.

Plume Measurement Capability Facility: This project is to develop and build a DOD Plume Measurement Test Capability incorporating sensors across the spectrum of tactical employment, from ultraviolet through radar. The approach will be to develop and build a site with the proper instrumentation mix and support resources capable of testing tactical motors of at least 30 inches in diameter, 14 feet in length, and capable of 80,000 pounds of thrust in either the horizontal or vertical nozzle-up attitude. The capability to acquire optical and radar-band data for applications to both defensive and countermeasure tactical doctrine is accomplished by on-site multiple sensors, such as IR radiometers and RCS-measurement radar systems. Existing propulsion test facilities are not suitable for tactical rocket motor plume measurement because of local hardware interferences and flame chute designs that impinge on the plume.

This project is funded by the DOD Centralized Test and Evaluation Investment Program, and will apply to multiservice testing roles. Estimated value of the facility is $6.5M in construction and sensor investment. Personnel from the Skytop test complex will perform tests at this facility; therefore,no impact on personnel will occur. This site will be maintained as another test site within the Skytop area of responsibility.

Program plans: Occasionally major unpredictable modifications to program plans occur that require quick-response capability from the NAWCWPNS energetics complex. These actions usually take the form of building modification to accommodate research, weapon exploitations, risk-reduction parallel development efforts, support activities not originally contracted, or joint efforts with contractors. An example of this is the quick reaction taken to accommodate the JSOW development contract with a joint effort with Texas Instruments for final weapon assembly of warheads and integration of the all-up JSOW weapon at the Missile/Rocket Motor Assembly Building. This facility was modified in a few months at very low costs to accommodate hardware, check out instrumentation, and contractor personnel. NAWCWPNS was selected to house the facility because much of the developmental and operational testing will be conducted on its ranges, and because appropriate integration assets already existed. The Ordnance Systems Department handles ordnance items on a daily basis and had the necessary trained personnel and properly equipped and certified buildings.

8. *Remaining tenants and other activities on the installation, name of organization, mission, total workyears.*

NAWCWPNS CHINA LAKE TENANTS

Tenant command name	Mission	Total work years
Marine Aviation Detachment (MAD)	Provides project management, aviation support, and technical expertise to assigned Marine Corps weapon systems, subsystems, and related devices throughout the weapon system life cycle	48
Air Test & Evaluation Squadron Nine (VX-9)	Conducts independent operational testing of weapon systems, aircraft, and conventional and electronic warfare equipment. Develops tactics and procedures for weapon systems employment in support of the Fleet.	355
Explosive Ordnance Disposal Mobile Unit 3 (EODMU)	Renders safe and recovers live ordnance; provides ordnance modification and disposal and blasting services. Provides services to installation, and to local, state, and federal law enforcement agencies when directed.	10
Defense Finance and Accounting Service (DFAS)	Provides finance and accounting services for the installation	25.1
Naval Aviation Engineering Support Unit (NAESU)	Provides field engineering assistance and instruction to naval aviation activities in the installation. Provides maintenance, repair, and operation of all types of aviation systems and equipment.	2
Branch Medical Clinic	Provides general practice outpatient medical services to installation personnel	61.2
Branch Dental Clinic	Provides dental services to installation personnel	6
Personnel Support Activity Detachment (PSD)	Provides personnel service to military personnel and travel services to all personnel at installation	16
Defense Printing Service Detachment Branch Office (DPSDO)	Provides printing services to installation	25
Resident Officer in Charge of Construction (ROICC)	Provides contracting and other services for NAVFAC projects at installation	155.25
Naval Criminal Investigative Service Resident Agency (NCISRA)	Provides criminal investigation and counter intelligence services at installation	8.3
Commissary	Provides commissary services to military personnel at installation	22.5
Navy Exchange	Provides g ls and services for authorized personnel at installation	89
Naval Pacific Meteorology & Oceanography Detachment	Provides weather reports	6.5

Defense Investigative Service (DIS)	Provides security clearance and other services at installation	3
Defense Reutilization and Marketing (DRMO)	Provides disposal services of excess equipment and property at installation	4.25
SEABEES Reserve Unit	Weekend duty projects	N/A
NAWS Reserve Unit 0176	Weekend duty projects	N/A
NAWC Reserve Unit 0276	Weekend duty projects	N/A
Joint Task Force #6 (JTF6)	Weekend duty projects	N/A
Army Recruiter	Provides recruiting services to installation	2
American Red Cross	Provides charity services	N/A
Anhauser Busch (Cabin Bar Ranch) (grazing rights)	Utilizes Navy land for cattle grazing	N/A
Billy Mitchell (water rights)	Pump water	N/A
Boeing (Bldg. #98012 A/F Compound)	Provides engineering and computer support services	N/A
Boeing (Bldg. #98023 ML Compound)	Provides engineering and computer support services	N/A
Boy Scouts	Youth development	N/A
Burroughs High School	Secondary school public education	N/A
California Energy Company/ Geothermal Facility	Provide electrical utility services to installation and pay royalties to Navy	N/A
Canada	Allied nation liaison for F/A-18	N/A
Canadian Forces Detachment (Officers Listed From Canada)	F/A-18 liaison	4
Ceramic Club	Provides community recreational services	N/A
Childers Construction Co.	Provides construction services	N/A
China Lake Branch Fleet Reserve	Fleet reserve retirees	
China Lake Mountain Rescue	Provides community rescue services	N/A
China Lake Players	Community theater group	N/A
China Lake Police Association	Fraternal/professional organization	N/A
Comarco (Bldg. #98001 Main)	Provides engineering and technical services to installation	N/A

Comarco (Bldg. #98018 CLP)	Provides engineering and technical services to installation	N/A
F2M Construction	Provides construction services	N/A
Federal Managers Association	Professional society	N/A
Finland	Allied nation liaison for F/A-18 FMS	N/A
Fire Fighter's Local	Union organization	N/A
Foreign Owned (F/A-18) (Spain) Bldg. 98032	F/A-18 FMS liaison	N/A
Garden Club	Provides community recreational support	N/A
Gem & Mineral Society	Provides community recreational support	N/A
German Air Force Detachment (Officer Listed From Germany)	FMS liaison	N/A
Girl Scouts	Youth development	N/A
Groves Elementary School	Elementary public education	N/A
Grumman Aircraft	Provides technical support services	N/A
Hughes Aircraft	Provides technical support services	N/A
Indian Wells Valley Search & Rescue	Provides community rescue services	N/A
Joint Software Support Activity (Harrier 11) (Officer Listed Is Spanish)	FMS liaison	N/A
Kuwait Air Force Detachment (F/A-18) (Officer Listed From Kuwait)	FMS liaison	N/A
Laubach Reading Program	Teaches English as a second language	N/A
Little League Fields	Provides community recreational support	N/A
Maytag Aircraft	Provides aircraft fuel services	N/A
Metal Trades Council	Union organization	N/A
Murray Junior High School	Provides public education	N/A
National Contract Managers Assoc./ Society Of Logistical Engineers	Professional society	N/A
NWC Federal Credit Union	Provides financial banking services	N/A
Richmond Elementary School	Provides public elementary education	N/A

Ridgecrest Regional Waste Water Facility	Provides sewage services	N/A
Royal Australian Air Force Detachment (Officer listed from Australia)	F/A-18 FMS liaison	1
Sea Cadets	Youth development	N/A
Sierra Gun Club	Provides community recreational services	N/A
Thrift Shop/Navy Relief & Storage	Provides community charity services	N/A
U.S. Post Office	Provides postal services	1
United Kingdom	Allied nation liaison	N/A
Veteran's Groups	Provides community support services	N/A
Vieweg Elementary School	Provides elementary public education	N/A
Women's Center	Provides community charity support	N/A
Veterinary food inspection service	Inspects food for commissary, Navy exchange, club systems, and installation schools	1

9. *Summarize your overall mission.*

MISSION STATEMENT.

The Naval Air Warfare Center (NAWC) stood up on 1 January 1992 in accordance with OPNAVNOTE 5450 of 23 December 1991. NAWC was formed by integrating the following activities into a single organization:

- Weapons Division (NAWCWPNS)
  - Pacific Missile Test Center (PMTC) Point Mugu, CA
  - Naval Weapons Center (NWC) China Lake, CA
  - Naval Weapons Evaluation Facility (NWEF) Albuquerque, NM
  - Naval Ordnance Missile Test Station (NOMTS) White Sands, NM
- Aircraft Division (NAWC-AD)
  - Naval Air Development Center (NADC) Warminster, PA
  - Naval Air Test Center (NATC) Patuxent River, MD
  - Naval Avionics Facility (NAC) Indianapolis, IND
  - Naval Air Engineering Center (NAEC) Lakehurst, NJ
  - Naval Air Propulsion Center (NAPC) Trenton, NJ

Subsequently, the Training Systems Division (TSD) Orlando, FL was added.

Mission Statement for NAWC

Naval Air Warfare Center, Arlington, Va., is the headquarters for the Navy's principal research, development, test, evaluation (RDT&E), engineering and Fleet support activity for naval aircraft, engines, avionics, aircraft support systems, ship/shore/air operations, air weapons and training aides, simulators, and devices.

This mission includes research and development of manned and unmanned air vehicles; air weapons and associated aircraft systems for strike, antisurface warfare (ASUW), and antiair warfare (AAW); air vehicles propulsion systems; core and mission-unique avionics including air ASW systems; airborne surveillance systems; electronic combat systems, and electronic devices for airborne electronic warfare (EW); aircraft launch and recovery systems; aviation support equipment; aircraft training simulators and mission training equipment; and related functions, such as aircraft modeling and analysis, and aircraft active and passive signatures; systems integration of all air platform subsystems; conduct of test and evaluation for these same aircraft throughout the spectrum of the life cycle to ensure successful operational performance; maintain life cycle aircraft and air weapons test and evaluation ranges; assure an effective transition to production, including manufacturing production support and pilot/emergency production, to maintain a responsive industrial base; perform in-service engineering of aircraft, avionics, air weapons, and launch/recovery systems; provide inter-service coordination and training systems support for the Army, Air Force, and NASA; direct the operations of NAWC-AD, NAWCWPNS, and the NAWC Training Systems Division and their subordinate activities. The NAWC Headquarters is scheduled to move to Patuxent River, Maryland, in FY 97.

Since the Energetics function is carried out at NAWCWPNS China Lake, the responses to this data call largely reflect the capabilities at that installation.

Mission Statement for NAWCWPNS

OPNAVNOTE 5450 of 23 December 1991 assigned the following mission to NAWCWPNS:

"To conduct research, design, development, test, and evaluation of air weapons and associated aircraft systems into strike, antisurface warfare (ASUW), and antiair warfare (AAW) aircraft.

To conduct research, design, development, test, and evaluation of tactical missiles for any naval platform.

To operate, maintain, and improve the Naval Western Test Range Complex (NWTRC) air, land, and sea test ranges for weapons and weapon systems testing and evaluation.

To provide production support, in-service engineering support, and production improvement for air weapons systems and tactical missiles.

To provide development and test, and continuing support of electronic combat systems and electronic devices for airborne electronic warfare.

To complete studies of naval warfare systems for strike, ASUW, AAW, and other warfare areas.

To ensure continued promotion and maintenance of fundamental research and the technology base to support the above mission areas."

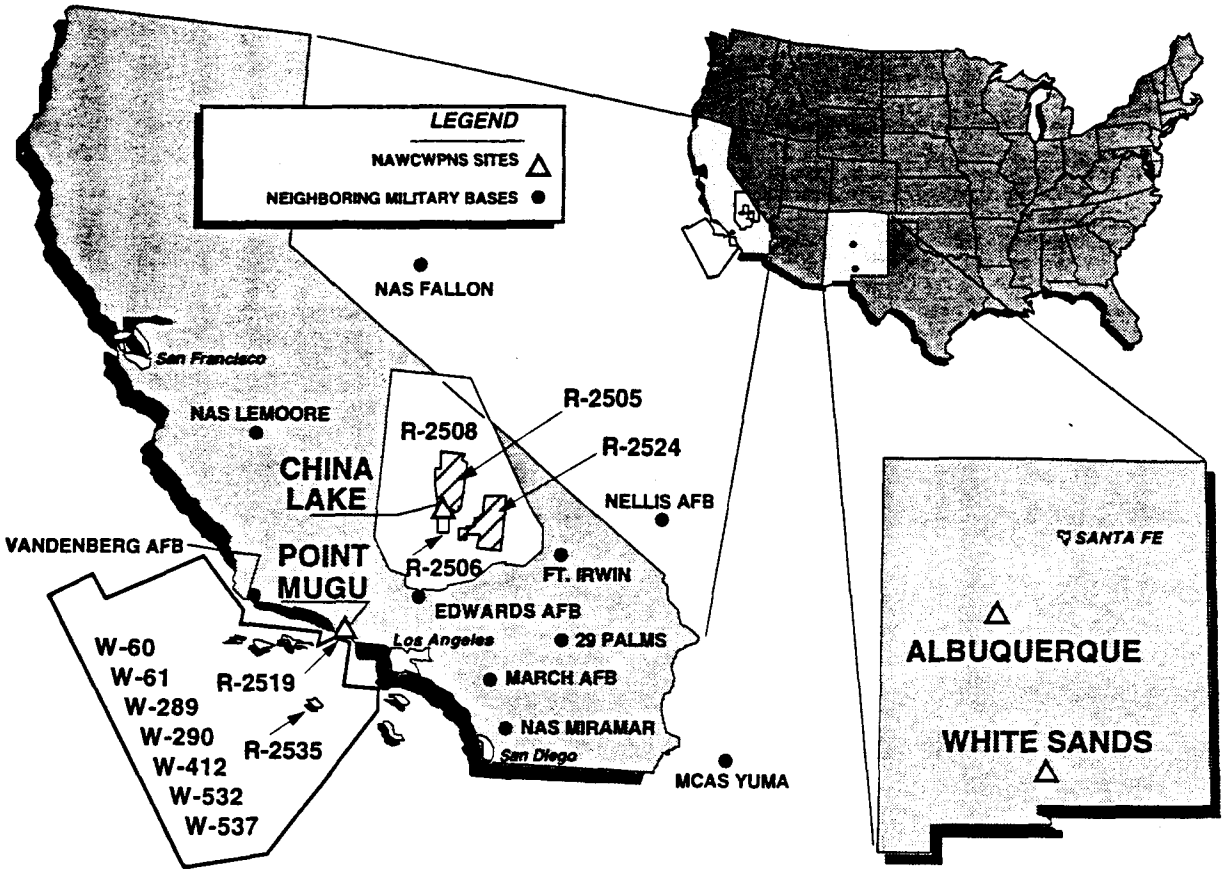
The officially assigned mission for NAWS Point Mugu and China Lake was provided by the same reference document as follows:

"To operate and maintain base facilities and provide base support services, including airfields, for the Naval Air Warfare Center Weapons Division organizations at Point Mugu and China Lake, assigned tenants and activities, and transient units."

Additionally, this OPNAVNOTE promulgated a mission for the Naval Ordnance Missile Test Station, White Sands, New Mexico, which has since become a NAWCWPNS detachment. This mission statement is as follows:

"Provide quality and responsive technical and material support to the Fleet for land-based flight test and evaluation of Navy weapon systems and directed-energy systems and subsystems test and evaluation, serve as the launch agent for suborbital space systems and research rockets, and participate in the operation of the DOD Missile Test Range at White Sands Missile Range."

The following figure provides geographical location and land/airspace depiction of the NAWCWPNS sites as well as the proximity of other key military bases, which enhances the joint-service use of the NAWCWPNS ranges and unique facilities.



NAWCWPNS Site Locations.

NAWCWPNS China Lake is located within the R-2508 Special Use Airspace Complex, which contains six restricted areas and 13 work areas, made up of combinations of Military Operations Areas (MOAs), Air Traffic Control Assigned Airspace Areas (ATCAAAs), and Restricted Area R-2508. The internal restricted airspaces (excludes R-2508) are independently managed by one of three military commands located within the Complex. Besides NAWCWPNS China Lake, which manages R-2505, R-2506, and R-2524, AFFTC Edwards AFB manages R-2515 and NTC Fort Irwin manages R-2502 (which is further subdivided into north and east areas). These commanders combine as the R-2508 Joint Policy and Planning Board to jointly manage R-2508 and the associated work areas. Although the areas are jointly managed, the Federal Aviation Administration (FAA) assigns NAWCWPNS China Lake as the Using Agency for R-2508, and this Command has annual reporting responsibilities for that airspace and the associated MOAs.

Of those airspaces under independent management of NAWCWPNS China Lake, R-2505 and R-2524 are active from the surface to infinity on a continuous basis, and R-2506 is active from the surface to 6,000 feet MSL Monday through Friday, sunrise to sunset. These areas segregate non-participating military and civil traffic from the hazardous activity that is conducted over the land ranges located beneath them. NAWS China Lake owns or has control over most of the land areas beneath R-2505 and R-2524. Use of bordering restricted and work area airspace is normally required to support the mission. R-2508 is published active from 20,000 feet MSL to infinity; however, when combined with the underlying MOAs and ATCAAAs it can extend down to 200 feet AGL in most areas. The work areas (combined R-2508, MOAs, and ATCAAAs) are normally active Monday through Friday, 0800 to 2200, but can be coordinated for activation at any time for military use.

NAWCWPNS is a truly integrated structure. Many organizational entities are spread across multiple sites. For example, the aircraft weapon systems programs at China Lake and Point Mugu have been consolidated into one organization. NAWCWPNS as a total entity represents the work of more than 8,000 civilian employees and 1,300 military personnel. It is the Navy's primary sector of scientific and technical knowledge for air warfare systems, guided missiles, and electronic warfare (EW). Its two primary sites, China Lake and Point Mugu, integrate DOD's largest and most completely instrumented land and sea test ranges.

CHINA LAKE SITE MISSION

Existence at China Lake of DOD's largest weapons R&D laboratory in immediate proximity to the land test range has repeatedly been shown to be of great significance in furthering the air weapons development function. NAWCWPNS China Lake has played a major role in the development of nearly all the Navy's air weapons and tactical guided missiles over the past 50 years and has similarly made substantial contributions to many Air Force and Army systems. China Lake's 1.1 million acres of land area and 17,000 square miles of military restricted use (R-2508) airspace represent 85% of the Navy's RDT&E land holdings and the largest area of overland airspace available to the Navy for test and evaluation of air weapons and tactics. This is particularly valuable for large-scale explosive propellant processing and testing, as well as ordnance and propulsion systems development and testing.

The large workforce—over 4,500 civilians and 1,000 military including the tenant VX-9* activity—with across-the-board technical skills in full life-cycle air weapon system development and support—together with the geographic expanse, many unique R&D and test and evaluation (T&E) facilities, instrumented ranges, and massive equipment investment—assure the ability to carry out and expand the scope of the current mission if required. The 43 square miles dedicated to RDT&E of energetic materials, ordnance, and propulsion systems as described under Section 4 represent a unique national asset. Also, China Lake is currently performing approximately one-third of its weapons programs as joint-service applications.

China Lake has dealt effectively with environmental and encroachment issues, meeting its responsibilities for environmental cleanup. There are no serious issues that adversely affect current mission accomplishment nor are serious issues anticipated in the foreseeable future. China Lake is an area that offers quality living conditions, such that attracting and retaining quality employees has not been a problem.

As one of the two primary sites of NAWCWPNS, China Lake conducts research, design, development, test and evaluation of

- Air weapons and associated aircraft systems for strike, ASUW, and AAW aircraft
- Tactical missiles for any naval platform
- Electronic combat systems and electronic devices for airborne electronic warfare

* * COMOPTEVFOR has consolidated the Operational Test and Evaluation Squadrons (VX-5 at China Lake and VX-4 at Point Mugu) into a single squadron (VX-9) headquartered at China Lake. On 29 April 1994 VX-9 officially stood up, and VX-5 was disestablished. COMOPTEVFOR disestablished VX-4 as a squadron in September 1994 and transitioned to an F-14 detachment of VX-9 at Point Mugu.

Additionally, China Lake (including detachments at Albuquerque and White Sands)

- Operates, maintains, and improves DOD's Major Range Test Facilities Base (MRTFB) air and ground test ranges for weapons and weapon systems testing, evaluation, and training for other services as well as for the Fleet
- Ensures continued promotion and maintenance of fundamental research and the technology base to support the above mission areas
- Conducts studies of naval warfare systems for strike, ASUW, AAW, and other warfare areas
- Provides production improvement support for air weapons systems and tactical missiles for all services
- Conducts independent developmental test and evaluation
- Provides support for operational test and evaluation
- Provides launch facilities for land-based testing of shipboard missiles
- Participates in the operation of the tri-service high-energy laser-directed energy system
- Serves as the launch agent for suborbital space systems and research rockets and is the Navy agent in the operation of the White Sands Missile Range (WSMR)

LEADERSHIP AREAS. China Lake's leadership areas include

- Missile/missile subsystems R&D and in-service engineering
- Missile signature, active and passive
- Free-fall/unguided weapons R&D and in-service engineering
- Combat and combat control systems R&D
- Weapons modeling and analysis
- Airborne weapons T&E
- Weapon systems integration
- Air and ground range
- Aircraft/missile survivability/vulnerability testing
- Aircraft armament systems/equipment
- Parachute systems/components
- Air/land, radar cross section, electronic warfare ranges
- Aircraft electronic warfare R&D

Unique Aspects of China Lake for Conduct of the Energetics Mission

China Lake was established during World War II (November 1943) as a proving ground and testing range for the development of rocket weapons and the first generation of guided missiles. Because of the remoteness of the location, with no large city closer than 90 miles, it was necessary to build an entire government city comprised of houses, stores, and service establishments, as well as laboratories, test ranges, and other military and scientific facilities. This uniqueness in retaining a remote and secure facility of over a million acres, which is situated under restricted military airspace of nearly 20,000 square miles, makes China Lake ideal for high-hazard testing that is a necessary part of weapons R&D. Also, the remoteness, coupled with the combination of favorable weather conditions, clear air, and lack of encroachment, provides a high degree of natural security for classified activities. The sparse population, nearly perfect year-round flying weather, and excellent visibility make the China Lake location a unique national asset for T&E activities, as well as for full-spectrum R&D. Furthermore, it is in close proximity to other key military bases that use China Lake's ranges and laboratories extensively.

Ground Range Test and Training Capability: Includes varied geography from flat lake beds to rugged mountains, and remote canyons and secluded valleys permit classified and hazardous testing. The primary range is 37 miles long for testing rockets, missiles, and gun ammunition. The ranges are fully instrumented with radars, cameras, telemetry, and metrology.

Propulsion Test Capability: Complete static testing operation for solid propulsion systems are available. Includes more than 300 buildings in remote areas with protective terrain features and proximity to other R&D facilities. Capable of handling systems up to 100,000 pounds of class 1.1 propellant with a variety of test stands accommodating rocket motors up to 1 million pounds of thrust. Includes unique radiographic and Trident vertical test stand capabilities with the largest and most completely instrumented complex for rocket motor testing in DOD.

Warhead Test Capability: Remote location and geographic expanse permit very large-scale testing with a unique capability for warhead/explosives testing from early research through final configuration qualification. *Over 1 million pounds of high explosives have been detonated.* Major R&D facilities at China Lake are near the warhead test site.

Supersonic Ground Sled Test Capabilities: Include the Supersonic Naval Ordnance Research Track (SNORT), a 4-mile-long heavy-duty track that can support speeds up to 6,000 feet per second, and the G-4 Exterior Ballistics Test Track with muzzle end overlooking a deep, wide valley where test items can be launched 500 feet above the impact point. Test capabilities cover radome tests, fuze tests, ordnance items, ballistic tests, penetration tests of live warheads, and aircrew escape.

Environmental and Safety Test Capabilities: Provide complete capability for environmental and safety qualification of all-up live ordnance systems and provide the most complete insensitive munitions test capability within DOD. This is due to a unique combination of remoteness, protective terrain, and completeness of instrumentation at the same location with proximity to R&D facilities. A complete environmental measurement and test laboratory for weapons can cover all mechanical shock and vibration, thermal, altitude, and electromagnetic conditions for service use.

Ordnance Systems RDT&E Capability: Consolidated at one activity is the technical expertise, equipment, and facilities required to do RDT&E on ordnance components—energetic materials, propulsion, fuzes and warheads. Support development of ordnance components containing energetic materials from basic research through engineering development, and provide

isolation and sufficient geographic space to ensure safety, security, and freedom from encroachment problems.

Gun Test Capabilities: Complete range for ground testing of aircraft guns up to 25 mm and Army guns up to 120 mm.

Weapon System Survivability Test Capabilities: Include the capability to conduct live-fire ballistic vulnerability tests on operational aircraft and weapons, including operating propulsion systems, and provides up to 540 knots airflow to simulate in-flight conditions for realistic tests of airflow over test articles up to full-size fighter aircraft. These unique capabilities have led to support of test programs for all services and for private industry.

Basic and Applied Research Capabilities: Cover unique aggregation of energetic materials and weapons-oriented research expertise nonexistent elsewhere, such as combustion instability, energetic materials, optics, and laser technology.

Air-Launched Weapon System Design, Development, Test, and Evaluation Capability: While others design, develop, or test weapons, no other place exists with the capability of this magnitude to carry out all phases of the process. Synergistic effects of this full-spectrum capability have been repeatedly demonstrated. The value of this synergy between R&D and T&E was most recently demonstrated during Operations Desert Shield and Desert Storm, where modifications to our weapon systems were very quickly made and tested and delivered to the Persian Gulf to meet the unique threats. The numerous special-purpose facilities/laboratories are not replicated elsewhere. A complete Type III Calibration Laboratory provides metrology services to NAWCWPNS as well as other customers, such as the USAF. NAWCWPNS China Lake also provides support to the Government/Industry Data Exchange Program (GIDEP) to identify faulty parts in the Fleet as part of its weapons quality and reliability engineering group.

Propulsion Research Capability: Provides individual laboratories for research on combustion instability, fluid control and ramjet systems, plume signature, and airborne particle analysis.

Fuze Development and Test Capability: NAWCWPNS China Lake is the Navy's lead laboratory for design, development, and test of fuzing systems. Of particular note are the assets for testing proximity fuzes, which include ranges for measuring performance in adverse environments, and obtaining precise antenna patterns, as well as the unique national assets of:

> **Encounter Simulation Laboratory (ESL) (Located in Corona, Calif.):** Provides enclosed, interference-free dynamic environments for development and testing of missile fuzes against realistic targets. A carriage moves the fuze-long missile trajectories, intercepting a variety of suspended targets that can be oriented through all aspect angles. The older ESL is being replaced with an upgraded facility, Missile Engagement Simulation Arena (MESA), that will accommodate new technology threats and provide significant increased capabilities at China Lake.
>
> **Missile Engagement Simulation Arena (MESA):** Is a major MILCON under way that will provide DOD and its allies with the most modern and capable facility in the world to perform indoor fly-by testing of proximity fuzes and missile seeker end-game conditions against realistic targets including new technology threats.

Provide Electrical Power From the Geothermal Energy Resource: Extensive geothermal power development on Navy land, under Navy cognizance, which will provide $600 million in revenue for the Navy over a 20-year period. This resource offers a high degree of energy

independence and is a potential source of very large amounts of power for weapon system developments having exceptional power requirements. Currently, the Coso Geothermal plant generates approximately 120 megawatts.

NAWCWPNS has the capability and capacity to support or lead DOD in RDT&E of

- Air warfare systems
- Joint air/land/sea warfare
- Aircraft/weapons integration
- Munitions
- Energetic materials including
  - Missile propulsion
  - Air-delivered warheads
  - Very large explosive tests
  - Insensitive munitions
  - Explosive safety
  - Rocket motor disposal

10. SUMMARY

In the past 25 years, numerous studies and home-on-home meetings have been held between various DOD laboratories involved in energetic materials RDT&E to make sure there was no unnecessary duplication of work and to examine the feasibility of consolidating energetic material activities at one site. In was the opinion of many representatives at such meetings that consolidation of energetics work at China Lake was the best option for a single site because of potential encroachment problems facing other sites. However, these meetings resulted in little progress toward consolidation because most sites were adequately funded and had stable operations. With the BRAC 95 process, an excellent opportunity exists to establish NAWCWPNS China Lake as DOD focus site for full-spectrum RDT&E activities associated with energetic materials used in conventional and strategic weapons. Consolidation at a focus site would provide economic gains and, at the same time, improved effectiveness in future weapon development programs. Specific factors, supported by this data call, that would motivate focus at the NAWCWPNS China Lake site include the following:

a. Technology. World-class energetic chemistry and formulation for explosives and solid propulsion technology exists at NAWCWPNS China Lake. Measures of excellence include: the vast number of China Lake energetic materials (e.g., PBXs) in-service use, number of technical publications, patents, and leadership roles in both national and international technical coordination groups. In recent years, NAWCWPNS China Lake has significantly expanded its facilities and capabilities in explosive synthesis and detonation research to the extent it is approximately equivalent to that of any U.S. modern energetic material laboratory.

b. Full-Spectrum Center. NAWCWPNS China Lake has existing Research and Ordnance Systems Departments that emphasize energetic materials R&D, as well as both land and sea T&E. Furthermore, because NAWCWPNS China Lake is the Navy's largest weapons center, the efficiency of coupling the energetics work to the RDT&E of the all-up rounds and total weapon system integration is maintained. All aspects of missile performance, such as propulsion or ordnance, depends on the interaction of the energetic material (propellants and explosives) with the associated components (rocket motor or warhead) and even the fuzing system of the ordnance section. The energetics development must be done in concert with the other associated weapon components. In all phases of this work, tri-service efforts exist. In addition. multinational participation exists in both research and testing programs. The departments representing these activities work collaboratively to provide a capability wherein testing can be performed using small laboratory quantities to over 500,000 pounds of explosive materials

c. Capacity. There is little or no need for new costly construction if existing DOD energetic material S&T, weapon components, and weapon design operations were moved to NAWCWPNS China Lake. The NAWCWPNS China Lake existing facilities can fully house and support much of these programs. The costs for moving large energetic facilities to China Lake could also be handled through Public Private Ventures with industrial partners who would invest private capital and thereby minimize cost impact to the government.

d. Encroachment. Encroachment from a surrounding community does not threaten test operations at NAWCWPNS China Lake for the present, nor is this a realistic threat in the future. NAWCWPNS China Lake has over a million acres of land space located in the northern Mojave Desert.

e. Environmental Impact. Environmental impact does not threaten operations at NAWCWPNS China Lake for the present, nor is this expected to be a significant problem in the future. NAWCWPNS China Lake has excellent working relations with the various air quality

districts, Regional Water Quality Control Board, county, state, and EPA representatives. Activities associated with solid propellant and explosives S&T have been addressed by these environmental authorities.

f. Bomb-Proofs. Laboratories that conduct energetic material S&T close to communities/residential areas or problem areas where explosive quantity-distance restrictions apply must resort to bomb-proofs to contain detonation waves. These bomb-proofs can cost tens of millions of dollars and they have limited life. At NAWCWPNS China Lake, available space is vast and bomb proofs are unnecessary. Some argue that bomb proofs are necessary to prevent air pollution and that environmental authorities will eventually require bomb-proofs. This is a fallacious argument because the products of a detonation are environmentally benign.

g. Geothermal Power The Geothermal Energy Facility is an extensive geothermal power development on Navy land, under Navy cognizance that will provide $600 million in revenue for the Navy over a 20-year period. This resource offers a high degree of energy independence and is a potential source of very large amounts of power for energetic material and weapon systems developments having exceptional power requirements. Currently, the Coso Geothermal plant generates approximately 240 megawatts.

h. Technical Transfer to Industrial Partners NAWCWPNS China Lake has existing industrial partners in areas dealing with energetic material. Major ongoing partnerships include the following:

1. CRDA with Alliant Technologies for injection loading of explosives.
2. Team effort with TI for the assembly and checkout of the first JSOW weapons.
3. CRDA with Thiokol for manufacture of CL-20
4. Team effort with Lockheed/Bechtel to develop the technology for constructing a large-scale disposal plant for solid rocket motors.

Another compelling reason for establishing NAWCWPNS China Lake as a single DOD focus site for full-spectrum RDT&E activities associated with energetic materials is to establish new major industrial/government partnerships in the area of energetic materials production. As noted above, work from other government laboratories working in S&T, weapon components, and weapon design areas associated with energetics could be relocated at NAWCWPNS China Lake with little expense to the government. The existing building/equipment capacity of NAWCWPNS China Lake is substantial enough to support much of the future needs of DOD. To achieve a single site for full-spectrum RDT&E activities associated with energetic materials for all DOD at NAWCWPNS China Lake, some facilities may have to be closed at other labs and relocated at China Lake. This would require MILCONs. An alternative approach would be to transition this work from a closing government laboratory to a government/industrial partnership located at China Lake. In this case, for example, NAWCWPNS China Lake could provide land to industry and industry would be responsible for the building/equipment installation. Technology transfer partnerships would be explored through CRDAs. Such a government/industrial partnership would be appealing to companies that want to stay in the energetic materials business and are presently being forced to close and move because of encroachment problems. Located at NAWCWPNS China Lake, environmental problems would be addressed fro a team standpoint. NAWCWPNS China Lake has experience in dealing with such partnership. For example, the Geothermal Energy Facility at Coso was constructed using nongovernment investors as a Public Private Venture. No major MILCON funds were used.

The recommendation is that through the BRAC-95 process, NAWCWPNS China Lake be considered as a future DOD focus site for full-spectrum RDT&E activities associated with energetic materials used in conventional and strategic weapons. A long-term plan would be developed showing how the energetic material capabilities from laboratory closures under BRAC 95 would be handled. One guideline for the plan would be that NAWCWPNS China Lake explore government/industrial partnerships that would provide the following benefits: (1) avoid major MILCONs, (2) provide a basis for retaining industrial involvement in energetic material, and (3) promote the transfer of defense technology to private industry. Implementation of this recommendation would provide an effective DOD energetic materials capability for the future at the most affordable price. Added expenses for relocation due to encroachment problems would not pose a risk in the future.

NUWC HQ DATA CALL 12 211
AMENDMENT 1

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

NAME (Please type or print) | Signature

G. R. STERNER | 10/18/94

Title: Commander, Naval Sea Systems Command | 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)

W. A. EARNER | Signature

NAME (Please type or print)

27 OCT 1994

Title | Date

94-11-21 10:03 RCVD

WC

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.

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

ACTIVITY COMMANDER

RADM SCOTT L. SEARS
NAME (Please type / print)

Scott L Sears
Signature

COMMANDER
Title

17 OCTOBER 1994
Date

NUWC
Activity

ENERGETICS JOINT CROSS SERVICE ANALYSIS
DATA CALL #12 AMENDMENT #1

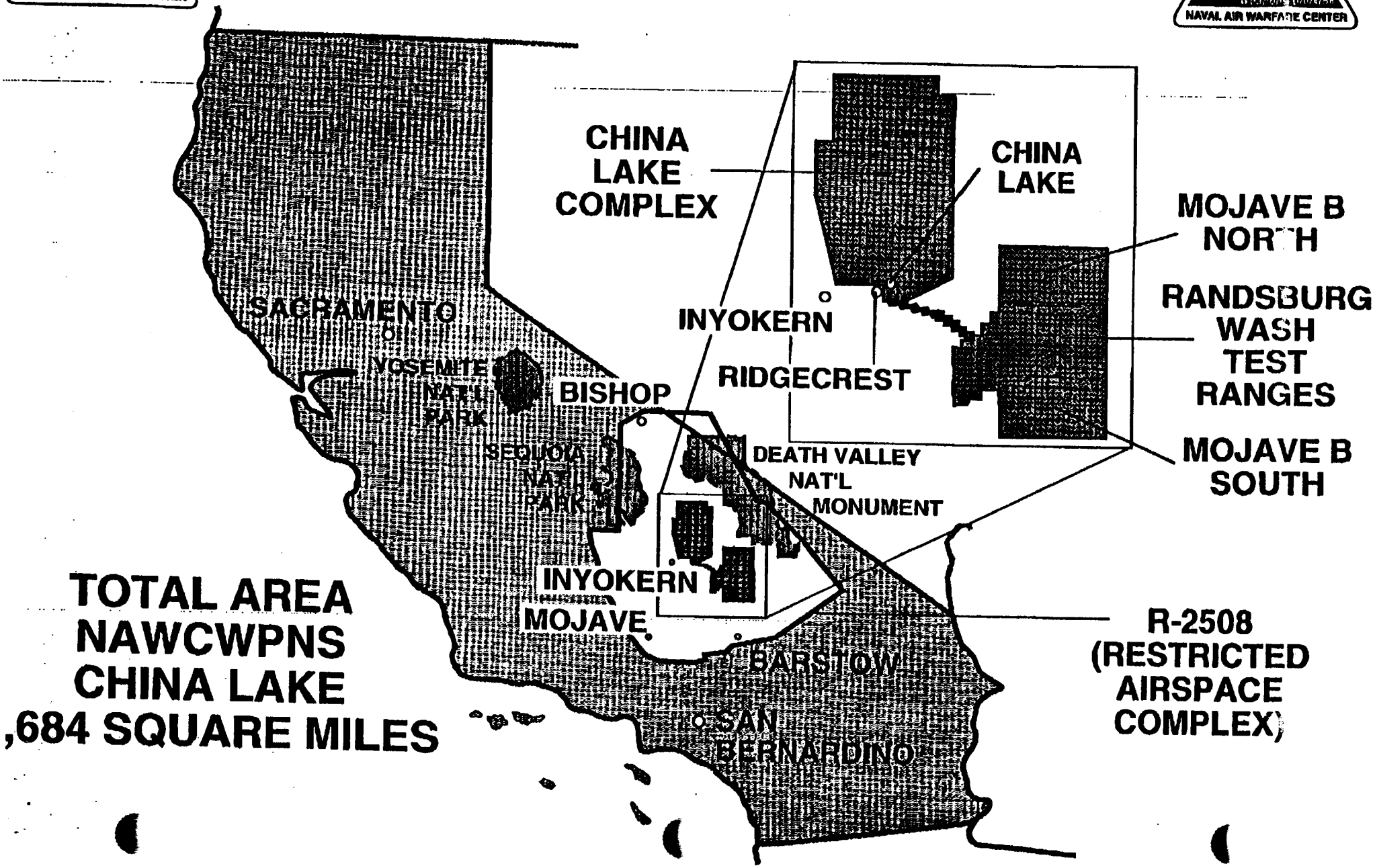
Activity Name: NUWC

UICs:

68934 (NUWC Newport)
66604 (NUWCDIV Newport)
00253 (NUWCDIV Keyport)
70024 (NUWCDET New London)

The Naval Undersea Warfare Center (NUWC) and its associated divisions and detachments have no major capital investment in energetic laboratory/processing facilities and equipment utilized for the research and development of energetics. Therefore, NUWC submits a negative response for this data call.

WAS 10/17/94 CODE C02228 (EXT 939-1391) F5004 165



TOTAL AREA
NAWCWPNS
CHINA LAKE
1,684 SQUARE MILES

DATA CALL #12
Amend #1 Energetics Presentation
NAWCHQ

165

I certify that the information contained herein is accurate and complete to the best of myknowledge 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

W. C. Bowes, VADM, USN
NAME (please type or print)

Signature

Commander
Title

31 OCT 94
Date

Naval Air 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

Title

11/2/94
Date

94-11-21 10:03 RCVD

WC

DATA CALL #12
Amend #1 Energetics Presentation
NAWCHQ

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.

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

ACTIVITY COMMANDER

W. E. Newman, RADM, USN
NAME (Please type or print)

W.E. Newman
Signature

Commander
Title

10/26/94
Date

Naval Air Warfare Center
Activity

LABORATORY JOINT CROSS-SERVICE GROUP

DATA REQUIREMENTS FOR

ENERGETICS CROSS-SERVICE ANALYSIS

20 OCTOBER 1994

PRESENTED BY

NAVAL AIR WARFARE CENTER

NAVAL AIR WARFARE CENTER WEAPONS DIVISION

INTRODUCTION

NAWCWPNS CHINA LAKE

- FULL-SPECTRUM, LIFE CYCLE CAPABILITY IN ENERGETICS
- UNIQUE FACILITIES
- MINIMUM DAYS OF INCLEMENT WEATHER
- GROWTH POTENTIAL
  - EXISTING CAPACITY (480 ADDITIONAL WORK YEARS MINIMUM)
  - VAST SPACE FOR EXPANSION (4,000 TO 24,000 ACRES)
  - NO ENCROACHMENT PROBLEMS (1.1 MILLION ACRES)
  - GEOTHERMAL POWER (240 MEGAWATTS)
- TEAMWORK
  - INDUSTRIAL/ACADEMIA
  - TRI-SERVICE
  - INTERNATIONAL

OPPORTUNITY

NAWCWPNS CHINA LAKE AS A DOD FOCUS
SITE FOR FULL SPECTRUM RDT&E ACTIVITIES
ASSOCIATED WITH ENERGETICS
FOR CONVENTIONAL AND STRATEGIC WEAPONS

NAWCWPNS MISSION

- FULL-SPECTRUM NAVY RDT&E AND IN-SERVICE ENGINEERING CENTER
  - WEAPON SYSTEMS ASSOCIATED WITH AIR WARFARE
  - MISSILES AND MISSILE SUBSYSTEMS
  - AIRCRAFT WEAPONS INTEGRATION
  - ASSIGNED AIRBORNE ELECTRONIC WARFARE SYSTEMS
  - MAINTAIN AND OPERATE THE AIR, LAND AND SEA NAVAL WESTERN TEST RANGE COMPLEX

NAVAL AIR WARFARE CENTER WEAPONS DIVISION

NAWC Weapons Division
NAVAL AIR WARFARE CENTER

COMMANDER
Rear Admiral McKinney
VICE COMMANDER
CAPT Hull

COMMAND STAFF

ENERGETICS ORGANIZATION

DEPUTY COMMANDER FOR RESEARCH & DEVELOPMENT (R&D)
Mr. Haaland

DEPUTY COMMANDER FOR TEST & EVALUATION (T&E)
Mr. Wrout

[redacted]
WEAPONS PLANNING GROUP Ms. Andrews
TECHNOLOGY ADVANCEMENT GROUP Dr. Derr

AIRCRAFT WEAPON SYSTEMS DIRECTORATE
Director - CAPT Henry
Associate Director - [redacted]
- [redacted]
- AIRCRAFT WEAPONS INTEGRATION DEPARTMENT (FIGHTER) CAPT Lewis

WEAPONS DIRECTORATE
Director - Mr. Homer
Military Director - CAPT Henry
- [redacted]
- [redacted]
- [redacted]
- [redacted]

INFORMATION & ELEC. WARFARE DIRECTORATE
Director - Dr. Smiley
Military Director - CAPT Christian

LAND RANGE DIRECTORATE
Director - Mr. Bellen (Actg)
Military Director - CAPT Beal (ADDU)
- OFFICER IN CHARGE NAWCWPNS WHITE SANDS CAPT Beal
- [redacted]
- ELECTRONIC COMBAT RANGE DEPARTMENT Mr. Bellen

SEA RANGE DIRECTORATE
Director - Dr. Warnagleris
Military Director - CAPT Barrett
- RANGE OPERATIONS DEPARTMENT CAPT Barrett
- RANGE INSTRUMENTATION SYSTEMS DEPARTMENT Mr. Knight
- RANGE DATA SYSTEMS DEPARTMENT Ms. Cook

THREAT SIMULATION DIRECTORATE
Director - Mr. G. Smith
Military Director - CAPT Dodd
- TARGET SYSTEMS DEPARTMENT CAPT Dodd
- THREAT, TELEMETRY & INSTRUMENTATION SYSTEMS DEPARTMENT Mr. Ballenger

WEAPONS SYSTEMS EVALUATION DIRECTORATE
Director - Dr. Kutchma
Military Director - CDR Bueker
- AIRCRAFT SYSTEMS DEPARTMENT Mr. Crews
- FLIGHT OPERATIONS DEPARTMENT LCDR Roach
- STRIKE SYSTEMS DEPARTMENT Mr. Ayub
- AIR INTERCEPT SYSTEMS DEPARTMENT Dr. Banks

SERVICES AND INFORMATION DIRECTORATE
Director - Mr. Bullard
- COMPTROLLER DEPARTMENT Mr. Macy
- HUMAN RESOURCES DEPARTMENT Ms. Blen
- INFORMATION SYSTEMS DEPARTMENT Mr. O'Neil
- TECHNICAL INFORMATION DEPARTMENT Mr. Sanders
- PROCUREMENT DEPARTMENT CDR Knight

COMMANDING OFFICER NAVAL AIR WEAPONS STATION (NAWS) POINT MUGU
CAPT Laughter
XO - CDR Kelly

[redacted]

NAVAL AIR WARFARE CENTER WEAPONS DIVISION

ENERGETICS ORGANIZATION

- COMMANDER / VICE COMMANDER
  - DEPUTY COMMANDER RESEARCH & DEVELOPMENT
    - AIRCRAFT WEAPON SYSTEMS DIRECTORATE
      - AIRCRAFT WEAPON INTEGRATION DEPARTMENT
      - WEAPONS SURVIVABILITY LABORATORY
    - WEAPONS DIRECTORATE
      - WEAPONS & ENGINEERING LOGISTICS DEPARTMENT
        - FABRICATION
        - CONFIGURATION MANAGEMENT
        - PRODUCT ASSURANCE
        - LOGISTICS
      - ORDNANCE SYSTEMS DEPARTMENT
        - TECHNOLOGY & DEVELOPMENT OF
          - ENERGETIC MATERIALS
          - PROPULSION
          - ORDNANCE
      - ATTACK WEAPONS DEPARTMENT
        - AERO
        - STRUCTURES
        - THERMAL
        - LETHALITY
      - INTERCEPT WEAPONS DEPARTMENT
        - PROXIMITY FUZING
    - RESEARCH DEPARTMENT
      - RESEARCH & TECHNOLOGY OFC
        - ENERGETIC MATERIALS
        - PROPULSION
        - ORDNANCE
  - NAVAL AIR WEAPONS STATION
    - SAFETY
    - ENVIRONMENTAL
    - MAGAZINES
    - EOD
  - DEPUTY COMMANDER TEST & EVALUATION
    - LAND RANGE DIRECTORATE
      - RANGE DEPARTMENT
        - ORDNANCE EVALUATION
        - SNORT
        - TEST RANGES

- WORKYEARS (FY-93)
  - GOVERNMENT – 1,188
  - CONTRACT – 518
- SPACE (SQ FT)
  - LABORATORY — 516,000
  - OFFICE — 247,000
  - OTHER — 427,000
- FUNDING (FY-93) – $230M

FY-93 CUSTOMERS/PROJECTS

(≈ $230 M)

•NAVY PROJECTS	
-NAVAIR	78
-NAVSEA	48
-ONR/NRL	26
•ARMY PROJECTS	15
•AIR FORCE PROJECTS	16
•OTHER GOVT PROJECTS	27
•PRIVATE INDUSTRY PROJECTS	4

ENERGETICS CAPABILITIES

- FULL SPECTRUM(LIFE-CYCLE) PRODUCTS & FUNCTIONS
  - PRODUCTS
    - -ENERGETIC MATERIALS
    - -PROPULSION COMPONENTS (ROCKETS/AIR) BREATHING)
    - -ORDNANCE COMPONENTS (WARHEADS, BOOSTERS, FUZES)
  - TECHNOLOGY AREAS
    - -ADV TECH DEMOS
    - -INTENSIVE MUNITIONS
    - -LARGE ROCKET MOTOR DISPOSAL
    - -NON-DESTRUCTIVE EVALUATION
  - TEST AND EVALUATION (t & e + T & E)
    - -RESEARCH MATERIALS
    - -ENERGETIC COMPONENTS
    - -INTIGIRATION OF ALL-UP-ROUNDS
    - -ONE-OF-A-KIND TESTS

NAWC
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ENERGETIC MATERIALS

NAWC
Weapons Division
NAVAL AIR WARFARE CENTER

SOLID PROPELLANTS

ENERGETIC SOLIDS

ENERGETIC BINDERS

HIGH EXPLOSIVES

NAWC
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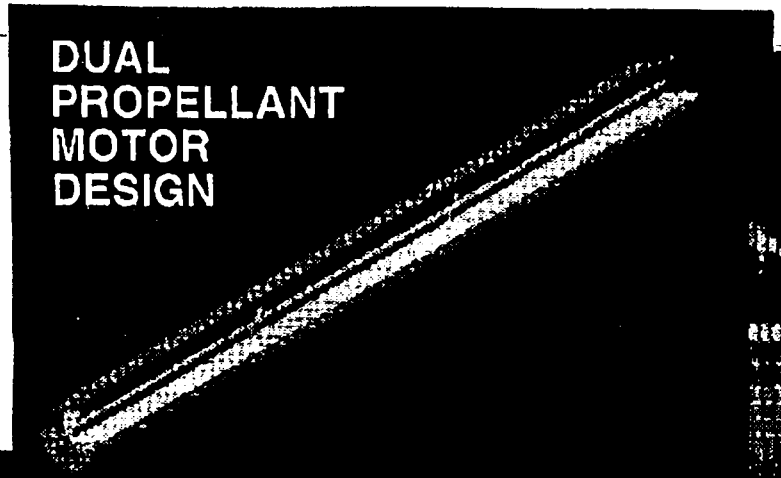
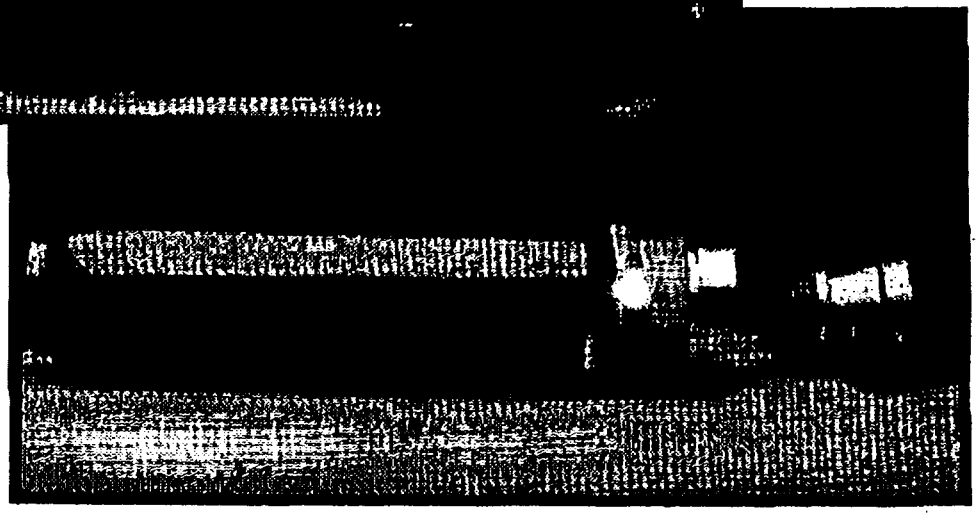
PROPULSION

NAWC
Weapons Division
NAVAL AIR WARFARE CENTER



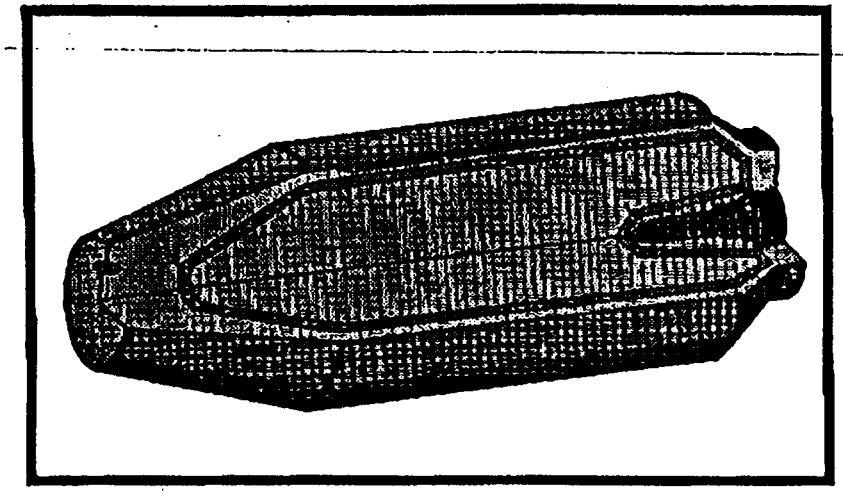
MOTOR FIRING WITH TVC

LOW DRAG RAMJET ENGINE

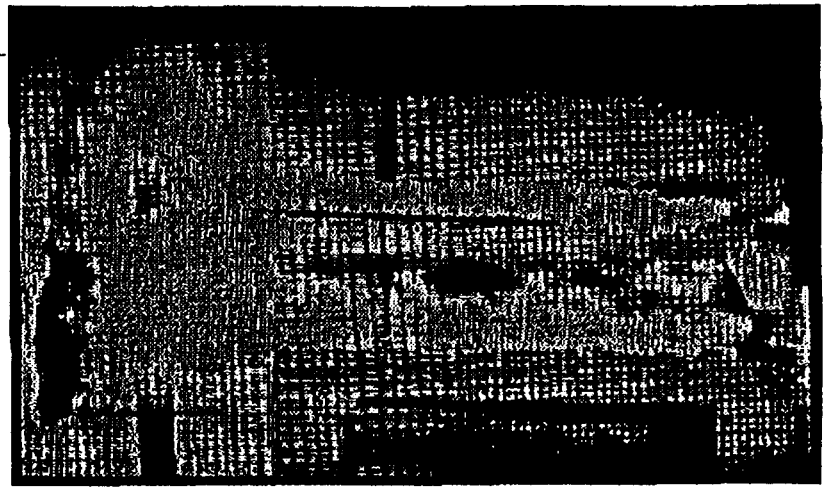


COMPOSITE RAMJET COMBUSTOR

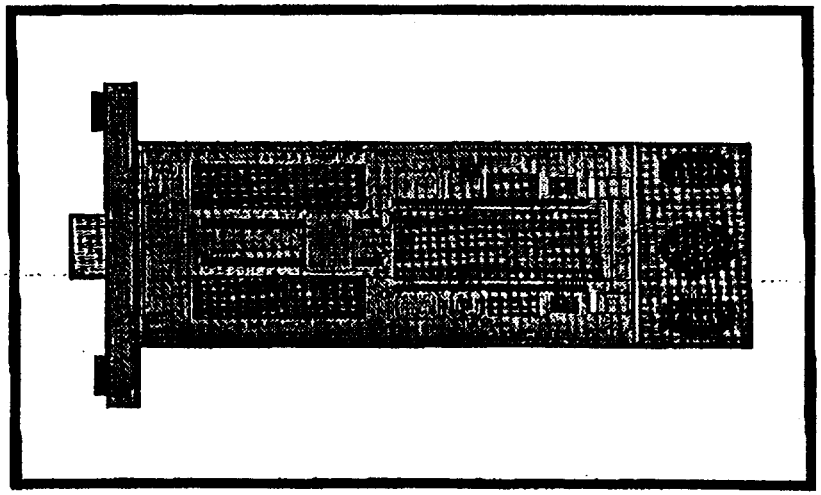
ORDNANCE PRODUCTS AND ACTIVITIES



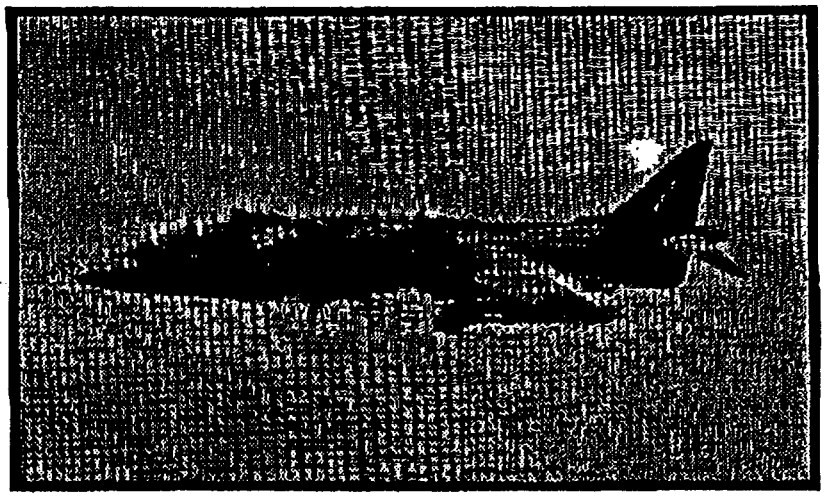
TOMAHAWK WARHEAD



TOMAHAWK WARHEAD TRACK TEST



ELECTRONIC SAFE & ARM DEVICE

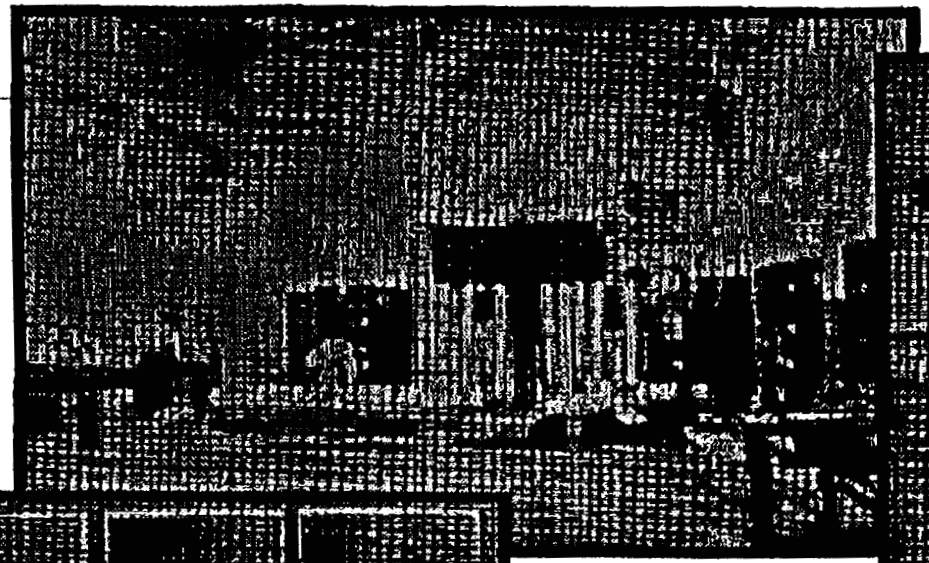


AV-8B GUN POD

NAWC
NAVAL AIR WARFARE CENTER

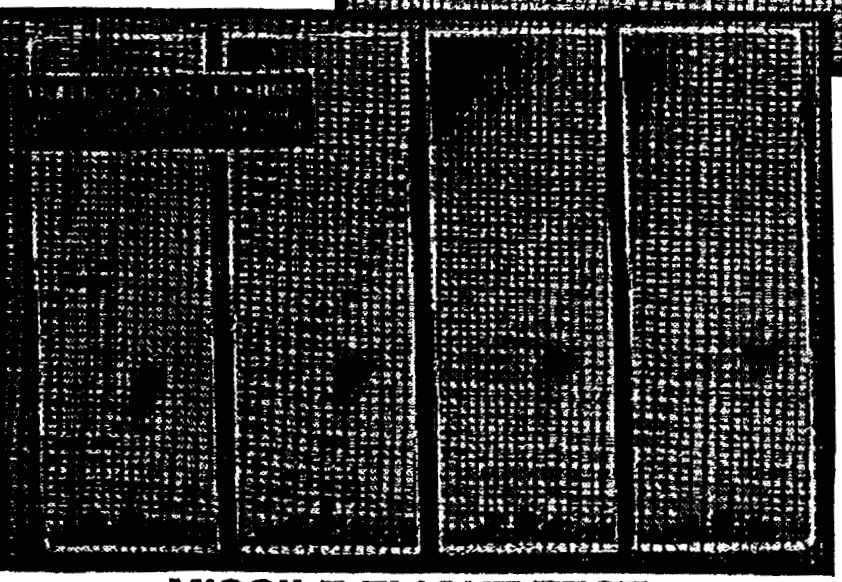
WEAPONS INTEGRATION/TESTING

NAWC
Weapons Divis
NAVAL AIR WARFARE CE



ASSEMBLY BUILDING

MISSILE MASS PROPERTIES TESTING



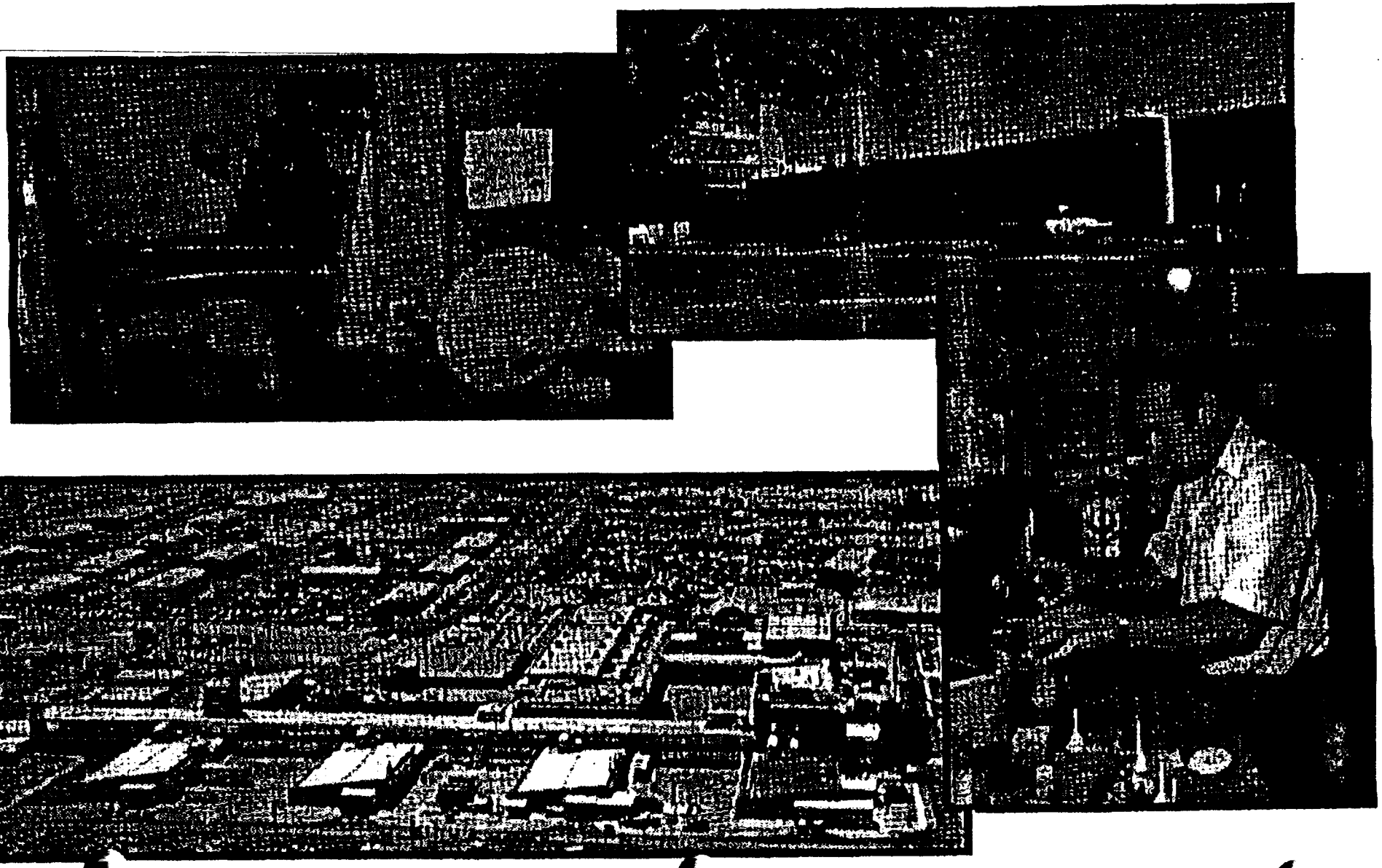
MISSILE FLIGHT TEST

MISSILE ASSEMBLY

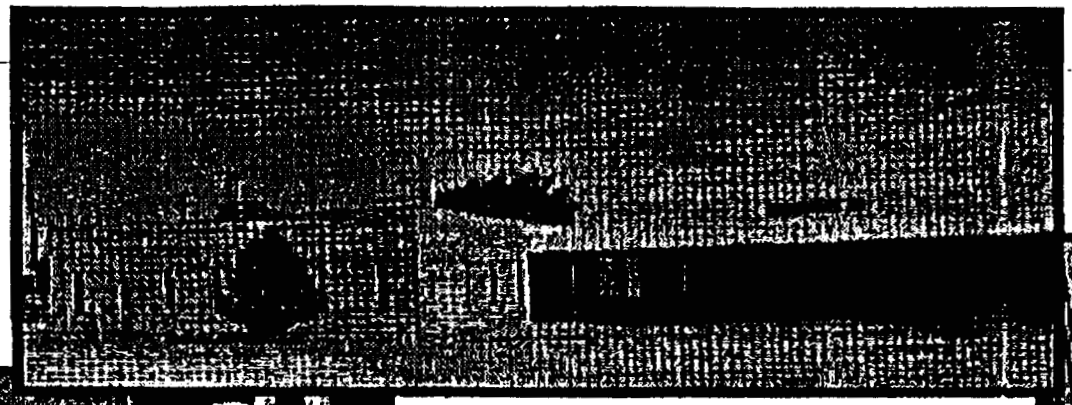
NAVAL AIR WARFARE CENTER

ENERGETIC MATERIALS RESEARCH

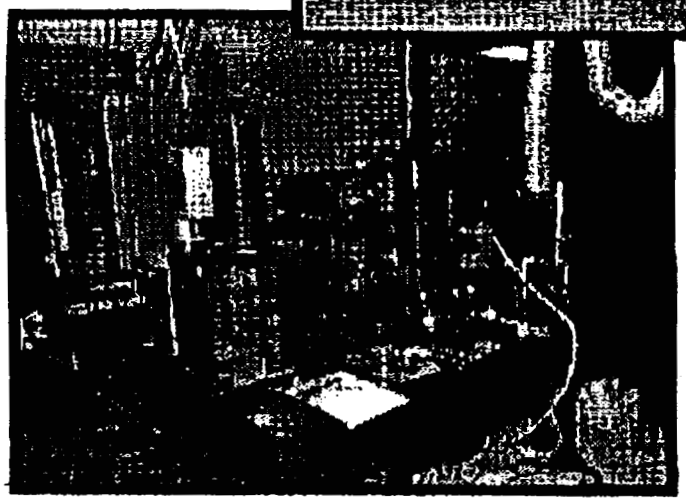
NAWC Weapons Division
NAVAL AIR WARFARE CENTER



PROPULSION RESEARCH



PROPULSION RESEARCH LABORATORY



COMBUSTION DIAGNOSTICS LABORATORY

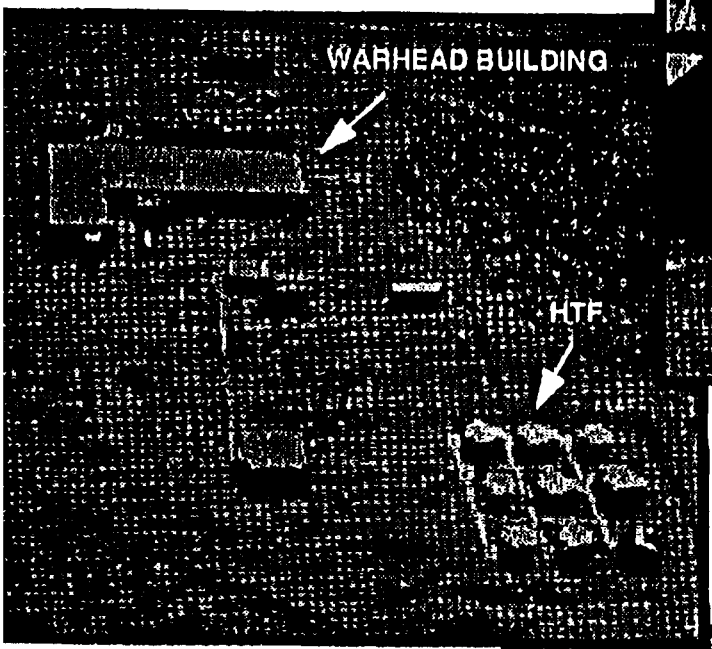
AIRBREATHING PROPULSION FACILITY

HIGH PRESSURE COMBUSTION INSTABILITY LABORATORY (UP TO 3000 PSI)

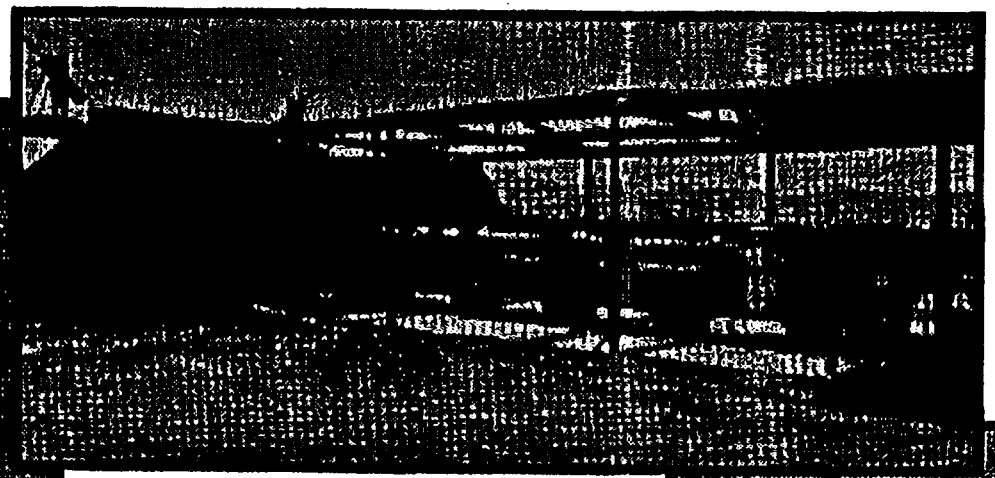
NAVAL AIR WARFARE CENTER

COMBUSTION/DETONATION RESEARCH

NAWC Weapons Division
NAVAL AIR WARFARE CENTER

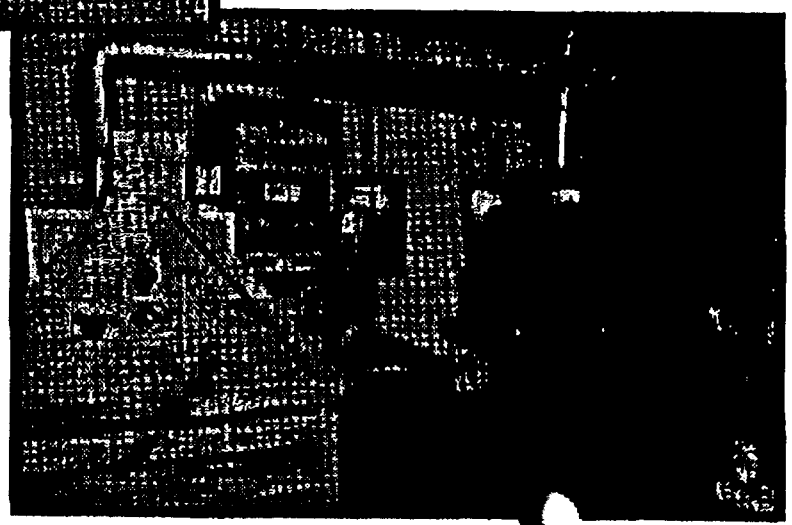


WARHEAD BUILDING AND HAZARDOUS MATERIAL TEST FACILITIES (HTF)



SIX INCH POWDER GUN FACILITY (FIRES EIGHT POUND CHARGE UP TO 2000 FPS)

HIGH PRESSURE COMBUSTION BOMB FACILITY (UP TO 100,000 PSI)



SOLID PROPELLANT IGNITION FACILITY (CARBON ARC AND LASER)

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DETONATION RESEARCH

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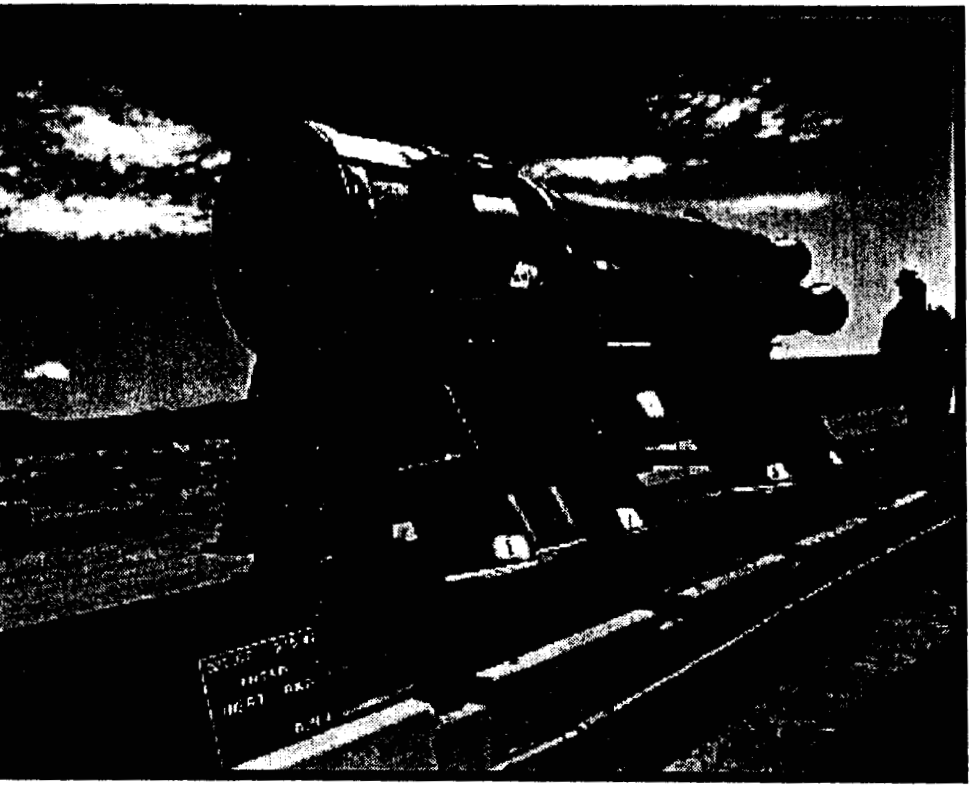
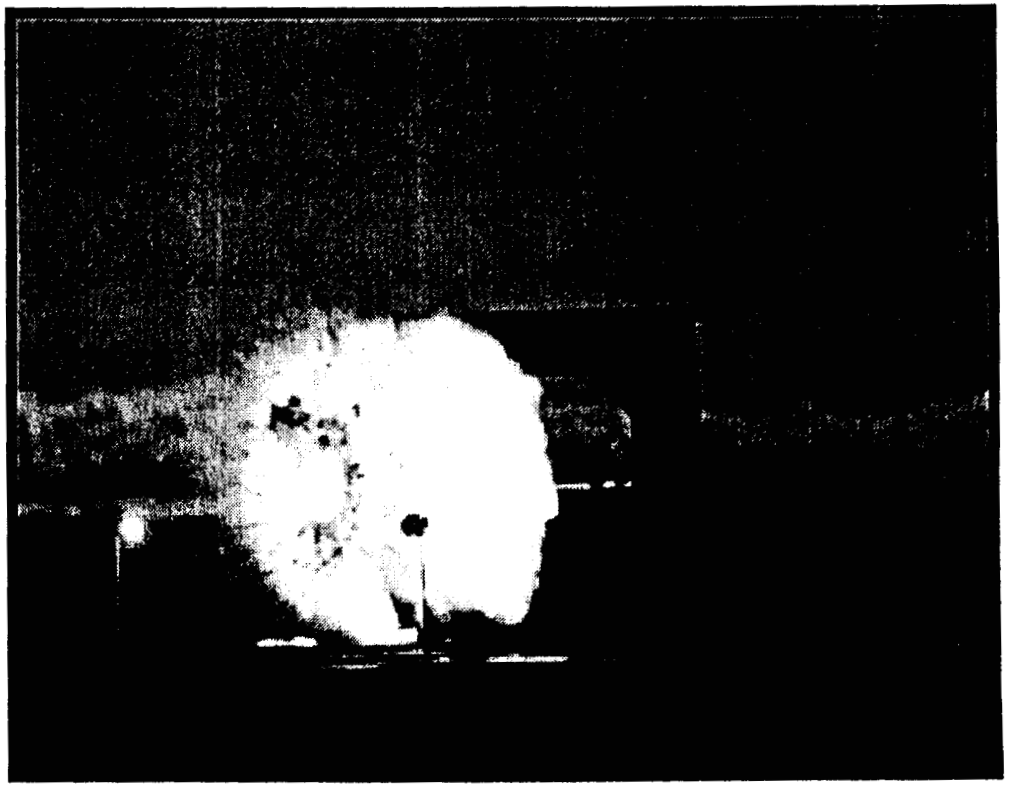
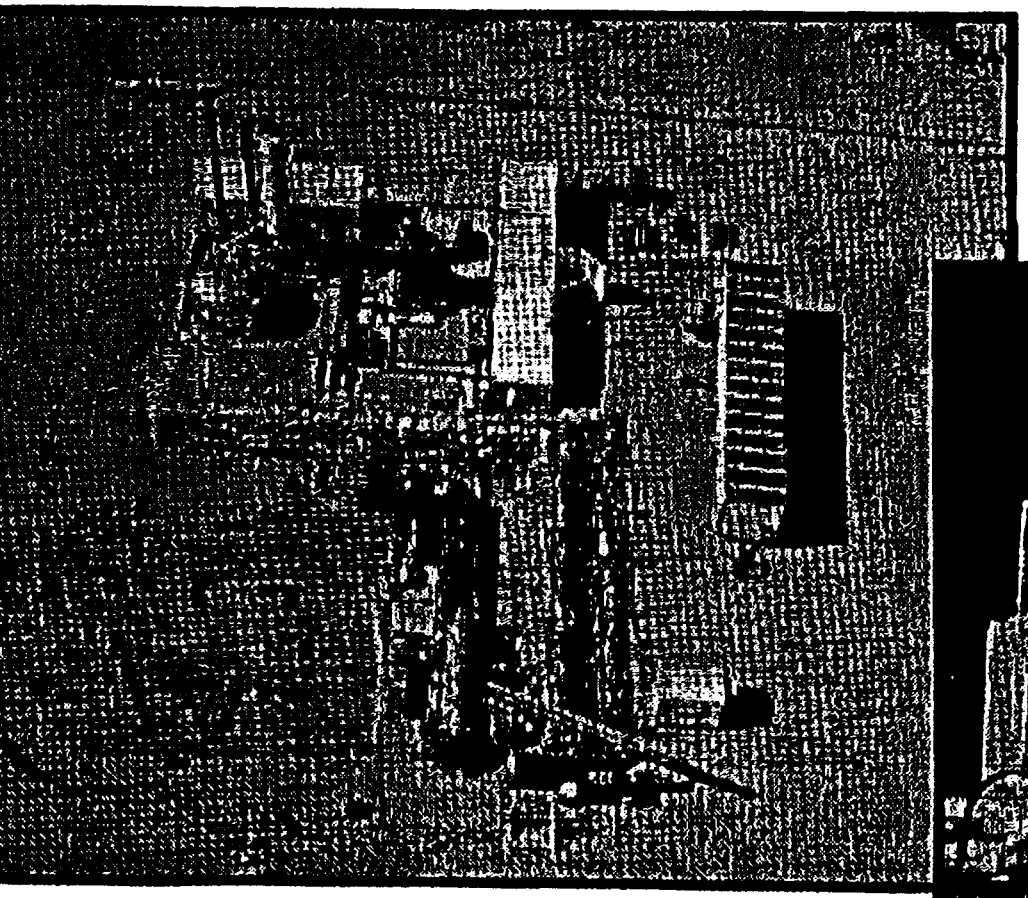


SUPERSONIC NAVAL ORDNANCE RESEARCH TRACK (SNORT)



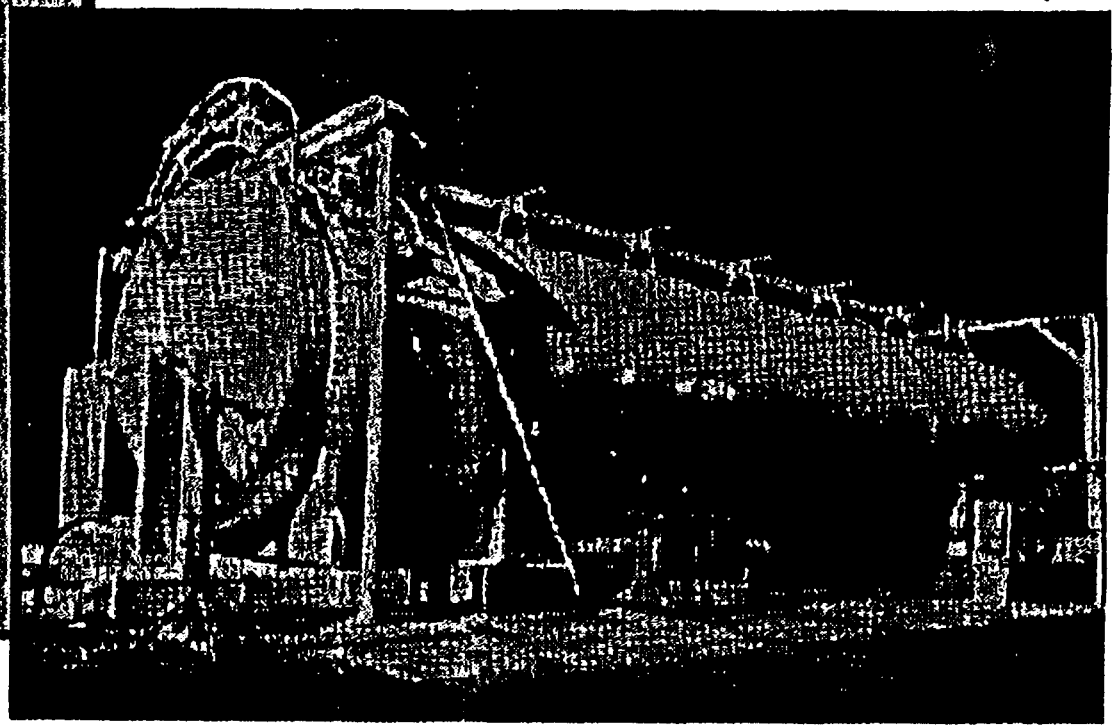
PROPELLANT HAZARD TEST ASSESSMENT PROGRAM (PHTAP)

LARGE SOLID ROCKET MOTOR DISPOSAL TECHNOLOGY



SUBSCALE FACILITY
(UP TO 200 POUNDS OF PROPELLANT)

CONTAINED BURN ASSESSMENT TEST (CBAT) FACILITY
(UP TO 40,000 POUNDS OF PROPELLANT)



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ADVANCED DEVELOPMENT

INSENSITIVE MUNITIONS PROPULSION

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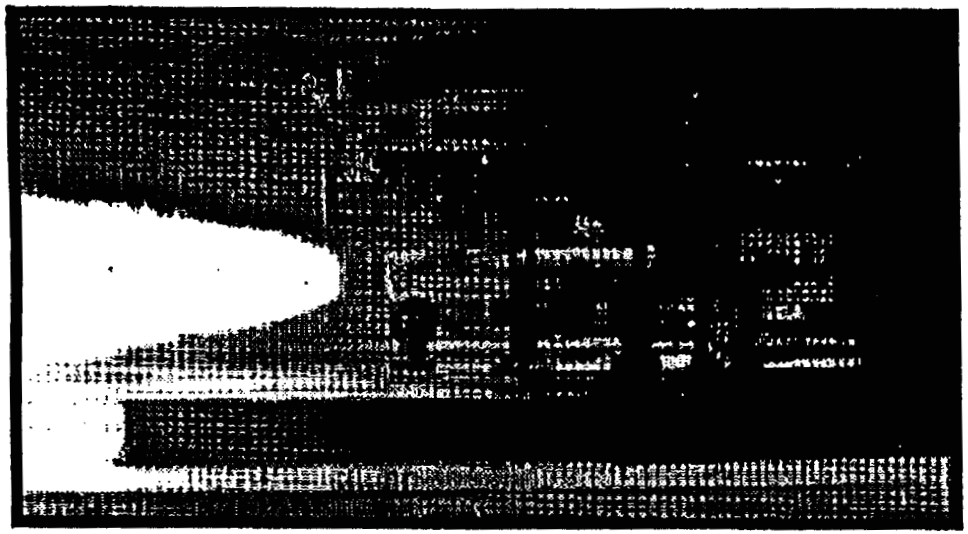
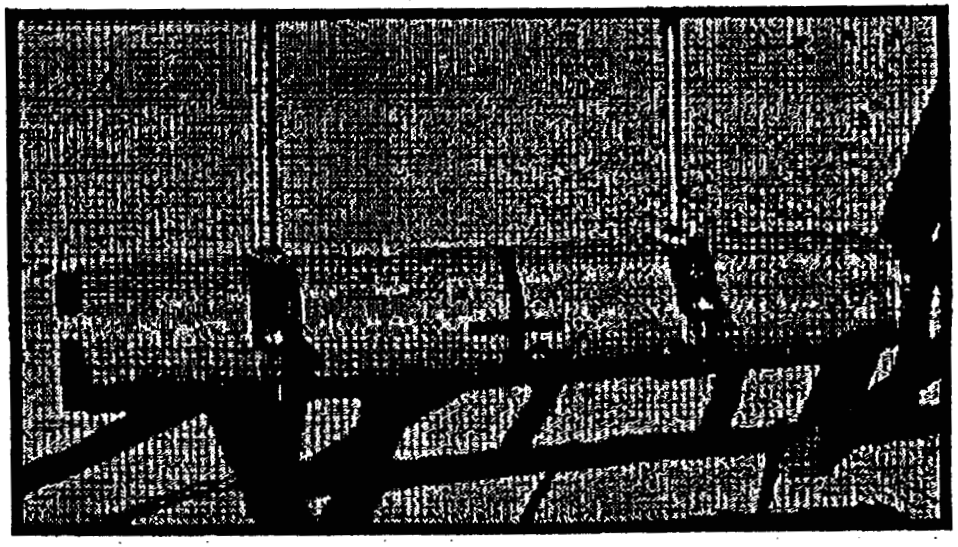


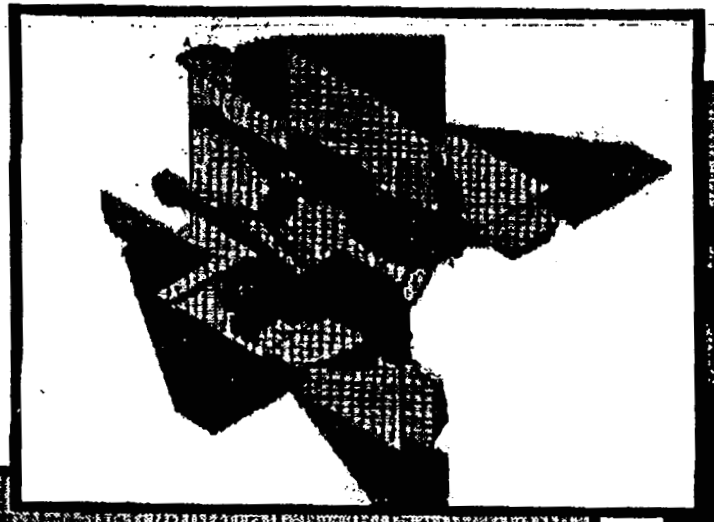
- INSENSITIVE PROPELLANTS
- COMPOSITE CASES
- MITIGATING SYSTEMS

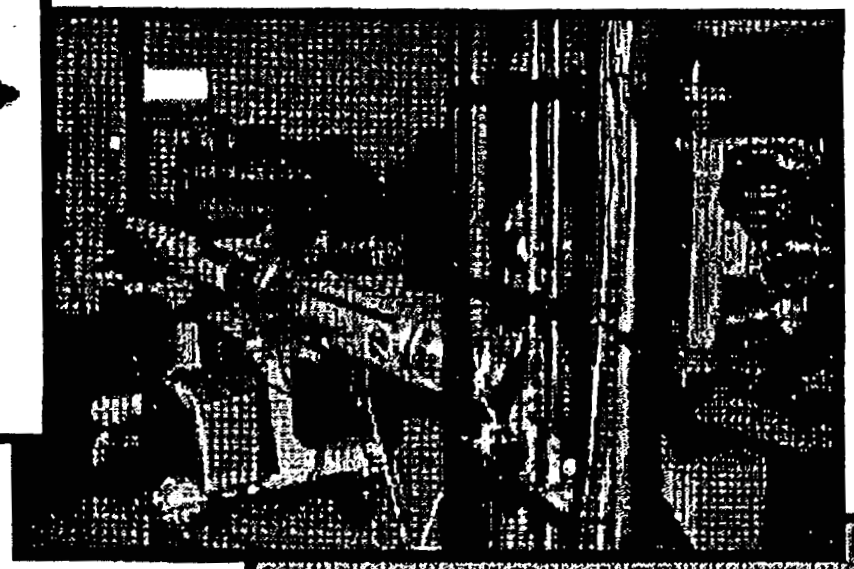
- FAST COOKOFF
- SLOW COOKOFF
- BULLET IMPACT
- FRAGMENT IMPACT
- SYMPATHETIC DETONATION



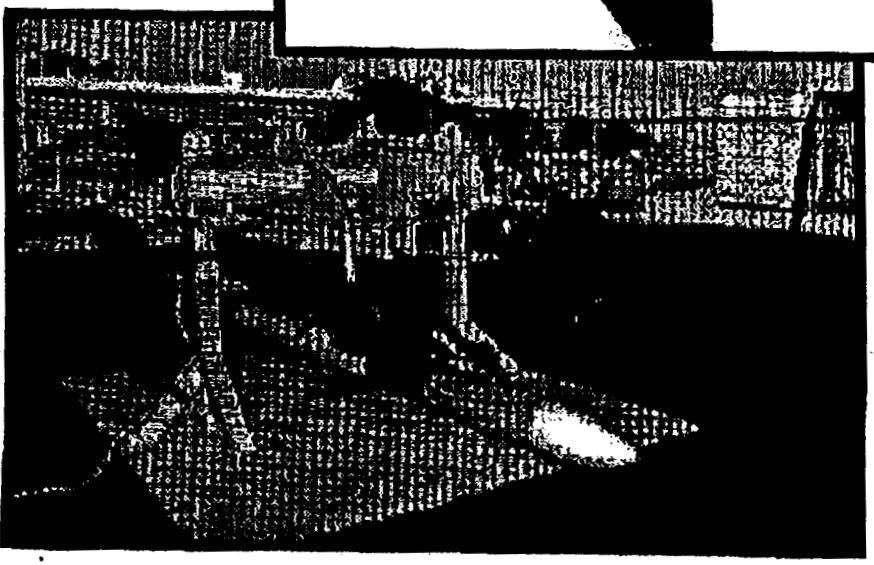
ADVANCED TECHNOLOGY DEMONSTRATIONS

INTEGRATED AERO/TVC SOLIDS DESIGN MODEL

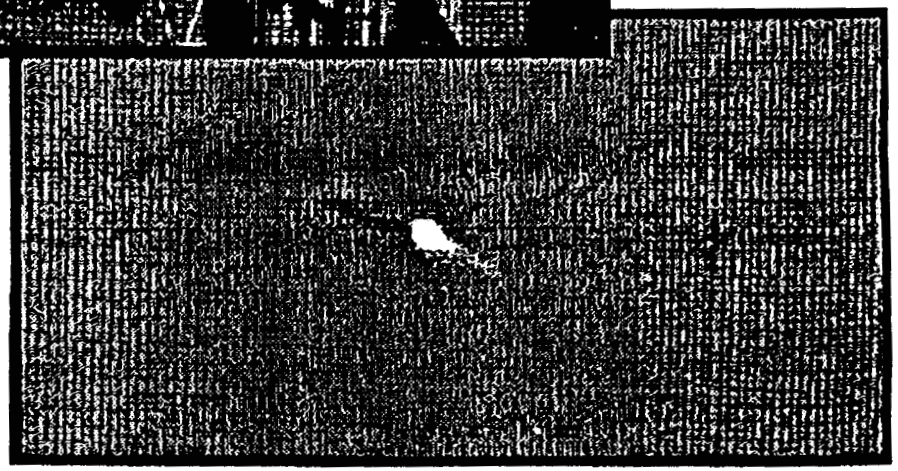




MISSILE COMPONENT INTEGRATION



MISSILE/LAUNCHER INTEGRATION



PULSE MOTOR WITH AERO TVC FLIGHT TEST

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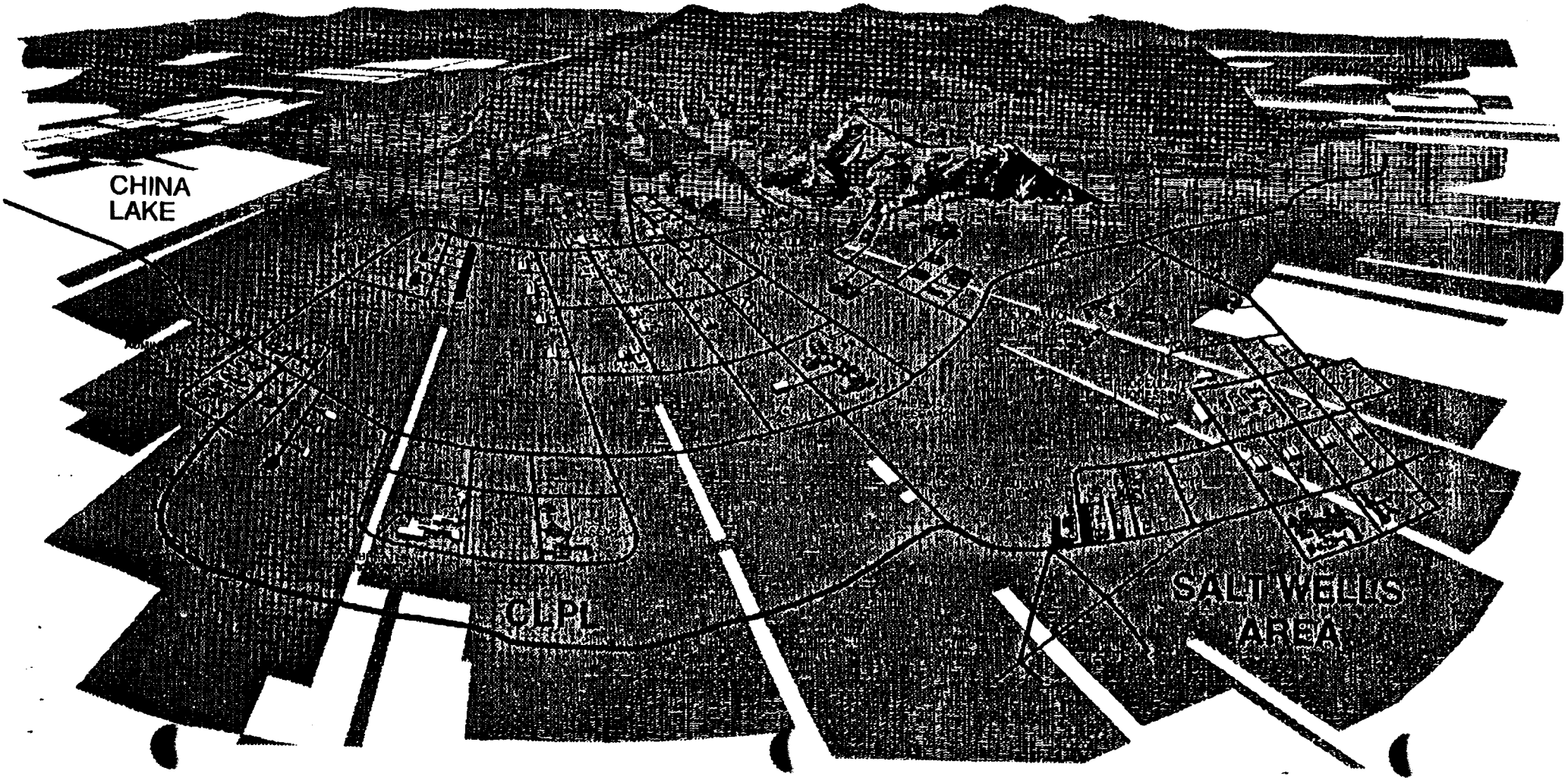
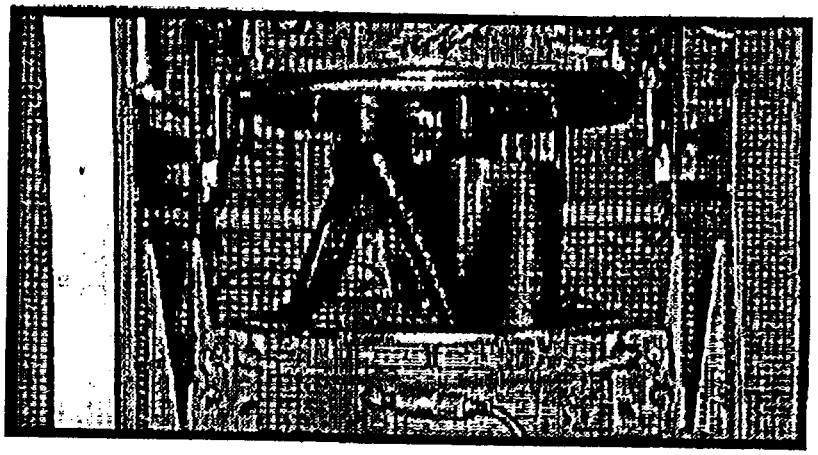
ORDNANCE PLANT
PHYSICAL ASPECTS

- AREA – 12,000 ACRES
- BUILDINGS – 300
- FLOOR SPACE – 415,000 SQ FT



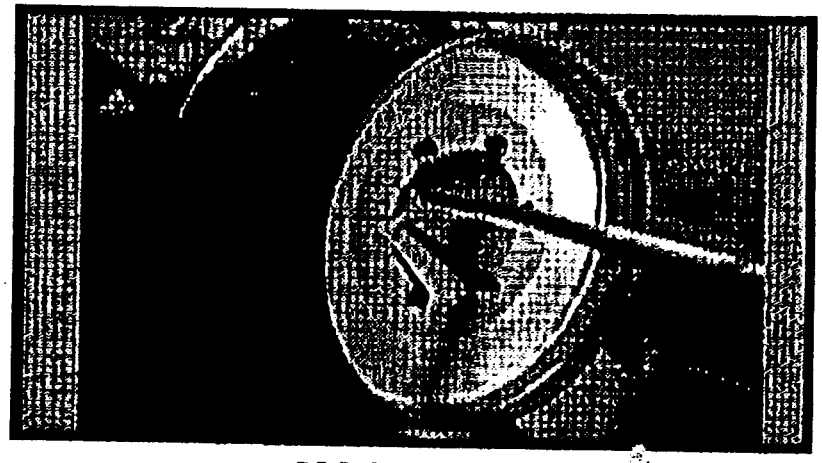
ORDNANCE PLANT CAPABILITIES
EXPLOSIVES & PROPELLANTS

FORMULATION & SCALE-UP



MIXING TO 150 GALLONS

CASTING



MACHINING

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ORDNANCE PLANT CAPABILITIES

EXPLOSIVES

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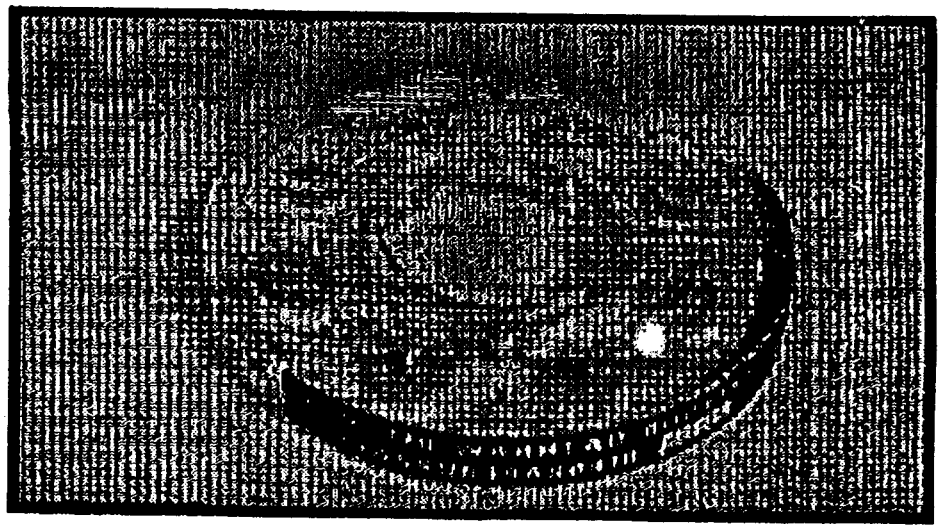
EXPLOSIVE PRESSING

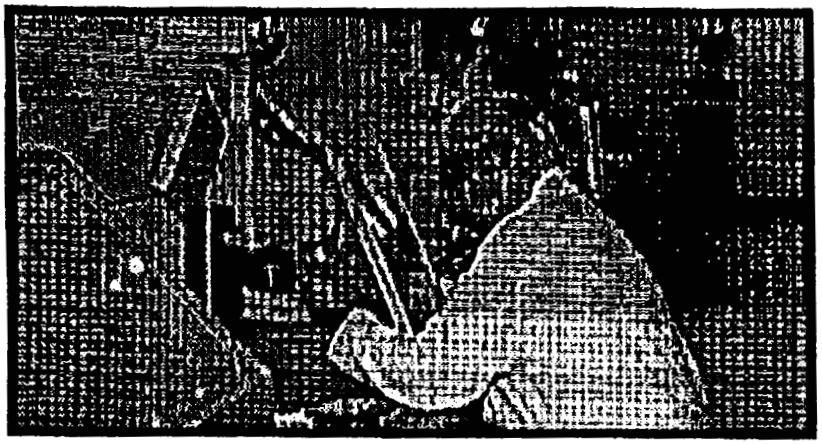
EXPLOSIVE MELT-CAST PROCESSING

INJECTION LOADING



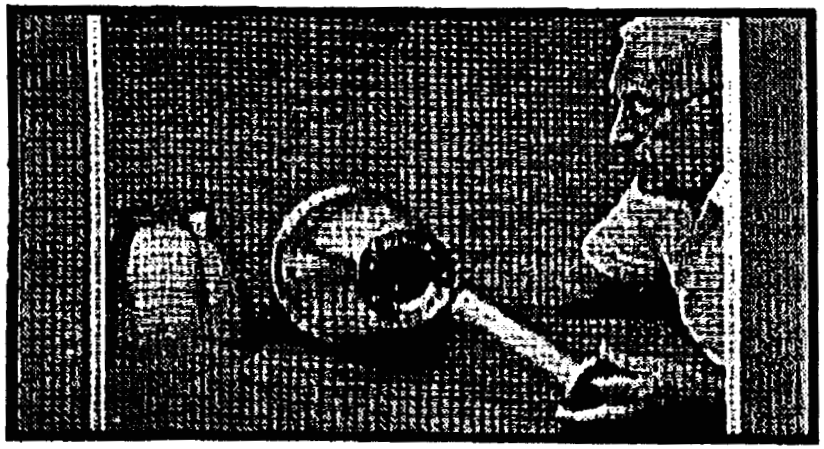
EXTRUSIONS

ORDNANCE PLANT CAPABILITIES
ASSEMBLY



FUZES & ARM-FIRING DEVICES

PROPULSION SECTION

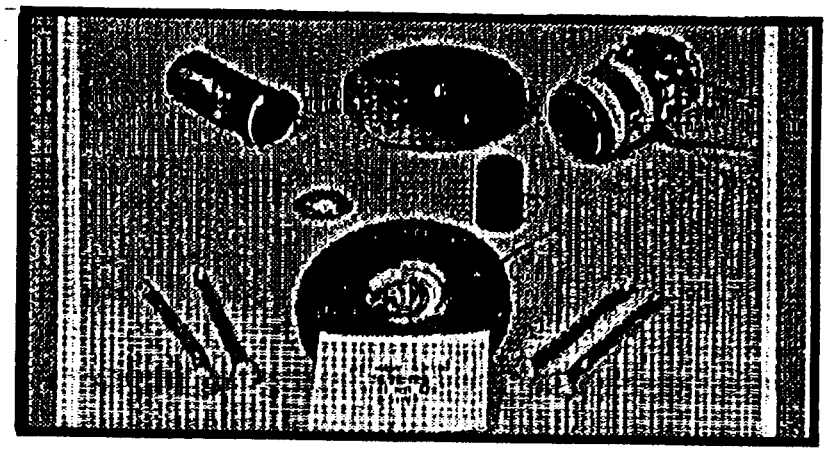


WARHEAD SECTION

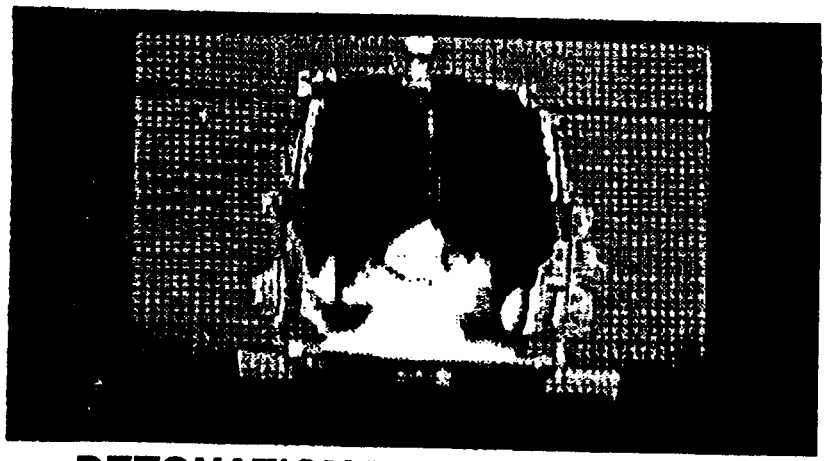
MISSILES

ORDNANCE PLANT CAPABILITIES EVALUATION

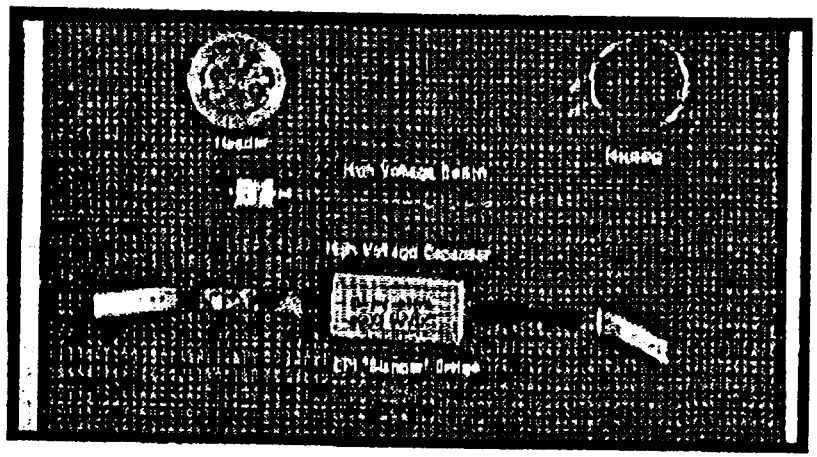
PROPERTIES ANALYSIS



THERMAL PROPERTIES



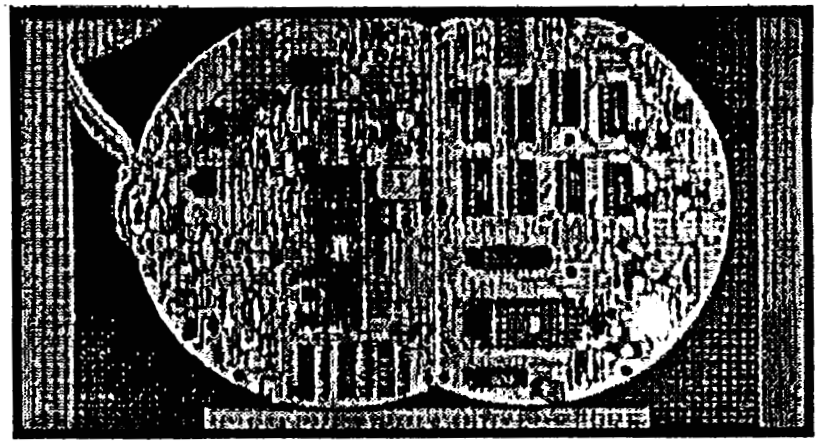
DETONATION MEASUREMENT



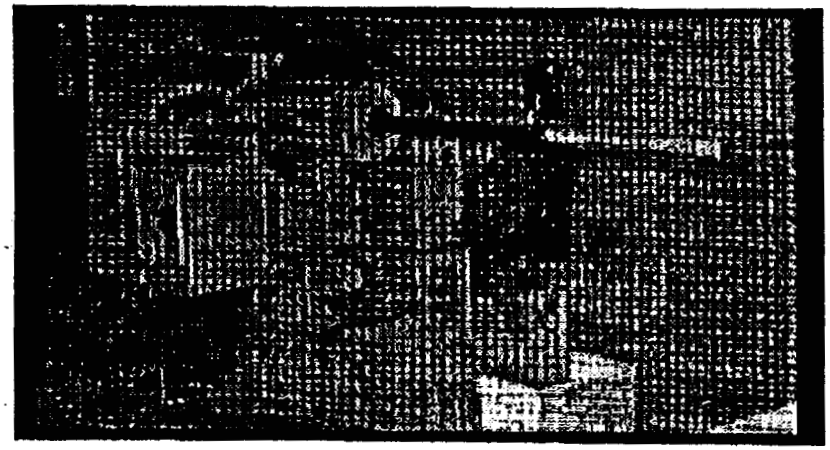
INITIATION DEVICE TESTING

ORDNANCE PLANT CAPABILITIES
EVALUATION

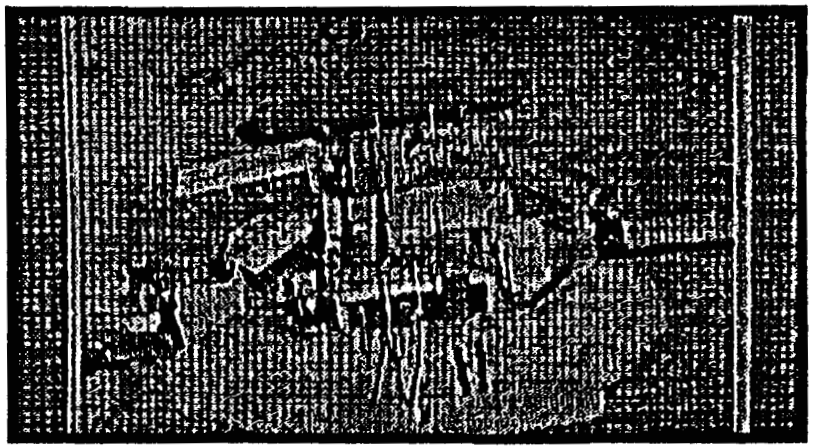
FUZE OPERABILITY



FUZE ELECTRONICS



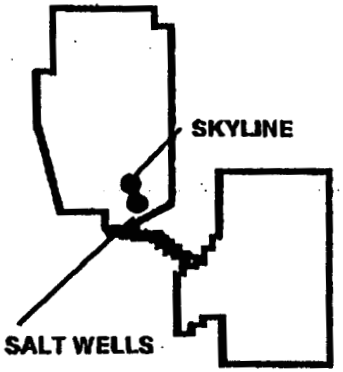
BALLISTICS LAB

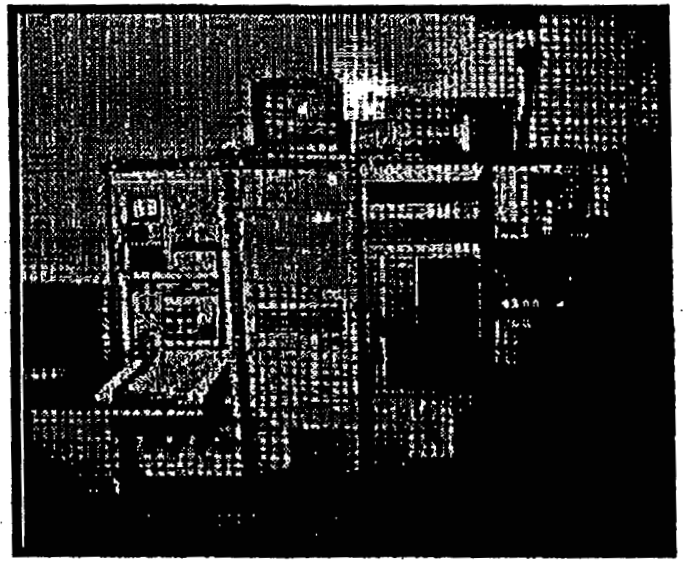


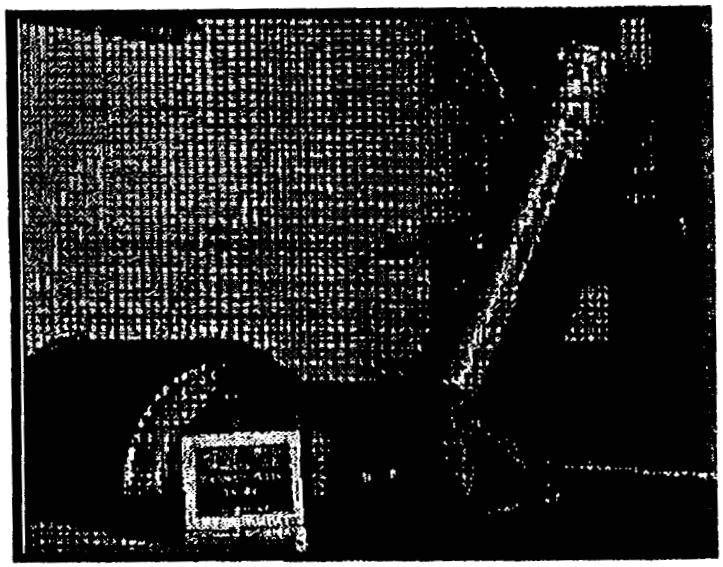
RAMJET LABORATORY

LIVE ORDNANCE TEST FACILITIES

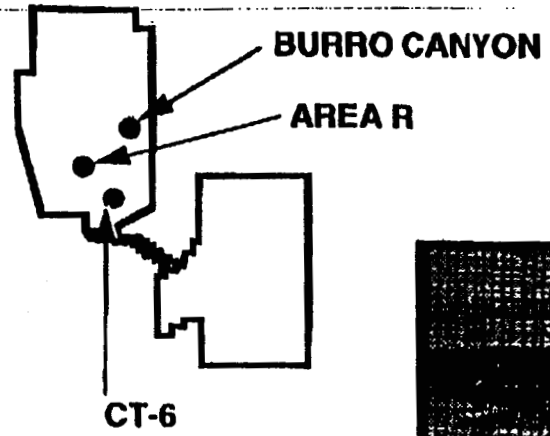
- STOCKPILE-TO-TARGET ENVIRONMENT TESTING
- DYNAMIC (VIBRATION & SHOCK)
- CLIMATIC (TEMPERATURE, HUMIDITY, SALT SPRAY)



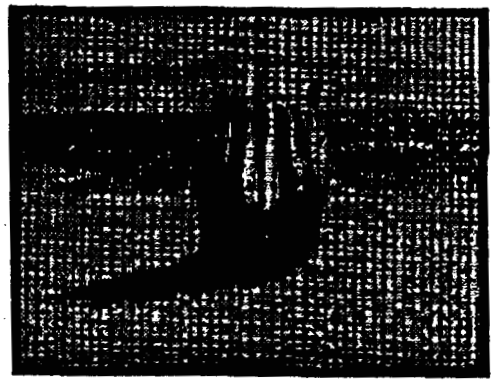


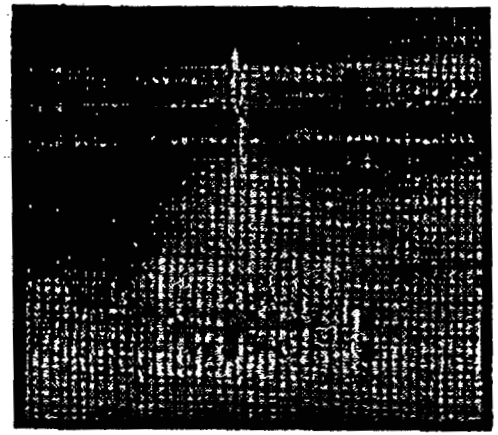


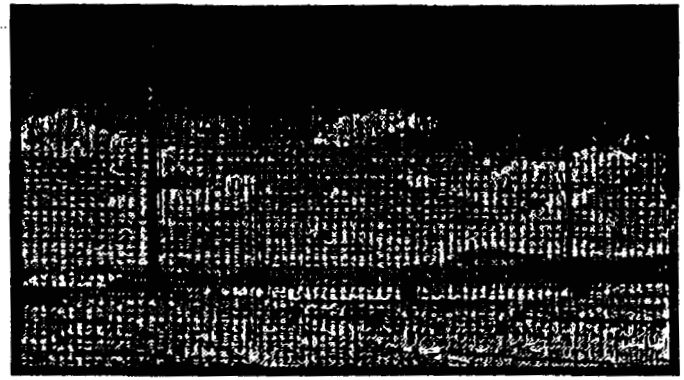
WARHEAD TEST ARENAS



- FRAGMENT DISTRIBUTION/ VELOCITY
- SHOCK/PRESSURE WAVES
- SHAPED-CHARGE PERFORMANCE
- WARHEAD EFFECTIVENESS

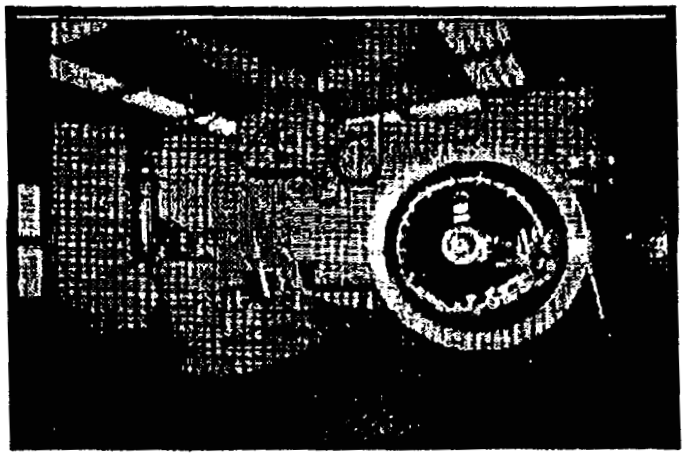


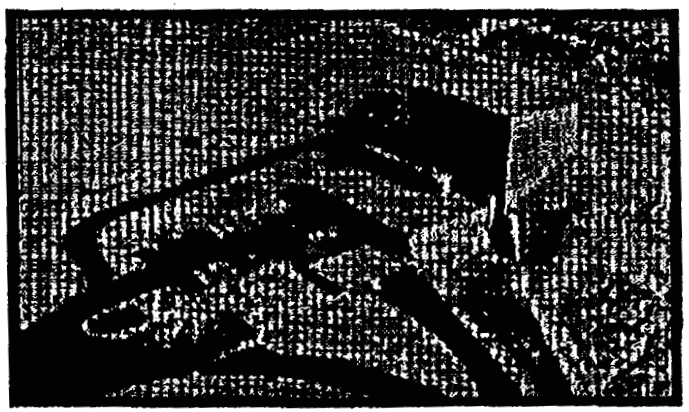


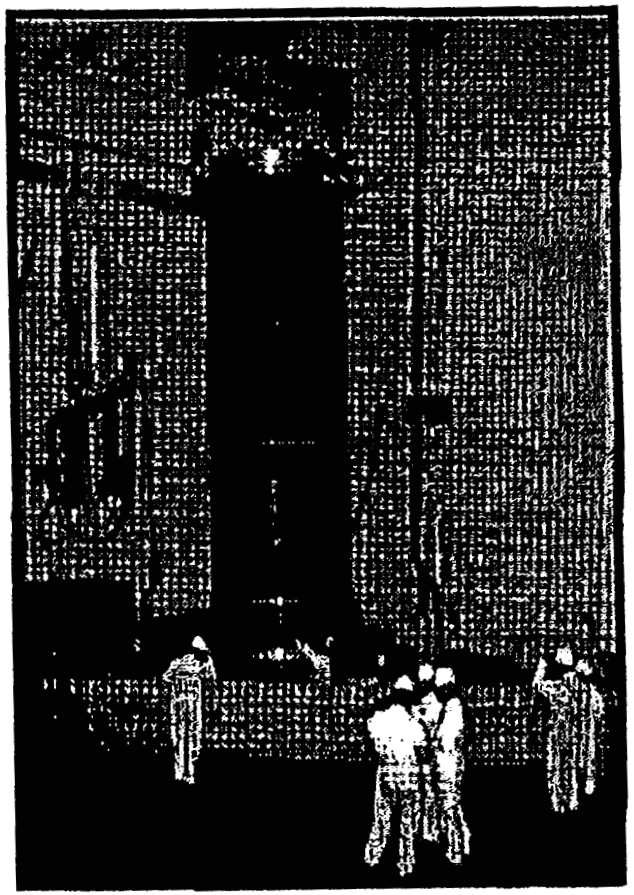


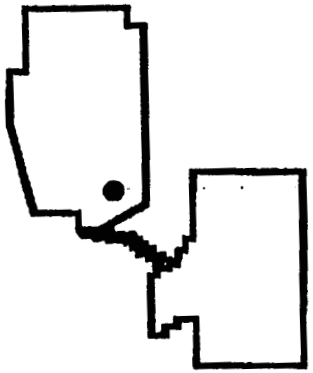
NON-DESTRUCTIVE EVALUATION FACILITIES

- HI-ENERGY COMPUTER- AUTOMATED TOMOGRAPHY (HECT)
- 25 MEV & 250 KVP X-RAYS
- MASS PROPERTY DETERMINATION
- LEAK DETECTION
- BORESCOPIC INSPECTION



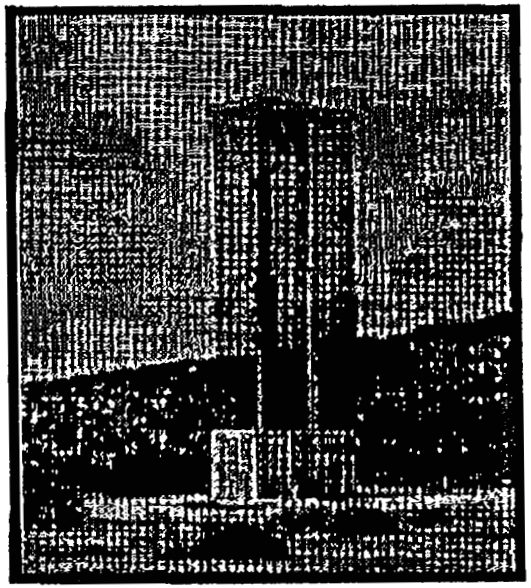


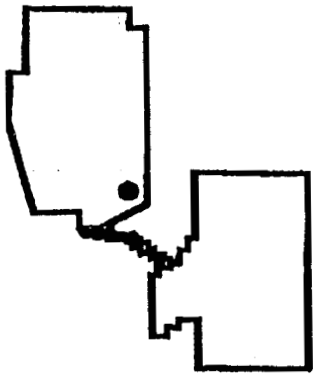


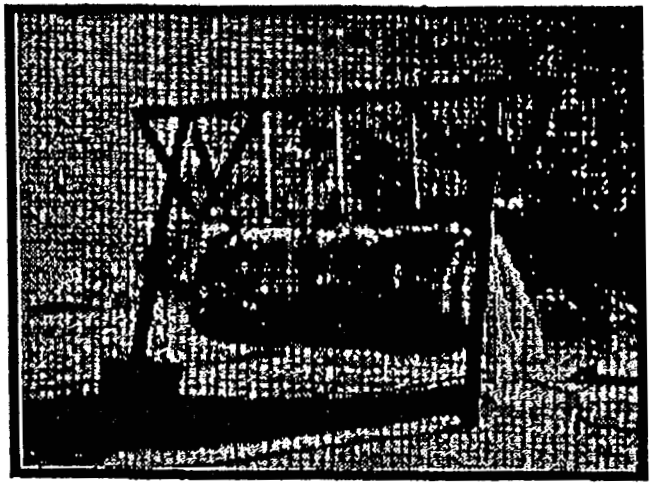


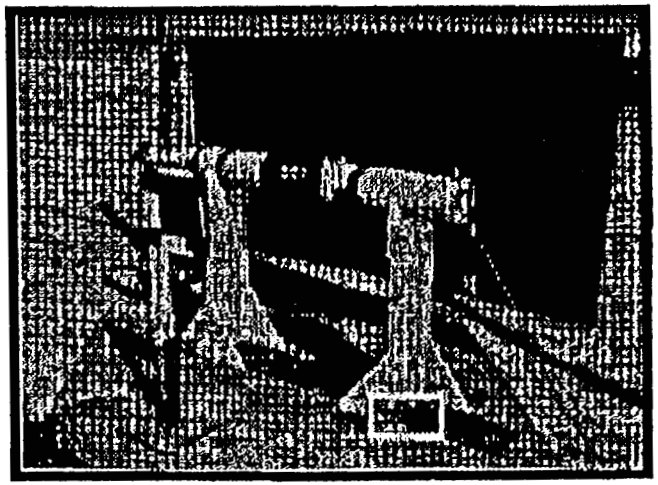
SAFETY TEST FACILITIES

- WEAPONS EVALUATION TO MILITARY HAZARDS
  - COOK-OFF TESTS
  - BULLET/FRAGMENT IMPACT
  - DROP TOWER TESTS
  - EXTERNAL FIRE STACK TESTS
  - SYMPATHETIC DETONATION TESTS



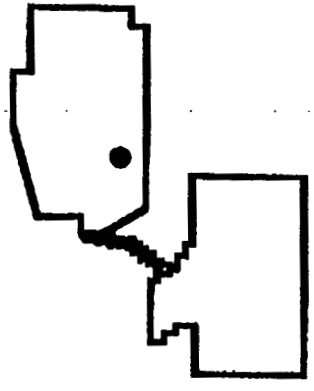


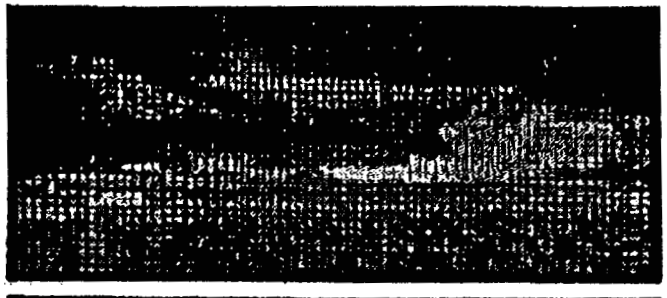




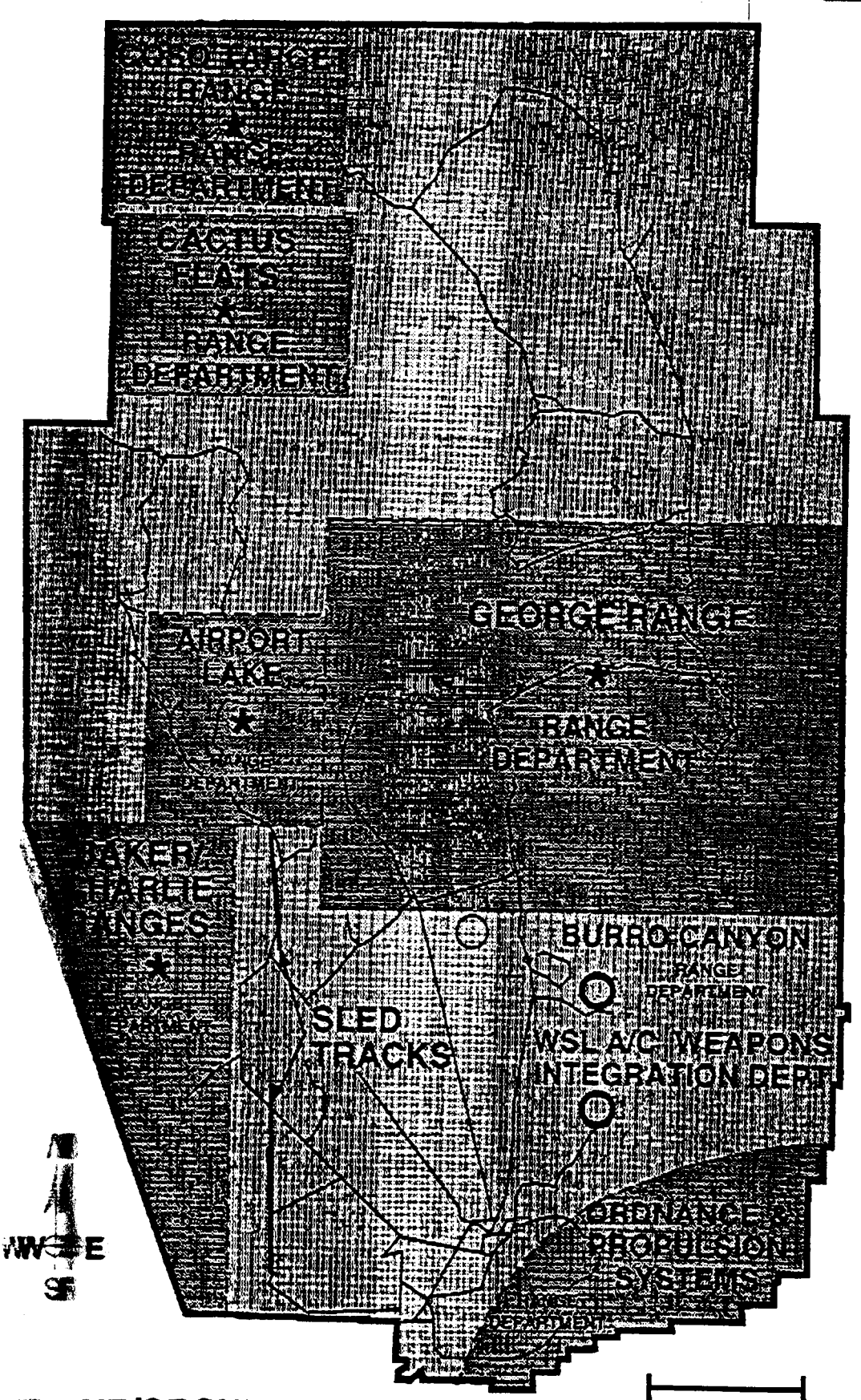
PROPULSION TEST FACILITIES

- STATIC FIRINGS OF SOLID PROPULSION SYSTEMS
- THRUSTS TO 1.5M LBS HORIZONTAL, 1.0M LBS VERTICAL
- STRATEGIC, TACTICAL, LABORATORY SCALE
- 7 TEST BAYS, MULTIPLE TEST STANDS
- AERO HEAT TEST OF MATERIALS
- SMALL RAM JET ENGINE TESTS





ESTIMATED ENERGETIC FACILITY REPLACEMENT COST ~ $900M



★–AIR/GROUND RANGE

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MARITIME PRE-POSITION SHIP TEST

BUILDUP

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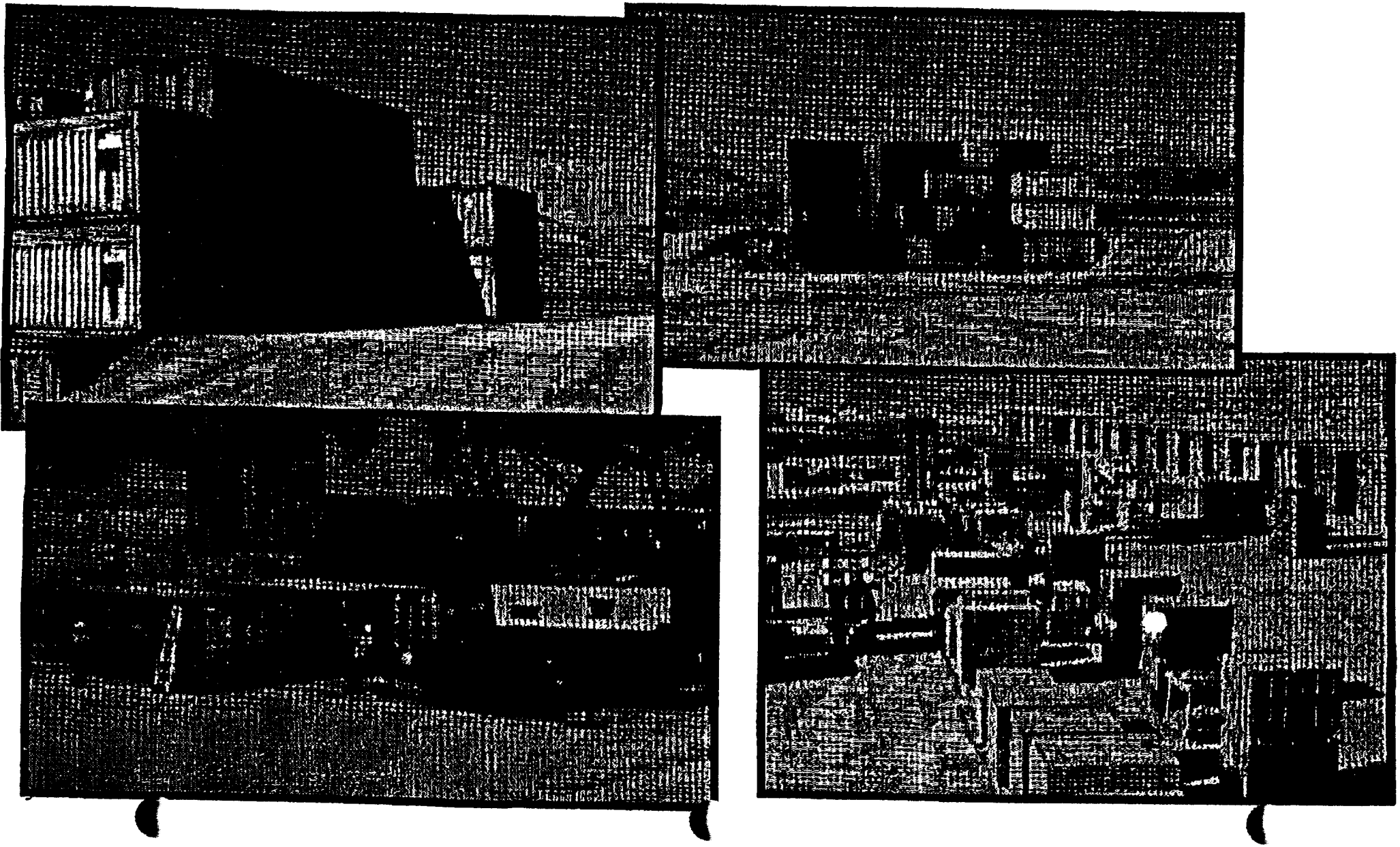
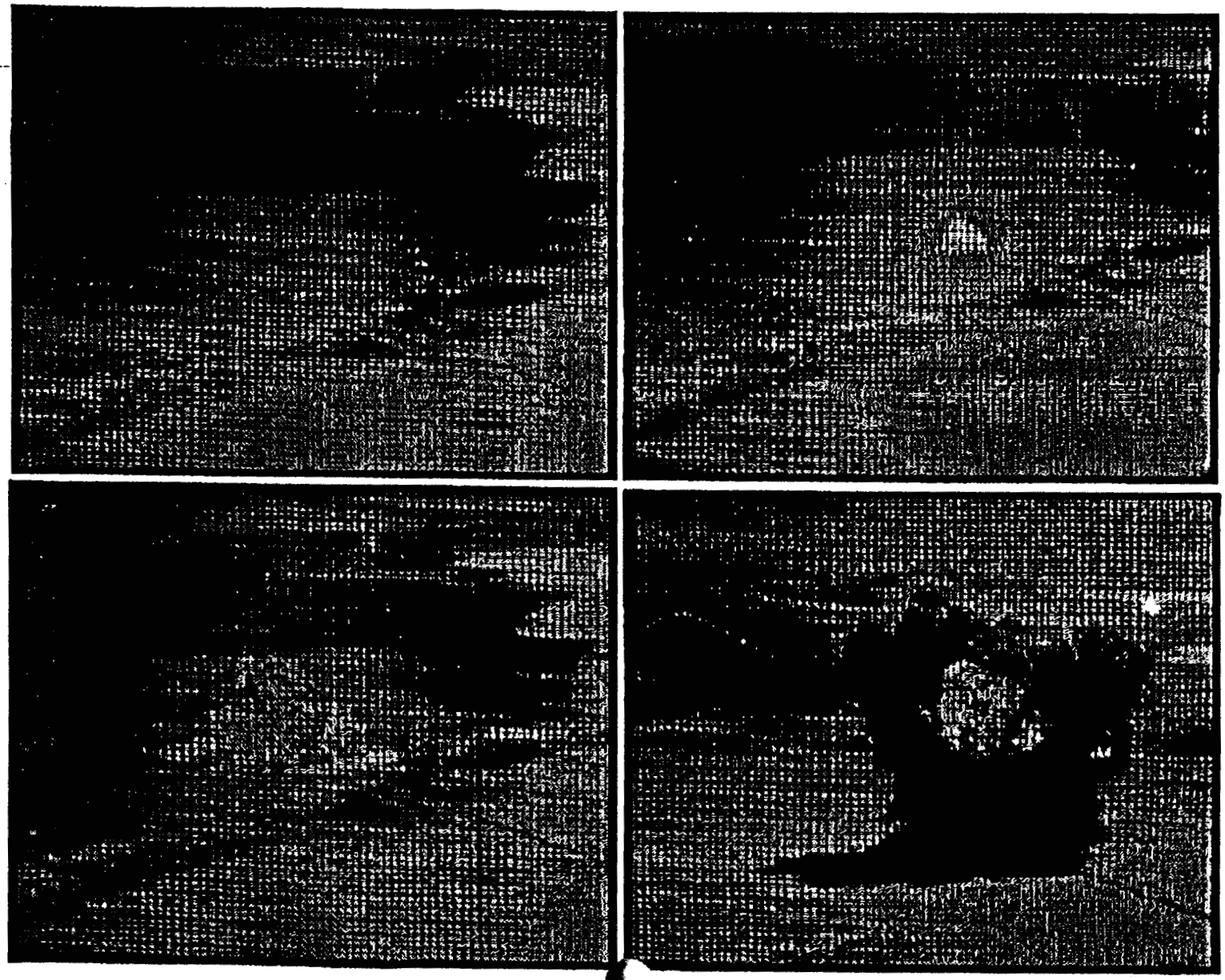


MARITIME PRE-POSITION SHIP TEST

DETONATION



EXPANSION CAPABILITY

- PHYSICAL SPACE, REMOTE LOCATION, FAVORABLE WEATHER
- NO ENCROACHMENT CONCERNS
- NO PREVIOUS BRAC IMPACTS TO ENERGETICS CAPABILITY
- INTELLECTUAL CAPITAL
- CAPACITY TO ABSORB ADDITIONAL WORK
  - -WITH MINOR MODIFICATIONS
  - -WITH MAJOR MODIFICATIONS

INTELLECTUAL/SKILL CAPABILITY

- 60 % OF ENERGETICS WORK FORCE SCIENTISTS AND ENGINEERS
- 30 % OF SCIENTISTS AND ENGINEERS HAVE ADVANCED DEGREES
- PUBLICATIONS AND PATENTS FY 91-93
  - 30 REFEREED OPEN LITERATURE PUBLICATIONS
  - 140 PAPERS AT VARIOUS ENERGETIC MATERIAL SYMPOSIA, MEETINGS, CONFERENCES
  - 70 PATENT ACTIONS
- EFFECTIVE TEAMING WITH GOVERNMENT , INDUSTRY & INTENATIONAL COMMUNITY

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CAPACITY TO ABSORB ADDITIONAL WORK

WITH LITTLE OR NO MODIFICATION

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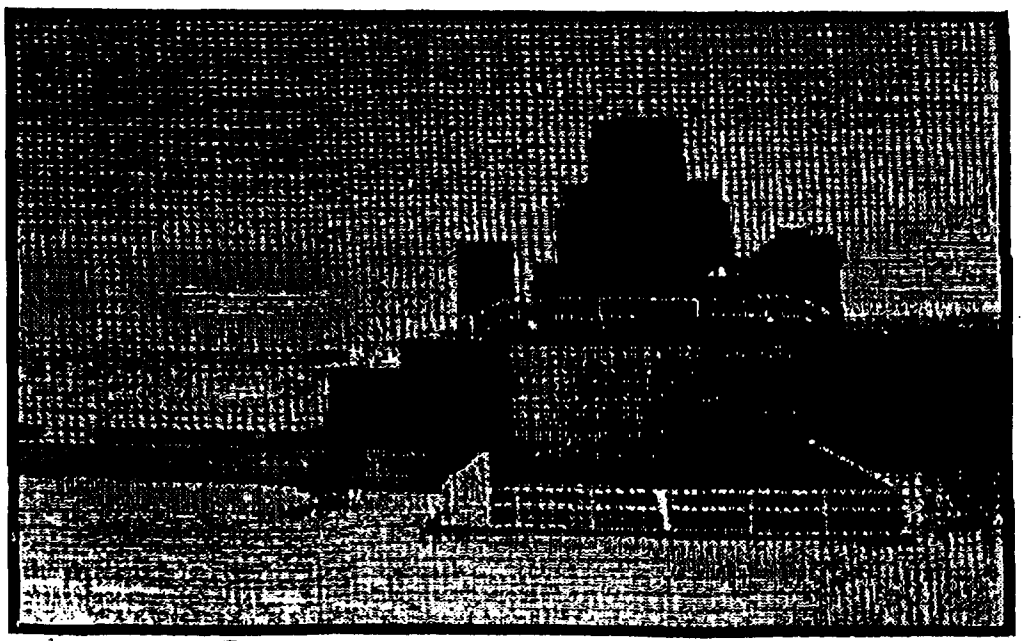
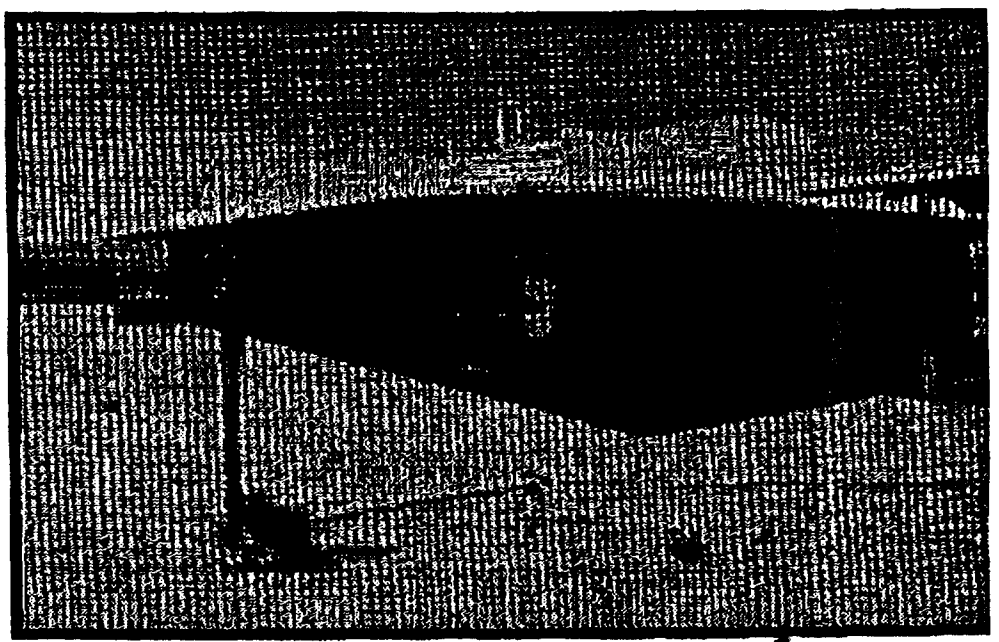
- CAN ADD MINIMUM OF 480 WORKYEARS
- 19 QUALIFIED ORDNANCE BUILDINGS AVAILABLE FOR UTILIZATION WITH MINOR MAINTENANCE/REPAIR
- EXAMPLES OF ADDITIONAL WORK
  - CONTINUOUS EXPLOSIVE OR PROPELLANT MIXER
  - WATER JET DEMIL EQUIPMENT
  - REACTIVATE DOUBLE BASE PROPELLANT PRESSES
- ADDITIONAL 900-TO-1,000 WORKYEARS ACCOMMODATED WITH ADDITIONAL SHIFTS





CAPACITY TO ABSORB ADDITIONAL WORK
WITH MAJOR MODIFICATIONS

- OVER 4,000 ACRES AVAILABLE FOR UNRESTRICTED GROWTH
- EXAMPLES OF ADDITIONAL WORK
  - ENERGETIC MATERIALS LABORATORY
  - CHEMICAL PROCESSING FACILITY
  - HYPERVELOCITY LABORATORY
- APPROXIMATELY 20,000 ADDITIONAL ACRES AVAILABLE WHICH WOULD REQUIRE ROADS AND UTILITIES

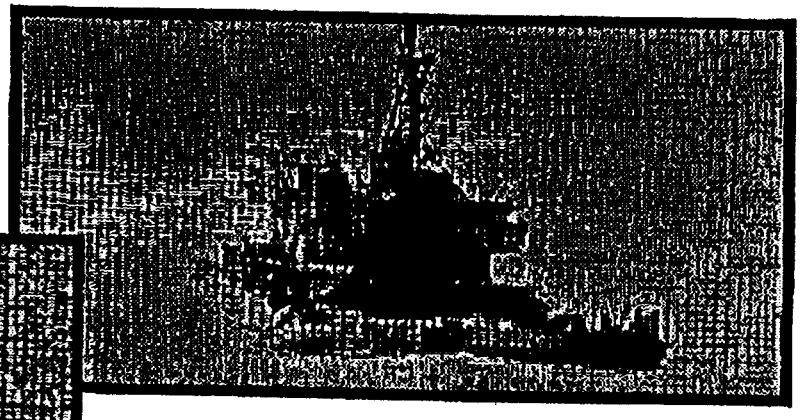
SUMMARY

- NAWCWPNS CHINA LAKE IS A POTENTIAL <u>FUTURE</u> DOD FOCUS SITE FOR FULL-SPECTRUM RDT&E ACTIVITIES ASSOCIATED WITH ENERGETICS FOR CONVENTIONAL AND STRATEGIC WEAPONS
  - ADDITIONAL CAPACITY FOR S&T, WEAPON DESIGN, AND TESTING
  - ENERGETICS CAPABILITIES CAN BE RELOCATED THROUGH GOVERNMENT/INDUSTRIAL PARTNERSHIPS

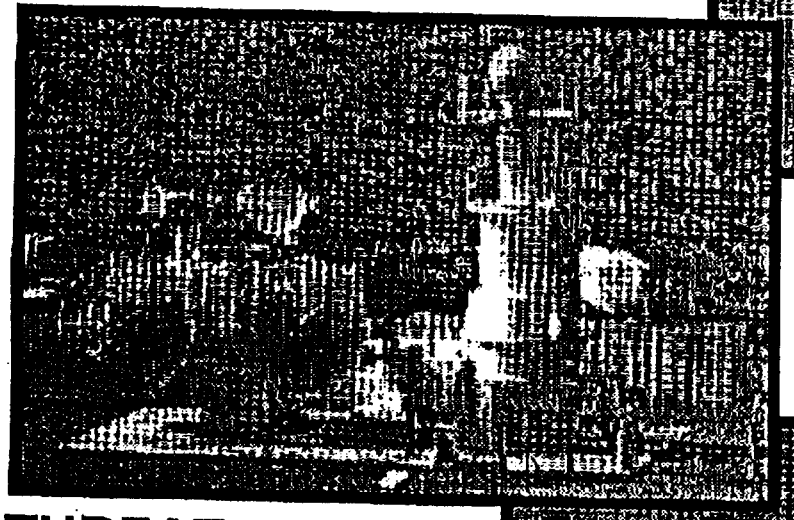
NAWC
NAVAL AIR WARFARE CENTER

WEAPONS DIVISION'S SEA/AIR/LAND RANGES

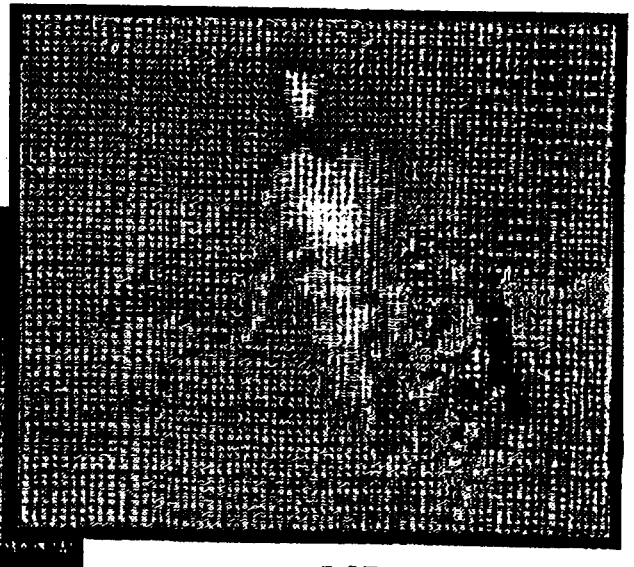
NAWC
Weapons Division
NAVAL AIR WARFARE CENTER



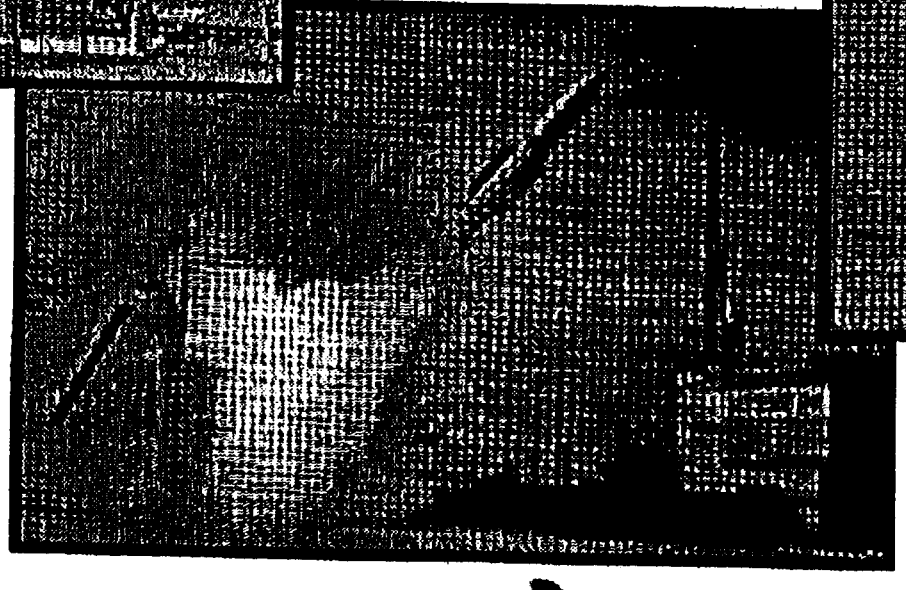
SEA



THREAT SIMULATION



AIR



LAND

DATA CALL 12, AMENDMENT 1
NSWC HQ

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

NAME (Please type or print) _____ Signature G R Sterner

Title G. R. STERNER, Commander, Naval Sea Systems Command Date 10/28/94

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 _____ Date 11/7/94

94-11-21 10:02 RCVD

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.

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

ACTIVITY COMMANDER

CAPT V. E. MAHAFFEY
NAME (Please type of print)

COMMANDER (ACTING)
Title

NAVAL SURFACE WARFARE CENTER
Activity

V E Mahaffey
Signature

28 Oct 94
Date

DATA CALL #12, AMEND 1
LJCSG PRESENTATION
NSWC
"ENERGETICS OVERVIEW"

NAVY ENERGETICS PRESENTATION
TO THE
LABORATORY JOINT CROSS-SERVICE GROUP

DR. IRA BLATSTEIN

20 OCTOBER 1994

Energetics

"Explosives, Propellants, and Pyrotechnics including their related component application in Weapons and Space Launched Vehicles. Typically, this would include all applications through the following components:"

*Conventional Rocket Motors
*Tactical Missile Motors
*Strategic Missile Motors
*Gun Ammunition Propelling Charge
*Rocket Assisted Projectile Motor
*Space Propulsion Booster
Orbit Transfer Vehicle Propulsion
*Cruise Missile Booster
*Gas Generators
*CAD/PAD/AEPS
*Torpedo Propulsion

*Anti-Armor Warheads
*High Explosive Warheads
*Hard Target Warheads
*Fuel Air Explosives
*Underwater Explosives
*Demolition Explosives
*Explosive Devices (Boosters, Detonators, Explosive Trains,etc)
*Ignition Devices
*Incendiary Devices
*Signal Devices (Light, Sound, Smoke)

* Related technology associated with Explosives, Propellants, Pyrotechnics: chemical synthesis and characterization, environmental engineering of energetics, environmental engineering of energetics processes and materials, energetics manufacturing technology (MANTECH), energetic demilitarization and disposal

* Denotes significant Navy capability/achievement

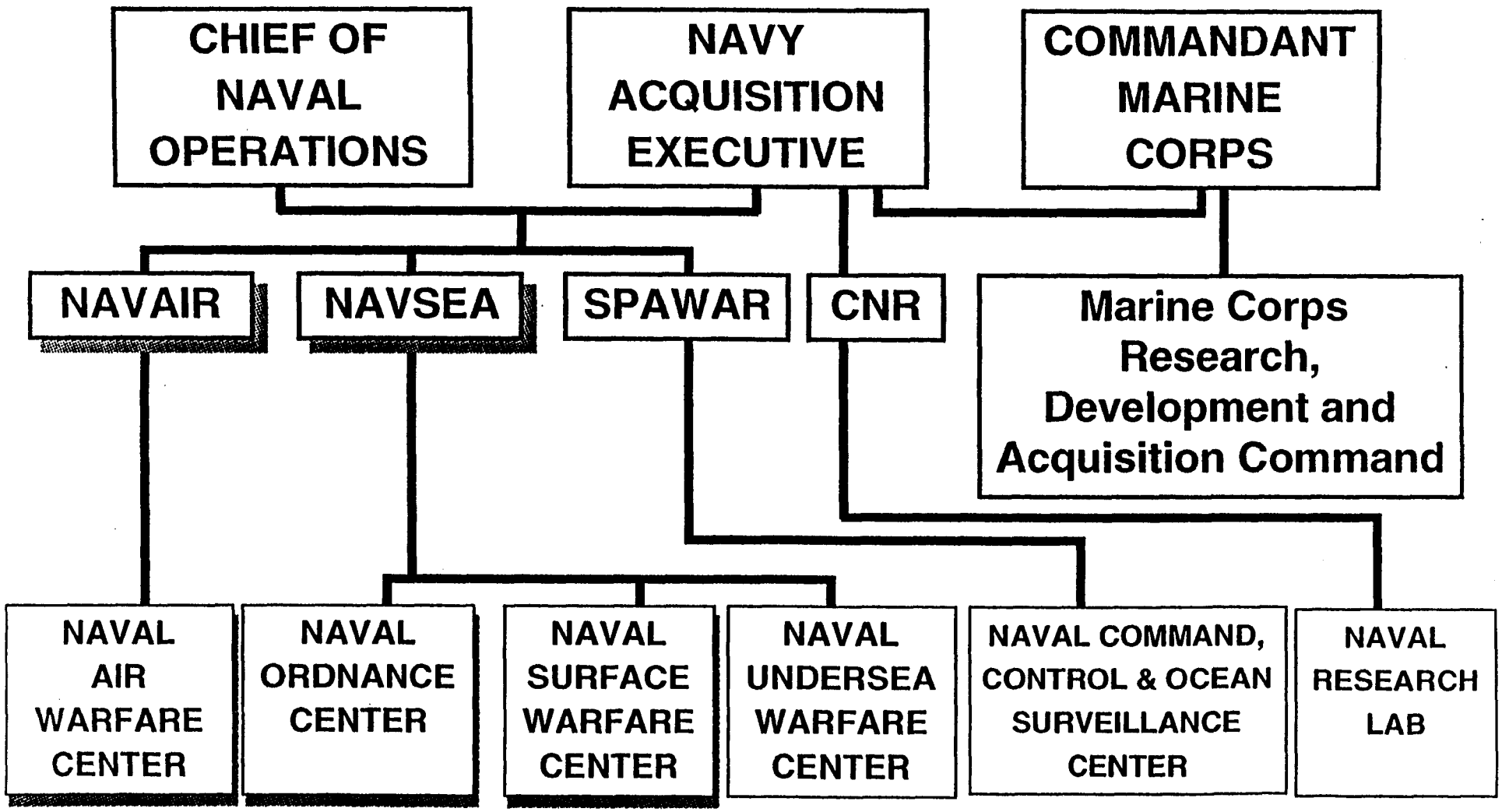
WHY THE NAVY MUST BE INVOLVED IN ENERGETICS

- Energetics Are Primarily Military and Require In-House Knowledge Base
- Navy Has Unique Requirements
  - Insensitive munitions
  - HERO / RADHAZ
  - Underwater explosives/warheads
  - Variety of platforms
- Navy Has Broadest Requirements and Capability
  - Knowledge
  - Fielded systems
  - Workload: Preponderance of RDT&E
  - Facilities: Modern, state-of-the-art
  - Leads the development of energetics

EXAMPLES OF CURRENT CROSS-SERVICE EFFORTS

- Low Vunerability Ammunition (LOVA) for Army
- Tri-Service Charter for CAD/PAD/AEPS
- Tri-Service Explosive Ordnance Disposal
- 2.75" Rocket for Army
- Tri-Service Jet Assisted Take Off (JATO)
- Joint development on JSOW/JDAM forAirForce
- Cooperative propulsion activities with AirForce, Phillips Lab and NASA Jet Propulsion Lab
- Propellant/Propulsion technology support for Army and Air Force
- Warhead support for AMRAAM for AirForce, Patriot and Javelin for Army, SRAW/SMAW for Marine Corps
- Principal US Group forAir Target vulnerability

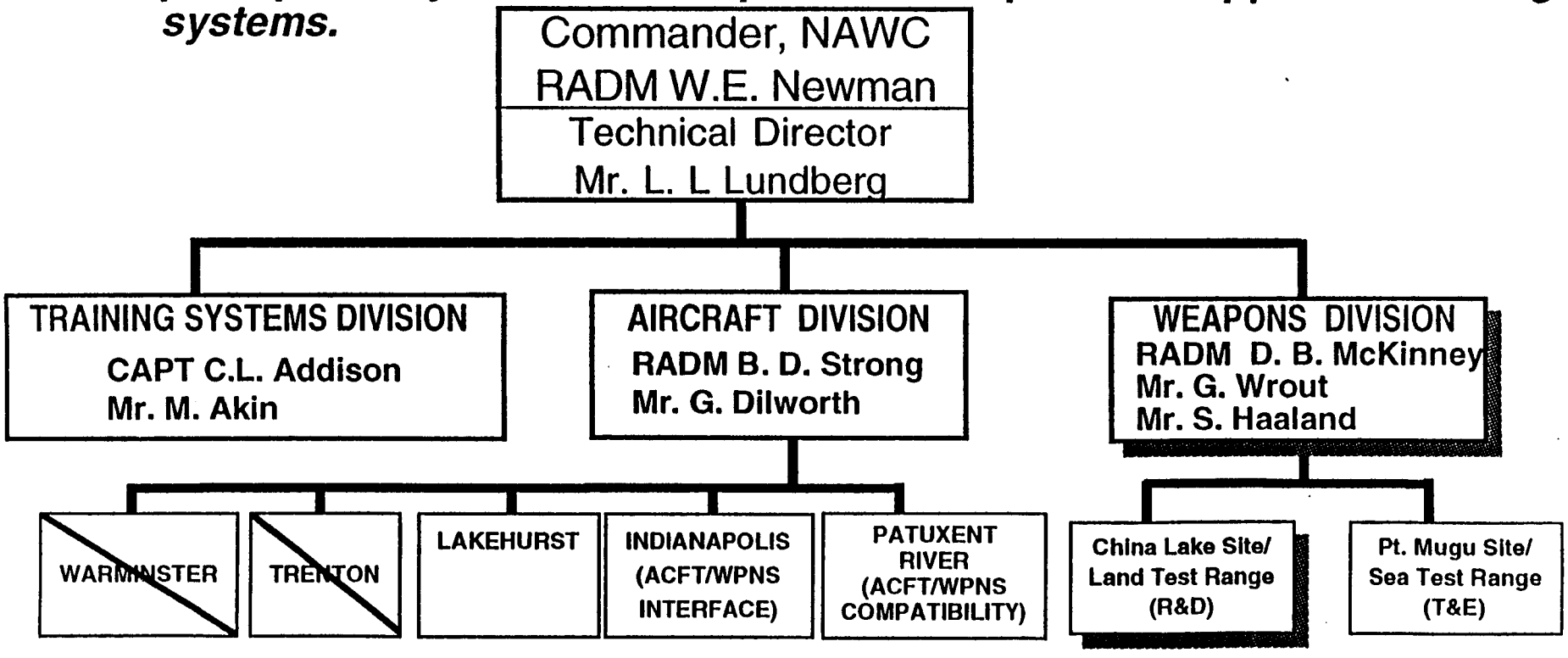
Navy Organizations Involved in Energetics



NAVAL AIR WARFARE CENTER

MISSION

To be the Navy's full spectrum research, development, test and evaluation, engineering, and fleet support center for air platforms, autonomous air vehicles, missiles and missile subsystems, weapons systems associated with air warfare, and for sensor systems used to conduct anti-submarine warfare from air platforms; and to be the principal Navy center for acquisition and product support of training systems.



(BRAC CLOSURES)

NAVAL ORDNANCE CENTER
NAVAL EXPLOSIVE ORDNANCE DISPOSAL TECHNOLOGY DIVISION

UNIQUE MISSION:

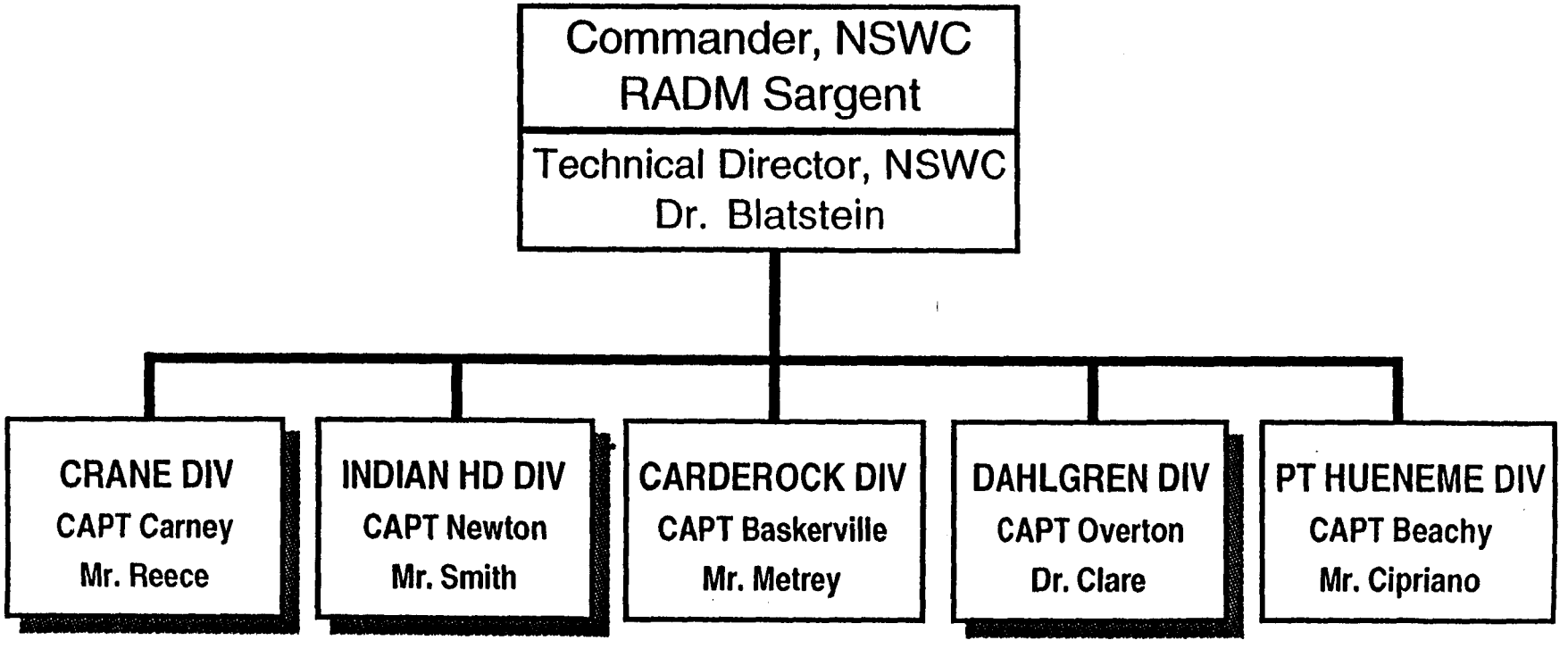
- NAVY SINGLE-SERVICE MANAGED DOD EOD TECHNOLOGY AND TRAINING PROGRAM
- SUPPORTS ALL JOINT SERVICE AND GOVERNMENT AGENCY PEACETIME EOD TECHNOLOGY REQUIREMENTS, NOT DUPLICATED ANYWHERE

- NEODTD USES CERTIFIED ENERGETIC MATERIALS AS AN ELEMENT IN THE DEVELOPMENT OF PROCEDURES AND EQUIPMENT USED BY MILITARY EXPLOSIVE ORDNANCE DISPOSAL TECHNICIANS
- SYNERGISTICALLY COLOCATED AT NSWC IHDIV

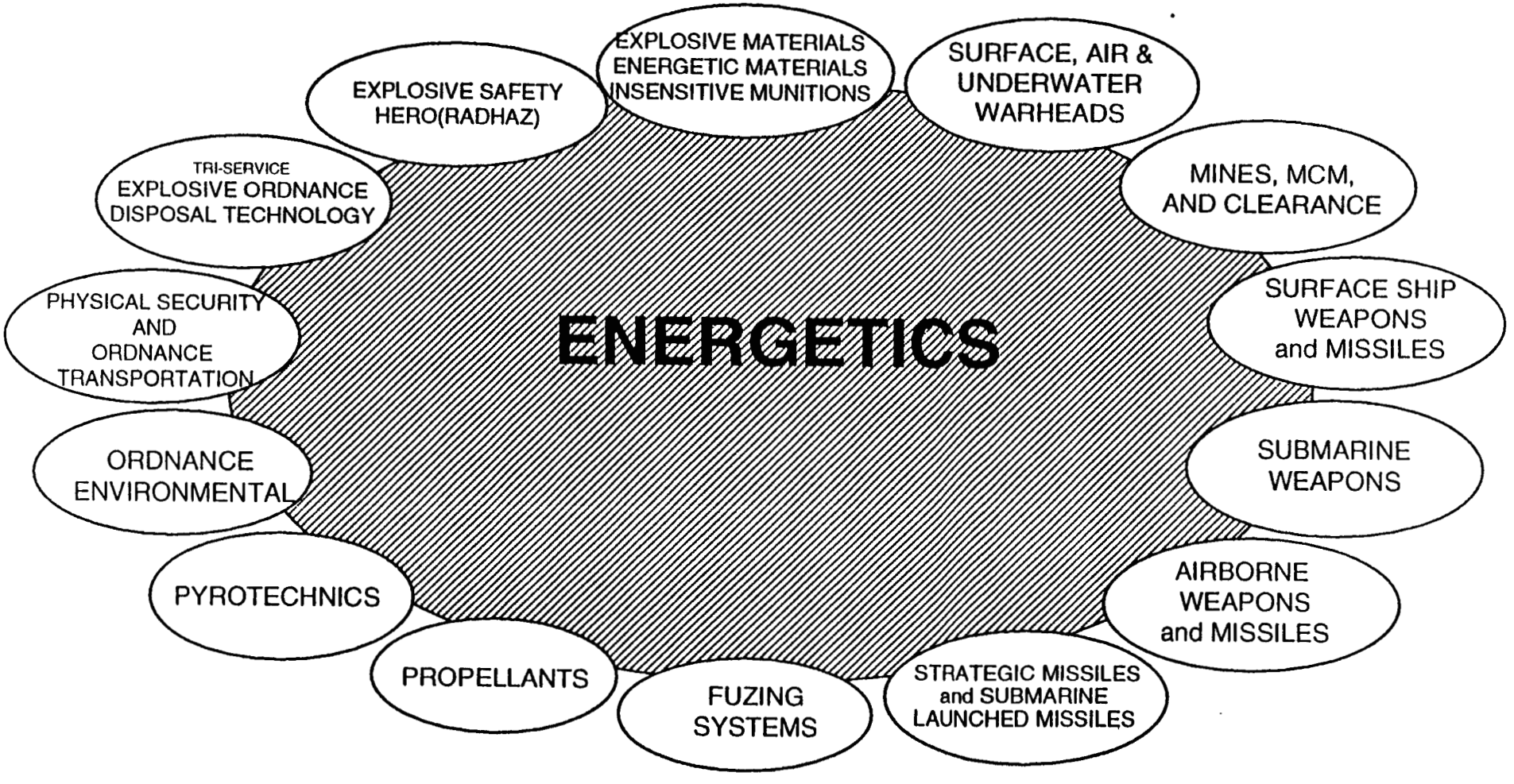
NAVAL SURFACE WARFARE CENTER

MISSION

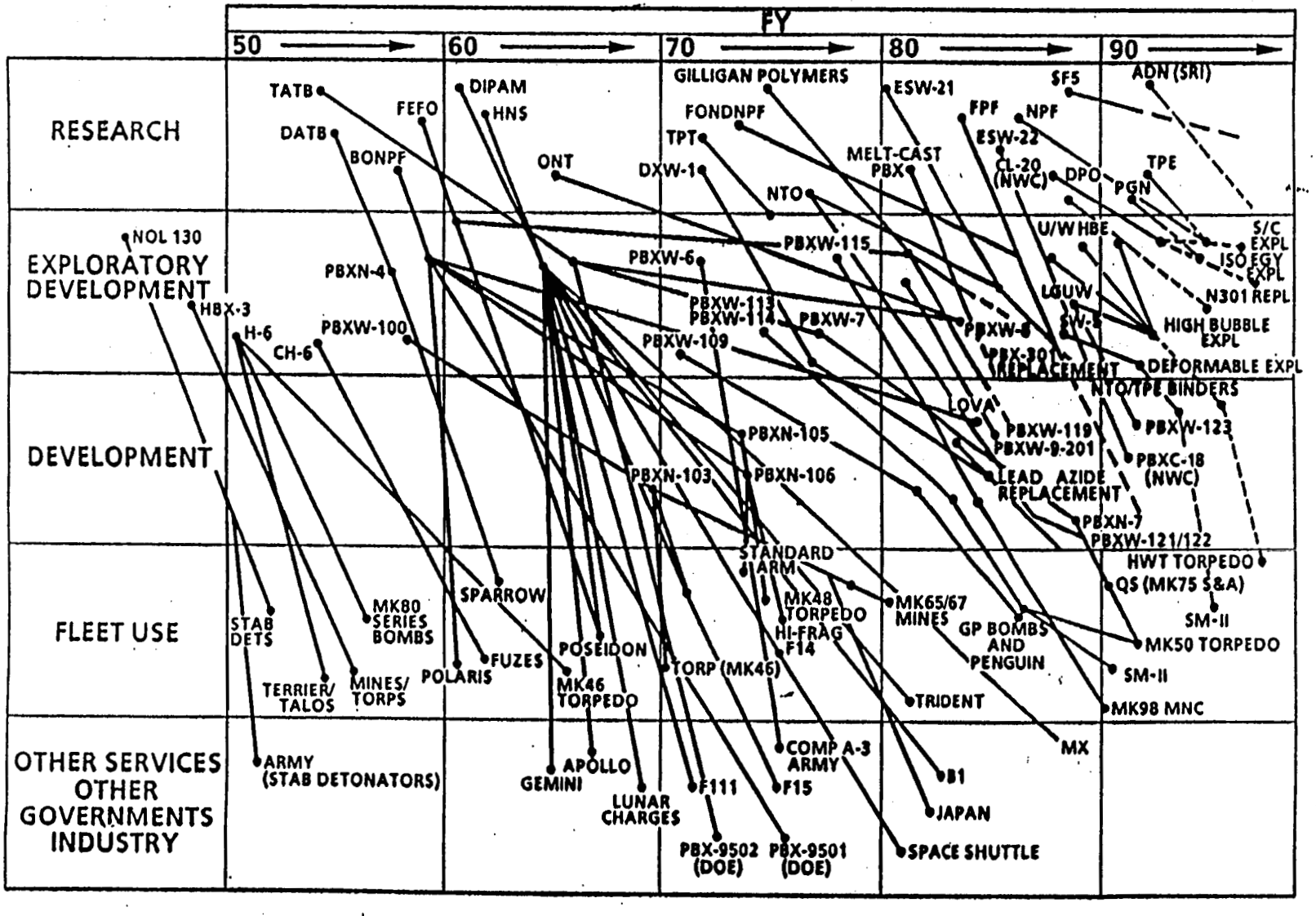
Operate the Navy's full spectrum research, development, test and evaluation, engineering, and fleet support center for ship hull, mechanical and electrical systems, surface ship combat systems, coastal warfare systems, and other offensive and defensive systems associated with surface warfare.



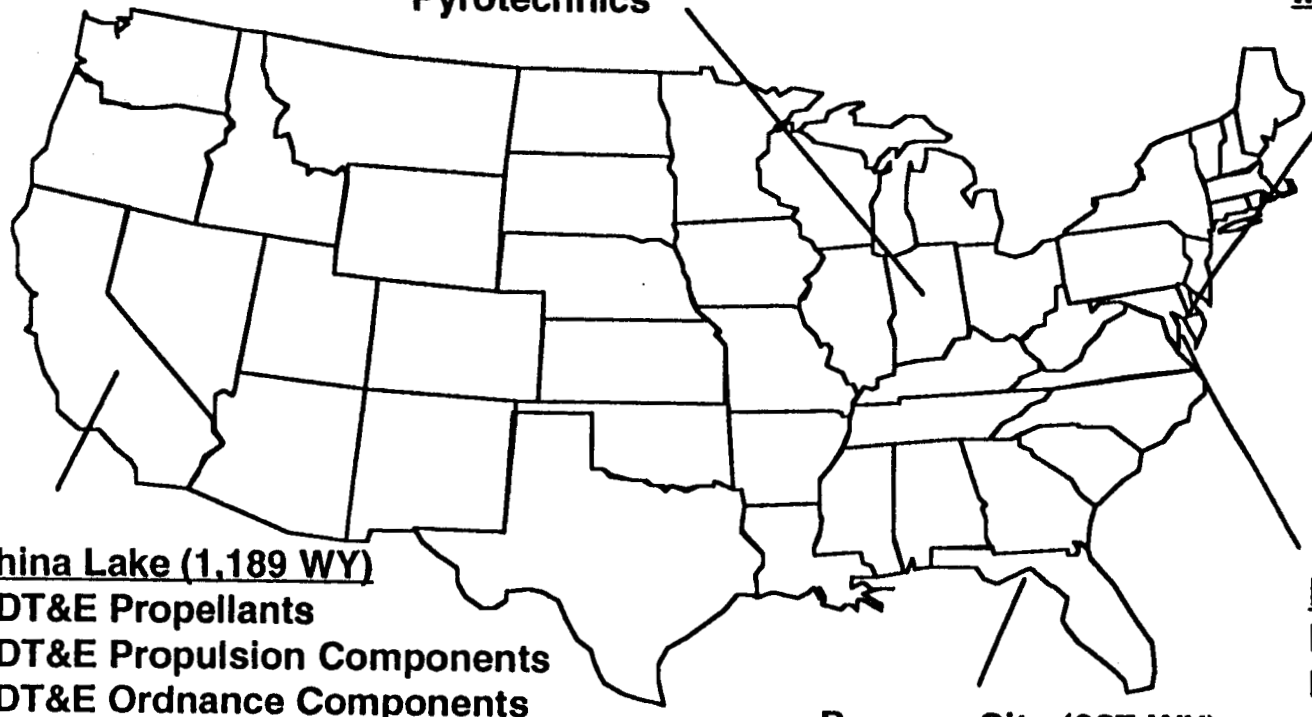
Navy Energetic and Related RDT&E Responsibilities



SAMPLE OF NAVY ENERGETICS INTELLECTUAL & TECHNICAL CAPABILITY



NAVY ENERGETICS
AND
RELATED CONSOLIDATIONS



Crane (112 WY)
Pyrotechnics

Indian Head(1,764 WY)
R&D Explosives,
R&D CADs/PADs,
Explosive Scale up
Propellant Scale up
Explosive/Propellant
Engr. Development
R&D UW Warheads
R&D UW Explosives

China Lake (1,189 WY)
RDT&E Propellants
RDT&E Propulsion Components
RDT&E Ordnance Components
RDT&E RAMJET Propulsion
RDT&E Fuzes
Large Rocket Motor Disposal

Dahlgren(211 WY)
R&D Surface Warheads
R&D Air Warheads

Panama City (627 WY)
Mine Warfare

* This chart denotes lead activity for indicated capabilities.

OBSERVATIONS

- Navy's broad requirement for energetic material and systems requires comprehensive in-house capability
- Past BRACs have led to significant consolidations
  - From four explosive and propellant capable sites to two (Indian Head, China Lake, ~~White Oak~~, ~~Yorktown~~)
  - Focused warheads
  - Focused mine warfare
  - Focused missiles
- Navy has a proven RDT&E infrastructure including universities, university labs and the private sector
- NSWC and NAWC provide complementary and back up capabilities in critical DoD areas
- Navy has capability and capacity for additional full spectrum Joint Cross-service energetics support

~~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)

Dr. Ira M. Blatstein
NAME (Please type or print)

Ira M Blatstein
Signature

Technical Director
Title

10/24/94
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

NAME (Please type or print)

G R Sterner
Signature

Title G. R. STERNER
Commander
Naval Sea Systems Command

10/28/94
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)

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

W A Earner
Signature

Title

11/7/94
Date

94-11-21 10:03 RCVD

DATA CALL #12, AMEND1
LJCSG PRESENTATION
CRANE
"ENERGETICS"

NAVAL SURFACE WARFARE CENTER
CRANE DIVISION
PRESENTATION MATERIAL
DATA CALL #12 AMENDMENT ONE - ENERGETIC

BRAC-95 CERTIFICATION

Reference: SECNAVNOTE 11000 of 08 December 1993

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

ACTIVITY COMMANDER

J. M. CARNEY
NAME (Please type or print)

J M Carney
Signature

COMMANDER
Title

10/19/94
Date

CRANE DIVISION, NSWC
Activity

1. This information will be presented to the Energetics Cross Service Analysis Team on 20 October 1994. It is a summation of the Crane response to the Base Structure Evaluation Committee Memorandum of 7 October 94.

NAVAL SEA SYSTEMS COMMAND

NSWC

Naval Surface Warfare Center

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NAVAL SURFACE WARFARE CENTER

CRANE DIVISION

Presented to:

ENERGETICS CROSS SERVICE ANALYSIS TEAM

20 October 1994

THE MESSAGE

- Crane Currently has World Class Capability In:
  - Pyro Countermeasures
  - Pyro Signals
  - Pyrotechnics
  - Obscurants
- This Capability Critical for Naval Aircraft & Ships
- Complements Co-located Army Production
- Complements Expertise of the Indian Head and Dahlgren Divisions of NSWC
- Crane Available for Expansion of Pyrotechnics Efforts

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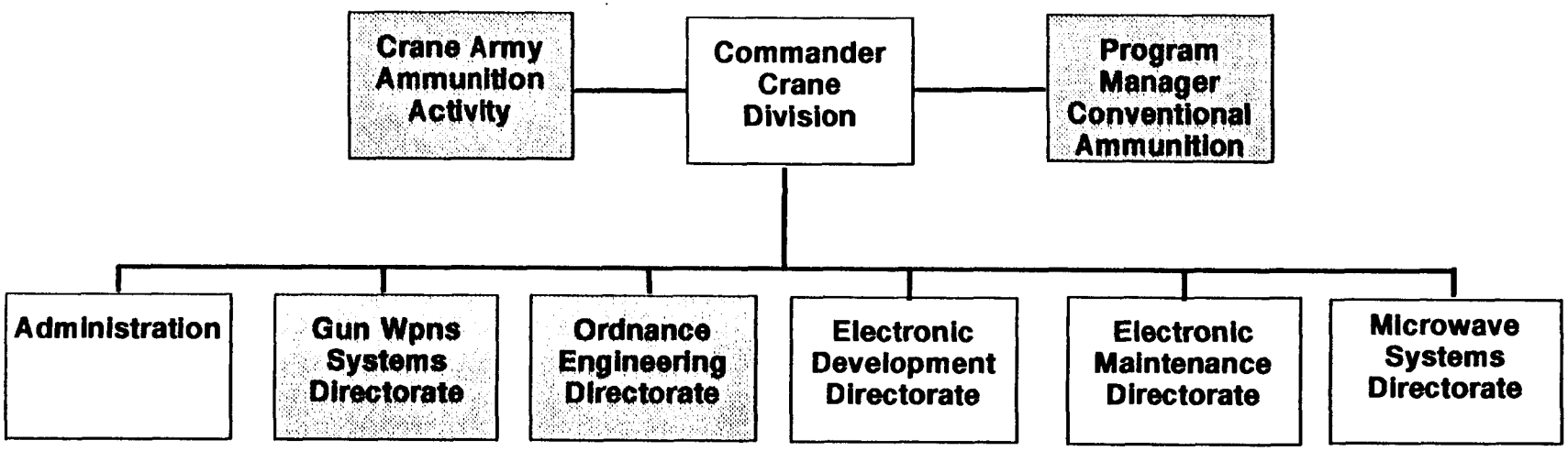
CRANE DIVISION

INSTALLATION ORGANIZATION
ENERGETICS HIGHLIGHTED



Highlighted Boxes = Directorates with Energetic Workload

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CRANE DIVISION

CRANE ARMY AMMUNITION ACTIVITY

Mission - **DOD Munitions and Energetics Engineering, Production, Storage and Demil**

Workyears = 740

Explosive Storage = 4.7 M Sq Ft

Ordnance Production = .7 M Sq Ft

Burning Grounds Demil = 40 Acres

Detonation Demil = 80 Acres

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CRANE DIVISION

CONVENTIONAL AMMUNITION MAJOR PRODUCTS

PRODUCT LINE	NAVY	AIR FORCE	ARMY	SOCOM	OTHER **
Major Caliber Gun Ammunition	PM, TE, AE,IS	No Rqmt	No Rqmt	No Rqmt	TE, AE, IS
Demolition Devices	PM,ED,TE, AE,IS	TE	TE	ED, TE, AE,IS	TE, AE, IS
Other Ammunition	PM,ED,TE, AE,IS	TE	TE	ED,TE, AE,IS	TE, AE, IS

* = Capability Exists but No Current Work

** = Coast Guard/FMS

ST = Science & Technology

ED = Engineering Development

AE = Acquisition Engineering

IS = In Service Engineering (includes demil/disposal)

TE = Test & Evaluation

NAVAL SEA SYSTEMS COMMAND

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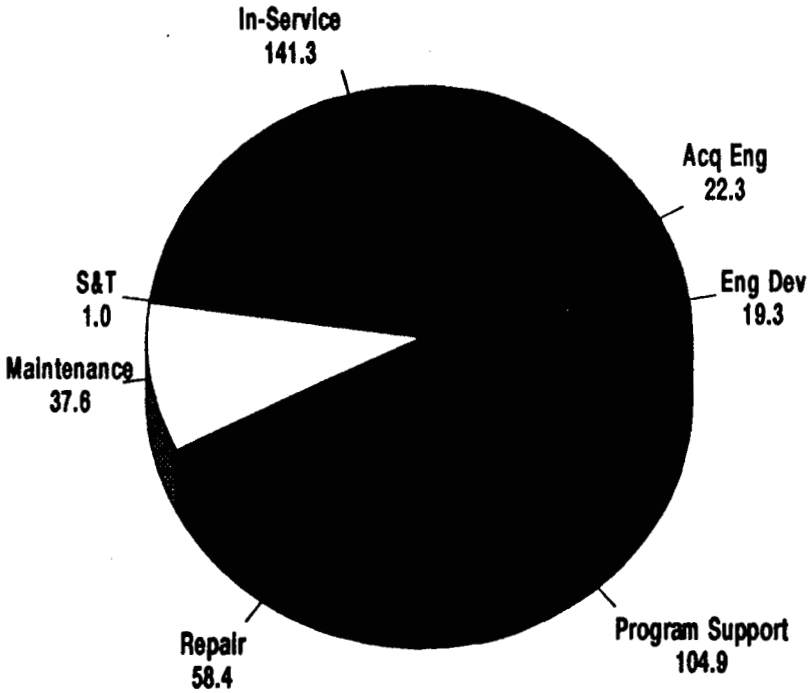
NAVAL SURFACE WARFARE CENTER
CRANE DIVISION

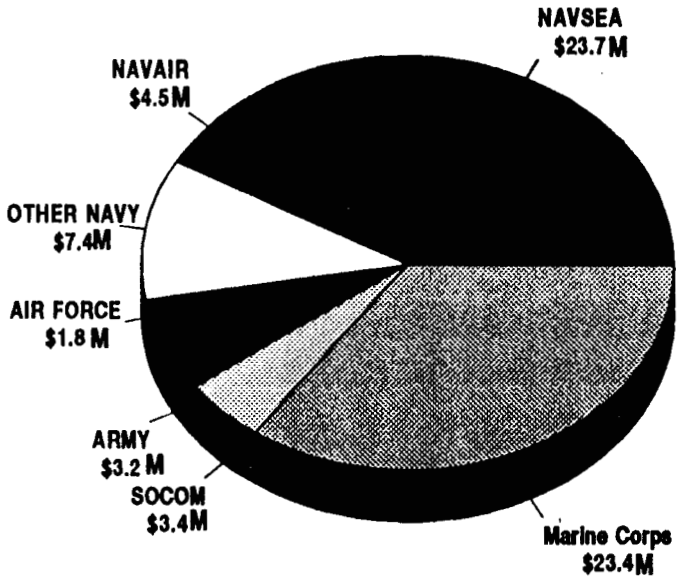
CONVENTIONAL AMMUNITION - BUSINESS BASE

Workyears by Job Category



Total = 585.5 WY
(Includes 141.1 Contractor WY)

Dollars by Customer



Total = $69.7M

NAVAL SEA SYSTEMS COMMAND

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NAVAL SURFACE WARFARE CENTER
CRANE DIVISION

PYROTECHNICS MAJOR PRODUCTS

PRODUCT LINE	NAVY	AIR FORCE	ARMY	SOCOM
Countermeasures	ST, ED, TE, AE, IS	ST, ED, TE	ED, TE	TE,AE
Colored Smoke/Flares	ED, TE, AE, IS	*	TE	TE, AE, IS
Illuminating Flares	ED, TE,AE, IS	*	TE	TE, AE,IS
Obscurants/Markers	ED, TE, AE, IS	*	ED,TE	*
Submarine Signals	ED,TE,AE,IS	No Rqmt	No Rqmt	No Rqmt
Target Flares	ED,TE, AE,IS	*	ED,TE, AE	*

* = Capability Exists but no Current Work

ST = Science & Technology
ED = Engineering Development
AE = Acquisition Engineering
IS = In Service Engineering (includes demil/disposal)
TE = Test & Evaluation

NAVAL SEA SYSTEMS COMMAND

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CRANE DIVISION

PYROTECHNICS - FACILITIES

Facility	Sq Ft	CPV Bldg $ M	ACE Eqpt $ M
Automated Infrared Test Facility *	10,167	0.6	2.4
Transient Velocity Windstream	900	0.4	0.4
Ordnance Prototype Manufacture *	27,966	6.3	3.8
Ordnance Test Area * (88 Acres)	7796	4.2	1.2
Ordnance Enviro & Radiographic *	28,782	12.7	7.6
Ord Material Characterization *	8,666	3.9	3.5
Demil Evaluation Facility *	4,480	3.0	3.0
TOTAL	88,757	31.1	21.9

* Dual Use with CAAA or Conventional Ammunition

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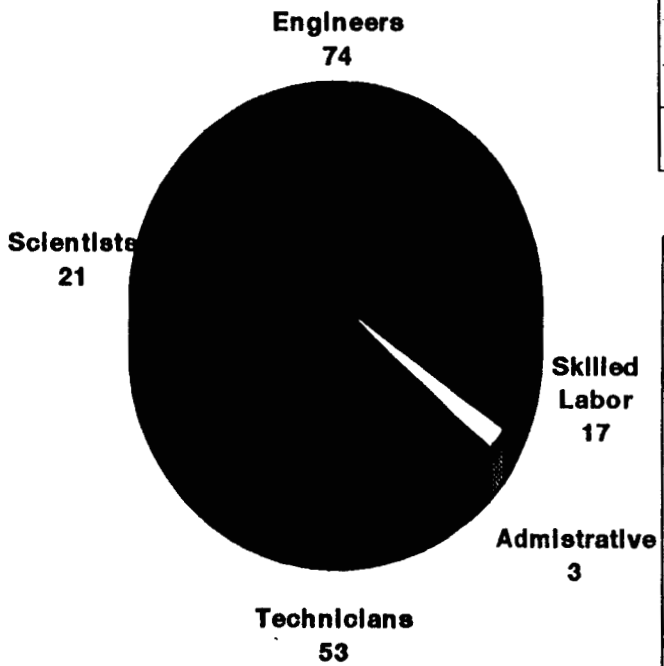
NAVAL SURFACE WARFARE CENTER CRANE DIVISION

Pyrotechnics - Available Personnel Skills

of People



Total = 168

Degree Level	
AS	10
BS	75
MS	20
PhD	7

Years of Experience	1-5	5-10	10-20	20+	Tot. Yrs
Engineers	2	21	17	34	1307
Scientists	2	4	4	11	427
Logistics Specialists	0	0	1	2	73
Technicians	0	9	13	31	1094
Explosive Workers	0	2	5	10	378
TOTAL	4	36	40	88	3279

NAVAL SEA SYSTEMS COMMAND

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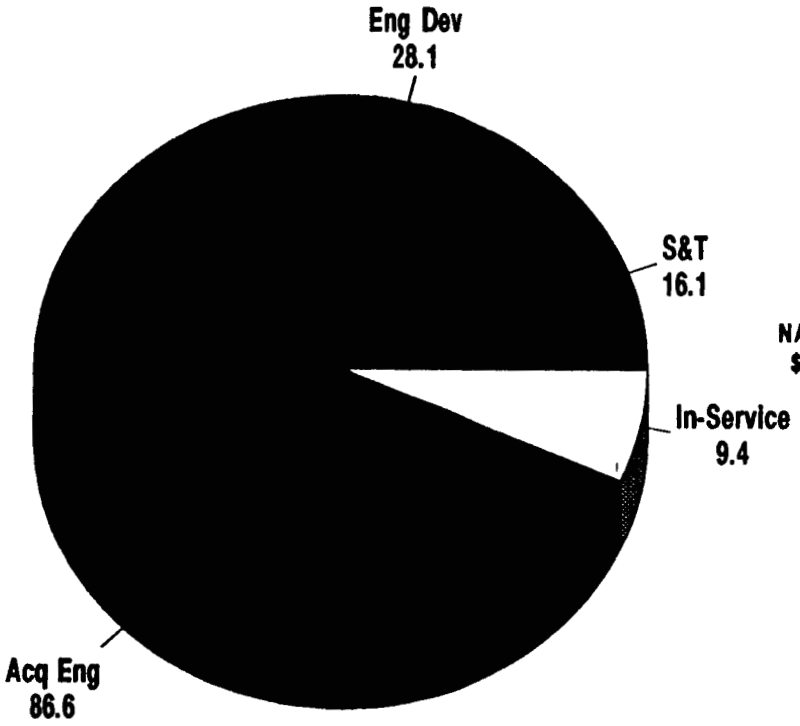
CRANE DIVISION

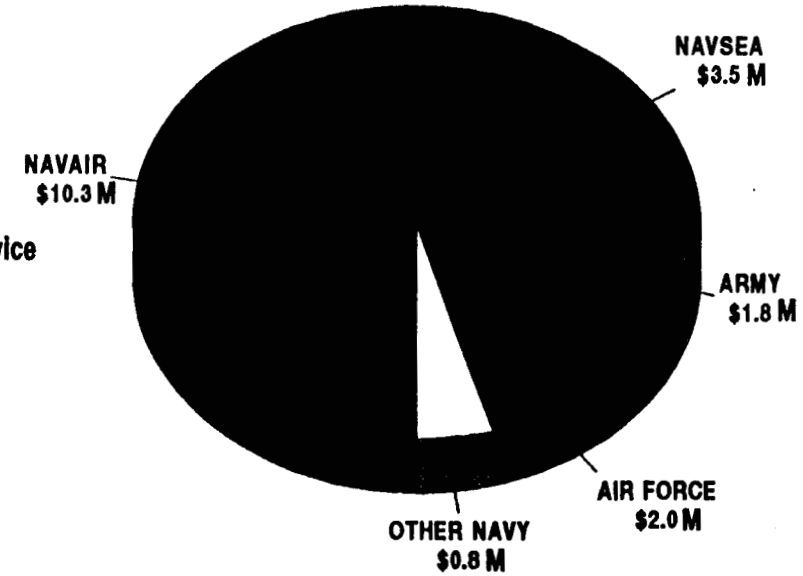
PYROTECHNICS - BUSINESS BASE

Workyears by Job Category



Total = 140.2 WY
(Includes 28 Contractor WY)

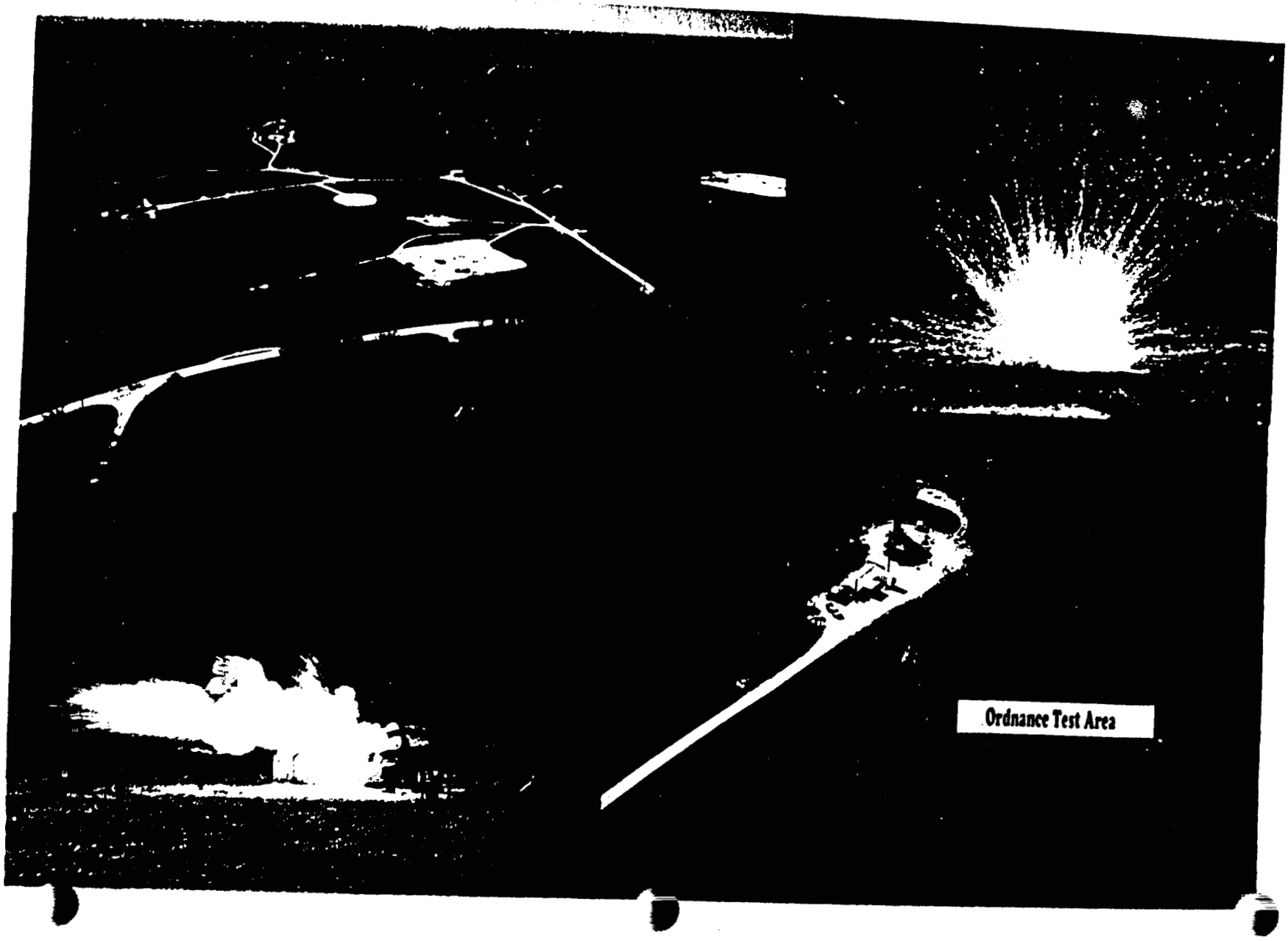
Dollars by Customer



Total = $18.4M

CINCINNATI
MILACRON
Automated Infrared
Test Facility

Ordnance Prototype
Manufacture


Ordnance Test Area

NAVAL SEA SYSTEMS COMMAND

NSWC

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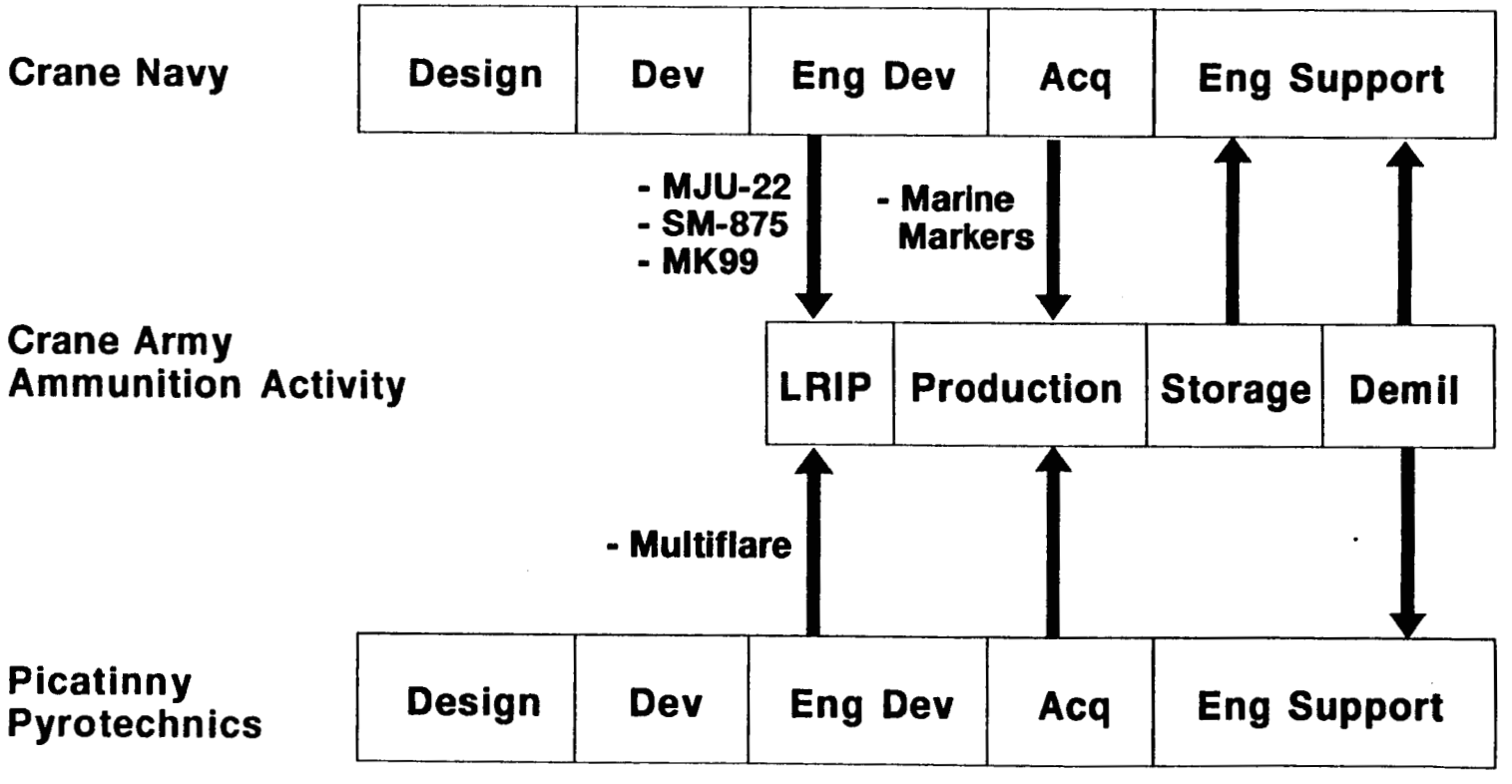
NAVAL SURFACE WARFARE CENTER
CRANE DIVISION

NAVY/ARMY ACTIVITY LINK



NAVAL SEA SYSTEMS COMMAND

NSWC

Naval Surface Warfare Center

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NAVAL SURFACE WARFARE CENTER
CRANE DIVISION

PYROTECHNICS - EXPANSION POTENTIAL

Type of Work	Expansion Work Years		
	Current	No Modification	Major Modification
Composition Development (Laboratory)	14	27	47
Prototype Manufacture	21	13	25
Pyro Test & Evaluation	65	21	30
Engineering	40	150	370
Ordnance Expl. Op.	0	68	-
Ordnance Pyro. Op.	0	15	148
TOTAL	140	294	620

Additionally 10 Sites Identified for 8 Million Square Feet Expansion

NAVAL SEA SYSTEMS COMMAND

NSWC

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NAVAL SURFACE WARFARE CENTER
CRANE DIVISION

PYROTECHNICS SUMMARY

PERSONNEL

- 2500 Work Years Experience
- Recognized Nationally & Internationally as Experts

FACILITIES

- State-of-the-Art
- Unique in DOD

EXPANSION

- 300 Work Years with Minimal Investment
- Unlimited Potential (8 Million Sq Ft)

LOCATION

- No Encroachment Threats
- Environmentally Compliant
- Navy/Army Functions Co-located

202

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)

Dr. Ira M. Blatstein
NAME (Please type or print)

Ira M Blatstein
Signature

Technical Director
Title

10/26/94
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

NAME (Please type or print) _____

G. R. Sterner
Signature

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

Commander
Title

10-27-94
Date

Naval Sea 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)

W A Earner
Signature

Title _____

11/1/94
Date

DATA CALL #12, AMEND 1
LJCSG QUESTIONS
CRANE

94-11-21 10:03 RCVD

WC

NAVAL SURFACE WARFARE CENTER
CRANE DIVISION
PRESENTATION MATERIAL
DATA CALL #12 AMENDMENT ONE - ENERGETIC

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 purpose 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 the 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

J. M. CARNEY	J M Carney
NAME (Please type or print)	Signature
COMMANDER	10/25/94
Title	Date
CRANE DIVISION, NSWC	
Activity	

1. During a presentation to the Laboratory Cross Service Analysis Team on 20 October 1994, a question was raised as to capability of Picatinny Arsenal to perform the Crane Division energetics workload. The following is the certified response to that question.

QUESTION: WHY CAN'T PICATINNY ARSENAL DO THE CRANE ENERGETICS WORK?

There are specific reasons why Picatinny is limited in the performance of the Navy pyro work as well as reasons that consolidation should be toward the Navy as opposed to the Army. In comparison:

OUTDOOR WINDSTREAM MEASUREMENTS - Crane operates a windstream test facility with a blowdown capability from 0.1 to 0.9 Mach, 10 - 300 degree azimuthal measurement sites, and distances up to 500 meters. The Picatinny windstream is located in a valley which limits measurement distances and the azimuthal coverage of flare measurements.

INDOOR TUNNEL - The windstream in the tunnel at Crane can simulate decoy flare launch at speeds up to 0.6 Mach. The tunnel is the Navy standard for infrared decoy flare testing. The Crane tunnels can burn decoy flares up to 1000 grams and illuminating devices up to 20 pounds. The Picatinny indoor tunnel is limited on the sample size, perhaps 150 grams.

LOADING - The experimental loading facilities at Crane handle 50 pounds of flare composition. The experimental loading facilities at Picatinny are limited to small quantities of materials. This capability was vital in satisfying an urgent Fleet requirement for 10,000 IR decoy flares during Desert Storm.

PERSONNEL - The personnel at Crane are the most experienced and active in pyrotechnics research, design, development and production of the three Services. There are currently over 120 scientists, engineers and technicians working in the pyro area compared to 20-25 at Picatinny.

NEW DEVELOPMENT - Crane leads in all new flare developments while the newest Picatinny (Army) devices use slight variations of compositions developed by Crane. Even the Army contractors are using variations of compositions and techniques developed at Crane.

UNIQUE DEVICE APPLICATION - Most Army devices are similar in composition and hardware to Navy devices making them relatively easy for Navy scientists to understand. On the other hand, the Navy has numerous special requirements and applications (e.g. submarine signals) whose design and development would be unfamiliar to Army scientists.

EXPANSION - Crane currently has the capability to take on 61 workyears of pyrotechnics development, prototype manufacture and testing and 150 workyears of engineering work with little or no facilities modifications. This capacity could be used to do all the on-going Army and Air Force in-house pyrotechnics work and probably most of the work that is now done on Army and Air Force contracts.

CO-LOCATION - The co-location with the Crane Army Ammunition Activity provides us with the opportunity to produce large quantities of new pyrotechnic munitions with a rapid response capability to meet immediate Fleet needs. The Crane Army facility is also used for low rate initial productions to verify processing techniques and validate technical data packages in-house.

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Submission of Data Call #12 Amendment #1, Naval Surface Warfare Center, Dahlgren Division, Dahlgren Site

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

NEXT ECHELON LEVEL (if applicable)

J. C. OVERTON, CAPT, USN
NAME (Please type or print)

Signature

COMMANDER
Title

18 Oct 94
Date

NAVAL SURFACE WARFARE CENTER

DAHLGREN DIVISION

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)

DR. IRA M. BLATSTEIN

NAME (Please type or print)

Signature

Technical Director
Title

10/20/94
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

E.S. MCGINLEY, II
NAME (Please type or print)

Signature

(ACTING) COMMANDER
Title

10/20/94
Date

NAVAL SEA 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

Title

27 OCT 1994
Date

94-11-21 10:03 RCVD

WC

BRAC-95 CERTIFICATION

Submission of Data Call #12 Amendment #1, Naval Surface Warfare Center, Dahlgren Division, Dahlgren Site

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.

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

ACTIVITY COMMANDER

J. C. OVERTON, CAPT, USN
NAME (Please type or print)

J C Overton
Signature

COMMANDER
Title

18 Oct. 94
Date

NAVAL SURFACE WARFARE CENTER
DAHLGREN DIVISION
Activity

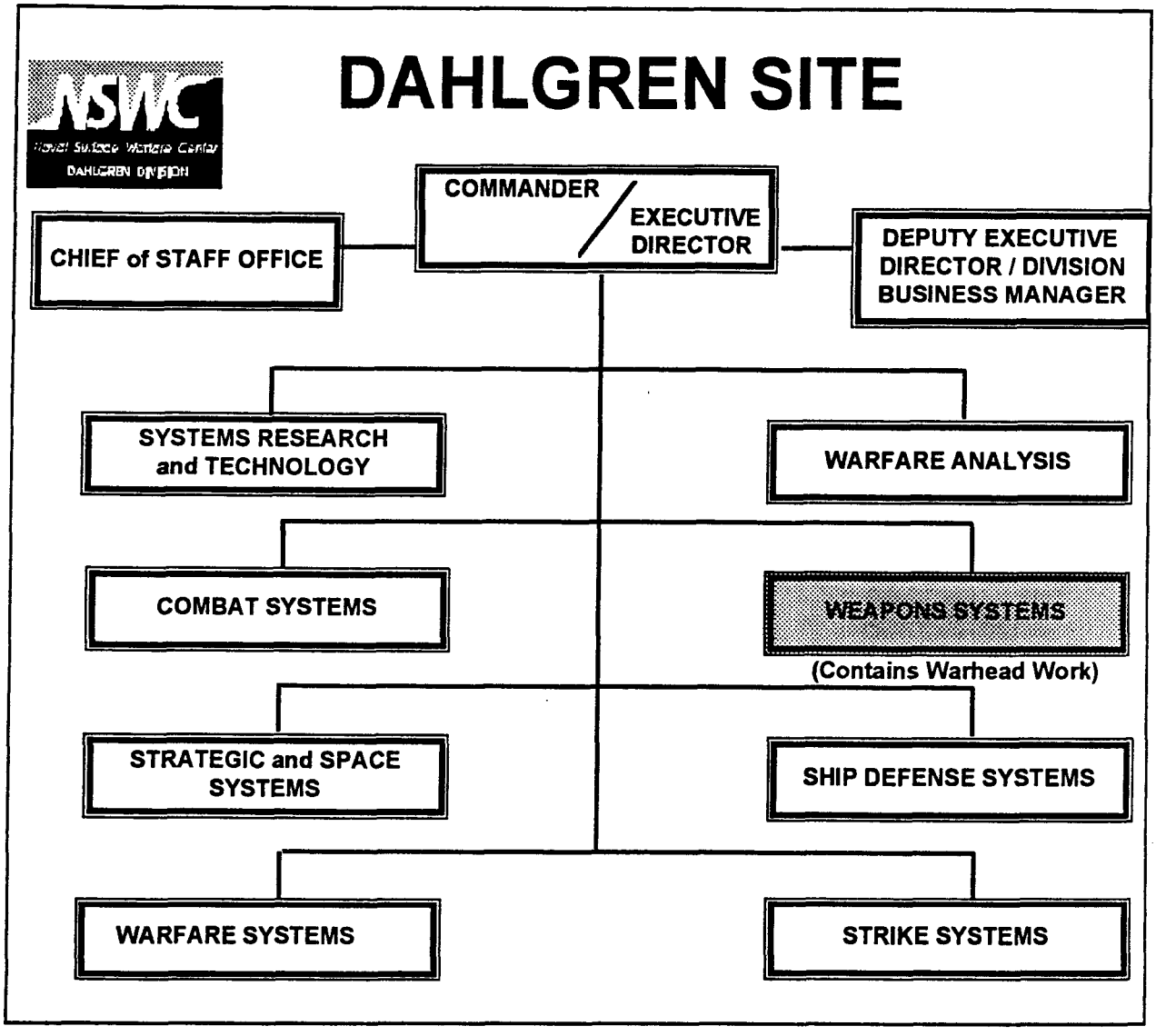
BRAC-95

DATA CALL #12
AMENDMENT #1

DAHLGREN SITE

18 OCTOBER 1994

1. (a) Organization Chart



1. (b) Describe organizational relationships.

The warhead work is a key element and integral part of the Dahlgren Division's primary mission of combat and weapon systems engineering. To effectively engineer complex combat and weapon systems, it is important to maintain expertise and first hand knowledge of all three parts of the sense-control-engage combat sequence. The warhead work constitutes Dahlgren's main "engage" work of the sense-control-engage sequence. While the Division's primary focus is in the

control portion, expertise and a strong working knowledge of the sense and engage portions are also critical. Thus, the warhead efforts provides the Division with the critical and necessary engagement expertise and working knowledge. The warhead work is an integral part and interfaces with all the other Dahlgren technical organizations except for our Strategic Systems organization.

The Dahlgren site hosts three major tenants - AEGIS Training Center , Naval Space Command, and Joint Warfare Analysis Center. The Dahlgren warhead efforts do not support or affect these tenants except for the Joint Warfare Analysis Center. The warheads group of the Weapons System Department works on various special tasks sponsored by the Joint Warfare Analysis Center.

The technical work, including the warhead efforts, are supported by a complement of support functions. These functions include personnel, supply operations, comptroller, public works, safety, and security. The support functions report to the Commander through the Division Business Manager and the Chief Staff Office. The services of the support functions are also available to the tenants located at the Dahlgren site.

2. (a) Breakout of FY 93 Work Years:

The Dahlgren Division at the Dahlgren site works a total of 2408 direct work years in FY 93. In addition, contractors under contract to Dahlgren contributed an additional 2187 work years toward technical program efforts. The direct work years (government) are broken down by technical organization are as follows:

TECHNICAL ORGANIZATION	WKYRS
Warfare Analysis & Modelling	37
Combat Systems	459
Ship Defense Systems	378
Weapon Systems[1]	483
Space & Strategic Systems	431
Strike Systems	197

Systems Research & Technology	133
Warfare Systems	208
Other[2]	82
Total	2408

[1] Weapon Systems includes the 211 work years of Dahlgren Division Energetics work.
[2] Other includes all direct work performed by support functions.

Dahlgren Division Energetics (Warheads) Work Years by Type and Category

TYPE / CATEGORY	GOVT	FFRDC ON-SITE	FFRDC OFF-SITE	CONTRACTOR ON-SITE	CONTRACTOR OFF-SITE
S&T	78	0	0	0.5	20
ENGINEERING DEVELOPMENT	92	0	0	2	7
PRODUCTION	25	0	0	0	7
IN-SERVICE ENGINEERING	16	0	0	1	0
OTHER	0	0	0	0	0
TOTAL	211	0	0	3.5	34

2. (b) Space Occupied by Energetics (Warhead) Work:

The Dahlgren site owns 1,127,600 sq. ft. of laboratory space; 509,400 sq. ft. of office space; and 857,000 sq. ft. of other space. In addition, the site leases 9,300 sq. ft. of space off-site. The space used to support the energetics (warhead) work is broken out below. All space supporting energetics work is owned by the government.

TYPE	SQUARE FEET
LABORATORY	
MISSILE WARHEADS	15,210
ANTI-ARMOR WARHEADS	7,706
TARGET VULNERABILITY	1,000
EXPLOSIVE TEST FACILITIES	34,480
LABORATORY TOTAL	40,186
GENERAL OFFICE	
MISSILE WARHEADS	2,759
ANTI-ARMOR WARHEADS	3,500
TARGET VULNERABILITY	3,237
EXPLOSIVE TEST FACILITIES	2,000
GENERAL OFFICE TOTAL	11,496
OTHER	
SUPPORT ENGINEERING (CM, QA, CAD, SAFETY)	1,775
CLASSIFIED THREAT MATERIAL STORAGE	4,500
TEST PREPARATION	1,800
EXPLOSIVE EXPERIMENTAL AREA (FULLY INSTRUMENTED, SECURE, AIR SPACE TO 8,000 FEET)	1640 Acres
POTOMAC RIVER TEST RANGE	26 MILES LONG, 5 MILES WIDE, AIR SPACE TO 60,000 FEET

2. (c) FY 93 Funds, Main Programs, and Customers:

Total FY 93 direct funding for the Dahlgren site including RCP's, but excluding tenant funding was $701M. The main programs for the site include AEGIS, Surface Launched Ballistic Missile (SLBM) Systems, Ship Self Defense, TOMAHAWK, STANDARD Missile, AN/SLQ-32, ASW Surface Ship Combat System, Marine Corps Weaponry, Cooperative Engagement, Theater Ballistic Missile Defense (TBMD), and many smaller programs. The major sponsors include: PMS-400, SSPO, PEO (TAD), PEO (CU), PEO (USW), NAVSEA, US Marine Corps, and NAVAIR.

The main programs within the warhead R&D and target vulnerability/systems effectiveness work With associated FY 93 funding include:

PROGRAM	FUNDING ($K)
WARHEADS	
INDEPENDENT RESEARCH	64
SURFACE WEAPONS TECHNOLOGY	1640
MATERIALS TECHNOLOGY	1200
INSENSITIVE MUNITIONS ADV. DEV.	5632
DIRECTIONAL ORDNANCE SYSTEM	1500
PHOENIX	25
SPARROW	10
PATRIOT	365
STANDARD MISSILE	4000
DEFENSE NUCLEAR AGENCY	75
NORWAY (FMS)	15
EVOLVED SEA SPARROW	25
AMRAAM	60
TOMAHAWK	15
OTHER TESTING	300
SPECIAL JOINT WARFARE PROGRAMS	Classified
SMAW	1600
SRAW	1200
SRAW-MP	3000
JAVELIN	175
DECOYS	3500
WARHEADS SUBTOTAL	20,901

TARGET VULNERABILITY AND SYSTEMS EFFECTIVENESS

SURFACE WEAPONS TECHNOLOGY	511
CLOSE IN WEAPON SYSTEM	483
JOINT TECHNICAL COORDINATING GROUP	761
JOINT LIVE FIRE	210
SOVIET SHIP VULNERABILITY	160
PROTEC	210
ETG	160
STANDARD MISSILE	1629
DIRECTIONAL ORDNANCE SYSTEM	100
TACTICAL BALLISTIC MISSILE DEFENSE	425
EVOLVED SEASPARROW MISSILE	216
STANDARD ENGINEERING TEST TARGET	410
OTHER	420
TARGET VULNERABILITY/SYSTEMS EFFECTIVENESS	5,275
GRAND TOTAL	26,176

Sponsors of the Dahlgren site energetics work include:

Office of Naval Research
US Marine Corps
PEO (TAD)
PEO (CU)
US Army (PATRIOT Project Office)
Joint Warfare Analysis Center
NAVAIR
NAVSEA-91WM
Defense Nuclear Agency
Norway (FMS)
US Air Force (AMRAAM/PROTEC)

3. Describe Major Functional and Product Lines in Energetics including manpower, intellectual/skill capability, and major facilities and equipment:

The Dahlgren Division maintains a world class capability in missile systems engagement (Warhead) research and development. The Division performs missile warhead system design and

development, warhead system testing and evaluation, target vulnerability evaluation and threat modeling, and surface ship missile systems effectiveness. The Division has 117 scientist and engineers (S&E's)working on warhead efforts with a combined 1767 work years of experience in warhead work. These 117 S&E's are physicists, mechanical engineers, and systems analyst. There are 6 PhD's and 15 Masters. They have unique and special expertise specific to warheads and warhead effectiveness which is not taught in any college. Supporting the 117 S&E are 85 technicians skilled in explosive testing, high speed instrumentation, terminal ballistics and ordnance handling. The technicians provide a combined 2206 work years of experience in warhead testing and explosives handling. Also supporting the direct warhead work are 10 specialty S&E's skilled in configuration management, quality assurance, computer aided design, safety and electromagnetic compatibility. These 10 S&E's had a combined experience of 200 work years in assisting and ensuring that warhead developments meet the requirements for operation systems.

The Division's warhead development facilities provide all the necessary design, prototype, and test capabilities to conduct missile warhead development. These development facilities include the warhead assembly and analysis facility, the warhead structural analysis facility, the material test facility, the gas gun facility, a storage facility for classified threat material, weapons systems assembly facilities, a computation laboratory, and a smart munition laboratory.

These development laboratories are supported by a complete suite of test facility, some of which are nationally unique. The unique facilities include the near miss shock simulator, barbettes for warhead tests within the blast radius, and a fully instrumented 26 mile over water Potomac River Test Range with air clearance to 60,000 feet. These unique facilities allow testing of warhead configurations for shock susceptibility, blast parameters and effectiveness, and when necessary over water testing of the warhead.

The development facilities and unique testing capabilities are supported by the space and instrumentation systems required for warhead development testing. There is a 1,600 acre test area with air clearance to 8,000 feet that supports development testing from small scale to 1,000 lbs of explosive. Instrumentation systems include high speed photography, flash X-ray, arena sites, shaker tables, velocity and pressure sensors, environmental conditions, shock machines, and target vulnerability test facilities.

All of the above facilities and equipment are supported by an infrastructure of 53 certified storage magazines, explosive system fabrication and assembly facilities, and more that 100 personnel trained and certified to handle ordnance.

4. Maps of Installation showing Facilities and Equipment:

(a) See attached maps for location of buildings.

(b) Some of the equipment is large and requires large stable foundations and some instrumentation would require special setup and calibration if moved. However with difficultly, all of the facilities used for warhead work are capable of being moved. It should be noted that to perform the warhead R&D effectively requires that all the facilities and equipment mentioned below be collocated. The warhead facilities and associated major equipment along with replacement cost are listed below.

FACILITY	MAJOR EQUIPMENT	REPLACEMENT COST (Does not include buildings)
WARHEADS	**RESEARCH FACILITIES**	
WARHEAD ASSEMBLY	GENERAL LAB EQUIP CLASSIFIED STORAGE	$200K
WARHEAD STRUCTURAL	BEND TEST FIXTURE	$130K
WARHEAD ANALYSIS	SILICON GRAPHICS WORKSTATIONS IMAGE ANALYZER	$125K
GAS GUN	SINGLE STAGE GAS GUN HIGH SPEED INSTRUMENTATION	$2,000K
MATERIAL TEST	SCANNING ELECTRON MICROSCOPE OPTICAL MICROCOPY INSTRON TEST MACHINE TINIUS OLSON TEST MACHINE	$995K
SMART MUNITION LAB	RATE TABLE	$3,750K
WEAPON SYSTEM ASSEMBLY AREA (3)		$260K
MECHANICAL ASSEMBLY LAB		$500K

FACILITY	MAJOR EQUIPMENT	REPLACEMENT COST (Does not include buildings)
EXPLOSIVE OPERATION FACILITY	CLASSIFIED ENERGETIC ASSEMBLY	$2,000K
	SUBTOTAL	$9,960K
TARGET	**VULNERABILITY FACILITY**	
LABORATORY	GENERAL LAB EQUIP VAX COMPUTER SYSTEM SILICON GRAPHICS WORKSTATION	$400K
	SUBTOTAL	$400K
EXPLOSIVE	**TEST FACILITIES**	
DESIGN FACILITIES	COMPUTER SYSTEMS AND EQUIP	$436K
SAFETY BUNKERS	FIRING CONSOLES AND SEQUENCERS	$1,012K
FRAG ANALYSIS FACILITY	CLEANING EQUIP AND PRECISION SCALES	$150K
SHAKER LABS	CONTROL EQUIP, UD-4000 SHAKER	$492K
SHOCK LABS	CONTROL AND RECORDERS	$358K
TEMP & HUMIDITY	4-WALK-IN COMPUTER CONTROLLED	$1,953K
FAST COOK-OFF	30' TEST PAN AND RECORDERS	$320K
12 METER DROP CAGE	100' DROP TOWER AND CAPTURE CAGES	$1,200K
NEAR MISS SHOCK TEST	SHOCK TESTER AND RECORDERS	$600K

FACILITY	MAJOR EQUIPMENT	REPLACEMENT COST (Does not include buildings)
STATIC FIRE ARENA	FULLY INSTRUMENTED ARENA SITE	$750K
OVERPRESSURE TEST ARENA	FULLY INSTRUMENTED GRID SYSTEM	$100K
STATIC FIRE TEST	100K LBS THRUST STAND	$200K
100 FOOT DROP TOWER	100' DROP TOWER AND IMPACT AREA	$180K
SLOW COOK OFF	COMPUTER CONTROLLED FULLY AUTO	$150K
MULTI BULLET IMPACT	3-50 CAL GUN SPECIAL DESIGN	$160K
MEDIUM WEIGHT SHOCK MACHINE	NEW SYSTEM (TO BE INSTALLED)	$1,100K
SUPPORT EQUIPMENT	FIBER OPTIC LINK AND INSTRUMENTATION	$6,925K
ORDNANCE RADIOGRAPHY	INDUSTRIAL X-RAY	$1,000K
SMALL SCALE EXPLOSIVE TEST	FLASH X-RAY ULTRA HIGH SPEED PHOTO	$1,000K
LARGE SCALE EXPLOSIVE TEST	FLASH X-RAY ULTRA HIGH SPEED PHOTO	$600K
OTHER		$2,237K
	SUBTOTAL	$20,923K
	GRAND TOTAL	$31,283K

5. Estimate Capacity of the Activity to absorb similar work years:

The Dahlgren Division is recognized as a national asset for the threat cruise missile vulnerability data. This vulnerability data is used by the Navy, Army, Air Force and Ballistic

Missile Defense Office. Dahlgren is also recognized as the prime US group for air target vulnerability. The warhead expertise at Dahlgren currently supports all services - AMRAAM for the Air Force/Navy, Patriot and Javelin for the Army and SRAW/SMAW for the Marine Corps.

In its recognized role of leader in warheads, the Dahlgren Division can absorb a reasonable amount of additional warhead R&D and vulnerability work of all types. Current and planned end-strength reductions provide office space for the expansion. The infrastructure to support warhead research and development currently exists. There exist the ordnance material handling and storage capability, the ordnance testing and evaluation facilities, target vulnerability and performance assessment, security, and contracts. In addition, Dahlgren is just 30 miles from the energetic materials expertise of Indian Head which provides close technical synergism between the developers of new explosives and the warhead designers.

If a large amount (hundreds of work years) of warhead R&D work were to be relocated to Dahlgren, additional office space would be required to house the additional personnel.

Even with major modifications, the Dahlgren site cannot expand significantly beyond the previously mentioned increase in the warhead research and development and target vulnerability/systems effectiveness work. The site does not have enough large open spaces to provide for expansion of energetic type work. Encroachment becomes a major problem if energetic work was to increase significantly beyond the warhead R&D.

6. Describe the impact of BRAC 91 and BRAC 93 decisions on the activity:

Prior to BRAC 91, the Naval Surface Warfare Center, Dahlgren, VA, was a laboratory, reporting directly to the Director of Navy Laboratories, with a major subordinate detachment located at Silver Spring, MD known as the White Oak Detachment. The BRAC 91 established the Naval Surface Warfare Center, located in Arlington, VA, with supporting divisions. The Dahlgren Division was established at that time with the following subordinate commands: The NSWCDD Coastal Systems Station, Panama City, FL and NSWCDD White Oak Det, Silver Spring MD.

BRAC 91 required the reassignment of Warfare Analysis, and ASW Combat Systems, from the Naval Surface Warfare Center, White Oak Detachment to the Naval Surface Warfare Center, Dahlgren Division, Dahlgren, VA. BRAC 91 also provided for relocating the ASW functions from NCCOSC to the Naval Surface Warfare Center, Dahlgren Division, Dahlgren, VA.

BRAC 93 directed the disestablishment of the White Oak Detachment of the Naval Surface Warfare Center, Dahlgren Division and stated that the functions would be transferred to the Dahlgren Division, Dahlgren and Coastal Systems Station sites as well as the Naval Surface

Warfare Center, Indian Head Division. This will result in an increase of personnel (both contractor and government) at the Dahlgren Site.

Neither BRAC 91 nor 93 decisions impacted the Division's warhead work directly. However, the BRAC 93 decision to move all energetics and underwater warheads work from the White Oak Detachment to the Indian Head Division places the energetics closer to Dahlgren. At Indian Head, the development of explosives is 30 miles from Dahlgren. Both sites are located on the Potomac River which allows for river transportation of sensitive ordnance.

7. Describe military department approved and programmed plans which impact the activity:

In March of 1991 NAVSEA, NAVAIR, and ASN(RD&A) entered into an agreement which dealt with the assignment of missile systems (subsystems) work. The result of that agreement was that missile systems engineering and integration was divided among three warfare centers as follows: Aircraft - Air Warfare Center, Surface Ship - Surface Warfare Center, and Submarine - Undersea Warfare Center. For certain missile subsystems (seekers, airframe/aerodynamics, fuzes, propulsion) the Air Warfare Center was assigned the responsibility. Missile warheads were assigned to the Surface Warfare Center and the Dahlgren Division.

8. Remaining Tenants and Other Activities on the installation:

The Dahlgren site has three major tenants - AEGIS Training Center, Naval Space Command, and Joint Warfare Analysis Center.

AEGIS Training Center — 279 Work Years (Does not include students)

Mission: To provide officers and enlisted personnel the knowledge, ability, and skill to operate, employ, and maintain the AEGIS Combat System aboard surface warships.

Naval Space Command — 342 Work Years

Mission: Naval Space Command uses the medium of space and its potential to provide essential information and capabilities to ashore and afloat naval forces by: operating surveillance, navigation, communication, environmental, and information systems; advocating naval warfighting requirements in the joint arena; and advising, supporting, and assisting naval sciences through training and developing space plans, programs, budgets, policies, concepts, and doctrine.

Joint Warfare Analysis Center 265 Work Years

Mission: Assist the Chairman of the Joint Chief of Staff and Commander of the Unified Commands in their preparation and analysis of joint operational plans.

In addition to the three major tenants, the Dahlgren site has numerous small tenants which support the site. All the tenants are listed below.

Tenant Command Name	UIC	Officer	Enlisted	Civilian
NAVAL SPACE COMMAND	00046	61	110	171
EXPLOSIVE ORDNANCE DISPOSAL	30703	1	5	0
NAVAL BRANCH MEDICAL CLINIC	32639	3	13	9
NAVAL DENTAL CLINIC	35755	1	3	0
DEFENSE PRINTING SERVICE	43630	0	0	6
PERSONNEL SUPPORT DETACHMENT	44175	1	8	4
NAVAL WARFARE ANALYSIS CENTER	49869	42	23	200
CHESDIV NAVFACENGCOM	62477	2	0	18
NAVY RESALE AND SERVICES SUPPORT OFFICE	63576	0	2	19
AEGIS TRAINING CENTER	68724	37	196	46
AEGIS TRAINING CENTER (Average students on board)	45541	11	135	0
NAVAL INVESTIGATIVE SERVICE	68896	0	0	2

Tenant Command Name	UIC	Officer	Enlisted	Civilian
DEFENSE COMMISSARY AGENCY	N/A	0	3	12
DEFENSE REUTILIZATION AND MARKETING OFFICE	N/A	0	0	2
NSWSES DET	N/A	0	0	20
DOD SECTION 6 SCHOOL	EVADL	0	0	22
COMSUBLANTREP	N/A	1	0	0
DEFENSE INVESTIGATIVE SERVICE	HS1500	0	0	1
DEFENSE FINANCE AND ACCOUNTING SERVICE	N/A	0	0	36

9. Summarize your overall mission:

DAHLGREN DIVISION MISSION STATEMENT

Provide research, development, test and evaluation, engineering, and fleet support for surface warfare systems, surface ship combat systems, ordnance, mines, amphibious warfare systems, mine countermeasures, special warfare systems, and strategic systems. Execute other responsibilities as assigned by the Commander, Naval Surface Warfare Center.

The primary focus of the Dahlgren Division is the systems engineering of large complex systems. These complex systems must work effectively with many other systems in a joint, multi-platform, multi-theater warfare arena of tomorrow. In order to properly engineer these complex systems, one must have the expertise and first hand knowledge of all parts of the combat sequence from sensing the threat, to controlling all combat assets, to engaging the threat.

The warhead R&D and vulnerability/systems effectiveness work is key part in maintaining expertise and working knowledge in the engage portion of the sequence.

Specifically, the technical capabilities that support our mission and the focus of systems engineering of large complex systems are:

- **SURFACE AND STRATEGIC WARFARE ANALYSIS, COST ANALYSIS, SIMULATION, AND MODELING** - This capability provides for the conduct of threat analysis, mission analysis, surface warfare analysis, multi-warfare analysis, requirements and cost analysis, and effectiveness analysis, as well as modeling and simulation in all areas related to surface ship combat systems, weapons systems and strategic systems.

- **SURFACE SHIP COMBAT SYSTEMS ENGINEERING R&D, T&E, ACQUISITION SUPPORT, AND SOFTWARE SUPPORT** - The methods and ideas in this capability encompass the whole warfighting system, and point out affordable technical paths toward improved warfighting capability in likely future regional conflicts. This over-arching role serves major combat systems roles such as that for AEGIS.

- **JOINT MISSION PLANNING SYSTEMS, R&D, T&E, ACQUISITION SUPPORT, AND SOFTWARE SUPPORT** - This capability encompasses Strategic and Strike Targeting and Mission Planning, particularly as it applies to Navy and Joint Strike systems such as TOMAHAWK, TACAIR, and Unmanned Aerial Vehicles (UAV), and to Strategic Systems such as the Submarine Launched Ballistic Missile (SLBM).

- **RF & EO SENSORS R&D, T&E, ACQUISITION SUPPORT, AND SOFTWARE SUPPORT** - The unique aspect of this capability in the Dahlgren Division is the requirement to consider the sensors from the full combat system perspective. Sensors and sensor systems are conceived, designed and developed based upon combat system requirements and the aggregate contribution of the sensor system to the combat system performance.

- **SURFACE SHIP COMBAT AND WEAPON CONTROL SYSTEMS R&D, T&E, ACQUISITION SUPPORT, AND SOFTWARE SUPPORT** - The Dahlgren Division is actively involved in the combat systems architecture computing, and advanced capabilities that will enhance the joint service operations that are envisioned in future DoD requirements.

- **SURFACE SHIP WEAPON SYSTEMS R&D, T&E, ACQUISITION SUPPORT, AND SOFTWARE SUPPORT** - The Dahlgren Division has evolved as the technical leader in total systems engineering and integration of detect, control, and engage

subsystem elements. The Dahlgren Division has the technical depth, operational understanding, experience and vision to develop and field new systems quickly and cost effectively.

- **THEATER AIR DEFENSE SYSTEMS R&D, T&E, ACQUISITION SUPPORT, AND SOFTWARE SUPPORT** - This is a highly integrated joint service network of sensors, communications, command and control and weapon subsystems that form a theater wide multifaceted and multilayered system. The Dahlgren Division responsibilities include systems engineering (from a joint and force perspective) and R&D of key system elements including sensors, weapons and control systems.

- **SURFACE SHIP DEFENSE SYSTEMS R&D, T&E, ACQUISITION SUPPORT, AND SOFTWARE SUPPORT** - Conduct total systems engineering and integration of detection, control, and engagement subsystems to provide an effective zero-loss capability for surface ships against all threats and particularly against antiship cruise missiles in the Littoral Warfare environment.

- **COOPERATIVE ENGAGEMENT CAPABILITY SYSTEMS R&D, T&E, ACQUISITION SUPPORT, AND SOFTWARE SUPPORT (CEC)** - The Dahlgren Divisions' experience in systems analysis, systems engineering and integration, Independent Validation and Verification (IV&V), software development and support, system safety, and electromagnetic effects establishes and assures continued overall CEC technical integrity. This breadth of experience and capabilities together with our unique knowledge and experience with special intelligence allows us to meet Fleet operational needs.

- **THEATER BALLISTIC MISSILE DEFENSE SYSTEMS R&D, T&E, ACQUISITION SUPPORT, AND SOFTWARE SUPPORT (TBMD)** - The Dahlgren Division defined the Navy's contribution to the TBMD and assumed the lead role in defining this Naval Mission.

- **GUN WEAPONS SYSTEMS R&D, T&E, ACQUISITION SUPPORT, AND SOFTWARE SUPPORT** - The Dahlgren Division conducts the full spectrum RDT&E in Gun Weapons Systems for the Surface Navy and Marine Corps. This area of responsibility includes the R&D of gun, fire control, sensors, and ammunition designs and the establishment/evaluation of performance thresholds necessary to meet operational requirements.

- **MARINE CORPS WEAPONRY R&D, T&E, ACQUISITION SUPPORT, AND SOFTWARE SUPPORT** - The Dahlgren Division directs and conducts programs for

the Marine Corps in the following areas: Weaponry Technology, Tactical Targeting Sensors, Mine Detection Technology, Land Mine Countermeasures Technology, and Chemical/Biological Defense Technology.

- **STRATEGIC AND SPACE SYSTEMS R&D, T&E, ACQUISITION SUPPORT, AND SOFTWARE SUPPORT** - The Dahlgren Division is the only Navy activity with a strategic role in this high national priority capability. The Dahlgren Division provides systems engineering, technology advancement, software development, and operational support for the Navy strategic systems and for space systems.

- **ELECTRONIC WARFARE SYSTEMS R&D, T&E, ACQUISITION SUPPORT, AND SOFTWARE SUPPORT** - The Dahlgren Division role is one of developing new technologies for the application in surface ship sensor and countermeasures systems, the transition of new technologies to existing and planned electronic warfare suites, acquisition support, technical evaluation, and development of technologies and fields systems for special purpose intelligence collection purposes.

- **ELECTROMAGNETIC ENVIRONMENTAL EFFECTS (E^3) R&D, T&E, ACQUISITION SUPPORT, AND SOFTWARE SUPPORT** - As the Navy's lead laboratory, the Dahlgren Division assures operational effectiveness of Naval systems exposed to stressing electromagnetic (EM) environments. The Dahlgren Division assesses the susceptibility of electronic components, circuits, and systems to the EM effects; investigates specific and generic susceptibility problems, develops, evaluates, and recommends procedural and hardware changes, as appropriate to harden Naval equipment to these effects.

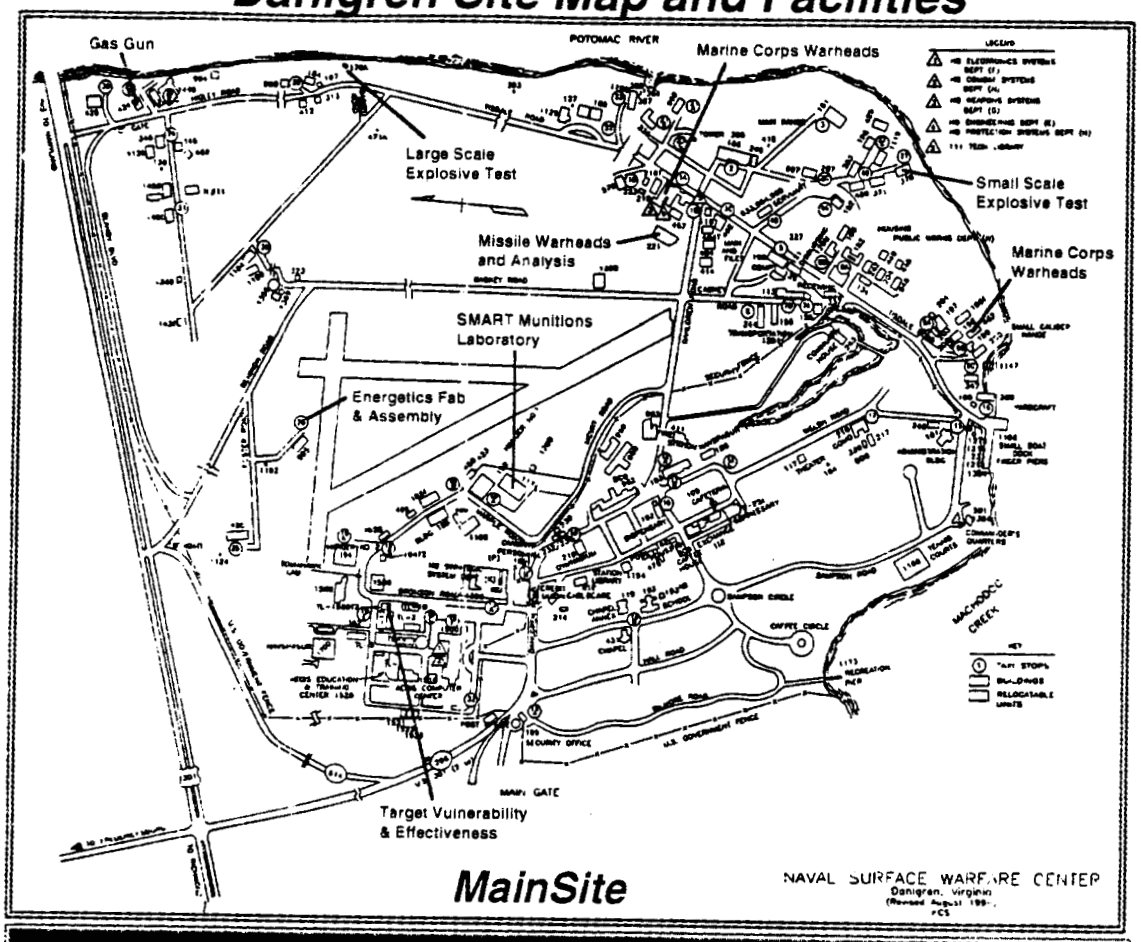
- **WEAPON SYSTEMS SAFETY R&D, T&E, ACQUISITION SUPPORT, AND SOFTWARE SUPPORT** - The Dahlgren Division provides the technology base, product development, and Fleet support for systems safety and survivability of Fleet assets, especially surface warfare assets. The Dahlgren Division assesses system and item vulnerabilities including software. The Division specifies, designs and develops means to remove failure modes, control environments, limit damage, or otherwise reduce possible loss of combat capability.

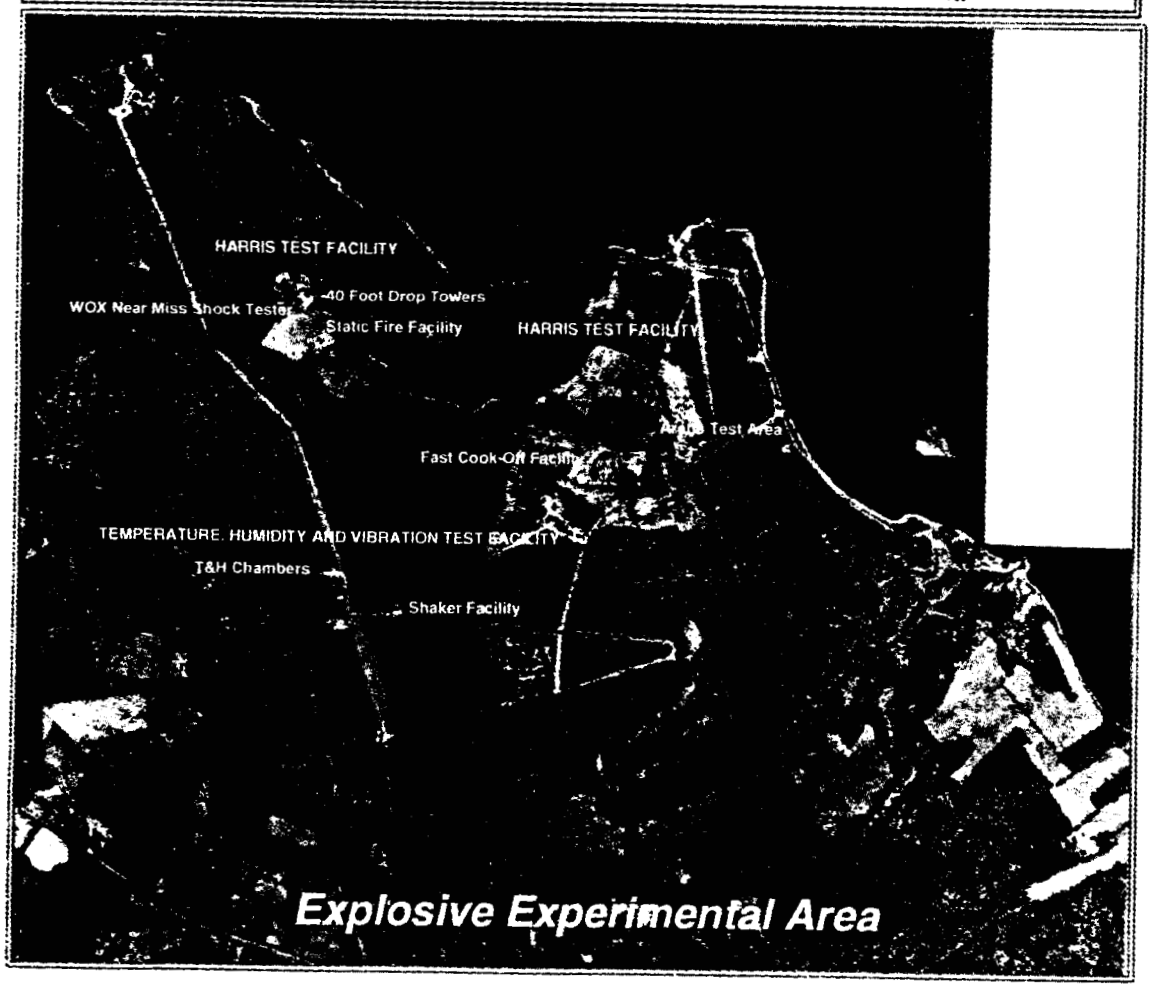
- **CHEMICAL/BIOLOGICAL WARFARE DEFENSE SYSTEMS R&D, T&E, ACQUISITION SUPPORT, AND SOFTWARE SUPPORT** - The Dahlgren Division is the principal Navy activity for Chemical/Biological Warfare for threat analysis and model development. The Division develops equipment and systems for the Marine Corps and is the principal Navy Development Activity for Chemical/Biological Detection and Protection Systems for Naval Forces.

- **WARHEADS R&D, T&E, ACQUISITION SUPPORT, AND SOFTWARE SUPPORT** - The Dahlgren Division is the Technical Direction Agent and Design Agent for warhead development, and is Chair of the Project Reliance and other joint DoD/DoE coordinating groups. Under 1991 directed mission purification SECNAV directed the Dahlgren Division to be the sole in-house technology development activity for missile warheads.

- **SPECIAL PROGRAMS** - This mission area complements naval warfare master planning efforts, analyzes future naval warfare requirements, establishes conceptual warfare initiatives with respect to potential warfare scenarios, and defines the platform and weapon requirements that must be satisfied to function within those scenarios.

Dahlgren Site Map and Facilities





Document Separator

203

~~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)

Dr. Ira M. Blatstein — Ira M Blatstein

NAME (Please type or print) — Signature

Technical Director — 10/28/94

Title — 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

10/28/94

Title G. R. STERNER — Date

Commander

Naval Sea 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 — W A Earner

NAME (Please type or print) — Signature

11/7/94

Title — Date

94-11-21 10:03 RCVD

WC

DATA CALL #12, AMEND 1
LJCSG PRESENTATION
DAHLGREN
"ENERGETICS"

BRAC-95 CERTIFICATION

Submission of Data Call #12 Amendment #1, Presentation Package for Naval Surface Warfare Center, Dahlgren Division, Dahlgren Site

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

J. C. OVERTON, CAPT, USN
NAME (Please type or print)

Signature

COMMANDER
Title

27 Oct 94
Date

NAVAL SURFACE WARFARE CENTER
DAHLGREN DIVISION
Activity

NAVAL SEA SYSTEMS COMMAND

NSWC

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NAVAL SURFACE WARFARE CENTER

DAHLGREN DIVISION

NSWC

Naval Surface Warfare Center

DAHLGREN DIVISION

Presented to:

ENERGETICS CROSS-SERVICE ANALYSIS TEAM

20 OCTOBER 1994

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THE MESSAGE

- DAHLGREN DIVISION CURRENTLY HAS WORLD CLASS CAPABILITY IN
  - MISSILE WARHEAD DEVELOPMENT
  - TARGET VULNERABILITY/SYSTEM EFFECTIVENESS
  - MISSILE WARHEAD TESTING
- THIS CAPABILITY CRITICAL FOR COMPLETING DAHLGREN DIVISION *COMPLEX SYSTEMS ENGINEERING* MISSION BY PROVIDING THE NECESSARY *ENGAGE ELEMENT* OF THE SENSE-CONTROL-ENGAGE SYSTEM PARADIGM
- 1991 NAVY CONSOLIDATION DECISION DIRECTS NAVY MISSILE WARHEAD LEADERSHIP TO DAHLGREN DIVISION
- COMPLEMENTS EXPERTISE OF THE INDIAN HEAD AND CRANE DIVISIONS OF NSWC
- DAHLGREN DIVISION AVAILABLE FOR EXPANSION OF WARHEADS AND VULNERABILITY EFFORTS

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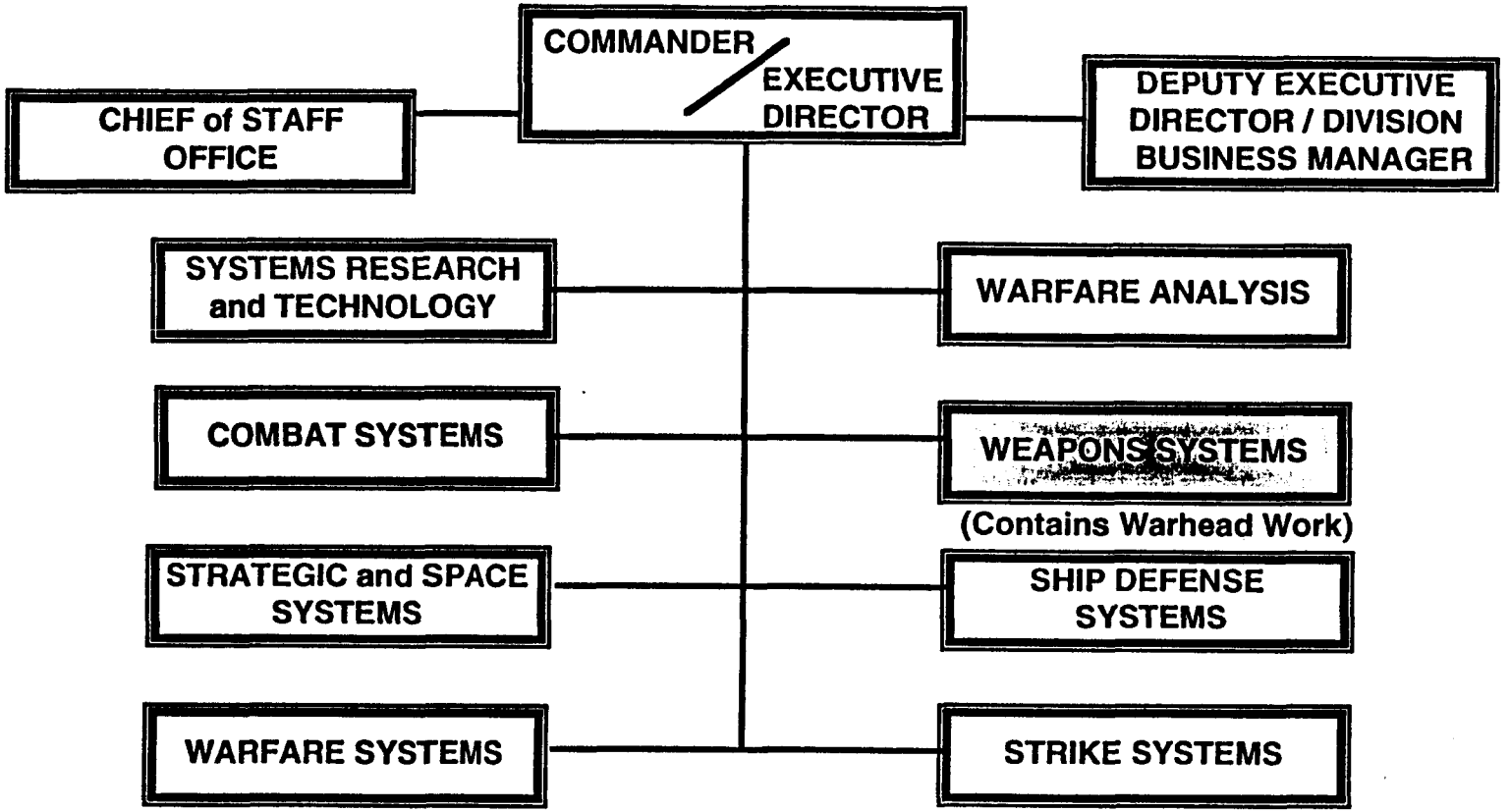
DAHLGREN SITE



MAJOR TENANTS:	AEGIS Training Center	297 WYs
	Naval Space Command	342 WYs
	Joint Warfare Analysis Center	265 WYs

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WARHEADS
MAJOR FY93 PROGRAMS

WARHEADS	FUNDING ($K)
INDEPENDENT RESEARCH	64
SURFACE WEAPONS TECHNOLOGY	1640
MATERIALS TECHNOLOGY	1200
INSENSITIVE MUNITIONS ADV. DEV.	5632
DIRECTIONAL ORDNANCE SYSTEM	1500
PHOENIX	25
SPARROW	10
PATRIOT	365
STANDARD MISSILE	4000
DEFENSE NUCLEAR AGENCY	75
NORWAY (FMS)	15
EVOLVED SEA SPARROW	25
AMRAAM	60
TOMAHAWK	15
OTHER TESTING	300
"SPECIAL" JOINT WARFARE PROGRAMS	CLASSIFIED
SMAW	1600
SRAW	1200
SRAW-MP	3000
JAVELIN	175
DECOYS	3500
	$24,276

TOTAL FY93 FUNDING: $29,971K

TARGET VULNERABILITY AND SYSTEM EFFECTIVENESS	FUNDING ($K)
SURFACE WEAPONS TECHNOLOGY	511
CLOSE IN WEAPON SYSTEM	483
JOINT TECHNICAL COORDINATING GROUP	761
JOINT LIVE FIRE	210
SOVIET SHIP VULNERABILITY	160
PROTEC	210
ETG	160
STANDARD MISSILE	1629
DIRECTIONAL ORDNANCE SYSTEM	100
TACTICAL BALLISTIC MISSILE DEFENSE	425
EVOLVED SEASPARROW MISSILE	216
STANDARD ENGINEERING TEST TARGET	410
OTHER	420
	$5,695

SPONSORS

* OFFICE OF NAVAL RESEARCH
* US MARINE CORPS
* PEO (TAD)
* PEO (CU)
* JOINT WARFARE ANALYSIS CENTER
* NAVSEA-91WM
* NAVAIR
* US ARMY (PATRIOT PROJECT OFFICE)
* US AIR FORCE (AMRAAM)
* DEFENSE NUCLEAR AGENCY
* NORWAY (FMS)

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WARHEAD RESEARCH AND DEVELOPMENT FACILITIES

SPACE TYPE	MAJOR EQUIPMENT	SQUARE FEET	ORIGINAL COST	REPLACEMENT COST
LABORATORY				
WARHEAD ASSEMBLY (4)	GENERAL LAB EQUIP CLASSIFIED STORAGE	3238	$190K	$460K
WARHEAD STRUCTURAL (2)	BEND TEST FIXTURE	1169	$80K	$630K
WARHEAD ANALYSIS	SILICON GRAPHICS WORKSTATIONS IMAGE ANALYZER	293	$115K	$250K
GAS GUN	SINGLE STAGE GAS GUN HIGH SPEED INSTRUMENTATION	9000	$800K	$2000K
MATERIAL TEST	SCANNING ELECTRON MICROSCOPE OPTICAL MICROCOPY INSTRON TEST MACHINE TINIUS OLSON TEST MACHINE	4495	$600K	$955K
SMART MUNITION LAB	RATE TABLE	2715	$1800K	$3750K
EXPLOSIVE OPERATION LAB	CLASSIFIED ENERGETIC ASSEMBLY	2006	$80K	$2000K
VULNERABILITY ANALYSIS LAB	VAX COMPUTER/WORKSTATIONS	1000	$300K	$600K
GENERAL OFFICE		9496		
OTHER				
SUPPORT ENGINEERING (CM, QA, CAD, SAFETY)	SILICON GRAPHICS WORKSTATIONS HEWLETT PACKARD WORKSTATION SUN WORKSTATIONS COMPUTERVISION/PROENGINEER	1775	$1500K	$2500K
	TOTAL:	35,187 SQ FT	$5,465K	$13,145K

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WARHEADS WORK YEARS

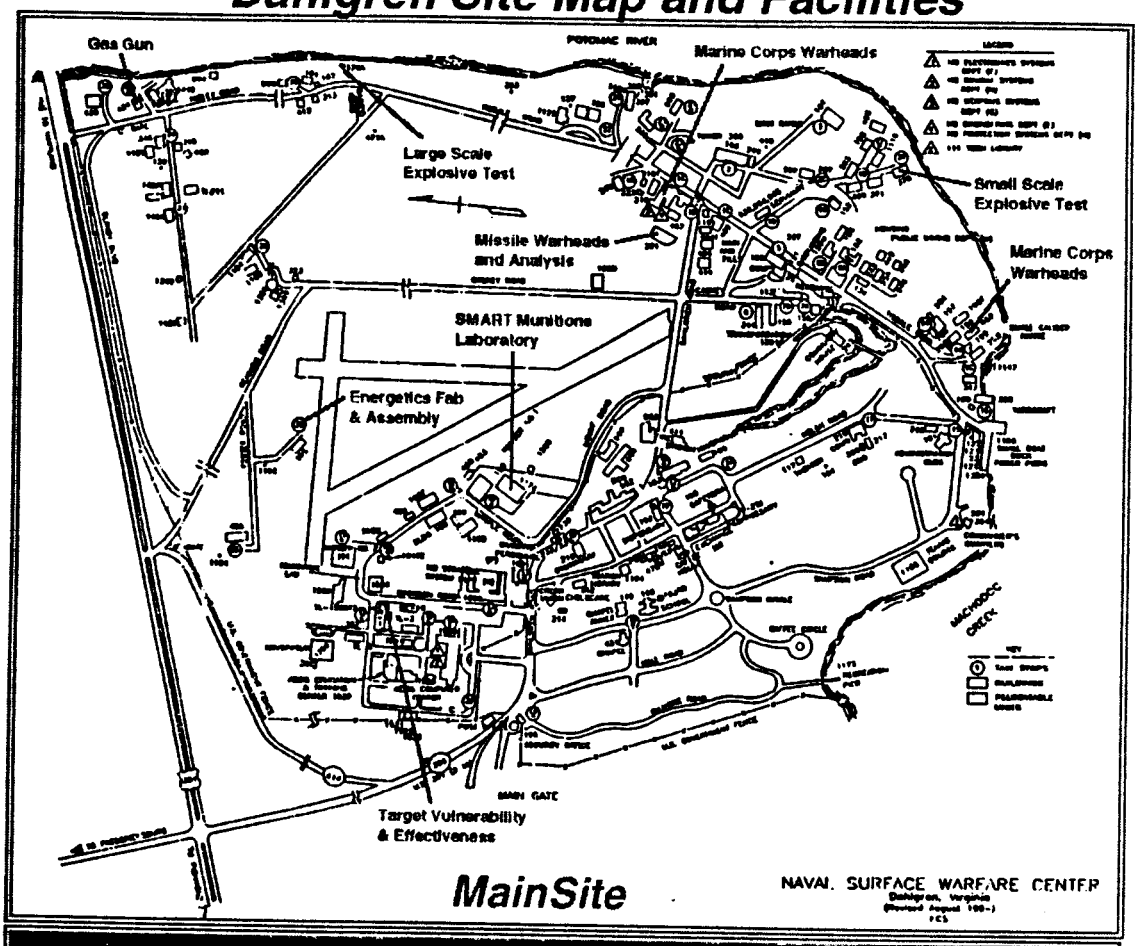
FY93

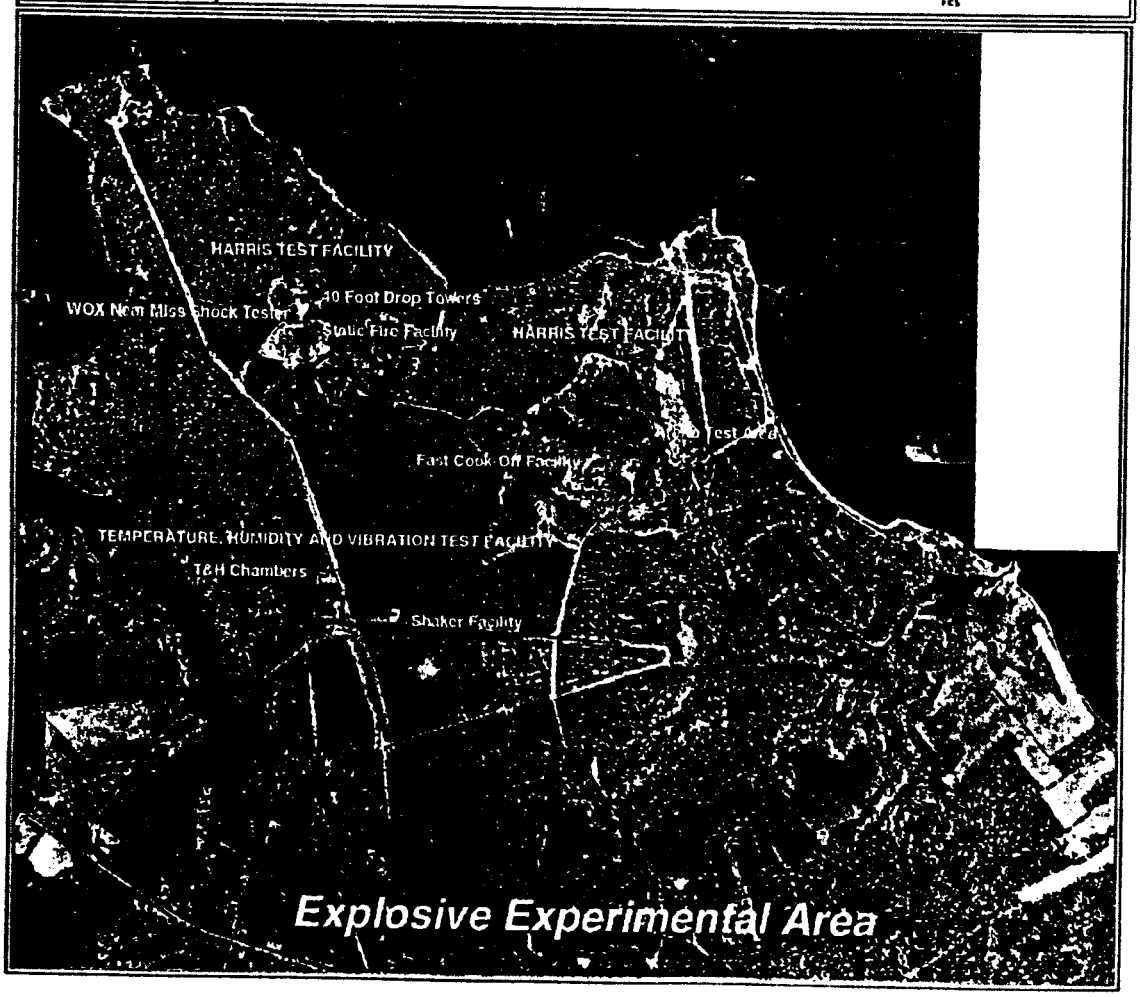
TYPE / CATEGORY	GOVERNMENT	FFRDC ON-SITE	FFRDC OFF-SITE	CONTRACT SUPPORT ON-SITE	CONTRACT SUPPORT OFF-SITE
S&T	78	0	0	0.5	20
ENGINEERING DEVELOPMENT	92	0	0	2	7
PRODUCTION	25	0	0	0	7
IN-SERVICE ENGINEERING	16	0	0	1	0
OTHER		0	0	0	0
TOTAL	211	0	0	3.5	34

WARHEAD TEST AND EVALUATION FACILITIES

SPACE TYPE	MAJOR EQUIPMENT	SQUARE FEET	ORIGINAL COST	REPLACEMENT COST
LABORATORY				
DESIGN FACILITIES	COMPUTER SYSTEMS AND EQUIP	3487		$436K
SAFETY BUNKERS	FIRING CONSOLES AND SEQUENCERS	2000		$1012K
FRAG ANALYSIS FACILITY	CLEANING EQUIP AND PRECISION SCALES	1200		$150K
SHAKER LABS	CONTROL EQUIP, UD-4000 SHAKER	1482		$492K
SHOCK LABS	CONTROL AND RECORDERS	1866		$358K
TEMP & HUMIDITY	4-WALK-IN COMPUTER CONTROLLED	3720		$1953K
FAST COOK-OFF	30' TEST PAN AND RECORDERS	1600		$320K
12 METER DROP CAGE	100' DROP TOWER AND CAPTURE CAGES	1600		$1200K
NEAR MISS SHOCK TEST	SHOCK TESTER AND RECORDERS	750		$600K
STATIC FIRE ARENA	FULLY INSTRUMENTED ARENA SITE	2000		$750K
OVERPRESSURE TEST ARENA	FULLY INSTRUMENTED GRID SYSTEM	325		$100K
STATIC FIRE TEST	100K LBS THRUST STAND	750		$200K
100 FOOT DROP TOWER	100' DROP TOWER AND IMPACT AREA	900		$180K
SLOW COOK OFF	COMPUTER CONTROLLED FULLY AUTO	400		$150K
MULTI BULLET IMPACT	3-50 CAL GUN SPECIAL DESIGN	200		$160K
MEDIUM WEIGHT SHOCK MACHINE	NEW SYSTEM (TO BE INSTALLED)	200		$1100K
SUPPORT EQUIPMENT	FIBER OPTIC LINK AND INSTRUMENTATION			$6925K
ORDNANCE RADIOGRAPHY	INDUSTRIAL X-RAY	1000		$1000K
SMALL SCALE EXPLOSIVE TEST	FLASH X-RAY	4000		$1000K
LARGE SCALE EXPLOSIVE TEST	ULTRA HIGH SPEED PHOTO	4000		$600K
OTHER				$2237K
GENERAL OFFICE		2000		
	TOTAL:	33,480 SQ FT		$20,923K
OTHER				
EXPLOSIVE EXPERIMENTAL AREA	FULLY INSTRUMENTED SECURE 8,000 FEET AIR SPACE	1642 ACRES		
POTOMAC RIVER TEST RANGE	26 MILES LONG 5 MILES WIDE 60,000 FEET AIR SPACE	41,550 ACRES USED FOR CERTAIN OVER WATER UNIQUE TEST REQUIREMENTS		IRREPLACABLE

Dahlgren Site Map and Facilities





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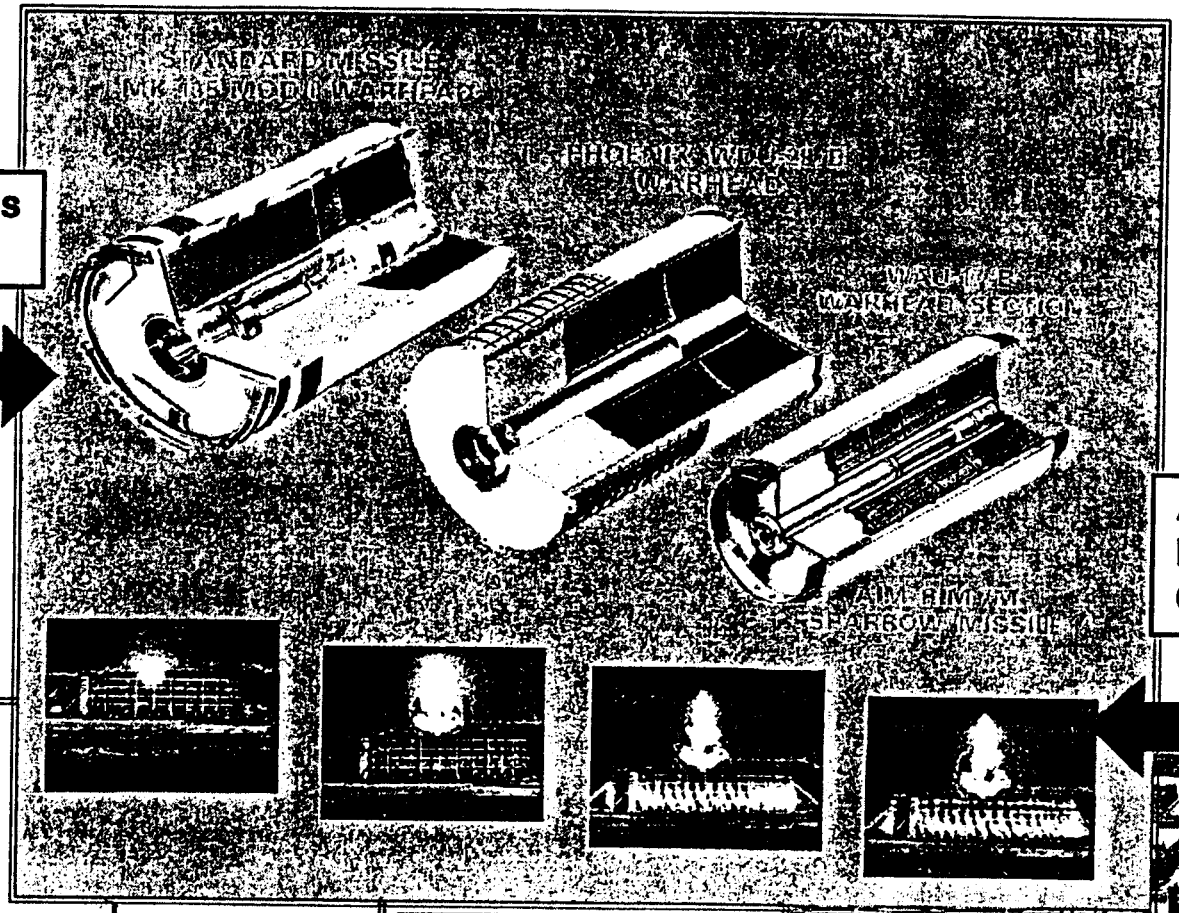
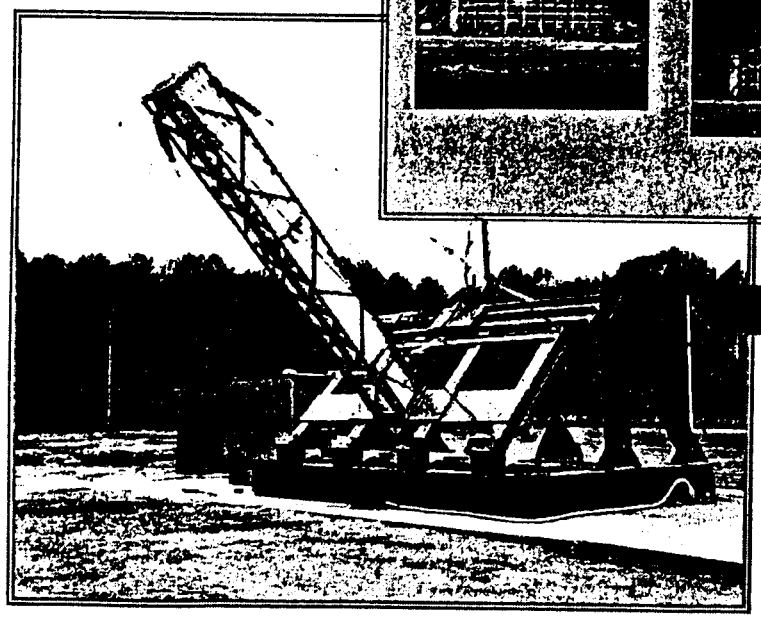
Warhead Programs and Facilities

Warhead Products To The Fleet

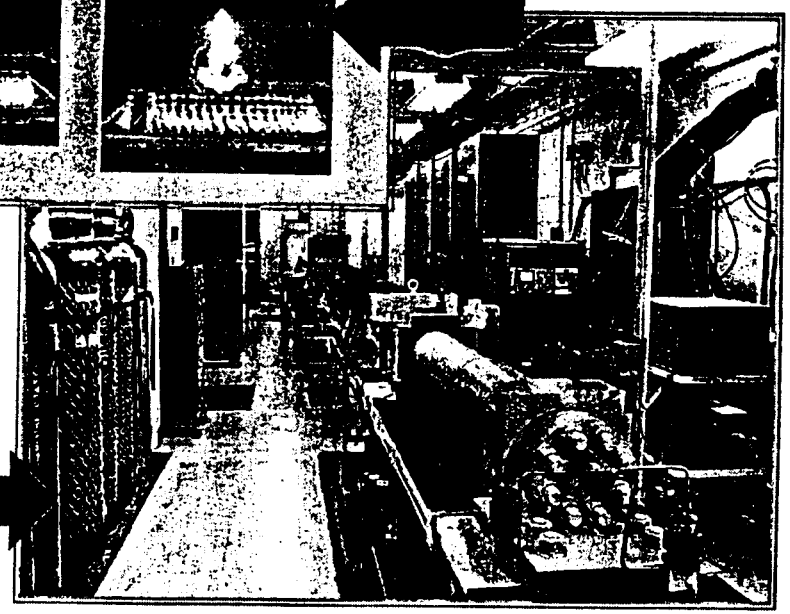


Arena Testing For Warhead Characterization



Near Miss Shock Equipment With Live Standard Missile in Canister
Unique vs Capability

Gas Gun Research Facility For Impact Dynamics Studies



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WORLD CLASS CAPABILITY

- **DAHLGREN DIVISION MAINTAINS A WORLD CLASS CAPABILITY FOR COMBAT SYSTEM ENGAGEMENT RESEARCH AND DEVELOPMENT**
  - WARHEAD SYSTEM DESIGN AND DEVELOPMENT
  - WARHEAD SYSTEM TEST AND EVALUATION
  - TARGET VULNERABILITY EVALUATION AND THREAT MODELING
  - SURFACE SHIP MISSILE SYSTEMS EFFECTIVENESS

- **ENABLING THE CAPABILITY IS EXPERIENCED PERSONNEL BASE**
  - 117 S&E (PHYSICISTS, MECHANICAL ENGINEERS, SYSTEM ANALYSTS)
    6 PhD 15 MASTERS
    - SPECIFIC WARHEAD AND INSTRUMENTATION TRAINING AND EXPERTISE (NOT TAUGHT IN ACADEMIA)
    - 1767 WORK YEARS EXPERIENCE
  - 85 ENGINEERING TECHNICIANS SKILLED IN
    - EXPLOSIVE TEST
    - HIGH SPEED INSTRUMENTATION
    - ORDNANCE HANDLING
    - 2206 WORK YEARS EXPERIENCE
    - TERMINAL BALLISTICS
  - 10 SPECIALTY SCIENTISTS AND ENGINEERS
    - CONFIGURATION MANAGEMENT
    - COMPUTER AIDED DESIGN
    - 200 WORK YEARS EXPERIENCE
    - ELECTROMAGNETIC COMPATIBILITY
      - DAHLGREN DIVISION IS CERTIFYING AUTHORITY FOR ALL SHIPBOARD APPLICATION OF ORDNANCE
    - QUALITY ASSURANCE, DRAFTING
    - SAFETY

- **ENABLING FACILITIES**
  - 68,667 SQUARE FEET OFFICE AND LAB SPACE
  - $34,068K EQUIPMENT REPLACEMENT COST
  - 43,192 ACRES TEST RANGES
  - UNIQUE FACILITIES (RIVER RANGE, SHOCK TEST MACHINE, BARBETTES)

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MAJOR FACILITIES AND EQUIPMENT SUMMARY

- **NATIONALLY UNIQUE CAPABILITIES**
  - NEAR MISS SHOCK SIMULATOR
  - BARBETTES FOR WARHEAD TESTS WITHIN BLAST RADIUS
  - 26 MILE OVER WATER POTOMAC RIVER TEST RANGE (60,000 FEET AIR CLEARANCE)

- **MAJOR WARHEAD DEVELOPMENT LABORATORIES**
  - WARHEAD ASSEMBLY AND ANALYSIS
  - MATERIAL TEST FACILITIES
  - GAS GUN
  - SMART MUNITION LABORATORY
  - WARHEAD STRUCTURAL ANALYSIS
  - WEAPON SYSTEM ASSEMBLY (3)
  - CLASSIFIED THREAT MATERIAL STORAGE
  - COMPUTER LABORATORY

- **ENERGETIC AND ORDNANCE HANDLING INFRASTRUCTURE**
  - 53 CERTIFIED STORAGE MAGAZINES
  - EXPLOSIVE SYSTEM FABRICATION AND ASSEMBLY
  - SAFETY AND PERSONNEL CERTIFICATION PROGRAM (>100 TRAINED PERSONNEL)

- **WARHEAD SYSTEM TEST**
  - SMALL SCALE TO LARGE SCALE (1000 LB) ENERGETIC DETONATION CAPABILITY ALLOWS SMALL SCALE TEST THROUGH END ITEM SAFETY QUALIFICATION (1642 ACRES - 8000 FEET AIR CLEARANCE)
  - COMPLETE INSTRUMENTATION SYSTEMS
    - HIGH SPEED PHOTOGRAPHY
    - FLASH X-RAY
    - ARENA TESTING
    - SHAKE TABLES
    - VELOCITY AND PRESSURE SENSORS
    - ENVIRONMENTAL CONDITIONERS
    - TARGET VULNERABILITY TESTING
    - SHOCK MACHINES

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EXPANSION CAPABILITY

- DAHLGREN DIVISION CAN EXPAND TO ABSORB ADDITIONAL WARHEAD AND VULNERABILITY WORK WITH EXISTING FACILITIES
  - OFFICE SPACE IS AVAILABLE
  - INFRASTRUCTURE CURRENTLY EXISTS
    - FOUNDATION OF EDUCATED/TRAINED/SKILLED WORKFORCE
    - ENERGETIC MATERIAL TEST AND EVALUATION
    - TARGET VULNERABILITY AND PERFORMANCE ASSESSMENT
    - SECURITY
    - CONTRACTS
    - ENERGETIC MATERIAL HANDLING
    - SPECIALTY ENGINEERING
  - PROXIMITY TO ENERGETIC MATERIAL EXPERTISE AT INDIAN HEAD ENHANCES TECHNICAL SYNERGISM
  - *COMPLEX SYSTEM* MISSION RELEVANCE
- DAHLGREN LOCATION EXPERTISE ALREADY SUPPORTS OTHER SERVICE WARHEAD PROGRAMS
  - AMRAAM (AIR FORCE/NAVY)
  - PATRIOT (ARMY)
  - JAVELIN (ARMY)
  - SRAW/SMAW (MARINE CORPS)
  - PRINCIPAL US GROUP FOR AIR TARGET VULNERABILITY
- DAHLGREN DIVISION IS NATIONAL ASSET FOR THREAT CRUISE MISSILE VULNERABILITY DATA
  - USED BY NAVY, ARMY, AIR FORCE, BMDO

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DAHLGREN DIVISION IMPACT OF BRAC 91 AND 93 DECISIONS

- NAVY CONSOLIDATION DECISION OF FY91 DIRECTS MISSILE WARHEAD LEADERSHIP FUNCTIONS TO DAHLGREN DIVISION
- BRAC 91 AND 93 HAD NO DIRECT IMPACT ON WARHEAD WORK AT DAHLGREN LOCATION
- BRAC 93 MOVE OF EXPLOSIVES AND UNDERWATER WARHEADS TO INDIAN HEAD AFFECTS DAHLGREN FAVORABLY
  - GEOGRAPHICALLY 30 MILES SEPARATION
  - RIVER AVAILABLE TO TRANSPORT SENSITIVE ORDNANCE

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DAHLGREN DIVISION TECHNOLOGY TO THE FLEET

DELIVERIES

LATE 1950s	MK5 MOD 7 TERRIER FRAGMENTING
LATE 1950s	MK10 MOD 0 TARTAR TERRIER CONTINUOUS ROD
1960	BULLPUP B WARHEAD (LATER USED IN TOMAHAWK)
1962	BULLPUP A WARHEAD (LATER USED IN PENGUIN)
1963	SPARROW M38 MOD 0 CONTINUOUS ROD
1973	PHOENIX MK82 CONTINUOUS ROD
1975	STANDARD MK90 FRAGMENTING
1970s	VULNERABILITYAND 6-DOF FLIGHT SIMULATIONS FOR SS-N-2 AND SS-N-3
1983	SPARROW WAU-17/B FRAGMENTING WARHEAD
1983	SEASPARROW WAU-17/B FRAGMENTING WARHEAD
1980s	VULNERABILITY AND 6-DOF FILGHT SIMULATIONS FOR SS-N-9, SS-N-12, SILKWORM, AS-4,AS-5, AS-6
1983	SHOULDER LAUNCHED MULTI-PURPOSE ASSULT WEAPON DUAL MODE (SMAW)
1983-1994	JAVELIN - INFANTRY DEFEAT WEAPON
1985	PHOENIX WDU-29B FRAGMENTING WARHEAD
1986	STANDARD MK115 MOD 0 FRAGMENTING WARHEAD
1986	STRATEGIC DEFENSE INITIATIVE DELTA 180 FLIGHT TERMINATION SYSTEM
1987	DRAGON II HIGH EXPLOSIVE ANTI-TANK (HEAT)
1990	STANDARD MK115 MOD 1 FRAGMENTING WARHEAD
1990s	VULNERABILITY AND 6-DOF FLIGHT SIMULATIONS FOR SS-N-22, SS-N-25, ANS, AS-16, AS-17
1993	STANDARD MK125 FRAGMENTING WARHEAD
1992	SHORT RANGE ASSULT WEAPON (SRAW) EXPLOSIVE FORMED PENETRATOR
1993	THREAT CRUISE MISSILE VULNERABILITY DATA TO PATRIOT PROJECT OFFICE
1992-94	PATRIOT FRAGMENTING WARHEAD PROTOTYPE

TECHNOLOGY APPLICATIONS

- DEVELOPED CONTINUOUS ROD TECHNOLOGY
- DEVELOPED FRAGMENTATION CONTROL TECHNIQUES
- DEVELOPED INCENDIARY MATERIAL TECHNIQUES
- DEVELOPED AIMABLE WARHEAD TECHNOLOGY
- TRANSITION OF SLAPPER INITIATOR TECHNOLOGY TO PRODUCTION
- DEVELOPED PENETRATING WARHEAD TECHNOLOGY
- DEVELOPED TERMINAL BALLISTIC TECHNOLOGY
- DEVELOPED VULNERABILITY MODELS FOR NUMEROUS AIR TARGET THREATS
- DEVELOPED 6-DEGREE OF FREEDOM SIMULATIONS FOR NUMEROUS AIR TARGET THREATS
- DEVELOPED END GAME EFFECTIVENESS ANALYSES FOR NUMEROUS MISSILES
- DEVELOPED SHAPED CHARGE AND EXPLOSIVE FORMED PENETRATOR TECHNOLOGY FOR MARINE CORPS APPLICATIONS

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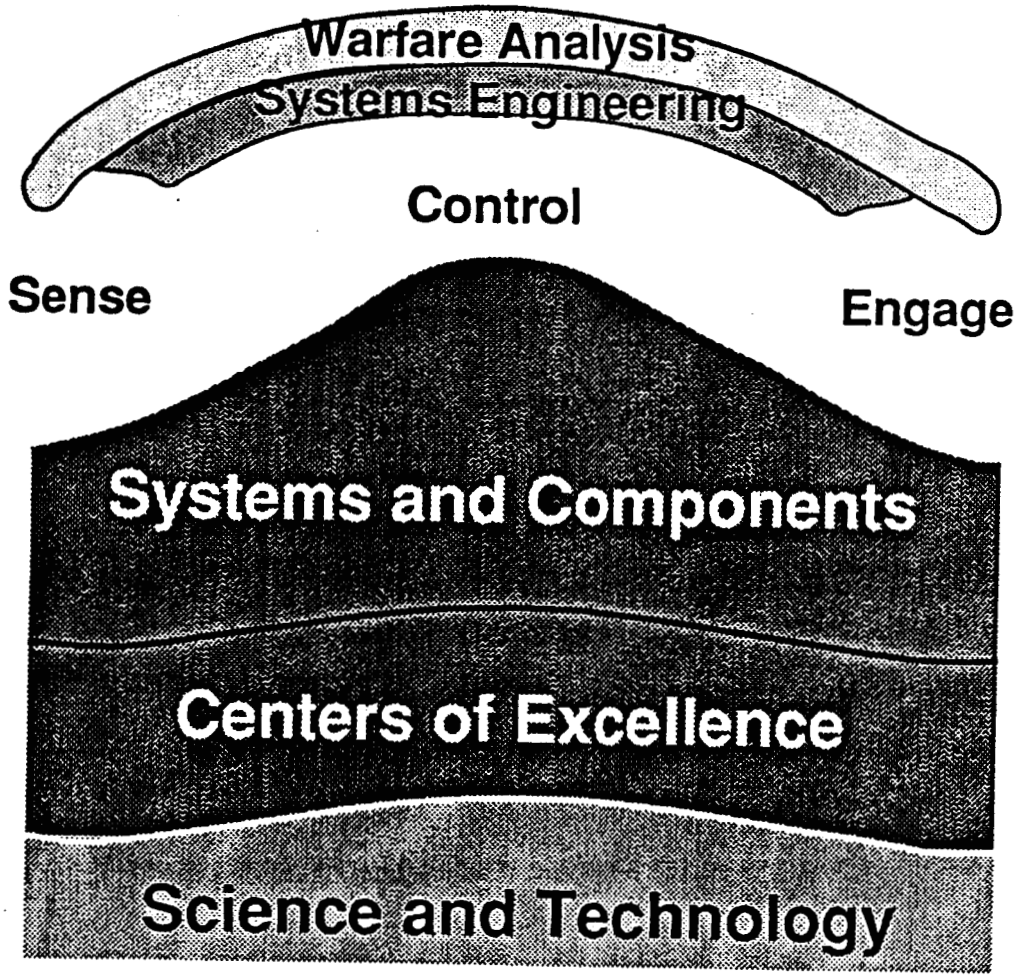
MISSION SUMMARY



- Surface Ship Combat and Weapon Systems
- Strategic Weapon Systems
- Mine Warfare Systems
- Amphibious Warfare Systems
- Special Warfare Systems
- Diving Systems

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THE MESSAGE

- DAHLGREN DIVISION CURRENTLY HAS WORLD CLASS CAPABILITY IN
  - MISSILE WARHEAD DEVELOPMENT
  - TARGET VULNERABILITY/SYSTEM EFFECTIVENESS
  - MISSILE WARHEAD TESTING
- THIS CAPABILITY CRITICAL FOR COMPLETING DAHLGREN DIVISION *COMPLEX SYSTEMS ENGINEERING* MISSION BY PROVIDING THE NECESSARY *ENGAGE ELEMENT* OF THE SENSE-CONTROL-ENGAGE SYSTEM PARADIGM
- 1991 NAVY CONSOLIDATION DECISION DIRECTS NAVY MISSILE WARHEAD LEADERSHIP TO DAHLGREN DIVISION
- COMPLEMENTS EXPERTISE OF THE INDIAN HEAD AND CRANE DIVISIONS OF NSWC
- DAHLGREN DIVISION AVAILABLE FOR EXPANSION OF WARHEADS AND VULNERABILITY EFFORTS

203

~~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)

Dr. Ira M. Blatstein
NAME (Please type or print)

Ira M Blatstein
Signature

Technical Director
Title

10/27/94
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

NAME (Please type or print)
G. R. STERNER
Commander
Naval Sea Systems Command
Title

G R Sterner
Signature

10-27-94
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)

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

W A Earner
Signature

Title

11/2/94
Date

DATA CALL #12, AMEND 1
LJCSG QUESTIONS
DAHLGREN

WC

BRAC-95 CERTIFICATION

Submission of Data Call #12 Amendment #1, Clarification Question for Naval Surface Warfare Center, Dahlgren Division, Dahlgren Site

Reference: SECNAVNOTE 11000 of 08 December 1993

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

ACTIVITY COMMANDER

JAMES S. PERRY, CAPT, USN
NAME (Please type or print)

James S. Perry
Signature

ACTING COMMANDER
Title

26 Oct 94
Date

NAVAL SURFACE WARFARE CENTER
DAHLGREN DIVISION
Activity

Answer to a question from the 20 October 1994 briefing to Energetics Cross Services Analysis Team

1. Can the warhead work at the Naval Surface Warfare Center, Dahlgren Division be moved?

YES. Given sufficient upfront money, the warhead work COULD be moved. The more important question is "SHOULD the warhead work be moved?" or do the benefits exceed the drawbacks. Our analysis of this question encompasses several points:

- The Dahlgren Division was assigned the air and surface warhead R&D by Assistant Secretary of the Navy in 1991,
- Warhead component work could be moved but the Dahlgren Division can identify no cost savings from the move,
- Moving the work will result in significant loss in unique expertise,
- Missile warhead R&D is more closely related to the engage function of the "sense-control-engage" paradigm of combat systems than to energetics, thus should be retained at NSWCDD
- Navy with NSWCDD lead has the most extensive missile warhead expertise when compared to the other services

NO COST REDUCTIONS HAVE BEEN IDENTIFIED BY THE DAHLGREN DIVISION

Our hypothesis is that there is an expectation that locating all warhead work (as a component) in one location will result in increased technical synergism. Moving the work might also result in some infrastructure savings; however, savings would only occur if the receiving site had excess capacity to support the new work and if the losing site support infrastructure decreases. While we cannot comment on the gaining site economics, we know the warhead work is a contributing portion of the overall Strategic and Surface Warfare Systems effort at the Dahlgren site and that the support infrastructure also supports other efforts; thus, infrastructure savings from moving the warhead work from Dahlgren would be negligible.

Offsetting the synergism and questionable cost saving benefits of collocating all warhead component work are major drawbacks to moving the warhead work.

UNIQUE EXPERTISE WILL BE LOST

Warhead technology and development require scientists and engineers with hands-on experience far beyond the formal college degree. Experience on warhead R&D must be grown over many years in an operational/laboratory environment. Dahlgren has 1767 work years of warhead experience in its S&E's. Previous consolidations have proven that if work moves many of the S&E's will not move with the work. The expertise will have to be rebuilt at considerable cost and mission impairment.

LOSS OF SYNERGISM WITH THE "ENGAGE" FUNCTION OF COMBAT SYSTEMS "SENSE-CONTROL-ENGAGE"

Today's combat systems are large complex systems which must be engineered as a system to function effectively. This was one of the fundamental reasons that Dahlgren was assigned sole leadership for air and surface warhead R&D by the Assistant Secretary of the Navy in 1991. The Dahlgren Division is a leader in engineering large complex combat systems, having system engineered or developed all generations of both fire control and targeting systems for Polaris, Poseidon, and Trident (I &II), the TOMAHAWK weapon control and mission planning systems, AEGIS baselines, and is currently involved in Ship Self Defense System and TBMD. Dahlgren is providing the technical leadership of a Navy wide and Joint team defining the next generation combatant. Dahlgren initiated and now is technically responsible for the Engineering of Complex Systems technology effort for ONR. This expertise and leadership has been acquired and sustained by hands-on knowledge of all phases of the combat engagement from sensing the threat, controlling the combat system, engaging the threat, to evaluating the destruction of the threat. We call this sequence the "sense-control-engage" paradigm. Warhead work is the crucial part of the hands-on knowledge base in the "engage" portion of the paradigm. Indeed, it is the warhead that projects lethal energy to the target completing the system mission. As a critical part of the "engage" function, weapons are not developed as components, but as elements of the larger system. We consider this system synergism as more critical to be collocated than collocation with other warhead work. We feel the benefits, if any, of cost savings from moving the warhead work from Dahlgren would be small and far outweighed by the loss to the Navy in capability to effectively engineer current and future combat systems modifications and improvements. In Dahlgren's opinion, the upfront costs associated with either moving scientists, engineers, and equipment or more likely, with hiring, training, and growing replacement personnel would be excessive.

LOSS OF THE MOST EXTENSIVE CORE OF MISSILE WARHEAD EXPERTISE OF THE SERVICES

The Navy's approach to R&D emphasizes the utilization of in-house expertise as well as contracted efforts. Through this approach, Dahlgren Division maintains a world class in-house capability for missile warhead R&D. Other services, contractors and foreign nations often turn to Dahlgren for support. Specifically, the Dahlgren Division does approximately 75% of the Navy's warhead R&D and in FY 1993 received 27% of its funding for warhead R&D from other services, agencies and foreign nations. For this reason as well as the systems synergism discussed in the preceding paragraph, the Assistant Secretary of Navy decided in 1991 that the Dahlgren Division should be the Navy's lead activity for warhead R&D. It is in the best interests of the Navy and country to effectively maintain this capability. If further consolidation is deemed desirable, then the Dahlgren site is the most logical choice of location.

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NAVAL SEA SYSTEMS COMMAND

NSWC

Naval Surface Warfare Center

A tradition of excellence!

ENERGETICS CROSS SERVICE ANALYSIS

NAVAL SURFACE WARFARE CENTER

CRANE DIVISION

CRANE, INDIANA SITE

NAVAL SURFACE WARFARE CENTER
CRANE, INDIANA
LOUISVILLE, KENTUCKY
CRANE DIVISION

94-11-21 10:03 RCVD

WC

CRANE

~~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)

Dr. Ira M. Blatstein — Ira M Blatstein

NAME (Please type or print) — Signature

Technical Director — 10/20/94

Title — 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

E. S. MCGINLEY, II

NAME (Please type or print) — Signature

(ACTING) COMMANDER — 10/20/94

Title — Date

NAVAL SEA 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

10/27/94

Title — Date

NAVAL SURFACE WARFARE CENTER
CRANE DIVISION
DATA CALL #12 AMENDMENT ONE - ENERGETICS
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."

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

ACTIVITY COMMANDER

J. M. CARNEY
NAME (Please type or print)

Signature

COMMANDER
Title

10/17/94
Date

CRANE DIVISION, NSWC
Activity

1. This information is provided in response to the Base Structure Evaluation Committe Memorandum of 7 October 94.

RESPONSE TO: ENERGETICS CROSS SERVICE ANALYSIS

FROM: NAVAL SURFACE WARFARE CENTER
CRANE DIVISION
CRANE, INDIANA SITE

ELEMENT	PAGE
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ATTACHMENT A
MAPS OF ENERGETICS TECHNICAL CAPABILITY

ATTACHMENT B
INSTALLATION MAPS OF FACILITIES UTILIZED FOR ENERGETICS

CAAA is designated as a Specified Mission Facility (SMF) with production capabilities in pyrotechnic production, Navy gun ammunition, bombs and propellant charges in support of production for all services. This designation is linked to the Army's Ammo Fast-21 facility strategy which is designed **to maintain a minimum essential industrial base and preserve the critical skills, capabilities and processes** that are necessary for readiness and contingency national emergency purposes.

CAAA is also designated as a Tier 1 Depot for munitions and energetics storage and distribution. As a Tier 1 Depot, CAAA provides routine and special purpose training munitions support as well as required short notice ordnance support to first strike forces of all services and pre-position ships, as well as war reserve munitions support during and beyond the first 30 days of multi-regional contingency support operations.

4. **Program Manager Conventional Ammunition** - The Program Manager for Conventional Ammunition (PMCA) is located at NSWC Crane. Conventional Ammunition includes surface and subsurface pyrotechnics, gun ammunition (small arms through 16 inch), demolition material and special warfare munitions. The PMCA program is summarized in Table 1 and includes: acquisition of munitions (annual effort of 100 commodities valued at 125-150 million dollars); funding and oversight of all engineering support efforts (approximately nine Navy engineering activities); and surveillance and maintenance of the Navy munitions inventory (approximately 1300 differently configured items valued at over 1.5 billion dollars).

5. **Interrelationship to CAAA and PMCA** - Crane Division is a **unique** Navy Activity in that Program Management (2T Cog) and engineering functions are co-located with a major ammunition producer, the Crane Army Ammunition Activity (CAAA). These co-located functions provide a synergism and efficiency for overall ammunition management. As a general example, Chart #2 depicts the life-cycle relationship of CAAA with the Navy Pyrotechnics TC to meet the requirements of a few flare programs. Other specific examples are that co-location provides:

- rapid response to engineering/production requirements throughout the life cycle under sudden emergency conditions of a major conflict such as Operation Desert Shield/Desert Storm.

- assists in developing specifications and data packages to allow the Single Manager for Conventional Ammunition to procure the devices and assists in introducing the devices into the Fleet by preparing technical and ordnance loading manuals.

- a close interaction between the development and production support engineers which provides the Navy with the ability to critically review and examine the items being developed and produced in the private sector.

- for Small Arms requirements to be more efficiently accomplished because of the availability of: facilities like environmental test and the ordnance test range; personnel expertise of the in-service engineering agent for small arms ammunition; and the CAAA magazines for ammunition storage, test support, and environmental support.

CONVENTIONAL AMMUNITION PROGRAM OFFICE (PM4) (2T COG) INTERFACE

DESIGN AGENTS

ACTIVITY	COMMODITY
CRANE	PYROTECHNIC/DEMOLITION DEVICES, SMALL ARMS, LANDING PARTY AMMUNITION
DAHLGREN	CIWS, MEDIUM CALIBER, MAJOR CALIBER, FUZES
INDIAN HEAD	PROPELLANT, PROPELLING CHARGES, CADS/PADS
EOD TECHNICAL CENTER	EOD ITEMS
WPNSTA EARLE	PHS&T
YORKTOWN	EXPLOSIVES

ACQUISITION AGENTS

ACTIVITY	COMMODITY
CRANE	ALL AMMUNITION
INDIAN HEAD	CADS/PADS

IN-SERVICE AGENTS

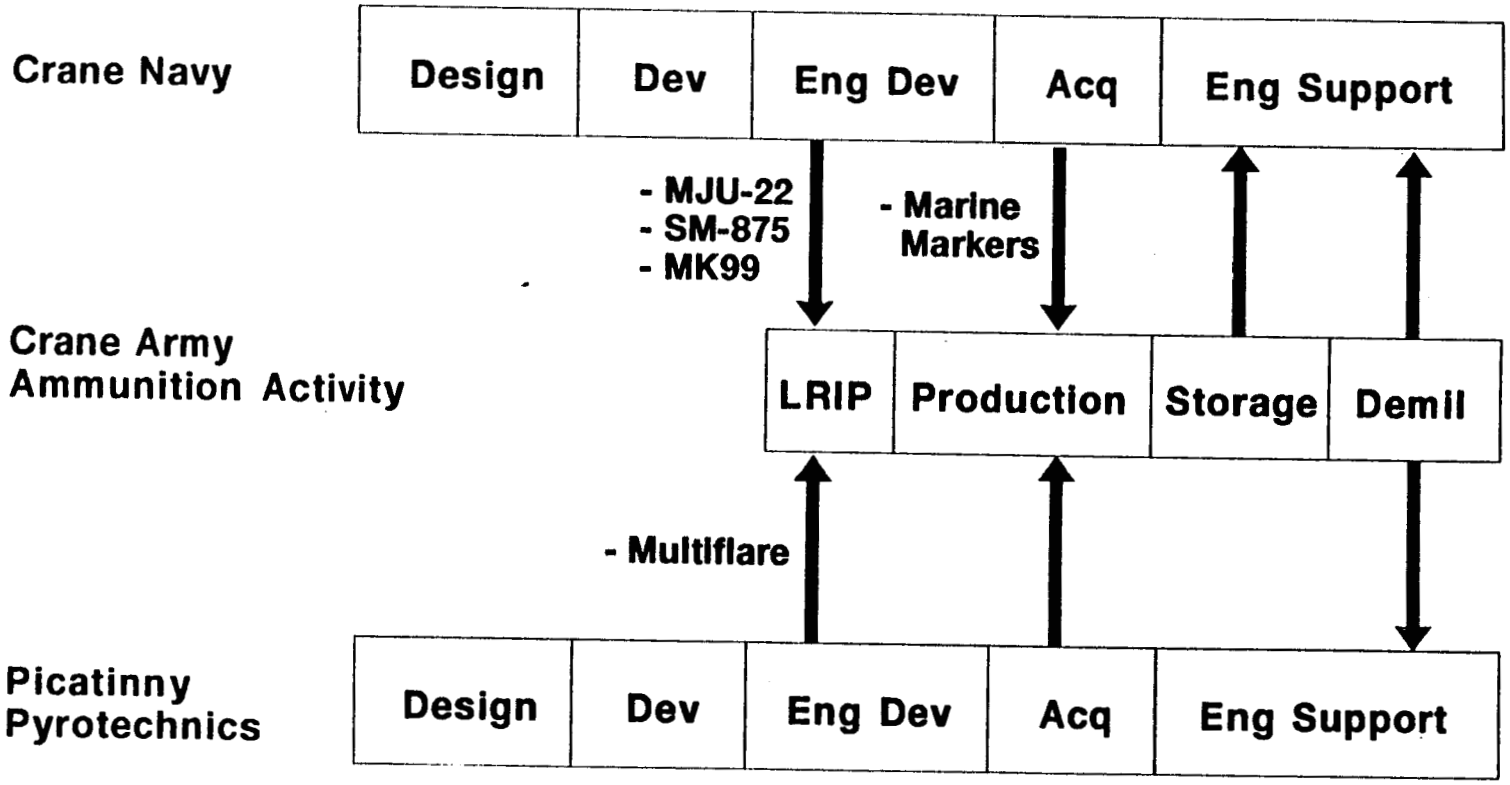
ACTIVITY	COMMODITY
CRANE	ALL AMMUNITION
INDIAN HEAD	CADS/PADS

OTHER ENGINEERING AGENTS

ACTIVITY	COMMODITY	FUNCTION
CRANE	DEMIL/DISPOSAL	TECHNICAL AGENT
WPNSTA CONCORD	ALL AMMUNITION	QUALITY/NDT
NOC IM-SD (SPCC)	ALL AMMUNITION	INVENTORY MNGT/MIPRS
DAHLGREN	ALL AMMUNITION	SYSTEMS INTEGRATION
NWAD CORONA	ALL AMMUNITION	GAGES

TABLE 1

NAVY/ARMY ACTIVITY LINK



1. **ORGANIZATION CHARTS**

A. **CRANE INSTALLATION** - As reported in BRAC95 Datacall #1, our mission is to provide responsive engineering and industrial base support for weapons systems, subsystems and components. On Crane's **nearly 100 square mile** property, we have combined skilled people, unique and capable facilities, product knowledge, and the ability to integrate engineering with "hands on" industrial processes to provide the broadest, deepest and most advanced industrial base capability in the Navy.

The top level Crane organization is depicted in Chart #1 and the Directorates involved in energetics are highlighted. Also highlighted are the significant tenant and program management functions, the Crane Army Ammunition Activity (CAAA) and the Program Manager for Conventional Ammunition (PMCA), which are co-located on the Crane installation.

B. **BACKGROUND** - In order to follow the information presented in this response, it is important to understand that Crane is managed and described in terms of Technical Capabilities (TC's). These are also shown on Chart #1. The Pyrotechnics, Conventional Ammunition Engineering and Small Arms TC's have **energetics** workload and are the focus of this data response.

1. **Technical Capabilities** - The Crane mission is accomplished by means of the unique synergy created by the interweaving of co-located facilities and people experienced in electronic and ordnance disciplines. The principal areas of expertise are managed and described in terms of the following twelve TC's.

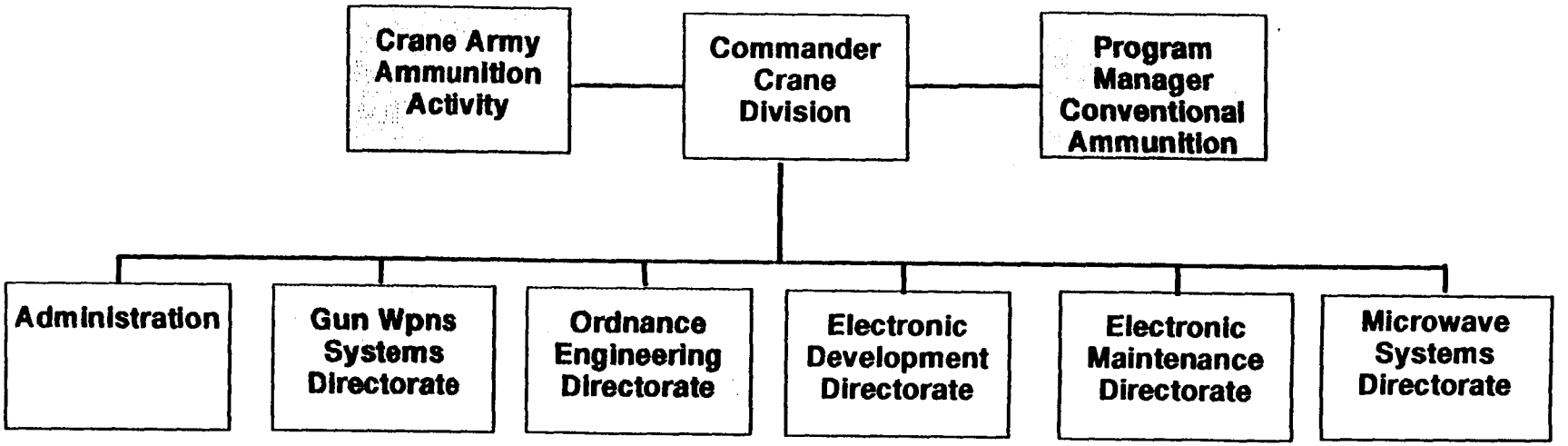
ENERGETICS TC's

- **PYROTECHNICS**
- **CONVENTIONAL AMMUNITION ENGINEERING**
- **SMALL ARMS**

ELECTRONICS TC's

- ELECTRONIC WARFARE
- MICROELECTRONIC TECHNOLOGY
- ELECTRONIC MODULE TEST AND REPAIR
- MICROWAVE COMPONENTS
- ELECTROCHEMICAL POWER SYSTEMS
- ACOUSTIC SENSORS
- NIGHT VISION/ELECTRO-OPTICS
- MINE COUNTERMEASURES
- RADAR

INSTALLATION ORGANIZATION
ENERGETICS HIGHLIGHTED



- Small Arms

- Pyrotechnics
- Conventional Ammunition

- Microelectronics
- Electrochemical Power Systems

- Electronics Module Test and Repair
- Acoustic Sensors
- Mine Countermeasures

- Electronics Warfare
- Microwave
- Radar
- Night Vision/ Electro-Optics

Highlighted Boxes = Directorates with Energetic Workload

Red Text = Technical Capability

2. **Installation Land Use Map** (Map A) - The diverse electronic and energetic operations at the installation have resulted in management and segregation of the Crane property into distinct areas. The Land Use Map provided in this section identifies ten functional areas of land use co-located at the Crane site. They are:
- Ordnance Engineering, Test, Evaluation, and Development;
- Inert Ordnance Engineering and Maintenance;
- Ordnance Pilot Production;
- Ordnance Full Scale Production;
- Explosive Storage;
- Inert Storage;
- Ordnance Laboratory;
- Ordnance Disposal;
- Small Arms Engineering, Development, Test and Evaluation; and
- Electronic Engineering, Development, Test, Evaluation, and Maintenance functions.

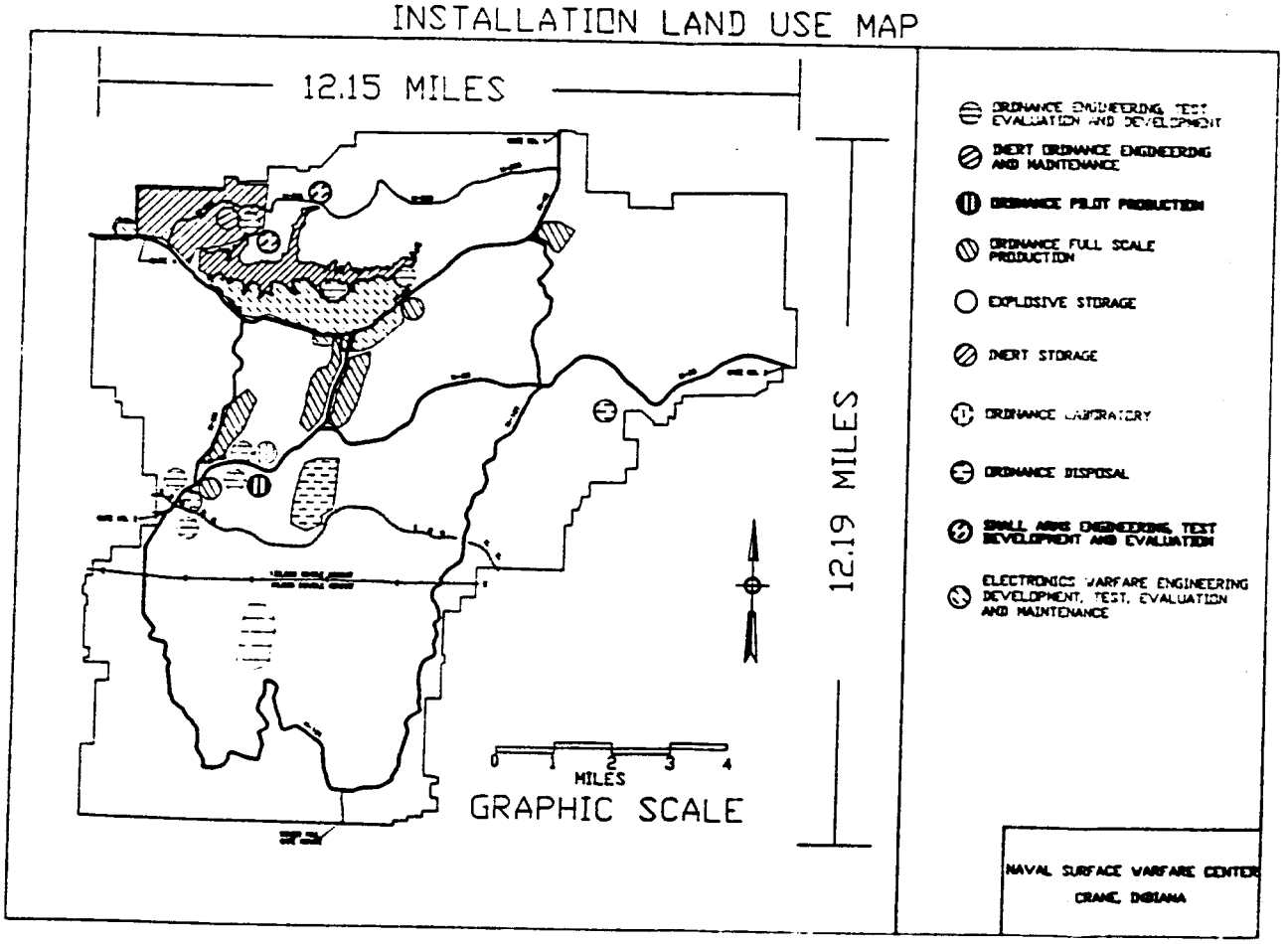
1.B. ORGANIZATIONAL RELATIONSHIPS. The following paragraphs describe the TC's involved in energetics, the CAAA and PMCA activities, and their relationship to each other.

1. **Conventional Ammunition Engineering and Pyrotechnics TC's** - All of the work within the Conventional Ammunition Engineering and Pyrotechnics TC's is classified as energetics. The Crane Division provides total life-cycle support and is the Navy's **recognized expert** in pyrotechnics and in the production and engineering support of surface ship ammunition. These co-located functions, which support surface ship, air launcher and Marine Corps ammunition, provide a synergism and efficiency for overall ammunition management. These TC's are the Naval Sea Systems Command Design Agent for Pyrotechnics and Demolition Devices.

2. **Small Arms TC** - Energetics comprises 26.8 workyears, or 23%, of the 114.8 workyears in the Small Arms TC. This TC, organized within the Gun Weapon Systems Directorate at Crane Division, is the Naval Sea Systems Command Design Agent for small arms ammunition (up to 20mm), mortar ammunition, shoulder fired unguided ordnance, cartridge grenades, hand grenades, and land mines.

3. The **Crane Army Ammunition Activity (CAAA)** is a Joint Service Command which provides ordnance related support (munitions and energetics) to the armed services in several major functional areas under the mission guidance and control of the US AMCCOM. US AMCCOM is the DOD designated Executive Agent and Single Manager for Conventional Ammunition (SMCA).

INSTALLATION LAND USE MAP



MAP A
PAGE 4

NC

2. DETAILED INFORMATION

2.A. FY 93 WORKEARS

2.A.1. The following Table 1 is the total direct workyears at the Crane Site for FY 93.

CRANE SITE TOTAL DIRECT WORKYEARS					
JOB CATEGORY	GOVT WKYRS	FFROC ON-SITE	FFRDC OFF-SITE	CONTRACT ON-SITE	CONTRACT OFF-SITE
S&T	151.6	0.0	0.0	67.4	17.7
Engineering Development	157.1	0.0	0.0	52.4	17.7
Production	102.3	0.0	0.0	14.9	5.1
In-Service Engineering	685.7	0.0	0.0	209.6	50.7
Other:					
Acquisition	1098.0	0.0	0.0	202.1	48.2
Maintenance & Repair	853.2	0.0	0.0	134.6	35.4
Test	19.3	0.0	0.0	0.0	0.0
Life Time Support	216.1	0.0	0.0	67.4	77.7
Training/ Operational Support	4.3	0.0	0.0	0.0	0.0
TOTAL	3287.6	0.0	0.0	748.4	252.5

TABLE 1

Of the total direct workyears portrayed in Table 1, 80% of the work is performed on electronics products in the following areas: Electronic Warfare, Microelectronic Technology, Electronic Module Test and Repair, Microwave Components, Electrochemical Power Systems, Acoustic Sensors, Night Vision/Electro-Optics, Mine Countermeasures and Radar. Energetics comprises 17% of the direct workyears, which includes Pyrotechnics, Conventional Ammunition, and Small Arms Energetics workload; the remaining Small Arms workload represents 3%.

2.A.2. The total direct workyears for the Pyrotechnics Technical Capability are shown in Table 2 below.

PYROTECHNICS DIRECT WORKYEARS					
JOB CATEGORY	GOVT WKYRS	FFRDC ON-SITE	FFRDC OFF-SITE	CONTRACT ON-SITE	CONTRACT OFF-SITE
S&T	13.1	0.0	0.0	0.0	2.0
Engineering Development	20.4	0.0	0.0	0.0	8.0
Production	0.0	0.0	0.0	0.0	0.0
In-Service Engineering	9.4	0.0	0.0	0.0	0.5
Other:					
Acquisition	69.3	0.0	0.0	4.0	13.5
Life Time Support	0.0	0.0	0.0	0.0	0.0
TOTAL	112.2	0.0	0.0	4.0	24.0

TABLE 2

2.A.3. FY 93 workyears for the Conventional Ammunition Technical Capability are shown in the following Table 3.

CONVENTIONAL AMMUNITION DIRECT WORKYEARS					
JOB CATEGORY	GOVT WKYRS	FFRDC ON-SITE	FFRDC OFF-SITE	CONTRACT ON-SITE	CONTRACT OFF-SITE
S&T	1.0	0.0	0.0	0.0	0.0
Engineering Development	16.7	0.0	0.0	2.0	0.6
Production	0.0	0.0	0.0	0.0	0.0
In-Service Engineering	124.6	0.0	0.0	12.5	4.2
Other:					
Acquisition	193.4	0.0	0.0	22.6	7.0
Life Time Support	108.7	0.0	0.0	14.5	77.7
TOTAL	444.4	0.0	0.0	51.6	89.5

TABLE 3

2.A.4. FY 93 workyears for energetics portion of the Small Arms Technical Capability is shown in the following Table 4.

SMALL ARMS AMMUNITION DIRECT WORKYEARS					
JOB CATEGORY	GOVT WKYRS	FFRDC ON-SITE	FFRDC OFF-SITE	CONTRACT ON-SITE	CONTRACT OFF-SITE
S&T	2.3	0.0	0.0	0.0	0.0
Engineering Development	12.7	0.0	0.0	0.0	0.0
Production	11.8	0.0	0.0	2.0	0.0
TOTAL	26.8	0.0	0.0	2.0	0.0

TABLE 4

2.B. OCCUPIED SPACE BY CATEGORY

2.B.1. There is nearly 11 million square feet of government-owned building space on the Crane property. Table 5 is a summary of the total space by category.

CRANE SITE OCCUPIED SPACE

BUILDING TYPE	CATEGORY CODE	TOTAL (KSF)
Operational & Training	100	106.8
Maintenance & Production	200	2,362.2
RDT&E	300	12.9
Supply Facilities	400	7,742.5
Hospital & other Medical	500	15.5
Administrative Facilities	600	213.4
Housing & Community	700	332.2
Utilities & Grounds	800	77.8
TOTAL		10,865.7

TABLE 5

2.B.2 Pyrotechnics and Conventional Ammunition.

The Pyrotechnics and Conventional Ammunition Engineering product lines currently occupy 72 buildings with a total area of 349,000 square feet and valued at over $69 million. There are another 93 structures used for explosive storage and 10 for inert storage. Tables 6 through 11 provide detailed information for the number of square feet of space for the ENERGETIC OPERATIONS at Crane. Table 12 shows the total size and the current plant value for these structures.

FACILITY ASSET INFORMATION
FOR ENERGETIC OPERATIONS AT
CRANE DIVISION, NAVAL SURFACE WARFARE CENTER
OCTOBER 1994

ENGINEERING OFFICE SPACE

BUILDING NO.	FUNCTIONAL AREA (SF)	CURRENT PLANT VALUE ($000)
108	10,167	704
115	2,858	2,221
143	8,743	5,873
180	2,971	1,262
2521	1,296	8,238
2524	18,400	3,489
2540	29,483	3,189
2807	620	110
2932	3,776	59
2935	3,548	207
3031	23,976	750
3212	5,150	183
3217	3,500	196
TOTAL	114,488	TOTAL 26,481

TABLE 6

ORDNANCE LABORATORY SPACE

BUILDING NO.	FUNCTIONAL AREA (SF)	CURRENT PLANT VALUE ($000)
2707	9,062	809
2947	2,275	209
TOTAL	11,337	TOTAL 1,018

TABLE 7

ORDNANCE TEST AND EVALUATION SPACE

BUILDING NO.	FUNCTIONAL AREA (SF)	CURRENT PLANT VALUE ($000)
34	900	3,957
100	403	33
109	10,167	573
142	18,179	1,790
143	14,553	5,873
190	2,478	466
363	10,167	780
364	10,661	562
365	10,167	556
366	10,167	628
1441	2,106	120
2084	10,167	503
2125	378	68
2390	5,356	222
2507	1,889	749
2508	1,889	177
2510	1,391	345
2521	4,825	8,238
2547	783	441
2551	117	33
2670	324	71
2797	960	34
2805	19,714	2,537
2806	1,024	143
2807	619	110
2837	144	51
2869	1,733	346
2870	486	80
2888	144	16
2898	1,588	181
2911	1,928	235
2921	5,933	574
2923	960	91
2925	126	21
2945	960	47
2951	2,040	160
2963	960	31
2964	7,744	632
2986	1,040	115
2987	6,087	1,020
2989	140	12
2995	1,040	283
3007	2,048	64
3054	2,048	221
3087	900	369
3108	460	42
3115	2,120	147

ORDNANCE TEST AND EVALUATION SPACE - CONTINUED

BUILDING NO.	FUNCTIONAL AREA (SF)	CURRENT PLANT VALUE ($000)
3165	768	36
3176	256	9
3223	3,000	194
3227	5,000	166
3233	672	124
3254	840	190
3255	1,748	700
3256	961	370
3259	5,000	220
TOTAL	198,258	TOTAL 35,756

TABLE 8

ORDNANCE PILOT PRODUCTION SPACE

BUILDING NO.		FUNCTIONAL AREA (SF)		CURRENT PLANT VALUE ($000)
198		24,686		6,123
	TOTAL	24,686	TOTAL	6,123

TABLE 9

EXPLOSIVE STORAGE SPACE

BUILDING NO.	FUNCTIONAL AREA (SF)	CURRENT PLANT VALUE ($000)
99	403	33
299	5,356	312
438	5,356	312
557	5,356	312
583	10,167	427
611	2,106	119
612	2,106	117
621	573	42
623	573	40
625	573	39
627	573	39
629	573	40
630	573	40
633	573	39
634	573	40
638	573	40
641	573	39
645	573	40
653	573	40
660	573	39
664	2,106	109
682	2,106	109
683	2,106	109
684	2,106	109
685	2,106	109
856	1,886	231
857	2,106	110
864	2,106	109
881	2,106	109
921	1,886	229
943	2,106	109
964	2,106	109
973	2,106	109
1019	2,106	110
1029	2,106	110
1041	2,106	110
1043	2,106	109
1044	2,106	109
1045	2,106	109
1140	2,106	109
1144	2,106	109
1150	2,106	109
1162	573	39
1163	573	39
1172	573	37
1184	573	37
1185	573	37

EXPLOSIVE STORAGE SPACE-CONTINUED

BUILDING NO.	FUNCTIONAL AREA (SF)	CURRENT PLANT VALUE ($000)
1192	573	37
1193	573	37
1195	573	37
1350	2,106	109
1356	2,106	109
1421	2,106	109
1750	2,106	104
1752	2,106	104
1759	2,106	104
1964	611	42
1965	611	42
1967	611	42
1974	611	42
1983	611	53
1984	611	62
2202	5,356	312
2208	5,356	312
2210	5,356	312
2265	5,356	312
2266	5,356	312
2370	5,356	222
2379	5,356	222
2380	5,356	222
2381	5,356	222
2382	5,356	235
2383	5,356	222
2384	5,356	222
2385	5,356	222
2386	5,356	222
2389	5,356	222
2407	5,356	222
2412	5,356	222
2414	5,356	222
2415	5,356	222
2417	5,356	222
2418	5,356	222
2419	5,356	222
3071	45	20
3075	45	15
3076	45	15
3077	45	15
3078	45	18
3079	45	18
3080	45	18
3081	45	18
3082	45	12
TOTAL	223,314	TOTAL 11,511

TABLE 10

Document Separator

INERT STORAGE SPACE

BUILDING NO.	FUNCTIONAL AREA (SF)	CURRENT PLANT VALUE ($000)
185	178	12
186	178	12
472	7,625	427
2082	10,167	300
2509	178	13
2663	63	19
2849	144	7
2897	1,156	25
3107	1,000	23
3109	441	42
TOTAL	21,130	TOTAL 880

TABLE 11

FACILITY TYPE	# BUILDINGS	SQ FT	VALUE ($K)
ENGINEERING OFFICE	13	114,488	26,481
LABORATORY	2	11,337	1,018
ORDNANCE PILOT PRODUCTION	1	24,686	6,123
ORDNANCE T&E	56	198,258	35,756
EXPLOSIVE STORAGE	93	223,314	11,511
INERT STORAGE	10	21,130	880
TOTAL	175	593,213	81,769

TABLE 12

2.C. FY 93 FUNDS

2.C.1. Table 13 below lists the total FY 93 funds by customer for the Crane Site of the Naval Surface Warfare Center, Crane Division.

CRANE SITE TOTAL FY 93 FUNDS ($K)	
CUSTOMER	FUNDS
NAVSEA	$255,777
NAVAIR	$41,612
SPO	$20,433
SPC	$10,463
SPW	$4,107
FAC	$819
CCA	$435
CCP	$290
ARMY	$29,408
USMC	$27,287
NUWC	$152
DOD	$2,779
OTHER GOVT	$3,894
OTHER	$1,756
OTHER NAVY	$74,617
NSWC	$15,604
NAWC	$3,016
DAF	$8,408
TOTAL	$500,857

TABLE 13

The main Crane Site programs (Product Areas and Product Area Elements) are:

Surface Ship Combat Systems
- Air & Surface Surveillance and Detection Systems
- Combat Control Systems
- Engagement Systems
- Electronic Warfare Systems
- Theater Air Defense Systems

Littoral Warfare Systems
- Special Warfare Systems

Navy Strategic Weapon Systems
- Targeting, Navigation, Fire Control, Missile and Launcher Subsystems

Ordnance
- Mines, Warheads, Rockets and Ammunition
- Energetic Chemicals, Pyrotechnics, Propellants, and Explosives

2.C.2. Pyrotechnics and Conventional Ammunition. Total funding for FY 93 was $18.4M for Pyrotechnics and $69.7M for Conventional Ammunition. The Business Base for Pyrotechnics is summarized on Table 14 and for Conventional Ammunition Engineering on Table 15.

Major work efforts included:

PYROTECHNICS (MARKERS, SIGNALS, SMOKES)
COUNTERMEASURES (IR DECOYS, OFF-BOARD COUNTERMEASURES)
SPECIAL PURPOSE MUNITIONS/SPECIAL WARFARE
CONVENTIONAL AMMUNITION LOGISTICS
CONVENTIONAL AMMUNITION ENGINEERING
DEMILITARIZATION/DISPOSAL
MARINE CORPS SUPPORT (MISSILES, COMMAND & CONTROL)
ORDNANCE EVALUATION (PYROTECHNICS, EXPLOSIVES, FUZES)

Major sponsors included:

NAVAL SEA SYSTEMS COMMAND
NAVAL AIR SYSTEMS COMMAND
MARINE CORPS
NAVAL RESEARCH LABORATORY
SPECIAL OPERATIONS COMMAND
AIR FORCE
ARMY
OTHER NAVY
- Indian Head
- Dahlgren
- China Lake
- Point Mugu
- Warminster

PRIVATE INDUSTRY
FEDERAL BUREAU OF INVESTIGATION
DEFENSE INTELLIGENCE AGENCY
COAST GUARD

2.C.3. Small Arms Technical Capability.

Total FY 93 funding was $2.2M.

Major sponsors included:

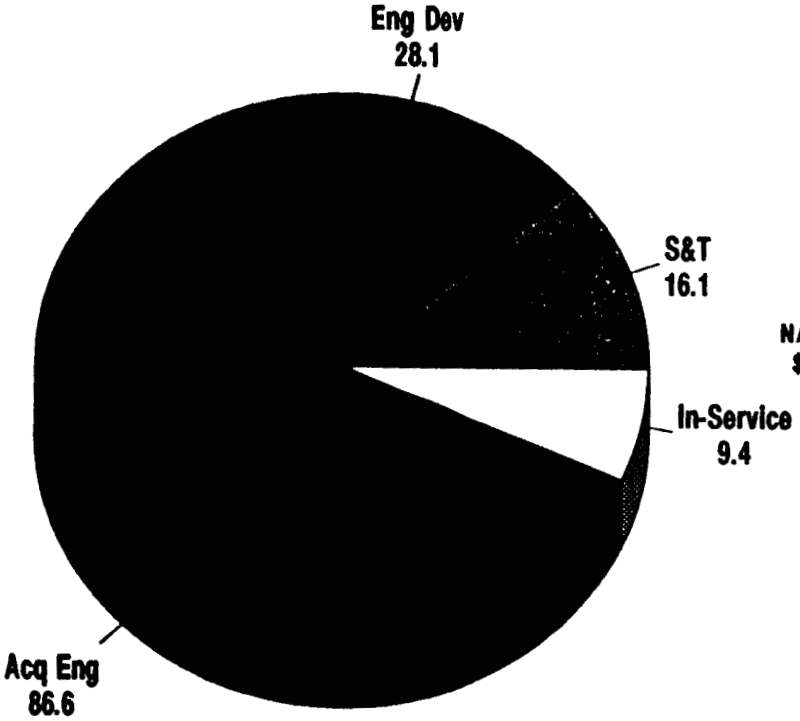
NAVAL SEA SYSTEMS COMMAND
NAVAL AIR SYSTEMS COMMAND
MARINE CORPS
ARMY

Major programs include:

NAVY DESIGN AGENT FOR:
- SMALL ARMS AMMUNITION (UP TO 20MM)
- MORTAR-AMMUNITION
- SHOULDER FIRED UNGUIDED ORDNANCE
- CARTRIDGE GRENADES
- HAND GRENDADES
- LAND MINES

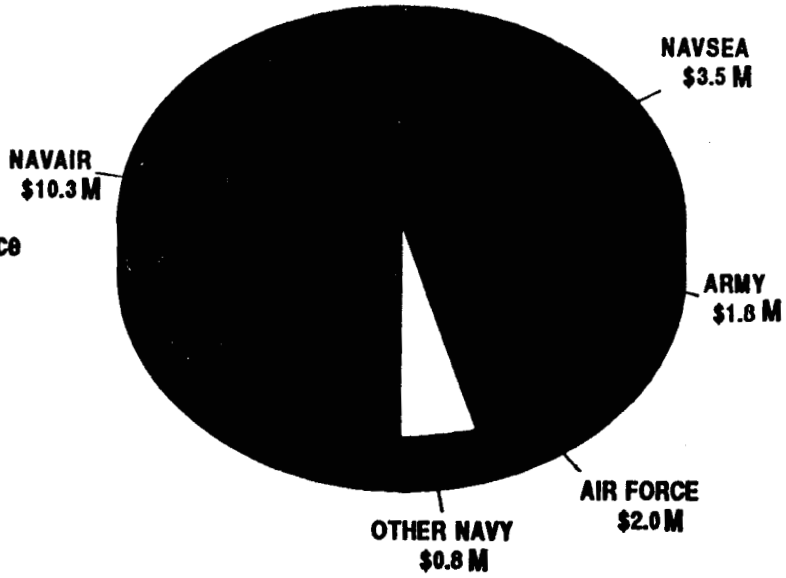
PYROTECHNICS - BUSINESS BASE

Workyears by Job Category



Total = 140.2 WY
(Includes 28 Contractor WY)

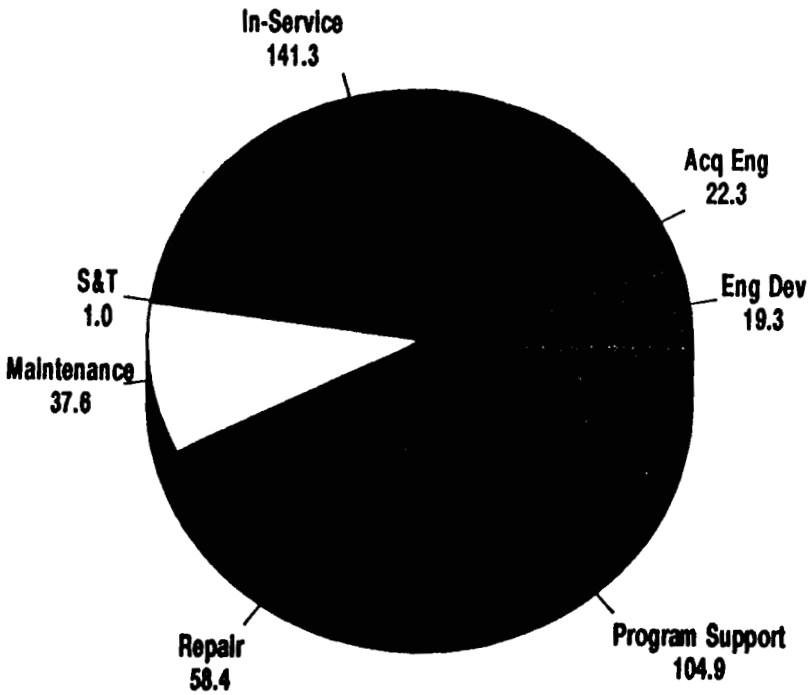
Dollars by Customer



Total = $18.4M

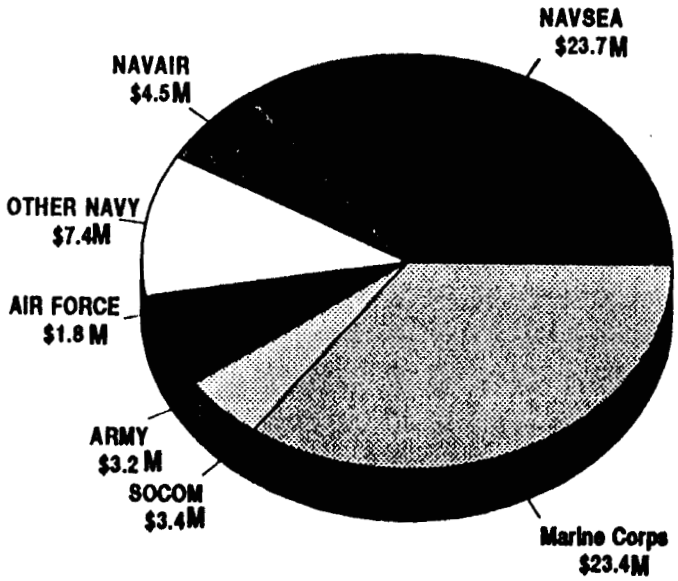
CONVENTIONAL AMMUNITION - BUSINESS BASE

Workyears by Job Category



Total = 585.5 WY
(Includes 141.1 Contractor WY)

Dollars by Customer



Total = $69.7M

3. NARRATIVE DESCRIPTIONS

3.A. Conventional Ammunition Engineering and Pyrotechnics. The Conventional Ammunition Engineering and Pyrotechnics product lines provide total life-cycle support including program management, design and development, test and evaluation, product improvement, acquisition and production support, quality evaluation, fleet support, and demilitarization and disposal for Naval Sea Systems Command, Naval Air Systems Command and Marine Corps conventional ammunition and pyrotechnics. **The Crane Division is the Navy's recognized expert in pyrotechnics and in the production and engineering support of surface ship ammunition. This recognition comes from demonstrated experience for the past thirty-five years in the development, engineering, and production of conventional ammunition and demolition devices and the research, design, development, engineering and production of pyrotechnics.**

3.A.1. Pyrotechnics. Table 1 indicates the major products provided for each of the four Services by product line.

3.A.2. Conventional Ammunition Engineering. The major products provided by the Conventional Ammunition Engineering Technical Capability are identified in Table 2.

PYROTECHNICS MAJOR PRODUCTS

PRODUCT LINE	NAVY	AIR FORCE	ARMY	SOCOM
Countermeasures	ST, ED, TE, AE, IS	ST, ED, TE	ED, TE	TE,AE
Colored Smoke/Flares	ED, TE, AE, IS	*	TE	TE, AE, IS
Illuminating Flares	ED, TE,AE, IS	*	TE	TE, AE,IS
Obscurants/Markers	ED, TE, AE, IS	*	ED,TE	*
Submarine Signals	ED,TE,AE,IS	No Rqmt	No Rqmt	No Rqmt
Target Flares	ED,TE, AE,IS	*	ED,TE, AE	*

* = Capability Exists but no Current Work

ST = Science & Technology
ED = Engineering Development
AE = Acquisition Engineering
IS = In Service Engineering (includes demil/disposal)
TE = Test & Evaluation

TABLE 1

CONVENTIONAL AMMUNITION MAJOR PRODUCTS

PRODUCT LINE	NAVY	AIR FORCE	ARMY	SOCOM	OTHER **
Major Caliber Gun Ammunition	PM, TE, AE,IS	No Rqmt	No Rqmt	No Rqmt	TE, AE, IS
Demolition Devices	PM,ED,TE, AE,IS	TE	TE	ED, TE, AE,IS	TE, AE, IS
Other Ammunition	PM,ED,TE, AE,IS	TE	TE	ED,TE, AE,IS	TE, AE, IS

* = Capability Exists but No Current Work

** = Coast Guard/FMS

ST = Science & Technology
ED = Engineering Development
AE = Acquisition Engineering
IS = In Service Engineering (includes demil/disposal)
TE = Test & Evaluation

MANPOWER & INTELLECTUAL/SKILLS CAPABILITIES

This total life cycle engineering support requires a knowledgeable technical staff of engineers, scientists, logisticians, and technicians. The experienced technical staff supporting the conventional ammunition engineering and pyrotechnics product lines totals 454 personnel and includes mechanical, industrial, aerospace, electronics and chemical engineers, chemists, physicists, safety and logistics specialists and a variety of technicians with experience in the design, manufacture and testing of conventional ammunition ordnance items. This technical staff is supported by an additional 62 administrative personnel. The skills mix is shown in Tables 3, 4 and 5.

TOTAL ORDNANCE PERSONNEL = 516 (includes 62 Admin personnel)

Engineers	Scientists	Technicians	Admin/Other Prof	Skilled Labor
29%	8%	32%	20%	11%

TABLE 3

PYROTECHNICS TECHNICAL PERSONNEL = 103

Engineers	Scientists	Technicians	Admin/Other Prof	Skilled Labor
33%	14%	33%	3%	17%

TABLE 4

CONVENTIONAL AMMUNITION ENGINEERING TECHNICAL PERSONNEL = 351

Engineers	Scientists	Technicians	Admin/Other Prof	Skilled Labor
33%	8%	36%	12%	11%

TABLE 5

The formal educational level of the staff includes 8 Ph.D.s, 38 Master's, 171 Bachelor's and 38 Associate degrees. The Pyrotechnics product line has 6 Ph.D's, 10 Master's, 36 Bachelor's and 8 Associate degreed personnel. The Conventional Ammunition product line has 2 Ph.D.'s, 28 Master's, 135 Bachelor's and 30 Associate degreed personnel.

The skills and knowledge required to develop and manufacture safe and reliable pyrotechnics and ordnance items cannot be obtained through an academic course of study. In addition to an understanding of the basic science and engineering involved in developing pyrotechnics and conventional ammunition ordnance items, experience and knowledge are required in the analysis of the end use effectiveness, safe manufacture, producibility, and testing of these items. **Basic scientific and engineering skills must be supplemented with hands-on work experience in the ordnance area.** This on-the-job training, coupled with the limited formal course work available, requires five to seven years working in the area to develop the required skill levels.

As shown on Table 6, **there are over 8500 workyears of pyrotechnics and ordnance related experience at Crane. Crane Division's professional and technical workforce averages almost 19 years of ordnance related experience per person.**

NUMBER OF PERSONNEL BY DISCIPLINE AND YEARS OF EXPERIENCE

YEARS OF ORDNANCE EXPERIENCE	1-5	5-10	10-20	20+
IND/MECH/AERO ENGINEERS (97)	4	23	28	42
ELECTRONICS ENGINEERS (32)	2	12	4	14
CHEMICAL ENGINEERS (20)	1	8	3	8
CHEMISTS/PHYSICISTS (18)	2	3	5	8
ENGR/MECH/IND TECHNICIANS (121)	1	16	32	72
ELECTRONICS TECHNICIANS (42)	4	8	17	13
MATH STAT/OPS RES ANALYSTS (24)	1	6	7	10
LOG MNGT/PROG ANALYST (45)	0	6	17	22
EXPLOSIVE OPERATORS (55)	2	5	23	25
TOTALS (454)	**17**	**87**	**136**	**214**

TABLE 6

Crane scientists and engineers are recognized nationally and internationally throughout defense establishments and the private sector as experts in the design, development and production of pyrotechnics and in the testing and analysis of the effectiveness of infrared pyrotechnics against a variety of domestic and foreign missile seekers.

Ammunition production, handling and usage provide many opportunities for catastrophic safety related incidents. A major turnover of personnel in this unique field would undoubtedly carry a high probability for increased occurrences of undesirable incidents. The maintenance of product expertise is the only means available to assure safe, reliable and effective ammunition to satisfy Fleet requirements.

Major portions of the conventional ammunition and pyrotechnics product lines are inherently governmental in nature and must be maintained by the Navy. Acquisition program management, engineering support for acquisition and production engineering **must be done as a government function.** The Crane Division is physically located within 750 miles of seventy five percent of the ammunition/end item production and within 500 miles of thirty eight percent. This close proximity allows Crane production engineers to provide almost same day response to resolve on-site production related problems.

FACILITIES & EQUIPMENT:

All ammunition/ordnance work at Crane is performed in government owned facilities. The facility assets comprise 72 engineering, operating and test buildings with a total of 349,000 square feet and a current plant value of $69 million. Specialized equipment investments total $33.9 million. Additionally there are 93 explosive storage magazines (including CAT I & II) with 223,000 square feet of space. Crane has 88 acres of unencumbered ordnance testing area with access to another 120 acres for ordnance disposal and reclamation efforts co-located with the Crane Army Ammunition Activity (CAAA). MILCON investments during the past five years total $11.2 M.

It would be extremely difficult to replicate or relocate these facilities at another location. These facilities are located in areas that allow production, testing and storage of ammunition within accepted quantity-distance arcs for the safe use of ammunition. The remote location of test areas provides the ability to do all-up round testing within State and Federal guidelines. **The Division's unencumbered location with no encroachment considerations provides the ideal place to develop and test pyrotechnic and ordnance items both now and in the future.**

Table 7 below provides information on Crane Division and Crane Army Ammunition Activity facilities.

	CRANE DIVISION FACILITIES			CAAA FACILITIES		
TYPE FACILITY	NO. BLDGS	SPACE (K SQ FT)	PLANT VALUE ($M)	NO. BLDGS	SPACE (K SQ FT)	PLANT VALUE ($M)
Engring	11	95.3	18.1	2	73	8
Ord Oper*	53	216.7	33.6	158	713	126
Ord Storage	87	208.7	10.8	1552	4703	262
Inert Storage	10	21.1	0.9	199	1764	69
TOTAL	161	541.8	63.4	1911	7253	465

*Includes Production, Testing, Maintenance & Repair

TABLE 7

FACILITY DESCRIPTIONS

The **Conventional Ammunition Engineering and Pyrotechnics** product lines are supported by a variety of specialized facilities that are essential to the design, development, production and testing of pyrotechnics and conventional ammunition. These facilities are fully operational and are designed to meet future projected needs.

The Automated Infrared Test Facility is used for first article, lot acceptance, quality evaluation and qualification testing of infrared decoy flares. **This unique state-of-the-art facility is not duplicated anywhere in the United States and is the accepted Navy standard for acceptance and first article testing.** The facility is contained in a specially modified 10000 square foot building and consists of a chamber capable of burning decoy flares up to 1000 grams, a 70 meter radiometric tunnel with an environmentally controlled measurement room and several support rooms adjacent to the tunnel. The test facility has the capability to provide adjustable air velocity versus time profiles to simulate the launch of decoy flares from a moving aircraft. The profiles can be controlled such that air flow across either free fall devices or rocket powered devices can be simulated.

The **Transient Velocity Windstream Facility** is a free jet expansion windstream apparatus designed to provide adjustable air velocity versus time profiles to simulate the launch of decoy flares from a moving aircraft. The outdoor apparatus consists of several air compressors, a bank of air storage tanks, a computer controlled valve to control air flow and a nozzle and can produce air flows from 0.1 to 0.9 Mach at either a constant velocity or, under computer control, a variable velocity versus time profile to simulate the observed velocity versus time behavior experienced by a decoy flare when ejected from an aircraft. Radiant and spectral radiant intensity are measured at distances of 30, 80 and 500 meters and at angles from 10 - 300 degrees around the device. **This combination of space, facilities and measurement equipment is unique in the United States and is used by all of DOD and several private contractors to assess the performance of decoy flares and concepts in a test apparatus that is much less expensive to operate than an actual air-to-air test.**

The **Ordnance Prototype Manufacturing Facility** is contained in four buildings and occupies 28000 square feet. It is used for the development of prototype models of new designs and product improvements of pyrotechnic devices and explosive components. Mixing, blending and consolidation equipment allows the development and production of a large .ange of pyrotechnic compositions for infrared, colored and illuminating flares, colored smokes and other devices. **Virtually any pyrotechnic composition in the DOD inventory can be manufactured in this facility.**

Crane Division provides test ranges and facilities for first article, lot acceptance, surveillance, qualification and safety testing of pyrotechnic, demolition and conventional ammunition items at the **Ordnance Test Area**. The test areas have a total of 88 unencumbered acres and are supported by eleven buildings (5600 square feet). In addition to normal function testing the ranges also support Insensitive Munitions Testing on All-Up-Rounds (pyrotechnic, demolition and conventional ammunition) including Fast and Slow Cookoff, Bullet Impact and Sympathetic Detonation. This facility also supports the Crane Army Ammunition Activity.

The **Ordnance Material Characterization Laboratory** provides chemical and metallurgical laboratories for performing failure evaluations, thermal characterization analyses, physical and chemical properties of materials and materials selection/compatibility of explosives, propellants, pyrotechnics, metals, polymers, ceramics, adhesives, coatings and compositions. Accelerated aging studies of ordnance materials complete with temperature controlled environments for isothermal studies as well as temperature cycling studies are provided in an ordnance qualified facility. In addition to the normal quality evaluation and safety tests of ordnance materials such as impact, friction and electrostatic sensitivity, vacuum and thermal stability, self-heating and ignition the Division operates a complete thermal characterization laboratory. This facility also supports the Crane Army Ammunition Activity and the Public Works Directorate.

In the **Ordnance Environmental Test Facility** the Crane Division provides environmental testing of ordnance items for the three Services. In these facilities the design, selection and procurement of test equipment and facilities have been made with the test and evaluation of explosive and other hazardous materials in mind. Environmental test facilities and equipment are available to do vibration, shock, temperature, humidity, altitude, jolt, jumble, sunshine and rain, sand and dust, and salt spray. Environmental test facilities are contained in four buildings with 20,000 square feet. This facility also supports the Crane Army Ammunition Activity.

The **Ordnance Radiographic Facility** provides radiographic testing of ordnance items for the three Services. Radiographic inspection capabilities include both real time and conventional X-ray. A special high bay exposure room with a high energy accelerator is available for radiographic inspection of very large items, e.g. 2,000 pound bombs, that can be brought in on trucks/trailers and X-rayed without unloading. The radiographic facilities are in two buildings with 7,100 square feet. This facility also supports the Crane Army Ammunition Activity.

The **Demilitarization Evaluation Facility** is a recently completed facility that allows for remote disassembly of various ordnance devices up to 500 lbs. The facility has the capability of pilot operations for the demilitarization of conventional and hazardous ordnance items. The facility's design is such that all waste is contained and disposed of without escaping to the environment.

The **Ordnance Components Test Facility** provides lot acceptance and surveillance testing of numerous ordnance components and sub-assemblies as well as small explosives devices. The facility has test cells which provide capability for controlled and monitored function testing of components. Test cells are also equipped with capability for remote breakdown and dissection of ordnance components for failure analysis. Ordnance items tested in the facilities include demolition devices, fuzes, linear explosives, detonators and offboard countermeasures.

Fleet Ballistic Missile, Ordnance Components Test Facility provides support to the Fleet Ballistic Missile Strategic Weapons System ordnance evaluation programs throughout the life cycle of the Trident I and II Missiles. This is accomplished through the design manufacture of ordnance test systems and the test and evaluation of missile ordnance components utilized in the Launch, Missile Body and Reentry Systems. This facility is unique in respect to its design, construction and safety site approval which allows ordnance components and assemblies to be destructively tested safely. This building allows explosive operations and still meets the quantity-distance requirements of NAVSEA OP-5.

The **Missile Fuze Test Facility** provides for testing a wide variety of missile fuzing components (warhead section components). Equipment used includes centrifuge, burn rate/velocity tester, active optical test ranges, leak detectors and many specialized pieces of equipment. This test equipment supports production acceptance, surveillance, and maintenance of these fuzing components. Approximately 25 missiles are supported including STANDARD, TOMAHAWK and SIDEWINDER. This effort supports the Navy as well as joint programs with the Air Force, Army, Foreign Military Sales and private parties.

The **Proximity Fuze Free Space Facility** (10,000 ft reflectivity plane) is the **certified Navy Standard** used to establish the electronic values of Radio Frequency Fuze Standard Monitors. These Standard Monitors are used for correlation of systems used in production and testing of Proximity Fuzes by both the private and public sectors. Radio Frequency Proximity Fuzes are used on all the major caliber ammunition in the Navy stockpile.

Missile Maintenance Facility performs intermediate level maintenance on STINGER air defense missiles and TOW and DRAGON anti-armor missiles. Engineering support services are available for test equipment and test fixture design, maintenance line layout and missile configuration monitoring and control. The larger of two facilities is a 19,000 square foot reinforced concrete multi-bay structure designed to minimize personnel injuries and capability loss in the event of an explosive incident. A second smaller facility is a 5,000 square foot earth covered structure designed to allow performance of minor maintenance and double as a shipping and receiving facility. Both structures are protected by static and ordnance grounding systems and lightning protection systems. Both facilities are DOD safety site approved and with no explosive operating waivers or exemptions.

Marine/Corps Weapons Command and Control Systems Development and Production performs prototype development and low rate initial production of Command and Control electronics shelters. Engineering support services available for systems integration and configuration control. Three separate facilities comprise the prototype complex. A 5,000 square foot facility is used for subsystem assembly and checkout. Two 4,000 square foot facilities are used for complete system assembly and checkout. All three facilities are pre-engineered steel structures. No special equipment or utilities are required.

Missile Storage Facilities perform storage of preposition war reserve Navy and Marine Corps Stinger Missiles and Marine Corps Tow and Dragon Missiles. Perform receipt, storage, and issue of training missiles for the Marine Corps. Urgent missile delivery capability to operational areas worldwide is provided via Wright Patterson Air Force Base, Dayton, Ohio. Total storage space for Risk Category 1 arms, ammunition and explosives (AA&E) is 45,000 square feet. Total storage space for Risk Category 2 AA&E is 50,000 square feet.

Ordnance Ready Magazine Storage provides ordnance receiving, shipping and storage for the various programs of the two product lines. The facilities are used to receive a wide variety of ammunition and explosives, After receipt, the ordnance is either forwarded immediately to the user or placed in storage magazines temporarily until ready for evaluation. Total number of magazines is 37 with 57,400 square feet of storage space.

Major facilities are summzarized in Table 8.

MAJOR FACILITIES

Facility	Sq Ft	CPV Bldg $ M	ACE Eqpt $ M
Automated Infrared Test Facility *	10,167	0.6	2.4
Transient Velocity Windstream	900	0.4	0.4
Ordnance Prototype Manufacture *	27,966	6.3	3.8
Ordnance Test Area * (88 Acres)	7,796	4.2	1.2
Ordnance Enviro & Radiographic *	28,782	12.7	7.6
Ord Material Characterization *	8,666	3.9	3.5
Demil Evaluation Facility *	4,480	3.0	3.0
Ordnance Components Test	28,346	2.4	1.7
FBM Ordnance Components Test	23,296	5.9	8.8
Missile Fuze Test	20,334	1.3	9.7
Missile Maintenance	26,094	2.9	3.1
Marine Corps Command & Control	13,150	0.5	0.0
TOTAL	199,977	44.1	45.2

* Dual Use with Pyro CAAA or Conventional Ammunition

PYROTECHNICS AND CONVENTIONAL AMMUNITION SPECIALIZED EQUIPMENT

Materials Sensitivity Analysis
- Impact
- Friction
- Electrostatic
- Vacuum Thermal Stability
- Henken Self Heating

Thermal Characterization
- Microcalorimeters
- Differential Scanning Calorimetry
- Thermal Gravimetric Analysis
- Adiabatic Calorimetry
- Thermal Conductivity

Materials Composition & Physical Analysis
- High Performance Liquid Chromatography
- Gas Chromatography/Mass Spectrometry
- UV/Vis/IR/AA Spectroscopy
- X-Ray Diffraction
- Scanning Electron Microscopy

Countermeasure Flare Analysis
- Optical Multichannel Analyzer (visible & IR)
- Calibrated Thermal Imager
- Fourier Tranform IR Spectormeter
- Circular Variable Filter Spectrometer
- Missile Seeker Measurement Facility (9 seekers)
- Mobile IR Measurement Van & Tracking Mount
- Four Channel IR Radiometer
- MOSIAC, DISAMS, ESAMS Computer Models

Environmental & Radiographic Test
- Vibration
- Shock
- Temperature, Humidity & Altitude
- Sunshine & Rain
- Salt Spray
- Jolt & Jumble
- Real Time X-Ray (70-160 kv)
- Mid-energy X-Ray (80-420 kv)
- High Energy Accelerator (up to 10 mev)
- High Bay facility

Missile Fuze Test Consoles

Missile Fuze Test Chambers

3.B. Small Arms Technical Capability. The Small Arms Technical Capability (TC), located in the Gun Weapon Systems Directorate at Crane Division, is the Naval Sea Systems Command Design Agent for small arms ammunition (up to 20mm), mortar ammunition, shoulder fired unguided ordnance, cartridge grenades, hand grenades, and land mines.

As the Design Agent, this TC performs test and evaluation, design and development, performance specification development, Technical Data Package development (specification and drawings), acquisition, limited production (in-house), production support, first article and lot acceptance testing, and malfunction investigation of the above ordnance items.

In addition to the above Design Agent assignment, this TC is assigned as the Technical Direction Agent, Acquisition Engineering Agent and In-Service Engineering Agent for similar ammunition items under a classified program in support of the NAVSEA Naval Special Warfare Program Office. This TC has also provided Research and Development services for ammunition to the Joint Service Small Arms Program (JSSAP), the USMC Ground Weapons Office, and US Army Small Arms Program Office, and has provided acquisition support to the USMC Ammunition Acquisition Office, and the USAF Ammunition Logistics Division.

Energetics comprises 27.3 workyears, or 23%, of the total workload of the Small Arms Technical Capability. The remaining 87.5 workyears are dedicated to the comprehensive life cycle support of small arms weapons and mounts, including design, development, acquisition, engineering, T&E, logistics management and maintenance functions. While this work falls outside of the categories of energetics or electronics, the unique synergy created through the integration of workload supporting small arms weapons, mounts and ammunition (energetics) provides the Navy with unmatched technical knowledge and capabilities in the area of small arms weaponry, and enhances a systems approach to meeting the needs of DOD.

MANPOWER & INTELLECTUAL/SKILLS CAPABILITIES

To support the above activities, the energetics work within this TC is manned by eight engineers and one mathematician/statistician (with baccalaureate degrees), eight mechanical engineering technicians (some with associate or baccalaureate degrees; others with significant military ordnance experience), one equipment specialist (ordnance), one program analyst (with public management certificate) and several engineering co-op students. Over 210 work-years of total experience with small arms ammunition and ordnance exist in the area of energetics.

These personnel are skilled in ammunition design engineering, ballistic analysis, test and evaluation, acquisition support and field analysis. This is in conjunction with over 1000 workyears of experience in small arms weapons and mounts which comprises the remainder of this Technical Capability and which forms a complete system oriented organization sharing resources and facilities.

FACILITIES & EQUIPMENT

Energetics programs utilize three ranges located within the Small Arms Technical Capability (100-meter underground range, 10-meter indoor range, and 1000-yard outdoor range), as well as the Outdoor Test Area operated by the Conventional Ammunition TC, and other government/contractor ranges.

A total of 16,000 square feet of magazine storage space is maintained as well as a 120 square foot ammunition loading room.

Specialized loading equipment utilized by energetics programs includes electronic and mechanical powder scales, precision dies, and single stage and multiple stage loading presses.

Specialized test equipment (which is shared with weapon and mount programs within the TC) includes Doppler Radar and Analyzer, Impulse Photometer, Ballistic Computers, Velocity Chronographs, Flash X-ray, Electronic Targeting Systems, Temperature Conditioning Equipment, Digital Oscilloscopes, Electronic Pressure Transducers, and over 350 each ammunition test barrels.

3.C. CRANE ARMY AMMUNITION ACTIVITY. Crane Army Ammunition Activity (CAAA) is a Joint Service Command which provides ordnance related support (munitions and energetics) to the armed services for DoD wholesale energetics and munitions load, assemble and pack (LAP) operations, manufacture and production, renovation and maintenance, storage, distribution, and demilitarization of: Naval gun ammunition; pyrotechnics; bombs; and propellant charges. The Activity is also designated as a Tier 1 Depot for munitions and energetics storage and distribution. As a Tier 1 Depot, CAAA provides routine and special purpose training munitions support as well as required short notice ordnance support to first strike forces of all services and pre-position ships, as well as war reserve munitions support during and beyond the first 30 days of multi-regional contingency support operations. The functions are conducted under the mission guidance and control of the US AMCCOM, the DoD designated Executive Agent and Single Manager for Conventional Ammunition.

MANPOWER & INTELLECTUAL/SKILLS CAPABILITIES

CAAA is supported by an knowledgeable staff of engineers, scientists, technicians and explosive ordnance workers experienced in ordnance manufacturing operations. The staff is 11% engineers and scientists, 82% skilled labor and 7% administrative personnel.

FACILITIES AND EQUIPMENT

CAAA has the demonstrated capability, facilities and equipment to perform the following energetics manufacturing functions:

CAST LOAD

Lines have total melt-pour capacity of 64,640 pounds per hour utilizing 12-160 gallon kettles, 2-180 gallon kettles, and 12-300 gallon kettles. Compositions such as HBX, H-6, Tritonol, Composition B, TNT, Minol and Octol are used in the casting of Low Drag Bombs, Naval Mines, Shock Test Charges, Demolition Charges, Rocket Warheads, Underwater Sound Signals and Cluster Bombs. Three Plants (Rockeye, Mine Fill A and Mine Fill B) have cast capability with total manufacturing area of 171,573 square feet.

PRESS LOAD

Forty two presses ranging from 6 to 500 tons are available in seven different locations to press tetryl, Composition A-3 and Plastic Bonded Explosives. Capabilities include 3", 76mm and 5" conventional projectiles as well as 165mm thin wall projectiles. The Press Loading Facility is the major facility at CAAA with 23,462 square feet of manufacturing area.

PYROTECHNICS

Typical pyrotechnic items produced are smoke, colored and illuminating flares, illuminating projectiles, marking devices, IR decoy flares. Capabilities also exist for extrusion of IR grains. The pyrotechnic plant consists of 52,086 square feet of manufacturing area and 15,294 square feet of support buildings. Equipment includes pulverizing machines, drying ovens, sand mullers, barrel tumblers as well as previously mentioned presses.

ACTUATING DEVICES

Two production plants with 30,094 square feet of manufacturing area make up the Explosive Actuating Device Area. Actuating devices such as detonators, squibs, boosters, bursters, cartridge actuating devices, primers, leads, relays, delays and electrically initiated components can be loaded. Explosives used in these lines include lead azide, tetryl, CH-6, black powder, and other highly sensitive initiating explosives. This area is also used for the production of the Mk 56 Sheet Charges and the Mk 57 Kit and the pressing of pellets for various items.

ORDNANCE DEMILITARIZATION

Ammunition Burning Grounds (ABG) - This approved and permitted open burning site includes:

(1) 18 clay-lined steel burning pans.

(2) 7 unlined steel burning pans.

(3) 3 explosive sludge dewatering units.

(4) 2 primer burning pits.

(5) Daily capacity of 54,000 pounds of smokeless powder or 9,000 pounds of high explosives.

(6) Capable of disposing small arms, pyrotechnic items, explosive contaminated material.

(7) At an alternate site - 3 large pads (clay and gravel lined for flashing trace contaminated projectiles), 3 clay-lined steel pans.

Open Detonation - 72 sites with explosive limit of 500 pounds or less per site with earth cover.

3.D. SUMMARY

In summary, the functional integration of the knowledge-based experience and the unique facilities and capabilities now allows the Navy to provide the Fleet with the lowest cost, highest quality and maximum performance ordnance devices in the most efficient manner. This integration provides a synergistic effect that makes the Crane organization unique in all DOD and private industry in the pyrotechnics and conventional ammunition fields. Crane engineers and scientists routinely provide assistance to both Army and Air Force personnel in the development, testing and acquisition areas.

The described Navy personnel, facilities and equipment co-located with the Crane Army Ammunition Activity provides unique capability for pyrotechnics and ordnance. Crane Army is a tenant activity and has significant production capability and workload as a Single Manager for Conventional Ammunition government owned, government operated activity. The availability of access to the Crane Army Ammunition Activity also provides a training ground for design and development engineers and scientists in the complexities of ordnance and pyrotechnic manufacture.

With its state-of-the-art laboratories, test ranges, prototype manufacturing facility and co-location with the Crane Army Ammunition Activity, Crane is able to design, develop, test and manufacture many different types of ordnance devices and virtually any pyrotechnic device for the Navy, DOD or private concerns.

4. MAPS OF THE INSTALLATION

Maps of the installation depicting the activity's energetic operations are provided in Attachment A. Building asset information for buildings associated with energetic operations is provided on the maps as well as buildings that are difficult to move or replicate at another site. On many of the individual maps there is a designation of "H" (Highway) or "R" (Railroad). The following paragraphs are provided to further describe the maps.

A. **ATTACHMENT A, MAP A** - The northwest portion of the installation has been identified for use by inert ordnance operations. These include: 1) Small Arms engineering, development, and test operations; 2) Conventional Ammunition Engineering; and 3) Marine Corps engineering, prototype development, and low rate initial production of Command and Control electronic shelters. Also located in this area is the Naval Sea Systems Command Program Management office for Conventional Ammunition (2T COG) acquisition and disposal.

The Small Arms Facility in Building 2521 includes an underground 100 meter firing range capable of conducting tests on ammuntion up to 25mm. This test facility was constructed in 1988 and would be difficult to move or replicate. The remaining facilities supporting energetic functions in this area are not unique and can be moved or replicated at another location.

B. **ATTACHMENT A, MAP B** - In addition to the testing capability at the underground firing range at Building 2521, testing of larger caliber small arms and long distance tests can be accomplished at the outdoor firing range at Building 2911. This facility, which has a capability for testing small arms at 600 and 1,000 yard targets, would be difficult to move or replicate.

C. **ATTACHMENT A, MAP C** - Environmental testing of ordnance items is accomplished in a four building complex. These pre-engineered metal buildings, which were constructed in the 1970's, support ordnance items from all three services. Environmental test equipment, valued at over $5.5 million is available to do vibration, shock, temperature, humidity, altitude, jolt, jumble, sunshine and rain, sand and dust, and salt spray tests. Ordnance items ranging from Class 1, Division 1 explosives to inert items can be tested in these faciltiies.

D. **ATTACHMENT A, MAP D** - The activity's Ordnance Radiographic Facility consists of a two building complex. Building 2986 and 2987 are reinforced concrete buildings constructed in 1974 and 1975 respectively. These facilities allow radiographic inspection of ordnance items in real time or by conventional x-ray. Very large items such as 2,000 pound bombs can be inspected right on the trailer in a high bay exposure room with a high energy accelerator. Due to the massive reinforced concrete walls to provide operator protection and the $2.1 million x-ray equipment contained in the facilities, this complex would be very difficult and expensive to replicate or move.

E. **ATTACHMENT A, MAP E** - The intermediate level maintenance of STINGER air defense missiles and TOW and DRAGON anti-armor missiles are performed in Buildings 2805 and 2390. These facilities are capable of handling Class 1, Division 1 explosive material and with their multi-bay design, minimizes personnel exposure and equipment loss in the event of an accidental explosion. These reinforced concrete facilities are protected with ordnance grounding grid systems and lightning protection. Due to their explosive design features and $3.1 million of installed equipment, these facilities would be difficult and expensive to replicate or move.

F. **ATTACHMENT A, MAP F** - Testing and evaluation of pyro and conventional ammunition items are conducted in the Ordnance Components Test Facility. Building 142 provides lot acceptance and surveillance testing of numerous ordnance components and subassemblies as well as small explosive devices. Explosive test cells within this facility provide the capability for controlled and monitored function testing of components and also remote breakdown and dissection capability of ordnance components for failure analysis. Demolition devices, fuzes, linear explosives, detonators and offboard countermeasures are samples of the ordnance items tested in this facility.

The ordnance evaluation program of the Fleet Ballistic Missile Strategic Weapons Systems is also supported by the Ordnance Components Test Facility at Building 143. The testing and evaluation support is provided through the life cycle of the Trident I and II Missiles. The design and construction of this facility is unique in that it allows ordnance components to be destructively tested safely.

Also located within the Ordnance Components Test Facility complex is Building 2707. This facility serves as a chemical sciences laboratory. Basic and applied research in the fields of physical and natural sciences in such areas as energy transfer phenomena, solid state mechanism, chemical kinetics, polymer synthesis and applications, organic/inorganic synthesis and laser studies are conducted in this facility. Constructed in the early 1940's and modified and improved over the past several years, these reinforced concrete facilities are protected with ordnance grounding grid systems and lightning protection. Due to their explosive design features and $13.45 million of unique and installed equipment, these facilities would be difficult and expensive to replicate or move.

G. ATTACHMENT A, MAP G - The development of prototype models of new designs and product improvements of pyrotechnic devices and explosive components is accomplished in a four building complex consisting of Building 198, 2507, 2508, and 2510. The $3.8 million of mixing, blending, and consolidation equipment installed in the facility allows for the development and production of a large range of pyrotechnic compositions for infrared, illuminating and colored flares, colored smokes and other devices. Any pyrotechnic composition in the Department of Defense inventory can be manufactured in this facility. These reinforced concrete facilities are protected with ordnance grounding grid systems and lightning protection. Due to their explosive design features and installed equipment, these facilities would be difficult and expensive to replicate or move.

H. **ATTACHMENT A, MAP H** - The Missile Fuze Test Facility in Buildings 363 and 364 provides for testing of a wide variety of missile fuzing components (warhead section components). Equipment used includes centrifuge, burn rate/velocity tester, active optical test ranges, leak detectors and many other specialized pieces of equipment. Approximately 25 missiles are supported in this facility including STANDARD, TOMAHAWK, and SIDEWINDER. The Navy as well as joint programs with the Air Force, Army, Foreign Military Sales and private parties is supported by these facilities.

Building 366 is an Automated Infrared Test Facility. This facility is used for the first article, lot acceptance, quality, evaluation and qualification testing of infrared decoy flares. Flares up to 1,000 grams can be burned within the facility. This unique state-of-the-art facility is not duplicated anywhere in the United States and is the accepted Navy Standard for acceptance and first article testing.

I. **ATTACHMENT A, MAP I** - A new 22,174 square foot explosive test facility and a 7,830 square foot engineering support building will be constructed and operational by December 1996 at this site. The new facility will contain eight test cells capable of handling ten pounds of Class 1, Division 1 explosives in each cell, two cells rated at 50 pounds each and one cell rated at 100 pounds of Class 1, Division 1 material. In the event of an accidental explosion, adjacent test cells and its associated equipment and ordnance will be protected to insure continued test capability. A 1,800 square foot remote 3,000 pound Class 1, Division 1 test cell will also be constructed for larger explosive devices and components.

J. **ATTACHMENT A, MAP J** - First article, lot acceptance, surveillance, qualification and safety testing of pyrotechnic, demolition, and conventional ammunition items are accomplished at the ranges and facilities located at the Ordnance Test Area. This 88 acre, unencumbered site is supported by eleven test buildings. In addition to normal function testing, the ranges also support Insensitive Munitions Testing on All-Up-Rounds (pyrotechnic, demolition, and conventional ammunition) including Fast and Slow Cookoff, Bullet Impact and Sympathetic Detonation. This facility also supports Crane Army Ammunition Activity. The installation is located in an Air Attainment area which allows for the flexibility to conduct open air tests. This ability carries over into the open burning and detonation of ordnance which can also be accomplished at other sites at the installation.

In addition, Crane Army Ammunition Activity has twelve separate ordnance production sites and two ammunition demilitarization functions located on the installation. These sites are utilized by Pyrotechnics and Conventional Ammunition Engineering and are depicted on Attachment B.

ATTACHMENT B, MAP 3: Constructed in the early 1940's, this full scale pyrotechnic production plant produced a majority of the pyrotechnics used in the Vietnam War. The plant contains a large, 67,519 square foot machine shop in Building 125 which is used to produce small metal parts used in the production of flares and other pyrotechnic devices. A plating shop to plate these metal parts is located in Building 1884. An Industrial Wastewater Treatment Facility was constructed in 1978 to treat the wastewater from the plating shop. Buildings 122, 126, 2697, and 2698 are the primary pyrotechnic production facilities.

ATTACHMENT B, MAP 4: Buildings 136 and 138 are the two primary production facilities in this production complex. Small actuating devices such as detonators, squibs, boosters, bursters, and primers using sensitive materials such as lead azide and tetryl are produced in this complex.

ATTACHMENT B, MAP 6: This is the third of the three large cast load production plants mentioned in map 5. This facility is currently used to renovate ammunition.

ATTACHMENT B, MAP 7: Building 104, which is a reinforced concrete structure constructed in 1942, is the primary facility used to press load 5 inch, 76 mm, and other medium caliber ammunition. Building 101, shown in Attachment B, map 10, also supports medium caliber production operations.

ATTACHMENT B, MAP 10: Buildings 102 and 103 are used for BAG Filling Prop Charges. These facilities contain 5 cells which can be used to produce ignition ends. Building 101 is used for the production of 76mm/3"/50 medium caliber ammunition.

ATTACHMENT B, MAP 12: This 28,532 square foot two building cast loading ordnance complex is used for the production of insensitive munitions such as the 5"/54 IM projectile.

ATTACHMENT B, MAP 14: The Ammunition Burning grounds is an open burning site that includes 18 clay lined steel burning pads, 7 unlined burning pans, 3 explosive sludge dewatering units, and 2 primer burning pits. The site has the capacity to open burn 54,000 pounds of smokeless powder or 9,000 pounds of high explosives. The site is also capable of disposing of small arms, pyrotechnic items and explosive contaminated material. At the Demolition Range (not shown in the detail map), 72 sites with an explosive limit of 500 pounds each is used to detonate ammunition unable to be renovated. Since the installation is an air attainment area, open burning and detonation is a effective, efficient and viable method of ordnance disposal. Groundwater monitoring wells are located throughout these two sites to ensure groundwater contamination is not occurring.

5. CAPACITY

5.A. CAPACITY TO ABSORB WORKLOAD WITHOUT MODIFICATION

Pyrotechnics and Conventional Ammunition Engineering. As a result of several military construction projects, declining workload and the loss of a significant number of personnel through incentive retirements, the Crane Division has a significant capacity to take on additional work in the pyrotechnics and conventional ammunition product lines. This capacity exists for all phases of energetics work including energetic laboratory work, design and development, prototype manufacture, test and evaluation, and demilitarization and disposal. Table 1 shows the additional workyears that could be accepted at the Crane Division and at the Crane installation with little or no modification of facilities. The additional workyears of laboratory and manufacturing space come from the use of two buildings now in use by the Crane Army Ammunition Activity.

Type of Space	Activity Workyears	Installation Workyears
Laboratory/Development (1.1 & 1.3)	27	42
Prototype Manufacture/Scale-up	13	81
Pyrotechnics/Ordnance Test	21	21
Engineering Office/Laboratory	150	150
Total	211	294

TABLE 1

Small Arms. The Small Arms Technical Capability can absorb up to 15 workyears of energetics workload with virtually no modification to facilities. Adequate office space, range and magazine capacity, and engineering T&E equipment exists to support this level of workload acquisition.

5.B. CAPACITY TO ABSORB WORKLOAD WITH MAJOR MODIFICATIONS

Conventional Ammunition Engineering and Pyrotechnics. Table 2 shows the additional space that could be accommodated at the Crane Division and the Crane installation with major modifications. In most cases the extent of the modifications would simply be renovation of existing structures to make them more habitable or to convert them from their original purpose to the required use.

- The laboratory space would be obtained by converting two buildings originally used for loading major caliber gun ammunition to laboratory space at a cost of $50 per square foot.

- The ordnance operation space could be obtained by converting a building now used to recondition missiles. Since this building already has the appropriate structure and explosive cells and fixtures to accommodate ordnance prototype operations the cost to convert to prototype operations is estimated to be $20 per square foot.

- The test space would be obtained by converting three inert storage warehouses to ordnance test operations. This has been done at Crane in the past for a number of buildings. The cost is estimated at $100 per square foot.

Type of Space	Activity Square Feet	Cost $K	Installation Square Feet	Cost $K
Laboratory	14,000	720	14,000	720
Ordnance Operation	20,000	400	70,000	1,900
Test	30,000	3,000	30,000	3,000
Engineering Office	61,000	720	61,000	720
Total	125,000	4,840	175,000	6,340

TABLE 2

Small Arms. With the addition of a $4 million MILCON which provides additional test facilities for energetics (controlled indoor firing ranges, production areas, and engineering T&E areas) an additional 10-30 workyears can be added to the Small Arms Technical Capability.

CRANE SITE EXPANSION CAPACITY MAP - Map A shows potential sites available at the Crane Site for expansion. In 1994, a study was conducted to identify potential sites for future development of all classes of explosives operating facilities. The study was restricted to the north portion of the installation due to proximity to the installation's water, electric, and sewer infrastructure. Site selection was based on the following rationale:

- Sites should have flexibility to accomodate all classes of operating facilities.

- Sites may accomodate large and small facilities. Large sites are defined as 30-40 acre sites which could accomodate large ammunition production lines. Small sites consist of approximately 10 acres for single building explosive production or testing operations.

- Sites were identified in unencumbered areas or on sites to minimize impacts on existing explosive operating or storage faciltiies.

- Sites were identified away from the electronics operation areas to allow further development of the electronic programs.

From this criteria, 10 potential sites were identified for explosive operations. An in-depth analysis of each site was conducted to investigate conditions that could limit the site's potential to accomodate explosive operations. Criteria used to for site selection included flexibility, adjacency, environmental impacts, and infrastructure impacts.

- Flexibility refers to the capacity of a particular site to readily accomodate future explosive operating facilities. Unencumbered sites receive a high rating, sites impacted by one to four facilities or magazines receive a moderate rating, and sites encumbered by six or more facilities or magazines receive a low rating.

- Adjacency refers to the impact of a prospective site on adjacent facilities and land use. It is rated by determining the compatibility between explosive operations and adjacent land uses. Sites located within or adjacent to existing operating areas were assigned a high rating, sites adjacent to storage areas or undesturbed/natural resource areas received a moderate rating, and sites adjacent to other land use have a low compatibility rating.

- Sites unaffected by major environmental factors or requiring minor modifications such as vegatation clearing were given a high rating from an environmental impact criteria. Moderate sites consisted of sites which required moderate modifications such as sites which contain slopes greater than 5% and low rated sites require mitigation of environmental factors such as wetlands.

- Infrastructure impacts refer to the infrastructure improvements such as highways, utilities, and railroad required to serve a site. Sites received a high rating if they were adjacent or contained highways and utilties. Sites were given a moderate rating if extension of the infrastructure would require extension up to 1,000 feet. Low rated site were sites which required extension of the infrastructure greater than 1,000 feet.

Sites A through J are described in the following paragraphs.

SITE A: Site A is a wooded ridge site of approximately 17 acres. The site is unencumbered by existing explosive operating facilities or explosive storage magazines. It is adjacent to the Mine Fill A and B operating plants. There are no known environmental impacts associated with the development of this site. Infrastructure support to this site is within 1,000 feet.

SITE B: Site B is a wooded ridge containing approximately 17 acres. The site is unencumbered with no known environmental impacts associated with development of the site. Due to its close proximity to other explosive operations, the supporting infrastructure is nearby.

SITE C: The use of this site would require the relocation of the existing salvage yard. This 17 acre site is unencumbered and the extent of any contamination from the scrapyard is unknown. Infrastructure support is fair with water, electricity, rail and road access good, however, the sanitary sewer is between 1,000 and 2,000 feet away.

SITE D: Use of this 40 acre site would require relocation of the existing demolition grounds. With the relocation of the demolition grounds, this site is unencumbered and access to the existing infrastructure is fair. This site is given a moderate expansion potential due to its size and close proximity to existing infrastructure at Mine Fill B.

SITE E: This site contains 11 acres and would require eight magazines to be downloaded or emptied. Due to its close proximity to streams, spill containment would be required. Access to existing infrastructure is poor. The overall rating for this site is poor for expansion capability.

SITE F: This 13 acre wooded site is encumbered by four magazines. There are no known environmental impacts from development of this site. Due to its close proximity to the existing Rockeye Facility, access to the existing infrastructure is excellent. The overall rating for this site for expansion capability is high.

SITE G: Located north of the Rockeye facility, this 34 wooded acre site is encumbered by four magazines and has no known environmental impacts from its development with the exception of a small wetland area in a corner of the site. Access to the existing infrastructure is excellent. This site has an overall high rating for expansion capability.

SITE H: This 38 acre wooded site would require the downloading of five storage magazines. Sites are available to construct many more magazines if required. Access to existing infrastructure is poor.

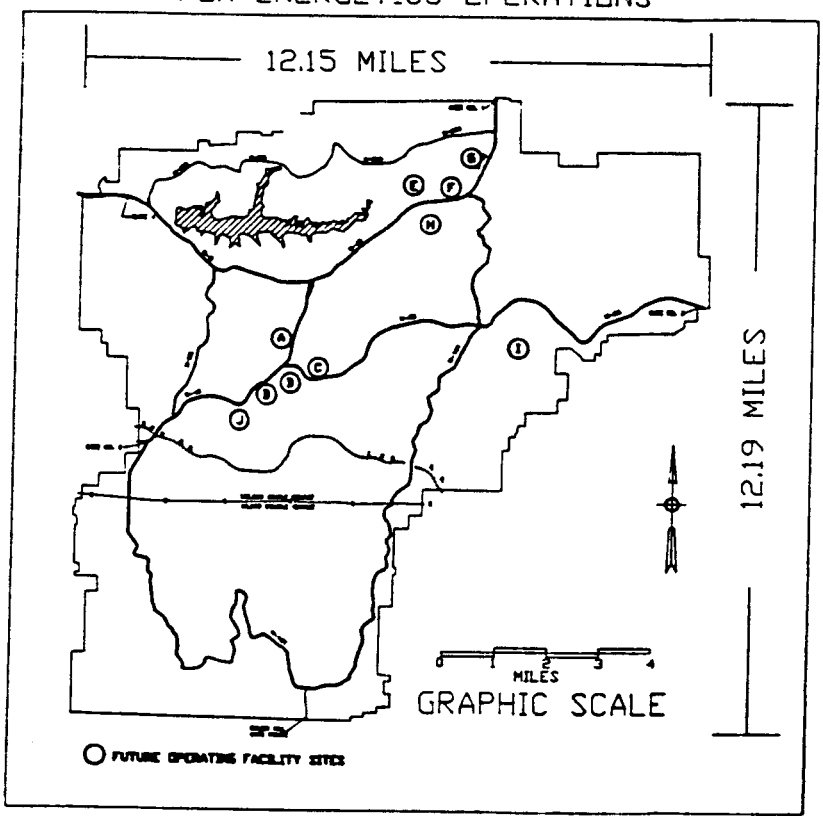
SITE I: With the relocation of the Ammunition Burning Grounds, a large 40 acre site becomes available for expansion. Access to existing infrastructure is poor. This site has an overall rating of poor.

Site J: This site is a small 3.5 acre site which could accommodate a small ordnance function. It is located adjacent to a wetland, therefore, spill containment would be required. Access to the existing infrastructure is poor, however, the site has good road access. The site is given an overall rating of low for expansion capability.

As was mentioned in the opening paragraph, specific criteria was used in this study. Final site selection will require a case by case analysis to determine the feasibility of a site to accommodate a specific ordnance operation. Additional sites, for example, are available for operations other than Class 1 Division 1 or Class 1 Division 2 operations. Other sites are also available for Class 1 Division 1 material if small quantities are involved as in the case of test and evaluation operations.

In conclusion, five of the ten potential sites are thirteen to seventeen acres in size. Four sites identified are between thirty five and forty acres. The total land area available for building in accordance with established quantity-distance arcs prescribed for handling large quantities of hazard classification 1.1 material is over eight million square feet. Up to ten separate facilities or test ranges could be constructed on this land. The current cost of new construction for an ordnance test or operation building is estimated to be $200-400 per square foot.

INSTALLATION MASTER SITE PLAN FOR ENERGETICS OPERATIONS



Potential Explosive Operating Site Matrix

	SITES									
	A	B	C	D	E	F	G	H	I	J
SITE STATISTICS										
Approximate Acreage	17	17	13	40+	11	13	34	30	40+	
Site Characteristics (Short or Large)	S	S	S	L	S	S	L	L	L	*
Magazines/Explosive Operating Facilities Impacted Site[1]	0	See Notes	0	0	1	4	1	2	0	See Notes
SITE SELECTION CRITERIA										
Flexibility										
Environment	○	○	○	○	●	◗	◗	◗	○	○
Adjacency										
Adjacent land use	○	○	◗	○	◗	◗	○	◗	◗	○
Environmental Impact										
Slope	◗	◗	○	○	○	◗	◗	○	○	○
Vegetation clearing required	○	○	○	○	○	○	○	○	○	○
Erosion/floods	○	○	●	○	●	○	○	○	○	●
Environmental contamination	○	○	●	●	○	○	○	○	●	○
Infrastructure Impacts										
Utility access										
Electricity	◗	○	○	○	●	○	○	●	●	●
Water	◗	○	○	○	●	○	○	●	●	●
Sanitary sewer	◗	◗	●	●	●	○	○	●	●	●
Gas	◗	●	●	●	●	●	●	●	●	●
Natural gas	◗	●	●	●	●	○	○	●	●	●
Transportation access										
Highway	◗	○	○	○	◗	○	○	◗	●	○
Railroad	◗	◗	○	◗	●	○	○	●	●	●
OVERALL RATING	◗	○	◗	◗	●	○	○	●	●	●

RATING
- ○ High Rating
- ◗ Moderate Rating
- ● Low Rating

NOTES
1. The following facilities impact the proposed explosive operating sites:
   - Site B: This site requires coordination with proposed Army MILCON project for a radiation testing facility.
   - Site E: Magazines 1241, 1242, 1243, 1441, 1442, 1444, 1445, 1449
   - Site F: Magazines 1247, 1248, 1250, 1253
   - Site G: Magazines 1251, 1259, 1260
   - Site H: Magazines 922, 928, 930, 931, 932
   - Site J: This site requires coordination with proposed Navy MILCON projects P-209 and P-211

6. IMPACT OF BRAC 91 AND BRAC 93

A. This activity was impacted directly by BRAC 91 and indirectly by BRAC 93.

1) BRAC 91 - The BRAC 91 decision consolidated this command with the Naval Ordnance Station, Louisville, Kentucky and established the Crane Division as an element of the Naval Surface Warfare Center. Mechanical workload was consolidated at the Louisville site and electronics workload was consolidated at the Crane site. In addition, underwater acoustic In-service Engineering responsibility was realigned from Crane to the Naval Undersea Warfare Center, Newport Division.

As a result of the BRAC 91 actions, the general and administrative support services for the Crane Division were consolidated at the Crane site with a savings of 203 indirect G&A workyears. This savings was 73 workyears beyond the 130 figure required by the BRAC 91 decision. In addition, many of the management information systems supporting the two sites have been consolidated into Crane Division or Naval Surface Warfare Center wide systems. Finally, this activity also received the printed wiring production fabrication function which transferred to Crane Division from the Dalghren Division of the Naval Surface Warfare Center.

2) BRAC 93 - The BRAC 93 decision to close Mare Island Naval Shipyard resulted in the Crane site receiving additional workload associated with its technical capability in electrochemical power systems. This work includes pre-installation testing of batteries for submarines and the installation of those batteries into submarines.

B. EFFECT UPON OPERATIONS - The outcome of the combined BRAC decisions has been to establish for the Navy a unique "one stop" defense technology industrial base activity. Electronic, mechanical, and electrochemical functions have been consolidated to better utilize special skills and knowledge of product area experts gained through years of education and experience in support of numerous Navy, other DoD, and private sponsors. The Crane Division is capable of design, prototype, production validation, in-service support and maintenance of electronics, mechanical and ordnance systems.

Another outcome of the combined BRAC decisions has been to increase the role this activity performs in assuring that DoD is a "smart buyer" of the components of combat weapons systems through validation of technical requirements; establishment of Navy safety standards for electrochemical power systems; and increased productivity through reduction of indirect expenses. Finally, with the transfer of electrochemical power systems work from Mare Island Naval Shipyard to Crane, unique state-of-the-art battery test facilities are being developed to support experienced personnel at the Crane site in the testing of submarine batteries to enhance Fleet readiness.

7. DEPARTMENT APPROVED PLANS

7.A. Small Arms Technical Capability. Since the standup of the United States Special Operations Command in 1987, the Small Arms TC has grown to become a primary weapon/armament developer for Special Operations programs. The unique co-location of functions and facilities capable of providing full life-cycle support for small arms weapons, mounts and ammunition, coupled with unmatched responsiveness to the special operations community, has contributed significantly to this growth.

Evidence of this is the Offensive Handgun Program (Crane Division acts as the Program Manager and engineering activity), the M4A1 Carbine SOPMOD Program (Program Manager and engineering activity), the Carl Gustaf Recoilless Rifle (primary engineering support activity for the program manager located at the US Army Armament Research, Development and Engineering Center), and numerous rapid response sniper support efforts (weapons, ammunition, personnel protection vests) and other mobilization support efforts. The decision by USSOCOM to utilize the Navy's Small Arms Technical Capability as a primary source of programmatic and engineering support has had and will continue to have significant impacts on both workload and acquisition levels.

8. REMAINING TENANTS

A. Defense Finance & Accounting Service Cleveland
28.0 workyears

Mission: Provide effective and efficient finance and accounting services during times of peace and conflict.

B. Defense Reutilization & Marketing Office
20.0 workyears

Mission: Provides for the receipt, segregation, inspection, and storage of excess and scrap material turned in by all organizations at the Crane Site and other organizations in this geographical area. Disposes of property through reutilization, transfer, donation, and sale. Provides technical assistance to the generating activities on proper disposal methods. Provides for the demilitarization of small arms and various other ordnance items. Average yearly receipts: 30,000 line items, 20 million pounds of scrap material.

C. Explosive Ordnance Disposal Group 2 Detachment
5.0 workyears

Mission: Provides Crane Division the capability for surface and underwater detection, identification, rendering safe, recovery, field and laboratory evaluation, and disposal of explosive ordnance which constitutes a hazard to operations, installations, personnel or material. The mission includes the rendering safe, and/or disposal of any ordnance which has intentionally or inadvertently become hazardous by damage or deterioration when the disposal is beyond the capabilities of personnel normally assigned the responsibility for routine disposition. EOD assistance and/or advice to civil authorities may be provided upon request if the service is in the interest of public safety.

D. Customer Service Branch
Personnel Support Activity Detachment Indianapolis
2.0 workyears

Mission: Provides passenger transportation and military service record management.

E. Engineering Field Activity Contracts Office, Crane, IN
18.0 workyears

Mission: Provides pre-award and post-award contract management for construction, facility support, and architect/engineer contracts for Crane, assigned tenants and the following Reserve Centers: Evansville, IN, Terre Haute, IN, St. Louis, MO, Cape Girardeau, MO, Danville, IL, Decatur, IL, and Springfield, IL.

F. Defense Commissary Agency
6.0 workyears

Mission: Enhances the quality of Navy life by responding to customer demand for food and household products at significant overall savings in a convenient shopping environment.

G. Navy Exchange Detachment
1.0 workyear

Mission: Enhances the quality of Navy life by responding to customer demand for food and household products at significant overall savings in a convenient shopping environment.

H. Naval Criminal Investigative Service Resident Unit
1.0 workyear

Mission: Conducts criminal and security investigations encompassing all felony crimes under the Uniformed Code of Military Justice and those property crimes with a loss value greater than $500. Actively involved with criminal, fraud, and counterintelligence investigative support to Crane and maintains liaison with appropriate local and federal law enforcement agencies throughout southern Indiana.

I. Naval Security Group Detachment
54.0 workyears

Mission: Performs duties pertaining to the storage and retrieval of information and material in support of Naval Security Group and other Navy and DoD elements. Includes maintaining and operating the Naval Security Group Command Central Depository for archival materials and to provide storage of certain records for other Navy and DOD elements.

J. U. S. Coast Guard Small Arms Repair Facility
4.0 workyears

Mission: Responsible for the depot level maintennce/repair of all Coast Guard owned small arms and equipment. Maintains an adequate supply of parts for depot maintenance and support of district armories. Provides Code "A" weapons to all Coast Guard units and provides weapons and support to the Coast Guard rifle and pistol teams.

9. OVERALL MISSION

A. CRANE MISSION - The Crane mission is to provide responsive engineering and industrial base support for weapons systems, subsystems and components. On Crane's nearly 100 square mile, rural and midwestern location, we have combined: skilled people; unique and capable facilities; product knowledge; and the ability to integrate engineering with "hands on" industrial processes; to provide the broadest, deepest and most advanced industrial base capability in the Navy. In summary:

NAVY CIVILIANS - CRANE SITE

Civ. FTP - 3500, Scientists/engrs/tech 1878, Military 32
Total Wkyrs - 3990, Dir/Indir ratio 65.3%, Business Base $464.6M

TENANTS - CRANE SITE

Activities:
- Crane Army Ammunition Activity
- Engineering Field Activity Contracts Office
- Navy Exchange Detachment
- Defense Commissary Agency
- Naval Security Group Detachment
- Explosive Ordnance Disposal Group 2 Detachment
- Naval Criminal Investigative Service
- Customer Service Branch, Personnel Support Activity Detachment Indianapolis
- U. S. Coast Guard Small Arms Repair Facility
- Defense Finance & Accounting Services Cleveland
- Defense Reutilization & Marketing Office

Total Wkyrs - 717 Civilians, 75 Military

CUSTOMERS: Crane site supports the Navy across all Warfare Centers. Navy customers include NAVSEA, NAVAIR, DRPM, PEO's, SPECWAR, Labs, ASO, SPCC). Other customers are the Coast Guard, Army, Airforce, Marine Corp, FMS, NASA, FAA and Private Industry.

NAVY CIVILIANS - LOUISVILLE SITE

Civ. FTP - 2101, Scientists/engrs/tech 1732, Military 13

Total Wkyrs - 2561, Dir/Indir ratio 61.5%, Business Base $224.9M

TENANTS - LOUISVILLE SITE

Activities: Defense Printing Service Branch Office
Defense Finance and Accounting Service
Engineering Field Activity Contracts Office
Naval Criminal Investigative Service
Customer Service Branch, Personnel Support Activity Detachment Indianapolis
Naval Phalanx Training Unit

Total Wkyrs - 41 Civilians, 1 Military

CUSTOMERS: Louisville Site Navy customers include NAVSEA, NAVAIR, DRPM, PEO's, SPCC. Other customers are Army, Marine Corps, Air Force, DoD and Private Industry

B. **MISSION EXECUTION** - The Crane mission is accomplished by means of a unique synergy created by the interweaving of co-located facilities and people experienced in electronic, mechanical, and ordnance disciplines.

1) **CO-LOCATED TECHNICAL CAPABILITIES** - Our principal areas of expertise are managed and described in terms of the following seventeen Technical Capabilities.

ENERGETICS TC's

- PYROTECHNICS
- SMALL ARMS
- CONVENTIONAL AMMUNITION ENGINEERING

MECHANICAL TC's
Louisville, KY site

- NAVAL GUN WEAPONS
- SURFACE MISSILE SYSTEMS
- MECHANICAL MANF.
- MANAGEMENT NAVAL DRAWINGS
- SHIPBOARD PHYSICAL SECURITY

ELECTRONICS TC's

- ELECTRONIC WARFARE
- MICROELECTRONIC TECHNOLOGY
- ELECTRONIC MODULE TEST AND REPAIR
- MICROWAVE COMPONENTS
- ELECTROCHEMICAL POWER SYSTEMS
- ACOUSTIC SENSORS
- NIGHT VISION/ELECTRO-OPTICS
- MINE COUNTERMEASURES
- RADAR

2) **CO-LOCATED FUNCTIONS** - Many of the functions performed at the Crane Division, Naval Surface Warfare Center **require access to other facilities and capabilities co-located on the base** in order to accomplish their missions. These include:

- Environmental simulation facilities such as humidity, temperature cycling, vibration, shock, altitude, sun/rain, sand/dust, salt spray, jolt, and jumble;
- X-ray facilities including real-time capability;
- Ordnance materials analysis lab;
- Cable engineering, repair and manufacturing support;
- Battery engineering and test support;
- Failure Analysis of components;
- Acquisition (contracting) of repair parts, complete equipment, and support materials and equipment;
- Firing Ranges and Range Support for Lasers and/or Weapon Sights/Fire Control Testing;
- Equipment Calibration Support;
- Defense Reutilization and Marketing Office for recycling and disposal of test and analysis samples.

3) **CO-LOCATED WITH ARMY TENANT** - The Crane Division is a unique Navy activity in that significant Single Manager for Conventional Ammunition (SMCA) production is performed by CAAA, the Army tenant, located at Crane. **Fifty-eight percent of CAAA's ordnance magazine storage (1.9 million square feet) contains Navy/Marine Corps Ammunition assets.** Co-location of the Program Management and engineering functions with a major DOD ammunition production, storage, maintenance and disposal activity provides rapid response capability throughout the life cycle to major regional conflicts such as Operation Desert Shield/Desert Storm.

C. **FUTURE MISSION**: The future mission of Crane will be the integration of the DOD requirements for electronic/mechanical/energetic products with the private commercial industrial base supplier. This future mission is enhanced not only by the co-location benefits of the current mission but by our remote midwestern location. **The nearly 100 square mile, remote site and unencumbered location with no encroachment considerations provide the ideal place to develop and test ordnance and pyrotechnics which require high safety measures under environmental compliance regulations.**

1) **REMOTE LOCATION** - Although Crane Division is set in the rolling hills of southwestern Indiana, it is conveniently located with respect to major urban areas, with good access to rail, highway, and air transportation. With nearly **100 square miles** inside its boundaries, Crane has the space to locate several unique facilities within a single organization with **significant unused area remaining for growth.**

2) **ENVIRONMENTAL COMPLIANCE** - From an environmental standpoint, the geographic location of this facility is key to its successful operation and the continuation of missions which other facilities are being forced to close. Crane Division is remote, with little encroachment from residential or private industry. **The facility occupies land which, due to the topography and soil types, is of little value for farming, residential development, or private industry.**

EPA Region V and the Indiana Department of Environmental Management work well with the people and operations at Crane. Furthermore, the communities surrounding the Division are extremely supportive of the facility and its programs. **In other words, there is almost no antagonistic opposition from the public or regulators to environmental permits and related activities.** This favorable relationship is extraordinary among Department of Defense facilities.

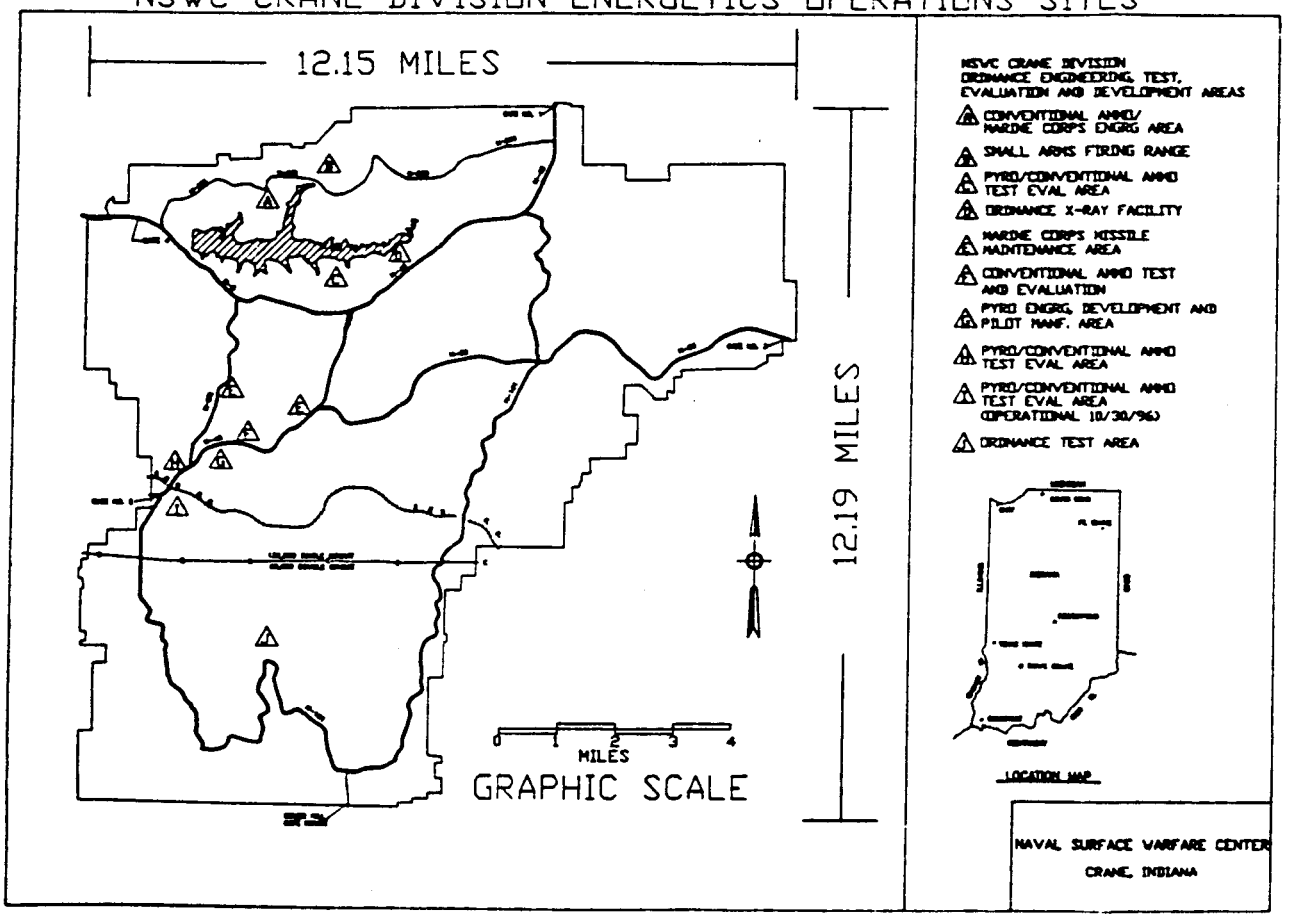
Crane Division is also located in an attainment area for criteria pollutants under paragraph 107 of the Clean Air Act. **The nearly 64,000 acres which the base occupies provide an excellent natural laboratory in which to conduct studies to determine and monitor the impacts and risks to the environment associated with mission activities.** A considerable amount of money has been spent doing environmental assessment and installing monitoring equipment (e.g. over 400 groundwater monitoring wells). All of this combines to allow a wide diversity of operations rarely available anywhere else. **The location of Crane Division ideally situates it for different types of test, demolition, and firing ranges, as well as manufacturing and munitions storage.**

3) **CENTRAL LOCATION** - Crane Division's central geographic location makes travel to either coast relatively equally convenient. Suppliers are dispersed throughout the country and travel to their locations is also made with greater ease. **This results in lower average time and costs for personnel travel and material shipments.** This advantage, combined with the on-site synergetic effects previously discussed, present customers with the opportunity of utilizing a maintenance and engineering resource that **can provide superior cost controlled services and project them throughout the country with similar ease.**

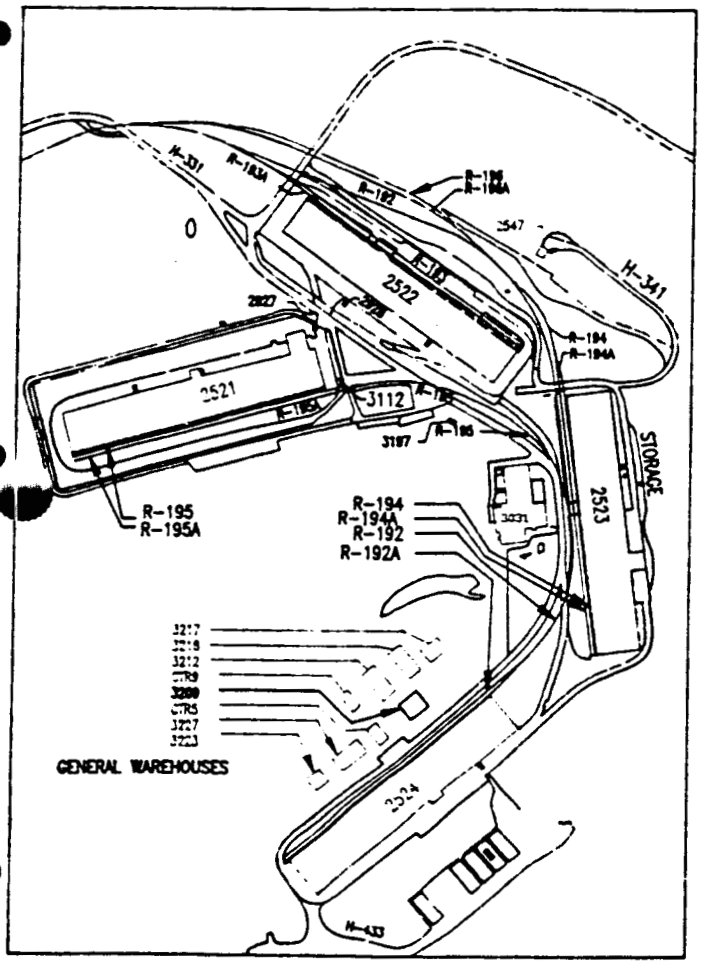
For example, 75 percent of ammunition component and end item production by both industry and government is within 750 miles (38 percent within 500 miles) of Crane Division, **allowing almost same-day response to resolve on-site production related problems.** The maintenance of product expertise is the only means available to **assure safe, reliable and effective ammunition to satisfy Fleet requirements.**

Document Separator

NSWC CRANE DIVISION ENERGETICS OPERATIONS SITES



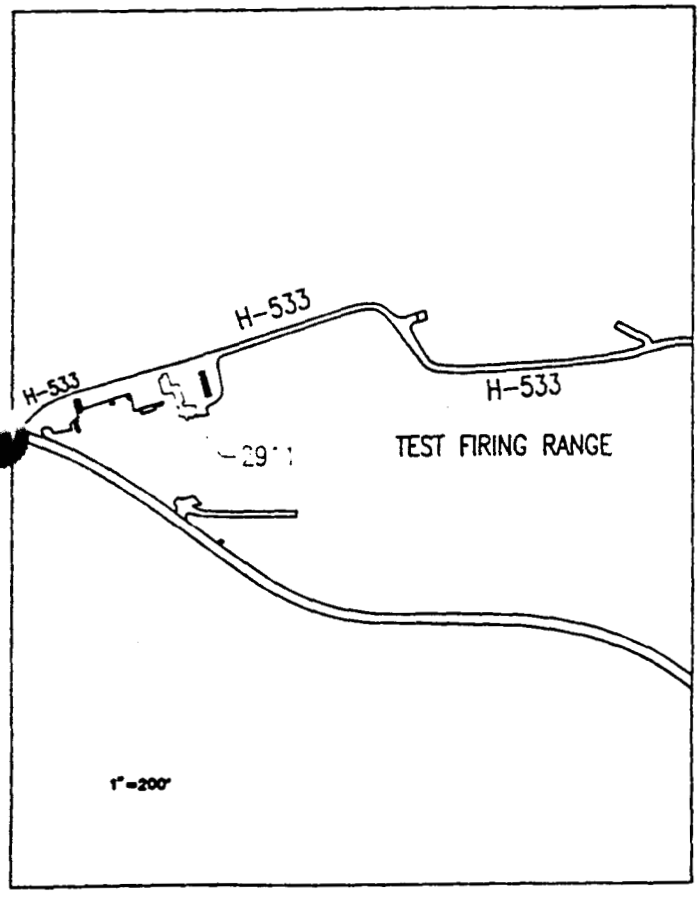
ATTACHMENT 4
NSWC Crane Division
Energetics Operations



CONVENTIONAL AMMUNITION ENGINEERING/MARINE CORPS AREA

Bldg. No.	Type Space	Square Footage	Gov't Owned	Difficult to Move/ Replicate	Building Replacement Cost (CPV)
2521	Office/Ord.T&E	8,121	Y	Y	8,238,000
2547	Ord. T&E	783	Y	Y	441,000
3031	Office	23,976	Y	N	750,000
2524	Office	18,400	Y	N	3,489,000
3217	Office	3,500	Y	N	196,000
3212	Office	5,150	Y	N	183,000
3227	Ord. T&E	5,000	Y	N	166,000
3223	Ord. T&E	3,000	Y	N	194,316

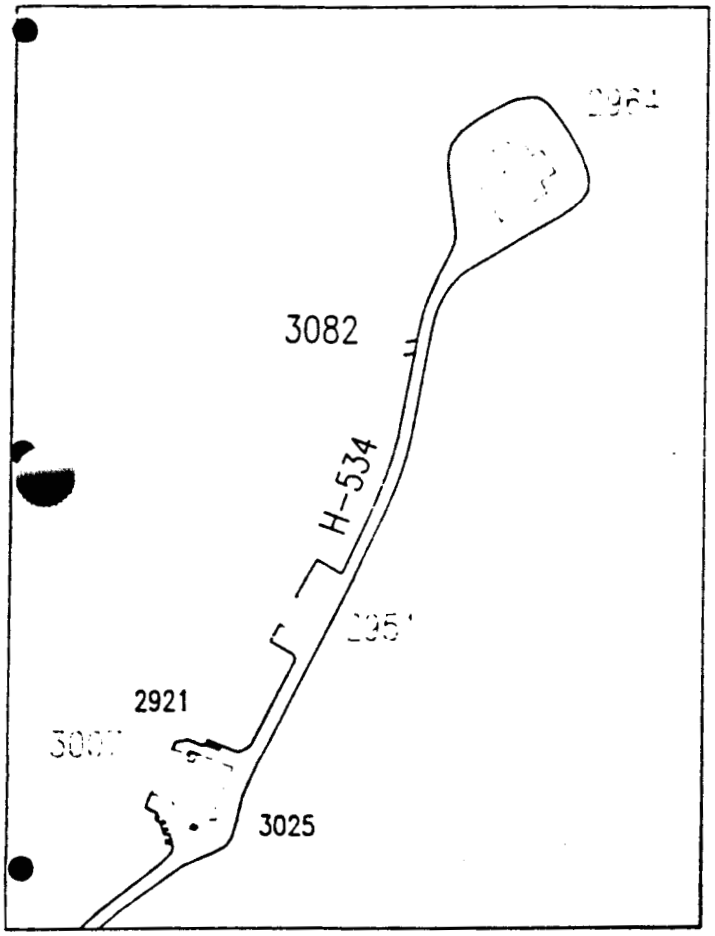
ATTACHMENT A, MAP 4



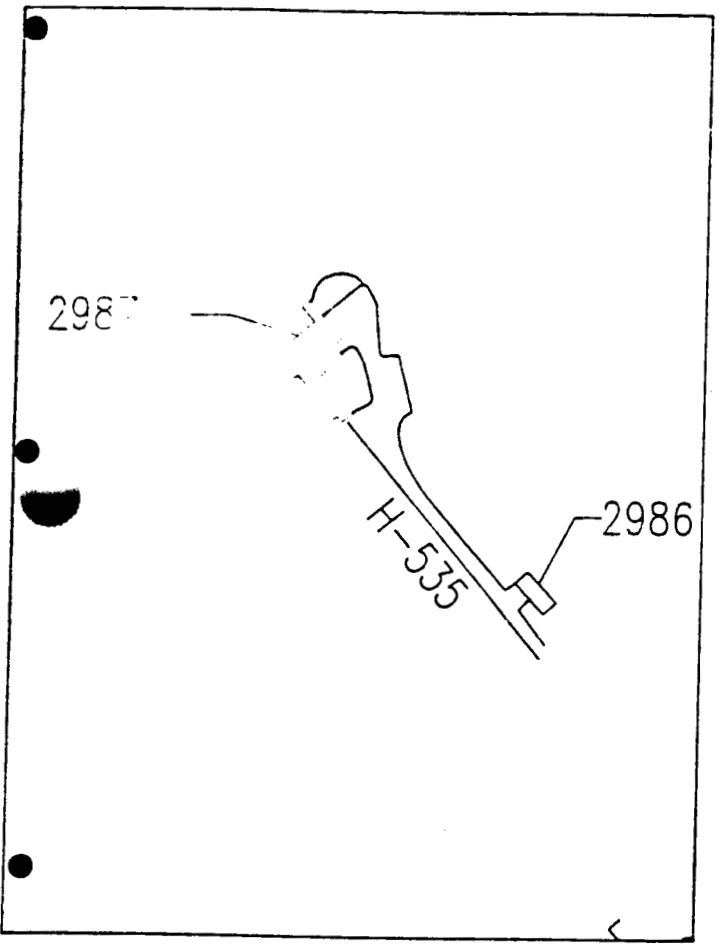
SMALL ARMS FIRING RANGE

Bldg. No.	Type Space	Square Footage	Gov't Owned	Difficult to Move/ Replicate	Building Replacement Cost (CPV)
2911	Ord. T&E	1,928	Y	Y	235,000

ATTACHMENT A, MAP 5

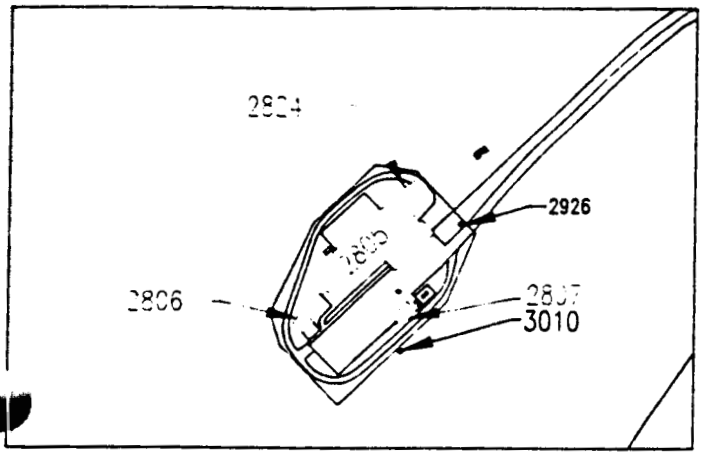


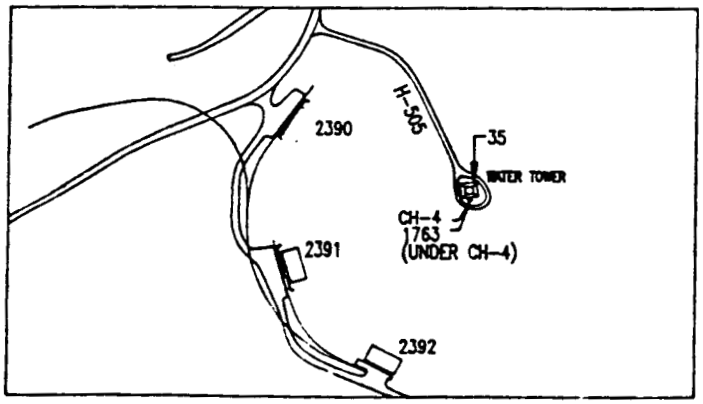
PYRO/CONVENTIONAL AMMUNITION TEST AND EVALUATION AREA					
Bldg. No.	Type Space	Square Footage	Gov't Owned	Difficult to Move/ Replicate	Building Replacement Cost (CPV)
2964	Ord. T&E	7,744	Y	N	632,000
3082	Expl Storage	45	Y	N	12,000
2951	Ord. T&E	2,040	Y	N	160,000
2921	Ord. T&E	5,833	Y	N	574,000
3007	Ord. T&E	2,048	Y	N	64,000



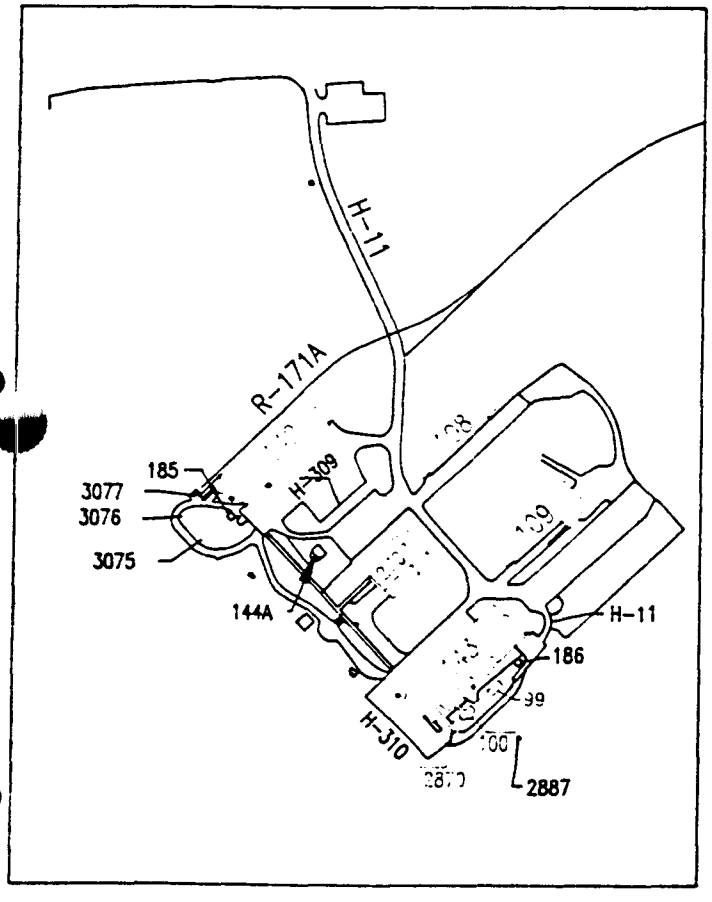
ORDNANCE X-RAY FACILITY					
Bldg. No.	Type Space	Square Footage	Gov't Owned	Difficult to Move/ Replicate	Building Replacement Cost (CPV)
2987	Ord. T&E	8,087	Y	Y	1,020,000
2986	Ord. T&E	1,040	Y	Y	115,000

ATTACHMENT A, MAP



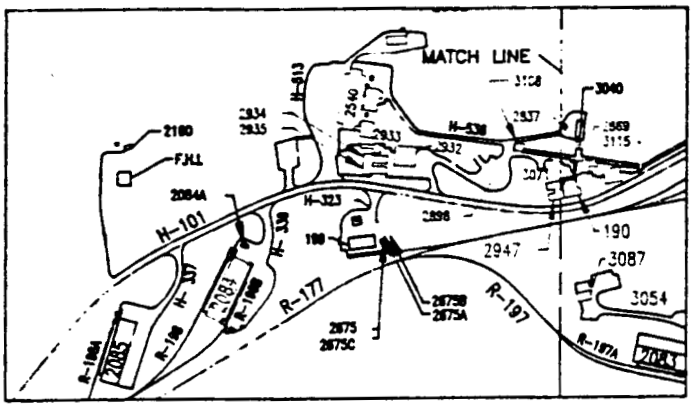


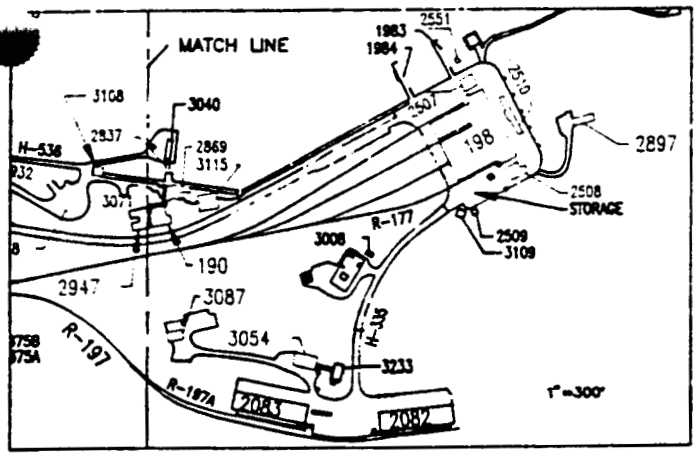
MARINE CORPS MISSILE MAINTENANCE AREA					
Bldg. No.	Type Space	Square Footage	Gov't Owned	Difficult to Move/ Replicate	Building Replacement Cost (CPV)
2380	Ord. TSE	5,356	Y	Y	222,000
2805	Ord. TSE	19,714	Y	Y	2,537,000
2806	Ord. TSE	1,024	Y	Y	143,000
2807	Office	820	Y	N	110,000



PYRO/CONVENTIONAL AMMUNITION TEST & EVALUATION AREA					
Bldg. No.	Type Space	Square Footage	Gov't Owned	Difficult to Move/ Replicate	Building Replacement Cost (CPV)
142	Ord. T&E	18,179	Y	Y	1,790,000
108	Office	10,167	Y	N	704,000
109	Ord. T&E	10,167	Y	Y	573,000
143	Office/Ord T&E	23,296	Y	Y	5,873,000
186	Inert Storage	178	Y	N	12,000
99	Expl Storage	403	Y	Y	33,000
100	Ord. T&E	403	Y	Y	33,000
2887	Tower	N/A	Y	N	3,000
2870	Ord. T&E	486	Y	Y	80,000
2707	Laboratory	9,062	Y	Y	809,000
3075	Expl Storage	45	Y	Y	15,000
3076	Expl Storage	45	Y	Y	15,000
3077	Expl Storage	45	Y	Y	15,000
185	Inert Storage	178	Y	N	12,000

ATTACHMENT A, MAP

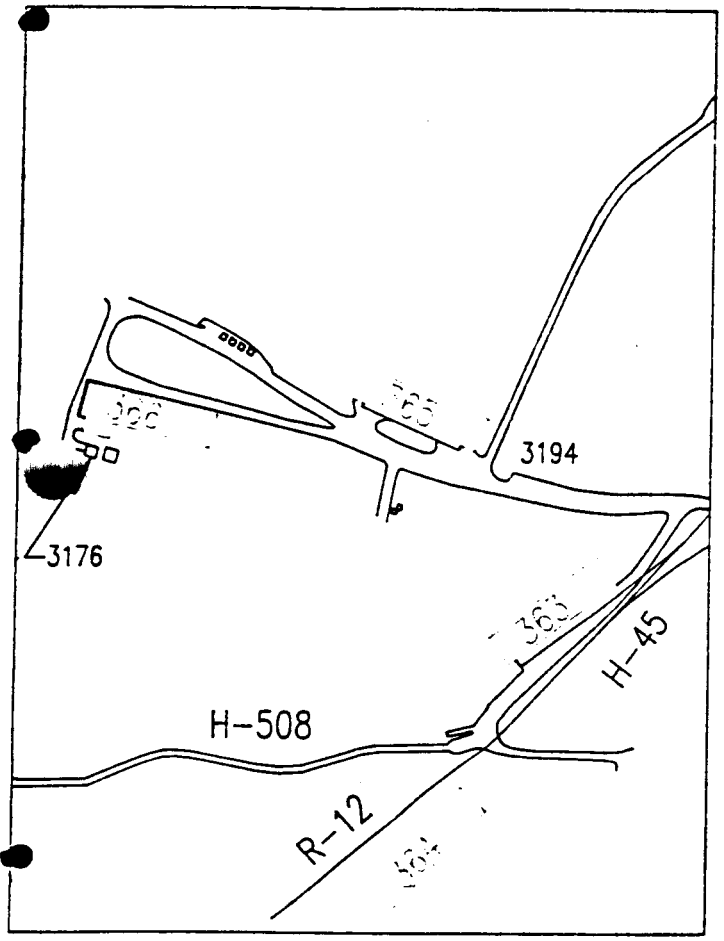




PYRO ENGINEERING, DEVELOPMENT, AND PILOT MANUFACTURING AREA

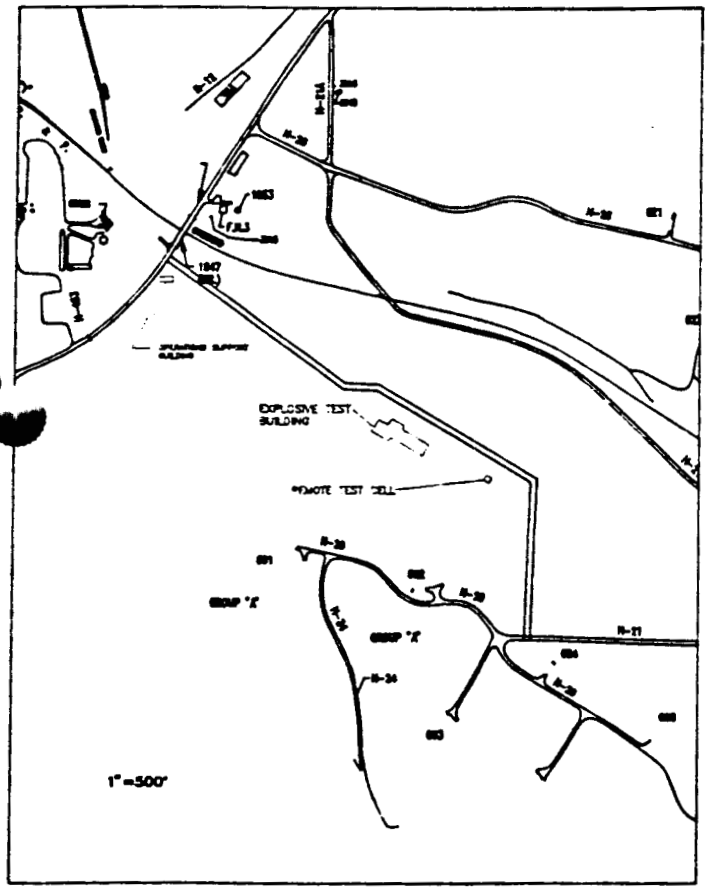
Bldg. No.	Type Space	Square Footage	Gov't Owned	Difficult to Move/ Replicate	Building Replacement Cost (CPV)
2540	Office	29,483	Y	N	3,189,000
2935	Office	3,548	Y	N	207,000
2932	Office	3,776	Y	N	59,000
2896	Ord. T&E	1,588	Y	Y	181,000
3108	Ord. T&E	480	Y	Y	42,000
2947	Laboratory	2,275	Y	Y	209,000
190	Ord. T&E	2,478	Y	Y	486,000
2837	Ord. T&E	144	Y	Y	51,000
2869	Ord. T&E	1,733	Y	Y	346,000
3071	Expl Storage	45	Y	Y	20,000
3115	Ord. T&E	2,120	Y	Y	147,000
1984	Expl Storage	611	Y	Y	82,000
1983	Expl Storage	611	Y	Y	53,000
2551	Ord. T&E	117	Y	Y	33,000
2507	Ord. T&E	1,889	Y	Y	749,000
2510	Ord. T&E	1,391	Y	Y	345,000
2897	Inert Storage	1,158	Y	N	25,000
198	Ord Production	24,686	Y	Y	6,123,000
2508	Ord. T&E	1,889	Y	Y	177,000
2509	Inert Storage	178	Y	N	13,000
3109	Inert Storage	441	Y	N	42,000
3008	Tower	N/A	Y	N	24,000
3054	Ord. T&E	2,048	Y	Y	221,000
3087	Ord. T&E	900	Y	Y	388,000
2084	Ord. T&E	10,167	Y	Y	503,000

ATTACHMENT A, MAP C



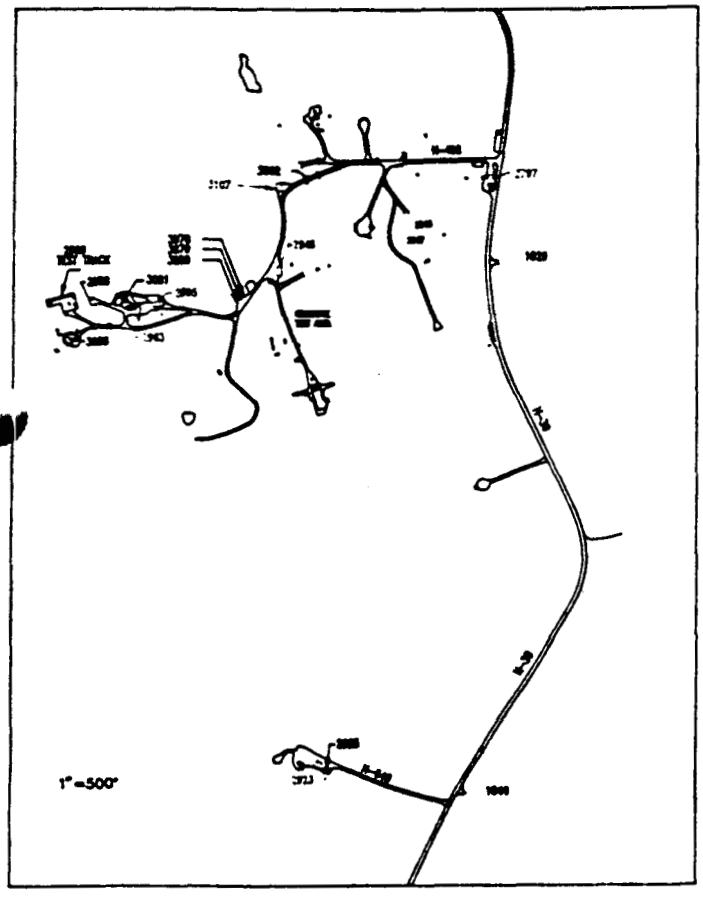
CONVENTIONAL AMMUNITION TEST AND EVALUATION AREA					
Bldg. No.	Type Space	Square Footage	Gov't Owned	Difficult to Move/ Replicate	Building Replacement Cost (CPV)
363	Ord. T&E	10,167	Y	Y	780,000
364	Ord. T&E	10,861	Y	Y	562,000
365	Ord. T&E	10,167	Y	Y	556,000
368	Ord. T&E	10,167	Y	Y	828,000
3176	Ord. T&E	256	Y	Y	9,000

ATTACHMENT A, MAP



PYRO/CONVENTIAL AMMUNITION TEST AMMEVALUATION AREA (OPERATIONAL 10/30/96)					
Bldg. No.	Type Space	Square Footage	Gov't Owned	Difficult to Move/ Replicate	Building Replacement Cost (CPV)
	Office	7,830	Y	Y	978,000
	Ord. T&E	22,174	Y	Y	7,197,000
	Ord. T&E	1,800	Y	Y	225,000

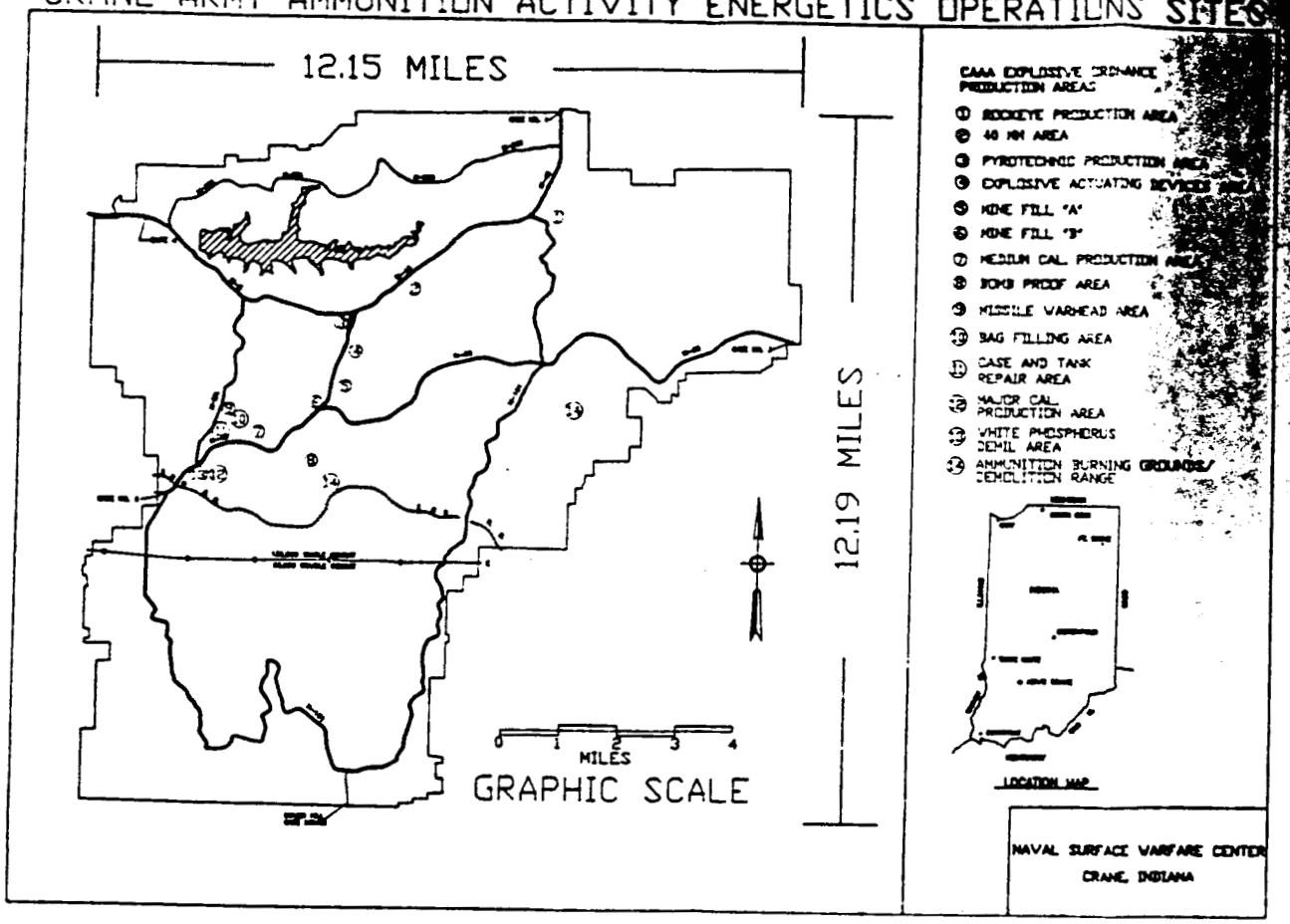
ATTACHMENT A, MAP I



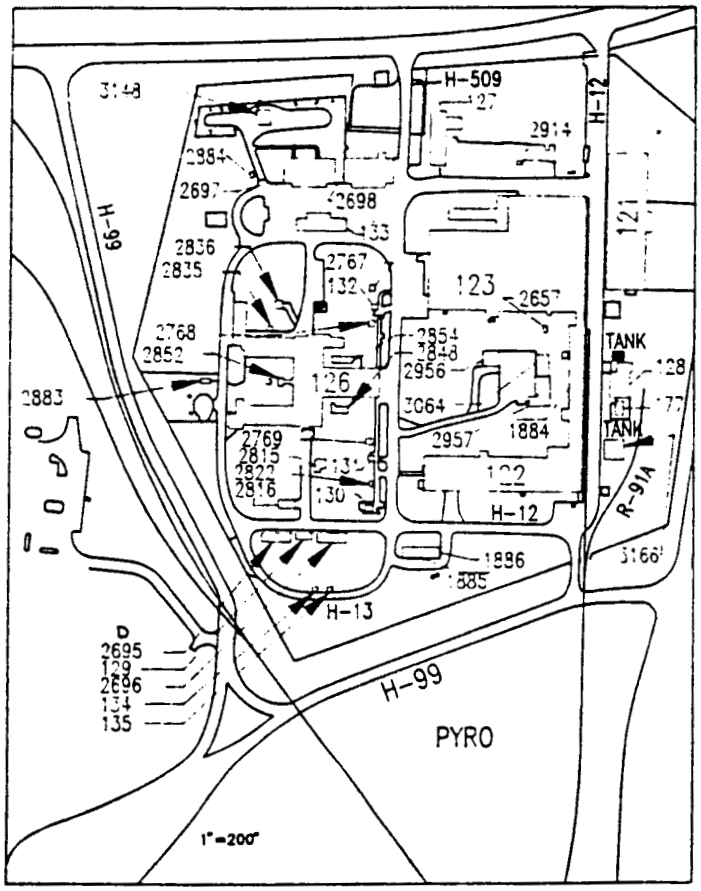
ORDNANCE TEST AREA

Bldg. No.	Type Space	Square Footage	Gov't Owned	Difficult to Move/ Duplicate	Building Replacement Cost (CPV)
2797	Ord. T&E	980	Y	N	34,000
2846	Tower	N/A	Y	N	7,000
2847	Tower	N/A	Y	N	7,000
3107	Inert Storage	1,000	Y	Y	23,000
2945	Ord. T&E	980	Y	Y	47,000
3078	Expl Storage	45	Y	Y	18,000
3079	Expl Storage	45	Y	Y	18,000
3080	Expl Storage	45	Y	Y	18,000
2995	Ord. T&E	1,040	Y	Y	283,000
2963	Ord. T&E	980	Y	Y	31,000
3081	Expl Storage	45	Y	Y	18,000
2888	Ord. T&E	144	Y	Y	16,000
3086	Tower	N/A	Y	N	20,000
2923	Ord. T&E	980	Y	Y	91,000
2925	Ord. T&E	128	Y	Y	21,000

CRANE ARMY AMMUNITION ACTIVITY ENERGETICS OPERATIONS SITES

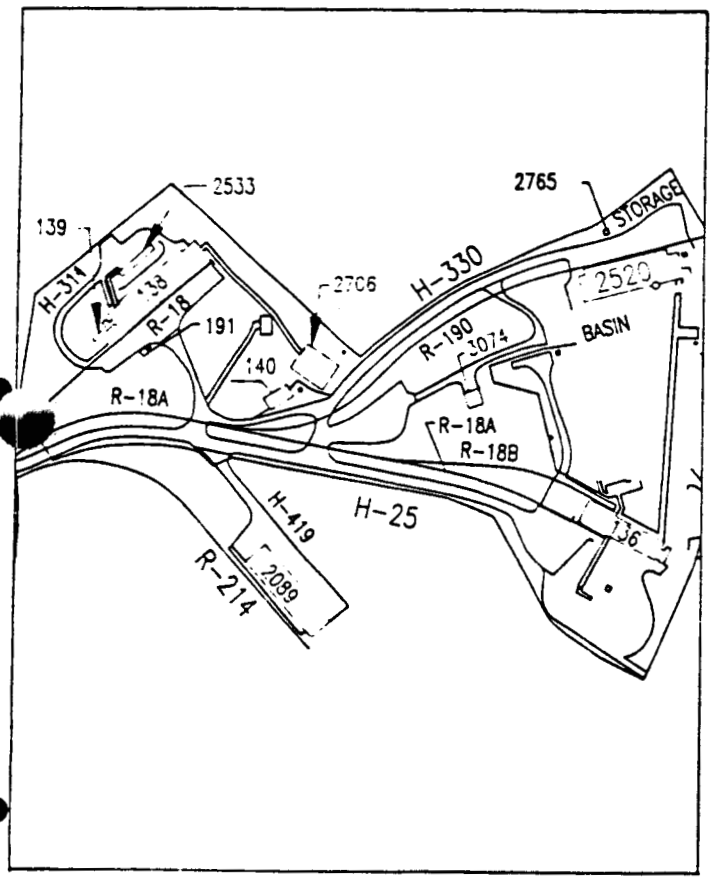


ATTACHMENT B
CRANE ARMY AMMUNITION ACTIVITY
ENERGETICS OPERATIONS SITES



PYROTECHNIC PRODUCTION AREA

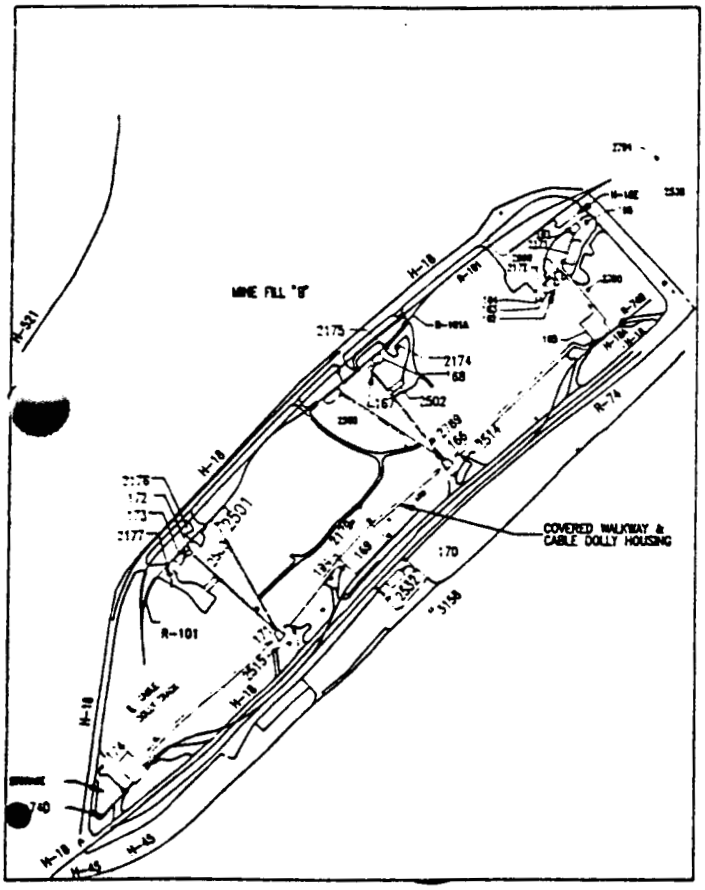
Bldg. No.	Type Space	Square Footage	Gov't Owned	Difficult to Move/ Replicate	Building Replacement Cost (CPV)
127	Ord. Production	4,338	Y	Y	711,000
2914	Inert Storage	1,026	Y	N	49,000
123	Ord. Production	64,511	Y	Y	2,499,000
2657	Expl Storage	54	Y	Y	8,000
1884	Ord. Production	4,800	Y	Y	843,000
122	Ord. Production	30,638	Y	Y	2,516,000
1886	Ord. Production	424	Y	Y	68,000
1885	Ord. Production	424	Y	Y	68,000
130	Ord. Production	287	Y	Y	139,000
131	Expl Storage	151	Y	Y	86,000
2848	Ord. Production	504	Y	Y	30,000
126	Ord. Production	38,437	Y	Y	8,853,000
2854	Ord. Production	504	Y	Y	58,000
2768	Inert Storage	198	Y	N	9,000
132	Expl Storage	151	Y	Y	68,000
2767	Inert Storage	198	Y	N	9,000
133	Ord. Production	2,784	Y	Y	455,000
2698	Ord. Production	5,125	Y	Y	957,000
2697	Ord. Production	5,125	Y	Y	584,000
2884	Inert Storage	84	Y	N	4,000
3148	Inert Storage	783	Y	N	173,000
2836	Inert Storage	140	Y	N	6,000
2852	Inert Storage	144	Y	N	7,000
2883	Inert Storage	84	Y	N	4,000
2769	Inert Storage	198	Y	N	9,000
2815	Inert Storage	458	Y	N	89,000
2822	Inert Storage	135	Y	N	9,000
2816	Inert Storage	642	Y	N	121,000
2695	Inert Storage	1,200	Y	N	88,000
129	Ord. Production	435	Y	Y	111,000
2696	Inert Storage	1,200	Y	N	88,000
134	Expl Storage	59	Y	Y	23,000
135	Expl Storage	59	Y	Y	23,000



EXPLOSIVE ACTUATING DEVICES AREA

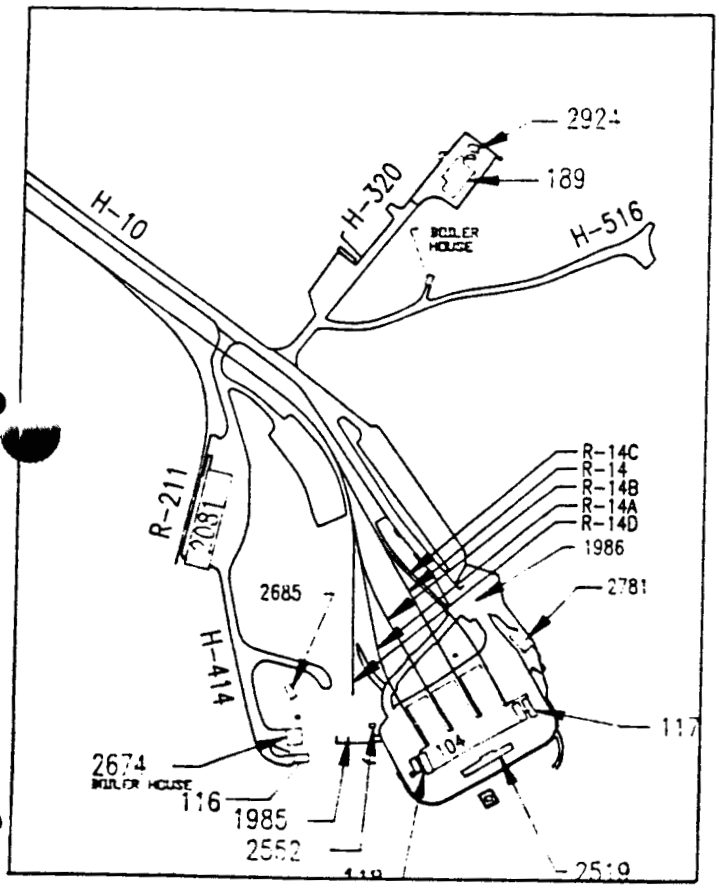
Bldg. No.	Type Space	Square Footage	Gov't Owned	Difficult to Move/ Replicate	Building Replacement Cost (CPV)
2533	Ord. Production	924	Y	Y	268,000
139	Expl Storage	63	Y	Y	52,000
138	Ord. Production	9,579	Y	Y	2,140,000
191	Ord. Production	178	Y	Y	12,000
2706	Ord. Production	4,196	Y	Y	331,000
2089	Inert Storage	10,167	Y	N	300,000
2764	Inert Storage	100	Y	N	5,000
2526	Expl Storage	689	Y	Y	74,000
2525	Ord. Production	117	Y	Y	91,000
137	Expl Storage	121	Y	Y	64,000
136	Ord. Production	6,613	Y	Y	1,731,000
2863	Ord. Production	671	Y	Y	205,000
2862	Ord. Production	80	Y	Y	89,000
2861	Ord. Production	80	Y	Y	89,000
2859	Ord. Production	202	Y	Y	84,000
2860	Ord. Production	202	Y	Y	84,000
2858	Ord. Production	269	Y	Y	86,000
2857	Ord. Production	269	Y	Y	86,000
2856	Ord. Production	152	Y	Y	93,000
2855	Ord. Production	136	Y	Y	103,000
2520	Ord. Production	5,538	Y	Y	613,000
2765	Inert Storage	100	Y	N	5,000
3074	Ord. Production	981	Y	Y	261,000

ATTACHMENT B, MAP .



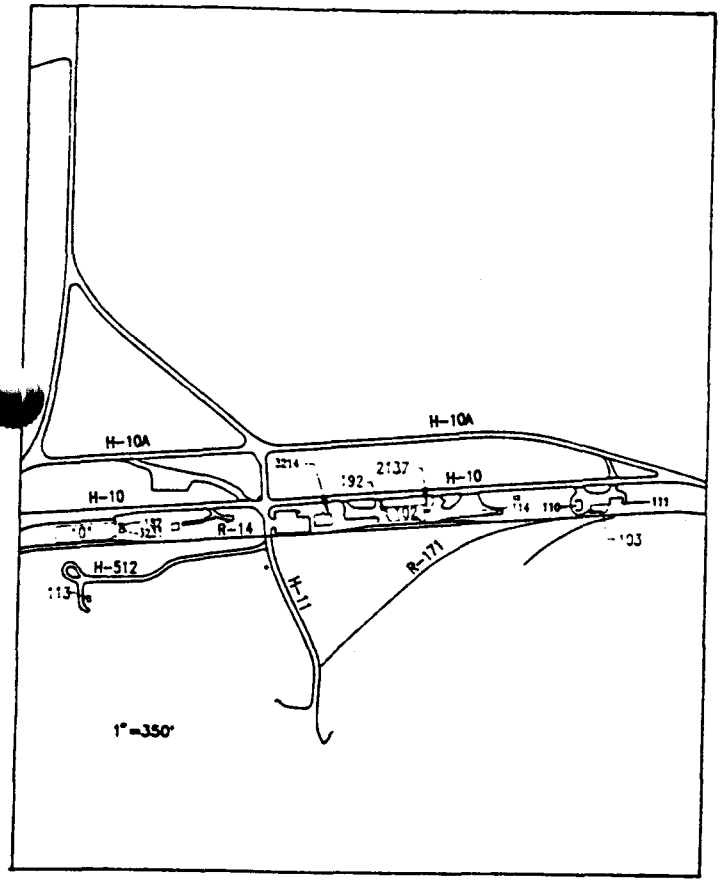
MINE FILL "B"

Bldg. No.	Type Space	Square Footage	Gov't Owned	Difficult to Move/ Replicate	Building Replacement Cost (CPV)
165	Ord. Production	8,330	Y	Y	2,526,000
2514	Ord. Production	96	Y	Y	9,000
166	Ord. Production	1,596	Y	Y	2,224,000
169	Ord. Production	20,301	Y	Y	3,003,000
2532	Ord. Production	24,588	Y	Y	1,518,000
170	Ord. Production	3,697	Y	Y	487,000
2179	Ord. Production	233	Y	Y	5,000
194	Ord. Production	178	Y	Y	12,000
2515	Ord. Production	96	Y	Y	9,000
171	Ord. Production	1,596	Y	Y	2,180,000
174	Ord. Production	8,330	Y	Y	2,402,000
193	Ord. Production	178	Y	Y	12,000
2177	Expl Storage	N/A	Y	Y	11,000
173	Ord. Production	1,394	Y	Y	268,000
172	Ord. Production	660	Y	Y	302,000
2176	Expl Storage	N/A	Y	Y	13,000
2503	Ord. Production	1,478	Y	Y	364,000
2501	Ord. Production	2,312	Y	Y	977,000
2500	Ord. Production	2,312	Y	Y	1,008,000
167	Ord. Production	660	Y	Y	304,000
2789	Ord. Production	128	Y	Y	23,000
2502	Ord. Production	1,478	Y	Y	365,000
168	Ord. Production	1,380	Y	Y	267,000
2175	Expl Storage	N/A	Y	Y	13,000
2174	Expl Storage	N/A	Y	Y	11,000
162	Ord. Production	121	Y	Y	97,000
163	Ord. Production	121	Y	Y	97,000
164	Ord. Production	121	Y	Y	97,000
2172	Ord. Production	2,100	Y	Y	20,000
2668	Ord. Production	248	Y	Y	18,000
2171	Ord. Production	3,678	Y	Y	251,000
181	Ord. Production	882	Y	Y	229,000
195	Ord. Production	178	Y	Y	12,000
2790	Ord. Production	128	Y	Y	23,000



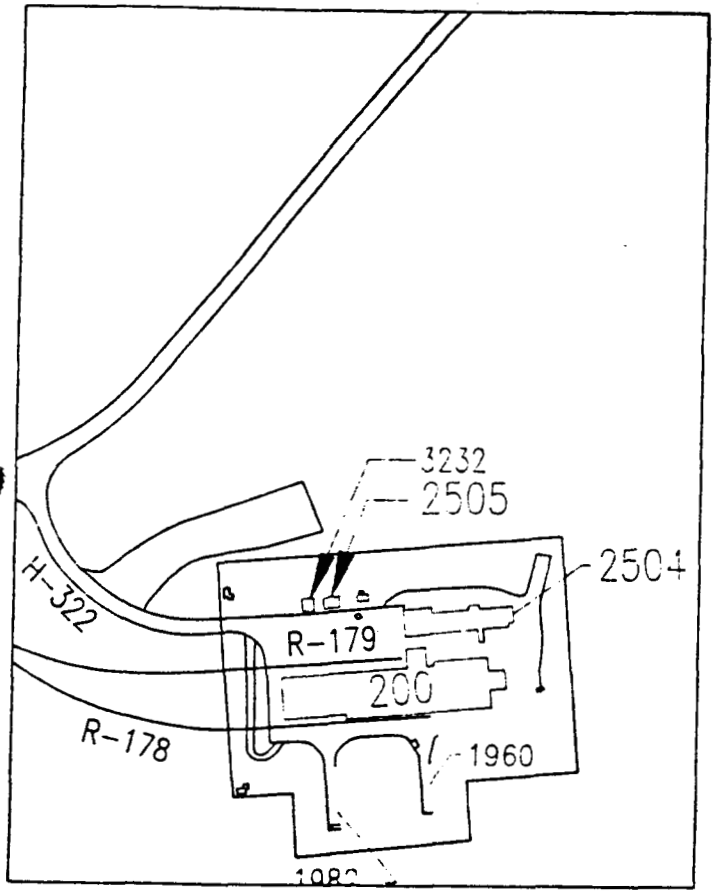
MEDIUM CALIBER PRODUCTION AREA

Bldg. No.	Type Space	Square Footage	Gov't Owned	Difficult to Move/ Replicate	Building Replacement Cost (CPV)
2924	Ord. Production	310	Y	Y	66,000
189	Ord. Production	2,088	Y	Y	400,000
1986	Expl Storage	611	Y	Y	62,000
2781	Ord. Production	980	Y	Y	25,000
117	Ord. Production	450	Y	Y	48,000
2519	Ord. Production	1,363	Y	Y	244,000
118	Ord. Production	20	Y	Y	28,000
104	Ord. Production	23,374	Y	Y	4,395,000
2552	Ord. Production	117	Y	Y	30,000
1985	Expl Storage	611	Y	Y	53,000
2081	Inert Storage	10,167	Y	N	300,000



BAG FILLING AREA

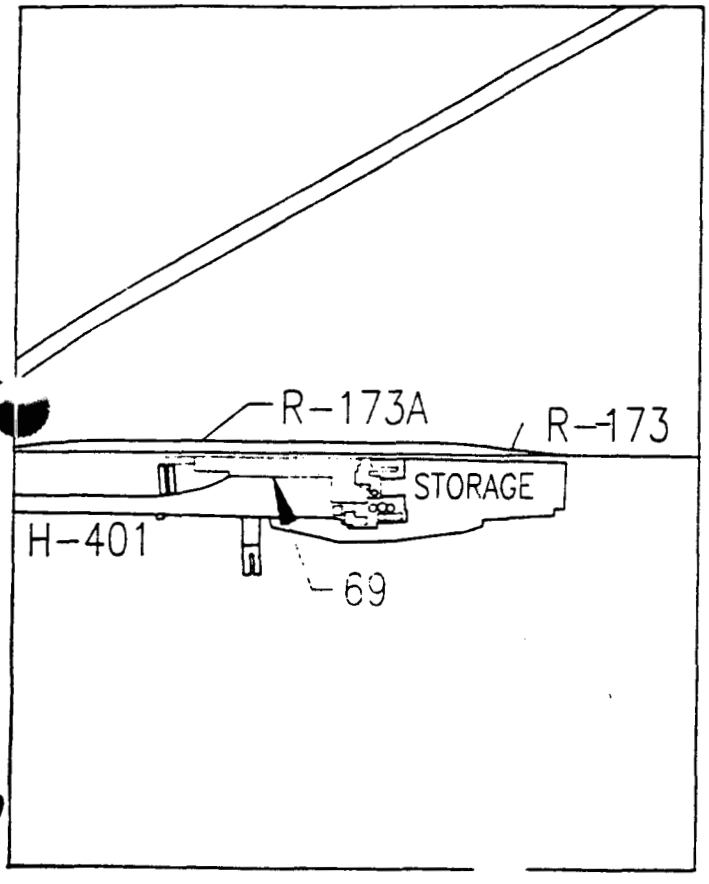
Bldg. No.	Type Space	Square Footage	Gov't Owned	Difficult to Move/ Replicate	Building Replacement Cost (CPV)
101	Ord. Production	12,502	Y	Y	1,930,000
182	Ord. Production	178	Y	Y	12,000
3214	Ord. Production	2,097	Y	Y	198,000
192	Ord. Production	178	Y	Y	12,000
102	Ord. Production	7,990	Y	Y	1,275,000
2137	Ord. Production	205	Y	Y	8,000
110	Ord. Production	49	Y	Y	15,000
111	Expl Storage	49	Y	Y	15,000
103	Ord. Production	1,030	Y	Y	612,000



MAJOR CALIBER PRODUCTION AREA

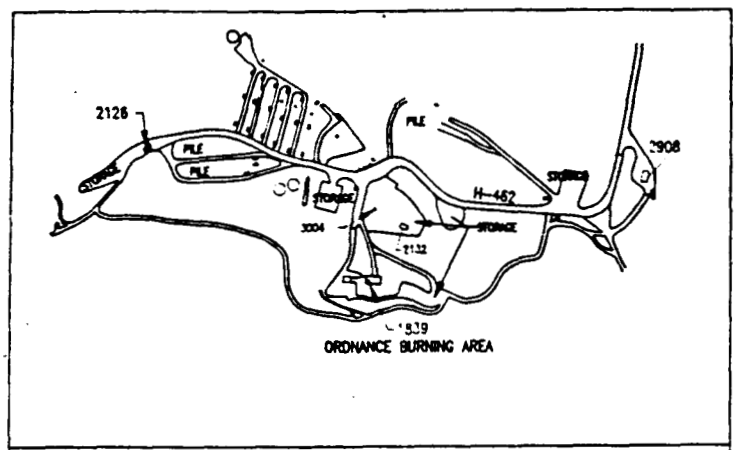
Bldg. No.	Type Space	Square Footage	Gov't Owned	Difficult to Move/ Replicate	Building Replacement Cost (CPV)
2505	Inert Storage	178	Y	N	15,000
2504	Ord. Production	3,599	Y	Y	340,000
200	Ord. Production	14,785	Y	Y	2,654,000
1960	Expl Storage	165	Y	Y	31,000
1982	Expl Storage	611	Y	Y	62,000

ATTACHMENT B, MAP

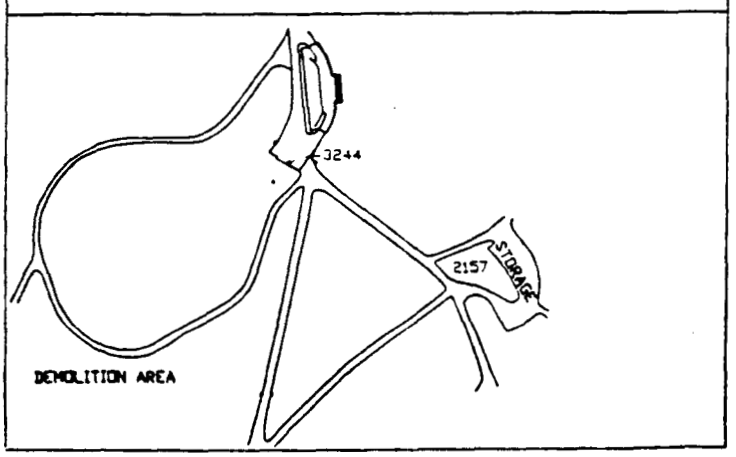


WHITE PHOSPHORUS DEMIL AREA					
Bldg. No.	Type Space	Square Footage	Gov't Owned	Difficult to Move/ Replicate	Building Replacement Cost (CPV)
69	Ord. Disposal	2,304	Y	Y	230,000

ATTACHMENT B, MAP 1



ORDNANCE BURNING AREA



DEMOLITION AREA

AMMUNITION BURNING GROUNDS

Bldg. No.	Type Space	Square Footage	Gov't Owned	Difficult to Move/ Replicate	Building Replacement Cost (CPV)
1839	Ord. Disposal	N/A	Y	Y	101,000
2908	Ord. Disposal	800	Y	Y	78,000
2126	Ord. Disposal	272	Y	Y	18,000

OPEN DETONATION AREA

Bldg. No.	Type Space	Square Footage	Gov't Owned	Difficult to Move/ Replicate	Building Replacement Cost (CPV)
3244	Ord. Production	N/A	Y	Y	126,000
2157	Ord. Production	49	Y	Y	328,000

EODTECHDIV DATA CALL 12, AMENDMENT 1

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

187

NEXT ECHELON LEVEL (if applicable)

J. W. EYER
NAME (Please type or print

Signature

ACTING COMMANDER
Title

10/18/94
Date

NAVAL ORDNANCE CENTER
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 herein is accurate and complete to the best of my knowledge and belief.

MAJOR CLAIMANT LEVEL

E.S. MCGINLEY, II
NAME (Please type or print
(ACTING) COMMANDER
NAVAL SEA SYSTEMS COMMAND
Title

Signature

10/20/94
Date

Activity

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

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

W. A. EARNER

NAME (Please type of print

Signature

Title

10/27/94
Date

WC

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.

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

ACTIVITY COMMANDER

BRAC Data Call 12 Amendment 1

Carroll D. Bernier
NAME (Please type or print)

Carroll D. Bernier
Signature

Acting Commanding Officer
Title

10/18/94
Date

NAVEODTECHDIV, Indian Head, MD
Activity

ENERGETICS CROSS SERVICE ANALYSIS - DATA REQUIREMENTS
NAVAL ORDNANCE CENTER
NAVAL EXPLOSIVE ORDNANCE DISPOSAL TECHNOLOGY DIVISION

1. Organization Chart (as of 30 Sept 94):

a. Show organizational elements (those which report directly to the activity commander). See attachment 1A.

b. Describe organizational relationships especially between support organizations and any other organizations located on the Installation/Base.

The Information Management and Resources Planning Department (Code 05) provides support to all departments at the Command and the four Service Detachments (tenants) in the areas of financial planning, budget execution, supply and inventory control, administrative and personnel management, payroll, facilities management, management of the automated information systems, mail and postal operations, and contracting.

Code 05 is a small department with a total of 32 civilian employees and 6 military personnel. This Command is a tenant activity of the Naval Surface Warfare Center, Indian Head Division, which provides support services in the areas of civilian personnel, EEO, large contracts, public works, disbursing, Morale Welfare and Recreation (MWR) services, family housing, printing, medical services for military personnel, security, food services and the Drug Free Workplace program. These services are funded through Base Operating Support, MWR, and reimbursable financing.

See also attachments 1B(1)-1B(8).

2. For each organizational element:

a. Breakout five types of FY 93 workyears (government, FFRDC on-site, FFRDC off-site, contract support on-site and contract support off-site) by the following job categories: S&T, Engineering Development, Production, In-Service Engineering and other (describe).

See attachment 2A.

b. Number of square feet of space occupied broken out by: laboratory specific space, general office space, and other space (describe). Note if government owned or leased.

All NAVEODTECHDIV space is government owned. See attachment 2B for departmental, type of space breakout.

c. List total FY 93 funds and list main programs and customers.

Total FY 93 funds for NAVEODTECHDIV were $46,335K.

Main programs include:

*Joint Service Exploratory Development
*Joint Service Advanced Development (Acquisition Program)
*Joint Service Engineering Development (EOD Publications)
*Joint Service Logistics Support (In-Service Engineering and Depot Level Maintenance)
*Intelligence and Foreign Ordnance Acquisition
*Joint Service Advanced Technology Demonstration
*Area Clearance Technology Demonstration

See also attachments 2c(1) - 2c(4)

Major Customers include:

*Joint Service EOD Technicians
*Office of Naval Reserach
*PEO-Mine Warfare
*Naval Engineering Logistics Office
*Army Environmental Center
*Office of Special Technology
*U.S. Secret Service
*Bureau of Alcohol, Tobacco & Firearms
*Federal Aviation Administration
*CIA
*FBI
*DIA
*Office of the Chief of Naval Operations
*Naval Maritime Intelligence Center (NAVMIC)
*Naval School, EOD
*Naval Surface Warfare Center Divisions (Indian Head, Crane, Dahlgren)
*Naval Weapons Center, China Lake
*Naval Research Laboratory
*Office of Naval Intelligence

3. Describe by major functional and product lines the capabilities of your activity to perform energetic functions in terms of manpower, intellectual/skill capability and capacity and major facilities and equipment.

The NAVEODTECHDIV uses certified energetic materials as an element in the development of procedures and equipment used by military explosive ordnance disposal technicians. We do not develop or manufacture energetic materials, or produce devices containing energetic materials.

In terms of increasing the capability of our activity to perform energetic functions, the following applies:

The Operational Support Department (Code 20) does not have the manpower required to conduct energetic functions.

The Equipment Management Department (Code 45) could absorb an additional three workyears' worth of fully funded EOD/SOF related energetics functions as specified in attachment 2A, with little or no modifications required to existing facilities.

The R&D Department's (Code 50) major functional and product lines are that portion of DOD life cycle acquisition which includes Concept Exploration, Demonstration/Validation, and Engineering and Manufacturing Development for special equipment for military bomb disposal technicians, and technology demonstration and technology development where it supports anticipated operational requirements from military bomb disposal technicians.

With respect to these functions, Code 50 has a capability to specify energetic tools to be manufactured by others and to plan tests of energetic tools which are specifically used to render safe or dispose of military fuzed conventional, explosive loaded ordnance in an unknown condition or to render safe or dispose of improvised explosive loaded devices. In FY 93 no department personnel were committed to development or testing of energetic tools. There were no operational requirements. The department has one explosives experienced chemical engineer, one pyrotechnic experienced technician, and one expert mechanical engineer (demolitionist). Without a major change in the workforce, Code 50 has no capability to absorb additional work in energetics. If an operational requirement is presented which requires specific development in energetics, we seek help from other government facilities or contractors.

In the Munitions Countermeasures Department (Code 60), a single product line related to energetics is supported where we conduct literature research, EOD procedures development and validation, and support joint service verification on render-safe procedures for the 60-Series Tech Manuals. The level of effort for these activities is indicated in Attachment 2A. This work is highly specialized, directly supporting DOD Directive 5160.62, for the Joint Service EOD Program. The skills/knowledges required to perform these tasks involve applied principles concerning:

a. Engineering (all categories)
b. Specialized EOD tools development and use
c. EOD-specific ordnance background for all munition categories, including improvised, foreign and domestic
d. Munitions-specific systems (e.g., fuzing systems, firing systems, propulsion systems, guidance systems, material parameters such as case thickness, etc. and hazardous

components).

e. Explosives (i.e., dynamics associated with detonation characteristics)

f. Country-specific ordnance trends

g. Intelligence information gathering capability (e.g., information required for developing Ordnance Order of Battle)

Code 60 could absorb an additional three workyears of effort (effectively more than tripling the output of this activity in this area of expertise) without modifications to facilities.

All of the above work requires the use of the following major facilities and equipment:

a. Explosive test ranges, both local and off-site. The local range is capable of running explosive tests on most munition items where relatively small energetics tools (e.g., caliber 50 dearmer) are used in the development of render safe procedures. Items for disposal, such as large rocket motors and bombs, require off-site ranges capable of handling larger detonations.

b. Munitions Disassembly Facility. This capability allows disassembly and analysis of munitions components for exploitation and development of EOD procedures.

c. Countermeasures Laboratories and Equipment.

(1) Electronic Exploitation Laboratory (EEL). The function of the EEL pertaining to the energetic function is to support range testing of explosive ordnance items, and to design and build prototype test hardware to meet specialized EOD test requirements.

The equipment used by the EEL in support of the energetic functions varies depending upon unique test requirements. Test equipment used in a typical test scenario can consist of the following:

Oscilloscopes to measure peak pressures
Video equipment to record test results
Data acquisition system to collect and process data from explosive tests
Piezoelectric gauges for measuring blast over-pressures
Other miscellaneous electronics

(2) Underwater Laboratory (UWL). The UWL uses acoustic and magnetic measuring devices to range EOD tools and equipment, boats, engines, mammals, etc., in underwater environments. The results determine safe distances for EOD operations on underwater ordnance.

Munitions Radiographic Laboratory. This laboratory is used to xray ordnance prior to disassembly to ensure the development of safe disassembly procedures.

Magnetometer Test Facility. The purpose of this facility is to measure magnetic effects and to provide initial certification and perform periodic recertification of tools, both explosive and nonexplosive and components in accordance with MIL-STD-19595C or other nonmagnetic standards (i.e., NATO Magnetic Test specifications).

d. Energetic EOD Tools. A variety of energetic tools are used in the development and testing of EOD procedures. The purpose of these tools is the dynamic disruption of munitions arming and firing trains (i.e., fuzing systems). Examples of energetic EOD tools include: J-RODS, 50 caliber Dearmer, Rocket Wrench, Shaped Charges, Flexible Linear Shaped Charge.

4. Map of the installation to include elements listed in 2 and 3:

a. Annotate buildings to show location of each organizational element. See attachment 4A.

b. Show buildings with equipment/facilities which would be difficult to move or replicate. List such equipment with initial cost. Provide an estimate of the replacement cost of the facilities.

Building	Name	Initial Cost	Replacement Cost
2134-2143	Munitions Disassembly Complex	$8.3M	$11.0M
2009	Munitions Radiographic Laboratory	$385K	$1.5M
2176	Hyperbaric Chamber	$315K	$1.8M
D21C	Magnetometer Test Facility	$24K	$900K
2172	Munitions Electronics Exploitation Lab	$250K	$300K
2131	Vibration Test Facility	$ 99K	$100K
2108	Range Operations Bldg. Range 3	$ 45K	$200K*

*Our procedures test and validation range may be impossible to replicate due to existing environmental constraints.

5. Estimate the capacity of the activity and installation (separately) to absorb similar workyears with little or no modification of facilities. Estimate the capacity of the activity and installation (separately) to absorb similar workyears with major modifications and describe the nature of those modifications and estimated cost. Use FY 97 as the baseline for such estimates.

As stated above, most of our departments do not have the manpower or capability to absorb unstaffed workyears associated with energetics. If changes were made in the workforce, however, the following could be accomplished with little or no modifications to existing facilities:

An additional six workyears (fully staffed and funded) could be accommodated in our munitions disassembly complex for the disassembly of ordnance.

An additional eight workyears (fully staffed and funded) could be accommodated with existing facilities for the EOD 2T design agent efforts.

An additional seven workyears (fully staffed and funded) could be accommodated with existing facilities in the validation and verification of render-safe procedures business line if the additional workyears for disassembly described above were provided.

If MILCON Project P-759 comes on line ($900K), an additional two workyears could be provided in the MIL-M-19595 testing area.

6. Describe the impact of BRAC 91 and BRAC 93 decisions on the activity and installation.

None.

7. Describe military department approved and programmed plans which will impact or have impacted the activity and installation.

None.

8. Remaining tenants and other activities on the installation: name of organization, mission, total workyears.

Marine Corps Detachment (RUC: M04640). Mission: Provide direct liaison between the Commandant of the Marine Corps (CMC), Commanding Officer, Naval Explosive Ordnance Disposal Technology Division, and Marine Corps Explosive Ordnance Disposal activities. These duties include identifying Marine Corps requirements for the development of tools, equipment and procedural publications. Provides Marine member to the Joint Service EOD Military Technical Acceptance Board. Other duties

and functions as identified in the current CMC (LPO) Letter of Instruction. Total Authorized Workyears: 6.

Fleet Liaison Unit (UIC 45184). Mission: Ensures Navy explosive ordnance disposal operational requirements for new development projects including all tools, equipment, and procedural publications are being met during the development cycle and prior to granting approval for Navy exlosive ordnance disposal use. Provides Navy member to Joint Service Explosive Ordnance Disposal Military Technical Acceptance Board. Total Authorized Workyears: 7.

Detachment 63 Aeronautical Systems Center. Mission: Detachment 63 serves as the focal point for managing joint service approved EOD tools, equipment, procedures, techniques, and publications within the Air Force. In this capacity, Detachment 63 provides Air Force representation to the DOD joint service EOD Military Technical Acceptance Board as prescribed in DODD 5160.62. Total Authorized Workyears: 11.

U.S. Army Technical Detachment. Mission: Represent U.S. Army in the Joint Service Explosive Ordnance Disposal Program. Participate in Joint Service technical programs relating to the development of EOD procedures, tools and equipment, and publications. Act for Department of the Army in acceptance of Joint Service EOD tools, equipment, publications and procedures. Serve as the U.S. Army liaison with NAVEODTECHDIV. Total Authorized Workyears: 9.

9. Summarize your overall mission.

The NAVEODTECHDIV is uniquely responsible for:

*execution of the Navy Single Service Manager responsibility for technology support of the Joint Service Explosive Ordnance Disposal Technology and Training Program;

*conduct of Exploratory and Advanced Development projects in response to Joint Service EOD requirements;

*providing logistics support for EOD Federal Supply Class 1385 and 1386 items (primarily in-service engineering and depot level maintenance services);

*developing and maintaining EOD 60-series publications for fleet and field EOD operators;

*providing a technical response team in support of the Army improvised nuclear device response team;

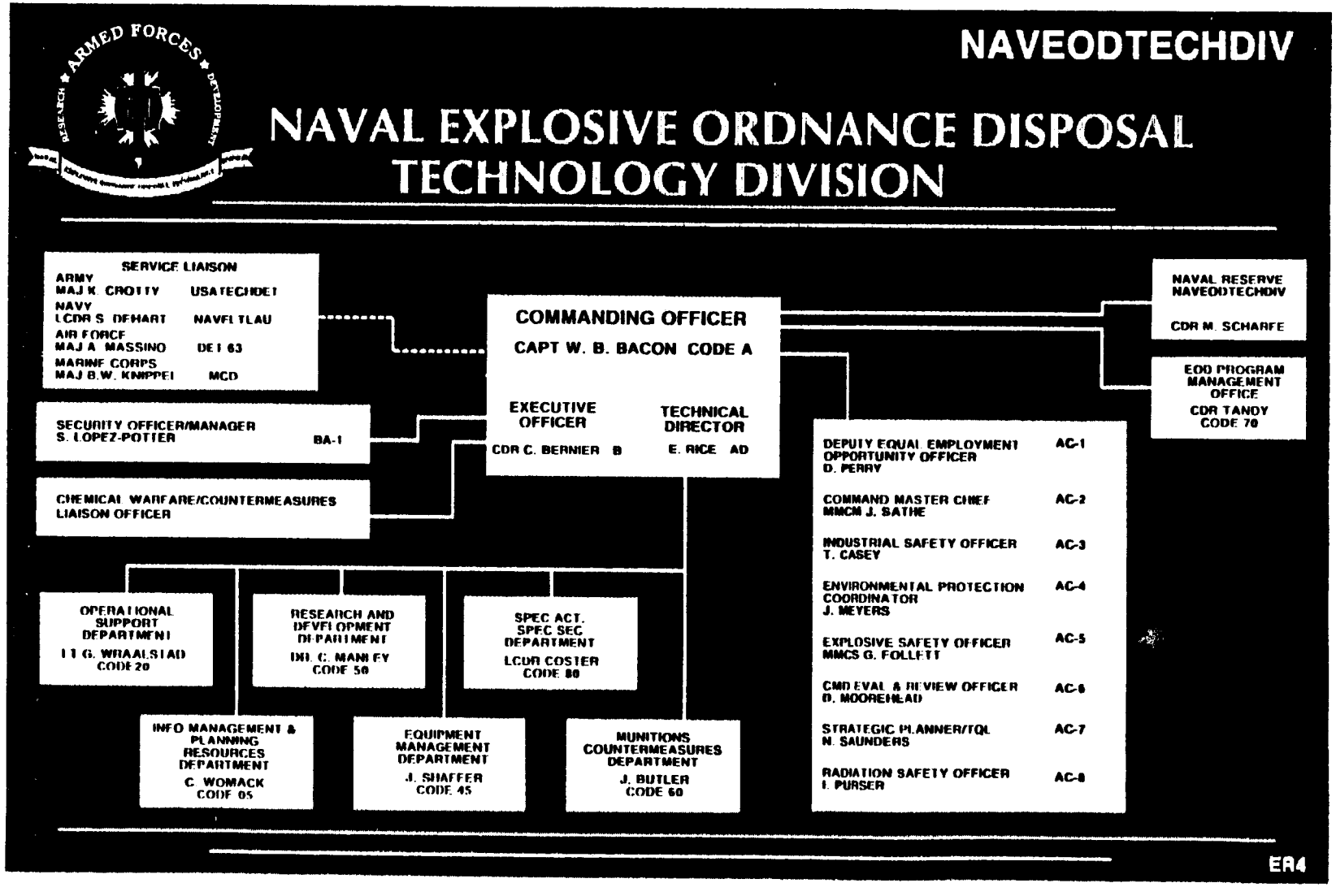
*maintaining testing capability and conducting testing of specialized nonmagnetic equipment for EOD and other customers;

*providing specialized EOD technology and management capabilities for clearing contaminated areas of unexploded ordnance;

*providing EOD technology support to the Army Environmental Center; and

*providing technical support to the Navy and DOD information exchange program related to EOD.

Attachment 1A



6

COMMANDING OFFICER [CODE A]

EXECUTIVE OFFICER [CODE B]

TECHNICAL DIRECTOR [CODE AD]

The Commanding Officer, Executive Officer and Technical Director provide guidance and policy for the Command.

The Commanding Officer is responsible to the Commander, Naval Ordnance Center for carrying out the mission of the Command as assigned by the Secretary of the Navy. He is responsible for the morale, welfare, efficiency, and safety of the Command, the accomplishment of the mission through the performance of specified functions and for ensuring that the Navy's regulations on Equal Employment Opportunity are implemented and effectively carried out.

The Executive Officer has responsibilities as the Deputy Commanding Officer and manages the support departments in addition to assuming command during the absence of the Commanding Officer.

The Technical Director is a special advisor to the Commanding Officer. He provides expert opinions on EOD matters or other topics as directed. He assists in the development, coordination, analysis, implementation, monitoring and evaluation of the programs at the command in the areas of technology, management and resources.

INFORMATION MANAGEMENT AND RESOURCES PLANNING DEPARTMENT [CODE 05]

A recent efficiency review led to the reorganization of two relatively small support departments into one larger support department for the entire Command. The result will be a shift from a reactive management approach to one with a proactive planning emphasis.

The Department is divided into four Divisions and two special staff codes:

The Financial Planning and Information Division is responsible for budget formulation, execution and justification, as well as general financial planning and management. It also performs the payroll operation for the Command.

The Acquisition Planning and Information Division manages the small purchase function of the Command, serves as a liaison between the internal customer and external contracting activities, performs shipping, receiving and plant property functions in support of the Command and manages the Command's mail operations.

The Internal Information Division is responsible for general administrative matters, coordinates all personnel matters with each department and the Civilian Personnel Office, serves as the Public Affairs Office and manages the Command's Technical Library.

The Information Systems Division manages the Command's local area network, coordinates all hardware and software procurement, inventory and management, and performs training in these areas.

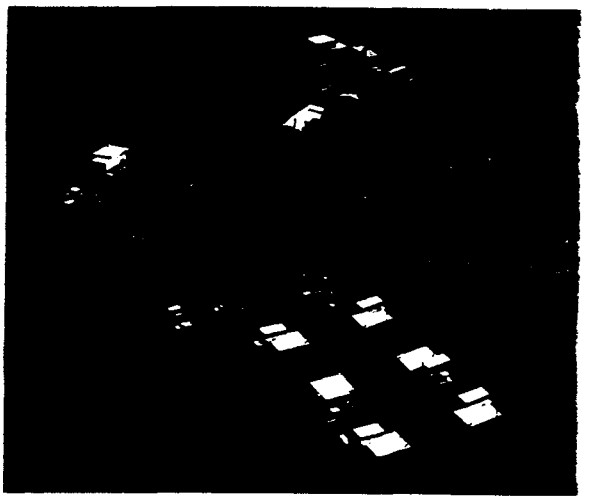
The Quality of Life Staff manages the Command's space utilization plan, coordinates all buildings and grounds maintenance operations, and manages the Command's vehicle, telephone, utilities and energy programs.

The Information Management Team consists of the Department Head, each Division Head and certain designated positions, such as the Public Affairs Officer and the Librarian.

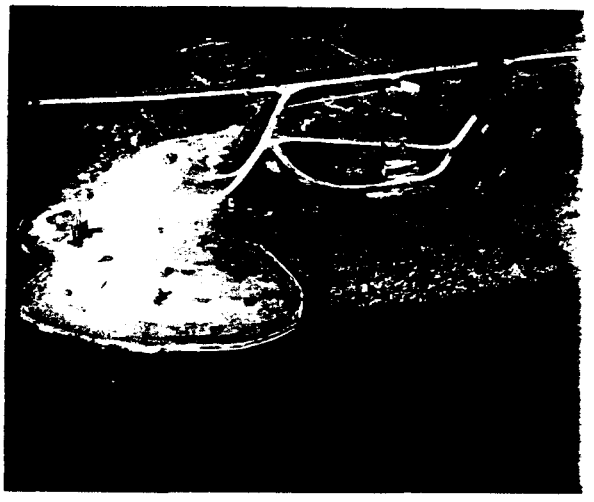
The Department is also responsible for preparing and executing intra and interservice support agreements for the Command, including the Host/Tenant agreement with the Indian Head Division, Naval Surface Warfare Center.

Team building concepts have been instituted in the creation of this department and will continue as the department becomes fully operational.

OPERATIONAL SUPPORT DEPARTMENT [Code 20]



The Operational Support Department provides foreign ordnance exploitation, disassembly, inerting, examination and documentation services.
It provides explosive testing for the development of EOD render safe procedures, stores and maintains records of accountability for all explosives and foreign ordnance stored by the Command and maintains a flyaway munitions examination capability which includes photography, radiography and munitions disassembly.
The Department also maintains and operates the Command's hyperbaric complex and all assigned smallcraft. It provides diving and underwater testing services in support of research and development of EOD underwater tools and equipment.
It also maintains and operates an expolsive test site used to support development of tools, equipment, and publications.

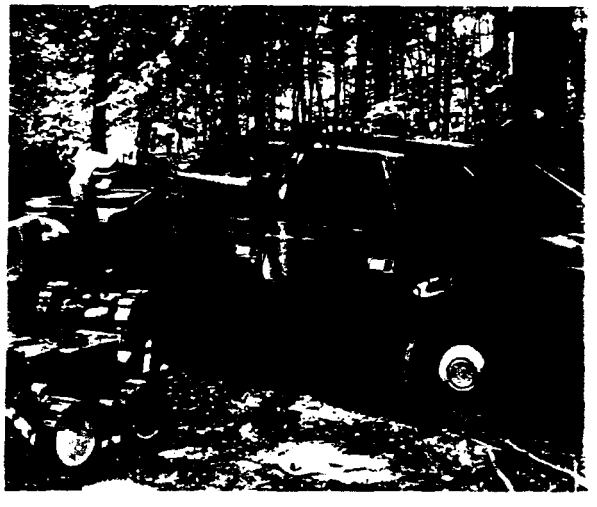


The department operates and maintains the following special facilities:

- Munitions Disassembly Complex
- Underwater Test Facility
- Explosive Test Site
- Radiography Facility

EQUIPMENT MANAGEMENT DEPARTMENT [CODE 45]

The Equipment Management Department provides logistics, in-service engineering and depot level repair support for in-service Joint Service EOD tools and equipment. This includes special underwater equipment used by EOD and Seal personnel and equipment used by EOD personnel to defeat Improvised Nuclear Devices (IND). As the logistics agent, In-Service Engineering Agent (ISEA) and Designated Overhaul Point (DOP) for this equipment, the department provides comprehensive logistics planning for life-cycle support, provides interim supply support, serves as the Inventory Control Point (ICP) on selected items, develops provisioning/procurement technical documentation, publishes and distributes the Equipment Management Data List (EMDL), monitors contracts, maintains an engineering drawing/specification/documentation repository, administers the EOD Configuration Management Program, provides 3M Program documentation/data, provides depot level maintenance support services, coordinates depot maintenance schedules and priorities, negotiates Depot Maintenance Interservice Support Agreements (DMISAs), conducts first article test inspections, and provides packaging, shipping and handling services. The department also operates and maintains the following special facilities:



MAGNETIC SIGNATURE TEST FACILITY

OXYGEN CLEANING AND CALIBRATION FACILITY

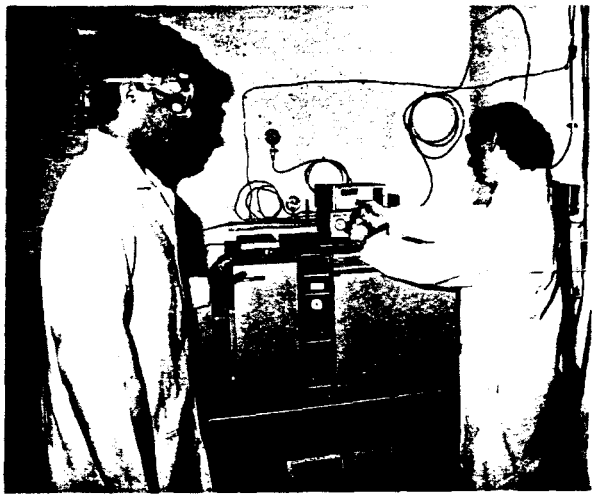
ENVIRONMENTAL TEST CHAMBER

MECHANICAL TEST AND INSPECTION FACILITY

VIBRATION TEST FACILITY

RESEARCH AND DEVELOPMENT [CODE 50]

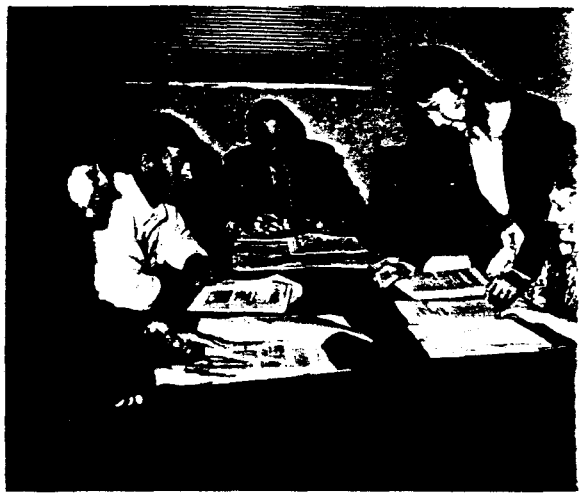
The Research and Development Department of the Naval EOD Technology Division is part of the material acquisition system for the Joint Service EOD community. The Department does that portion of the acquisition life cycle phases associated with Concept Exploration, Demonstration/Validation and Full Scale Development. The Department responds to Mission Need Statements, Operational Requirements Documents and other tasking requiring engineering development. The principal product of the Department is verified engineering documentation. The Department also develops and maintains an EOD technology base, and produces technology demonstration, prototype hardware. The Department accomplishes it's work using a mix of internal resources, other Government facilities and industry.



The Department is organized into eight functional branches inside a matrix structure. These branches represent a cross section of engineering and engineering management skills.

The Department is a non-traditional organization which emphasizes the following:

- egalitarian culture
- non-hierarchical management
- horizontal communications, authority and responsibility
- decentralized control
- mutual support
- intense functional specialization
- commitment to the organization and the work of the organization
- individual professional development



MUNITIONS COUNTERMEASURES DEPARTMENT [Code 60]

The Munitions Countermeasures Department conducts engineering development and life cycle management of EOD procedures and tactics and associated publications dealing with domestic and foreign ordnance. To do this, it must maintain a state-of-the-art munitions design technology base; conduct validation of EOD procedures; conduct initial evaluation of foreign explosive ordnance, and develop preliminary render safe procedures. It also conducts acquisition of domestic munitions/design data of all types to provide a data/munitions base to prepare, maintain, and update Explosive Ordnance Disposal procedures for Joint Service use.

Another important mission is to conduct technology development and maintain a technical response team and equipment for improvised nuclear device (IND) threat countermeasures.

The department operates and maintains the following special facilities and capabilities:

- Automated Ordnance Graphics Capability
- IND Response Team
- Automated Publication System

EOD PROGRAM MANAGEMENT OFFICE [CODE 70]

The EOD Program Management Office performs all program management functions to include planning, programming,and budgeting of RDT&E, procurement and production, in-service engineering life cycle management, and operation and maintenance support for assigned systems. The responsibilities and authority for total program management of the program is executed by the Program Office under the NAVEODTECHDIV and as PMO-EOD under the Program Executive Officer for Mine Warfare [PEO[MIW]].

The office supports:

Joint Service EOD Program

Underwater EOD Program

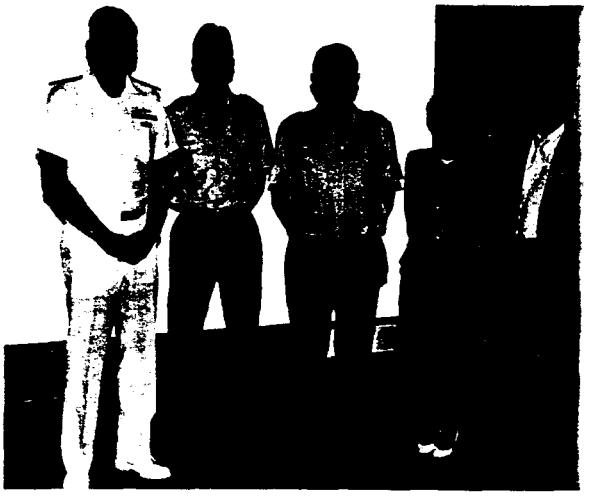
Marine Mammal Systems

Specific functions of the Program Management Office are to:

Plan and direct the execution of advanced and engineering development, production, installation, support and in-service engineering for assigned systems.

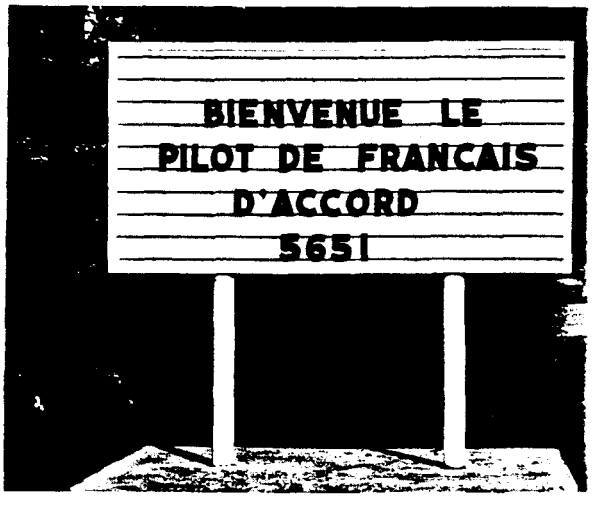
- Chair Configuration Control Boards for assigned systems.
- Coordinate development and testing of EOD diving systems.
- Plan and direct technical test and evaluation programs.
- Provide advisory guidance for NAVSEA to the Office of Naval Technology on execution of Joint Service EOD, IND and
- Marine mammal technology base (exploratory development).
- Provide PMS-300 with interface and funding when required for small boats.

SPECIAL ACTIVITIES SPECIAL SECURITY DEPARTMENT [CODE 80]



The Special Activities Special Security Department provides information services and through liaison with civilian government and military organizations, both foreign and domestic, in support of Command objectives and international relations. In this respect, it is responsible for the scientific and technical intelligence services as it pertains to EOD, foreign materiel acquisition of ordnance, foreign military sales of EOD publications and equipment, and international exchange programs to include NATO, ABCA-5, and Mutual Weapons Development Data Exchange Agreements. Unique responsibilities/capabilities of the Department include:

- Command Sensitive Comparted Information Facility [SCIF]
- Foreign Disclosure Technical Information System [FORDTIS]
- Communication Security Material System [CMS]
- North Atlantic Treaty Organization COSMIC Control Point



ENERGETICS CROSS SERVICE ANALYSIS
NAVAL EOD TECHNOLOGY CENTER
ATTACHMENT 2A

Type	Department	S&T	Engineering Development	Production	ISE	Other	Total
Government	00/05 1/	-	-	-	-	57.1	57.1
	20 2/	-	-	-	-	35.4	35.4
	45 3/	-	-	-	16.5	36.7	53.2
	50 4/	28.2	21.0	-	5.0	-	54.2
	60 5/	6.2	45.3	-	-	26.3	77.8
	70 6/	-	5.9	-	-	3.6	9.5
	80 7/	-	-	-	-	11.8	11.8
Total		34.4	72.2	-	21.5	170.9	299.0

There were no on-site or off-site contractors associated with energetics.
We do not contract with FFRDCs.
Government workyears include both military and civilian efforts.

1/ Codes 00/05 include Command, staff codes and the support department. "Other" includes management, administrative, and other support categories (i.e., facilities management, information systems management, supply and purchasing, mail room operations, etc.)

2/ Code 20 deals almost exclusively with services as opposed to products. The department does not create hardware as a manufacturer might, but instead deals with items that have been manufactured by others. These items are the basis of the diverse tests and investigations conducted by Code 20. The efforts may involve disassembly or radiographic examination of munitions, test and evaluation (T&E) of new diving equipment, or ordnance

malfunction investigations. They may be used to establish the basis of an aircraft mishap, to further the production of a hardware item, or to be incorporated into ordnance 60 series publications. "Other" includes EOD technicians, disassembly technicians, radiographers and divers.

3/ Code 45 energetics efforts include 1.5 workyears associated with EOD 2T cog design agent for Crane PM4 (to include configuration management, production support, engineering support, master documentation and malfunction investigation) and MIL-M-19595 magnetic testing efforts. "Other" includes depot maintenance, depot support, and acquisition support associated with EOD specific tools and equipment.

4/ Code 50 energetics efforts include .8 workyears associated with an explosive detection program (TAGGANTS) for the Federal Aviation Administration. Also, in FY 93 the Department supported at another government facility, a project to examine entrainment of small explosive globules in a water jet to make holes in bombs and projectiles.

5/ Code 60 energetics efforts include 1.2 workyears associated with highly specialized joint service research, validation and verification of render safe procedures for the 60-Series Tech Manuals. "Other" includes editors, techwriters, graphic artists, and managerial and clerical support.

6/ Code 70 has a small energetics effort (.5 workyears) associated with the MK 98 Mine Neutralization Charge. This product is currently under development at NSWC Dahlgren, White Oak Detachment. Code 70's efforts include program management, participation in configuration management board and failure analysis board. "Other" includes program management personnel.

7/ Code 80 has no energetics efforts. "Other" includes intelligence, FMS, and NATO operations.

ENERGETICS CROSS SERVICE ANALYSIS
NAVAL EXPLOSIVE ORDNANCE DISPOSAL TECHNOLOGY DIVISION
ATTACHMENT 2B
(IN SF)

Organizational Element	Ops & Train.	Maint.& Prod.	Labs	Storage	Admin.
Command & Support*	-	-	875	8,420	45,233
Operational Support (Code 20)	2,976	1,319	30,066	10,198	-
Equipment Management (Code 45)	-	33,707	7,424	9,653	2,667
R&D (Code 50)	1,900	-	36,609	4,715	752
Munitions Counter-measures (Code 60)	51,839	-	22,200	-	14,660
Total	56,715	35,026	97,174	32,986	63,312

*Includes Codes 00/05/70/80.

NAVEODTECHCEN

JOINT SERVICE EOD PROGRAM

OBJECTIVE: Provide centralized field activity and support direction for research, development, and life cycle management of Navy and Joint Service EOD equipments, systems, and EOD procedures.

REQUIREMENT: Managed in accordance with DoD Directive 5160.62 of 26 Apr 89, Single Manger Responsibility for Military Explosive Ordnance Disposal Technology and Training (EODT&T); DOD Program Board Policy Agreement 1-87 of 06 Oct 87, Policy Agreement for DoD EOD Hardware Development Program (Advanced and Full Scale Development); and NAVSEAINST 5450.16B of 07 Jun 88, Mission and Functions of Naval Explosive Ordnance Disposal Technology Center.

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Attachment 2c(1)

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JOINT SERVICE EOD PROGRAM

APPROACH: The Command conducts engineering development and life cycle management of EOD procedures and tactics and associated publications dealing with domestic and foreign ordnance. The engineering development includes the development, validation and Joint Service verification of render safe procedures. Includes the development of detection sensors, remote platforms, target mapping and navigation systems, directed energy systems, explosively actuated tools, case entry tools, area access systems, imaging systems, and removal equipment.

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Attachment 2c(2)

EXPLORATORY DEVELOPMENT PROGRAM

OBJECTIVE: Develop enabling technologies to support EOD tools and equipment development.

REQUIREMENT: Managed in accordance with DOD Program Board Policy Agreement 1-91, Explosive Ordnance Disposal/ Improvised Nuclear Device Exploratory Development. EOD Technology Block Plan part of the ONR Exploratory Development Program. Long term plan for EOD technology provides road map for development for EOD related technologies in next 10 years. NAVEODTECHCEN is lead service activity for Reliance/JDL. Supports Joint Service EOD, EOD diving equipment, and DTRG.

APPROACH: Development of technologies in 5 mission related areas: detection and localization, examination and identification, disposal/disruption, area access/clearance, low intensity conflict. Currently are 16 active tasks in these areas.

Attachment 2c (3)

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NAVEODTECHCEN

AREA CLEARANCE TECHNOLOGY DEMONSTRATION PROGRAM

OBJECTIVE: To develop and demonstrate systems to detect, locate, and remove buried unexploded ordnance (UXO) which have become a hazard to life and property from contaminated test ranges and other areas.

REQUIREMENT: Area clearance mission defined under NAVSEAINST 5450.16B. Tasked by the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) to perform work.

APPROACH: The scope of this multi-year effort includes the development of detection sensors, sensor platforms, information processing hardware and software, target mapping and navigation systems, and removal interface equipment.

Attachment 2c(4)

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Document Separator