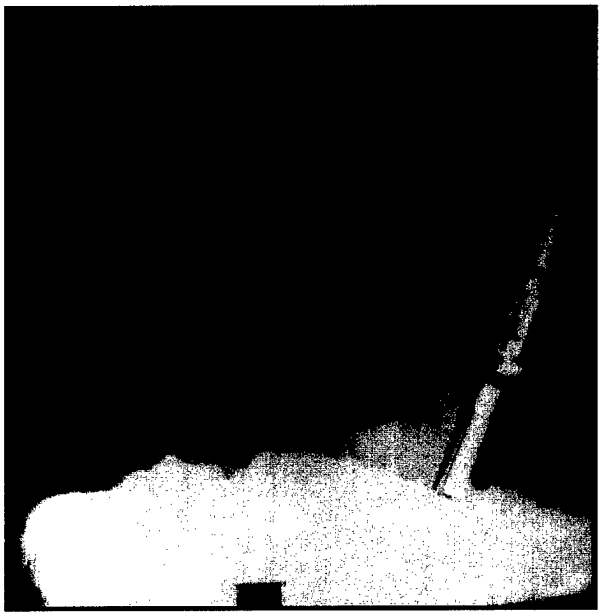
Environmental Assessment

Navy Lightweight Exoatmospheric Projectile (LEAP) Technology Demonstration



May 1994

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(BMDO)

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Ballistic Missile Defense Organization

May 1994

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Cover Sheet

Responsible Agency Ballistic Missile Defense Organization (BMDO)

Proposed Action Navy Lightweight Exoatmospheric Projectile (LEAP) Technology Demonstration

Responsible Individual

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Designation Environmental Assessment (EA)

Abstract

This environmental assessment (EA) is an analysis of the environmental consequences of conducting activities in support of the Navy (LEAP) Technology Demonstration Program, pursuant to the National Environmental Policy Act (NEPA), the Council on Environmental Quality (CEQ) regulations implementing NEPA (40 CFR Parts 1500-1508), and the U.S. Department of Defense (DoD) Directive 6050.1.

The purpose of the technology demonstration is to identify and address key technology issues involved with incorporating miniature hit-to-kill interceptors into a tactical weapon system (i.e., surface-to-air ship launched missile systems) to demonstrate the feasibility of performing high altitude ballistic missile defense from a Navy platform. To support these requirements, the proposed action involves integration and testing of Navy LEAP demonstration technologies. An environmental assessment of the Navy LEAP Technology Demonstration was concluded in September 1992 in a Finding of No Significant Impact. Subsequent changes to the program have precipitated additional analysis. This EA presents an assessment of the potential consequences of conducting flight tests 3, 4 and 5 at Wallops Flight Facility in Wallops Island, Virginia. The assessment indicates that no significant impacts are anticipated as a result of the proposed changes to the Navy LEAP program.

Availability Unclassified. Available June 1994

Summary

The Lightweight Exoatmospheric Projectile (LEAP) program is a Ballistic Missile Defense Organization program aimed at developing, integrating, and validating by experiment miniature kinetic energy (hit-to-kill) interceptors. These interceptors have applications to strategic, theater, and tactical ballistic missile defense. The LEAP program is under the direction of the Interceptor Technology Directorate of the Technology Deputate within the Ballistic Missile Defense Organization (BMDO). An incremental and comprehensive approach to developing and testing LEAP technologies has been adopted. Incremental tests allow weapon designers to isolate key technical elements during development and testing to produce early results which are useful to weapons systems designers and demonstrate cost, schedule and program success. The LEAP test program begins with early development testing of the components at contractor facilities and progresses to extensive ground testing at government facilities before final flight testing.

Ballistic Missile Defense Organization and the Navy have identified the need to demonstrate LEAP technologies in a ship-based environment in the near term to determine potential applications in sea-based missile defense. In order to perform this demonstration, the Ballistic Missile Defense Organization proposes to use the STANDARD Missile 2 (SM2) Block II/III Terrier Missile and its associated launch platform (a Terrier class guided missile cruiser). The purpose of the Navy LEAP Technology Demonstration is to identify and address key technology integration issues involved with incorporating miniature, kinetic energy interceptors into a tactical weapon system. These integrated technologies will be used to demonstrate the feasibility of performing high altitude (exoatmospheric) ballistic missile defense from a Navy platform for protection of U.S. and allied forces, territories and facilities ashore.

An initial EA was performed for the five flight Navy LEAP program, resulting in a Finding of No Significant Impacts (FONSI) in September, 1992 (SDIO, 1992b). Since then, the initial two flights have been completed. The launch location for the remaining three missions has been moved from the Eastern Range (ER), Cape Canaveral, Florida to the NASA/Goddard Space Flight Center, Wallops Flight Facility at Wallops Island, Virginia, requiring a new EA.

The technology demonstrations include three STANDARD Missile flight tests against Aries targets. After integration of the SM2 LEAP at White Sands Missile Range, the integrated missile is transported from White Sands Missile Range to the East Coast Navy Weapons Station in Yorktown, Virginia for load-out to the ship. No testing of the SM2 LEAP Vehicle will occur at Yorktown - only acceptance, storage (if necessary), and load-out to the ship. The target booster is shipped to Wallops Flight Facility (WFF) from Hill Air Force Base. The target integration activities for Flight Test Vehicles 3, 4 and 5 take place at WFF. The target vehicle is launched from WFF.

During flight test activities, the target is launched from WFF in a southeasterly direction. The Terrier ship, positioned in the Atlantic ocean southeast of WFF, launches the LEAP interceptor in a northeasterly direction. Intercept of the target vehicle occurs over open ocean

approximately 350 km (220 miles) off-shore. No construction is required at any of these facilities to accommodate Navy LEAP activities.

During the original range selection process, nine test ranges were evaluated for potential performance of the Navy LEAP missions. This evaluation process is defined in the Navy LEAP EA. The Eastern Range and Cape Canaveral Air Force Station was originally selected as the test range for the last three Navy LEAP missions (Flight Test Vehicles 3, 4 and 5). The test range has since been changed to Wallops Flight Facility, primarily because of cost and schedule considerations. A more detailed discussion is contained herein.

After an extensive survey and screening, nine target launch vehicles were evaluated in detail for their capability to meet LEAP requirements. The Aries I was chosen because it is representative of a TBM threat, is a proven launch vehicle, has been used on previous LEAP missions, the boosters are readily available, can be maintained within a 2-3 km/second intercept velocity requirement (helps ensure ABM Treaty compliance) with minimal ballast, and meets performance requirements outlined in the Target Requirements Document. It also has the advantage of being a single-stage vehicle. This feature lowers mission risk and complexity. The entire Aries vehicle serves as the target and will not separate any components.

The No Action alternative to the proposed action is to not conduct flight tests 3, 4 and 5. The No Action alternative would preclude a critical series of flight tests that are needed to demonstrate the feasibility of using existing Navy shipboard weapon systems with LEAP technologies. These tests are essential for the near term evaluation of Navy upper tier BMD (ANSER 1993).

Potential impacts of the proposed action at WFF were assessed on the following environmental resources: physical setting; geology and soils; water resources; biological resources; threatened and endangered species; cultural resources; air quality; noise; and hazardous materials and wastes. Infrastructure and human health and safety were also assessed.

Potential impacts from the LEAP Test Program have previously been assessed in the LEAP Test Program Environmental Assessment (SDIO, 1991), the LEAP Supplemental Environmental Assessment (SDIO, 1992a) and the initial Navy LEAP Environmental Assessment (SDIO, 1992b). Each of these assessments resulted in a finding of no significant impact (FONSI). The environmental effects of STANDARD Missile development and operational tests at White Sands Missile Range were assessed in the STANDARD Missile Environmental Assessment (SDIO, 1992b). This assessment also resulted in a FONSI. The launch of an Aries booster from WFF is extremely similar to the Brilliant Pebbles Flight Experiment 3 Record of Environmental Consideration (REC), which resulted in a FONSI. An REC for a demonstration flight of the Navy LEAP Target (FTV-TD) also resulted in a FONSI. The Council on Environmental Quality (CEQ) NEPA Regulations encourage agencies to incorporate material by reference when the effect will be to cut down on bulk without impeding agency and public review of the action (CEQ, Sec. 1502.21). The analyses from each of these documents has been incorporated into this document by reference, where appropriate. The environmental analysis concludes that implementing the proposed action would not result in significant impacts to the natural

environment or to human health and safety, at any of the aforementioned program facilities. This EA, and the information herein, is unclassified and available to the public.

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1.0 Description of Proposed Action and Alternatives (DOPAA)

The Navy Lightweight Exoatmospheric Projectile (LEAP) Technology Demonstration is proposed by the Ballistic Missile Defense Organization. This section presents a technical description of the proposed action and a discussion of the alternatives, specifically as those alternatives relate to the National Environmental Policy Act (NEPA) and the Council on Environmental Quality (CEQ) Regulations implementing NEPA (40 CFR Parts 1500-1508).

The Lightweight Exoatmospheric Projectile (LEAP) program is a Ballistic Missile Defense Organization program aimed at developing, integrating, and validating by experiment miniature kinetic energy (hit-to-kill) interceptors. These interceptors have applications to strategic, theater, and tactical ballistic missile defense. The LEAP program is under the direction of the Interceptor Technology Directorate of the Technology Deputate within the Ballistic Missile Defense Organization (BMDO). An incremental and comprehensive approach to developing and testing LEAP technologies has been adopted. Incremental tests allow weapon designers to isolate key technical elements during development and testing to produce early results which are useful to weapons systems designers and demonstrate cost, schedule and program success. The LEAP test program begins with early development testing of the components at contractor facilities and progresses to extensive ground testing at government facilities before final flight testing.

1.1 Purpose and Need for the Proposed Action

The Navy LEAP Technology Demonstration Program is a BMDO program conducted jointly with the U.S. Navy. An environmental assessment was conducted in September of 1992 of the Navy LEAP program as it was planned at that time. The need for the Navy LEAP program, established in the September 1992 Navy LEAP EA, was to test LEAP technologies in a ship-based environment to evaluate the feasibility of a sea-based upper-tier ballistic missile defense capability. The purpose of the Navy LEAP Technology Demonstration is to identify and address key technology integration issues involved with incorporating miniature, kinetic energy interceptors into a tactical weapon system.

Since September 1992, technical factors have changed which necessitate a change in the Navy LEAP program. As stated in the 1992 Navy LEAP EA, BMDO is using the STANDARD Missile 2 (SM2) Block II/III Terrier Missile and its associated launch platform (a Terrier class guided missile cruiser) to perform the demonstration. However, all Terrier class cruisers are scheduled to be decommissioned in October 1994. The SM is the Navy's primary surface-to-air missile system. It is the only advanced ER surface-to-air missile system currently deployed or planned for future deployment in the fleet. The purpose of the Navy LEAP Technology Demonstration is specifically to demonstrate the capability of integrating LEAP technology with the SM2 in order to identify critical integration issues for the use of these technologies in an operational Navy Anti-Tactical Ballistic Missile (ATBM) system. The Navy has no other

extended range surface-to-air missile with the performance capabilities to perform the Navy LEAP exoatmospheric experiments in the near term.

The Terrier class ship has been configured to handle the SM2 launches. The Navy LEAP Program is using the Terrier class ship to perform these flight tests in order to assess the feasibility and desirability of transferring the technology to the Aegis class ships for use in the aforementioned ATBM system. The more technologically sophisticated Aegis class ships are not equipped to launch the SM2, and significant expenditures of resources would be required to equip the Aegis class ship for this technology. In addition, the SM2 is launched from an above-deck rail on the Terrier class ship. If the missile failed during the launch, it would simply be ditched into the ocean. On the Aegis class ships, however, the SM2 would be launched from silos built into the Aegis class ship. Safety concerns for the below-deck crew would be much greater on the Aegis class ship than for the above-deck rail on the Terrier class ship.

The Navy LEAP flight tests, as originally planned, would have been performed at the Atlantic Fleet Weapons Test Facility (AFWTF) off Puerto Rico and the Cape Canaveral Air Force Station (CCAFS) in Florida. However, cost, scheduling, and safety constraints prevent the use of CCAFS before October, when the Terrier class cruisers will be decommissioned. Therefore, the BMDO has identified a need to conduct test flights at a flight test range which can accommodate the two flight tests prior to October 1994.

1.2 Proposed Action

The proposed action is to conduct Flight Tests 3, 4, and 5 at Wallops Flight Facility at Wallops Island, Virginia. Two additional changes have been made to the program since the 1992 Navy LEAP EA. First, General Dynamics was to fabricate and ground test the SM2. The company has since been purchased by the Hughes Missile Systems Company, who will now fabricate and ground test the SM2 at their Tuscon, Arizona facility. Second, the East Coast Navy Weapons Station in Yorktown, Virginia has been added as an alternative location for loading of the SM2 to the Terrier cruiser.

All other Navy LEAP Technology Demonstration activities remain unchanged from the program as described in the 1992 Navy LEAP EA and subsequent Finding of No Significant Impact. These activities consist of component/vehicle fabrication, assembly, and ground tests at several locations in the United States. Preflight integration and testing of the SM2 sustainer (second stage) and Advanced Solid Axial Stage (ASAS)/LEAP technologies (third and fourth stages) occur at White Sands Missile Range, New Mexico. These preflight activities are followed by a series of three flight tests over open ocean. These flight tests involve intercept of a target missile (Aries I) by a LEAP Kinetic Kill Vehicle. The Aries target is launched in a southeasterly direction from WFF. A Navy Terrier ship in open ocean approximately 150 kilometers east of North Carolina, launches the LEAP interceptor on a SM2 Blk II/III ER missile in a northeasterly direction. Intercept of the Aries target occurs approximately 425 kilometers downrange of WFF in open ocean outside the WFF range boundary. All program activities and the locations where they will be conducted are illustrated in Exhibit 1.1

Activity	Location	Activity Description
Component Assembly/ Ground Test Activities	**Hughes Missile Systems Company** Canoga Park, California	LEAP Interceptor development and test
	Rockwell International Rocketdyne Division Anaheim, California	LEAP Interceptor development and test
	Thiokol Corporation Tactical Operations Elkton, Maryland	ASAS development and test
	Orbital Sciences Corporation Chandler, Arizona	Build-up Non-ordnance Components of Aries target
	Hughes Missile Systems Company Pomona, California Tuscon, Arizona	SM2 Stage 2 development and LEAP/ASAS Integration and Test
Preflight Activities	**White Sands Missile Range** White Sands Missile Range, New Mexico	SM2 Stage 2 and LEAP/ASAS Integration and Test
	East Coast Navy Weapons Station Yorktown, Virginia	SM2 LEAP Vehicle Integration and Load-out to Ship
	Terrier Ship	SM2 LEAP Vehicle Checkout
	Wallops Flight Facility Wallops Island, Virginia	Aries I Target Integration and Test
Flight Test and Postflight Activities	**Terrier Ship**	SM2 LEAP Vehicle Launch and data retrieval
	Wallops Flight Facility Wallops Island, Virginia	Aries I Target Launch and data retrieval

Exhibit 1.1: Navy LEAP Technology Demonstration Activities

1.2.1 Component Assembly/Ground Test/Pre-Flight Activities

Hughes Missiles Systems Company in Tuscon, Arizona, conducts the design and systems integration tasks for the SM2 Block II/III ER Terrier Missiles and the Advanced Solid Axial Stage (ASA) propulsion system using existing capabilities and proven technology. Hughes purchased the General Dynamics division previously identified to conduct the tasks. All required

activities are described in the September 1992 Navy LEAP EA. The modifications to the SM2 are performed according to Hughes Missile Systems Company normal operating procedures for modifications to an engineering round as well as Navy LEAP specific procedures. All activities are conducted within existing facilities.

After testing at Hughes, the SM2 is shipped to White Sands Missile Range, New Mexico for integration with the fueled LEAP projectile and ASAS and further tested as described in the September 1992 Navy LEAP EA. The White Sands Missile Range tests utilize existing SM2 facilities and equipment. The SM2 is routinely integrated and tested at White Sands Missile Range and these activities are described and assessed in the September 1992 Navy LEAP EA and have not changed since that time. After completion of the integration and tests, the integrated system is shipped from White Sands Missile Range by truck to the East Coast Navy Weapons Station, Yorktown, Virginia.

At Yorktown, the shipping container is transported to the pier where it is off-loaded from the truck and lifted onto the ship. Once on the ship, the missile is removed from the container and loaded into the ship's magazine where it is mated with the MK 70 Booster and stored in the ship's magazine. All loading and transportation procedures are approved and certified by the Navy Weapons Systems Explosive Safety Review Board prior to any operations. The fueled SM LEAP Launch Vehicle is transported to the launch location at sea onboard the Terrier ship. Detailed procedures for handling the fueled and integrated SM LEAP vehicle (including safing, disarming, defueling, and other contingency procedures) are described in the Transportation and Shipboard Damage Control Document and Navy LEAP Stockpile-to-Target Sequence (ANSER, 1993). The Stockpile-to-Target Sequence includes a discussion of factory, field, launch platform, and post launch operations.

Integration activities occur in the Missile Assembly Building (MAB) buildup area (building W-65) on Wallops Island (Exhibit 1.2e). The Aries target missile is moved from the WFF storage bunker to launch pad 1 (Exhibit 1.2a and b) or pad 3 (Exhibit 1.2c & d) and mounted on the rail approximately nine days before launch according to ordnance handling procedures established at WFF. The integrated inert components are then transported from the MAB to the pad for mating to the Aries motor on the rail. Installation of pyrotechnic devices such as squibs and arming devices occurs on the rail. Final arming of the Aries target vehicle occurs approximately 2 hours prior to launch.

The preflight activities at WFF, Virginia include transporting the Aries motor, interstage, payload module bus, shroud, tailcan, fins and test equipment to the launch site. Preflight tests also involve integration and checkout of the Aries target missile. The facilities used by the Brilliant Pebbles Flight Experiment 3 and Firebird experiments adequately provide for Aries target missile launches for Flight Tests 3, 4 and 5. The facilities to be used for the Aries target vehicle include the Missile Assembly Building (Bldg W-65), Blockhouse 3 (Bldg W-20) and launch pads 1 and 3b. A fixed 20K (pound feet of torque) launcher is installed at pad 1b and a 50K launcher is installed at pad 3. Two targets are built-up as part of each count-down (the primary target on pad 1 and a backup on pad 3b). One target is selected (based on health and status) and armed

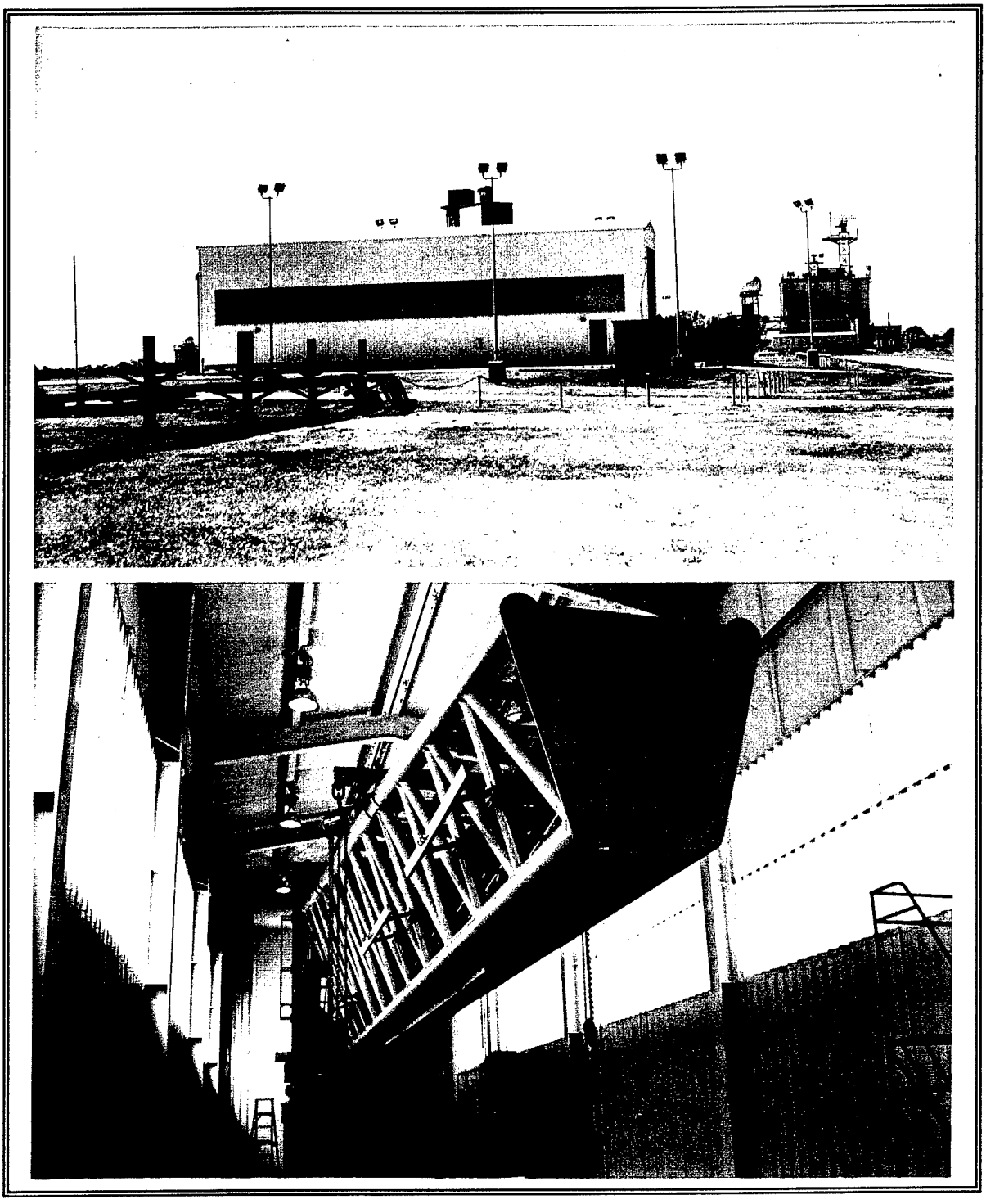


Exhibit 1.2a & b: Launch Pad 1, WFF

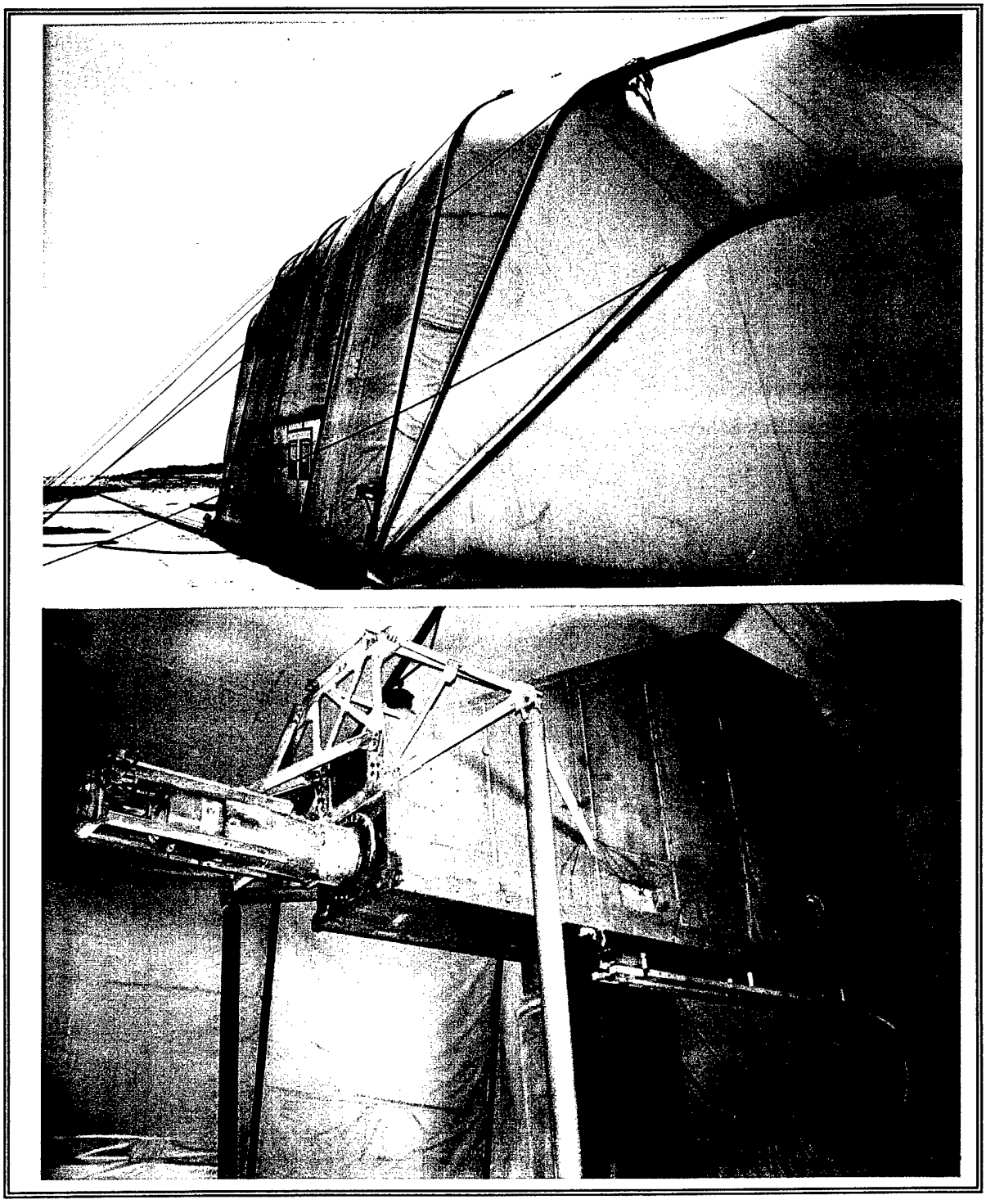


Exhibit 1.2c & d: Launch Pad 3, WFF

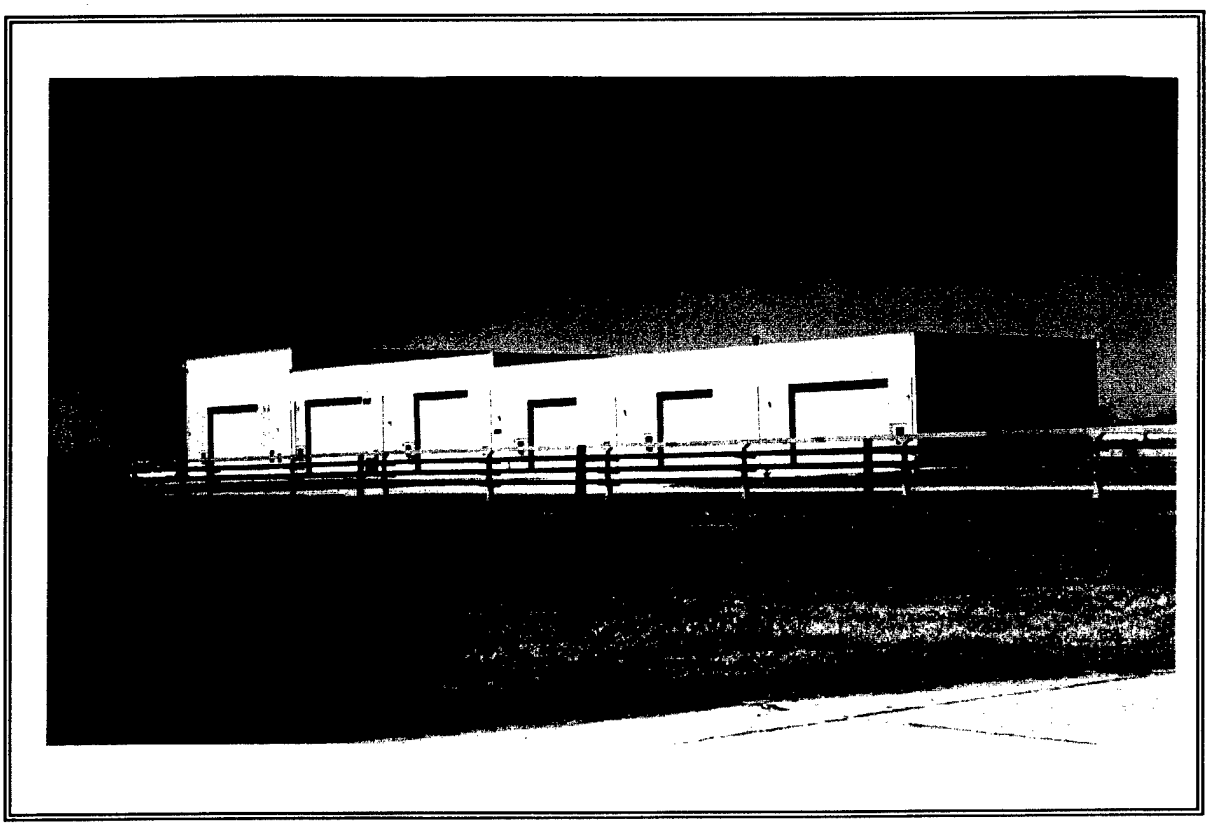
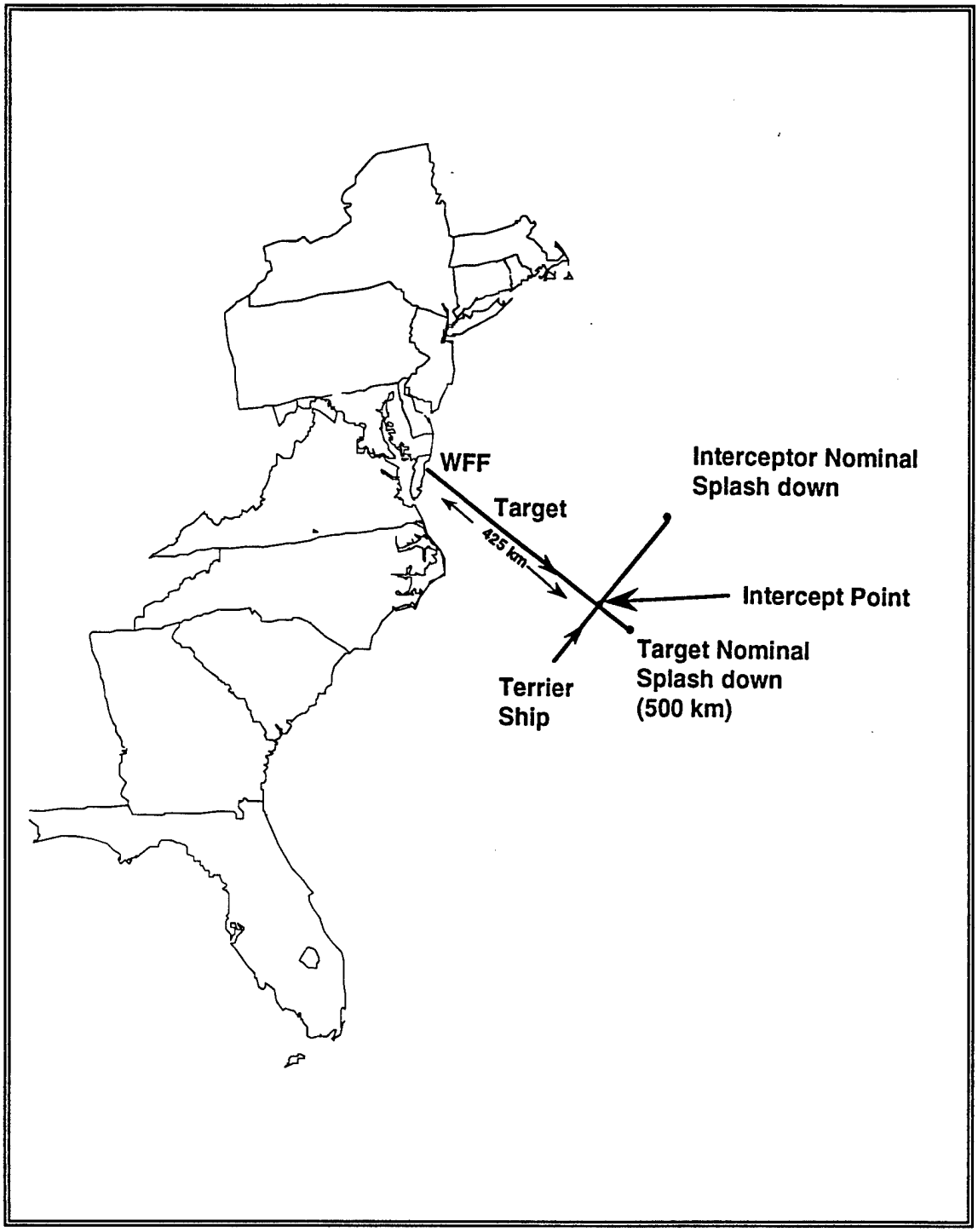


Exhibit 1.2e: Missile Assembly Building, WFF

approximately 2 hours prior to flight while the other is disarmed. No construction or modification of existing facilities is required to perform these preflight tests.

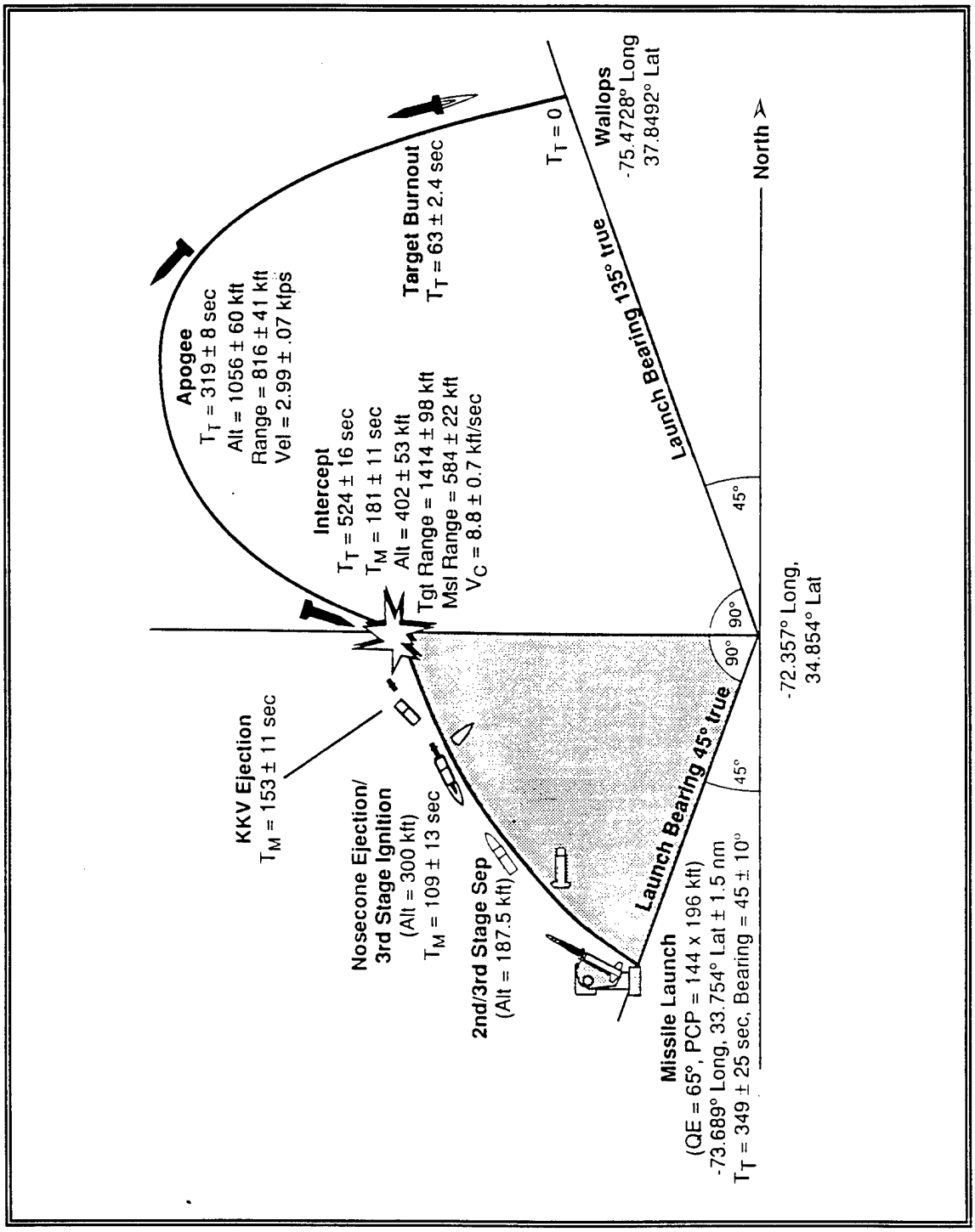
1.2.2 Flight Test Activities

Flight test activities are planned at the WFF Flight Test Range (See Exhibits 1.3, Mission Launch Trajectories, and 1.4, Mission Launch Profile). Flight test activities include target launch from Pad 1 or 3b from WFF Launch Complex, SM2 LEAP Vehicle launch from a Terrier ship in the Atlantic, monitoring and control of the target and SM2 LEAP Vehicles during flight, and data retrieval. All SM2 LEAP flight tests use existing ground facilities at the East Coast Navy Weapons Station, Yorktown, Virginia for the SM2 LEAP Vehicle and WFF for the target vehicle. The SM2 LEAP Vehicle uses existing Terrier ship facilities and equipment for the launch of the LEAP interceptor. The demonstration consists of three flight tests from a Terrier ship using the SM2 LEAP technologies. Each flight demonstrates the actual interception of a target by the LEAP interceptor. Debris splashes down in open ocean several hundred kilometers east of the U.S. Atlantic Coast. Three sigma (99.7% probability) dispersion patterns for potential impact of components and debris are shown in Exhibit 1.5.



Source: Ballistic Missile Defense Organization

Exhibit 1.3 Mission Launch Trajectories



Source: Ballistic Missile Defense Organization

Exhibit 1.4 Mission Launch Profile

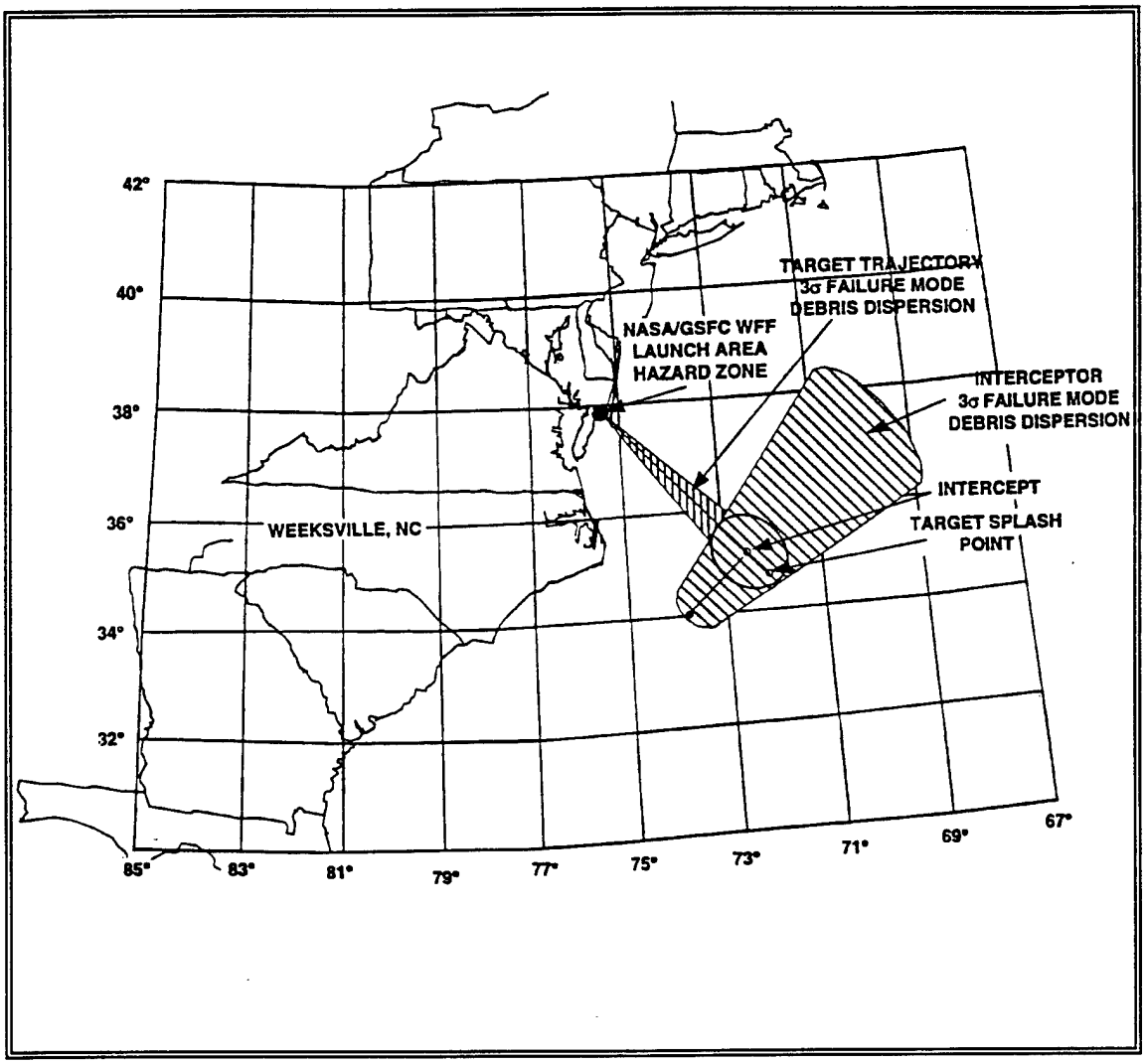


Exhibit 1.5: Aries Target and SM2 LEAP Vehicle Debris Dispersion Pattern

The Navy and Hughes Missile Systems Company are responsible for SM2 flight test activities for the Navy LEAP Technology Demonstration, and provide mission planning, analysis, certification, and operations at the East Coast Navy Weapons Station, Yorktown, Virginia and on-board the Terrier ship. Phillips Laboratory is responsible for coordinating payload ground operations which include fueling and pressurizing the interceptors at White Sands Missile Range.

Existing WFF and Navy facilities, tracking and telemetry equipment is used for the flight tests. The target and LEAP interceptor flight, trajectories and dispersions occur in open ocean and are approved by appropriate WFF and Navy range safety authorities.

The primary objective of Flight Tests 3, 4 and 5 is to demonstrate that the LEAP kinetic-kill vehicle, integrated with a modified SM2 Block II/III ER missile and Terrier ship system, can intercept a simulated theater/tactical ballistic missile. All three missions use extremely similar mission scenarios. A representative mission profile is depicted in Exhibit 1.2.

For Flight Tests-3, 4 and 5 at WFF Test Range, the Aries target missile, the SM2 LEAP Vehicle and their components are not recovered. The Aries target missile, SM2 and LEAP Kinetic Kill Vehicle are not reusable and are considered expendable after launch. Large numbers of SMs and a number of Aries boosters are fired annually at WFF and other ranges and are not recovered.

Because of the high altitude (exoatmospheric) flight, the SM2 upper stages (2, 3 and 4) used for Navy LEAP impact much farther downrange than is typical of SM engagements. An attempt to recover the round or any of its components would require a fleet of downrange ships and/or aircraft to track the components as they reenter and to collect the debris. Costs of such a recovery compared to the value of the expended missile and the risk associated with a successful recovery are considered prohibitive. In addition, since the Navy LEAP launches are the first exoatmospheric tests of the SM2, large safety corridors or "keep-out zones" are used to ensure protection of personnel and equipment during the experiment.

No debris from any of the LEAP Kinetic Kill Vehicles tested on previous experiments at White Sands Missile Range has been found. The majority of each vehicle is believed to have burned up on reentry. The SM2 and its components do not have recovery packages or flotation devices and are not expected to float more than a few minutes, if at all.

As determined by the previous White Sands Missile Range LEAP flight tests, Brilliant Pebbles flight experiments, and the Red Tigress Program flight tests, none of the Aries target missile components are considered reusable, particularly after being contaminated with sea water. Open ocean impact of the vehicles is expected to occur approximately 484 kilometers (303 miles) off-shore from WFF. The Aries target missile is not expected to float. Obviously, should the planned intercept occur, debris recovery would be even more difficult, if not impossible. The debris is not expected to float for more than a few minutes, if at all.

1.2.3 Ground and Flight Safety

LEAP procedures follow the SSOPs for fueling and transportation developed by Phillips Laboratory and used successfully at White Sands Missile Range under the LEAP Test Program. Flight safety is ensured by proper selection of flight corridor, clearance of densely trafficked shipping areas, dissemination of notice to mariners, and use of a range-approved flight termination systems and procedures. A probability analysis of debris hazards to personnel, facilities, vessels, aircraft and other assets is also performed to ensure risk is within acceptable, published range safety standards. All SM2 LEAP operating procedures and hardware configurations are approved by the Weapons Systems Explosive Safety Review Board. The SM2 LEAP configuration undergoes ground tests in accordance with the Weapons Systems Explosive Safety Review Board approved system safety program plan to ensure safe handling,

transportation, and launch of the missile. The SSOP includes tailored testing in accordance with MIL-STD2105A. Navy LEAP activities are conducted in accordance with Navy safety program procedures which include the following:

• OP	4	Ammunition Afloat
• OP	5	Ammunition and Explosives Ashore
• OP	3347	Navy Ordnance Safety Precautions
• OPNAVINST	5100.8G	Department of the Navy Safety Program
• OPNAVINST	5100.24A	Navy System Safety Program
• OPNAVINST	8010.13A	Policy on Intensive Munitions
• NAVSEAINST	010.5A	Tech. Req. - Insensitive Munitions
• NAVSEAINST	8020.6C	Navy Weapons System Safety Program
• SEA-06 G&PP	89-06	Approval of Weapon System Tand E
• MILSTD	2015A	Hazard Tests for Non-nuclear Munitions
• MILSTD	1658	Shipboard GMLS Safety Requirements
• NavOrd	2165	Navy Trans Safety HDBK for Ammo, Explosives and HAZMAT
• NavOrd	3199	Handling and Storage of Liquid Propellants
• CPIA Pub	394	Hazards of Chemical Rockets and Propellants
• NAVSEA S9000-AB-GTP-010		Shipboard Safety and Damage Control Facilities for Hypergolic Fuels and FAI Bombs
• NAVSEA S6340-AAMMA-010		Otto Fuel II Safety, Storage, and Handling Instruments
• TSDCD		Navy LEAP Transportation and Shipboard Damage Control Document
•STS 8800	4R50-DH/193	Stockpile-to-Target Sequence for Standard Missile-2 ER / LEAP
•Weapons Systems Explosive Safety Rev. Bd.		Navy LEAP Findings and Recommendations

In addition, the following representative safety analyses and tests are conducted prior to flight testing:

- System Safety Program Plan
- Preliminary Hazard Analysis
- Subsystem Hazard Analysis
- Operating and Support Hazard Analysis
- System Hazard Analysis
- Safety Assessment Report
- Forty Foot Drop Analysis
- Fast Cook-off Analysis, Test Plans and Reports
- Hazards of Electromagnetic Radiation to Ordnance (HERO) analysis reports and tests
- Environmental Tests and Reports
- Electromagnetic Environmental Effects Analyses, Tests, and Reports

1.2.3.1 Launch and Range Control

Wallops Flight Facility (WFF) Test Range - The NASA/WFF Range Safety Officer, Test Director, Project Engineer, and Pad Supervisor share responsibility (within the limits of their jurisdiction as defined in GMI 1771.1) for the safe conduct of operations associated with Flight Tests 3, 4 and 5. The controlling document for safety in all NASA launch operations conducted by GSFC/WFF is Goddard Handbook, GHB 1771.1 Range Safety.

1.3 Alternatives

1.3.1 East Coast Navy Weapons Station, Yorktown, Virginia or Charleston, South Carolina

All appropriate Navy certifications and approvals are obtained through the Navy Weapons Station. No construction or modification of existing facilities are required to perform these preflight activities. No other Navy Weapons Stations are available for supporting SM operations on the East Coast. Current plans are to conduct missile load-out at Yorktown prior to ship departure for the launch location. Charleston is an alternate load-out location should scheduling and logistics problems with Yorktown prohibit its use.

1.3.2 Solid Divert Propellant for LEAP Interceptor

A solid divert propulsion system being developed by Thiokol Corporation, Tactical Operations, Elkton Division is an alternative to the liquid divert propulsion currently used in the LEAP interceptor, and is described in Section 1.3.2 of the September 1992 LEAP EA.

1.4 Alternatives Considered But Not Carried Forward

1.4.1 Build-up, Integration and Checkout of SM2 LEAP at Yorktown vs White Sands Missile Range.

Another alternative considered was to build-up, fuel and integrate stages 2, 3 and 4 of the SM2 LEAP Vehicle at the existing Yorktown NWS facilities instead of at White Sands Missile Range. This option was not carried forward because of the additional time, expense and potential facility modifications required at Yorktown to handle the Kinetic Kill Vehicle and ASAS integration and fueling issues.

1.4.2 Range Selection

An iterative evaluation process was used by the Navy LEAP Test & Evaluation Coordination Group (TECG) and Systems Engineering Working Group (SEWG) to select ranges for the Navy LEAP Technology Demonstration. This process was similar to that used for the LEAP flight test program and is based on experience gained in both previous LEAP and SM range selection efforts. During the process of selecting candidate ranges, international sites were not considered

because they presented operational control issues. Sites in the U.S. and its territories were screened to eliminate sites that were known to have significant concerns of availability, limitation of range space, interference from on-going operations, and/or problems associated with security or safety of populated areas. These sites were also reviewed to determine if a SM2 Block II Extended Range launch could be performed either from land or ship at sea. This screening resulted in the selection of nine ranges and/or surface missile launch sites, as identified below, which could potentially accommodate Navy LEAP experiments:

- Atlantic Fleet Weapons Training Facility (AFWTF), Puerto Rico
- Cape Canaveral Air Force Station (CCAFS), Florida
- Pacific Missile Test Center (PMTS), California
- Pacific Missile Range Facility (PMRF), Hawaii
- Kwajalein Missile Range (KMR), Marshall Islands
- Wake Island, U.S. Territory
- Wallops Flight Facility (WFF), Virginia
- Mobile Sea Range (MSR)
- White Sands Missile Range (WSMR), New Mexico

Detailed evaluations for each of these ranges are included in Section 1.4.2 of the Initial Navy LEAP EA (SDIO, 1991).

Since the initial EA, several constraints and issues have arisen to change the selection of the preferred range for flights 3, 4, & 5 from CCAFS to WFF. This is a departure from the selection of AFWTF and CCAFS as the recommended ranges as specified by the Initial Navy LEAP EA (SDIO, 1991). The following summarizes the analyses that warranted the change. Reference analyses for these changes are found in the *Summary of Navy LEAP Range Selection Assessment by the System working Group/Test and Evaluation Coordinating Group,* APL-F1E(92)C-1-417, 15 Dec 92, and *East Coast Range Evaluation: Navy LEAP FTV 3-5*, ANSER, 30 Oct 92.

AFWTF was eliminated from consideration for FTV 3, 4 & 5 primarily because it has no target launch capability. AFWTF was selected as the preferred range for the initial Navy LEAP tests not involving a target and was used during FTV-1 in September 1992. The missions for FTV-3 & 4 were changed since the writing of the Initial Navy LEAP EA. Each mission now includes the requirement to intercept a TBM-like target, and AFWTF cannot support that capability. The remote site launch of a target from CCAFS to the AFWTF range is kinematically possible, but this option was eliminated due to treaty and safety issues. This long range scenario requires a target which exceeds the velocity constraints (2-3 km/s) of the FTV missions and makes down range safety control near the impact point difficult.

The initial Navy LEAP EA stated that WFF is not a designated SM2 Block IIER training or test range. Since that time, WFF range has successfully launch SM2 Block IIER missiles and intercepted targets. Range safety analyses has since indicated that the Navy LEAP SM2 Block IIER missions can be performed at WFF. WFF is also the host of the Aegis Combat System Center (ACSC) and provides NSWC/DD experience with WFF operations. The NSWC/DD ship

simulator facility resides on WFF. Navy FACFACS (VA) controls scheduling, downrange safety, communications, and air traffic for all Navy training operations. The U.S. Navy cooperative engagement program has conducted operations during sounding rocket launches (SPFE) at Wallops. Even though WFF is not a formal SM training range, the above aforementioned activities show that WFF has a legacy of Naval support operations which makes it compatible with Navy LEAP type operations and support.

The Initial LEAP EA states that it is difficult to schedule repeated one-shot demonstrations from the WFF range. An agreement has been reached between BMDO and WFF to allow more frequent access to WFF launch support facilities. A dedicated, dual target launch capability has been provided. Cancellation of other launch programs at WFF has opened up flexible launch support windows between FY 94 and FY 97, with no anticipated major schedule conflicts with current programs.

The Initial Navy LEAP EA stated that previous Navy tests at WFF have met with some difficulty in coordinating support assets from multiple support organizations. Recent efforts by BMDO and PEO-TAD to gain high level support have helped to resolve these conflicts.

The initial Navy LEAP EA stated that it would be difficult to meet range safety constraints for a near head-on, ascending interceptor engagement. The scenarios for FTV-3, 4, & 5 have been changed by the SEWG to an ascending, broadside engagement (see Exhibit 1.6). This new engagement scenario was developed through refined systems engineering simulations to give the preferred closing velocities, crossing angles, signatures, and intercept probabilities for the SM2 and LEAP interceptor. As a result, projected interceptor and target debris remain well out to sea, away from the Atlantic coastline and can now be performed at WFF.

The initial Navy LEAP EA stated that WFF tracking, telemetry, and control would have to be augmented by downrange support assets. Recent equipment upgrades have improved WFF support capabilities. Also, a low cost telemetry ground station has been dedicated by NASA to use at the Coquina site to support FTV's 3, 4 & 5.

WFF is the lowest cost CONUS range. At WFF, the average cost per launch attempt is $110K as compared to $1,260K per launch at CCAFS. Because of recent budget cuts, this has become a critical element in range selection.

WFF provides scheduling flexibility and reliability. WFF has much fewer launches and fewer "higher priority" programs per year than CCAFS. this aspect is critical for Navy LEAP to ensure that the flight tests can be performed by the October 1994 Terrier ship decommissioning deadline (see TECG.SEWG study dated 15 Dec 92).

WFF has streamlined documentation requirements increasing ease of operations versus other CONUS ranges to ensure near-term, short suspenses mandated by the Navy LEAP program can be met. This aspect is especially critical to Navy LEAP since all Terrier cruisers, including the LEAP firing platform (USS R K Turner), are now scheduled for decommissioning NLT 1 Oct 94.

1.4.3 Target launch Vehicle Selection

Navy LEAP target options for FTV-3, 4 & 5 are constrained by ABM Treaty limitations, range compatibility, LEAP performance, and LEAP mission objectives. The primary target requirements considered for Navy LEAP target selection as defined in the original TRD are listed below:

- Minimum velocity of 2 kilometers/second; maximum of 3 kilometers/second with minimum ballast (helps ensure ABM Treaty compliance)
- Minimum exoatmospheric flight time of 5 minutes
- Approximate diameter of 1 meter
- Must be threat representative (have adequate radio frequency (RF) and IR signature for LEAP engagements and similar kinematic capability).

Many target launch vehicles were initially considered, including sounding rockets, commercial motors, and government furnished boosters. The following target vehicles were potentially able to meet LEAP requirements:

- Aries I (M56A1)
- Aries (M56A1)/Orbus
- Aries II (M56A1 and M57A1)
- Sergeant/M57A1
- Talos/M56A1
- Talos/M57A1
- Castor IVA, IVB
- Talos/Sergeant/Orbus
- Talos/Sergeant/M57A1

Evaluation criteria for these candidate vehicles included range safety restrictions, target support capability, target complexity, cost, availability, and guidance accuracy requirements to perform the mission. The three stage vehicles were eliminated because of unnecessary complexity and mission risk as well as maximum velocity complications. Several of the vehicles would have to be significantly modified to meet velocity and signature requirements. The vehicle that best meets the selection criteria is the Aries I Launch Vehicle.

The Aries I Launch Vehicle has been selected as the Target Launch Vehicle for the Navy LEAP target flight at WFF. The Aries I has been flown at WFF for the BP FE 3, Firebird (Talos/Aries), and High Performance Booster (HPB) experiments (Ref *Program Requirements Document for ALV Program,* Ball Space Systems Division, AF0040-601, Feb 92; and *Operations and Safety Directive for Aries Launch Vehicle (ALV),* NASA (GSFC/WFF), DRW-0358, Oct 92). The Aries I has adequate performance to meet program objectives and satisfy ABM treaty requirements. The Aries I can be maintained within the 2 -3 km/second intercept velocity requirement with minimal ballast. It also has the advantage of being a single-stage vehicle, which will lower mission risk, cost, and complexity. Further, the LEAP program has direct experience

with the Aries booster, having flown it on several previous WSMR tests. This advantage is extremely important considering the very short development schedule requirements.

A recent series of Aries M56A1 motor failures occurred (FE-3, TCMP-1A and Catura flights) during FY 93 and early FY94 which raised suspicion of the reliability of the Aries booster. An extensive failure review board was held including representatives from AFSMC, USAF Phillips Lab, USAF BMO, TRW (the nozzle manufacturer), ANSER, OSC and other organizations. Nozzle O-ring failure was suspected as the root cause (Ref. *M56A1 Recertification Status*, AFSMC/CUBE, 2 Dec 93). Since then, a set of static motor firings has been performed with and without refurbished nozzle O-rings. With a high degree of confidence, the nozzle throat support O-ring was suspected to be the cause of failure (*Target Vehicle Testing Results*, PL/SXA, 3 Jan 93). These tests and refurbishment procedures were sufficient for the Navy PEO-TAD to accept the motor risk and for AFSMC to lift the motor grounding based on the new refurbishment procedures, thereby clearing use of the Aries booster for the Navy LEAP program. An Aries booster was successfully launched as part of the Navy LEAP program (FTV-TD) from, WFF on 25 Feb 94 with refurbished nozzle O-rings.

1.5 No Action

The No Action alternative for Navy LEAP Technology Demonstration is to not conduct the Navy LEAP Technology Demonstration. Flights associated with Navy LEAP would not occur at WFF or at sea. Environmental, schedule, and cost constraints prevent the use of other test ranges to conduct flight tests 3, 4 and 5 prior to decommissioning of the Terrier Class Cruisers. The No Action alternative is not preferred because it would preclude a series of flight tests that are needed to demonstrate a critical aspect of ballistic missile defense capability needed for protection of US and friendly personnel, territories and equipment. Moreover, the demonstration is mandated by Federal legislation such as the Missile Defense Act of 1991 and the 1993 Defense Authorization Bill.

Existing Conditions 2.0

2.0 Affected Environment

The affected environment encompass the physical attributes of locations that potentially are affected by the proposed action and no action alternative. These attributes include the physical setting at each location, as well as air quality, threatened and endangered species, noise, and safety considerations. With the exception of the Hughes Missile Systems Company in Tuscon, Arizona and the Wallops Flight Facility in Wallops Island, Virginia, all program facilities are described in detail in the September 1992 Navy LEAP EA and the subsequent Finding of No Significant Impact (FONSI). This section will encompass only those facilities that have been added as a result of the program changes that precipitated the need for this EA.

The Council on Environmental Quality (CEQ) NEPA Regulations encourage agencies to incorporate material by reference when the effect will be to cut down on bulk without impeding agency and public review of the action (CEQ, Sec. 1502.21). The LEAP EA (July 1991), LEAP Supplemental EA (June 1992), Navy LEAP Technology Demonstration EA (September 1992), STANDARD Missile WSMR EA, Project Starbird EA, Starlab Program EA, and Red Tigress EA provide indepth analysis of LEAP and Navy LEAP technologies and their impacts on the environment (e.g., air quality, human health and safety, etc.). Only changes from the original EA are addressed here, and information from the documents listed above is incorporated by reference where appropriate.

The USS RK Turner Terrier class ship is stationed at the East Coast Navy Weapons Station located in Charleston, South Carolina. It is not necessary to discuss the existing conditions for the East Coast Navy Weapons Station because the preflight activities at this facility only involve the same missile standard functional tests, prior to being accepted on the Terrier ship, that took place at the East Coast Navy Weapons Station in Yorktown, Virginia for the previous two launches. The activities are consistent with practices that support SM operations on a routine basis at the facility.

Pertinent location changes for this EA include component assembly and ground testing at the Hughes Missile Systems Company in Tuscon, Arizona, and preflight and flight tests activities at Wallops Flight Facility in Wallops, Virginia.

2.1 Hughes Missile Systems Company - Tuscon, Arizona

As identified in Section 1.2.3.1, Hughes Missile Systems Company in Tuscon will conduct the design and systems integration, test and checkout, and system environmental tests for the SM2 Block II/III ER Terrier Missiles. The Tuscon facility is in a rural area surrounded by light industry, some low-density residential, and low latitude desert. The 1380 acre complex consists of 70 buildings and 70 employees. Existing buildings 802, 803, 805, and 840 will be used, and no new buildings or modifications to existing buildings will be necessary.

Navy LEAP activities will be covered by existing environmental permits. An endangered cactus exists on the site. A groundwater and soil remediation project is under way at the site under the DOD Installation Restoration Program, equivalent to the EPA CERCLA remediation process. No hazardous wastes will be used for or generated by the project. Although the facility maintains a RCRA permit for treatment, storage and disposal, the RCRA permit is not required for this project.

Industrial Procedures and Safety Bulletins and the individual Manufacturing Procedures will cover all Navy LEAP activities at the site. Ground transportation, regulated by DOT, will be used to transport materials to and from the Tuscon facility. Decommissioning of facilities will not be required because they will be used for ongoing activities.

2.2 Wallops Flight Facility - Wallops Island, Virginia

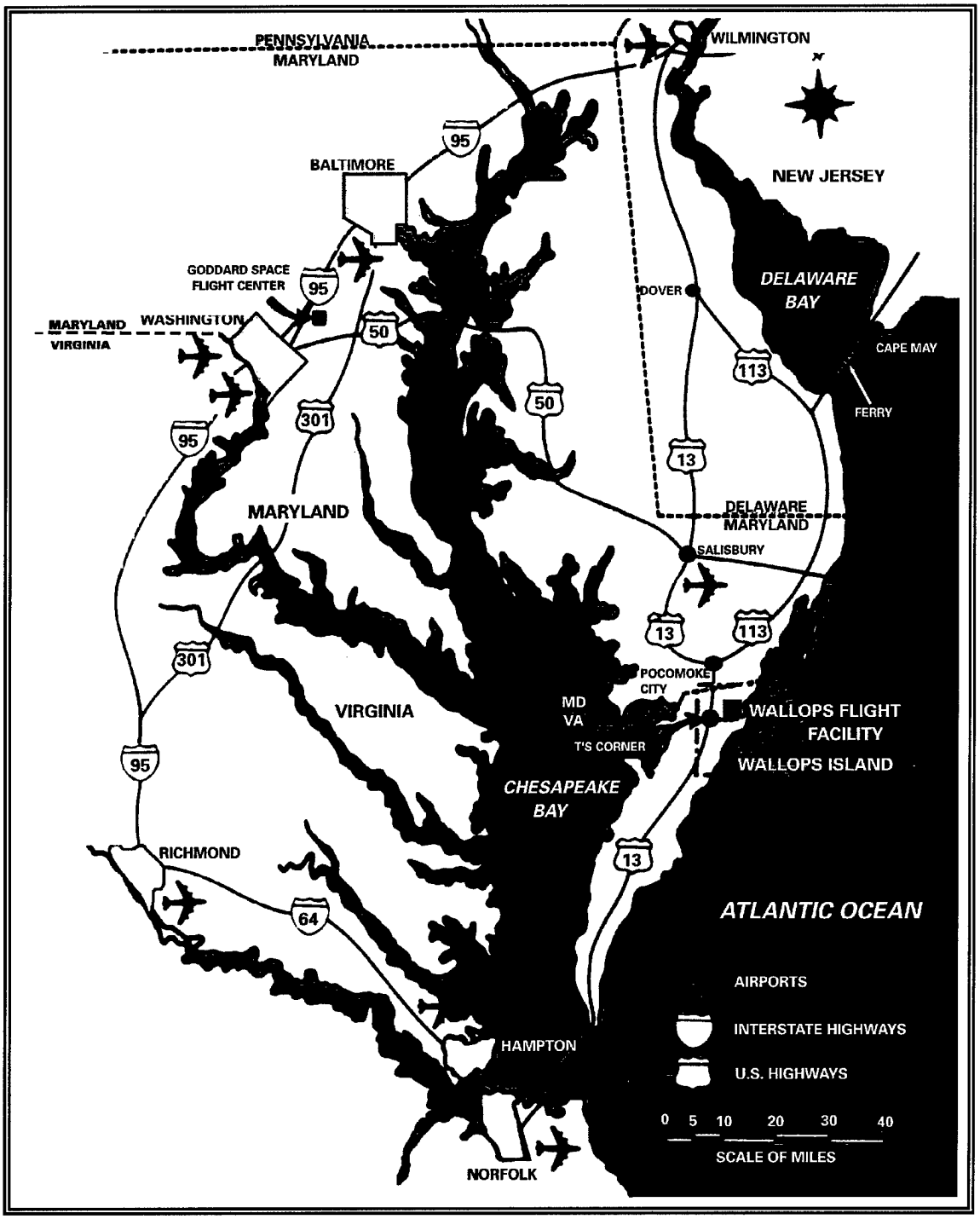
The Environmental Resources Document (ERD), July 1990, NASA provides a comprehensive baseline description of environmental conditions at Wallops Flight Facility, and is incorporated by reference (CEQ, Sec 1502.21) into this document. This section presents a summary of the environmental resource information presented in the ERD.

Wallops Flight Facility (WFF), in Accomack County, Virginia, on the Atlantic Coast of the Delmarva Peninsula, (Exhibit 2.1), encompasses three separate land areas, Wallops Island, the Main Base, and Wallops Mainland (Exhibit 2.2). Wallops Island is used as the primary site for various launch and tracking facilities associated with the Sounding Rockets Program, with launch activities aimed seaward. Approximately 100 launches are currently supported per year. (See Exhibit 2.3).

Wallops Island is a barrier island typical of those found on the East and Gulf Coasts of the United States. The majority of the land area on the island is 5 feet above sea level occasionally rising to 10 feet above sea level. The barrier island acts as a natural shock absorber protecting the mainland area. No archeological sites were found in a 1980 study by the Virginia Research Center for Archeology on Wallops Island, and no cultural or historical sites have been identified at WFF. Additionally, all of the test facilities associated with the Navy LEAP program are consistent with past uses.

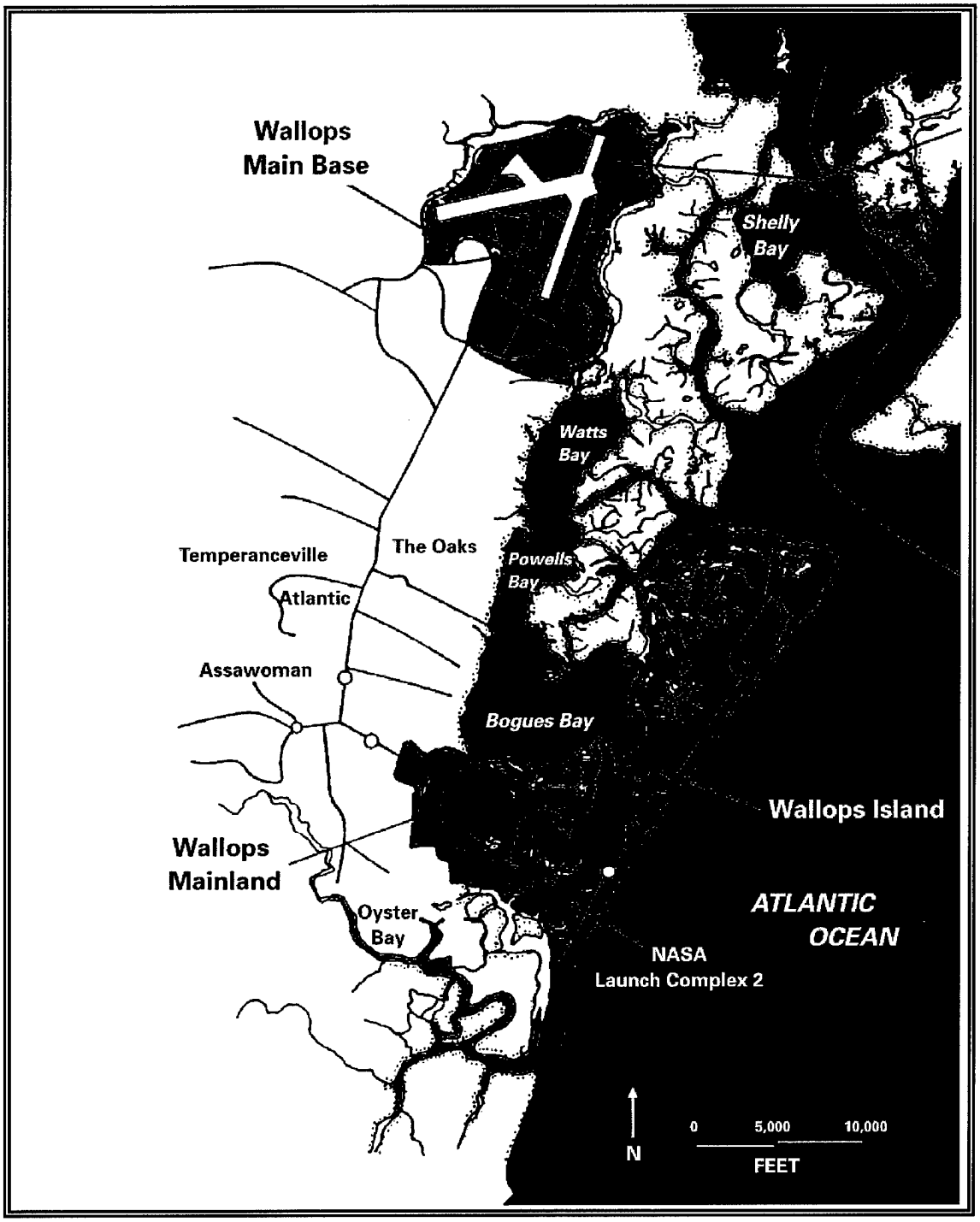
The biotic environment of WFF is characteristic of local coastal areas and barrier islands throughout the unglaciated segment of the Atlantic coastline. The island communities consist of various fauna, ranging from species of crustaceans and fish to various species of shorebirds, raccoons, red foxes, and white tail deer. Plant communities are similarly diverse, ranging from algae and phytoplankton to thicket areas and a loblolly forest. Appendices A through F of the ERD provide a comprehensive listing of the flora and fauna found at the WFF.

There are a number of federally listed threatened or endangered species in the vicinity of the WFF. Exhibit 2.4 lists these endangered and threatened species that could be found in the WFF



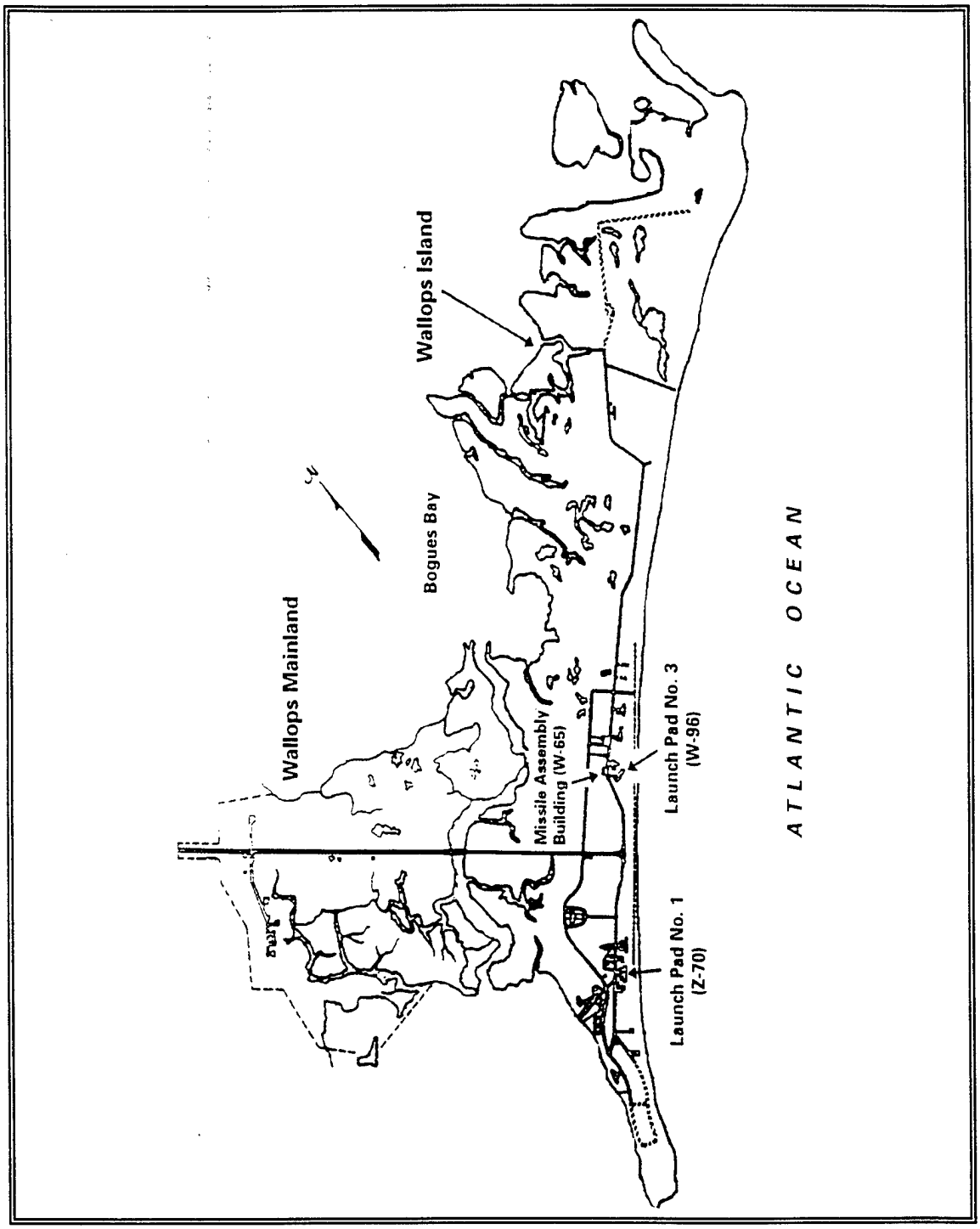
Source: U.S. Department of the Navy, 1991

Exhibit 2.1 GSFC Wallops Flight Facility Regional Map



Source: U.S. Department of the Navy, 1991

Exhibit 2.2 Wallops Flight Facility Layout



Source: WFF

Exhibit 2.3 Wallops Island Launch Facility Layout

area. No plants listed as endangered or threatened on the Federal or State lists have been found at the facility.

Common Name	Scientific Name	Status Federal	Status State
	BIRDS		
Bald Eagle	*Haliaetus Leucocephalus*	E	E
Falcon, Peregrine	*Falco pereginus*	E	E
Plover, Piping	*Charadrius melodus*	T	T
Plover, Wilson's	*Charadrius wilsonia*		E
	MAMMALS		
Delmarva Fox Squirrel	*Sciurus niger cinercus*	E	E
Whale Finback	*Balaeoptera physalus*	E	E
Whale, Sei	*Balaeoptera borealis*	E	E
Whale, Humpback	*Megaptera novaeangliae*	E	E
Whale, Right	*Balaena glacialis*	E	E
Whale Sperm	*Phseter catodon*	E	E
	REPTILES		
Turtle hawksbill	*Eretmochelys imbricata*	E	E
Turtle Kemps	*Lepidochelys kempii*	E	E
Turtle leatherback	*Dermochelys coriacea*	E	E
Turtle loggerhead	*Caretta caretta*	T	

Note: Data derived from U.S. Fish and Wildlife Service correspondence and Endangered Species List, 50 CFR Ch. 1 (10/1/80 Edition).

Exhibit 2.4 Threatened and Endangered Species (WFF Area)

The WFF is located in the climatic region known generally as the humid continental warm summer climate zone. Temperatures and precipitation levels at the WFF vary seasonally. Overall air quality at the WFF is excellent. This region does not exceed standards for any of the components (Suspended Particulates, Carbons Monoxide, Sulfur Dioxide, Nitrogen Dioxide, Ozone, and Lead) measured by the State Air Pollution Control Board in accordance with the National Ambient Air Quality Standards (NAAQS). Sources of air pollution at the facility include operation of the central boiler plant, rocket launches, disposal of rocket motors by open burning, aircraft emissions, and auto emissions. Pollutants from aircraft operations are mainly hydrocarbons which are readily diluted in the atmosphere. The volume of aircraft operations is small and pollutant accumulation is not measurable. Unlike metropolitan areas, auto emissions do not accumulate at the facility because of the relatively low volume of automotive traffic and also because of the favorable atmospheric conditions.

The major sources of noise in the community from the operations of the Wallops Island are from rocket launches. The island itself is surrounded by marshland and water which together act as a buffer zone. Rockets are launched on the seaward side and the island itself consists of sand, shrub and marsh which also act as noise buffers. The island launch areas are approximately 2-1/2 miles from the mainland.

The majority of solid waste generated by the WFF is garbage, construction, and demolition debris. This waste is disposed of at the Accomack County Landfill located near Atlantic, Virginia. The WFF also generates, treats, and disposes of hazardous waste and is classified as a large-quantity generator. Wallops Island is classified as a separate facility.

The WFF has emergency plans for the handling of hazardous wastes in the event of an emergency involving such material. For other than petroleum products the WFF has the Hazardous Waste Contingency Plan and Emergency Procedures which codifies procedures to be used in the event of a mishap. The controlling document for safety in all launch operations at WFF is the Range Safety Manual for Goddard Space Flight Center/Wallops Flight Facility. In addition, an Operations and Safety Directive is issued for each mission. Within this Operations and Safety Directive are the Ground Safety Plan and the Flight Safety Plan. The Ground Safety Plan defines the safety responsibilities, possible hazards associated with the project, pre-launch and launch danger areas, and personnel restrictions. The Flight Safety Plan defines flight safety responsibilities, launch hazard areas, flight termination criteria, and weather requirements.

Consequences 3.0

3.0 Consequences

The purpose of this section is to identify impacts resulting from implementing the proposed action or the no action alternative, and to determine whether those impacts are potentially significant. The consequences of implementing the proposed action are described in Sections 3.1 and 3.2, and the consequences of implementing the no action alternative are described in Section 3.3.

The methodology employed to identify potential impacts, if any, of implementing the proposed action or no action alternative involved three phases. First, a determination was made, after implementation of the engineering/environmental practices and safety measures described in Sections 1.0 and 2.0, whether the proposed action would result in any impacts to the environmental resources described in Section 2.0. Next, it was determined if these impacts were potentially significant, as defined in 40 CFR Part 1508.27. The emphasis is to determine both the context in which the action will occur and the intensity of the action. The action was also reviewed in the context of various laws and regulations to determine if impacts exceeded defined threshold levels (e.g., NAAQS, etc.). Finally, for any impacts from the proposed action that were potentially significant, it was determined whether mitigation measures could be implemented to reduce the impacts to less than significant levels.

As previously stated, the environmental consequences of implementing the LEAP Test Program have been previously assessed in the LEAP Test Program EA (July 1991), the LEAP Supplemental EA (June 1992), and the Navy LEAP Technology Demonstration EA (September 1992), all three documents resulted in a FONSI. Where appropriate, the findings of these documents have been incorporated into this EA by reference (CEQ, Sec. 1502.21) to avoid unnecessary duplication in analysis.

3.1 Proposed Action - Site-Specific Analysis: Hughes Missile Systems Company - Tuscon, Arizona

As identified in Section 2.1.6, all Navy LEAP activities will occur in existing buildings on the site. No new buildings or modifications to existing buildings will be required. No sensitive environmental resources will be affected by this program. All required environmental and safety procedures are in place. Therefore, the proposed action is not anticipated to have significant impacts on existing environmental conditions at the facility.

3.2 Proposed Action - Site-Specific Analysis: Wallops Flight Facility, Wallops Island, Virginia

The environmental resources evaluated at the Wallops Flight Facility involved the physical setting and land use; water resources; geology and soils; biological resources; threatened and endangered

species; cultural resources; air quality; noise; hazardous materials and wastes; and human health and safety.

3.2.1 Physical Setting and Land Use

Wallops Island is used as the primary site for various launch and tracking facilities associated with the Sounding Rockets Program, with launch activities aimed seaward. Approximately 100 launches are currently supported per year. No modifications to existing facilities are necessary for the Navy LEAP Technology Demonstration activities. Navy LEAP activities are consistent with present facility use. No disturbance to the existing physical setting is required and no alterations to land use at WFF will occur. Therefore, the flight tests are not anticipated to have significant impacts on the physical setting or land use at WFF.

3.2.2 Water Resources

Debris from the LEAP flight tests will be dispersed over the open ocean over 484 kilometers (303 miles) off-shore from WFF. The Aries target missile is not expected to float. Should the intercept be successful, the debris is not expected to float for more than a few minutes. As identified in the LEAP EA (SDIO, 1991), emissions from an Aries I launch include 1,388 pounds of water. This water is emitted as vapor. Analysis presented in the LEAP EA demonstrates that Aries launches for the LEAP test program would not result in damage to surrounding water quality. Therefore, implementing the proposed action is not anticipated to have significant impacts on the water resources at WFF.

3.2.3 Topography, Geology, and Soils

No construction or modification of existing facilities at WFF will be required and soil resources will not be disturbed. Therefore, implementing the proposed action is not anticipated to have significant impacts on the surrounding topography, geology and soils.

3.2.4 Biological Resources

Although WFF performs almost 100 launches per year, several different species commonly use the island for nesting and feeding habitats. The Aries, like most other missiles launched at Wallops, is small and uses existing facilities. No vegetation will be disturbed because no construction activities are required. Vegetation and wildlife in the vicinity of the launches would only be affected if the missiles were destroyed immediately after launch. If this occurred, only a small area of vegetation would be affected, and the impacts would be short term.

The NASA ERD (NASA, 1990) presents analysis demonstrating that no significant impact resulted to wildlife (wading birds and bald eagles) from noise levels of 100 and 102 dBA, respectively. The Starlab EA demonstrated that noise generated from launch activities could cause hearing loss in individual animals and subsequently a small temporary decrease in population density. These potential impacts would be temporary.

As previously stated, the debris from the launches will be dispersed over the open ocean. No debris from previous missile test flights at White Sands Missile Test Range has been recovered, in spite of the fact that no intercept of the target missile occurred. The debris is believed to have burned up on reentry into the atmosphere. Given the size of the dispersion area, and the size of the debris, impacts to marine biological species is extremely remote. The National Marine Fisheries Service has been contacted regarding this project, and is expected to provide concurrence with this finding before May 20. Therefore, implementing the proposed action is not anticipated to have significant impacts on biological resources.

3.2.5 Threatened and Endangered Species

As previously stated, only existing facilities will be used for the Aries target launches. The LEAP EA found that for air emissions from launch activities, occurrences are sporadic, single event episodes with rapid dispersion. Launch range activities may pose a remote possibility of having an effect on marine transients, though the probability of missile debris actually hitting a marine mammals is infinitesimally small.

There is an active program in place to protect the nest sites of the piping plover during the incubation and fledgling periods. Nesting sites are closed off and vehicular and pedestrian traffic are banned. Surveys of the area are made by the U.S. Fish and Wildlife Service (USFWS) to ascertain nesting status, and areas are reopened only after the fledgling period ends. In a proposal to designate critical habitat for the piping plover on the northern and extreme southern ends of Wallops Island, the USFWS indicated that there was no evidence to suggest that NASA operations on the Island affected the piping plovers or their habitat.

In a letter of concurrence for continuation of NASAs Sounding Rocket Program at WFF and a revision of the WFF ERD, the USFWS stated that the operations at WFF are not likely to affect federally listed species. Therefore, implementing the proposed action is not anticipated to have significant impact on threatened and endangered species in the area.

3.2.6 Cultural Resources

No archeological sites were found in a 1980 study by the Virginia Research Center for Archeology on Wallops Island, and no cultural or historical sites have been identified at WFF. Additionally, all of the test facilities associated with the Navy LEAP program are consistent with past uses. Therefore, the proposed action is not anticipated to have significant impact on cultural, archeological, or historical resources.

3.2.7 Air Quality

The July 1991 LEAP EA included an analysis of air quality impacts from Aries launches at a programmatic level, at White Sands Missile Range, New Mexico, and at Kwajalein Missile Range in the Marshall Islands. During the LEAP analysis, a PUFF transport and dispersion model was used to evaluate impacts from both a routine launch and an accident scenario in the marine environment at Kwajalein Missile Range. Impacts to air quality from the Navy LEAP Aries

launches at Cape Canaveral Air Station, Florida were assessed in the September 1992 Navy LEAP EA. The NASA Environmental Resources Document (1990) presents an analysis of rocket launch impacts on air quality at WFF. Exhibit 3.1 provides a list of the chemical components of the rockets commonly used at the facility. The pollutants of concern from the Aries target missile are carbon monoxide, nitrogen dioxide, particulate matter (aluminum oxide) and hydrogen chloride from solid rocket propellants. NAAQS standards apply to long durations of emissions.

Of all the combustion products produced, hydrogen chloride could be the most worrisome because upon cooling and on contact with water vapor, it readily forms hydrochloric acid. This has been associated with acid rain coming from the atmosphere. However, the amount of HCL associated with the launch is readily diluted in the atmosphere. Combustion products from burning of the propellants are the same as for a launch of the rocket motors.

Overall air quality at WFF is excellent and does not exceed any of the National Ambient Air Quality Standards (NAAQS). The aforementioned environmental analyses establishes that these combustion products are readily dispersed, are diluted, and occur infrequently, resulting in no long-range impacts on air quality. The analysis in the LEAP EA demonstrates that a regular launch or a catastrophic failure of an Aries target missile would not have a significant impact on air quality in a marine environment similar to that at WFF. Therefore, implementing the proposed action is not anticipated to have significant impacts on air quality at WFF.

Rocket Motor	Chemical Composition	Propellant weight (lbs.)	Propellant type*
Aries	Ammonium Perchlorate Polyurethane/Aluminum	10,370	C
Black Brant V	Ammonium Perchlorate Polyurethane/Aluminum	2,198	C
Malemute	Ammonium Perchlorate Hydroxyl Terminated Polybutane w/Aluminum	1,115	C
Nihka	Ammonium Perchlorate Hydroxyl Terminated Polybutadiene w/Aluminum	756	C
Nike	Nitrocellulose/Nitroglycerine	750	DB
Orion	Ammonium Perchlorate/Nitroguandine/ Polyurethane	604	C
Super Arcas	Ammonium Perchlorate/Polyvinylchloride	40	C
Super loki	Ammonium Perchlorate/Polysulfide/ Aluminum	38	C
Talos	Nitrocellulose/Nitroglycerine (ARP and AHH)	2,803	DB
Taurus	Nitrocellulose/Nitroglycerine	1,663	DB
Terrier	Nitrocellulose/Nitroglycerine/Aluminum (CAP w/AHH)	1,202	DB
Tomahawk	Ammonium Perchlorate/ Carboxy-Terminated Polybutadiene/Aluminum	387	C

Note: Data derived from WFF Safety and Quality Assurance Branch
* C = composite
DB = double base

Exhibit 3.1 Chemical Composition of Rocket Motors in Use at WFF

3.2.8 Noise

Rocket launches at WFF are infrequent events and the noise generated by them is predominantly in the low-frequency range and is of short duration. The LEAP EA (SDIO, 1991) includes a finding that launch induced exterior noise levels from an Aries launch are not expected to exceed the OSHA recommended criteria limit of 115 dBA for 15 minutes. Hearing protection equipment is used at WFF during launch activities to protect program personnel positioned closer to the launch pad. Therefore, conducting the proposed rocket launches is not anticipated to have significant impacts on human health and safety or biological resources due to noise.

3.2.9 Hazardous Materials and Wastes

The primary substances of concern in the LEAP program are the liquid fuels, which will not be stored or used at WFF. Therefore, implementing the proposed action is not anticipated to have significant impacts from the generation of hazardous wastes at WFF. Handling and disposal of all hazardous wastes will be conducted in accordance with the procedures outlined in the September 1992 Navy LEAP EA and 1991 LEAP EA.

3.2.10 Human Health and Safety

As previously stated, potential hazards to human health and safety result from the handling of hazardous and explosive substances and potential noise impacts. All Navy LEAP activities are conducted in accordance with standard safety program procedures. The controlling document for safety in all launch operations at WFF is the Range Safety Manual for Goddard Space Flight Center/Wallops Flight Facility. In addition, an Operations and Safety Directive is issued for each mission. This Directive contains general mission information, range support information, a ground safety plan, a fight safety plan, and countdown procedures.

Prior to the rocket launches, WFF personnel issue a notice to mariners to clear the flight zone. The personnel count aircraft and ships which are visible on radar. These personnel then conduct an analysis of the probability of hitting an aircraft or ship in the flight corridor. If the probability of striking an aircraft is greater than 10^{-6} (1 in 1,000,000) or the probability of striking a ship is greater than 10^{-5} (1 in 100,000), then the launch is delayed.

Previous launches of Aries target missiles have been conducted at WFF without resulting in impacts to human health and safety or the environment. Therefore, implementing the proposed action is not anticipated to have significant impacts on human health and safety at WFF.

3.3 No Action Alternative

As stated in Section 1.5, the No Action Alternative is not to conduct the Navy LEAP Technology Demonstration flight tests 3, 4 and 5. No test flights would occur at Wallops Flight Facility. Selection of the No Action Alternative would not result in significant impacts to the environment. However, selection of the No Action alternative would preclude the possibility of demonstrating the possibility of using Navy shipboard weapon systems with LEAP technologies for exoatmospheric flight.

3.4 Cumulative Impacts

Cumulative impact is defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future action regardless of what agency (Federal or non-Federal) or person undertakes such other actions." (40 CFR Part 1508.7).

All government and private contractor facilities participating in the Navy LEAP test program are required to comply with Federal, state, and local regulations which guarantee the maintenance and integrity of environmental resources. These regulations include, but are not limited to the:

- National Environmental Policy Act (NEPA);
- Clean Air Act;
- Clean Water Act of 1977;
- Resource Conservation and Recovery Act of 1976;
- Toxic Substances and Control Act; and
- Comprehensive Environmental Response, Compensation, and Liability Act of 1980.

Compliance with these regulations contributes to the insurance that Navy LEAP Technology Demonstration activities will not contribute to significant cumulative impacts on the environment.

As previously stated, implementing the proposed action will not require the construction of any new facilities. All test activities occur in facilities designed and used for activities of this nature. The Navy LEAP technology demonstration, when viewed with other LEAP program activities will not result in cumulative environmental impacts which are significant. Cumulative impacts from all these tests would include primarily impacts to air quality. These impacts, when compared to other test rocket launches, is not viewed as significant.

The programmatic discussion of the effects on air quality from the LEAP program were presented in the LEAP EA. This discussion presented a detailed description on the potential effects of hydrogen chloride (HCl) on the environment, with the finding that HCl deposition would not lead to significant impacts from use of the LEAP projectile.

The pollutants of concern from the Aries and SM vehicles are carbon monoxide, nitrogen dioxide, particulate matter (aluminum oxide) and HCl from solid rocket propellants. The primary air quality issue associated with the Aries and STANDARD Missile launches is HCl and its potential impacts to the ozone. For the purpose of this analysis, the Aries II will be used for assessing potential air quality impacts since this vehicle contains more total propellants than the Aries I.

The impact of chlorine produced by solid rocket motors on stratospheric ozone was studied by NASA, including representatives of the NASA Goddard Institute of Space Studies and the NASA Goddard Space Flight Center (SDIO, 1992a). The study modeled the impacts of nine Space Shuttle and six Titan IV launches per year, which comprise the largest potential source of stratospheric chlorine from the United States space fleet. This study concluded that the total annual launches would inject 0.726 kilotons of chlorine into the stratosphere, with corresponding ozone depletion less than 0.25 percent locally and less than 0.1 percent of total stratospheric ozone. The study concluded that regional or global impacts to ozone from the launches would not be significant (SDIO, 1992a).

In comparing the Space Shuttle launches to the Navy LEAP Technology Demonstration, the total weight of solid propellants on the Aries II and SM configurations would equal 14,035 pounds and

1,202 pounds (respectively), compared to the Space Shuttle's 2,218,858 pounds. The effects of the Aries and SM are addressed by scaling the available data from the largest rockets. Relative to the total weight of the solid propellant of the Space Shuttle, the amount of chlorine emitted into the stratosphere by a launch of an Aries II or SM would be anticipated to be less than 1 percent of that emitted by a single Space Shuttle launch (SDIO, 1991). The NASA study concluded that the Space Shuttle and Titan combined launches would not have a significant impact on ozone; therefore, the localized effects from the Aries II and SM launches would be much less and more transient since these launch vehicles are considerably smaller than the Space Shuttle.

Using another model for comparison, the Strategic Target System EIS analyzed ozone depletion for boosters containing a total weight of 13,844 kilograms of solid fuel relative to the NASA study. Compared with a schedule of nine Space Shuttle and six Titan launches, it was estimated that the Strategic Target System boosters could result in an annual global ozone depletion of approximately 0.00001 to 0.0001 percent, substantially less than the Space Shuttle and Titan combined launches (0.1 percent). Although the propellants are different for the Strategic Target System and the Aries II and STANDARD Missile, the propellant weights and emissions are similar; therefore, the Aries II and SM would be anticipated to have similar annual global ozone depletion as the Strategic Target System. Because of the brief and sporadic nature of air emissions associated with Aries II and SM launches, the long-term cumulative impacts are not expected to be significant.

3.5 Relationship Between Short-Term Use of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity

The Navy LEAP Technology Demonstration involves the use of existing facilities and resources. As identified in Section 1.0, private contractors involved in the program will use existing structures and facilities to support their program activities. In addition, pre-flight and flight test activities will occur at White Sands Missile Range, East Coast Navy Weapons Station (Yorktown, Virginia), the Terrier Ship, and Wallops Flight Facility. These facilities are dedicated primarily to programs and activities of this nature; consequently, the proposed action will result in no net loss of any significant environmental resources (e.g., prime agricultural land, wetlands, historical properties) or significant amounts of natural resources.

3.6 Irreversible or Irretrievable Commitment of Resources

Implementing the proposed action will result in no impact on threatened or endangered resources, or archaeological or historic properties. In addition, the action will not result in changes in land use or cause loss of habitat for plants or animals.

Irretrievable commitment of some resources will be required to support the program. The resources would include raw materials to fabricate the various components of the launch vehicles and support systems. This commitment will be small-scale in nature, and not substantively different from similar activities carried out on a routine basis.

3.7 Conflicts with Federal, Regional, State, Local, or Indian Tribe Land Use Plans, Policies, and Controls

All activities to support the proposed action, at both private and government facilities, will occur within existing areas and structures previously used for similar purposes. All activities at private contracting facilities are in compliance with local plans and ordinances. Preflight and flight test activities will take place at existing launch facilities. Similar activities have occurred at these facilities and pose no threat to tribal land or surrounding land uses.

Finding of No Significant Impact
Ballistic Missile Defense Organization

Agency

Ballistic Missile Defense Organization (BMDO)
U.S. Department of Defense

Action

Conducting activities to support the Navy Lightweight Exoatmospheric Projectile (LEAP) Technology Demonstration

Background

The Lightweight Exoatmospheric Projectile (LEAP) program is a Ballistic Missile Defense Organization program aimed at developing, integrating, and validating by experiment miniature kinetic energy (hit-to-kill) interceptors. These interceptors have applications to strategic, theater, and tactical ballistic missile defense. The LEAP program is under the direction of the Interceptor Technology Directorate of the Technology Deputate within the Ballistic Missile Defense Organization (BMDO). An incremental and comprehensive approach to developing and testing LEAP technologies has been adopted. Incremental tests allow weapon designers to isolate key technical elements during development and testing to produce early results which are useful to weapons systems designers and demonstrate cost, schedule and program success. The LEAP test program begins with early development testing of the components at contractor facilities and progresses to extensive ground testing at government facilities before final flight testing.

Description of Proposed Action

Ballistic Missile Defense Organization and the Navy have identified the need to demonstrate LEAP technologies in a ship-based environment in the near term to determine potential applications in sea-based missile defense. In order to perform this demonstration, the Ballistic Missile Defense Organization proposes to use the modified STANDARD Missile 2 (SM2) Block II/III Terrier Missile and its associated launch platform (a Terrier class guided missile cruiser). The purpose of the Navy LEAP Technology Demonstration is to identify and address key technology integration issues involved with incorporating miniature, kinetic energy interceptors into a tactical weapon system. These integrated technologies will be used to demonstrate the feasibility of performing high altitude (exoatmospheric) ballistic missile defense from a Navy platform for protection of U.S. and allied forces, territories and facilities ashore.

An environmental assessment was performed Navy LEAP technology demonstration program, resulting in a Finding of No Significant Impacts (FONSI) in September, 1992 (SDIO, 1992b). Since then, the initial two flights have been completed. The launch location for the remaining three missions has been moved from the Eastern Range, Cape Canaveral, Florida to the

NASA/Goddard Space Flight Center, Wallops Flight Facility at Wallops Island, Virginia, requiring a new EA.

The technology demonstrations include three STANDARD Missile flight tests against Aries targets. After integration of the SM2 LEAP at White Sands Missile Range, the integrated missile is transported from White Sands Missile Range to the East Coast Navy Weapons Station in Yorktown, Virginia for load-out to the ship. No testing of the SM2 LEAP Vehicle will occur at Yorktown - only acceptance, storage (if necessary), and load-out to the ship. The target booster is shipped to Wallops Flight Facility (WFF) from Hill Air Force Base. The target integration activities for Flight Test Vehicles 3, 4 and 5 take place at WFF. The target vehicle is launched from WFF.

During flight test activities, the target is launched from WFF in a southeasterly direction. The Terrier ship, positioned in the Atlantic ocean southeast of WFF, launches the LEAP interceptor in a northeasterly direction. Intercept of the target vehicle occurs over open ocean approximately 350 km (220 miles) off-shore. No construction is required at any of these facilities to accommodate Navy LEAP activities.

During the original range selection process, nine test ranges were evaluated for potential performance of the Navy LEAP missions. This evaluation process is defined in the Navy LEAP EA. The Eastern Range and Cape Canaveral Air Force Station was originally selected as the test range for the last three Navy LEAP missions (Flight Test Vehicles 3, 4 and 5). The test range has since been changed to Wallops Flight Facility, primarily because of cost, schedule, safety, and environmental considerations. A more detailed discussion is contained in the EA.

After an extensive survey and screening, nine target launch vehicles were evaluated in detail for their capability to meet LEAP requirements. The Aries I was chosen because it is representative of a TBM threat, is a proven launch vehicle, has been used on previous LEAP missions, the boosters are readily available, can be maintained within a 2-3 km/second intercept velocity requirement (helps ensure ABM Treaty compliance) with minimal ballast, and meets performance requirements outlined in the Target Requirements Document. It also has the advantage of being a single-stage vehicle. This feature lowers mission risk and complexity. The entire Aries vehicle serves as the target and will not separate any components.

A recent series of Aries M56A1 motor failures occurred (FE-3, TCMP-1A and Catura flights) during FY 93 and early FY94 which raised suspicion of the reliability of the Aries booster. An extensive failure review board was held including representatives from AFSMC, USAF Phillips Lab, USAF BMO, TRW (the nozzle manufacturer), ANSER, OSC and other organizations. Nozzle O-ring failure was suspected as the root cause (Ref. *M56A1 Recertification Status*, AFSMC/CUBE, 2 Dec 93). Since then, a set of static motor firings has been performed with and without refurbished nozzle O-rings. With a high degree of confidence, the nozzle throat support O-ring was suspected to be the cause of failure (*Target Vehicle Testing Results*, PL/SXA, 3 Jan 93). These tests and refurbishment procedures were sufficient for the Navy PEO-TAD to accept the motor risk and for AFSMC to lift the motor grounding based on the new refurbishment procedures, thereby clearing use of the Aries booster for the Navy LEAP program. An Aries booster was successfully launched as part of the Navy LEAP program (FTV-TD) from, WFF on 25 Feb 94 with refurbished nozzle O-rings.

The No Action alternative to the proposed action is to not conduct flight tests 3, 4 and 5. The No Action alternative would preclude a critical series of flight tests that are needed to demonstrate the feasibility of using existing Navy shipboard weapon systems with LEAP technologies. These tests are essential for the near term evaluation of Navy upper tier BMD (ANSER 1993).

Findings

Potential impacts of the proposed action at WFF were assessed on the following environmental resources: physical setting; geology and soils; water resources; biological resources; threatened and endangered species; cultural resources; air quality; noise; and hazardous materials and wastes. Infrastructure and human health and safety were also assessed.

Potential impacts from the LEAP Test Program have previously been assessed in the LEAP Test Program Environmental Assessment (SDIO, 1991), the LEAP Supplemental Environmental Assessment (SDIO, 1992a) and the initial Navy LEAP Environmental Assessment (SDIO, 1992b). Each of these assessments resulted in a finding of no significant impact (FONSI). The environmental effects of STANDARD Missile development and operational tests at White Sands Missile Range were assessed in the STANDARD Missile Environmental Assessment (SDIO, 1992b). This assessment also resulted in a FONSI. The launch of an Aries booster from WFF is extremely similar to the Brilliant Pebbles Flight Experiment 3 Record of Environmental Consideration (REC), which resulted in a FONSI. An REC for a demonstration flight of the Navy LEAP Target (FTV-TD) also resulted in a FONSI. The Council on Environmental Quality (CEQ) NEPA Regulations encourage agencies to incorporate material by reference when the effect will be to cut down on bulk without impeding agency and public review of the action (CEQ, Sec. 1502.21). The analyses from each of these documents has been incorporated into this document by reference, where appropriate. The environmental analysis concludes that implementing the proposed action would not result in significant impacts to the natural environment or to human health and safety, at any of the aforementioned program facilities. This EA, and the information herein, is unclassified and available to the public.

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Glossary and Acronyms 5.0

5.0 Glossary and Acronyms

5.1 Glossary

Advanced Solid Axial Stage (ASAS)—See ASAS Propulsion System.

Apogee—The farthest or highest point; apex; the point of an artificial satellite or missile most distant from the earth.

ARIES I—A single-stage solid rocket booster; will serve as the target launch vehicle in the Navy LEAP Technology Demonstration.

ASAS Propulsion System—Consists of the ASAS solid propellant rocket motor for final forward boost of the LEAP projectile in the 3rd stage of the SM LEAP launch vehicle (Configuration B).

Azimuth—A distance in angular degrees in a clockwise direction from the north point.

Ballistic Missile—Any missile which does not rely upon aerodynamic surfaces to produce lift and consequently follows a ballistic trajectory when thrust is terminated.

Block II or III—Technological improvements that improve guidance, ordnance, and propulsion capability of the STANDARD Missile.

Booster—An auxiliary or initial propulsion system which travels with a missile or aircraft and which may or may not separate from the parent craft when its impulse has been delivered.

Burnout—When booster, sustainer, or ASAS impulse is delivered or expended.

Carbon dioxide (CO_2)—A colorless, odorless, incombustible gas which is a product of respiration, combustion, fermentation, decomposition and other processes, and is always present in the atmosphere.

Carbon monoxide (CO)—A colorless, odorless gas which is a by-product of the incomplete combustion of organic fuels.

Chlorofluorocarbons—A group of synthetic organic compounds composed of chlorine, fluorine, carbon, and hydrogen used primarily as industrial solvents and refrigerants.

Clam Shell Shroud—The nose cone that opens on the STANDARD Missile to enable LEAP projectile ejection on flight test 2 and subsequent missions.

Command Destruct System—Involves a flexible linear shaped charge on the ASAS and the clam-shell separation mechanism for terminating the flight of the missile. This is initiated by sending an RF tone or sequence of RF tones to the missile from the ship or range safety officer.

Cultural Resources—Prehistoric and/or historic districts, sites, structures, or other physical evidence of human use considered of some importance to a culture, subculture, or community for scientific, traditional, religious, or other reasons.

Debris—The scattered remains of something broken, destroyed, or exploded.

Decibel—Standard unit for sound measurement and represents the acoustical energy present in the environment.

Dispersion—A scattered pattern of hits around the mean point of impact of bombs and projectiles dropped or fired under identical conditions.

Endangered Species—A species that is threatened with extinction throughout all or a significant portion of its range.

Explosive Safety Quantity-Distance—The quantity of explosives material and distance separation relationships providing defined types of protection. These relationships are based on levels of risk considered acceptable for the stipulated exposures.

Flight Test—Test of an aircraft, rocket, missile, or other vehicle by actual flight or launching.

Flight Termination System (FTS)—A flight safety measure added to the ASAS motor that will be a dual, redundant system which is capable of terminating the ASAS thrust and destablizing the flight of the STANDARD Missile and LEAP.

Floodplain—A plain along a river formed by the combination of the deposition on alluvial materials and downcutting of surface geology through flooding.

Fuel Carts—Used to transfer fuels from HOKE bottles to the LEAP projectiles. It contains all necessary storage, liquid transfer, and safety systems for transporting the liquid propellants, and consists of a pressurization system (helium or nitrogen), a propellant scale, manifolding and valves used to regulate flow, and a stainless steel propellant transfer bottle.

Halon—A group of synthetic organic compounds composed of fluorine and other halogens (e..,g bromine, carbon, and hydrogen) used primarily as fire suppressant agents.

Hydrazine (N_2H_4)—A colorless, fuming, corrosive hygroscopic (moisture absorbing) liquid used in jet and rocket fuels; a potential fuel for LEAP.

Hypergolic Fuel—Fuel which will spontaneously ignite with an oxidizer.

Impact—An assessment of the meaning of changes in all attributes being studied for a given resource; an aggregation of all the adverse effects, usually measured by a qualitative and nominally subjective technique.

Kinetic Energy—Energy associated with motion, equal for a body in pure translational motion at nonrelativistic speeds to one half the product of its mass and the square of its speed ($K = 1/2\ m\ V^2$).

Kinetic Kill Vehicle Test Support—Capability of the range to provide adequate facilities and equipment necessary to handle the STANDARD Missile launch vehicle; to transport and store liquid fuel and oxidizer; to fuel the LEAP projectile; and launch the SM launch vehicle.

Lightweight Exoatmoshperic Projectile (LEAP)—The miniature integrated interceptor developed by SDIO to serve as a technology demonstrator for intercepting ballistic missile-type targets. The 10 Kg class LEAPs use on-board target detection, tracking, and maneuvering capabilities to intercept and destroy their targets by direct impact (kinetic energy) with the warhead.

Liquid Bipropellants—See Propellant; The propellants for LEAP consist of hydrazine or monomethylhydrazine as the fuel, and nitrogen tetroxide as the oxidizer.

Mitigation—A method or action to reduce or eliminate adverse environmental impacts.

National Ambient Air Quality Standards—Standards established on a Federal level that define the limits for airborne concentration of designated "criteria" pollutants to project public health with an adequate margin of safety (primary standards) and to project public welfare, including plant and animal life, visibility, and materials (secondary standards) Standards cover ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulates, and hydrocarbons.

Nitrogen tetroxide (N_2O_4)—A dark brown, fuming liquid or gas with a pungent, acrid odor, used in rocket fuels; the oxidizer for LEAP.

Ordnance—Explosives, chemicals, pyrotechnic and similar stores, e.g., bombs, guns and ammunition, flares, smoke, napalm.

Oxidize—To combine with oxygen; make into an oxide.

Oxidizer—A substance that oxidizes or induces another substance to oxidize.

Ozone (O_3)—A highly reactive form of oxygen that is the predominant component of photochemical smog. Ozone is not emitted directly into the atmosphere but results from a series

of chemical reactions between oxidant precursors (nitrogen oxides and volatile organic compounds) in the presence of sunlight.

Playa—A nearly level area at the bottom of a desert basin, sometimes temporarily covered with water.

Propellant—That source which provides the energy required for propelling a projectile. Specifically, a fuel, either solid or liquid, for propelling a rocket or missile.

Propellant Decontamination and Neutralization System (PDNS)—Works in conjunction with the fuel carts and uses water to dilute residual propellants.

Proven Technology—Technology which has been shown to perform as expected or within accepted bounds as determined by experimentation.

Radome—A domelike protective housing for a Radio Frequency antenna.

"Ready Room"—The location on the Terrier ship for locating projectile support equipment (e.g. test and checkout and pressurization "carts"). Final SM2 integration and check-out is done here.

Scenario Realism—Whether or not the range (in conjunction with nearby ranges if necessary) can support launch of a target and LEAP launch vehicle in a manner that is representative of a realistic engagement scenario.

Solid Divert Propellant—An alternative propulsion system for LEAP; being developed by Thiokol Corporation, Tactical Operations, Elkton Division; does not involve pressurization and is clean-burning and non-toxic.

Shipboard Weapon Systems—Any type of weapons systems (i.e., surface-to-air ship launched missile systems) in a mobile (ship-based) environment.

STANDARD Missile (SM)—A supersonic, solid-rocket propelled, tail-controlled missile. It is deployed by the Navy, primarily as a surface-to-air ship-launched missile for defense against attacking aircraft and anti-ship missiles.

SM-2 Block II ER—An improved version of the STANDARD Missile used as the LEAP launch vehicle.

Storage Compatibility Group—In view of storage principles, ammunition and explosives are assigned the appropriate one of 12 storage compatibility groups (A through H, J, K, L, and S).

Storage Compatibility Group B—Detonators and similar initiating devices. Items containing initiating explosives that are designed to initiate or continue the functioning of an explosive train.

Examples are detonators, blasting caps, small arms primers, and fuzes without two or more safety features.

Surface-to-Air Missile—A surface-launched missile designed to operate against a target above the surface.

Sustainer—The second stage rocket motor used on the SM-2 Block II ER during the midcourse guidance phase. This motor buns longer than the booster at a lower thrust level.

Threatened Species—Species likely to become endangered in the foreseeable future.

Tracking, Control, and Telemetry Requirement—Capability of the range to provide adequate tracking, control, and telemetry support.

Target Support—Whether or not the range can support launch and control of an acceptable target vehicle.

Tartar—A shipborne, surface-to-air missile system similar to Terrier with solid-propellant rocket engine and non-nuclear warhead.

Telemetry—The science and technology of automatic measurement and transmission of data from remote sources, as from space vehicles, to a receiving station for recording and analysis.

Terrier ship - A guided missile cruiser or destroyer equipped with a Terrier missile system.

3-Sigma Dispersion Area—Area over which debris is disbursed in which the probability of all the debris being contained within the boundaries is greater than 97% based on a normal distribution.

Trajectories—The flight paths of moving objects.

Terrier—A surface-to-air missile system with solid-fuel rocket motors. It is equipped with radar beam rider or homing guidance and non-nuclear warhead.

Thrust Vector Control (TVC) System—Located in the 3rd stage of Configuration B of the STANDARD Missile and is used to control the direction of ASAS thrust.

Wetlands—Areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

5.2 Acronyms

ABM	Anti-Ballistic Missile
ACHP	Advisory Council on Historic Preservation
ACS	Attitude Control System
AFB	Air Force Base
AFWTF	Atlantic Fleet Weapons Training Facility
AICUZ	Air Installation Compatible Use Zone
Al	Aluminum
ALFA	Military nomenclature. Designation for Northern Range at AFWTF
AMC	Air Mobility Command
ANSER	Analytical Services. Inc.
AP	Ammonium Per( )rate
AQCR	ir Quality Control Region
AQM	A (Air launched) Q (Special) M (Missile)
ARIA	Advanced Range Instrumentation Aircraft
ASAS	Advanced Solid Axial Stage
ATBM	Anti-Tactical Ballistic Missile
BAE	Boeing Aerospace & Electronics Company
BOE	Bureau of Explosives
BMO	Ballistic Missile Operations
BP	Brilliant Pebbles
CAA	Clean Air Act
CARIB	Caribbean
CCAFS	Cape Canaveral Air Force Station
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CG	Center-of-Gravity
CONUS	Continental United States
dBA	Decibels (A-weighted)
DoD	Department of Defense
DOPAA	Description of Proposed Action and Alternatives
DOT	Department of Transportation
EA	Environmental Assessment
EIS	Environmental Impact Statement
EOD	Explosive Ordnance Division
EPA	Environmental Protection Agency
EQB	Environmental Quality Board
ER	Extended Range
ERD	Environmental Resource Document
ESMC	Eastern Space and Missile Center
ESMCR	Eastern Space and Missile Center Regulation
FAA	Federal Aviation Administration
FONSI	Finding of No Significant Impact

FTS	Flight Termination System
FY	Fiscal Year
GHB	Goddard Handbook
GHe	Gaseous Helium
GMLS	Guided Missile Launching System
GN_2	Gaseous Nitrogen
GPS	Global Positioning System
GSFC	Goddard Space Flight Center
HAC	Hughes Aircraft Company
HALO	High Altitude Learjet Observatory
HCl	Hydrogen Chloride
HEDI	High Endoatmospheric Defense Interceptor
HMSC/PO	Hughes Missile Systems Company, Pomona
HTPB/AP	Hydroxy-terminated Polybutadiene/Ammonium Perchlorate
IMU	Inertial Measuring Unit
IR	Infrared
KKV	Kinetic Kill Vehicle
KMR	Kwajalein Missile Range
KSC	Kennedy Space Center
KTF	Kauai Test Facility
LAE	LEAP Auxiliary Equipment
LC	Launch Complex
LEAP	Lightweight Exoatmospheric Projectile
MAB	Missile Assembly Building
MAF	Missile Assembly Facility
MIL-STD	Military Standard
MIT/LL	Massachusetts Institute of Technology/Lincoln Laboratories
MK	Navy nomenclature. Navy equipment identifier prefix
MMH	Monomethylhydrazine
MOTR	Multi-Object Tracking Radar
MR	Medium Range
N_2H_4	Hydrazine
N_2O_4	Nitrogen Tetroxide
NAAQS	National Ambient Air Quality Standards
NASA	National Aeronautics and Space Administration
NAVLO	Naval Liaison Officer
NEPA	National Environmental Policy Act
NOMTS	Naval Ordnance Missile Test Station
NPL	National Priorities List
NRHP	National Register of Historic Places
OSHA	Occupation Safety and Health Administration
PAB	Payload Assembly Building
PCB	Polychlorinated Biphenyl
PDNS	Propellant Decontamination and Neutralization System
PL	Phillips Laboratory

PM 10	Suspended particulates less than 10 microns in diameter
PMOA	Programmatic Memorandum of Agreement
PMRF	Pacific Missile Range Facility
PMTC	Pacific Missile Test Center
POL	Petroleum Oil and Lubricant
RCRA	Resource Conservation and Recovery Act
RF	Radio Frequency
ROC	Range Operations Center
ROCC	Range Operations and Control Center
RSO	Range Safety Officer
SC	South Carolina
SDIO	Strategic Defense Initiative Organization
SDS	Strategic Defense System
SFAE	Identifies BMD Payload Product Office
SLC	Space Launch Complex
SM	STANDARD Missile
SSC	Species of Special Concern
SSOPs	Standard Safety Operating Procedures
SSRT	Single Stage Rocket Technology
STARS	Strategic Target System
STP	Space Test Projectile
STS	Stockpile to Target Sequence
TECOM	Test and evaluation Command
TLV	Target Launch Vehicle
TMD	Theater Missile Defense
TOPs	Technical Operations Procedures
TPS	Translator Processing System
TSDCD	Transportation and Shipboard Damage Control Document
TVC	Thrust Vector Control
ug/m^3	Micrograms per cubic meter
US	United States
USACOE	United States Army Corps of Engineers
USASDC	United States Army Strategic Defense Command
USFWS	United States Fish and Wildlife Service
VAFB	Vandenberg Air Force Base
VLS	Vertical Launch Ship
WFF	Wallops Flight Facility
WSESRB	Weapons Systems Explosive Safety Review Board
WSMR	White Sands Missile Range
WSTF	White Sands Test Facility

References 6.0

6.0 References

The purpose of the reference list is to provide a list of documents used in describing and analyzing the proposed action and alternatives. The reference list is indexed alphabetically.

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White Sands Missile Range,
STEWS-TE-MH
White Sands Missile Range, NM
88002-5167

Post Library
Building 464, STEWS-DP-L
White Sands Missile Range, NM 88002

Public Affairs Office
White Sands Missile Range, NM 88002

Phillips Laboratory (AFSC)/SXD
Attn: Keith Flint
Edwards AFB, CA 93523-5000

U.S. Army Environmental Hygiene Agency
HSHB-MR-LM
Aberdeen Proving Grounds, MD
21010-5442

Debbie Hernandez
NSWC/PHD 4R50
4363 Missile Way
Port Hueneme Way
Port Hueneme, CA 93043-4307

Darren Van Every
PL/OLAC/SXX
Edwards AFB, CA 93523

8.2 Federal, State, Local, and Other Government Agencies

Safety and Occupation Health Division
Environmental Protection Agency
(OP-45)
Crystal Plaza, Bldg. 5
Arlington, VA 20360

Office of Federal Activities
Environmental Protection Agency
401 M Street, SW, Mail Code A104
Washington, DC 20460

Council on Environmental Quality
722 Jackson Place, SW, 2nd Floor
Washington, DC 20503

Office of Public Affairs
Department of Interior
C Street
Washington, DC 20240

National Security Council
Old Executive Office Building
Room 389
Washington, DC 20506

Arms Control and Disarmament Agency
Office of Public Affairs
320 21st Street, NW
Washington, DC 20541

Defense Technical Information Center
FDAC Division
Cameron Station
Alexandria, VA 22304-6145

Ron McMillan
Office of Commercial Space Transportation
Department of Transportation
400 7th Street, SW
Washington, DC 20590

Thomas Branigan Memorial Library
200 E. Picacho
Las Cruces, NM 88001

8.3 Related Participants

NASA GSFC/Wallops Flight Facility
Operations Management Section/832.3
Attn: Mike Fillis
Wallops Island, Virginia 23337

Orbital Sciences Corporation
Space Data Division
Attn: L. Bons
3380 South Price Rd.
Chandler, AZ 85248

Hughes Aircraft Company
Missile Systems Group
Attn: Richard C. Hussey
P.O. Box 7928
Canoga Park, CA 91309-7928

Hughes Aircraft Company
Missile Systems Group
Attn: Cindy Rowey

1802 W. Second St., P.O. Box 2507
Pomona, CA 91766-1248

Thiokol Corporation
Elkton Division
Attn: Michael Stransky
Elkton, MD 21922-0241

Rockwell International Corporation
Rocketdyne Division
Attn: Cathy Schmidt
6633 Canoga Avenue
Canoga Park, CA 91303

Analytic Services, Inc. (ANSER)
Attn: Scott Robinsin
1215 Jefferson Davis Highway, Suite 800
Arlington, VA 22202