



Theater High Altitude Area Defense (THAAD) Pacific Test Flights



Environmental Assessment

20 December 2002

**THEATER HIGH ALTITUDE AREA DEFENSE (THAAD)
PACIFIC TEST FLIGHTS
ENVIRONMENTAL ASSESSMENT**

MISSILE DEFENSE AGENCY

AGENCY: Missile Defense Agency

ACTION: Finding of No Significant Impact

BACKGROUND: Pursuant to the Council on Environmental Quality regulations for implementing the procedural provisions of the National Environmental Policy Act (40 Code of Federal Regulations [CFR] 1500-1508); 32 CFR Part 651, *Environmental Analysis of Army Actions* (Army Regulation 200-2); and Executive Order 12114, *Environmental Effects Abroad of Major Federal Actions*, the Missile Defense Agency (MDA) conducted an Environmental Assessment (EA) to analyze the environmental consequences of conducting test flights of the Theater High Altitude Area Defense (THAAD) missile over the Pacific Ocean. Up to 50 THAAD interceptor missiles and up to 50 target missiles could be launched over a 4-year period. The next phase of THAAD flight testing is currently scheduled to begin in late FY 2005 and would continue through at least FY 2010.

THAAD flight tests and intercepts of target missile launches over realistic distances (50–3,000 kilometers [31–1,860 miles]) are required to validate the performance capability and overall effectiveness of the THAAD weapon system (i.e., interceptor missiles, radar, and support components) against representative threat ballistic missiles. The THAAD Pacific Test Flights Environmental Assessment (EA) analyzes the activities designed to confirm the effectiveness of the THAAD missile system before its procurement and deployment, including construction and operational procedures.

After a Department of Defense 2001 review and reorganization, THAAD, formerly a part of Theater Defense, became an element of the Terminal Defense Segment. THAAD, under development since the early 1990s, is designed to intercept ballistic missiles during the terminal phase of their flight, before their reentry into the Earth's atmosphere. Some aspects of its testing at White Sands Missile Range, New Mexico were analyzed in earlier analyses performed pursuant to the National Environmental Policy Act.

As noted above, the THAAD missile flight tests are needed to obtain radar data and to test intercept capability against ballistic missiles with this range. However, THAAD missile tests using realistic distances cannot be conducted at White Sands Missile Range; therefore, the MDA needs to conduct tests at a range that allows those distances in order

to confirm the effectiveness of the THAAD weapon system prior to its procurement and deployment.

The attached EA considers all potential impacts of the Proposed Action and Alternatives, including the No Action Alternative, both as solitary actions and in conjunction with other activities. This Finding of No Significant Impact (FONSI) summarizes MDA's evaluation of the proposed THAAD Pacific Flight Tests and alternatives.

DESCRIPTION OF THE PROPOSED ACTION: The Proposed Action would involve THAAD interceptor missile launches and THAAD radar operation from a site at the Pacific Missile Range Facility (PMRF) located on the island of Kauai, Hawaii. An alternative to the Proposed Action, would be the use of the Ronald Reagan Ballistic Missile Defense Test Site (RTS) in the Republic of the Marshall Islands. A second alternative would involve a combination of some or all of the proposed activities described in the Proposed Action, test flights at PMRF, and some or all of the alternative actions at RTS. The Proposed Action and alternatives would also require the construction of test support facilities and site preparation for THAAD launcher, radar, and support equipment. Some clearing and road construction would be associated with the THAAD test facilities.

Target missiles would be launched from the air, sea, and/or land. Land launches of target missiles would occur from either Toton or Bigen islands in the Republic of the Marshall Islands or from Wake Island if RTS were used as the THAAD missile flight test location.

The THAAD interceptor missile is basically a non-explosive war head (a kinetic kill vehicle (or KV)) that is attached to a missile body/booster. The THAAD KV includes an infrared seeker that detects and homes in on the target missile to destroy the target by high-speed collision. For testing, one or more THAAD missiles would be loaded in the missile round pallet, an eight-round container that doubles as the launch tubes for the launcher. The missile round pallet is mounted on to a modified U.S. Army Heavy Expanded Mobility Tactical Truck, which serves as both the transporter and launcher for the THAAD interceptor missile.

MDA is proposing to use an upgraded version of the THAAD Prototype Radar, which has already undergone assembly and integration. The upgraded radar is a wide-band, X-band, single faced, phased array radar system of modular design that can be transported by truck or aircraft. The radar system consists of four individual units: (1) Antenna Equipment Unit, (2) Electronic Equipment Unit, (3) Cooling Equipment Unit, and (4) Prime Power Unit. There would be a maximum of two radars on location during flight-testing; however, only one radar would be operated at any given time. The other radar would be stored nearby for use as a spare, should problems be encountered with the primary radar.

THAAD flights could use a variety of solid or liquid propellant target missiles to satisfy testing requirements. Some target missiles represent fully integrated systems, while others can be assembled using surplus rocket boosters to create particular test conditions or to emulate specific missile threats. Surplus booster motors that potentially could be used on solid propellant target missiles include the SR-19, GEM-40, Castor IV, Orbus-1, Polaris A3 and A3R, and the M-57A1. These motors vary in size, boost capability, and in the amount of emissions created during launch, and the most energetic motor stack that would potentially be used would be a combination of two SR-19 boosters.

Liquid propellant target missiles use a kerosene-based fuel mixed with an oxidizer to provide thrust. The liquid propellant targets are represented by systems already in use and a new system represented by the Liquid Fuel Booster Target System. The current liquid propellant target system uses inhibited red fuming nitric acid as the oxidizer, whereas the Liquid Fuel Booster Target System in development would use hydrogen peroxide.

Prior to a THAAD interceptor missile launch, the aim point and launch time to intercept the target would be computed. This information would then be downloaded to the THAAD interceptor missile. Upon launch, the THAAD interceptor missile would fly out using inertial and radar-provided guidance and seek, detect, and home in on the target missile to destroy the target by high-speed collision.

At intercept, interceptor missile and target debris would fall in the ocean west and north of PMRF in areas previously analyzed. Missile impact zones would be confined to open areas at sea and not over landmasses. Standard operating and safety procedures for missile launching and testing would be followed throughout the test program. At the conclusion of testing activities, THAAD program personnel would remove all equipment and assets brought to the range. Final ownership and disposition of permanent facilities constructed in support of THAAD testing would be determined by an inter-service agreement between the MDA and the host installation.

ALTERNATIVES CONSIDERED: White Sands Missile Range has been the THAAD program's baseline flight test range. However, White Sands Missile Range does not offer realistic test distances (50 to 3,000 kilometers [31 to 1,860 miles]) against target missiles emulating threat ballistic missiles.

A THAAD Alternate Range Study was initiated in 2001 to determine if a long-range alternative to White Sands Missile Range exists to support THAAD's flight test program. Cost, schedule and technical issues were evaluated at potential test ranges to support the determination. The study process was designed using the Ballistic Missile Defense Organization Directive 6051, "Comprehensive Siting Analysis Process." This study was conducted in phases.

In Phase I, the following ranges were considered: Atlantic Fleet Weapons Training Facility, Vieques, Puerto Rico; Eastern Range, Florida; Eglin Air Force Base, Florida; Kodiak Launch Complex, Alaska; RTS; PMRF; Poker Flat Research Range, Alaska; Utah Test and Training Range; Wallops Flight Facility, Virginia; White Sands Missile Range; and Vandenberg Air Force Base/Naval Air Warfare Center, California. Based on the Phase II screening criteria, PMRF and RTS emerged as the two best candidate sites.

The No-action Alternative was also considered. Under the No-action Alternative, the MDA would not proceed with THAAD Pacific Flight Testing. Flight test data for tactical missiles, needed for development of Terminal Missile Defense radars, interceptor missiles, and technology, would not be collected. Flight-testing would be continued at White Sands Missile Range to the maximum extent possible and within the constraints of the operational area of the range. The capability of the THAAD element against longer-range ballistic missiles would not be evaluated. Another range with a suitable operational area would potentially have to be developed at a substantial cost and delay to the program.

CONCLUSION: Based on the environmental analysis in the THAAD Pacific Test Flights EA, MDA has determined that no significant impacts would occur as a result of the construction and operation of any of the THAAD test sites and related support facilities. Under the No-action Alternative, no environmental consequences associated with THAAD test flights activities would occur. Preparation of an EIS, therefore, is not required.

DEADLINE FOR RECEIPT OF WRITTEN COMMENTS: 20 January 2003

POINT OF CONTACT: Submit written comments or requests for a copy of the EA to:
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**THEATER HIGH ALTITUDE AREA DEFENSE (THAAD)
PACIFIC TEST FLIGHTS
ENVIRONMENTAL ASSESSMENT**

MISSILE DEFENSE AGENCY

ACTION: Finding of No Significant Impact

APPROVED:



DATE: 5 Mar 03

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APPROVED:



DATE: 7 Mar 03

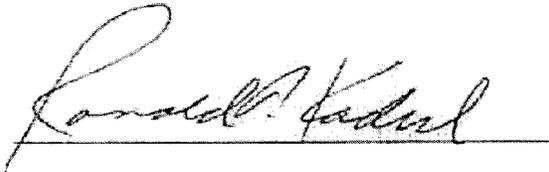
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APPROVED:



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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

Introduction

The Theater High Altitude Area Defense (THAAD) Project Office of the Missile Defense Agency proposes to conduct THAAD missile flight tests over the Pacific Ocean. The Missile Defense Agency proposes to establish THAAD flight test launch capabilities at Pacific Missile Range Facility (PMRF) located on the island of Kauai, Hawaii. The Proposed Action would involve THAAD interceptor missile launches and THAAD radar operation from a site at PMRF. An alternative to the Proposed Action would be the use of the Ronald Reagan Ballistic Missile Defense Test Site (RTS) in the Republic of the Marshall Islands. A second alternative would involve a combination of some or all of the proposed activities described in the Proposed Action, test flights at PMRF, and some or all of the alternative actions at RTS. The Proposed Action and alternatives would also require the construction of test support facilities and site preparation for THAAD launcher, radar, and support equipment. Some clearing and road construction would be associated with the THAAD test facilities.

Target missiles would be launched from the air, sea, and/or land. Land launches of target missiles would occur from either Toton or Bigen islands in the Republic of the Marshall Islands or from Wake Island if RTS were used as the THAAD missile flight test location.

The THAAD flight test program would determine the capabilities of THAAD to (1) work together as an element, (2) intercept endoatmospheric and exoatmospheric targets threatening its defended area, (3) integrate into the larger Ballistic Missile Defense architecture, and (4) anchor simulations.

The THAAD test program is divided into developmental cycles called "Blocks." The flight test program would be conducted in two biennial blocks, Block 04 and Block 06. The Block 04 flight test program would consist of four flight tests (F/Ts): an interceptor controls flight test, a seeker characterization test, and two intercept flight tests. The interceptor controls flight test would be conducted to confirm proper flight control operations in the exoatmospheric intercept regime. The seeker characterization flight test would ensure proper functioning of the interceptor's seeker in a live intercept environment. The remaining two flight tests would focus on demonstrating and characterizing exoatmospheric performance capability, ultimately with soldier operation of the element.

The Block 06 flight test program would be conducted to demonstrate endoatmospheric and exoatmospheric engagement capability. Block 06 would consist of 2 radar data collection missions and 12 flight tests: an interceptor controls flight test, a seeker characterization flight test and 10 intercept flight tests. The two radar data collection missions would be non-interceptor (target only) flights using separating target missiles to gather data to support the development of radar software required later in the Block 06 flight test program. The interceptor controls flight test would be conducted to confirm proper flight

control operations in the endoatmospheric intercept regime. The seeker characterization flight test would characterize the seeker in the endoatmospheric intercept environment. The F/T 9 would consist of two THAAD interceptors launched against a single target. The F/T 13 would be conducted as a multiple simultaneous engagement mission (two interceptors against two targets, conducted simultaneously). All other Block 06 flight tests would be single intercept missions (single interceptor, single target). The F/Ts 15 and 16 would demonstrate expanded capability for THAAD to acquire and intercept threat-representative targets at higher velocities and longer ranges. Block 06 flight testing would resolve critical technical issues and critical operational suitability and effectiveness issues associated with the THAAD element design using the production representative missile configuration, BMC2 and radar software upgrades.

THAAD has been under development since the early 1990s. Some aspects of its testing at White Sands Missile Range, New Mexico were analyzed under earlier analyses performed pursuant to the National Environmental Policy Act, such as the 1994 *Theater High Altitude Area Defense (THAAD) Initial Development Program Environmental Assessment* and the 1995 *Theater Missile Defense Flight Test Environmental Assessment*, which analyzed follow-on testing at White Sands Missile Range, New Mexico. The decisions to be made by the Missile Defense Agency and supported by information contained in this environmental assessment include the selection of a range to test the THAAD missile and the specific range sites and targets that would be used in THAAD testing.

The THAAD missile is intended to intercept and destroy incoming ballistic missiles with ranges of 50 to 3,000 kilometers (31 to 1,860 miles), which are currently fielded throughout the world by a large number of nations. THAAD flight tests and intercepts of target missile launches over these ranges are required to validate the performance capability and overall effectiveness of the THAAD weapon system (i.e., interceptor missiles, radar, and support components) against representative threat ballistic missiles. Because THAAD missile tests using realistic distances cannot be conducted at White Sands Missile Range, the Missile Defense Agency needs to conduct tests at a range that allows those distances in order to confirm the effectiveness of the THAAD weapon system prior to its procurement and deployment.

Proposed Action

The THAAD missile round is a certified round encased in a canister and consists of a booster and a Kill Vehicle. The THAAD interceptor missile is basically a non-explosive war head (a Kill Vehicle) that is attached to a missile body/booster. The Kill Vehicle consists of a shroud, fore-cone, seeker, divert and attitude control system, and guidance and control electronics. The infrared seeker detects the target vehicle and homes in on the target missile to destroy the target by body-to-body contact. The booster is a single stage, solid propellant rocket motor with a flare. The flare consists of overlapping petals that lock into position after deployment. The inter-stage provides physical interface between the KV and the booster. For testing, one or more THAAD missiles would be loaded in the missile round pallet, an eight-round container that doubles as the launch tubes for the launcher.

The Missile Defense Agency is proposing to use an upgraded version of the THAAD Prototype Radar, which has already undergone assembly and integration. The upgraded radar is a wide-band, X-band, single faced, phased array radar system of modular design and can be transported by truck or aircraft. There would be a maximum of two radars on location during flight testing. Only one radar would be operated at any given time. The other radar would be stored in an existing area of the installation and would be available for use should problems be encountered with the primary radar. An electromagnetic radiation hazard exclusion area would be established in front and to the side of the THAAD radar antenna. The electromagnetic radiation hazard exclusion area for personnel would extend for 400 meters (1,312 feet) in front and to the side of the radar.

THAAD flights could use a variety of target missiles to satisfy testing requirements. Some target missiles represent fully integrated systems. Others can be assembled using surplus rocket boosters to create particular test conditions or to emulate specific missile threats. Two categories of target missiles could be used, solid or liquid propellant. Booster motors that potentially could be used on solid propellant target missiles include the SR-19, GEM-40, Castor IV, Orbus-1, Polaris A3 and A3R, and the M-57A1. These motors vary in size, boost capability, and in the amount of emissions created during launch. The most energetic motor stack that would potentially be used would be a combination of two SR-19 boosters.

Liquid propellant target missiles use a kerosene-based fuel mixed with an oxidizer to provide thrust. The liquid propellant targets are represented by systems already in use and a new system represented by the Liquid Fuel Booster Target System. The current liquid propellant target system uses inhibited red fuming nitric acid as the oxidizer, whereas the Liquid Fuel Booster Target System in development would use hydrogen peroxide.

At intercept, interceptor and target missile debris would fall in the ocean west and north of PMRF in areas previously analyzed. Missile impact zones would be confined to open areas at sea and not over landmasses. Standard operating and safety procedures for missile launching and testing would be followed throughout the test program. At the conclusion of testing activities, THAAD program personnel would remove all equipment and assets brought to the range. Final ownership and disposition of permanent facilities constructed in support of THAAD testing would be determined by an inter-service agreement between the Missile Defense Agency and the host installation.

No-action Alternative

Under the No-action Alternative, the Missile Defense Agency would not proceed with THAAD Pacific Flight Testing. Flight test data for tactical missiles, needed for development of Terminal Missile Defense radars, interceptor missiles, and technology, would not be collected. Flight-testing would be continued at White Sands Missile Range to the maximum extent possible and within the constraints of the operational area of the range. The capability of the THAAD element against longer range ballistic missiles would not be evaluated. Another range with a suitable operational area would potentially have to be developed at a substantial cost and delay to the program.

Methodology

To assess the significance of any impact, a list of activities necessary to accomplish the Proposed Action was developed. The affected environment at all applicable locations was then described. Next, those activities with the potential for environmental consequences were identified. The degree of analysis of proposed activities is proportionate to their potential to cause environmental impacts.

Thirteen broad areas of environmental consideration were considered to provide a context for understanding the potential effects of the Proposed Action and to provide a basis for assessing the severity of potential impacts. These areas included air quality, airspace, biological resources, cultural resources, geology and soils, hazardous materials and waste, health and safety, infrastructure, land use, noise, socioeconomics, water resources, and environmental justice. The areas were analyzed as applicable for each proposed location or activity.

Results

This section summarizes the conclusions of the analyses made for each of the areas of environmental consideration based on the application of the described methodology. Within each resource summary, only those activities for which a potential environmental concern was determined are described. A summary of the potential environmental effects is provided in table ES-1.

Cumulative Impacts

THAAD test flight activities are proposed for a number of widely separated geographic areas. Consequently, there is little or no potential for significant cumulative impacts between the various THAAD-related sites. THAAD activities would not increase the total number of launches currently allowed at the Pacific Missile Range Facility, the Ronald Reagan Ballistic Missile Defense Test Site, or Wake. Launches from Bigen or Toton would not exceed U.S. Army Kwajalein Atoll standards. There may be some temporary minor cumulative impacts to air quality, increase in the use of hazardous materials, generation of hazardous waste, and demand on infrastructure and utility systems during construction and operation (testing). There would be no long-term, significant cumulative impacts to biological resources, since activities would be performed at varying times and locations. There would be no net loss of wetlands. Some cumulative beneficial impacts on local economies in the vicinity of construction and operation of THAAD test flight sites would be expected.

Table ES-1: Summary of Environmental Impacts

Resource Category	Pacific Missile Range Facility	Reagan Test Site	Wake	Bigen	Toton	Open Ocean	No-action
Air Quality	Temporary localized increase in air emissions from construction and minor emission levels from launches/operations; no effect to region's current attainment status	Temporary localized increase in air emissions from construction and minor emission levels from launches/operation; no exceedance of U.S. Army Kwajalein Atoll Environmental Standards	Temporary localized increase in air emissions from construction and minor emission levels from launches/operation; no change to the region's current attainment status	Temporary localized increase in air emissions from construction and minor emission levels from launches/operation; no exceedance of U.S. Army Kwajalein Atoll Environmental Standards	Temporary localized increase in air emissions from construction and minor emission levels from launches/operation; no exceedance of U.S. Army Kwajalein Atoll Environmental Standards	Temporary localized minor emissions from missile/target flights	No change to the region's current attainment status
Airspace	No impacts	No impacts	No impacts	No impacts	No impacts	No impact	No impact
Biological Resources	Short-term noise-related impacts to wildlife; no impacts to Essential Fish Habitat; minimal impacts are expected to vegetation and wildlife, including threatened or endangered species during operations; no direct impacts to wetlands	Short-term noise-related impacts to wildlife. No impacts to Essential Fish Habitat; minimal impacts are expected to vegetation and wildlife, including threatened or endangered species during operations	Short-term noise-related impacts to wildlife. No impacts to Essential Fish Habitat; minimal impacts are expected to vegetation and wildlife, including threatened or endangered species during operations	Short-term noise-related impacts to wildlife; minimal impacts are expected to vegetation and wildlife, including threatened or endangered species during operations	Short-term noise-related impacts to wildlife; minimal impacts are expected to vegetation and wildlife, including threatened or endangered species during operations	Short-term noise-related impacts to wildlife; minimal impacts are expected to wildlife, including threatened or endangered species during operations	No impacts, resources would continue to be managed in accordance with applicable regulations
Cultural Resources	Proposed launch site was moved, no impacts to identified cultural resources	No impact to historically significant World War II or Cold War facilities	No impacts to identified cultural resources	No impacts to identified cultural resources	No impacts to identified cultural resources	N/A	No impacts, resources would continue to be managed in accordance with cultural resource regulations
Geology and Soils	Minor localized soil erosion during construction	Minor localized soil erosion during construction	Minor localized soil erosion during construction	Minor localized soil erosion during construction	Minor localized soil erosion during construction	N/A	No impact
Hazardous Materials and Hazardous Waste Management	No substantial impact	No substantial impact	No substantial impact	No substantial impact	No substantial impact	No substantial impact	Continued use of hazardous materials and generation of hazardous waste

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1.0

PURPOSE AND NEED

1.0 PURPOSE AND NEED

1.1 INTRODUCTION

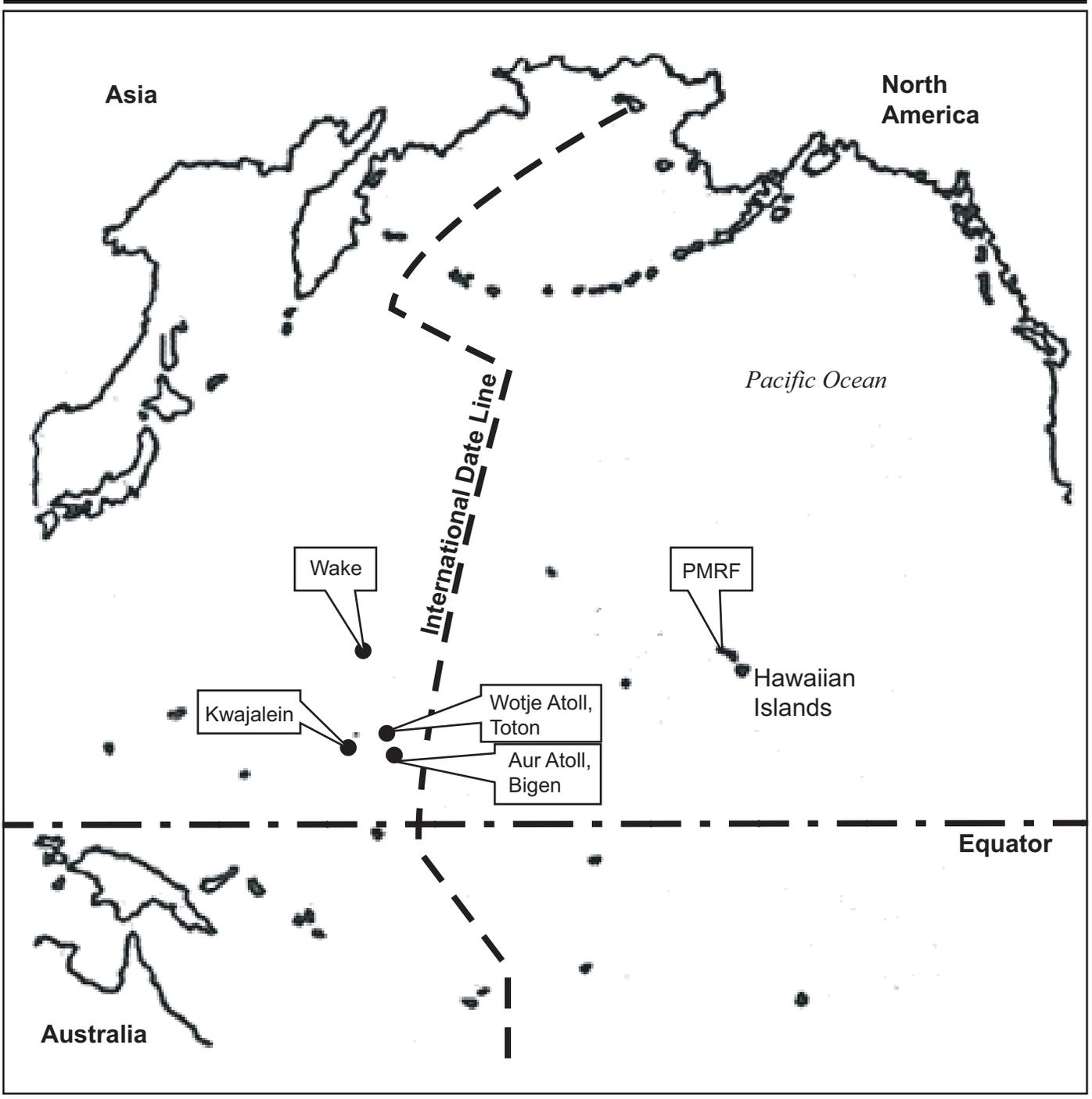
The Theater High Altitude Area Defense (THAAD) Project Office of the Missile Defense Agency (MDA) proposes to conduct THAAD missile flight tests over the Pacific Ocean (figure 1-1). The Proposed Action would involve THAAD interceptor missile launches and THAAD radar operation from a site at the Pacific Missile Range Facility (PMRF) located on the island of Kauai, Hawaii (figure 1-2). An alternative to the Proposed Action would be the use of the Ronald Reagan Ballistic Missile Defense Test Site (RTS) on the U.S. Army Kwajalein Atoll in the Republic of the Marshall Islands (RMI) (figure 1-3). A second alternative would involve a combination of some or all of the proposed activities described in the Proposed Action, test flights at PMRF, and some or all of the alternative actions at RTS. The Proposed Action and alternative would also require the construction of test support facilities and site preparation for THAAD launcher, radar, and support equipment. Some clearing and road construction would be associated with the THAAD test facilities.

Target missiles would be launched from the air, sea, and/or land. Land launches of target missiles would occur from either Toton or Bigen islands in the Republic of the Marshall Islands or from Wake Island if RTS were used as the THAAD missile flight test location.

1.2 BACKGROUND

The National Environmental Policy Act (NEPA) of 1969, as amended, and the Council on Environmental Quality regulations implementing NEPA (40 Code of Federal Regulations [CFR] 1500-1508) require MDA to consider the potential environmental consequences of major federal actions. This Environmental Assessment (EA) was done in accordance with 32 CFR Part 651, *Environmental Analysis of Army Actions* (Army Regulation 200-2) and Executive Order 12114, *Environmental Effects Abroad of Major Federal Actions*. The EA analyzes the potential environmental consequences of missile test flights, intercepts, and target missile launches from a variety of locations in support of the THAAD program, as well as operation of radar in support of THAAD flight tests. The environmental resource areas analyzed herein reflect the unique features of the THAAD Pacific flight tests and the environmental setting.

The development, production and initial testing of the THAAD missile system was described and analyzed in the *Theater High Altitude Area Defense (THAAD) Initial Development Program Environmental Assessment* (U.S. Army Space and Strategic Defense Command, 1994). Follow-on testing at White Sands Missile Range, which included flight preparation, launch, flight/intercept, and data collection, was analyzed in the *Theater Missile Defense Flight Test Environmental Assessment* (U.S. Army Space and Strategic Defense Command, 1995).



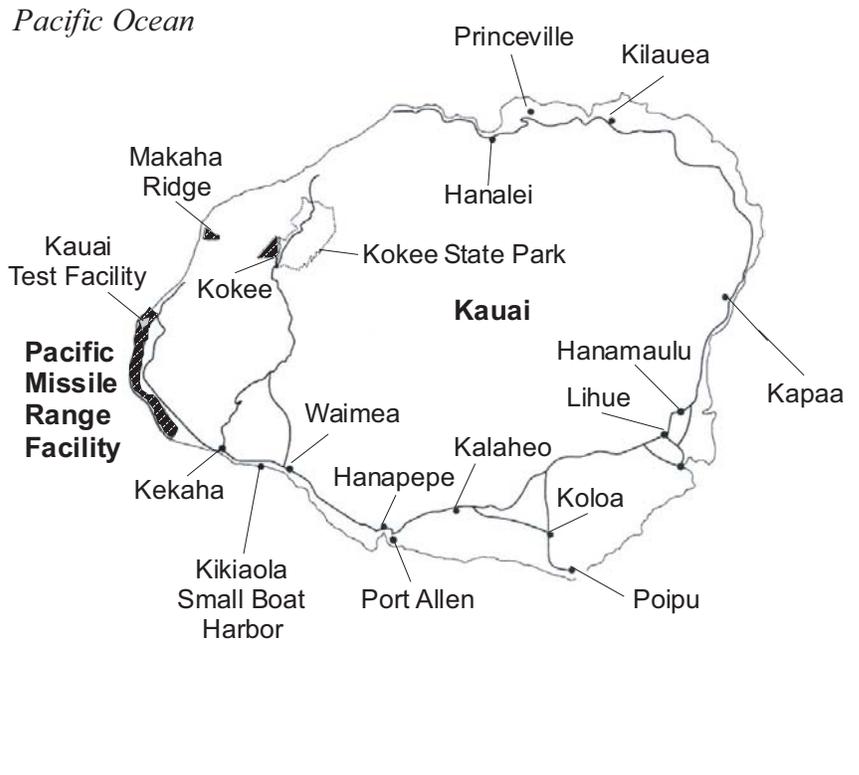
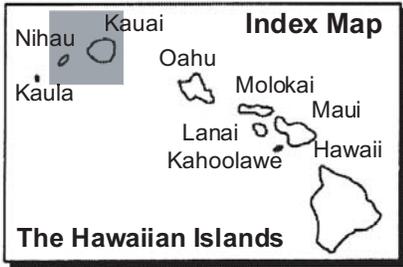
Relative Locations of THAAD Pacific Test Activity Sites

Pacific Ocean

Figure 1-1



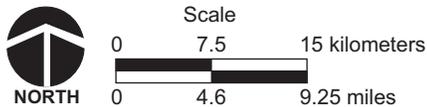
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EXPLANATION

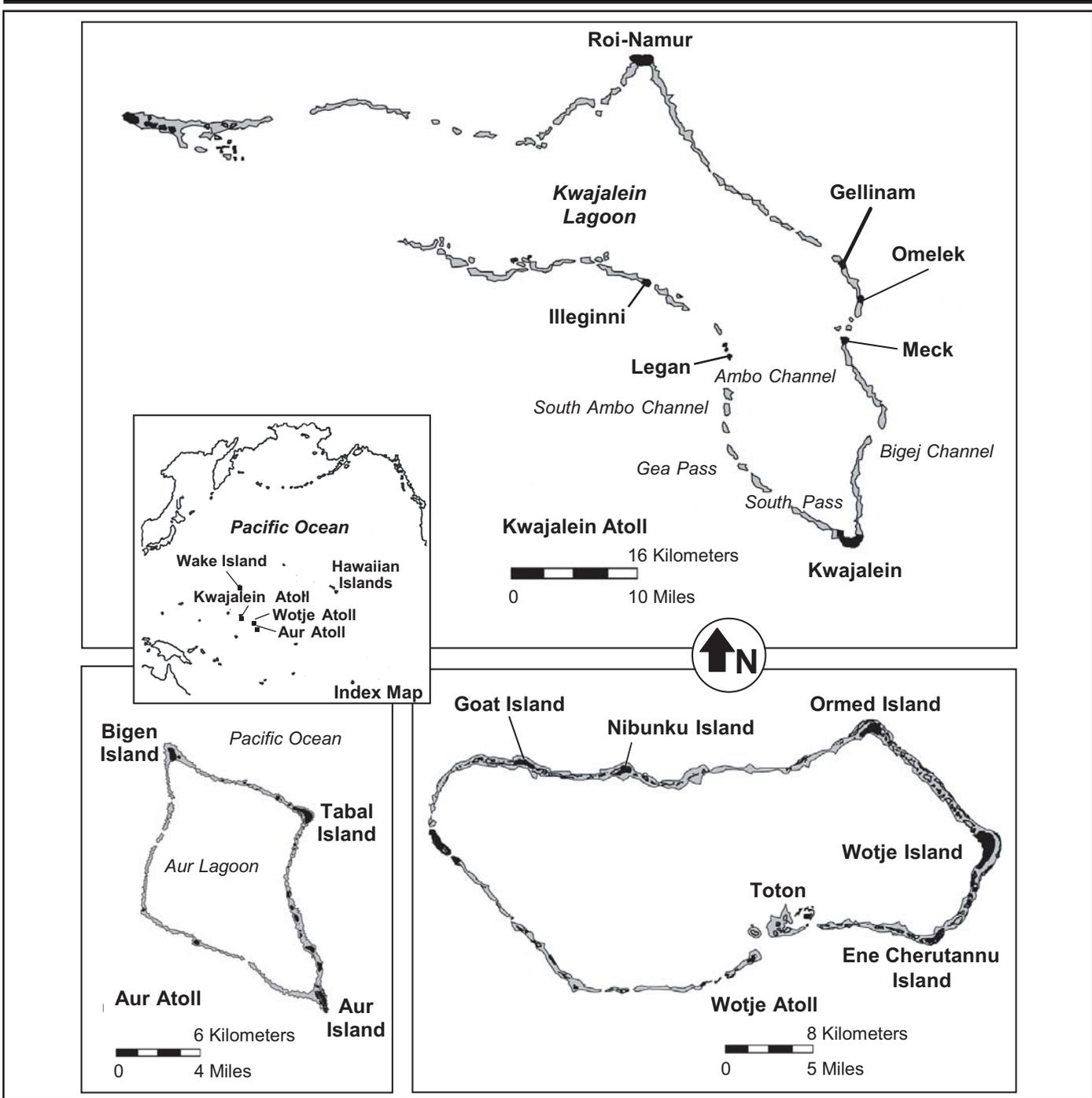
-  Pacific Missile Range Facility
-  Keep-Out Zone
-  Lakes (Playa)

Location of Pacific Missile Range Facility



Kauai, Hawaii

Figure 1-2



Location of Kwajalein, Aur, and Wotje Atolls, Republic of the Marshall Islands

Pacific Ocean

Figure 1-3



1.2.1 THEATER HIGH ALTITUDE AREA DEFENSE AS PART OF THE BALLISTIC MISSILE DEFENSE SYSTEM

Within the Department of Defense (DoD), the MDA is responsible for developing and testing a conceptual Ballistic Missile Defense System (BMDS). The concept of a BMDS is to provide an effective defense for the United States, its deployed forces, and its friends and allies from limited missile attack during any phase of an attacking missile's flight. The BMDS would increase overall effectiveness by incrementally deploying layered, yet independent, defenses that use complementary interceptors, sensors, and battle management, command and control (BMC2) components to provide multiple engagement opportunities against all classes of ballistic missile threats (short-, medium-, and long-range) in the boost, midcourse, and terminal phases of flight. The BMDS would be composed of three segments: Boost Phase Defense, Midcourse Defense, and Terminal Defense, based on the three phases of missile flight.

Each segment of the BMDS could include several elements. Elements are different ways of providing a defense during the same phase, or segment, of a threat missile flight. All segments and elements are designed to be interoperable as each element is developed. At the same time, each element is being developed to provide an effective stand-alone defense against a specific type of threat. No element is dependent upon the other for its usefulness, and each provides a different defense capability.

After a DoD review and reorganization, THAAD, formerly a part of Theater Defense, became an element of the Terminal Defense Segment. THAAD, under development since the early 1990s, is designed to intercept ballistic missiles during the terminal phase of their flight, before their reentry into the Earth's atmosphere. Some aspects of its testing at White Sands Missile Range, New Mexico were analyzed in earlier analyses performed pursuant to NEPA, such as the THAAD Initial Development Program EA (U.S. Army Space and Strategic Defense Command, 1994) and the Theater Missile Defense Flight Test EA (U.S. Army Space and Strategic Defense Command, 1995).

1.3 PURPOSE OF AND NEED FOR THE PROPOSED ACTION

1.3.1 PURPOSE

THAAD flight tests and intercepts of target missile launches over realistic distances (50–3,000 kilometers [31–1,860 miles]) are required to validate the performance capability and overall effectiveness of the THAAD weapon system (i.e., interceptor missiles, radar, and support components) against representative threat ballistic missiles.

1.3.2 NEED

As stated above, the THAAD missile is intended to intercept and destroy incoming ballistic missiles with ranges of 50 to 3,000 kilometers (31 to 1,860 miles), which are currently fielded throughout the world by a large number of nations. Flight test experiments are needed to obtain radar data and to test intercept capability against ballistic missiles with this range. Such experiments would facilitate research and enable the development of the THAAD missile to counter the threat presented by short- and mid-range ballistic missiles.

White Sands Missile Range has been the THAAD program's baseline flight test range. However, White Sands Missile Range does not offer realistic test distances (50–3,000 kilometers [31–1,860 miles]) against target missiles emulating threat ballistic missile parameters. Because THAAD cannot conduct tests using realistic distances at White Sands Missile Range, MDA needs to conduct tests at a range that allows those distances in order to confirm the effectiveness of the THAAD weapon system prior to its procurement and deployment.

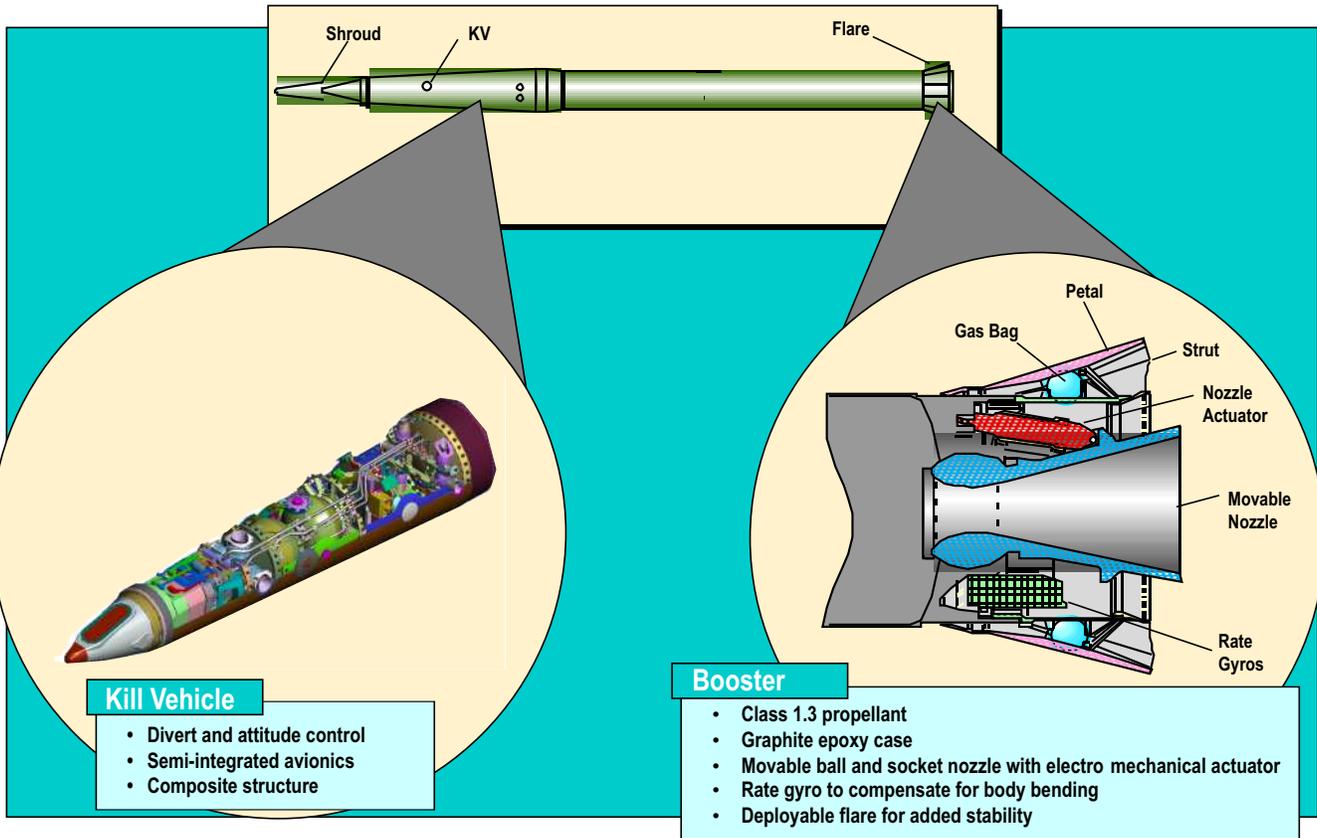
1.4 THEATER HIGH ALTITUDE AREA DEFENSE ELEMENT DESCRIPTION

This section describes the existing THAAD element, including the interceptor missile, launcher, radar, and BMC2 components and support equipment. The development and manufacture of the THAAD missile system was analyzed in the THAAD Initial Development Program EA (U.S. Army Space and Strategic Defense Command, 1994). The THAAD flight test interceptor missile is a hit-to-kill anti-tactical missile. It is transported on and launched from a modified M-1120 Heavy Expanded Mobility Tactical Truck (HEMTT)–Load Handling System (LHS) Truck. Missile launch procedures are controlled from separate BMC2 shelters mounted on XM-1113 High Mobility Multi-Purpose Wheeled Vehicles (HMMWVs). Surveillance and fire control are provided by the THAAD radar components. Launch commands to the M-1120 HEMTT-LHS are transmitted via fiber-optic cable.

1.4.1 INTERCEPTOR

The THAAD missile round is a certified round encased in a canister and consists of a booster, and a kill vehicle (KV) as shown in figure 1-4. The booster is a single stage, solid propellant rocket motor with a flare. The flare consists of overlapping petals that lock into position after deployment. The inter-stage provides physical interface between the KV and the booster. The KV consists of a shroud, fore-cone, seeker, divert and attitude control system and guidance and control electronics. The KV has an uncooled sapphire window with an infrared seeker mounted on a two-axis stabilized platform. The KV uses liquid bi-propellant for divert and attitude control.

The missile round is approximately 7 meters (22 feet) long and weighs 975 kilograms (2,145 pounds). The missile as it flies is approximately 6 meters (20 feet) long with a major diameter of 0.4 meters (1 foot) (KV base diameter).



THAAD Missile

Not to Scale

Figure 1-4

The THAAD interceptor missile is basically a non-explosive war head (a KV) that is attached to a missile body/booster. The THAAD EKV includes an infrared seeker that detects the target vehicle and homes in on the target missile to destroy the target by body-to-body contact. It contains a Divert and Attitude Control System, which is a pressure fed, propellant managed, hypergolic bi-propellant system (4.3 liters (1.1 gallons) of monomethyl hydrazine and 5 liters (1.3 gallons) of a 25 percent solution of mixed oxides of nitrogen).

The booster solid propellant is a hydroxyl-terminated polybutadiene composition that is rated as a Class 1.3 explosive. A deployable flare is located on the aft of the booster to provide aerodynamic stability during separation while avoiding added drag during boost. The flare consists of individual petals that are deployed by a pressurized gasbag. After the booster and interstage separate from the KV, the Divert and Attitude Control System steers the KV to intercept the target missile by the systematic firing of small motors to obtain proper direction and alignment of the KV. The THAAD missile is equipped with a flight termination system to terminate thrust if unsafe conditions develop during powered flight. The Class 1.3 booster rating includes the additional high-explosives energy associated with the flight termination system.

The interceptor missile would be obtained from contractor or government facilities, and no additional assembly would be required at the test installation. The missile booster, Divert and Attitude Control System, and solid-fueled Separation Motor are fully fueled at the production plant. For testing, one or more THAAD missiles would be loaded in the missile round pallet (MRP), an eight-round container that doubles as the launch tubes for the launcher. It has two tiers of four launch tubes. The remaining tubes would be filled with dummy missiles, which serve only to balance the load across the breadth of the MRP. The live THAAD missiles would be sealed in their container in the MRP. The live missile container would have internal monitoring devices that would alert should any traces of leaked fuel be detected inside the container.

The interceptor missile produces emissions during each launch event. Table 1-1 lists the constituents and general amounts of emissions.

The THAAD launcher (figure 1-5) uses a modified U.S. Army M-1120 HEMTT-LHS to perform the functional requirements of the transporter. The MRP can be quickly loaded onto or removed from the transporter using the integral HEMTT-LHS. The M-1120 HEMTT-LHS also provides all launcher mobility requirements on improved and unimproved roads. Final preparation would involve installing the MRP on the M-1120 HEMTT-LHS. THAAD missiles could be extracted from one MRP and loaded to another on the M-1120 HEMTT-LHS. No hazardous materials or wastes would be generated as a result of this activity.

1.4.2 RADAR

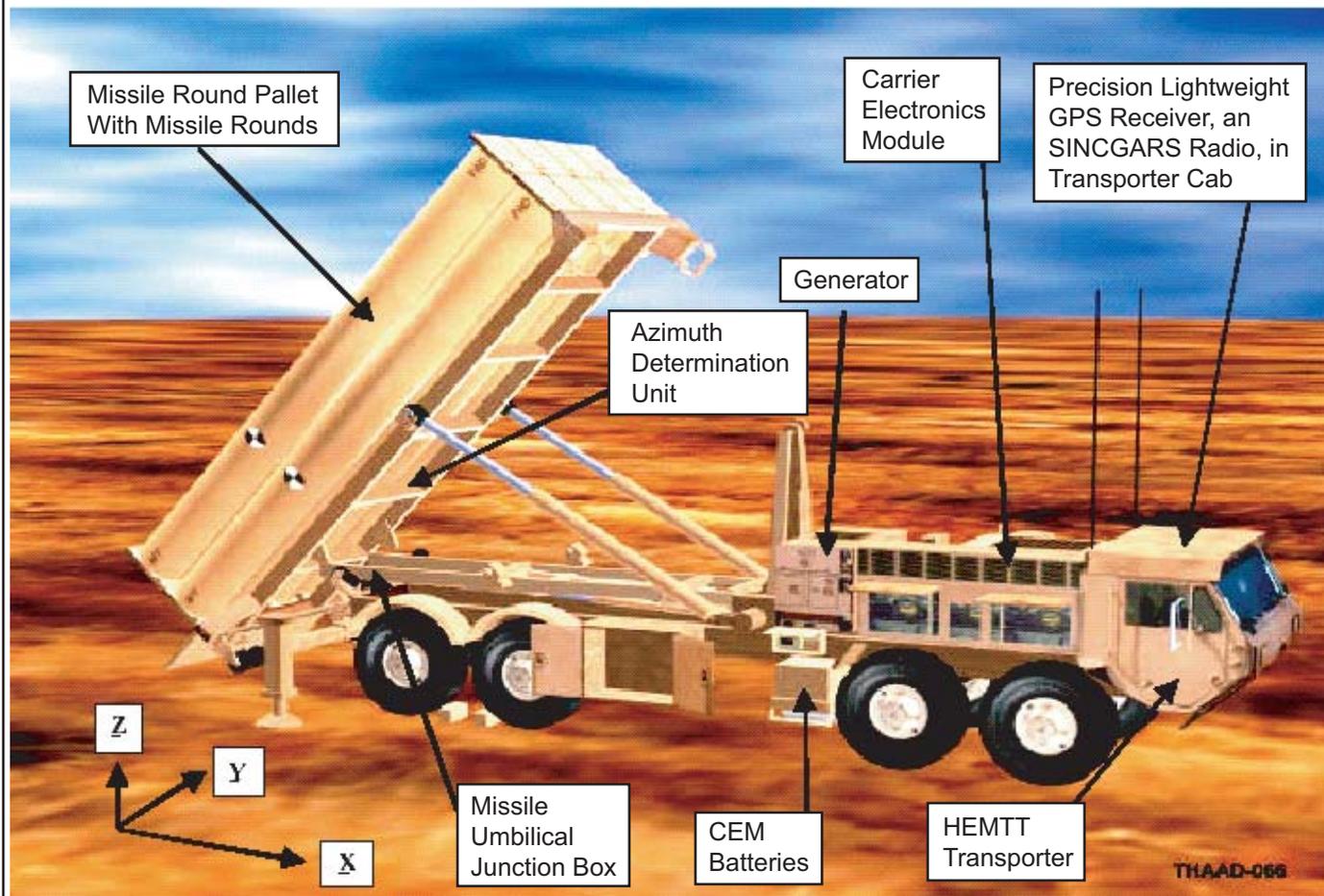
The radar component to be used in the proposed flight tests is an upgraded version of the THAAD Prototype Radar, which has already undergone assembly and integration. Therefore, no assembly or integration at the operation site would be required. This upgraded version would include:

Table 1-1: Total Interceptor Emission Constituents

Constituent	Amounts	
	Kilograms	Pounds
Al ₂ O ₃ (aluminum oxide)	< 159	< 350.0
CO (carbon monoxide)	< 113	< 250.0
HCl (hydrogen chloride)	< 90.7	< 200.0
N ₂ (nitrogen)	< 45.3	< 100.0
H ₂ O (water)	< 22.6	< 50.00
H ₂ (hydrogen)	< 22.6	< 50.00
CO ₂ (carbon dioxide)	< 6.80	< 15.00
Cl* (chlorine)	< 2.26	< 5.00
CaCl* (1) (calcium chloride)	< 2.26	< 5.01
NaCl (sodium chloride)	< 2.26	< 5.00
AlCl* (2) (aluminum chloride)	< 0.45	< 1.00
AlCl ₂ * aluminum chloride)	< 0.22	< 0.500
AlCl ₃ (aluminum chloride)	< 0.22	< 0.500
AlOCl (aluminum chloride)	< 0.22	< 0.500
AlOH* (aluminum hydroxide)	< 0.22	< 0.500
H* (hydrogen)	< 0.22	< 0.500
KCl (potassium chloride)	< 0.22	< 0.500
OH* (hydroxide)	< 0.22	< 0.500
PN* (phosphorous nitride)	< 0.22	< 0.500
PO* (phosphorous oxide)	< 0.22	< 0.500
Bi (bismuth)	< 0.045	< 0.100
FeCl ₂ (2) (ferrous chloride)	< 0.045	< 0.100
FeCl ₃ (3) (iron chloride)	< 0.045	< 0.100
FeCl ₄ (4) (iron chloride)	< 0.045	< 0.100
FeH ₂ O ₂ (iron hydroxide)	< 0.045	< 0.100
Na (sodium)	< 0.045	< 0.100
PO ₂ * (phosphorous dioxide)	< 0.045	< 0.100
AlOOH* (aluminum hydroxide)	< 0.005	< 0.010
Cl ₂ (chlorine)	< 0.005	< 0.010
K (potassium)	< 0.005	< 0.010
NO (nitric oxide)	< 0.005	< 0.010
P (phosphorous)	< 0.005	< 0.010
Al (aluminum)	< 0.0005	< 0.001
CH ₄ (methane)	< 0.0005	< 0.001
NaOH (sodium hydroxide)	< 0.0005	< 0.001
NH ₃ (ammonia)	< 0.0005	< 0.001
O* (oxygen)	< 0.0005	< 0.001
PH* (phosphinidine)	< 0.0005	< 0.001

Source: THAAD Missile Directorate, 2002

Note: * = radicals, (#) = valence



EXPLANATION

THAAD = Theater High Altitude Area Defense
 GPS = Global Positioning System
 SINCGARS = Single Channel Ground-Air Radio System
 CEM = Carrier Electronics Module
 HEMTT = Heavy Expanded Mobility Tactical Truck

THAAD Launcher

Figure 1-5

- Upgraded transmit/receive module, which has a higher power output and improved reception
- Increased overall system bandwidth
- Increased ruggedness and reduction in weight and simplified maintenance

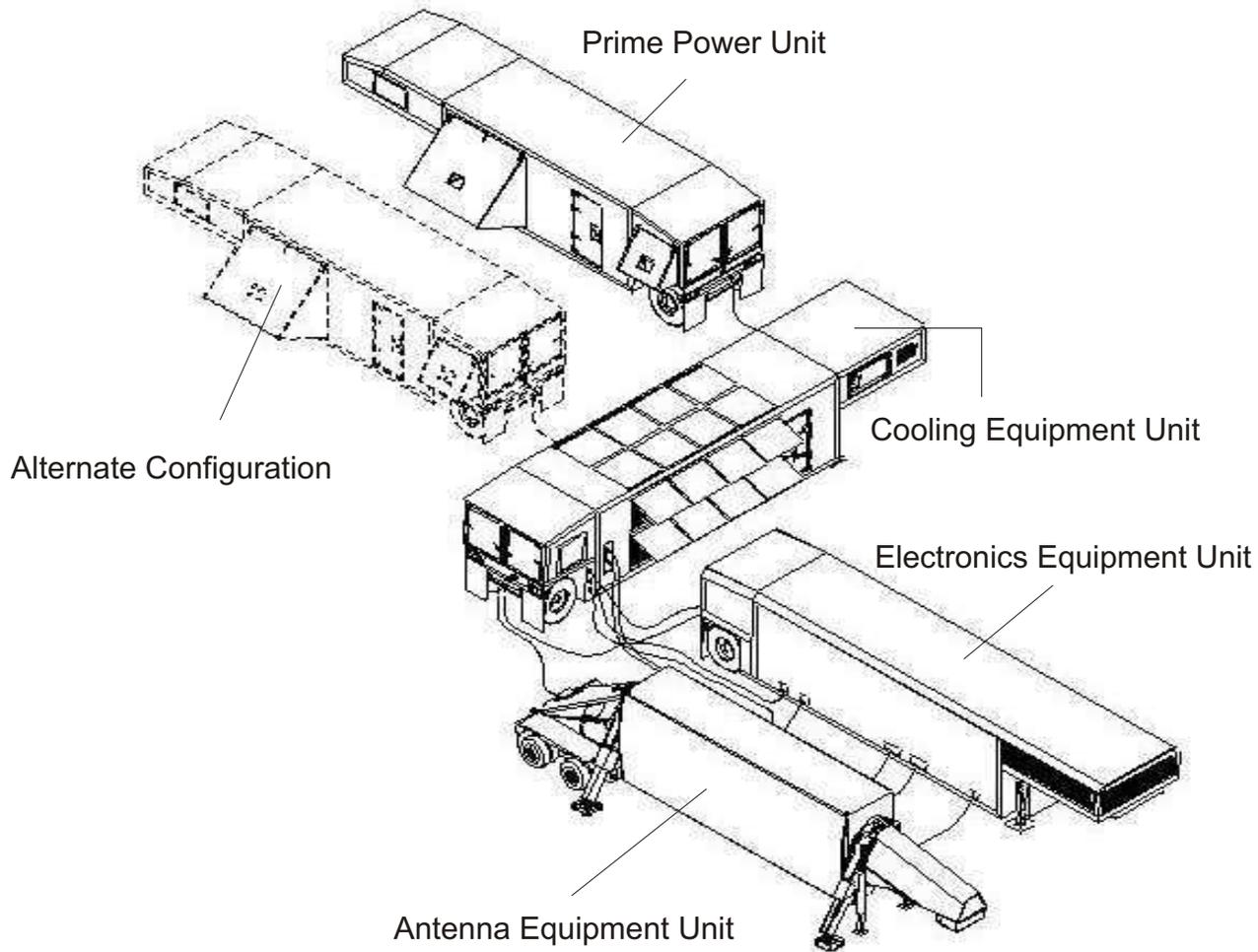
The upgraded radar is a wide-band, X-band, single faced, phased array radar system of modular design that can be transported by truck or aircraft. Its development and manufacture was analyzed in the *Ground Based Radar Family of Radars Environmental Assessment* (U.S. Army Space and Strategic Defense Command, 1993). The radar system consists of four individual units: (1) Antenna Equipment Unit, (2) Electronic Equipment Unit, (3) Cooling Equipment Unit, and (4) Prime Power Unit (figure 1-6). The Antenna Equipment Unit includes all transmitter and beam steering components as well as power and cooling distribution systems. The Electronic Equipment Unit houses the signal and data processing equipment, operator workstations, and communications equipment. The Cooling Equipment Unit contains the fluid-to-air heat exchangers and pumping system to cool the antenna array and power supplies. The Prime Power Unit, used to power the THAAD radar system, is a self-contained trailer with a noise-dampening shroud that contains a diesel generator, governor and associated controls, a diesel fuel tank, and air-cooled radiators. Each individual unit is housed on a separate trailer interconnected with power and signal cabling, as required.

There would be a maximum of two radars on location during flight testing. However, only one radar would be operated at any given time. The other radar would be stored nearby in an existing area of the installation for use as a spare should problems be encountered with the primary radar.

An electromagnetic radiation (EMR) hazard exclusion area would be established in front and to the side of the THAAD radar antenna. The EMR hazard exclusion area for personnel would extend for 400 meters (1,312 feet) in front and to the side of the radar.

Operation of the Prime Power Unit would require refueling operations. The fuel tank of the Prime Power Unit would be filled from a fuel truck as necessary. Impermeable ground-covering material and spill containment berms would be emplaced for containment of fuel during coupling/uncoupling of the fuel tanker to the Prime Power Unit. Spill control procedures would be established in cooperation with the host installation, and spill control kits would be present at the site in the unlikely event of a fuel leak or spill.

The Cooling Equipment Unit is a closed system, and no emissions of the ethylene glycol solution are planned. However, because of a potential for leaks or spills to occur during system hook-up, or the possibility of ruptured hoses or accidental disconnections, impermeable ground cover would be in place as was described for the Prime Power Unit.



**Notional THAAD
Radar Site Layout**

Not to Scale

Figure 1-6

1.4.3 BATTLE MANAGEMENT COMMAND AND CONTROL

The BMC2 component is connected both internally and externally to allow the exchange of data and commands among the various components of the THAAD element. It uses a netted, distributed, and replicated flow of information to ensure uninterrupted execution of engagement operations. Key engagement operations include surveillance, threat evaluation, weapon assignment, engagement control, target engagement, and kill assessment. The BMC2 would be in shelters mounted on XM-1113 HMMWVs. These BMC2 shelters are lightweight yet rugged enclosures designed to offer protection under extreme environmental conditions. The BMC2 would be collocated with the radar for testing. A Data Analysis Team 186-square meter (2,000-square foot) facility (two trailers) supporting approximately 45 people would be required.

1.5 TARGET MISSILE ALTERNATIVES CONSIDERED

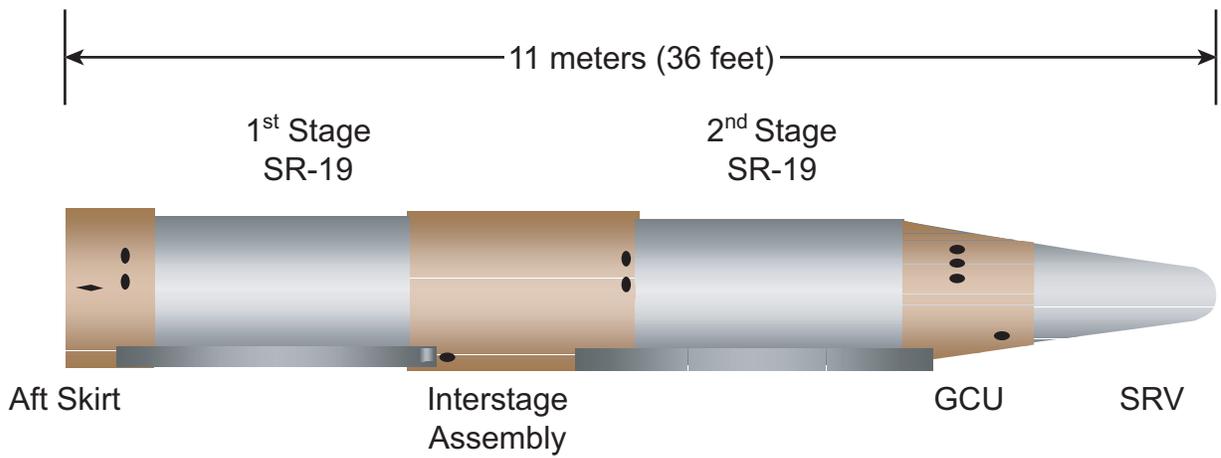
THAAD flights could use a variety of solid or liquid propellant target missiles to satisfy testing requirements. Some target missiles represent fully integrated systems, while others can be assembled using surplus rocket boosters to create particular test conditions or to emulate specific missile threats. Both solid and liquid propellant target missiles can be launched by a variety of means. The target missiles being proposed for use as part of the THAAD test flights are missiles currently used in the proposed locations or missiles, which would have applicable environmental documentation prepared prior to their use. Specific launch techniques and locations are discussed in chapter 2.0.

1.5.1 SOLID PROPELLANT TARGET MISSILES

Solid propellant target missiles would be stacked with one or two solid rocket boosters. The selection of target missile boosters for each test flight would be based on the distance and trajectory needs of each flight.

Booster motors that potentially could be used on target missiles include the SR-19, GEM-40, Castor IV, Orbus-1, Polaris A3 and A3R, and the M-57A1. These motors vary in size, boost capability, and in the amount of emissions created during launch. The most energetic motor stack that would potentially be used would be a combination of two SR-19 boosters, with guidance sections and payloads (figure 1-7).

The target missile would consist of a single reentry vehicle, a guidance and control unit, one or two solid fuel boosters, and an aft skirt assembly. In its largest configuration with two SR-19s, the target missile is approximately 11 meters (36 feet) long with a maximum diameter of approximately 154 centimeters (61 inches), and weighs approximately 15,876 kilograms (35,000 pounds).



EXPLANATION

SRV = Single Reentry Vehicle
 GCU = Guidance and Control Unit

Double SR-19 Solid Propellant Target Missile

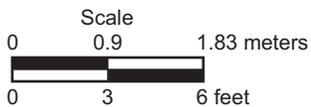


Figure 1-7

The guidance and control unit includes a telemetry system, with associated batteries, power supply, encoders, and transmitters. There is also an attitude control system containing pressurized nitrogen gas stored in lightweight bottles. The single reentry vehicle currently weighs approximately 400 kilograms (882 pounds) and contains a separate telemetry system with associated batteries, power supply, encoders, and transmitters.

Solid rocket boosters are equipped with a flight termination system to terminate thrust if unsafe conditions develop during powered flight. The flight termination system is initiated by receipt of a radio command from the Missile Flight Safety Officer. The flight termination system also contains the logic to detect a premature separation of the booster stages and initiate thrust termination action. Thrust is terminated by initiation of a linear shaped charge, which splits the motor casing, venting any gases into the atmosphere. For an air launched target, the missile is designed to be safe while in the aircraft and in the vicinity of the aircraft. When the aircraft is clear and system checks are complete, the Missile Flight Safety Officer sends an enable signal that arms the flight termination system on the missile while it is descending via parachutes. Should some malfunction occur following its release from the aircraft, and descent by parachute, the Missile Flight Safety Officer would not send the command and the missile would descend on the parachutes to the ocean, resulting in a whole body impact.

Small solid propellant “kick motors” (M26) might be used in combination with the boosters previously described. The kick motors, which also power the artillery rockets used for the Army’s Multiple Launch Rocket System, would be attached to the sides of first stage boosters to provide extra thrust during launch.

Table 1-2 lists the characteristics of various solid propellant target boosters. Table 1-3 lists the emissions for the various potential solid propellant boosters, including the kick motors.

Table 1-2: Solid Propellant Target Booster Characteristics

Name	Length in meters (feet)	Diameter in meters (feet)	Launch Weight in kilograms (pounds)
SR19-AJ-1	4 (13)	1 (4)	7,024 (15,485)
GEM-40	15 (49)	1 (3)	12,966 (28,590)
Castor IV	9 (30)	1 (3)	10,488 (23,122)
Orbus-1	1.3 (4.3)	0.7 (2.3)	471 (1,038)
Polaris A3	4.6 (15)	1.4 (4.6)	10,846 (23,911)
M57A-1	2 (7)	1 (3)	1,927 (4,248)
M26	4 (13)	0.2 (0.7)	307 (677)

Source: U.S. Army Space and Strategic Defense Command, 1995a.

Table 1-3: Combustion Products for Representative Target Rocket Motors

Species	M57A-1 kilograms (pounds)	SR19-AJ-1 kilograms (pounds)	Castor IV/GEM 40* kilograms (pounds)	Orbus-1	Polaris A3	M26 kilograms (pounds)
Aluminum oxide (Al ₂ O ₃)	533 (1,174)	1,763 (3,886)	2,450 (5,402)	156 (344)	3,555 (7,837)	--
Hydrogen chloride (HCl)	331 (731)	1,399 (3,084)	2,009 (4,430)	74 (163)	1,575 (3,472)	--
Carbon monoxide (CO)	420 (927)	1,324 (2,919)	2,600 (5,733)	93 (205)	2,354 (5,190)	50 (110)
Water (H ₂ O)	148 (325)	775 (1,708)	786 (1,732)	23 (51)	5,998 (3,223)	19 (41)
Nitrogen (N ₂)	135 (297)	544 (1,200)	807 (1,779)	48 (106)	874 (1,927)	15 (33)
Carbon dioxide (CO ₂)	48 (106)	287 (633)	381 (840)	9 (20)	192 (424)	26 (57)
Hydrogen (H ₂)	39 (87)	117 (257)	226 (498)	10 (22)	220 (485)	1 (3)
Other	3.5 (7.7)	74 (164)	3 (6)	<1 (2)	19 (42)	--
Total	1,658 (3,655)	6,283 (13,851)	9,262 (20,420)	414 (913)	14,787 (32,600)	111 (244)

*Castor IV and GEM 40 have the same emissions. The GEM 40 has a graphite fiber/epoxy case.

Source: U.S. Space and Missile Defense Command, 2001a; U.S. Army Space and Strategic Defense Command, 1994; Chemical Propulsion Information Agency, 1994.

1.5.2 LIQUID PROPELLANT TARGET MISSILES

Liquid propellant target (LPT) missiles use a kerosene-based fuel mixed with an oxidizer to provide thrust. The LPTs are represented by Scud systems already in use and a new system represented by the Liquid Fuel Booster Target System. The Scud system uses inhibited red fuming nitric acid (IRFNA) as the oxidizer, whereas the Liquid Fuel Booster Target System in development would use hydrogen peroxide. Table 1-4 lists characteristics of the launcher, although LPTs can also be launched from fixed rails and sea-based platforms. Table 1-5 provides the emissions for the systems. The LPTs and Liquid Fuel Booster Target Systems are similar in size and weight.

Table 1-4: Liquid Propellant Target Launcher Characteristics

Characteristic	Parameter
Wheels	8
Fuel	Diesel
Length	13 meters (43 feet)
Width	3 meters (10 feet)
Height	3 meters (10 feet)
Height with missile erected	13 meters (43 feet)
Weight without missile	27,800 kilograms (61,287 pounds)

Source: U.S. Army Space and Strategic Defense Command, 1995a.

Table 1-5: Liquid Propellant Target Emission Constituents

Constituent	Amount of Emission in kilograms (pounds)	
	Scud	Liquid Fuel Booster Target System
CO (carbon monoxide)	982 (2,165)	230 (508)
CO ₂ (carbon dioxide)	922 (2,033)	1,755 (3869)
H ₂ (hydrogen)	38 (84)	30 (65)
H ₂ O (water)	961 (2,119)	2,388 (5264)
N ₂ (nitrogen)	674 (1,486)	--
Other	9 (20)	--

Source: U.S. Army Space and Strategic Defense Command, 1995b; 2002.

As with solid propellant target missiles, LPTs would also be equipped with a flight termination system to terminate flight if unsafe conditions developed. The flight termination system used is a fuel shut-off, which cuts off the fuel or oxidizer flow and interrupts the burning of fuel when a missile hits the no fly zone. This causes the missile to fall to earth essentially intact, since forward thrust is immediately terminated.

1.5.3 PAYLOADS FOR TARGET MISSILES

Target missiles could house optical sensors, guidance and control electronics, radio transmitters and receivers, a power supply (possibly including lithium, nickel-cadmium, or other types of batteries), or a payload section for simulated biological or chemical munitions or decoys.

THAAD element test activities associated with the MDA lethality program may include development and testing of nuclear, biological, or chemical (NBC) material simulants within a laboratory or other indoor and outdoor test facilities. These activities are analyzed in the *Programmatic Environmental Assessment, Theater Missile Defense Lethality Program* (U.S. Army Space and Strategic Defense Command, 1993c). Testing could involve the use of simulated environmental conditions and simulated NBC agents to determine how each material would react to stresses expected from a typical engagement. The simulant would serve as a substitute for live chemical, biological, and bulk payloads, and would mimic the significant qualities of the NBC agent for test purposes. No live NBC agents would be used during flight test activities. The purpose of using simulants in target missiles would be to assess the effectiveness of THAAD interceptors against threat missiles carrying chemical and biological agents as payloads. Proposed simulants could include water, tri-butyl phosphate, diatomaceous earth, and other materials. Diatomaceous earth is a light colored, porous, and friable sedimentary rock that is composed of the siliceous shells of diatoms (unicellular aquatic plants of microscopic size). It is often used as a filter and has been adapted to almost all industrial filtration applications. The use of simulants is considered the best available and most practicable approach to obtain required data for testing Ballistic Missile Defense effectiveness.

Proposed activities associated with the MDA test program could include packaging of simulants within sub-munitions, transportation of simulants and sub-munitions, laboratory and outdoor testing, and disposal of any wastes produced as a result of test activities. Handling procedures for the simulants would follow material safety data sheet recommendations or other appropriate task-specific guidance. Although potential human health effects may result from exposure to any chemical (or simulant), these simulants are safe to use under existing, established laboratory, range, and installation operating procedures. Any hazardous materials used in testing would be handled and disposed of in accordance with existing compliant procedures.

Decoys such as chaff and small spheres, which are normally fabricated from non-hazardous materials such as graphite, stainless steel, and tungsten, could also be used. The decoys would not be recovered.

1.6 DECISIONS TO BE MADE

The decisions to be made by the MDA and supported by information contained in this EA include the selection of a range to test the THAAD missile and the specific range sites and targets that would be used in THAAD testing.

- Construction and testing at PMRF (Proposed Action)
 - Whether to prepare THAAD launch sites and supporting facilities at PMRF
 - Selection of the site locations for THAAD radar and support equipment to support the potential launch scenarios
 - The selection of a target missile launch means and locations
- Construction and testing at RTS (Alternative 1)
 - Whether to prepare THAAD launch sites and supporting facilities at RTS
 - Selection of the site locations for THAAD radar and support equipment to support the potential launch scenarios
 - The selection of a target missile launch means and locations
- Construction and testing at both PMRF and RTS (Alternative 2)
 - Whether to prepare THAAD launch sites and supporting facilities at both PMRF and RTS
 - Selection of the site locations for THAAD radar and support equipment to support the potential launch scenarios
 - The selection of a target missile launch means and locations
- No-Action Alternative
 - Under the No-Action Alternative, the THAAD missile would continue to be tested at White Sands Missile Range and would not be tested at more realistic distances

1.7 RELATED ENVIRONMENTAL DOCUMENTATION

THAAD activities and the target missiles in this document have been described and analyzed in several previous environmental analyses. This environmental analysis will summarize and incorporate by reference analyses in these documents, where appropriate. Affected environment information and conditions of the earlier analyses have been updated where applicable. Some analyses that provide information for more than one of the areas below may have multiple listings.

Theater High Altitude Area Defense

U.S. Army Space and Strategic Defense Command, 1993. *Ground-Based Radar Family of Radars Environmental Assessment.*

U.S. Army Space and Strategic Defense Command, 1994. *Environmental Assessment for Theater Missile Defense Ground Based Radar Testing Program at Fort Devens, Massachusetts.*

U.S. Army Space and Strategic Defense Command, 1994. *Theater High Altitude Area Defense (THAAD) Initial Development Program Environmental Assessment.*

U.S. Army Space and Strategic Defense Command, 1995. *Theater Missile Defense Flight Test Environmental Assessment.*

Activities at Pacific Missile Range Facility

U.S. Army Strategic Defense Command, 1992. *Environmental Impact Statement for the Strategic Target System.*

U.S. Army Space and Strategic Defense Command, 1993. *Environmental Impact Statement for the Restrictive Easement, Kauai, Hawaii.*

U.S. Navy, 1998. *Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement.*

Activities at Reagan Test Site

U.S. Army Strategic Defense Command, 1989. *Environmental Impact Statement, Proposed Actions at U.S. Army Kwajalein Atoll.*

U.S. Army Space and Strategic Defense Command, 1993. *Supplemental Environmental Impact Statement, Proposed Actions at U.S. Army Kwajalein Atoll.*

U.S. Army Space and Strategic Defense Command, 1995. *U.S. Army Kwajalein Atoll Temporary Extended Test Range Environmental Assessment.*

Target Missile Launches from Wake Island

U.S. Army Space and Strategic Defense Command, 1992. *Theater Missile Defense Countermeasures Mitigation Program Environmental Assessment.*

U.S. Army Space and Strategic Defense Command, 1994. *Wake Island Environmental Assessment.*

U.S. Army Space and Missile Defense Command, 1999. *Wake Island Launch Center Supplemental EA.*

Use of Land Based Liquid Propellant Target Missiles

U.S. Army Space and Strategic Defense Command, 1995. *U.S. Army Kwajalein Atoll Temporary Extended Test Range Environmental Assessment.*

Use of Sea Launched and Air Launched Target Missiles

U.S. Army Space and Strategic Defense Command, 1994. *Theater Missile Defense Extended Test Range Environmental Impact Statement.*

Ballistic Missile Defense Organization, 1998. *Air Drop Target System Program Programmatic Environmental Assessment.*

U.S. Navy, 1998. *Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement.*

U.S. Department of the Air Force, 1998. *Theater Missile Defense Extended Test Range Supplemental Environmental Impact Statement—Eglin Gulf Test Range.*

U.S. Department of the Air Force, 2002. *Development and Demonstration of the Long Range Air Launch Target System Environmental Assessment.*

2.0

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

2.0 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

The MDA proposes to establish THAAD flight test launch capabilities at PMRF. An alternative would be to establish these capabilities at RTS. A second alternative would be to establish the capabilities at both PMRF and RTS. Up to 50 THAAD interceptor missiles and up to 50 target missiles could be launched over a 4-year period. The Proposed Action and alternative would require the construction of test support facilities and the site preparation for THAAD launcher, radar, and support equipment. Some clearing and road construction would be associated with the THAAD test facilities.

The initial THAAD flight test is currently scheduled for the third quarter of fiscal year 2005. Tests would continue until at least fiscal year 2010. The Proposed Action and alternatives would involve the potential use of ground, sea, and air launched target missiles. Land-based target missile launches would occur from either Bigen (Aur Atoll) or Toton (Wotje Atoll) in the RMI, or from Wake. Minimal site preparation activities would be required to establish a temporary launch site on these islands.

The THAAD flight test program would determine the capabilities of THAAD to (1) work together as an element, (2) intercept endoatmospheric and exoatmospheric targets threatening its defended area, (3) integrate into the larger Ballistic Missile Defense architecture, and (4) anchor simulations.

The THAAD test program is divided into developmental cycles called "Blocks." The flight test program would be conducted in two biennial blocks, Block 04 and Block 06. The Block 04 flight test program would consist of four flight tests (F/Ts): an interceptor controls flight test, a seeker characterization test, and two intercept flight tests. The interceptor controls flight test would be conducted to confirm proper flight control operations in the exoatmospheric intercept regime. The seeker characterization flight test would ensure proper functioning of the interceptor's seeker in a live intercept environment. The remaining two flight tests would focus on demonstrating and characterizing exoatmospheric performance capability, ultimately with soldier operation of the element.

The Block 06 flight test program would be conducted to demonstrate endoatmospheric and exoatmospheric engagement capability. Block 06 would consist of 2 radar data collection missions and 12 flight tests: an interceptor controls flight test, a seeker characterization flight test and 10 intercept flight tests. The two radar data collection missions would be non-interceptor (target only) flights using separating target missiles to gather data to support the development of radar software required later in the Block 06 flight test program. The interceptor controls flight test would be conducted to confirm proper flight control operations in the endoatmospheric intercept regime. The seeker characterization flight test would characterize the seeker in the endoatmospheric intercept environment. The F/T 9 would consist of two THAAD interceptors launched against a single target. The

F/T 13 would be conducted as a multiple simultaneous engagement mission (two interceptors against two targets, conducted simultaneously). All other Block 06 flight tests would be single intercept missions (single interceptor, single target). The F/Ts 15 and 16 would demonstrate expanded capability for THAAD to acquire and intercept threat-representative targets at higher velocities and longer ranges. Block 06 flight testing would resolve critical technical issues and critical operational suitability and effectiveness issues associated with the THAAD element design using the production representative missile configuration, BMC2 and radar software upgrades.

Section 1.4 provides a description of the THAAD element. Section 2.1 describes the Proposed Action of THAAD activities at PMRF and associated target missile launches. Section 2.2 is an alternative to the Proposed Action and describes THAAD activities at RTS and associated target missile launches. Section 2.3 discusses another alternative to the Proposed Action, activities at both PMRF and RTS. The No-action Alternative is presented in section 2.4. Section 2.5 describes alternatives that were considered but not carried forward for analysis. Section 2.6 provides a description of activities that would be occurring concurrently with the proposed THAAD test flights.

2.1 PROPOSED ACTION—THEATER HIGH ALTITUDE AREA DEFENSE TEST FLIGHTS AT PACIFIC MISSILE RANGE FACILITY

PMRF is an instrumented, multi-environment military test range capable of supporting subsurface, surface, air, and space operations. PMRF consists of 3,425 square kilometers (1,322 square miles) of instrumented underwater ranges and 144,000 square kilometers (55,599 square miles) of controlled airspace. PMRF is located in Hawaii on the western shore of the island of Kauai, and includes broad ocean areas to the north, south, and west.

2.1.1 TRANSPORTATION TO PACIFIC MISSILE RANGE FACILITY

All components of the THAAD element and required support equipment would be transported from U.S. Government installations or contractor facilities to a designated air base or port for transport to PMRF by aircraft or ship. Materials arriving via ship or barge would be received at the Port of Nawiliwili on the island of Kauai and then trucked over roads to PMRF. If equipment is flown in, it would be transported from U.S. Government or contractor installations to a designated U.S. Air Force Base for transportation to the airfield at PMRF by U.S. Air Force Air Mobility Command C-5, C-17, C-130, or C-141 cargo aircraft. Once missiles arrive at the PMRF airfield, they would be handled per the range's operation procedures.

If a military sea-borne platform (see section 2.1.6) is used for target missile launches, it would be anchored at a safe explosive distance off the island of Oahu or Kauai when not in operation. The platform would be initially serviced in the San Francisco Bay area and moved to Pearl Harbor, Hawaii for loading.

All transportation within the Continental United States and Hawaii would be performed in accordance with U.S. Department of Transportation (DOT)-approved procedures and routing as well as Occupational Safety and Health Administration requirements, U.S. Army safety regulations, and U.S. Air Force regulations. Appropriate safety measures would be followed during transportation of the propellants as required by the DOT and as described in 49 CFR 171-180, *Hazardous Materials Regulations of the Department of Transportation*. For ship or barge transportation, U.S. Coast Guard and/or applicable U.S. Army transportation safety regulations would also be followed. For aircraft transportation, Federal Aviation Administration (FAA) and Air Force Joint Manual 24-204, *Preparing Hazardous Materials for Military Shipment*, would be followed.

Safety concerns involved with transporting the THAAD missiles involve the transportation of hazardous materials, which includes Class 1.3 hydroxyl-terminated polybutadiene solid propellant explosives and a small amount of hypergolic chemical located in the Divert and Attitude Control System. The MRP would serve as a limited duration containment barrier for the hypergolic chemicals. The MRP would be equipped with passive and active sensors to detect any leak that may occur. Should a leak occur during transport, the aircraft would land at designated airfields where trained personnel would be standing by to deal with the leaking missile. Once the MRP arrives at PMRF it would be stored in an ammunition bunker until needed for flight testing.

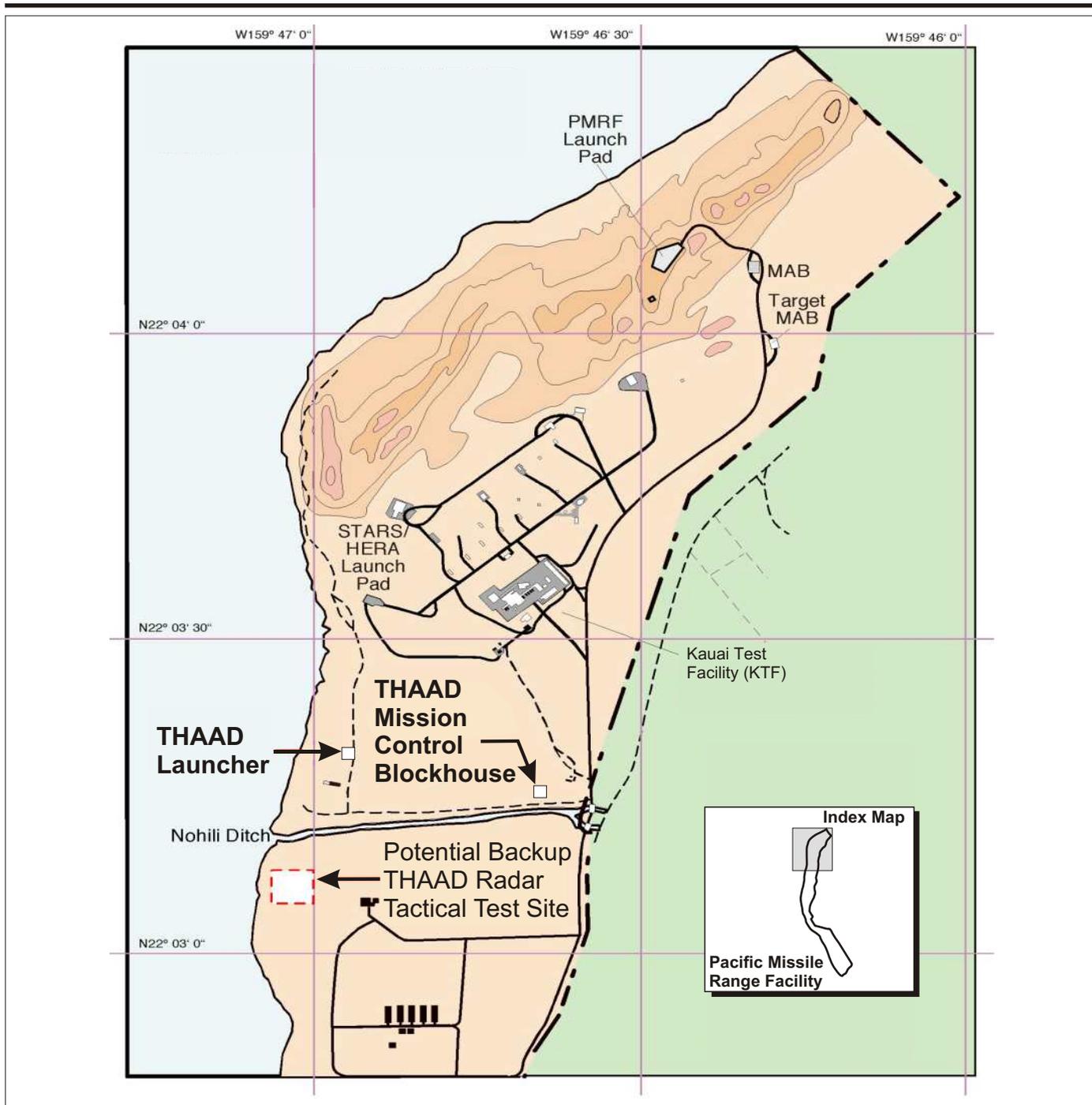
2.1.2 PREFLIGHT ACTIVITIES AT PACIFIC MISSILE RANGE FACILITY

2.1.2.1 Interceptor

Final integration and preflight testing of the THAAD element components would occur at the THAAD launch site located in North PMRF (figures 2-1 and 2-2). An environmental shelter would be used to protect the launcher and personnel during testing. The THAAD hardware and equipment that would be located on site include the THAAD launcher (modified M-1120 HEMTT-LHS Palletized Load System, generators, fuel tank, lightning protection, and security surveillance) and associated fiber-optic and other cabling.

THAAD ground vehicles would use existing vehicle maintenance and fueling facilities at PMRF. Ground vehicle maintenance and refueling are normal on-going activities on the installation. Any hazardous wastes generated during vehicle maintenance would be handled by PMRF through an inter-service support agreement. The MRP would be moved from its storage bunker and mounted on the THAAD launcher during this time. Movement of the MRP with live THAAD missiles would occur in compliance with PMRF policy and procedures.

Fiber-optic cables would be trenched to the depth of 0.3 to 0.46 meter (12 to 18 inches) to protect them from vehicle and foot traffic in the launch area. Fencing would also be erected around the launch area. To protect cultural and archaeological resources, any ground disturbing activity would be done in accordance with Stipulations 1.A and 1.C of the Memorandum of Agreement between PMRF and the State Historic Preservation Officer, which among other things, could include observation of ground disturbance activities by a qualified cultural archaeologist. Monitoring (Stipulation 1.B) would only be necessary if avoidance was not possible.



EXPLANATION

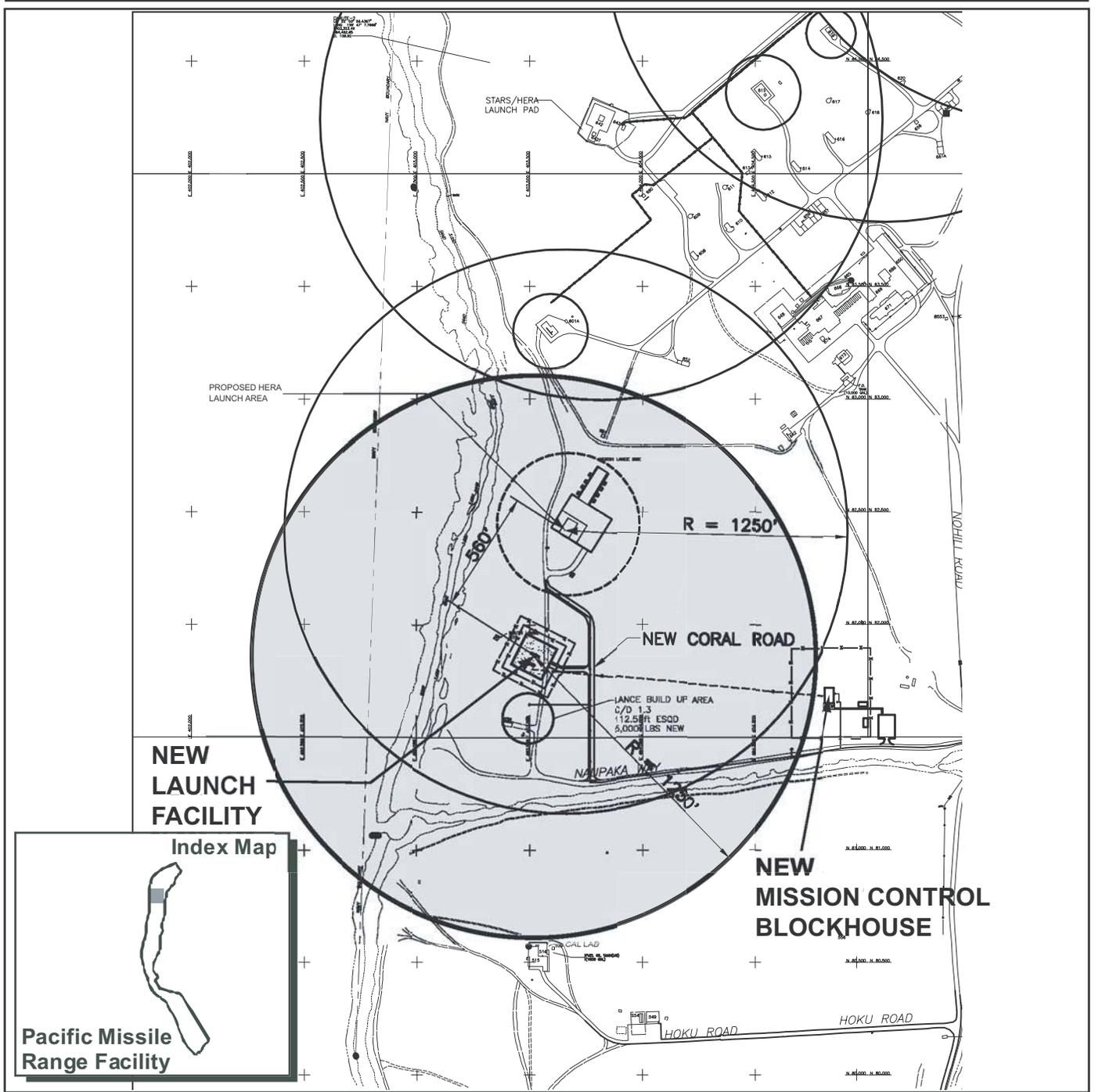
THAAD = Theater High Altitude Area Defense
 PMRF = Pacific Missile Range Facility
 MAB = Missile Assembly Building
 STARS = Strategic Target System

THAAD Facility Locations in PMRF North

Kauai, Hawaii

Figure 2-1

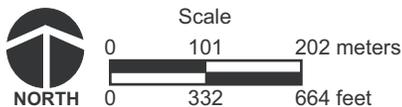




EXPLANATION

- 381-meter (1,250-foot) Explosive Safety Quantity-Distance for THAAD Launch Facility
- Explosive Safety Quantity-Distance Arcs for Other Facilities

THAAD Launch Facility and Mission Control Blockhouse



Pacific Missile Range Facility

Figure 2-2

A 30.5- to 38-meter (100- to 125-foot) high re-radiation tower would be required at the THAAD launch site to verify the X-band communication link (transmit and receive) between THAAD radar and the THAAD interceptor missile launch site. The metal tower would be three-legged and would be constructed on site. The base of the tower would be large enough so that the tower could be erected without guy lines that would inhibit movement in the launch area.

2.1.2.2 Radar

The radar component would be located in South PMRF (figures 2-3 and 2-4). The radar component involved in these flight tests is an upgraded THAAD Prototype Radar, which would require only final checkout and calibration. Checkout and calibration activities would include observation of targets of opportunity that may occur on the range and observation of existing satellites. As described above, a 30.5- to 38-meter (100- to 125-foot) high re-radiation tower would be required at the radar site to verify the X-band communication link (transmit and receive) between the THAAD radar and the THAAD launch site.

2.1.3 CONSTRUCTION OF SUPPORT FACILITIES FOR THE THEATER HIGH ALTITUDE AREA DEFENSE

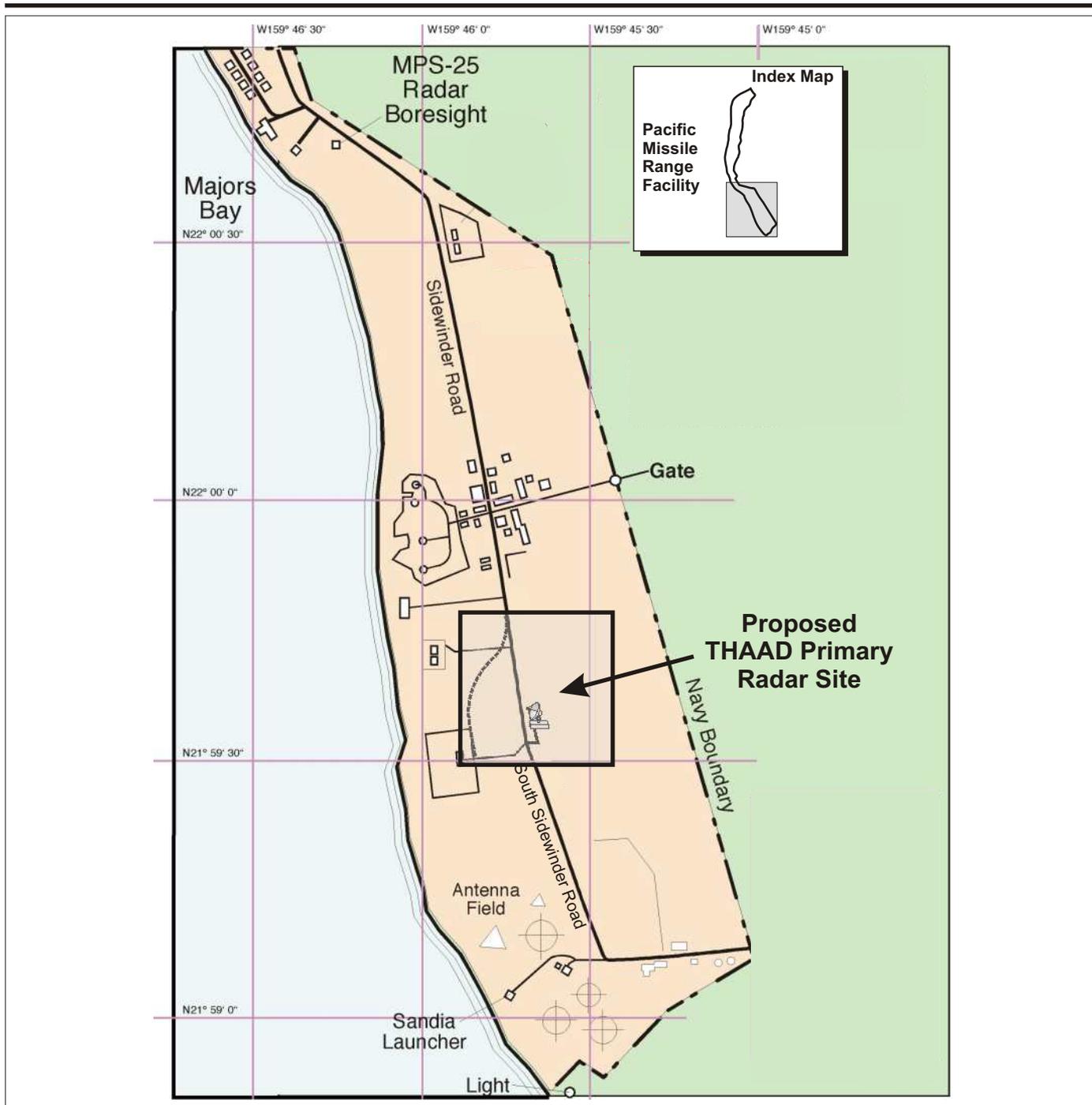
Existing PMRF facilities would provide much of the support required for THAAD activities; however, some new construction would be required. Sections 2.1.3.1 and 2.1.3.2 describe these new facilities. Existing missile storage facilities would be used to store interceptor missiles and test support equipment until they are transported to the launch site. All design and construction activities would be coordinated with PMRF and would comply with existing installation policies.

2.1.3.1 Contractor Logistics Support Building

Space is required to provide maintenance, repair, and storage for the THAAD element. This includes:

- A maintenance area/electronics shop
- An environmentally-controlled storage area
- An environmentally-controlled secure work and storage area
- A repair area
- Office space for 12 logistics personnel

The proposed Contractor Logistics Support (CLS) building would be located 24 meters (80 feet) away from all roadway and parking areas. It would be a reinforced concrete structure with reinforced concrete exterior bearing walls and a combination of pre-stressed tees and planks with concrete topping and cast in place concrete slabs for the roof system. A concrete floor slab in the CLS maintenance bay would be designed to support THAAD ground vehicles.



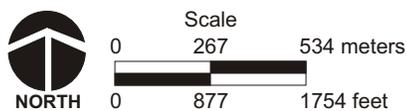
EXPLANATION

THAAD = Theater High Altitude Area Defense
 PMRF = Pacific Missile Range Facility

THAAD Facility Locations in PMRF South

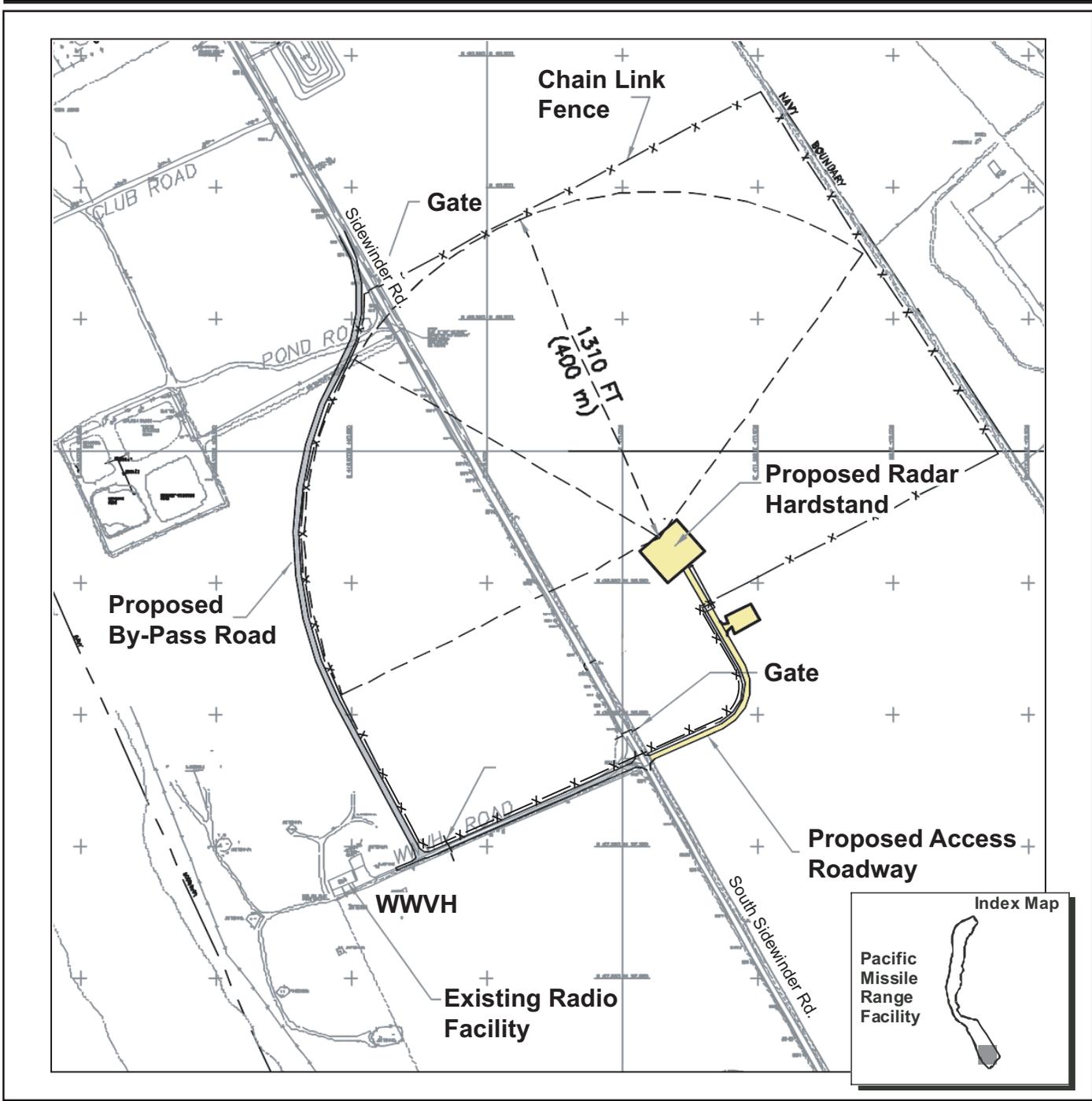
Kauai, Hawaii

Figure 2-3



10-30-02 Loc in PMRF S

THAAD Pacific Test Flights EA



EXPLANATION

THAAD = Theater High Altitude Area Defense
 —x— Proposed Chain Link Fence

THAAD Radar Site Location

Pacific Missile Range Facility, Kauai, Hawaii

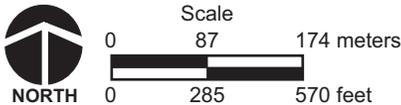


Figure 2-4

The new CLS building would be situated in the central portion of the PMRF maintenance area that lies between Nohili Road and Lii Road (figures 2-5 and 2-6). A new access road for the CLS building would also be provided to access the maintenance bay of the facility.

2.1.3.2 Central Support Facility

The Central Support Facility (CSF) would be a new building and would provide office and administrative space for the up to 60 permanently assigned personnel (figures 2-5 and 2-6). The CSF would include a conference room with video teleconferencing capability to accommodate 60 people. The proposed CSF building would be located 24 meters (80 feet) away from all roadway and parking areas.

The CSF building would be situated in the central portion of the PMRF administration area that lies between Nohili Road and Lii Road (figures 2-5 and 2-6). A new fire lane would be provided for emergency access to the facility. The personally owned vehicle parking lot on the east of Lii Road would provide parking for both the CLS and CSF buildings.

2.1.3.3 Mission Control Blockhouse

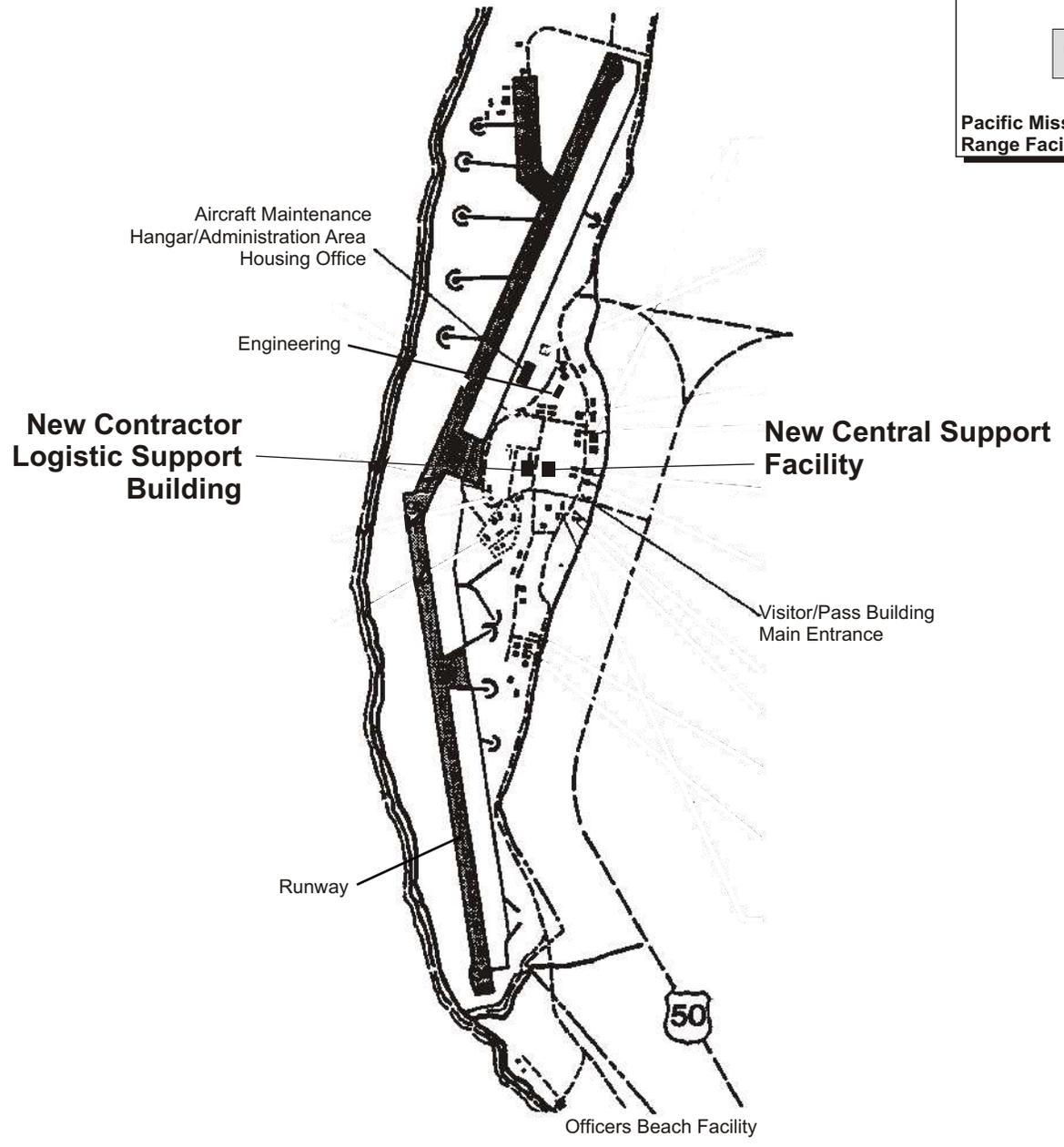
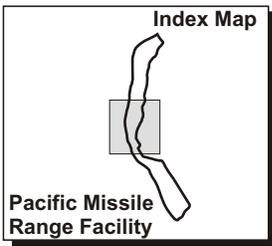
A Mission Control Blockhouse would be located more than 381 meters (1,250 feet) from the launcher hardstand outside the explosive safety quantity-distance. It is required to provide space for personnel, test equipment consoles, and support items necessary for missile checkout, launch, and control. This facility would house a mission control room for personnel and equipment, a telemetry ground station with various test support consoles and countdown displays, and a technical support area. The blockhouse would be raised 1.2 meters (4 feet) above current grade to comply with floodplain requirements. Figures 2-1 and 2-2 show the location of the blockhouse.

The Mission Control Blockhouse would be located east of the launcher hardstand in an undeveloped area that supports grass and kiawe trees. It would be located outside of the 411-meter (1,350-foot) explosive safety quantity-distance arc from other PMRF launch facilities and outside the 381-meter (1,250-foot) explosive safety quantity-distance arc from the new launcher hardstand to comply with range safety criteria.

2.1.4 THEATER HIGH ALTITUDE AREA DEFENSE SITE PREPARATION AND ESTABLISHMENT

2.1.4.1 Interceptor

The proposed site for the new THAAD launcher hardstand to be constructed at North PMRF would be in an undeveloped grassy area, south of the Sandia National Laboratories Kauai Test Facility (KTF) (figure 2-1). The new launcher hardstand would be located at the end of Naupaka Way and would lie north of Building 550 and west of the new Mission Control Blockhouse. The hardstand would be a 45.7- by 45.7-meter (150- by 150-foot) concrete pad encircled by a chain-link fence with some clearance away from the edge of



Source: Modified from U.S. Department of Defense, 1991, Sep, p.60.

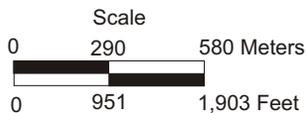
EXPLANATION

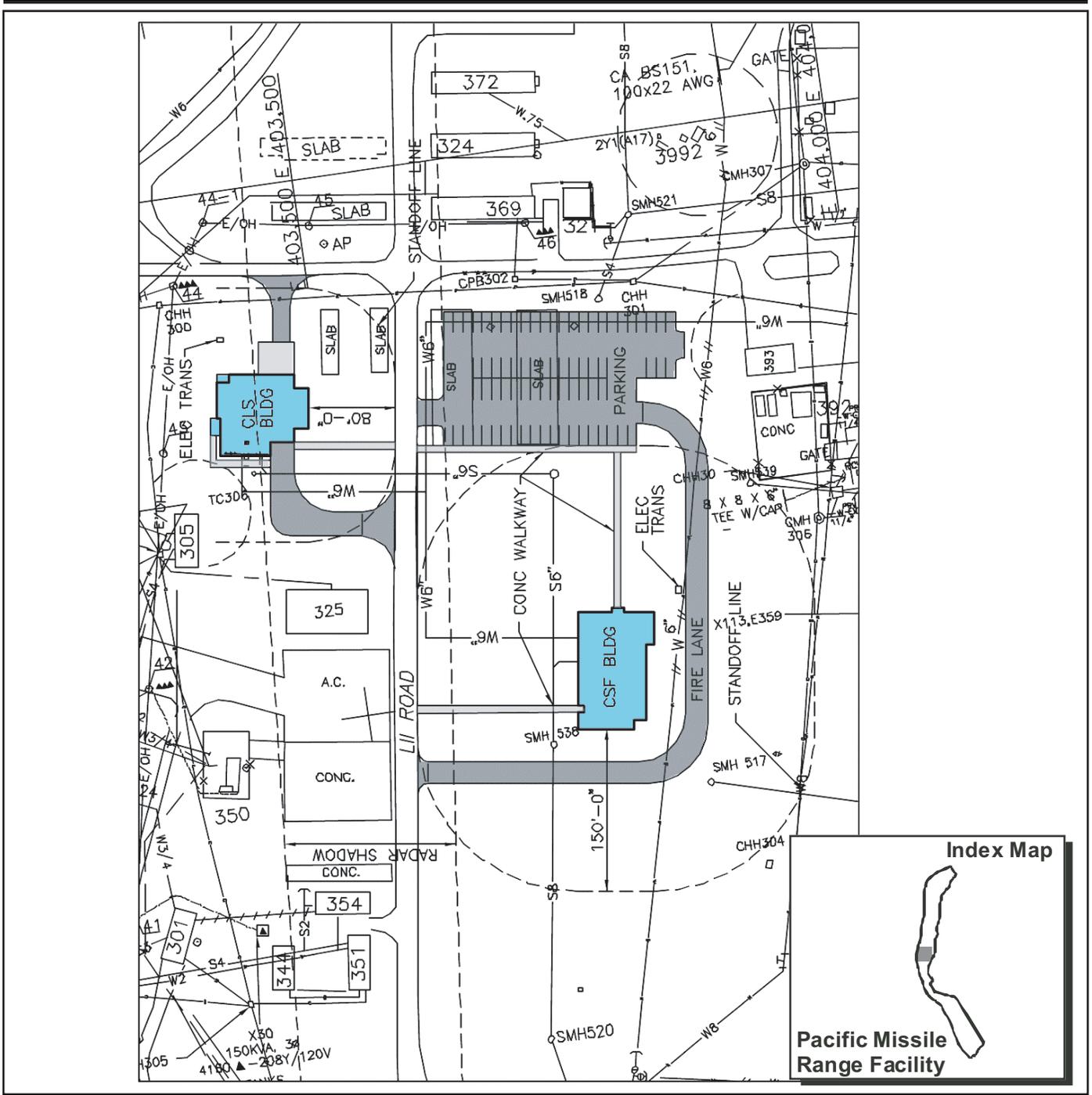
THAAD = Theater High Altitude Area Defense
 PMRF = Pacific Missile Range Facility

THAAD Facility Locations in PMRF Central

Kauai, Hawaii

Figure 2-5





EXPLANATION
 [Grey Box] New Construction

Contractor Logistics Support and Central Support Facility Buildings Site Plan

Pacific Missile Range Facility

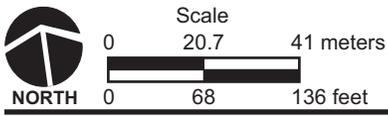


Figure 2-6

10-30-02 CLS and CSF Site

the concrete pad. A small, 37-square-meter (400-square-foot) environmentally controlled van serving as a launch equipment building would be installed on a trailer or truck near the launcher on the hardstand. The structure would provide weatherproof storage for small launch equipment items.

2.1.4.2 Radar and Battle Management, Command and Control

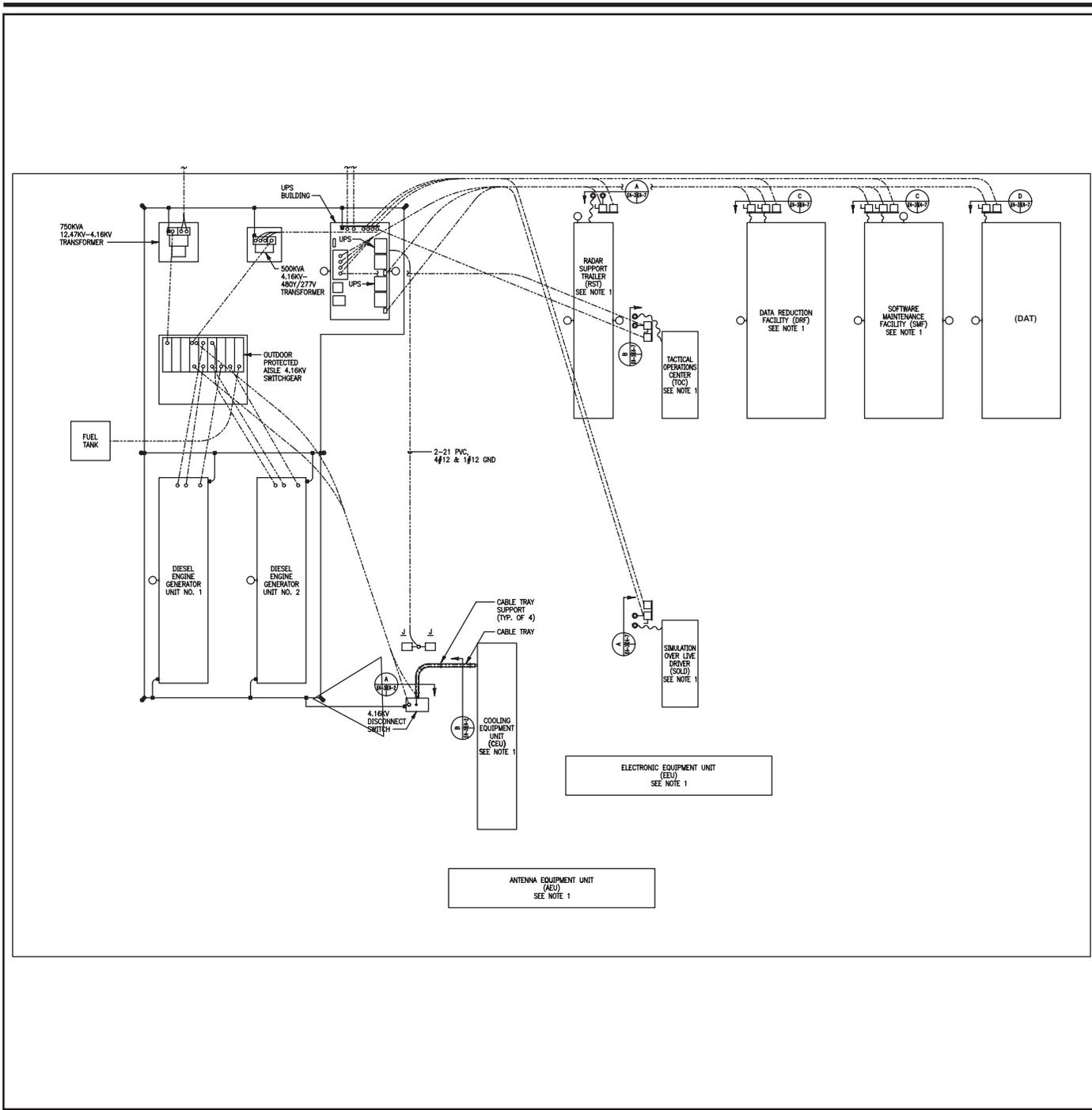
Two locations for the THAAD radar are being considered. The first THAAD radar site would be in South PMRF (figures 2-3, 2-4, and 2-7). A second THAAD radar site has been identified for possible use during later tactical testing. This second site would be located south of the Nohili Ditch to support testing under tactical operations (figure 2-1). During this later tactical testing, two radars would be at PMRF. The second radar would be a backup set and would be used only if the primary radar should malfunction. Its footprint would be similar to or smaller than that of the first radar.

The THAAD radar requires a 49- by 67-meter (160- by 220-foot) hardstand with two 2-megawatt (MW) dedicated generators during the testing for full-up operations until the Prime Power Unit is made available. The largest utility demand for the THAAD radar would be 3-phase, 4,160-volt, and 60-hertz electrical power, which would be provided by two 4,160-volt skid mounted generators and an 18,927-liter (5,000-gallon) diesel fuel aboveground storage tank with secondary containment. A security fence would be required around the THAAD radar. Also located at this site would be the BMC2. Missile launch procedures are controlled through these BMC2 shelters (Tactical Operations Station and Launch Control Station) that are mounted on the backs of XM-1113 HMMWVs. Collectively these vehicles are called the Tactical Operation Center.

The radar hardstand siting would comply with the 400-meter (1,312-foot) radiation hazard area required during radar operations. Personnel and vehicles would be restricted from entering into the radiation hazard area by a chain link fence. Additionally, all structures, roadways, and overhead power lines are below the 5-degree look angle of the radar. The existing road and overhead power lines that are located within the radiation hazard area would be relocated outside the area or installed underground.

Commercial power provided by local utilities would be used for housekeeping purposes in the administrative buildings, except during times when the THAAD radar would be in operation. During those times, the generators would provide all power.

A Data Reduction Facility and a Software Maintenance Facility, mounted in trailers, would be located on the southwest corner of the radar hardstand (figure 2-7). A trailer-mounted Simulation Over Live Driver would generate simulated targets to add to live targets during flight tests. The BMC2 Tactical Operation Center consisting of a Tactical Operations Station and Launch Control Station and a portable Radar Support Trailer would also be located on the hardstand. These facilities would use commercial power provided by local utilities except when the THAAD radar is in operation. Power would then be provided by the generators described in the previous paragraph.



EXPLANATION

- UPS = Uninterrupted Power Supply
- DAT = Data Analysis Team
- THAAD = Theater High Altitude Area Defense
- KV = Kilovolt
- KVA = Kilovolt Ampere
- V = Volt

**THAAD Radar
Hardstand Layout**

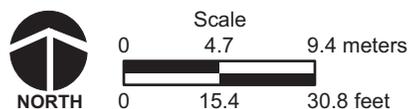


Figure 2-7

Vehicle access to the radar site and parking lot would be from the new bypass road constructed to route traffic on South Sidewinder Road around the personnel hazard zone generated by the radar. The bypass road would run around the perimeter of the restriction zone west of Sidewinder Road, using an existing east-west road, and reconnect to South Sidewinder Road south of the radar. The bypass road would have asphalt concrete surfacing. The existing east-west access road would also be widened and resurfaced with asphalt concrete.

2.1.5 FLIGHT TEST ACTIVITIES

2.1.5.1 Interceptor

The THAAD interceptor would be launched from PMRF as part of the Proposed Action. Table 1-3 lists emission constituents for each THAAD launch. Up to 60 permanent personnel would be at PMRF to perform prelaunch and launch operations, with up to 110 transient personnel during launch.

Interceptor missile launch activities would be controlled from the Mission Control Blockhouse. Shortly before launch, all personnel would be evacuated from the launch area to the Mission Control Blockhouse and from the exclusion area to the required safety distance. Exclusion areas are configured to provide the maximum protection for personnel and take into account the ability to control access to the hazard areas.

Prior to missile launch, PMRF Range Safety officials would issue Notices to Airmen (NOTAMs) and Notices to Mariners (NOTMARs) identifying areas to remain clear of and the times that avoidance of the area is advised. The Range Safety officials would then determine that the areas are clear of both surface vessels and aircraft. During standard range warning and checking procedures, personnel would check for visible large concentrations of marine mammals in the area of the target launch trajectory and landing location. Vessels, aircraft, or marine mammals in the exclusion area would not necessarily preclude a launch. However, launch safety personnel would always adhere to established range safety guidelines.

After the Range Safety Officer provides a safety clearance, the launch signal would be given from the launch control area. Standard protective procedures would be followed during test activities to provide hearing protection of workers. Missile impact zones would be confined to open areas at sea. Standard operating and safety procedures for missile launching and testing would be implemented to minimize the risk of any adverse health or safety impacts associated with the program.

2.1.5.2 Radar

Approximately 20 to 25 people would be at PMRF to perform pre-test operations and operate the radar during the flight tests. The required radiation hazard keep-out area for the THAAD radar is approximately 400 meters (1,312 feet) to the front and sides of the radar face. Before activating the radar, a visual survey of the area would be conducted to

verify that all personnel and wildlife are outside the hazard zone, and a warning beacon would be illuminated when the radar is operating.

2.1.5.3 Use of Non-Theater High Altitude Area Defense Radars and Sensors

The PMRF radar suite is composed of precision tracking, surveillance, and identification-friend-or-foe radars. They are located at PMRF/Main Base, Makaha Ridge, and Kokee on Kauai; at Kaena Point and Mount Kaala on Oahu; and on Niihau. Two PMRF range aircraft are equipped with airborne search radars. The tracking, surveillance, and identification-friend-or-foe radar resources combine to provide data collection on missile testing and safety coverage throughout the warning areas and approach corridors from Oahu.

Optical sensors (cameras) are located at various points throughout PMRF facilities, providing remote, unmanned surveillance. The video data from the remote optical site cameras aids detection and evaluation of exercises on the range. A mobile, trailer-mounted system, the Intermediate Focal Length Optical Tracking System, is used primarily to track and record missile launches from PMRF. The self contained Intermediate Focal Length Optical Tracking System unit can be located virtually anywhere a truck can go in the vicinity of PMRF to provide remote video relay.

Telemetry sensor equipment is used to receive data transmitted by missiles in flight. Makaha Ridge has two 3-meter (10-foot) parabolic dish telemetry antenna systems and three 10-meter (33-foot) parabolic dish tracking systems that receive telemetry signals from low-flying missiles at a range of 111 kilometers (60 nautical miles). An additional 3-meter (10-foot) dish is located at Kokee. This tracking antenna can receive telemetry signals from a low-flying missile at a range of 167 kilometers (90 nautical miles) or for tracking high altitude exoatmospheric reentry vehicles. Makaha Ridge houses receivers, recorders, telemetry processing equipment, and display equipment that displays and records the telemetry data.

At the time of the preparation of this EA, the specific radars and sensors for each test have not been defined. If any radars or sensors specifically deployed for the Proposed Action fall outside of the parameters described in existing NEPA analyses, they would receive supplemental NEPA analysis and documentation as necessary.

2.1.6 TARGET MISSILES LAUNCH ALTERNATIVES

Chapter 1.0 discusses specific target missiles and boosters. This section describes target missile launch techniques for THAAD flight tests from PMRF. No land-based target missiles would be associated with THAAD flight tests at PMRF.

Safety concerns related to transporting the target missiles involve the transportation of hazardous material, which include Class 1.3 solid propellant explosives and hypergolic chemicals contained in the LPT missiles. Once the target missile arrives at PMRF, it would be stored in an ammunition bunker until needed for flight testing. Figure 2-1 shows the location of the target missile assembly building (MAB) on PMRF.

2.1.6.1 Sea Launched Target Missiles

Sea launched target missiles could be launched from a variety of sea-borne platforms. These platforms could be military or commercial vessels that have been designed or adapted for launch operations. Safety procedures would be implemented at existing explosive ordnance facilities for target missile and fuel loading, or the sea-borne platforms would be ported at an explosive anchorage. Military sea-borne platforms would be the Mobile Aerial Target Support System (MATSS) or the Mobile Launch Platform (MLP) (figure 2-8).

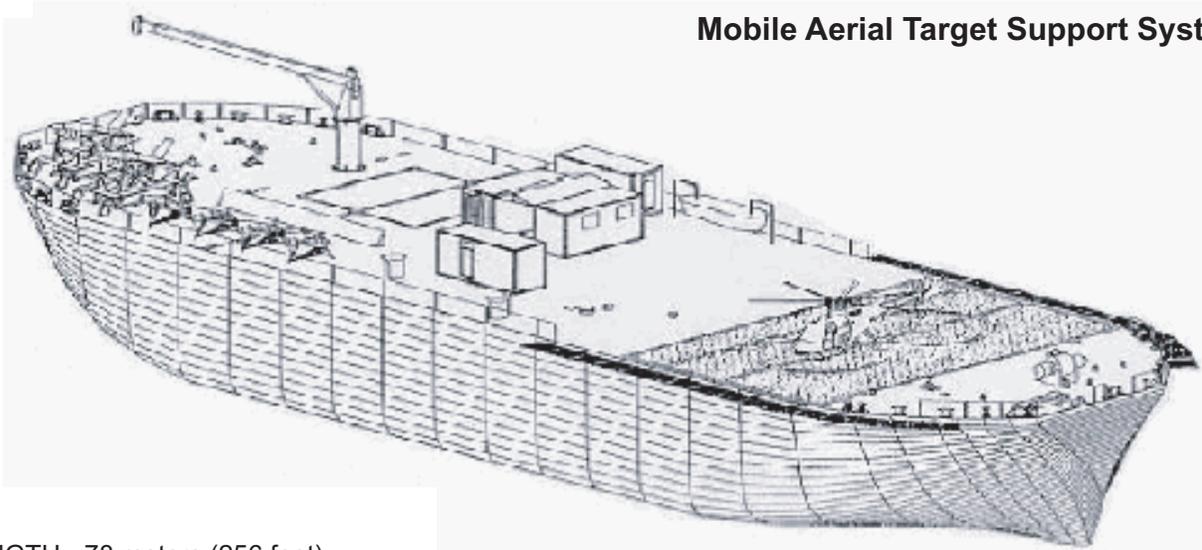
Sea launched target missiles could be solid or liquid propelled missiles or a combination of both. Solid fueled target missiles could possess single or multiple stages and a variety of payloads. Until THAAD target requirements are finalized, it is not clear exactly what target configuration would be required for sea launches.

The MATSS would not only act as the launch platform but would also hold recording, communications, and measuring equipment. It is non-powered and relies on a tow vessel for mobility. The MATSS is free-floating and not anchored to the ocean floor during launching. The MATSS has berthing facilities for 20 people, a full galley, and a control/operations room with a full suite of communications and launch support equipment. It can carry 18,927 liters (5,000 gallons) of JP-5 fuel and 10,600 liters (2,800 gallons) of diesel fuel. It has a draft of 1.5 meters (5 feet). It carries its own fresh water, and wastewater would be held in existing ship holding tanks. It would also provide a safe shelter for personnel engaged in the proposed mission.

The MLP is a decommissioned U.S. Navy LPH-10 (helicopter landing platform) and is retrofitted to allow for missile storage and launches. It is non-powered and relies on a tow vessel for mobility. The MLP would not only act as the launch platform but would also hold recording, communications, and measuring equipment. The MLP has quarters for 100 people, a full galley, and a control/operations room with a full suite of communications and launch support equipment. Although capable of holding more, the MLP would only contain about 113,600 liters (30,000 gallons) of JP-5 fuel for the on-board generators during a test campaign. It would also be stocked with about 1,041 liters (275 gallons) of lubricating oil, 15,140 liters (4,000 gallons) of hydraulic oil, and 379 liters (100 gallons) of antifreeze. These materials would be stored in appropriate authorized tanks onboard the ship. It carries its own fresh water, and wastewater would be held in existing ship holding tanks. The MLP and its tow vessel would not be anchored to the ocean floor during launching. The MLP would provide increased flexibility for establishing target azimuths and ranges of target missiles. Any launches on sea platforms would comply with existing treaties that are in effect.

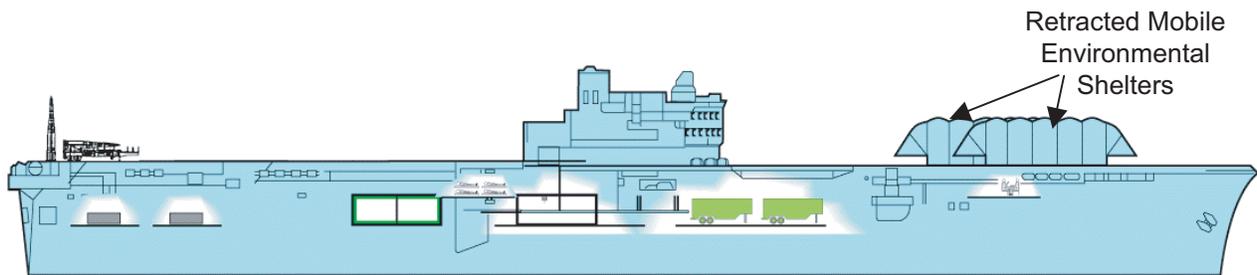
Solid propellant targets would most likely be launched from a stool or rail mounted on the flight deck of the MATSS or MLP. These target vehicles typically consist of a re-entry vehicle, a guidance and control module, an interstage assembly, an SR-19-AJ-1 motor, and an aft skirt assembly. To meet mission-specific requirements, other solid propellant boosters, which are described in chapter 1.0, may be used. The launch vehicle includes a

Mobile Aerial Target Support System



LENGTH - 78 meters (256 feet)
BEAM - 24.4 meters (80 feet)
DRAFT - 1.5 meters (5 feet)

Mobile Launch Platform



LENGTH - 183.6 meters (602 feet)
BEAM - 31.7 meters (104 feet)
DRAFT - 9.7 meters (32 feet)

MATSS and MLP



Not to Scale

Figure 2-8

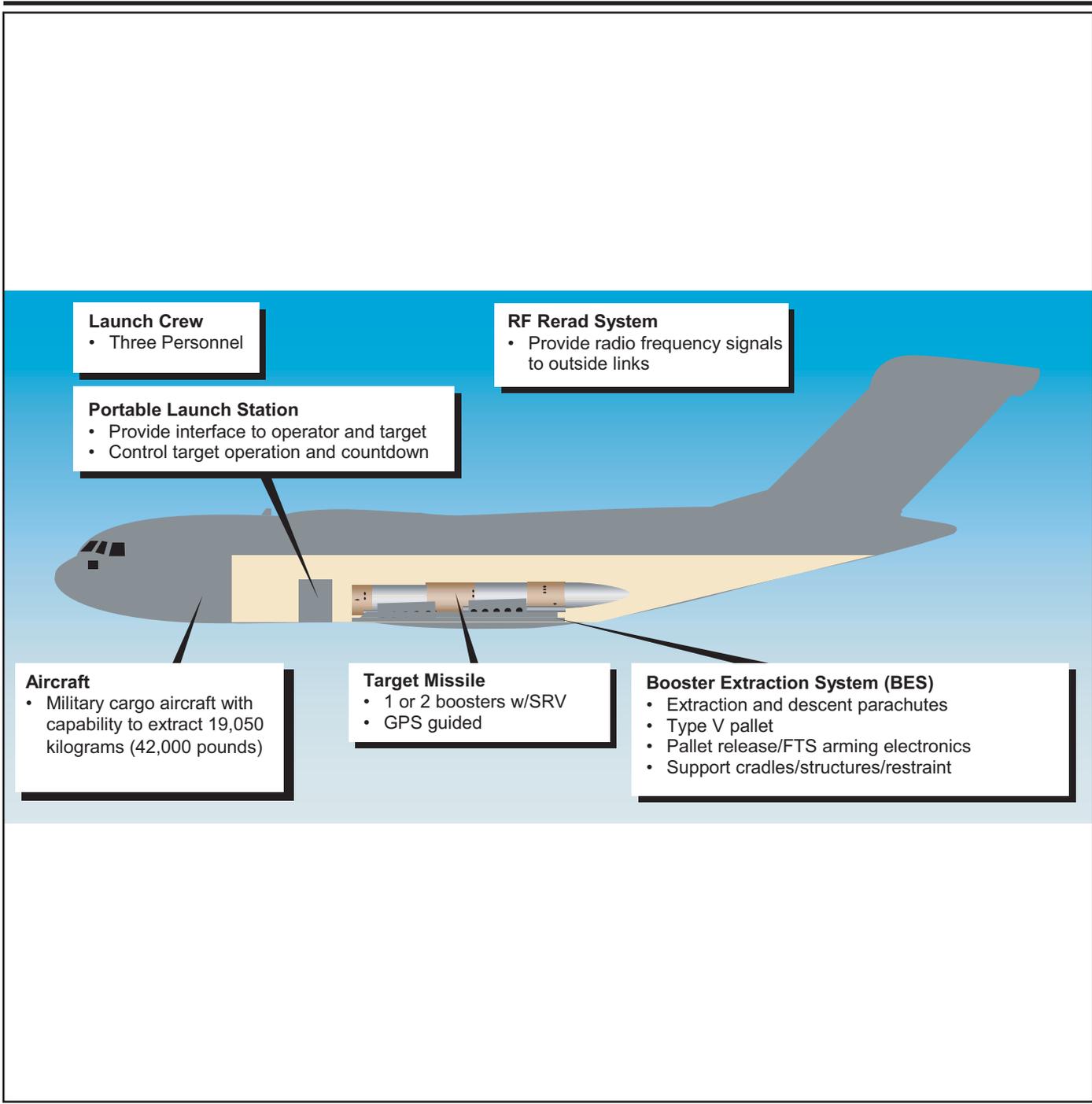
guidance and control system, an inertial navigation system, a global positioning system receiver, and a telemetry system. The vehicle contains ordnance in the form of solid-rocket motor propellant, a flight termination system and explosive bolts that separate the booster and the payload.

2.1.6.2 Air Launched Target Missiles

The air launched target is carried aloft and launched by a military cargo aircraft, such as the C-17 and C-130. The C-17 is a large U.S. Air Force logistical turbofan aircraft, whereas a C-130 is somewhat smaller and powered by four turboprops. The air launched target vehicle would be mounted on a pallet and loaded onto the aircraft through a large aft door that accommodates military vehicles and/or palletized cargo. While in flight, the aft door can be opened, allowing release of the palletized launch vehicle.

Build-up of the air launched target would take place at a government or contractor facility in the United States. Various target missile configurations could be used depending on the range needed for a particular test. Support equipment carried in the military aircraft's cargo bay would consist of a rack of equipment with two crew stations mounted on a 2.4-meter (8-foot) pallet, a radio-frequency antenna system, and umbilical cable assemblies. The aircraft support equipment would provide pre-launch power, check the vehicle and telemetry functions, transmit ground positioning system and trajectory information, and engage the mechanism for the explosive release bolts just before drop.

The air launched target would be attached to a pallet, or booster extraction system, which supports the air launched target during missile buildup, loading, and dropping from the aircraft. The booster extraction system is 9 meters (30 feet) long and weighs approximately 1,225 kilograms (2,700 pounds). Booster extraction is initiated by the Pallet Release/Flight Termination System Arming Box System. Figure 2-9 shows how the palletized target vehicle and other support equipment would be configured on the aircraft while in transport and before launch. The booster extraction system would be pulled from the aircraft by parachute and dropped. The target missile would separate from the pallet, then descend via parachutes. The parachutes would release the target missile and motor ignition would occur during free-fall. After firing and booster drop (depending on target missile configurations), the target would follow its flight path to interception or to splash down within a designated ocean impact area. Figure 2-10 illustrates the extraction and launch sequence for the air launched target. A total of eight parachutes would be used to deploy the air launched target vehicle from the aircraft in preparation for actual launch. The parachutes use a ring-slot design with multiple panel openings made of a nylon/Kevlar composition. They would range from 4.5 to 29 meters (15 to 94 feet) in diameter.



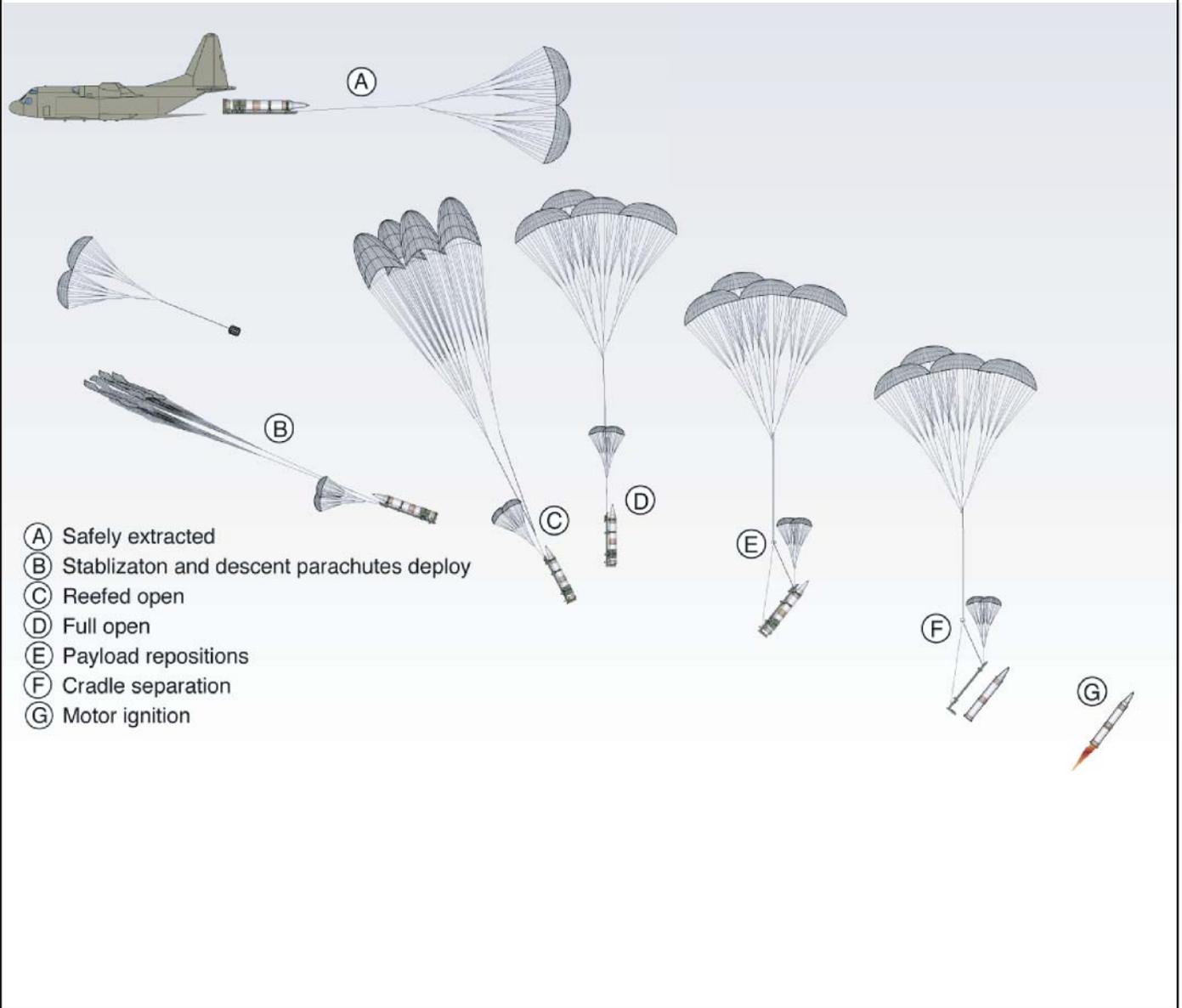
EXPLANATION

SRV = Single Reentry Vehicle
 FTS = Flight Termination System
 RF = Radio Frequency
 GPS = Global Positioning System

**Typical Air Launch
 Target Air Delivery
 System Configuration**

Not to Scale

Figure 2-9



Conceptual Aerial Target Launch

Not to Scale

Figure 2-10

The target vehicle contains ordnance in the form of a solid-rocket motor propellant, parachute reefing cutters, flight termination system, and detonation cord. The target vehicle is secured to the booster extraction system with a nylon "blanket." The blanket is stitched together with detonation cord. When the detonation cord is exploded, the blanket releases the target missile from the pallet. The pallet and parachutes are weighted to allow them to sink after release of the target missile.

The air launched target could be composed of a single SR-19-AJ-1 (modified) rocket motor or if longer ranges are required, possibly two SR-19-AJ-1s (modified). The most energetic combination of boosters used for an air launched target would be two SR-19-AJ-1s. Other rocket motors, such as the Castor IVB, GEM-40, M57-A1 and M26, could be used in addition to or instead of the SR-19-AJ-1s, but would have less environmental impact than two SR-19-AJ-1 (modified) boosters examined under the Proposed Action. Until THAAD target requirements are finalized, it is not clear exactly what target missile configuration would be required for the air launched target.

Aircraft for the air launched target would be staged out of existing military installations, such as Point Mugu, California, PMRF, and RTS, which routinely handle the types of aircraft necessary for deploying the air launched targets.

2.1.7 FLIGHT TRAJECTORIES

Prior to the THAAD interceptor missile launch from PMRF, the aim point and launch time to intercept the target would be computed. This information would then be downloaded to the THAAD interceptor missile. The missile would fly out using inertial and radar-provided guidance to intercept the target. At intercept, the target would be destroyed by body-to-body impact of the non-explosive KV. Interceptor missile and target debris would fall in the ocean west and north of PMRF in areas previously analyzed in the *PMRF Enhanced Capability Environmental Impact Statement (EIS)* (U.S. Department of the Navy, 1998). All flight tests would be designed to ensure launch debris is confined to the established temporary operating area for missile debris. The Range Safety Officer would continuously monitor the flight of any launch vehicle to ensure it does not exceed its flight safety parameters, and if necessary would terminate the vehicle's flight.

Standard range warning and checking procedures would be used to identify visible concentrations of marine mammals in the area of the target launch trajectory and impact areas. Patrol and surveillance aircraft would be dispatched prior to launch and would patrol the area of potential hazard to detect civilian aircraft and vessels. The aircraft would also use surface radar to search the water surface. If contacts are made and confirmed, the Flight Safety officer would, based upon location, heading, and speed of the contact, determine whether to continue on schedule, delay the test flight, or postpone it until another day.

2.1.8 POST FLIGHT TEST ACTIVITIES

At the conclusion of testing activities at PMRF, THAAD program personnel would remove all mobile equipment/assets brought to the range. Final ownership and disposition of permanent facilities constructed in support of THAAD testing would be determined by an inter-service agreement between the MDA and the host installation. Fencing that was erected for THAAD activities would be retained or removed according to the needs of the installation. The bypass road around the THAAD radar hazard area would be closed, and South Sidewinder Road through the hazard area would be reopened to traffic. Transportation for removal of THAAD equipment would be the same as when it was brought into the installation.

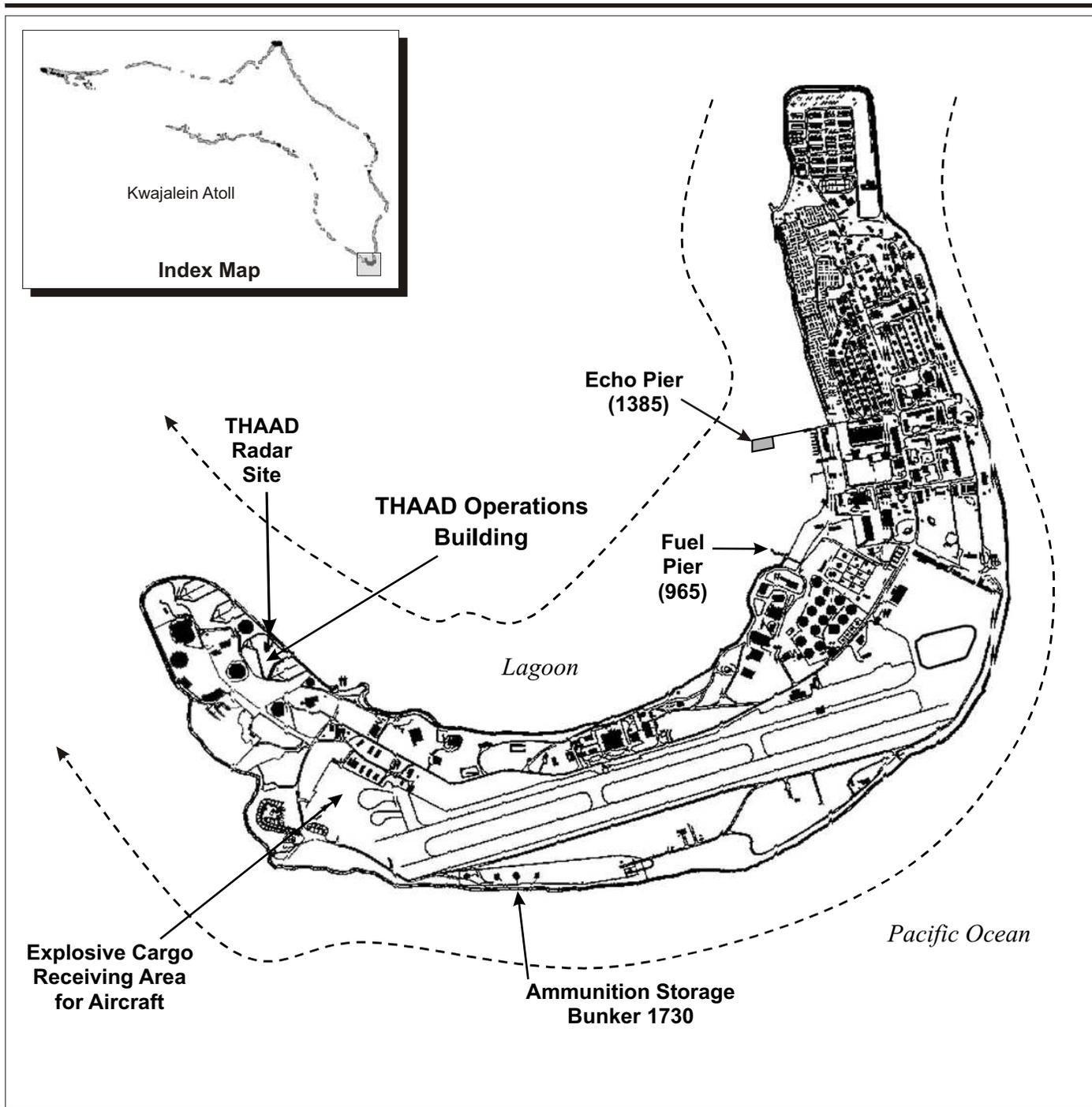
2.2 ALTERNATIVE TO THE PROPOSED ACTION – THEATER HIGH ALTITUDE AREA DEFENSE TEST FLIGHTS AT REAGAN TEST SITE

An alternative location for THAAD flight tests would be RTS, located at the U.S. Army Kwajalein Atoll (USAKA) in the RMI. USAKA is approximately 3,889 kilometers (2,100 nautical miles) southwest of Honolulu, Hawaii and is the home to a fully instrumented missile testing facility. Missile testing and radar operations have occurred at USAKA since the 1950s.

2.2.1 TRANSPORTATION TO REAGAN TEST SITE

The THAAD components and target missiles would be transported from U.S. Government installations or contractor facilities to a designated air base or port for transport to RTS via aircraft and/or ship. Materials arriving via ship or barge would be received at the Kwajalein marine facilities (figure 2-11). The equipment flown in would be transported from U.S. Government installations or contractor facilities to a designated U.S. Air Force Base for transportation to the RTS by U.S. Air Force Air Mobility Command C-5, C-17, C-130, or C-141 cargo aircraft. Materials arriving via aircraft would be received at Bucholz Army Airfield, Kwajalein. Missiles would be stored in an ammunition storage bunker after arrival. Before THAAD flight test activities, the missiles in their MRPs would be taken to Meck by existing marine transportation and stored in the MAB. Other components of the THAAD launcher would also be transported to Meck by existing marine transportation.

All transportation within the Continental United States would be performed in accordance with DOT-approved procedures and routing as well as Occupational Safety and Health Administration requirements, U.S. Army safety regulations, and U.S. Air Force regulations. Liquid propellants would be transported in DOT-approved containers based on the issuance of a Certificate of Equivalency. Appropriate safety measures would be followed during transportation of the propellants as required by the DOT and as described in 49 CFR 171-180, *Hazardous Materials Regulations of the Department of Transportation*. For ship or barge transportation, U.S. Coast Guard and/or applicable U.S. Army transportation safety regulations would also be followed.



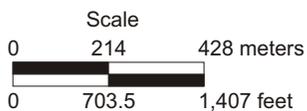
EXPLANATION

- > Reef Edge
- Structures

Potential Activity Locations

Kwajalein Island,
Kwajalein Atoll

Figure 2-11



For aircraft transportation, FAA and Air Force Joint Manual 24-204, *Preparing Hazardous Materials for Military Shipment*, would be followed. THAAD missiles would be stored in accordance with the USAKA Environmental Standards (UES). The UES establish environmental protection that is equivalent in effect to the public health and safety protection provided by applicable U.S. statutes and regulations, taking into consideration the particular environment of USAKA and the special relationship between the RMI and the United States.

Safety concerns involved with transporting the missiles involve the transportation of hazardous materials, Class 1.3 explosives, and a small amount of hypergolic chemical located in the Divert and Attitude Control System. The MRP would serve as a limited duration containment barrier for the hypergolic chemicals. The MRP would be equipped with passive and active sensors to detect any leak that may occur. Should a leak occur during transportation, the aircraft would land at designated airfields where trained personnel would be standing by to deal with the leaking missile. Section 2.2.7.2 discusses target missile transportation.

2.2.2 PREFLIGHT ACTIVITIES AT REAGAN TEST SITE

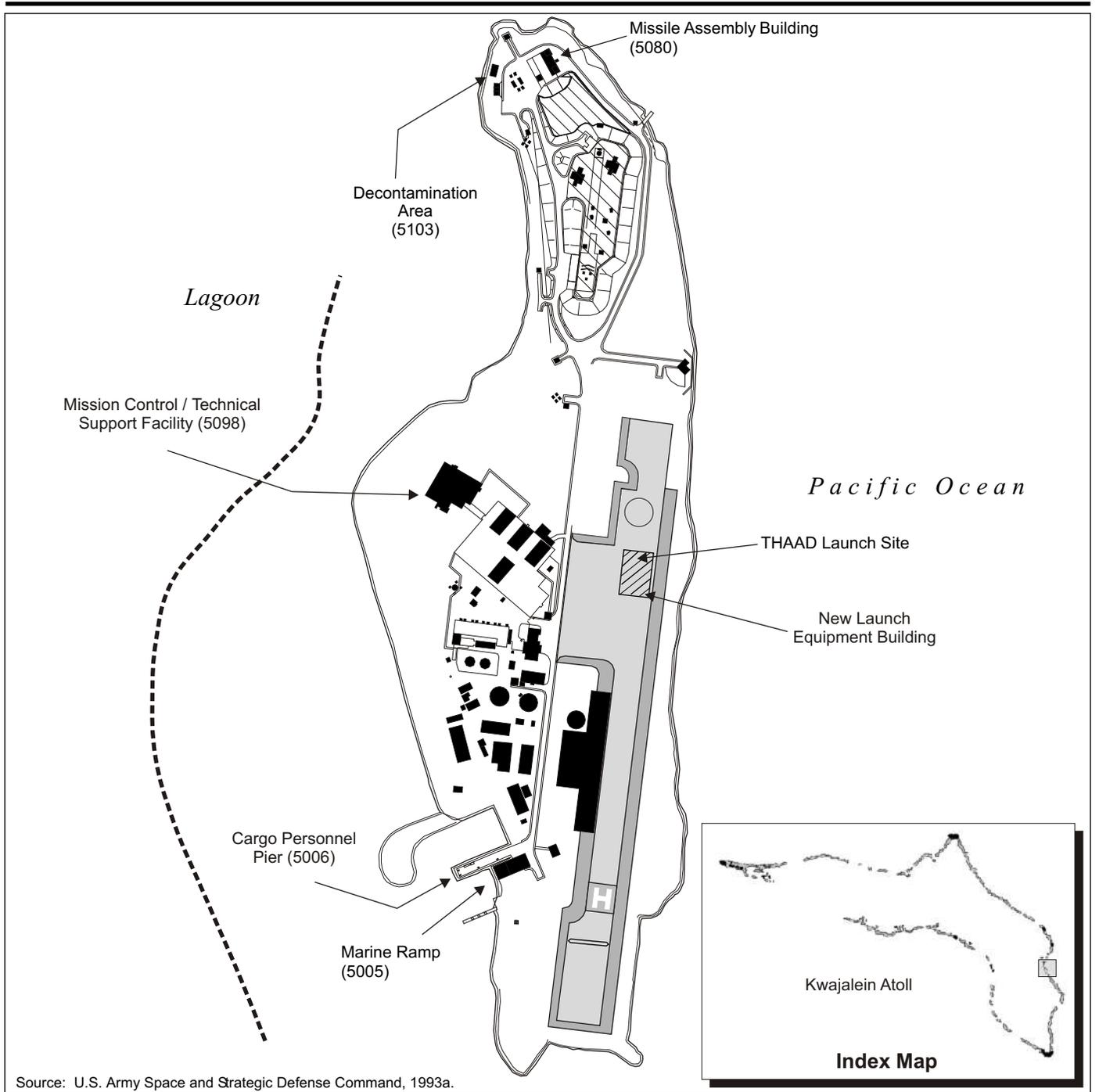
2.2.2.1 Interceptor

THAAD launches at RTS would occur at Meck (figure 2-12) on an inactive runway. The site is south of the 381-meter (1,250-foot) safety zone around launch hill. Meck is the center for all missile launches at RTS. Approximately 100 permanent personnel commute to Meck each day from Kwajalein. During peak mission activities, an additional 150 people may work on the island for short periods of time. About one-third of the island is man-made, and almost the entire island has been developed. The inactive runway is paved with asphalt and offers a stable and level platform for launch activities. THAAD launch hardware and equipment would be transported from Kwajalein to Meck by existing marine transportation and would be off-loaded at the island's docking facilities. This is a common activity at Meck. Before launches, the MRP would be moved from storage in the MAB to the launch site and would be lifted and mounted on the THAAD launcher.

An environmental shelter would be used to protect the launcher during testing and checkout, and to provide thermal conditioning for specific missions. The THAAD hardware and equipment that would be located on site include the THAAD launcher (modified M-1120 HEMTT-LHS Palletized Load System) and associated fiber-optic and other cabling. THAAD ground vehicles would use existing vehicle maintenance and fueling facilities at Meck.

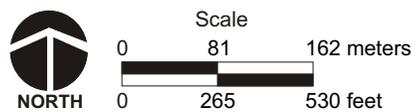
Ground vehicle maintenance and refueling are normal on-going activities on the island. Any hazardous wastes generated during vehicle maintenance would be handled by RTS through a support agreement.

Fiber-optic cables would be trenched to the depth of 0.3 to 0.46 meter (12 to 18 inches) to protect them from vehicle and foot traffic in the launch area. Fencing would also be erected around the launch area. All trenching and postholes would be in an area that has had heavy ground disturbance in the past.



EXPLANATION

-  Potential Interceptor Launch Location
-  Reef Edge
-  Helicopter Pad
-  Structures



Potential Activity Locations

Meck Island,
Kwajalein Atoll

Figure 2-12

In order to verify the X-band communication link (transmit and receive) between THAAD radar and the interceptor missile located on Meck a 30.5- to 38-meter (100- to 125-foot) high re-radiation tower and an existing fiber-optic line from this site to the radar site on Kwajalein would be required. The metal tower would be three-legged and would be constructed on site. The base of the tower would be large enough to be erected without guy lines that would inhibit movement in the launch area. The re-radiation tower would be erected on the west side of the launch equipment building, within the fenced launch area.

2.2.2.2 Radar

The radar component involved in this flight test is an X-band, solid state, phased array radar capable of tracking threats and interceptors during engagements that would require only final checkout and calibration. Checkout and calibration activities would include observation of targets of opportunity that may occur on the range and observation of existing satellites. The final checkout and calibration of the various RTS sensor systems would be considered to be routine activities at RTS. The primary radar site is on Kwajalein. Two alternative sites, the Speedball Site and the Army Optical Site, are located on Roi-Namur, 72 kilometers (45 miles) north of Kwajalein (figure 2-13).

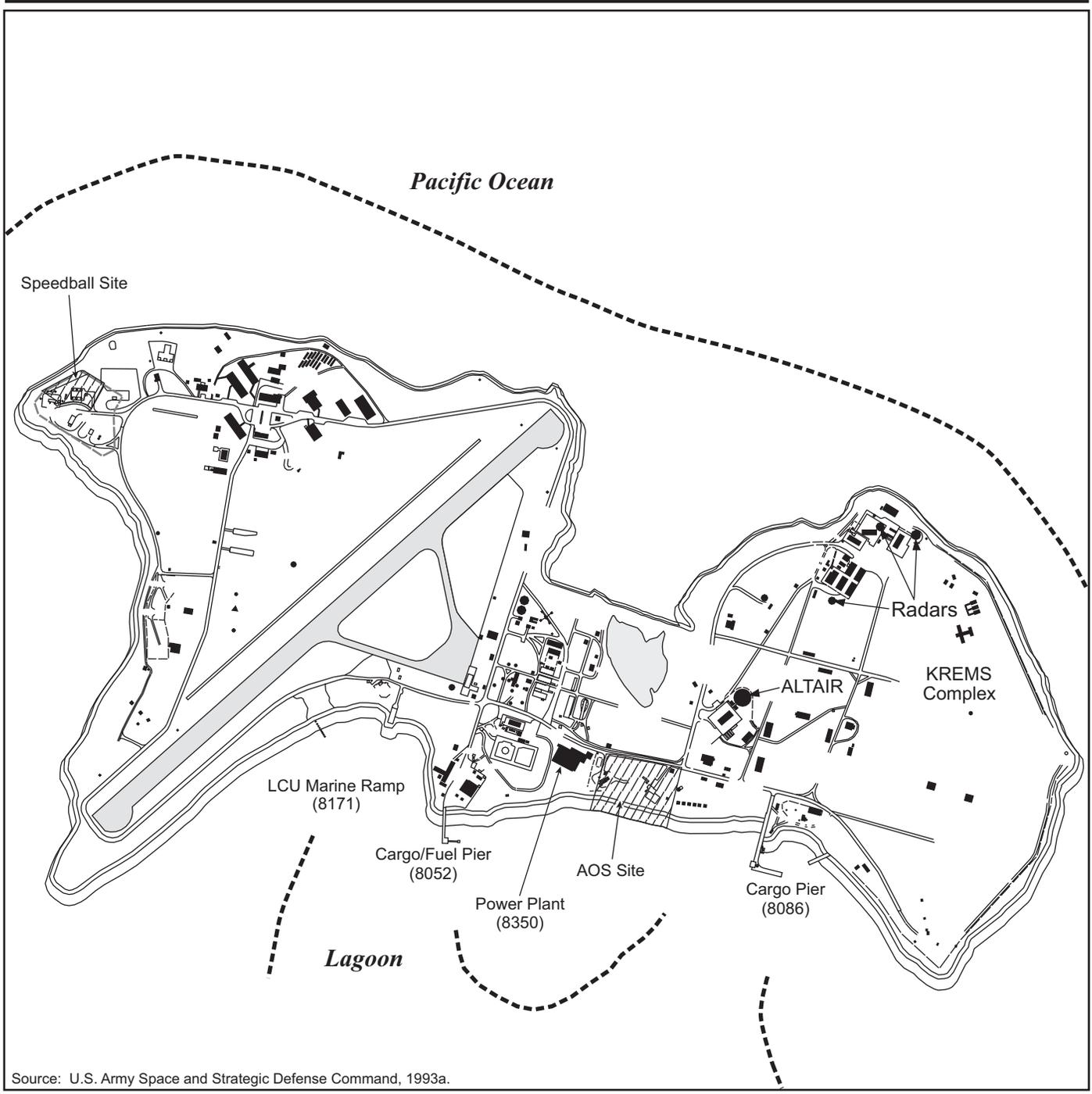
During later phases of testing, two radars would be at RTS. The second radar would be a backup set and would be used only if the primary radar should malfunction. The backup radar would be stored at an existing facility/area of RTS.

2.2.3 CONSTRUCTION OF SUPPORT FACILITIES FOR THAAD

Most of the THAAD activities at RTS can be performed with existing facilities and infrastructure. This section describes those THAAD facilities that would need to be prepared at RTS. All design and construction activities would be coordinated with RTS and would be performed in accordance with existing installation policies. Standard building practices as conducted by the U.S. Army Corps of Engineers at USAKA would be employed.

2.2.3.1 Theater High Altitude Area Defense Operations Center and Storage Maintenance Building and Radar Hardstand

The THAAD Operations Center and Storage/Maintenance Building would be constructed on Kwajalein (figure 2-14). This building would provide the center for THAAD operations, including office space, maintenance and storage areas, a single location to oversee the THAAD element testing activities, and a single point of focus for day-to-day planning and scheduling. The Operations Center and Storage/Maintenance Building would be approximately 1,300 square meters (14,000 square feet) and would be located near the Grassy Knoll adjacent to the THAAD radar site, a 49- by 67-meter (160- by 220-foot) hardstand. The radar site would be between the Operations Center and Storage/Maintenance Building and the lagoon shore. The building and hardstand would be constructed on the man-made portion of the island and thus would pose no threat to sub-surface archaeological resources.

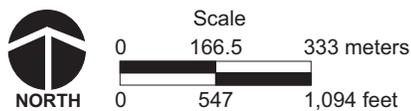


Source: U.S. Army Space and Strategic Defense Command, 1993a.

EXPLANATION

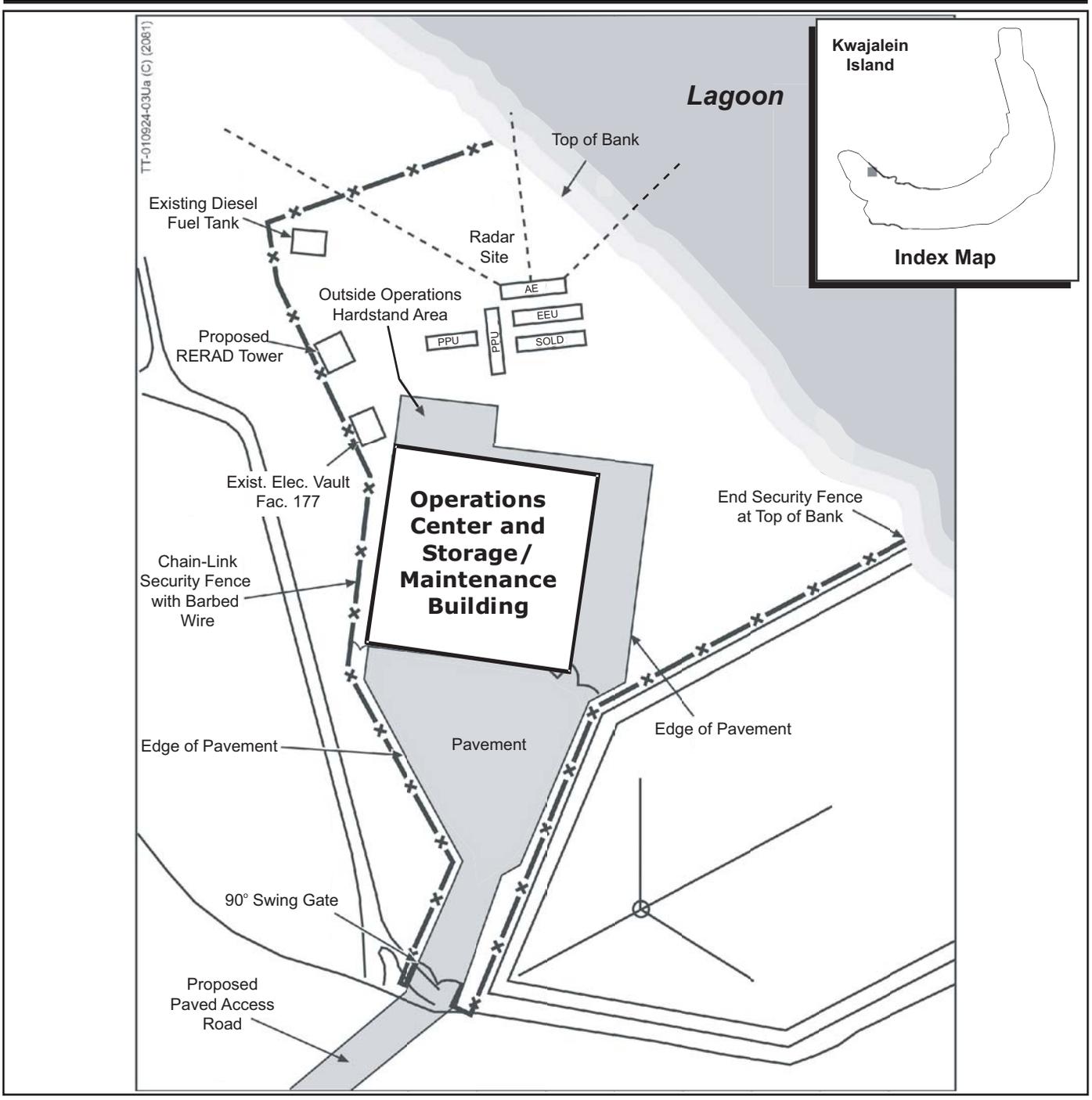
- Reef Edge
- Structures
- - - - Fence
- ▨ Potential THAAD Radar Location

Potential Activity Locations



Roi-Namur Island,
Kwajalein Atoll

Figure 2-13



THAAD Operations Center Buildings and Radar Layout

Kwajalein Island

Figure 2-14



The Maintenance and Storage area would require approximately 697 square meters (7,500 square feet) of the Operations Center and Storage/Maintenance Building. The THAAD element equipment (except missiles) may be stored in this facility when it is on Kwajalein. The maintenance area would be sized to accommodate the THAAD radar components (Antenna Equipment Unit, Electronic Equipment Unit, Cooling Equipment Unit, and Prime Power Unit) in the event of extreme weather. Individual components may be moved into this facility for routine maintenance/repair. Regularly scheduled maintenance would be performed on the hardstand. All hazardous wastes associated with maintenance would be disposed of in accordance with existing installation policy at RTS. Containment for the Prime Power Unit and Cooling Equipment Unit would be as described in section 1.4.2.2. Parking would be provided on the south side of the Operations Center and Storage/Maintenance Building. A security fence would enclose the building and the radar site.

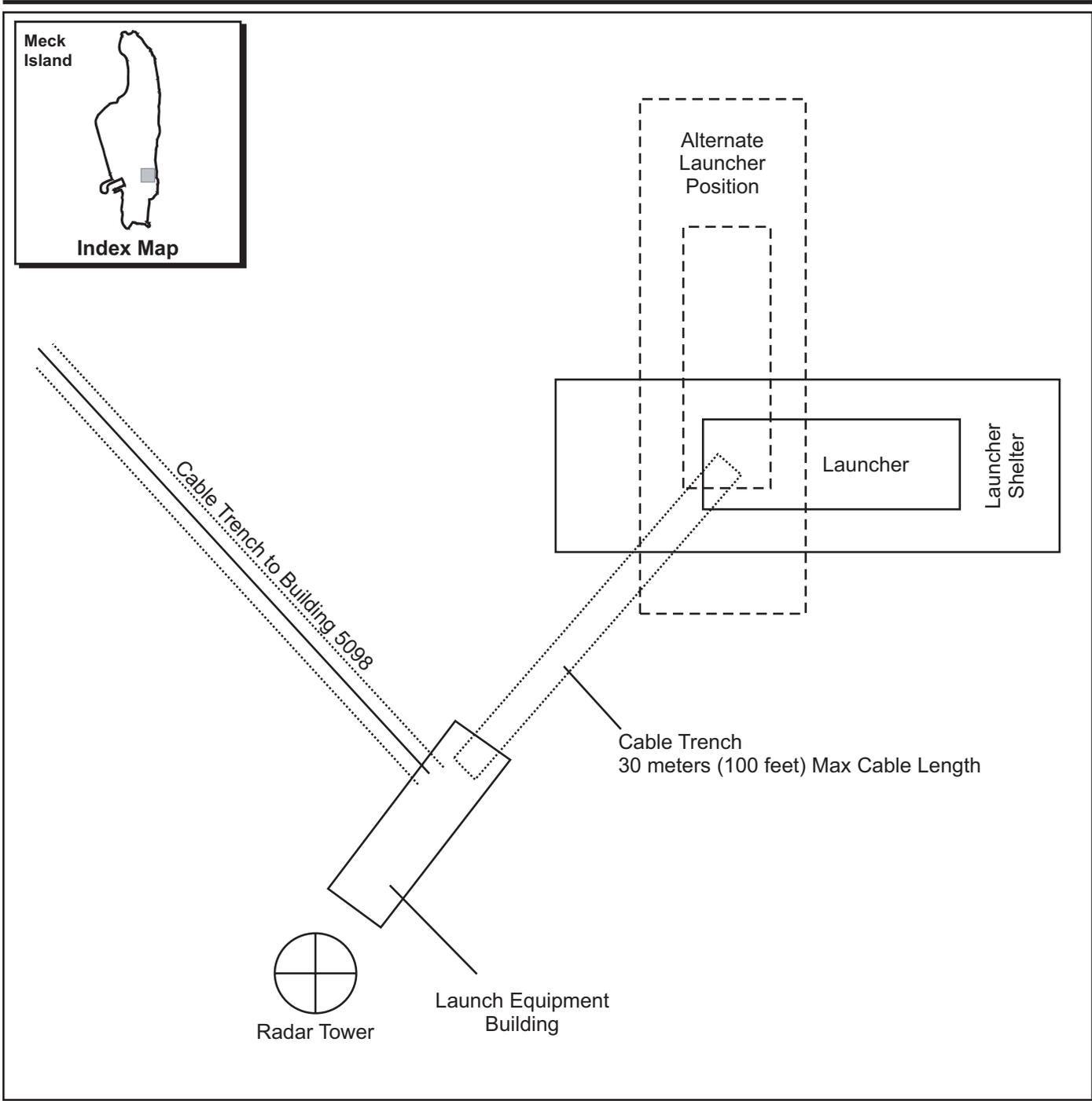
The office area would provide workspace for 60 people, including standard building support facilities (e.g., restrooms, a conference room, and mechanical, electrical, and communication rooms) as necessary to support the planned number of personnel. In addition, the THAAD Project Office would use this facility to support flight analysis.

2.2.3.2 Theater High Altitude Area Defense Launch Equipment Building on Meck

The Launch Equipment Building (figure 2-15) would be a small 37-square-meter (400-square-foot) environmentally controlled van that would be installed on a trailer or truck. It would be fabricated in the United States and brought to RTS along with the other THAAD hardware and equipment. It would be within approximately 4 meters (12 feet) of the THAAD launcher on Meck and would be enclosed within the THAAD launch area fencing. The structure would provide weatherproof storage for small launch equipment items.

2.2.3.3 Mission Control/Technical Support Facility on Meck

The Mission Control/Technical Support Facility would be located in the southeast corner of Facility Number 5098 and would be approximately 420 square meters (4,600 square feet). This area in Facility Number 5098 would be rehabilitated to accommodate THAAD activities. Areas of this facility would function as the Mission Control Room, technical support desk and board area, and a 46.5-square-meter (500-square-foot) environmentally controlled equipment storage and maintenance area. This area would also house the telemetry ground station, the various test support consoles, and countdown displays. During final countdown, the Mission Control Room data displays provide a backup capability to the Mission Control Center (Facility Number 1010) on Kwajalein. Approximately 15 personnel are expected to support routine operations, while up to 50 additional personnel would be on site for launches. The additional 50 personnel would be composed of launcher/interceptor sub-system experts and range safety personnel required to support the launch activities.



THAAD Launch Layout



Not to Scale

Meck Island

Figure 2-15

Normal electrical, mechanical, and communication equipment rooms/closets would also be necessary, as well as access to restroom facilities. Only household and office waste would be generated during operation of this facility.

2.2.4 THAAD SITE PREPARATION AND ESTABLISHMENT

Kwajalein is a RMI National Historic Landmark because of the World War II battle that occurred there. To ensure the protection of any prehistoric, historic, or traditional resources already identified within the project area from unauthorized artifact collection or vandalism, personnel would be briefed before activities commence on the significance of these types of resources and the penalties associated with their disturbance or collection. If, during the course of program activities, cultural and/or historic materials (particularly human remains) are discovered, activities in the immediate vicinity of the cultural materials would be halted and the RMI Historic Preservation Officer would be consulted through the RTS Environmental Office.

2.2.4.1 Interceptor

See section 2.2.2.1.

2.2.4.2 Radar

The THAAD radar would use a test site on Kwajalein with alternate sites on Roi-Namur. Figure 1-5 shows a notional THAAD radar site layout. The site would be near the western tip of Kwajalein on the lagoon side near the Grassy Knoll, directly behind the Operations Center and Storage/Maintenance Building. Two alternate radar sites on Roi-Namur are being considered. Site configuration for the THAAD radar at either site at Roi-Namur would be the same as that on Kwajalein. The first radar location would be located within the fenced area at the Sounding Rocket Launch Facility (also known as the Speedball Site), on the northwest corner of Roi-Namur. The second site would be located on the southern side of Roi-Namur (known as the Army Optical Site). Figure 2-13 shows potential radar locations.

The THAAD radar requires a 49- by 67-meter (160- by 220-foot) hardstand with 1.5-MW power for full-up operations. Power would be supplied by the Kwajalein or Roi-Namur power plant, depending on which site is chosen. A security fence would be required around the THAAD radar. A ground safety hazard keep-out zone of 400 meters (1,312 feet) is currently required. The BMC2 would also be located at this site. Missile launch procedures are controlled from separate BMC2 shelters mounted on XM-1113 HMMWVs.

An approximately 30.5-meter (100-foot) high re-radiation tower and an existing fiber-optic line from this site on Kwajalein (or Roi-Namur) to the launch site on Meck would be required to verify the X-band communication link (transmit and receive) between THAAD radar and the interceptor missile located on Meck. The metal tower would be three-legged and would be constructed on site. The base of the tower would be large enough at the base to be erected without guy lines that would inhibit movement at the radar site.

The largest utility demand for the THAAD radar would be 3-phase, 4,160-volt, 60-hertz electrical power. Some trenching may be required for power lines. Depth of the trench would be approximately 1 meter (3 feet); however, the specific location of the trench will not be known until THAAD radar layouts are finalized.

RTS standard operating procedures for explosive safety would be implemented and explosive ordnance disposal personnel would be onsite if trenching is necessary. For any activities that require ground disturbance in areas determined to be sensitive for archaeological resources, a qualified professional archaeologist would monitor the activities in accordance with the UES.

If existing transformers cannot be used, then a small concrete pad would be constructed for new transformers. An aggregate pad (4.3-meter by 5.8-meter [14-foot by 19-foot]) may also be constructed to support an 18,927-liter (5,000-gallon) diesel fuel aboveground storage tank to fuel the Prime Power Unit. The tank would be installed with secondary containment in accordance with the UES.

2.2.5 TRANSPORTATION TO LAUNCH LOCATIONS

2.2.5.1 Interceptor

The THAAD launchers and missiles would be taken from their arrival point at Bucholz Army Airfield, Kwajalein, to the Kwajalein Port vicinity, where they would be loaded into existing marine transportation assets for transportation to Meck.

2.2.5.2 Radar

The primary radar location would be on Kwajalein; however, if the alternate sites are used, the THAAD radar components would then be taken by existing marine transportation to Roi-Namur. Those components would arrive at Roi-Namur at the cargo pier (8052 or 8086).

2.2.6 FLIGHT TEST ACTIVITIES

2.2.6.1 Interceptor

The THAAD interceptor would be launched from Meck. Table 1-3 provides emission constituents for each THAAD launch. Approximately 35 to 50 people would be on the island to perform prelaunch and launch operations. THAAD personnel on Meck would be supported using the current infrastructure and utilities. Their activities are defined in section 2.2.3.3 but can be summarized as preparing the missile for launch, providing pre-flight checkout of the missile, and conducting launch operations. Only essential personnel are allowed into the launch area once a live missile is installed.

Interceptor missile launch activities would be controlled from Facility Number 5098. Shortly before launch, all mission-essential personnel would be evacuated from the launch

area to Facility Number 5098, and non-mission-essential personnel would be evacuated from the launch hazard area (LHA) to the required safety distance of approximately 2,000 meters [6,562 feet] around the launcher. LHAs are configured to provide the maximum protection for personnel and take into account the ability to control access to the hazard areas.

Prior to missile launch, RTS Range Safety officials would issue NOTAMs and NOTMARs identifying areas to remain clear of and the times that avoidance of the area is advised. The Range Safety officials would then determine that the areas are clear of both surface vessels and aircraft. If ships or fishing boats are seen in an impact area, their cooperation is requested to leave the area voluntarily. Launches are put on hold until the impact area is clear of traffic.

After the Range Safety Officer provides a safety clearance, the launch signal would be given from the launch control area. Standard protective procedures would be followed during test activities to provide hearing protection of workers and minimize any noise impacts associated with launch activities. Missile impact zones would be confined to open areas at sea. Standard operating and safety procedures for missile launching and testing would be implemented to minimize the risk of any adverse health or safety impacts associated with the program.

2.2.6.2 Radar

The THAAD radar would be operated from one or more of three sites: the western end of Kwajalein, the northwest corner of Roi-Namur (in the vicinity of the Speedball Site), or at the Army Optical Site on the southern portion of Roi-Namur. Only one of the radar sites would be operated at any given time. Approximately 20 to 25 people would be on the island to perform pre-test operations and operate the radar during the flight test. The required personnel radiation hazard area for the THAAD radar is approximately 400 meters (1,312 feet) to the front and sides of the radar face. As required by U.S. Army regulation, bilingual warning signs (in English and Marshallese) would indicate the radiation hazard keep-out area. Before activating the radar, a visual survey of the area would be conducted to verify that all personnel and wildlife are outside the hazard zone, and a warning beacon would be illuminated when the radar is operating.

Should radar sites at Roi-Namur be established, workers may be billeted on Roi-Namur or may commute daily from Kwajalein by air. Approximately 200 personnel currently commute to Roi-Namur from Kwajalein daily for normal operations. THAAD activities would not impact the flight schedules for normal commuting.

2.2.6.3 Use of Non-Theater High Altitude Area Defense Radars

Some or all of the RTS MPS-36 radars, the RTS FPQ-19 radar, and the Kiernan Reentry Measurement System radars would observe the launches. These would be normal range activities that have been previously addressed in earlier USAKA NEPA documentation.

Optical sensors (cameras) are located at several points throughout RTS providing remote, unmanned surveillance. The video data from the remote optical site cameras aids detection and evaluation of exercises on the range. Telemetry sensor equipment is used to receive data transmitted by missiles in flight. Telemetry sensors are located on Roi-Namur, Gagan, Illeginni, and Ennylabegan islands.

RTS would provide range safety for all interceptor and target missile launches. Currently RTS provides this service with the Kwajalein Mobile Range Safety System, which is ship mounted, provides flight safety data, and consists of four equipment vans, a telemetry receiver, and two command destruct transmitters.

2.2.7 TARGET MISSILE LAUNCH ALTERNATIVES

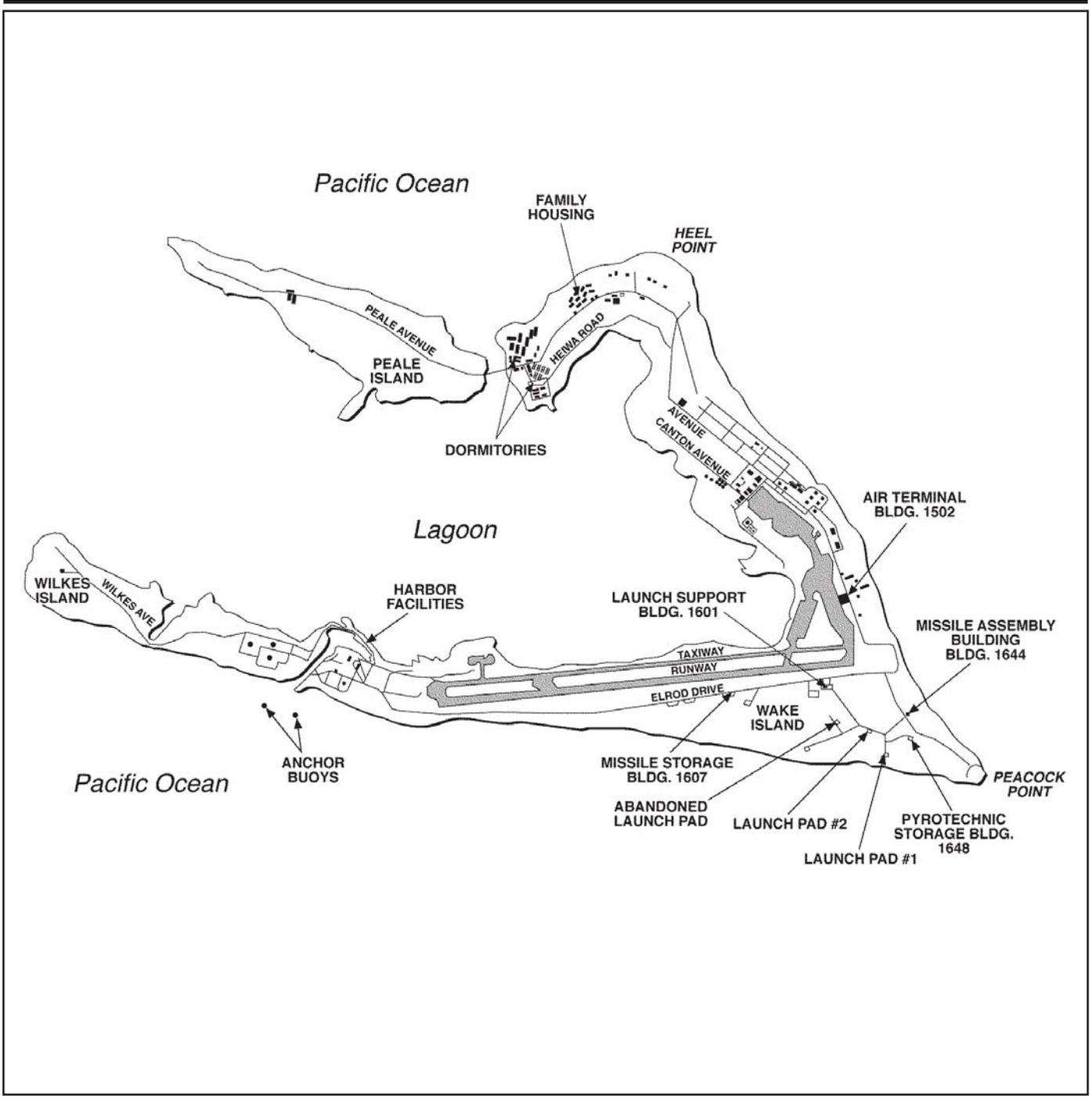
Target missile launches in support of THAAD interceptor missile flight tests at RTS could be those that are described in chapter 1.0 or section 2.1.6, or they could be land launched target missiles. These include launches from Wake and LPT missile launches from Bigen or Toton. These alternatives are described in the following sections. The land launched target alternatives would only be used for THAAD intercept tests from RTS. The sea and air launch target missiles described in section 2.1 could be used for intercept tests from RTS or PMRF.

2.2.7.1 Launches from Wake

Wake Island Launch Center (figure 2-16) is an established missile launch facility that is located approximately 3,200 kilometers (2,000 miles) west of Hawaii. Wake Island Launch Center has launch facilities for both rail and stool launch solid propellant target missiles and can also support launches of LPTs. A second launch stool could potentially be required for target missile launches from Wake. Specific details for installation, including location, of this launch stool have not yet been developed. However, the launch stool would likely be placed in the vicinity of existing launch pads and construction would follow applicable U.S. Air Force guidelines. Wake Island Launch Center also has a full suite of missile storage buildings and MABs. Until THAAD target requirements are finalized, it is not clear exactly what target missile configuration would be required at Wake.

However, use of liquid or solid propellant targets that are analyzed in the referenced NEPA documents would be the most likely choice. If the target missiles chosen have different environmental effects than those analyzed, appropriate NEPA analysis would be prepared before their use.

Trajectories for flights from Wake are structured to preclude debris from impacting any protected area. Each populated landmass in the RTS operational area has a protection circle associated with it (nominally 8-16 kilometers [5-10 miles] around the landmass). Scenarios that result in debris impacting within the protected areas are not normally allowed. However, occasionally a risk-based approach is used and limited amounts of debris are sometimes allowed to impact inside the protected areas. In such cases acceptable levels of risk are maintained, consistent with the Range Commanders Council (RCC) Standards 321-00.



Wake Island Launch Center



10-30-02 Wake Launch Centre

THAAD Pacific Test Flights EA

Figure 2-16

2.2.7.2 Land Launched Liquid Propellant Targets

Land launched LPT missiles would be associated with THAAD activities at RTS only. LPT launches would be conducted from Bigen or Toton. All liquid propellants would be transported in DOT-approved containers from their current storage location to a Continental United States site of embarkation over the roadway. Propellants would be loaded onto a certified surface vessel and shipped over the ocean to RTS. The main fuel and oxidizer (IRFNA and hydrogen peroxide) would be packaged in DOT-approved 208-liter (55-gallon) drums, and the starter fuel would be packaged in DOT-approved 114-liter (30-gallon) drums. The IRFNA would also be packed inside a secondary 322-liter (85-gallon) overpack drum. All aspects of transportation would comply with applicable safety regulations.

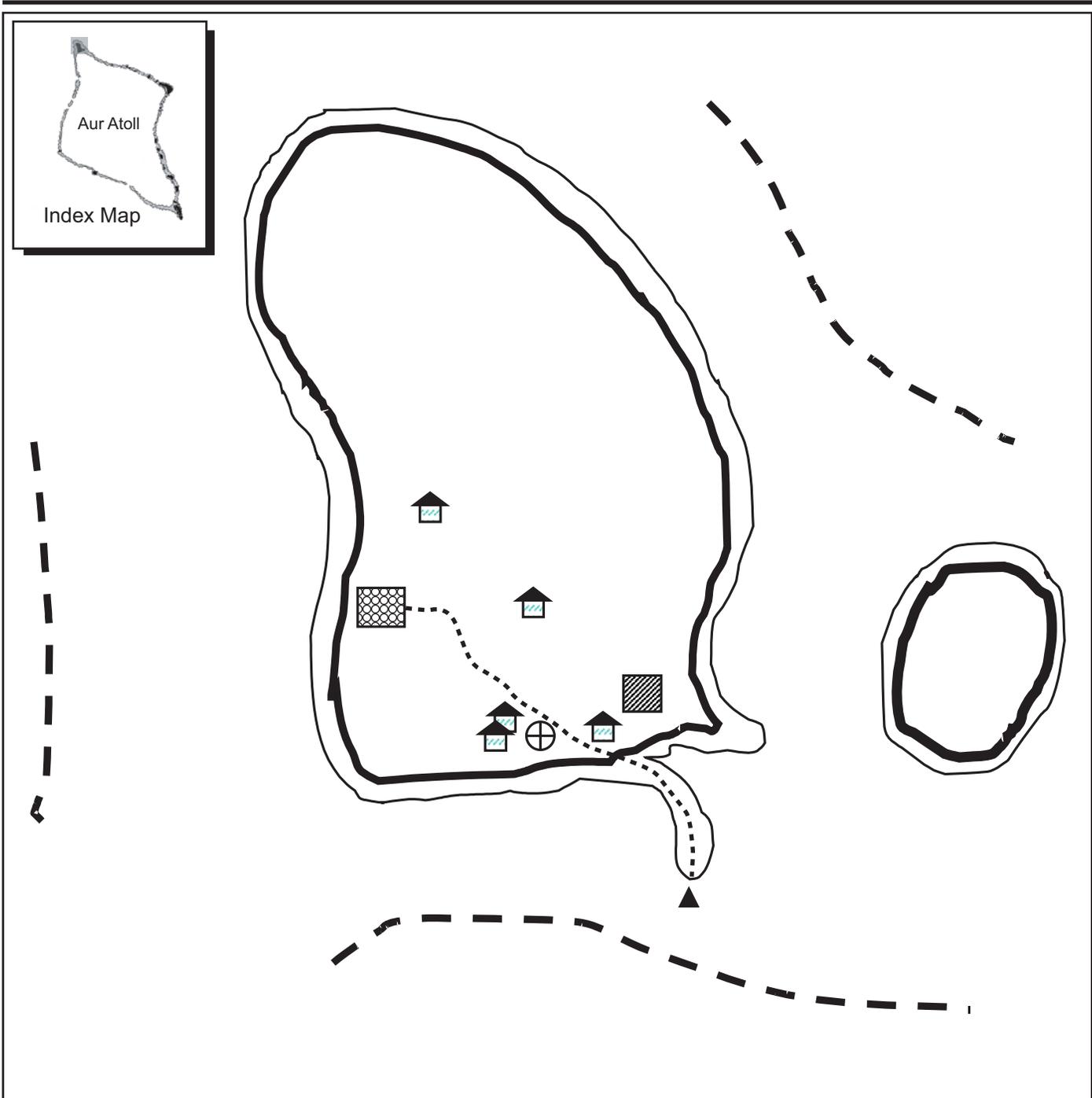
The single stage LPT missile would be transported on and launched from a self-propelled Transporter Erector Launcher vehicle. Missile launch procedures would be controlled from a separate command center. Launch commands to the Transporter Erector Launcher would be transmitted via the existing fiber-optic and analog cabling. Table 1-4 shows the characteristics of the LPT Transporter Erector Launcher.

Liquid Propellant Target Transportation to Reagan Test Site

The LPT and propellants would arrive at the RTS harbor and/or airfield approximately 90 days before the scheduled launch. The flight termination system ordnance would be temporarily stored in an existing ammunition storage bunker (Facility Number 1730) on Kwajalein, pending transportation to Meck by existing marine transportation. The propellants, on arrival, would immediately be taken to Meck for storage. All target missile fueling and preparation would occur at Meck before transport by existing marine transportation to Toton or Bigen.

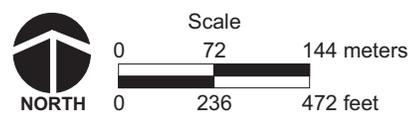
Liquid Propellant Target Temporary Launch Site Preparation

To support launch operations, a temporary remote launch site would be established on either Bigen (figure 2-17) or Toton (figure 2-18). The temporary launch sites would include a cleared and leveled 30-meter by 30-meter (100-foot by 100-foot) launch area, and temporary use latrines, metal matting, and miscellaneous launch equipment. Existing access routes for vehicles and personnel would be used as much as possible. Vegetation clearance would be minimal, primarily transplanting a limited number of coconut palm seedlings in the immediate vicinity of the launch area. Marshallese landowners would be notified of this action, and the trees would be transplanted or the owners would be compensated for the loss of each tree. If other temporary facilities are required, additional analysis and documentation would be completed prior to any construction. RTS contractor personnel would be transported by existing marine transportation from RTS to establish the launch site. The vessel would anchor at a designated beach-landing area at the temporary launch site. A temporary marker buoy with passive navigation measures would be installed. All personnel for the launch site establishment team would live on the existing marine transportation. This crew would utilize earth-moving equipment as necessary to level and prepare the 30-meter by 30-meter (100-foot by 100-foot) launch area. Local Marshallese labor may supplement the RTS contractor personnel to prepare the proposed launch area.



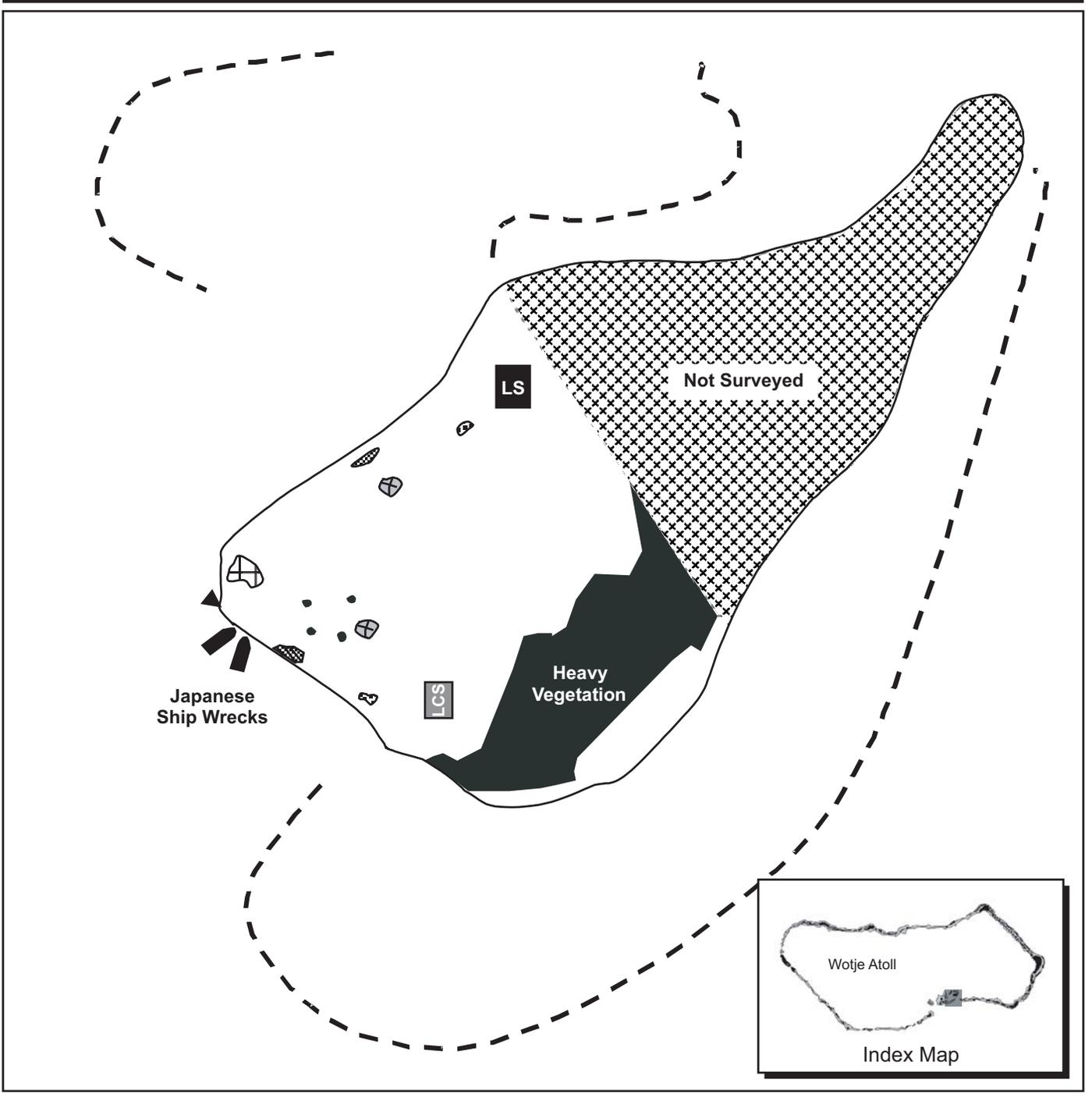
EXPLANATION

- | | |
|---|---|
|  Dwelling |  Launch Control Site |
|  Launch Site |  Reef Edge |
|  Cemetery |  Landing Site |
|  Vehicle Trail | |



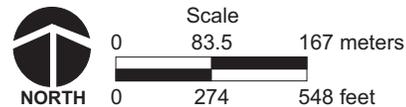
Bigen Island

Figure 2-17



EXPLANATION

- | | | | |
|---|-----------------------|-----|---------------------|
| ▲ | Landing Point | --- | Reef Edge |
| ● | Bomb Craters | ▣ | Not Surveyed |
| ⬢ | Sand Dune | ■ | Launch Site |
| ⊞ | Food Preparation Site | ▣ | Launch Control Site |
| ⊞ | Temporary Dwelling | | |
| ⊙ | Coral Spread | | |



Toton Island

Wotje Atoll

Figure 2-18

LPT Launch Activities

Actual launch activities would begin with the arrival of the launch team at the temporary launch site, approximately 30 days prior to the scheduled launch. The LPT, Transporter Erector Launcher, and other launch support equipment would be brought in, and set-up activities, flight readiness testing, and final ordinance installation would occur during this time period. Property owners would be notified of program activities 60 days in advance of the proposed launch date.

Although unlikely, missile propellants or diesel fuel could spill at the launch area. Specialized training in liquid propellant emergency response would be completed before any propellant is shipped, and the training and documentation would be approved by RTS. Representatives from RTS would approve response standard operating procedures. Rehearsals would be conducted prior to the start of operations, to include the use of proper safety equipment and personnel protective equipment, simulated defueling, spill containment, and clean-up activities.

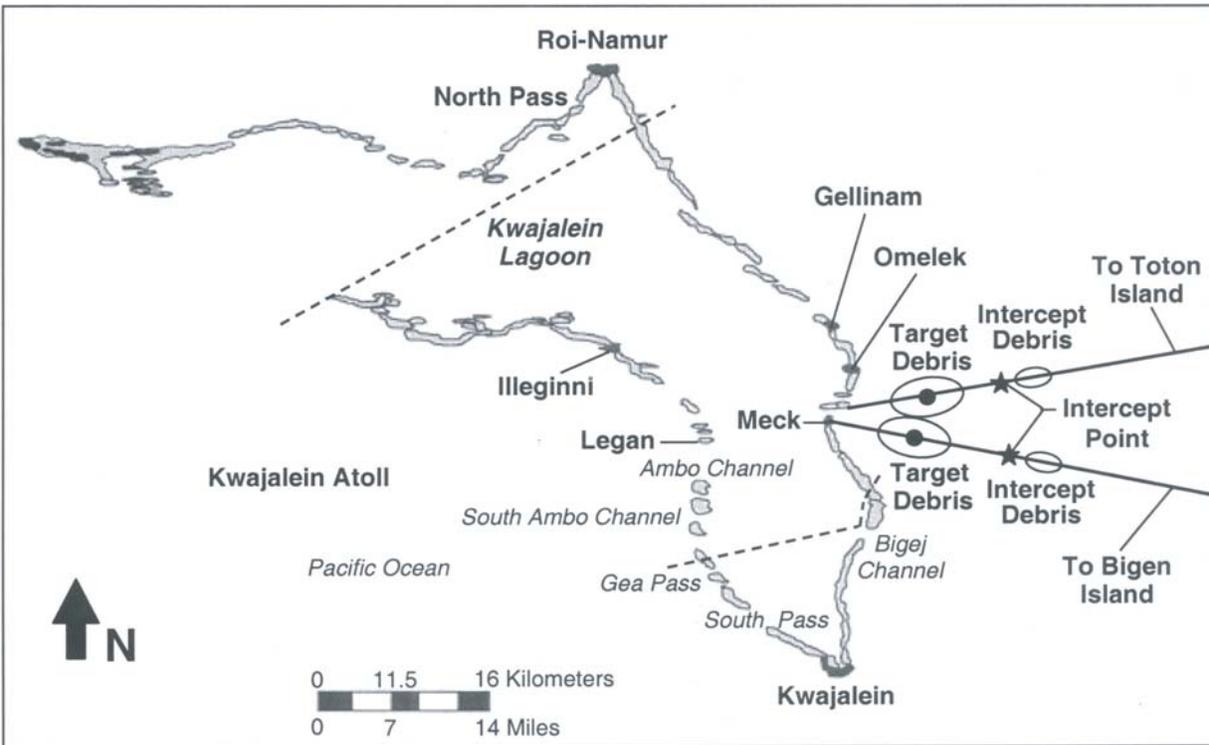
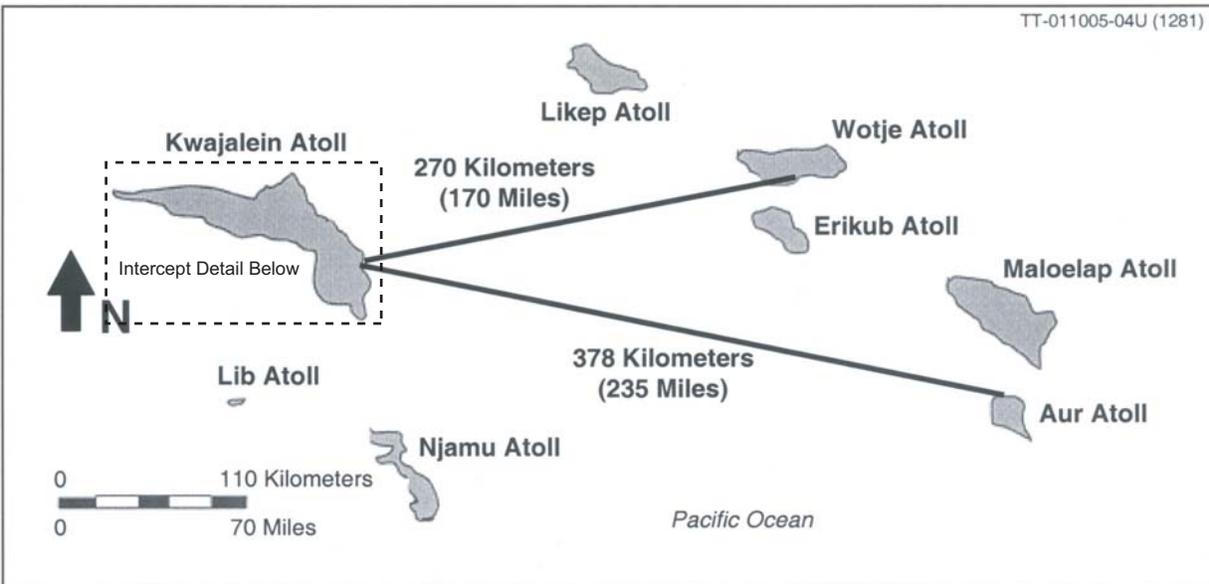
Shortly before launch, all mission-essential personnel would be evacuated from the launch area to a launch control van (approximately 457 meters [1,500 feet] from the launcher) or to the existing marine transportation. Non-mission-essential personnel would be evacuated from the LHA (approximately 2,000 meters [6,562 feet] around the launcher). A small security vessel would sweep the ocean LHA for the presence of any personnel or watercraft. After the LHA is verified to be clear, the launch signal would be given from the launch control van or the existing marine transportation. Intercept debris impact zones and target vehicle impact zones (in the event of a failed intercept), would be confined either to open areas at sea or to existing range areas which have been verified clear of personnel. Prior to missile launch, RTS Range Safety officials would issue NOTAMs and NOTMARs identifying areas to remain clear of and the times that avoidance of the area is advised.

The target launch vehicle would follow a flight trajectory from the temporary launch site approximately west toward USAKA (figure 2-19). The LPT would be intercepted in flight over the broad ocean area east of USAKA.

Following the completion of the launch program from the temporary launch site, all associated vehicles and equipment would be returned to the RTS. Metal matting at the launch site and miscellaneous launch equipment such as wires and portable latrines would be removed. Following completion of the interceptor missile testing, all LPT components would depart the RTS as previously described (at arrival) for storage.

2.2.8 FLIGHT TRAJECTORIES

Prior to the THAAD missile launch from Meck, the aim point and launch time to intercept the target would be computed. This information would then be downloaded to the THAAD missile. The missile would fly out using inertial and radar-provided guidance to intercept the target. Up to three dual launches would occur. At intercept, the target would be destroyed by kinetic energy impact of the non-explosive KV. Figure 2-19 shows a representative trajectory and debris patterns for target missile. Any interceptor missile or



Notional Intercept Scenario From Toton and Bigen Island

Figure 2-19

target debris, which would inadvertently land in the Kwajalein Lagoon, would be recovered in accordance with the RTS Reentry Vehicle Recovery Procedures. In the event of a missed intercept or other flight termination action, all debris would be contained within the Mid-atoll Corridor or the broad ocean area, or the probability of impact within the area would be consistent with the Range Commanders Council guidance. The Range Safety Officer would continuously monitor the flight of any launch vehicle to ensure it does not exceed its flight safety parameters and if necessary would terminate the vehicle's flight.

2.2.9 POST TEST FLIGHT ACTIVITIES

THAAD program personnel, at the conclusion of testing activities at RTS, would remove all mobile equipment/assets brought to the range. Final ownership and disposition of permanent facilities constructed in support of THAAD testing would be determined by an inter-service agreement between the MDA and the host installation. Fencing that was erected for THAAD activities would be retained or removed according to the needs of the installation. Transportation for removal of THAAD equipment would be the same as when it was brought into the installation.

2.3 ALTERNATIVE TO THE PROPOSED ACTION—ACTIVITIES AT BOTH PACIFIC MISSILE RANGE FACILITY AND REAGAN TEST SITE

This alternative would involve the activities described in the Proposed Action, test flights at PMRF (section 2.1), and some or all of the alternative actions at RTS (section 2.2). As functionality performance characteristics of the THAAD missile are revealed during flight tests, it may be necessary to alter the interceptor missile launch point or the target missile type to characterize the interceptor and target phenomenology in more realistic scenarios.

If both PMRF and RTS are used for testing, the full suite of facilities and targets as described in section 2.1 would be required. Those required for RTS could range from no new facilities with all THAAD operation done in a tactical manner, to the complete range of new facilities and targets as described in section 2.2.

2.4 NO-ACTION ALTERNATIVE

Under the No-action Alternative, the MDA would not proceed with THAAD Pacific Flight Testing. Flight test data for tactical missiles, needed for development of Terminal Missile Defense radars, interceptor missiles, and technology, would not be collected. Flight-testing would be continued at White Sands Missile Range to the maximum extent possible and within the constraints of the operational area of the range. The capability of the THAAD element against longer range ballistic missiles would not be evaluated. Another range with a suitable operational area would potentially have to be developed at a substantial cost and delay to the program.

2.5 ALTERNATIVES CONSIDERED BUT NOT CARRIED FORWARD

White Sands Missile Range has been the THAAD program's baseline flight test range. However, White Sands Missile Range does not offer realistic test distances (50 to 3,000 kilometers [31 to 1,860 miles]) against target missiles emulating threat ballistic missiles.

A THAAD Alternate Range Study was initiated in January 2001 to determine if a long-range alternative to White Sands Missile Range exists to support THAAD's flight test program. Cost, schedule and technical issues were evaluated at potential test ranges to support the determination. The study process was designed using the Ballistic Missile Defense Organization Directive 6051, "Comprehensive Siting Analysis Process." This study was conducted in three phases.

The ranges considered were Atlantic Fleet Weapons Training Facility, Vieques, Puerto Rico; Eastern Range, Florida; Eglin Air Force Base, Florida; Kodiak Launch Complex, Alaska; RTS; PMRF; Poker Flat Research Range, Alaska; Utah Test and Training Range; Wallops Flight Facility, Virginia; White Sands Missile Range; and Vandenberg Air Force Base/Naval Air Warfare Center, California.

Phase I: Area Narrowing

Phase I was a "filtering" process that eliminated ranges that could not support the THAAD requirements. These exclusionary criteria were used in the filtering process:

- Criterion 1—Test range must be a U.S. owned/leased and operated facility.
- Criterion 2—Missile ground tracks must not pass through populated areas or foreign countries that do not have missile overflight agreements with the United States.
- Criterion 3—Post-intercept debris footprints from two high exoatmospheric intercept missions must be safely contained without trajectory shaping.

Phase I resulted in narrowing candidate sites to four installations: PMRF, RTS, Kodiak Launch Complex, and Vandenberg Air Force Base.

Phase II: Screening

Phase II screened and weighted the four sites to determine the instrumentation factors and the facility availability of each installation. These two screening criteria and nine sub-criteria were:

- **Instrumentation**
 - Telemetry
 - Position accuracy
 - Hit point

- Infrared signature
- Radio frequency signature
- **Facilities**
 - Fire unit facilities
 - Storage/support
 - Target operations
 - Housing

Based on the Phase II screening criteria and weighted scores, PMRF and RTS emerged as the two best candidate sites.

Phase III: Evaluation

Phase III was used to determine which of the two installations identified in Phase II would be the proposed range and which would be the alternative range. Eight programmatic criteria with 28 sub-criteria were used to determine the proposed range for THAAD activities.

Criterion 1—Flight Test Requirements

- Required targets
- Scenario supportability
- Real-time displays
- Data products and timelines
- On-range communications
- Metric data collection
- Infrared signature data
- Radio frequency signature data
- Telemetry
- Data transfer
- Hit point data
- Photography

Criterion 2—Operational Test Requirements

- Interoperability
- Operational deployment
- Radar operation
- Unscripted scenarios

Criterion 3—Facility Requirements

- Test support
- Housing

Criterion 4—Logistics Requirements

- Transportation
- Other requirements

Criterion 5—Environmental

- Environmental compliance

Criterion 6—Security

- Physical security

Criterion 7—Operations Schedule

- Potential conflicts
- Days available

Criterion 8—Operations Cost

- Per mission cost
- Initial set-up cost
- Yearly costs
- Non-range logistics costs

At the end of Phase III, PMRF emerged as the preferred range and the Proposed Action based on the analysis and weighting of the 28 sub-criteria in the siting study.

2.6 OTHER CONCURRENT PROGRAMS TO BE EVALUATED FOR CUMULATIVE IMPACTS

In addition to the THAAD Program activities, there are other potential programs at each of the alternative locations that are reasonably foreseeable during the 2005 to 2008 timeframe. These potential programs are listed below to serve as the basis for cumulative analysis under the relevant resources related to each alternative location.

Pacific Missile Range Facility*Sea-Based Midcourse Defense (formerly known as the Navy Theater Wide Test Program)*

MDA will continue various phases of its interceptor test program against different target types offshore of PMRF.

Ground-Based Midcourse Defense Program

PMRF will continue to provide Strategic Target System missile and instrumentation support during each phase of Ground-Based Midcourse Defense Program test activities.

Prototype High Power Discrimination Radar Test Program

This prototype X-band radar is a component of a planned future integrated missile defense system. Once operational, it could replace current multifunction radars on today's cruisers and destroyers. The proposed radar equipment test site is just southwest of the Calibration Laboratory (Building 515). It has the potential for performing testing activities into the THAAD Program timeframe.

Rim of the Pacific Exercise

Portions of this biennial international exercise are typically performed for a month in the summer at PMRF. Various onshore activities consist of amphibious landings, special warfare operations. The majority of the activities is offshore and includes submarine and anti-submarine operations, air and surface missile firings and ship sinkings.

Reagan Test Site, U.S. Army Kwajalein Atoll

Ground-Based Midcourse Defense Program

RTS will continue to provide interceptor launches from Meck. There may also be target launches from RTS to support Ground-Based Midcourse Defense interceptor tests. Existing instrumentation support continues to be provided from Kwajalein and Roi-Namur during each phase of program test activities. Radar support is on the west end of Kwajalein.

ARROW System Improvement Program

The ARROW weapon system could be located at RTS. Target missile launches could occur from the open ocean area surrounding the atoll. Interceptor launches and radar activities could occur from Meck as one of the program alternatives. The flight test portion of the ARROW System Improvement Program would consist of four (4) missile intercept tests divided among two series or caravans of two tests each. The primary location for the tests is the Naval Air Warfare Center Weapons Division Sea Range in California. However, the program is also looking at USAKA as an alternative location. The ARROW radar and battle management equipment would be stationed on Meck at RTS within USAKA. The interceptor missile would launch from Meck. One of the test scenarios in the second caravan would consist of multiple target missile launches to test the ability of the ARROW Weapon System to conduct multiple simultaneous engagements.

Wake

U.S. Air Force Programs

The U.S. Air Force is resuming operational control of Wake Island Airfield, upon which Wake Island Launch Center will continue to be a tenant. Increased aircraft activities are planned to occur. One such activity could be the temporary detachment of aerial tanker aircraft. These activities have the potential to be 24 hours a day. Coordination of the increased aircraft activities and the launch clearance requirements will have been developed before the THAAD timeframe.

Theater Missile Defense Critical Measurements Program

Missile launches have continued since the initial program was established. Whether it will continue into the THAAD timeframe is unknown. Generally, the payloads carried by each launch vehicle include a reentry vehicle and one or several decoys. The Theater Missile Defense Critical Measurements Program is conducting a series of campaigns, each consisting of two to four launches with scenarios typical of current or projected Theater Missile Defense threats. Radar and optical data in a wide variety of wavebands, as well as on-board instrumentation measurements, are collected throughout the trajectory on each flight. Future campaigns are planned to include longer range missiles.

ARROW System Improvement Program

The Wake Island Launch Center could potentially be used to provide long-range land-based target launches toward RTS as part of the ARROW System Improvement Program.

Bigen, Aur Atoll

ARROW System Improvement Program

Target launch activities toward RTS could occur as one of the ARROW System Improvement Program alternatives.

Toton, Wotje Atoll

ARROW System Improvement Program

Target launch activities toward RTS could occur as one of the ARROW System Improvement Program alternatives.

3.0

AFFECTED ENVIRONMENT

3.0 AFFECTED ENVIRONMENT

This chapter describes the environmental characteristics that may be affected by the Proposed and Alternative Actions. The information provided serves as a baseline from which to identify and evaluate environmental changes resulting from flight testing the THAAD element in the Pacific region. To provide a baseline point of reference for understanding any potential impacts, the affected environment is briefly described; any components of greater concern are described in greater detail.

Available reference materials, including EAs, EISs, and base master plans, were reviewed. To fill data gaps (questions that could not be answered from the literature) and to verify and update available information, installation and facility personnel; federal, state, and local regulatory agencies; and private individuals were contacted.

Environmental Resources

Thirteen broad areas of environmental consideration were originally considered to provide a context for understanding the potential effects of the Proposed and Alternative Actions and to provide a basis for assessing the severity of potential impacts. These areas included air quality, airspace, biological resources, cultural resources, environmental justice, geology and soils, hazardous materials and waste, health and safety, infrastructure, land use, noise, socioeconomics, and water resources. The resource areas were analyzed as applicable for each proposed location or activity. This EA summarizes as appropriate the analyses of existing related environmental documentation listed in section 1.6.

3.1 PACIFIC MISSILE RANGE FACILITY

The main base portion of PMRF is located on the west side of the island of Kauai, approximately 222 kilometers (120 nautical miles) from Pearl Harbor. The majority of PMRF's facilities and equipment are at the main base, which occupies a land area of 779 hectares (1,925 acres) and lies south and adjacent to Polihale State Park.

3.1.1 AIR QUALITY—PACIFIC MISSILE RANGE FACILITY

Air quality in a given area is described by the concentrations of various pollutants in the atmosphere, expressed in units of parts per million or micrograms per cubic meter. The type and amount of pollutants emitted into the atmosphere, the size and topography of the air basin, and the meteorological conditions related to the prevailing climate determine pollutant concentrations. The significance of a pollutant concentration is determined by comparison with National Ambient Air Quality Standards (NAAQS) and local ambient air standards that establish limits on the maximum allowable concentrations of various pollutants to protect public health and welfare.

Region of Influence

Identifying the region of influence (ROI) for the air quality analysis requires the knowledge of the pollutant types, source emissions rates and release parameters, proximity relationships of project emission sources to other emission sources, and local and regional meteorological conditions. Most air pollutants are photochemically (chemical reactions initiated by sunlight) inert. This category includes all criteria pollutants other than ozone and its precursors. The ROI for inert pollutants is the area in which the pollutant is concentrated enough to have a measurable effect on ambient air quality. These pollutants are generally dispersed within a few kilometers (miles) of the source.

The second category of air pollutants consists of photochemically reactive pollutants. This category is restricted to ozone and its precursors (oxides of nitrogen and reactive organic gases). Due to photochemical reactivity, the major effects of the precursor emissions on ozone concentration may not be noticed for several hours after emission. Ozone concentrations tend to be regionally distributed because precursor emissions are homogeneously dispersed in the atmosphere. Therefore, the ROI for photochemically reactive pollutants is the regional area near the source. This is known as the geographic airshed.

For the air quality analysis, the overall ROI is the existing airshed surrounding the various sites, which encompasses the Mana Plain, including PMRF/Main Base and the ground hazard area restrictive easement. This ROI encompasses the effects of both the photochemically inert and reactive pollutants. For regulatory purposes, project emissions are compared to emissions generated in the appropriate region or county. Where emission summaries are not available, population density and local industrialization levels are used to characterize the levels of the criteria pollutants.

Affected Environment

Climate

PMRF, which is located just south of the Tropic of Cancer, has a mild and semitropical climate with scattered clouds and generally light and variable trade winds from the northeast. The mean annual temperature ranges from 21° to 26° Celsius (C) (70° to 78° Fahrenheit [F]); however, seasonal highs in the low 30s °C (90s °F) and seasonal lows in the mid 10s °C (50s °F) are not uncommon. Annual rainfall at PMRF is about 52 centimeters (20 inches). Approximately 75 percent of the rainfall occurs during the October through April wet season. Relative humidity is about 60 percent during the day in all seasons.

Regional Air Quality

The only sampling station on Kauai is located in Lihue and monitors for particulate matter 10 microns or less in diameter (PM-10). The State of Hawaii is in attainment of the NAAQS established for carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter, ozone, and lead (40 CFR 81.312 and 52.631(b)).

The major source of air pollution emissions external to, and not associated with, PMRF/Main Base is the seasonal burning of the cane fields east of the base. This burning produces periods of elevated smoke and ash. In addition, the smoke temporarily degrades visibility over an extended area.

Existing Emissions Sources

The main pollution sources at PMRF are diesel-fuel powered generators, aircraft, and rocket launches. PMRF was issued a Title V Covered Source Permit for five diesel generators, which covers all significant stationary emission sources on PMRF. Aircraft emissions and missile exhaust emissions are both considered mobile sources and are thus exempt from permitting requirements. (U.S. Department of the Navy, 1998)

3.1.2 AIRSPACE—PACIFIC MISSILE RANGE FACILITY

Airspace, while generally viewed as being unlimited, is finite in nature. It can be defined dimensionally by height, depth, width, and period of use (time). The FAA is charged with the overall management of airspace and has established criteria and limits for use of various sections of this airspace in accordance with procedures of the International Civil Aviation Organization (ICAO).

Region of Influence

The ROI for airspace includes the airspace over and surrounding PMRF. It includes the PMRF Operational Areas, the R-3101 Restricted Area, and surrounding airspace off the western and northwestern coast of Kauai (figure 3-1).

Affected Environment

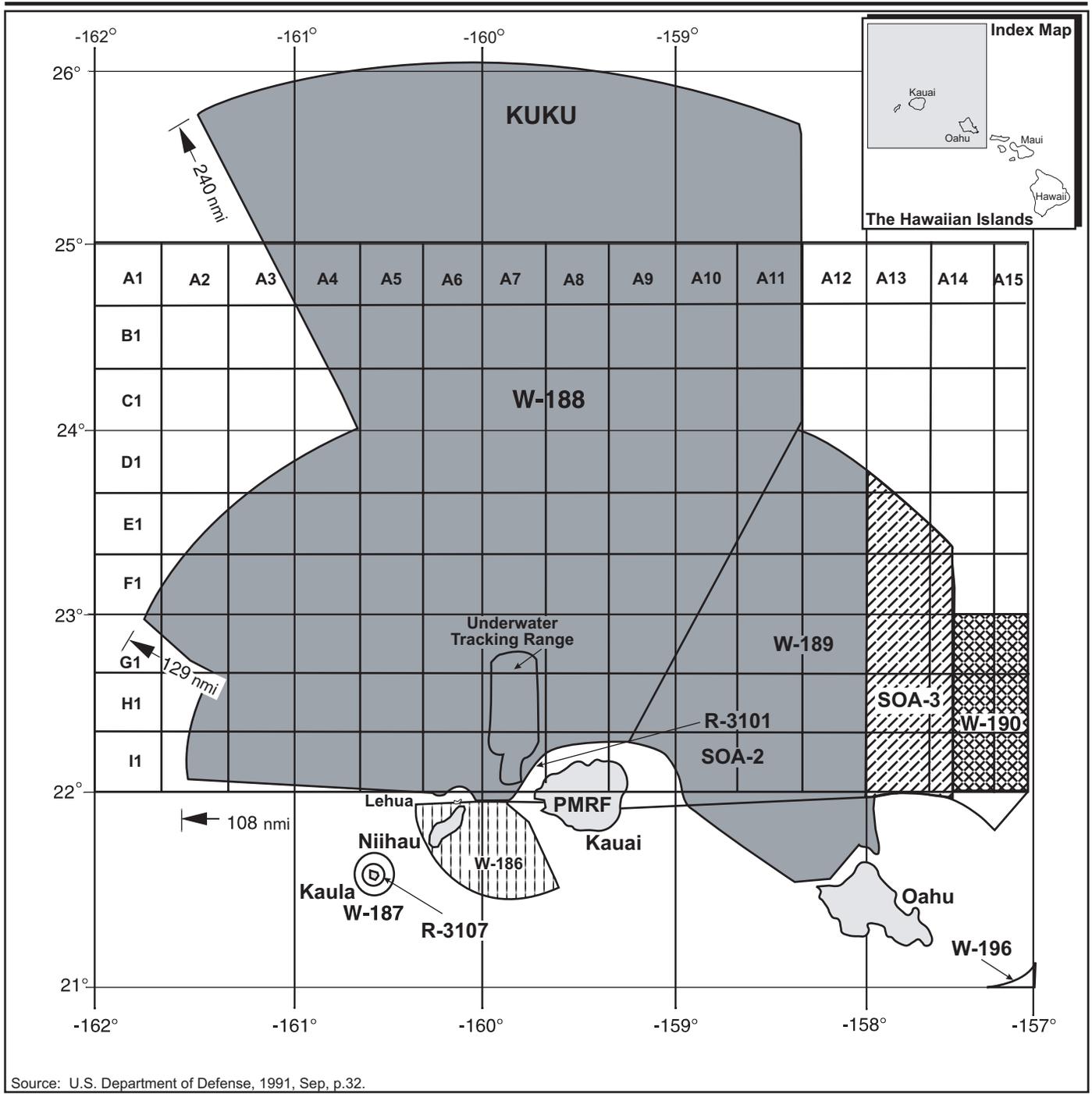
The PMRF airspace was discussed in detail in the PMRF Enhanced Capability EIS (U.S. Department of the Navy, 1998). The following paragraphs summarize pertinent data from the EIS, which is incorporated by reference.

Special Use Airspace

Restricted Areas are airspace segments within which the flight of nonparticipating aircraft, while not wholly prohibited, is subject to restriction. Restricted Area R-3101 has been established to provide the airspace required by PMRF to meet its primary missions (figures 3-1 and 3-2). Special use airspace in the PMRF ROI also includes portions of Warning Area W-188 north of Kauai and Warning Area W-186 southwest of Kauai. The FAA provides separation between non-participating aircraft and the missile flight test activities in the Temporary Operating Area (figure 3-3).

En Route Airways and Jet Routes

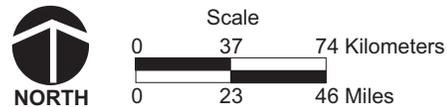
Although relatively remote from the majority of jet routes that crisscross the Pacific, the airspace ROI has two instrument flight rules, en route low-altitude airways used by commercial air traffic that pass through the ROI: V-15, which passes east-west through



Source: U.S. Department of Defense, 1991, Sep, p.32.

EXPLANATION

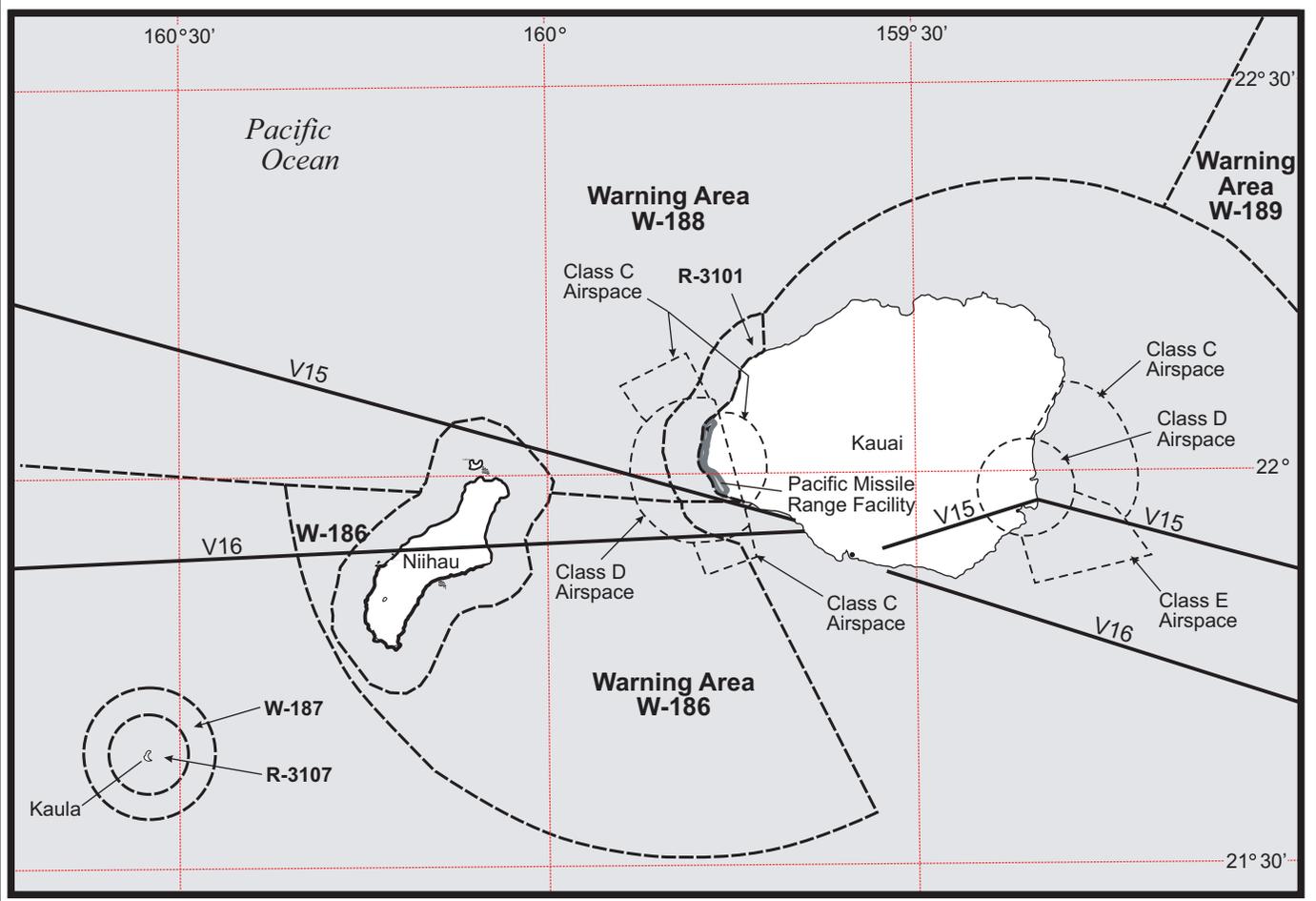
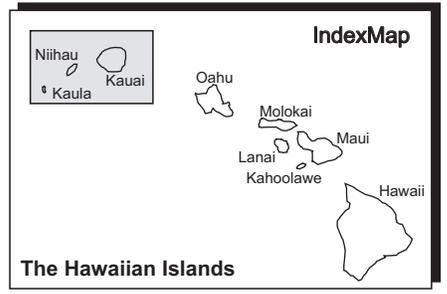
-  W-188/W-189/W-196
-  W-186
-  SOA-3
-  W-190
- PMRF = Pacific Missile Range Facility
- R = Restricted
- SOA = Special Operating Area
- W = Warning Area



Pacific Missile Range Facility Operational Areas

Open Ocean

Figure 3-1

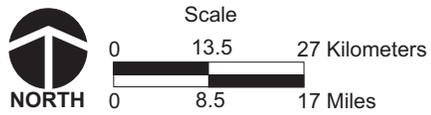


Source: National Ocean Service, 1997, Hawaiian Islands Sectional Aeronautical Chart, May 22.

EXPLANATION

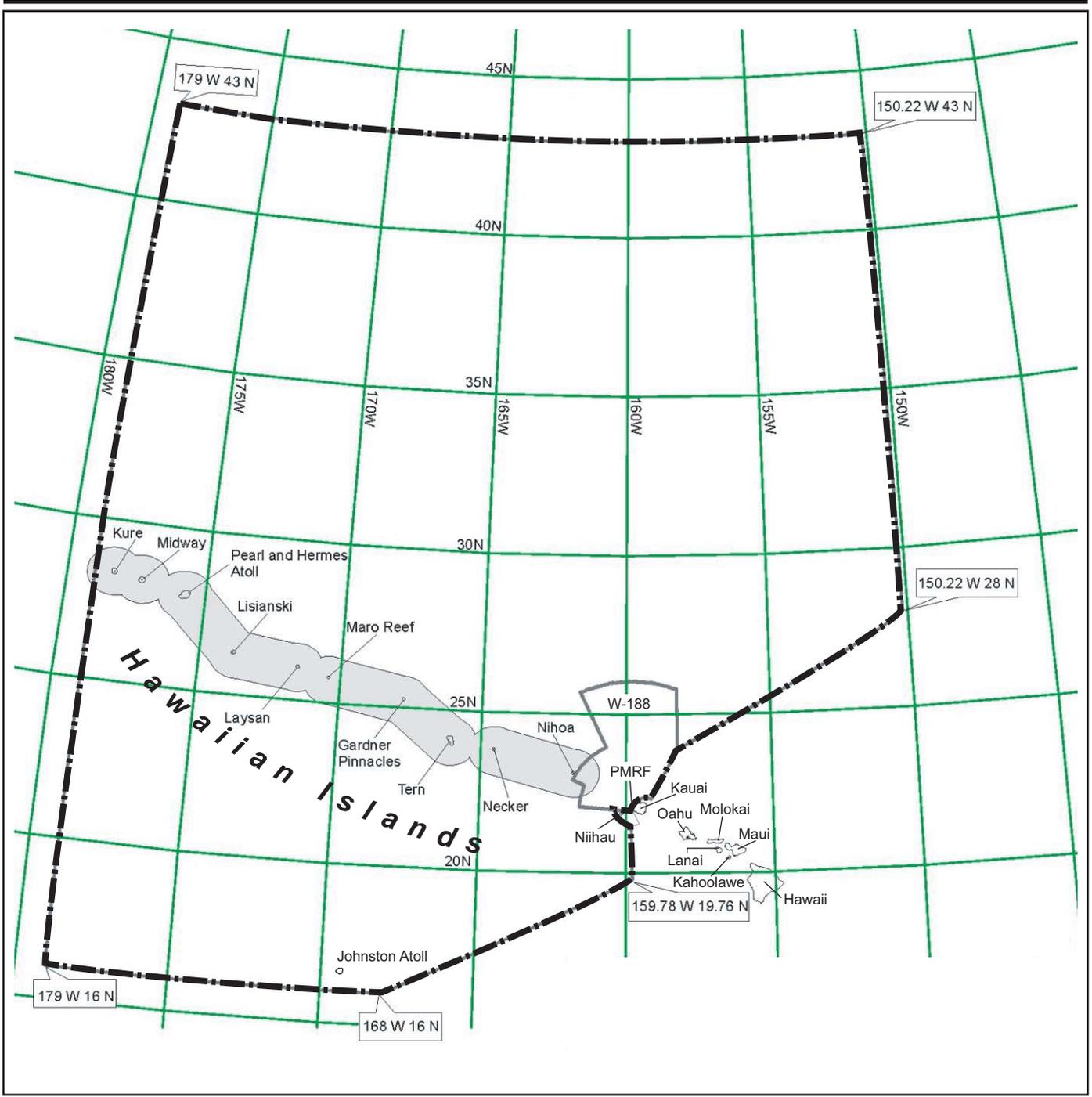
— En Route Low Altitude Airways

Airspace Use Region of Influence Immediately Surrounding Pacific Missile Range Facility/ Main Base



Hawaii

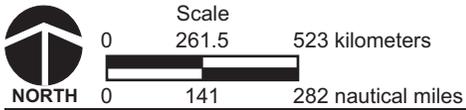
Figure 3-2



EXPLANATION

- PMRF = Pacific Missile Range Facility
- Temporary Operating Area
- Northwestern Hawaiian Island Coral Reef Ecosystem Reserve

Temporary Operating Area



Open Ocean

Figure 3-3

the southernmost part of the Warning Area W-188; and V-16, which passes east-west through the northern part of Warning Area W-186 (figure 3-2). A count of the number of flights using each airway is not maintained. The airspace ROI, located to the west and northwest of Kauai, is far removed from the low-altitude airway carrying commercial traffic among Kauai, Oahu, and the other Hawaiian Islands, all of which lie to the southeast of Kauai. The island helicopter sightseeing flights along the Na Pali coastline and over the Waimea Canyon do not fly into Restricted Area R-3101.

Airports/Airfields

There are no airports or airfields in the ROI with the exception of the airfield at PMRF-Barking Sands itself and the Kekaha airstrip approximately 5 kilometers (3 miles) to the southeast and 3 kilometers (2 miles) northwest of Kekaha. The standard instrument approach and departure procedure tracks for Kauai's principal airport at Lihue are all to the east and southeast of PMRF, well removed from the airspace use ROI.

Air Traffic/Range Control

A Letter of Agreement between the FAA and PMRF establishes use of the airspace by PMRF. By this agreement PMRF is required to notify the FAA by 1400 the day before range operations are going to infringe upon the designated airspace.

Range Control and the FAA are in real time direct communication to ensure safety of all aircraft using the airways and the Warning Areas. Within the Special Use Airspace, military activities in Warning Areas W-186 and W-188 are under PMRF control.

The Warning Areas are located in international airspace. Because they are in international airspace, the procedures of the ICAO are followed. The FAA acts as the U.S. agent for aeronautical information to the ICAO, and the Honolulu Air Route Traffic Control Center (ARTCC) manages air traffic in the ROI.

3.1.3 BIOLOGICAL RESOURCES—PACIFIC MISSILE RANGE FACILITY

Native or naturalized vegetation, wildlife, and the habitats in which they occur are collectively referred to as biological resources. Existing information on plant and animal species and habitat types in the vicinity of the proposed sites was reviewed, with special emphasis on the presence of any species listed as threatened or endangered by federal or state agencies, to assess their sensitivity to the effects of the Proposed Action. For the purpose of discussion, biological resources have been divided into the areas of vegetation, wildlife, threatened and endangered species, and environmentally sensitive habitat.

Region of Influence

The ROI for biological resources includes the area within and adjacent to the proposed launch, radar, and new building construction sites on PMRF that could potentially be affected by ground disturbance, noise, emissions, EMR, debris, explosions, and increased use of the proposed facilities as a result of site preparation and launch activities.

Affected Environment

Vegetation

The vegetation on PMRF/Main Base is composed of two principal habitat types: ruderal vegetation and non-native kiawe/koa haole scrub. Within PMRF/Main Base and the KTF area of the complex, ruderal vegetation is present where man has disturbed the natural vegetation, and much of this vegetation is mowed on a regular basis. The vegetation adjacent to PMRF/Main Base in the ground hazard area is dominated by sugar cane, ruderal vegetation, and wetlands associated with agricultural ponds and drains. Kiawe/koa haole scrub and ruderal vegetation are the dominant vegetation in the undeveloped portions of the PMRF/Main Base ROI. In the south-central part of PMRF/Main Base, mosaic-like patches of vegetation dominated by the indigenous hop bush species are present on a sandy substrate. Coastal dune vegetation covers much of the dunes north of KTF, and a well-developed native strand community exists along the shoreline.

Wildlife

Forty species of birds have been identified at PMRF/Main Base, including non-native and migratory birds and species endemic to Hawaii. The pueo (*Asio flammeus sandwichensis*) (Hawaiian short-eared owl) is a state listed endangered species. This owl is the only endemic non-migratory bird species that occurs in the region. Non-native bird species on Kauai are usually common field and urban birds such as the ring-necked pheasant. Several species of migratory waterfowl may be present during some portion of the year. The Laysan albatross, a migratory bird protected under the Migratory Bird Treaty Act, uses ruderal vegetation areas for courtship and nesting. PMRF has an ongoing feral dog-trapping program to protect the albatross as well as the wedge-tail shearwater and other birds on base. However, the Laysan albatross is being discouraged from nesting at PMRF/Main Base to prevent interaction between the species and aircraft using the runway. Albatross on the airfield are tagged and released on the north portion of the base or returnees are relocated to Kilauea National Wildlife Refuge in order to prevent bird/aircraft strikes. This action is being accomplished under a U.S. Fish and Wildlife Service permit. (U.S. Department of the Navy, 1998; U.S. Army Space and Missile Defense Command, 2001a)

Feral dogs and cats occur in the region and prey on native and introduced species of birds. Rodents including the Polynesian black rat, Norway or brown rat, and the house mouse are also known to occur in the region. (U.S. Department of the Navy, 1998; U.S. Army Space and Missile Defense Command, 2001a)

The Magnuson–Stevens Fishery Conservation and Management Act requires that federal agencies consult with the National Marine Fisheries Service on activities that could harm Essential Fish Habitat areas. Essential Fish Habitat refers to “those waters and substrate (sediment, hard bottom) necessary to fish for spawning, breeding, feeding or growth to maturity.” Essential Fish Habitat occurs and is incorporated within Kauai’s Exclusive Economic Zone, the 322-kilometer (200-mile) limit around the island.

Essential Fish Habitat for adult and juvenile bottomfish includes the water column and all bottom habitat extending from the shoreline to a depth of 400 meters (219 fathoms), which encompasses important steep drop-offs and high relief habitats. Shallow-water (0 to 100 meters [0 to 328 feet]) bottomfish species include uku, thicklip trevallies, groupers, emperors, amberjack, and taape. Deep-water (100 to 400 meters [328 to 1,312 feet]) species include ehu, onaga, opapaka, gindai, hapupuu, and lehi. (Western Pacific Fishery Management Council, 1998)

Pelagic habitat areas of particular concern are designated as the water column down to 1,000 meters (3,280 feet) from the shoreline to the Exclusive Economic Zone that lies above all seamounts and banks shallower than 2,000 meters (1,100 fathoms). Marketable pelagic species include striped marlin, bluefin tuna, swordfish, albacore, mackerel, skipjack, sailfish, kawakawa, and various sharks. (Western Pacific Fishery Management Council, 1998)

Banks with summits less than 30 meters (98 feet) have been designated as habitat areas of particular concern for crustaceans. Crustacean species include spiny lobster, slipper lobsters, and Kona crabs. (Western Pacific Fishery Management Council, 1998)

Threatened and Endangered Species

Table 3-1 lists threatened and endangered species that could potentially be located within the ROI.

Two federally listed plant species have been observed north of, but not on, PMRF. Ohai (*Sesbania tomentosa*), a spreading shrub, is a federally endangered species that has been observed in the sand dunes to the north of the KTF launch complex in Polihale State Park and could potentially occur on PMRF/Main Base. Lau'ehu (*Panicum niihauense*), a federally endangered species of rare grass, has been observed near Queens Pond north of PMRF/Main Base.

Six species of birds that are listed as federally threatened or endangered are potentially present or confirmed in the PMRF area. Kauai provides the majority of Hawaii's habitat for the federally threatened Newell's Townsend's shearwater (*Puffinus auricularis newelli*). The Newell's shearwater nests from April to November in the interior mountains of Kauai. Nestlings leave the nesting grounds at night in October and November and head for the open ocean. They may become temporarily blinded by lights when flying near brightly lit urban areas or street lights and some may collide with trees, utility lines and light poles, buildings, and automobiles. The most critical period for these collisions is 1 week before and 1 week after the new moon in October and November.

The Hawaiian dark-rumped petrel (*Pterodroma phaeopygia sandwichensis*), which is listed as federally endangered, arrives in February and may traverse the area from its nesting grounds to the sea. Nesting occurs from April through May. Fledging occurs in October, slightly earlier than that of the Newell's Townsend's shearwater.

**Table 3-1: Listed Species Known or Expected to Occur
in the Vicinity of the Proposed Action**

Scientific Name	Common Name (Location)	Status	
		State	Federal
Reptiles			
<i>Caretta caretta</i>	Loggerhead sea turtle (PMRF, RTS, Wake)	E	T
<i>Chelonia mydas</i>	Green sea turtle (PMRF, RTS, Wake, Bigen, Toton,)	E	T
<i>Dermochelys coriacea</i>	Leatherback sea turtle (PMRF, RTS, Wake)	E	E
<i>Eretmochelys imbricata</i>	Hawksbill sea turtle (PMRF, RTS, Wake, Bigen, Toton)	E	E
<i>Lepidochelys olivacea</i>	Olive ridley (PMRF, RTS)	E	T
Birds			
<i>Anas wyvilliana</i>	Hawaiian duck (PMRF)	E	E
<i>Fulica americana alai</i>	Hawaiian (American) coot (PMRF)	E	E
<i>Gallinula chloropus sandvicensis</i>	Hawaiian common moorhen (PMRF)	E	E
<i>Himantopus mexicanus knudseni</i>	Hawaiian black-necked stilt (PMRF)	E	E
<i>Pterodroma phaeopygia sandwichensis</i>	Hawaiian dark-rumped petrel (PMRF)	E	E
<i>Puffinus auricularis newelli</i>	Newell's Townsend's shearwater (PMRF)	E	T
Mammals			
<i>Balaenoptera borealis</i>	Sei whale (Open Ocean)	E	E
<i>Balaenoptera musculus</i>	Blue whale (Open Ocean)	E	E
<i>Balaenoptera physalus</i>	Fin whale (Open Ocean)	E	E
<i>Lasiurus cinereus</i> spp. <i>semotus</i>	Hawaiian hoary bat (PMRF)	E	E
<i>Megaptera novaeangliae</i>	Humpback whale (Open Ocean)	E	E
<i>Monachus schauinslandi</i>	Hawaiian monk seal (PMRF)	E	E
<i>Physeter macrocephalus</i>	Sperm whale (Open Ocean)	E	E
Plants			
<i>Panicum niihauense</i>	Lau'ehu (PMRF)	E	E
<i>Sesbania tomentosa</i>	Ohai (PMRF)	E	E

NOTES:

- Not listed
- T Threatened
- E Endangered
- PMRF = Pacific Missile Range Facility
- RTS = Ronald Reagan Ballistic Missile Test Site, U.S. Army Kwajalein Atoll

The Hawaiian (American) coot (*Fulica americana alai*), Hawaiian black-necked stilt (*Himantopus mexicanus knudseni*), Hawaiian common moorhen (*Gallinula chloropus sandvicensis*), and Hawaiian duck (*Anas wyvilliana*) are federal and state endangered birds that have been observed in the drainage ditches and ponds on PMRF. The Hawaiian coot, black-necked stilt, and common moorhen are non-migratory species, which nest year round, May through September, and April through October respectively.

The Hawaiian hoary bat (*Lasiurus cinereus semotus*) is listed as a federal and state endangered species. While it has not been recorded as flying over PMRF, it is known to feed offshore and has been observed at the Polihale State Park north of the base. It is likely that the bat also flies over PMRF.

Three marine wildlife species listed as federal and state threatened or endangered commonly occur in the area. The endangered Hawaiian monk seal (*Monachus schauinslandi*) is an indigenous mammal that has been observed at PMRF. The first Hawaiian monk seal birth observed on a Kauai beach since 1993 occurred on PMRF in 1999 (Pacific Missile Range Facility, 1999). Only four other Hawaiian monk seal births had been recorded on Kauai since 1961 (Navy Environmental News, 1999). Pups are usually born between March and June. The fact that humans frequent all beaches on PMRF may generally discourage use by monk seals.

The federal threatened and state endangered green sea turtle (*Chelonia mydas*) basks and nests on PMRF adjacent to the Nohili Ditch. Reproduction of the Hawaiian population occurs mainly in the Northwest Hawaiian Islands. Ninety percent of the green sea turtle population returns to French Frigate Shoals in late spring to breed (National Oceanic and Atmospheric Administration, 2002). Adults return to the main Hawaiian Islands in late summer to early fall. Nesting occurs on sandy beaches above the high tide mark. In 1990, 15 green sea turtles were observed in an elongated depression within an area of caves and undercuts offshore of Nohili Ditch. Four were observed during preparation of the PMRF Integrated Natural Resources Management Plan. In 1989, nine turtles were observed foraging within 50 meters (164 feet) of either side of the ditch discharge. In 1999, two green sea turtle nests were documented that produced 38 hatchlings. The PMRF Natural Resources Manager monitors sea turtle nests and maintains records on all nesting activity at Barking Sands. Security patrols reports include a record of the presence and locations of turtles and turtle nesting sites. This data is evaluated for any necessary changes or improvements that may be required to continue protection of the species. (Pacific Missile Range Facility, 2001)

The federal and state endangered migratory humpback whale (*Megaptera novaeangliae*) is known to use the channel between Kauai and Niihau. Approximately two-thirds of the North Pacific population of humpback whales winter in Hawaii, with the greatest influx occurring in February.

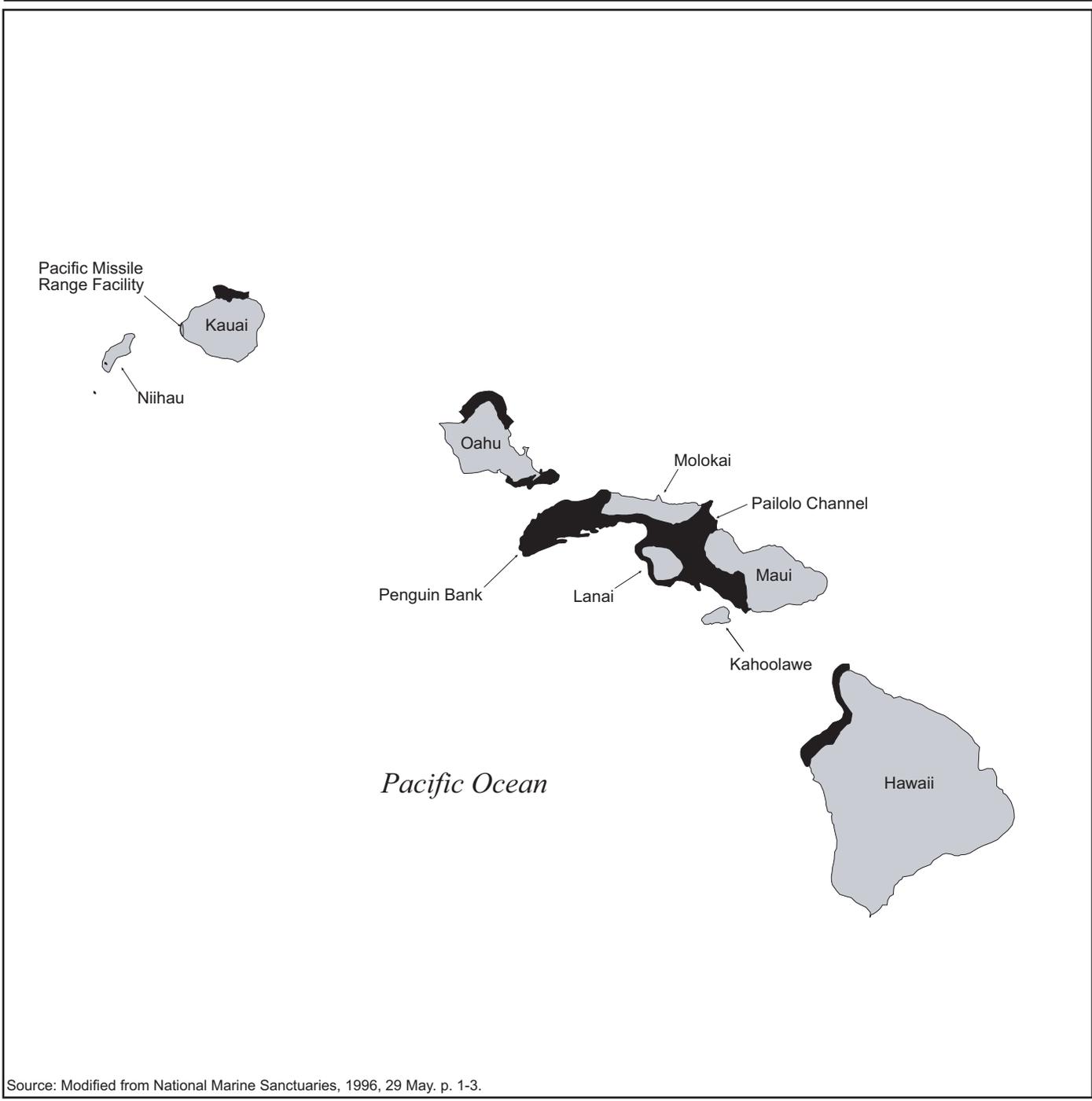
Environmentally Sensitive Habitat

Wetlands

Wetlands are associated with the Mana base pond, Kawaele wildlife sanctuaries (a new State Waterbird Refuge for Hawaii's four endangered waterbird species, created at Mana during a sand removal program), and agricultural drains (Nohili and Kawaele ditches) within PMRF/Main Base.

Hawaiian Islands Humpback Whale National Marine Sanctuary

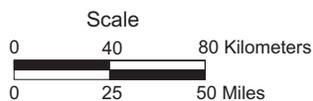
The Hawaiian Islands Humpback Whale National Marine Sanctuary was created by Congress in 1992 (figure 3-4). Humpback whales are endangered marine mammals and are therefore



EXPLANATION

-  State of Hawaii's Areas for Inclusion in Sanctuary Boundary, 1997 (defined as within the 100 fathom isobath)
-  Land Area

**Hawaiian Islands
Humpback Whale
National Marine
Sanctuary Boundary**



Hawaiian Islands

Figure 3-4

protected under provisions of the Endangered Species Act and the Marine Mammal Protection Act wherever they are found. Humpbacks are seen in the winter months in the shallow waters surrounding the Hawaiian Islands where they congregate to mate and calve. The humpback population is growing by an average of 7 percent annually. That means their numbers, which stand at about 5,000, would double in approximately 13 years. The whales travel more than 5,633 kilometers (3,500 miles) from Alaska to Hawaii's warm waters to mate, give birth, and care for their calves. The estimated 5,000 whales span more than a half-million square kilometers (quarter-million square miles) of ocean surrounding Hawaii. The first whales of the season usually arrive around October, with the greatest number seen around Hawaii between 1 December and 15 May. (Mobley, 2002)

Submerged Barrier Reef Offshore of PMRF

A submerged barrier reef, roughly 13 kilometers (8 miles) long, lies offshore of PMRF. Coral density is low and is dominated by *Porites lobata* and small stands of arborescent (branched or tree shaped) corals.

Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve

Executive Order 13178, *Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve*, created the Reserve. Executive Order 13196, *Final Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve*, amended Executive Order 13178 by finalizing several of its provisions. The principal purpose of the Reserve is the long-term conservation and protection of the coral reef ecosystem and related marine resources and species of the Northwestern Hawaiian Islands in their natural character.

The Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve lies to the northwest of the main islands of the Hawaiian chain. The Reserve includes submerged lands and waters of the Northwestern Hawaiian Islands, extending approximately 2,220 kilometers (1,200 nautical miles) long and 185 kilometers (100 nautical miles) wide. The Reserve is adjacent to and seaward of the seaward boundaries of the State of Hawaii and the Midway Atoll National Wildlife Refuge, and overlays the Hawaiian Islands National Wildlife Refuge to the extent that it extends beyond the seaward boundaries of the State of Hawaii. The seaward boundary of the Reserve is 93 kilometers (50 nautical miles) from the approximate center geographical positions of Nihoa Island, Necker Island, French Frigate Shoals, Gardner Pinnacles, Maro Reef, Laysan Island, Lisianski Island, Pearl and Hermes Reef, Midway Atoll, and Kure Island. Where the areas are not contiguous, parallel lines drawn tangent to and connecting those semi-circles of the 93-kilometer (50-nautical mile) areas that lie around such areas delimit the remainder of the Reserve.

Hawaiian Islands National Wildlife Refuge

The Hawaiian Islands National Wildlife Refuge was designated by President Theodore Roosevelt in 1909. It consists of a chain of islands, atolls, and reefs extending approximately 1,287 kilometers (800 miles) in a northwest direction from the main Hawaiian Islands. The refuge consists of Nihoa, Necker, French Frigate Shoals, Gardner Pinnacles, Maro Reef, Laysan, Lisianski, and Pearl and Hermes Reef. Millions of seabirds,

such as the sooty tern and albatross, live within the refuge, which also provides a rich habitat for marine life. (U.S. Fish and Wildlife Service, Pacific Islands, 2002)

Midway Atoll National Wildlife Refuge

Midway Atoll National Wildlife Refuge was established in 1988 to allow the U.S. Fish and Wildlife Service to assist the U.S. Navy in managing the atoll's wildlife and resources. Midway has the world's largest Laysan albatross colony and the second largest colony of black-footed albatross. Midway's only native marine mammal is the Hawaiian monk seal. Green sea turtles are frequently observed within the refuge. (U.S. Fish and Wildlife Service, Pacific Islands, 2002)

Critical Habitat

Critical habitat is the term used in the Endangered Species Act to define those areas of habitat that are known to be essential for an endangered or threatened species to recover and that require special management protection. A proposed rule to designate critical habitat for 76 listed plant species on the islands of Kauai and Niihau was published in the *Federal Register* in November 2000. This proposed rule included land in the northwestern end of PMRF near Polihale Park as critical habitat for the endangered Ohai and Lau'ehu. In January 2002, the U.S. Fish and Wildlife Service proposed critical habitat for additional plant species on Kauai and Niihau, revising the total number of plants to 83, which includes additional land in the southern portion of PMRF for protection of Lau'ehu. The U.S. Fish and Wildlife Service evaluated the dune habitat on PMRF and determined that it was not essential for the conservation of Ohai. The U.S. Fish and Wildlife Service may exclude some of the PMRF lands based on consideration of conflicting present or projected land uses and habitat factors. (U.S. Fish and Wildlife Service, Pacific Region, 2002; *Federal Register*, 2002).

3.1.4 CULTURAL RESOURCES—PACIFIC MISSILE RANGE FACILITY

Cultural resources include prehistoric and historic sites, structures, districts, artifacts, or any other physical evidence of human activity considered important to a culture, subculture, or community for scientific, traditional, religious, or other reason. For ease of discussion, cultural resources have been divided into archaeological resources (prehistoric and historic), historic buildings and structures, and native populations/traditional resources (e.g., Native Hawaiian sacred or ceremonial sites).

Numerous laws and regulations require that possible effects to cultural resources be considered during the planning and execution of federal undertakings. These laws and regulations stipulate a process of compliance, define the responsibilities of the federal agency proposing the action, and prescribe the relationship among other involved agencies (e.g., State Historic Preservation Officer, the Advisory Council on Historic Preservation). In addition to NEPA, the primary laws that pertain to the treatment of cultural resources during environmental analysis are the National Historic Preservation Act (especially Sections 106 and 110), the Archaeological Resources Protection Act, the Antiquities Act of 1906, and the Native American Graves Protection and Repatriation Act.

Region of Influence

The term ROI is synonymous with the area of potential effect as defined under cultural resources regulations (36 CFR 800.16(d)). In general, the ROI for cultural resources encompasses areas requiring ground disturbance (e.g., areas of new facility or utility construction) and all buildings or structures requiring modification, renovation, demolition, or abandonment.

Affected Environment

Prehistoric and Historic Archaeological Resources

PMRF is located within an archaeologically and ethnographically sensitive region of Kauai known as Mana. The Nohili Dune area on the northern portion of PMRF has been specifically cited in recorded Hawaiian oral literature as a burial area. Traditional Hawaiian mortuary practices indicate that human burials may be present in all sandy, coastal beach areas such as those at PMRF. Throughout prehistory, large areas of the Mana Plain were covered by the great Mana swamp and large inland lakes, which allowed natives from the village of Mana to canoe as far south as Waimea. It is believed that these wet conditions encouraged the independent invention of aquaculture on Kauai. After the arrival of Europeans to the island, aquaculture transitioned to agriculture through the eventual draining of the swamp and the cultivation of sugar cane and rice. The first successful sugar plantation to export from the islands was established at Koloa in 1835, and by the 1930s, nearly all of the Mana swamp had been filled to produce this crop. (U.S. Department of the Navy, 1998)

Except for the historic cemeteries, all archaeological resources at PMRF are located within the shoreline dune system that forms the installation's western border. Currently documented sites extend from Barking Sands in the northern portion of the facility to Waiokapua Bay in the south, indicating that the dune zone was used in the pre-contact period for burial interment and for seasonal habitation. Based on evidence provided by the number of burials along the PMRF coastline, the dune zone at the facility has the potential to contain significant cultural resources throughout its north to south extension on the base. Inland from the dune area, archaeological evidence indicates the presence of distinct cultural resources. The potential exists for the presence of other similar small, unmarked plantation period cemeteries in the interior area of PMRF. The two zones, which constitute the coastal portion of the installations property, contain distinct cultural resources, and both zones should be considered as archaeologically sensitive areas. (U.S. Department of the Navy, 1998)

Historic Buildings and Structures

Military use of the area known as PMRF began in 1940 when the U.S. Army acquired a pre-existing grass airstrip. Thirty-nine historic period resources were identified at PMRF; 35 of these are associated with World War II base construction. Four resources date from the late 19th or early 20th centuries. These include the Kawaiete Drain, a Japanese cemetery, another set of unmarked historic burials, and the Waterfront Operations Building used by PMRF at Port Allen. This building dates to 1931 and is owned by the State of Hawaii and leased by PMRF. These 4 resources and another 16 World War II structures

are potentially eligible for the National Register. Nineteen other World War II structures are not considered eligible for the National Register due to their loss of integrity. While some commonplace infrastructure items and paved areas within PMRF are known to date to World War II, these facilities appear to have been replaced or paved over and can no longer be considered as historic resources. (U.S. Department of the Navy, 1998)

Native Populations/Traditional Resources

Traditional resources can include archaeological sites, burial sites, ceremonial areas, caves, mountains, water sources, plant habitat or gathering areas, or any other natural area important to a culture for religious or heritage reasons. Significant traditional sites are subject to the same regulations, and afforded the same protection as other types of historic properties. By their nature, traditional resources sites often overlap with (or are components of) archaeological sites. As such, some of the recorded and unrecorded sites identified within the ROI could also be considered traditional sites or contain traditional resources elements. (U.S. Department of the Navy, 1998)

Within the ROI, all of the traditional cultural materials identified to date have been associated with native Hawaiians; however, a Japanese cemetery and other historical burials are located within the boundary of PMRF. The Nohili Dune has been determined to be a site eligible for the National Register as a traditional cultural property. (U.S. Department of the Navy, 1998)

The Nohili Ditch is located on the Mana Plain in the northern part of PMRF near the proposed THAAD launch site. It is believed that many native Hawaiians have buried their dead here (Hawaiian.net, 2002). A number of archaeological surveys have been performed on and near the Nohili Ditch. These surveys have revealed finds such as middens, possible fire pits, and human remains. (State of Hawaii Department of Land and Natural Resources, 1994) An archaeological survey of the area near the proposed location for the THAAD launch site concluded that significant cultural deposits associated with Site 50-30-05-1829 extend from the coastal dune to the western boundary of the proposed launch site and at least 5 meters (16 feet) into the present project site. (Naval Facilities Engineering Command, Pacific Division, 2002)

3.1.5 GEOLOGY AND SOILS—PACIFIC MISSILE RANGE FACILITY

Geology and soils include those aspects of the natural environment related to the earth, which may affect or be affected by the Proposed Action. These features include physiography, geologic units and their structure, the presence or availability of mineral resources, soil condition and capabilities, and the potential for natural hazards.

Region of Influence

The ROI encompasses the geology and soils contained within the boundaries of PMRF, specifically those aspects of the natural environment related to the earth that may be directly disturbed by the Proposed Action.

Affected Environment

Geology

PMRF/Main Base's boundaries lies within a low-lying coastal terrace called the Mana Plain. The plain covers the western flank of the island forming gentle westerly slopes ranging from about 2 percent near the volcanic uplands, to relatively flat over the coastal margins and shorelines occupied by PMRF (U.S. Department of the Navy, 2000). Local relief consists of undulating blanket sands, low beach barrier dunes, and the more prominent Nohili Dune located in the base's northern portion. Elevations over the facility average between 3.0 meters (10 feet) and 6.1 meters (20 feet) above sea level and vary from sea level along the coast to 30.4 meters (100 feet) above sea level at Nohili Dune. (U.S. Department of the Navy, 2000)

Soils

The U.S. Department of Agriculture Soil Conservation Service published a soil survey that includes the surficial deposits of the Mana Plain (PMRF and Easement areas). The area contains some alluvium lagoon deposits, calcareous beach, and dune sands. The dominant soil within the PMRF area has been mapped as Jaucas loamy fine sand, 0 to 8 percent slopes. In some cases it is more than 1.5 meters (5 feet) thick. The sand is neutral to moderately alkaline through its profile. It has an available water capacity of 0.1 to 0.2 centimeter/meter (0.05 to 0.07 inch/foot) of soil. The soils are permeable, and infiltration is rapid. Wind erosion is severe when vegetation has been removed. Lands within the PMRF-Main Base are not designated as agricultural land. (U.S. Army Strategic Defense Command, 1992)

Active sand dunes and beaches exist along the ocean margins of PMRF. Dune lands consist of hills and ridges of sand drifted and piled by the wind. No soil horizons have developed for these areas because the hills and ridges are actively shifting. The sand is primarily calcareous, derived from coral and seashells (U.S. Army Strategic Defense Command, 1992).

3.1.6 HAZARDOUS MATERIALS AND WASTE—PACIFIC MISSILE RANGE FACILITY

Hazardous materials and hazardous waste management activities at PMRF are governed by specific environmental regulations. For the purposes of the following analysis, the terms hazardous material or hazardous waste will mean those substances defined by both federal and state regulations. In general, this includes substances that, because of their quantity, concentration, or physical, chemical, or infectious characteristics, may present substantial danger to public health or welfare or the environment when released into the environment.

Several regulatory agencies (e.g., the U.S. Environmental Protection Agency [EPA] and the DOT) have promulgated differing definitions of a hazardous material as applied to a specific situation. Of these definitions, the broadest and most applicable is the definition specified by the DOT for regulation of the transportation of these materials. As defined by the DOT, a hazardous material is a substance or material that is capable of posing an unreasonable

risk to health, safety, or property when transported in commerce and has been so designated (*Federal Hazardous Materials Regulations*, 49 CFR 171.8).

Waste materials are defined in 40 CFR 261.2, *Protection of Environment: Identification and Listing of Hazardous Waste, Definition of Solid Waste*, as "any discarded material (i.e., abandoned, recycled, or 'inherently waste-like')" that is not specifically excluded. This waste can include materials that are both solid and liquid (but contained). Hazardous waste is further defined in 40 CFR 261.3 (*Definition of Hazardous Waste*) as any solid waste not specifically excluded, which meets specified concentrations of chemical constituents or has certain toxicity, ignitability, corrosivity, or reactivity characteristics.

Region of Influence

The ROI for potential impacts related to hazardous materials/wastes would be limited to PMRF property boundaries and those areas that could be affected by a release of a hazardous substance from THAAD and Terminal Missile Defense related launch activities.

Affected Environment

Hazardous Materials Management

PMRF manages hazardous materials through the U.S. Navy's Consolidated Hazardous Materials Reutilization and Inventory Management Program, which mandates procedures to control, track, and reduce the variety and quantities of hazardous materials in use at facilities. All departments, tenant commands, and work centers must order hazardous materials from Hazardous Materials Minimization Centers (inventory controllers for U.S. Navy facilities), where all such transactions are recorded and tracked. The operations and maintenance contractor manages hazardous materials on PMRF. Typical materials used on PMRF/Main Base and stored at Building 338 include cleaning agents, solvents, and lubricating oils. (U.S. Department of the Navy, 1998)

PMRF has management plans for hazardous materials outlined in its Spill Prevention Control and Countermeasures Plan and Oil/Hazardous Substance Spill Contingency Plan, both of which also regulate tenant organizations and associated range sites. These plans provide guidance on handling any emergency that may arise from activities conducted at PMRF and supporting sites. The Integrated Contingency Plan, Commander Navy Region Hawaii dictates how situations at sea involving petroleum, oils, and lubricants spills are handled in order to prevent environmental contamination. This plan specifies how cleanup is to be performed and procedures to be followed concerning agency notification. (U.S. Department of the Navy, 1998)

Operations at PMRF involve the use of numerous hazardous materials. Historically, the bulk of these hazardous materials have been rocket fuels and propellants. Other hazardous materials include cleaning solvents used for equipment maintenance and small amounts of pesticides. The propellants described in this document would be handled following standard PMRF procedures. (U.S. Department of the Navy, 1998)

Hazardous Waste Management

PMRF/Main Base is a large-quantity generator with an EPA generator identification number. Hazardous waste on PMRF is not stored beyond the 90-day collection period. Hazardous wastes generated on PMRF/Main Base include contaminated soil, batteries, asbestos, gasoline, paint, methanol, sand blast material, and otto (torpedo) fuels.

PMRF/Main Base has two accumulation points on base for hazardous wastes: Building 392 and Building 419. Building 392 accumulates all base waste except for otto fuel, a liquid monopropellant. Building 419 is the torpedo repair shop. At present, both buildings are not used at their maximum hazardous waste storage capacity. KTF has one accumulation point. (U.S. Department of the Navy, 1998) The majority of wastes are collected and containerized at PMRF/Main Base for direct offsite disposal through the Defense Reutilization and Marketing Office at Pearl Harbor within 90 days. (U.S. Army Strategic Defense Command, 1992) The Defense Reutilization and Marketing Office provides for the transportation and disposal of the wastes to the final disposal facility. (U.S. Department of the Navy, 1998)

There are currently 16 Installation Restoration Program sites on PMRF. The two fire fighting training pits, battery acid disposal pit, and torpedo post run facility require no further action based on the results of past investigations and decision documents prepared and approved by State of Hawaii, Department of Health. Three former oil change pits and a battery acid neutralization unit are currently being investigated. Three landfills, a tanker truck pod facility, former missile (Regulus) defueling pit, and former oil/fuel pipelines are scheduled to be investigated. Investigation at a reclamite asphalt rejuvenator burial area and various transformer sites (4 each) has been completed and is awaiting Department of Health concurrence for no further action. (Navy Region Hawaii, 2002)

PMRF's Hazardous Waste Management Plan provides for the requisition, inventory, substitution, reduction, and disposition of hazardous substances. The Plan provides guidance for the storage to ensure segregation for compatibility and management of inventory to comply with shelf-life and expiration dates and minimize waste. The usage, spill prevention and spill response are addressed in the Plan. Additionally, waste minimization is accomplished through source reduction and recycling. The Hazardous Waste Management Plan identifies responsible persons and provides for training. The Plan includes requirements for packaging and labeling, periodic inspections, inventory control, and tracking. PMRF also has a formal hazardous material and used oil recycling program and a used solvent elimination program. (U.S. Department of the Navy, 1998)

3.1.7 HEALTH AND SAFETY—PACIFIC MISSILE RANGE FACILITY

Health and safety includes consideration of any activities, occurrences, or operations that have the potential to affect one or more of the following:

- **The well-being, safety, or health of workers**—Workers are considered to be persons directly involved with the operation producing the effect or who are physically present at the operational site.
- **The well-being, safety, or health of members of the public**—Members of the public are considered to be persons not physically present at the location of the operation, including the off-base population and workers at nearby locations who are not involved in the operation. Also included within this category are hazards to equipment, structures, vegetation, and wildlife.

Region of Influence

The ROI for health and safety of workers includes the immediate work areas, radiation hazard areas, the launch site, and the flight debris corridor. The ROI for public safety includes PMRF and any bordering areas that may be affected by proposed activities.

Affected Environment

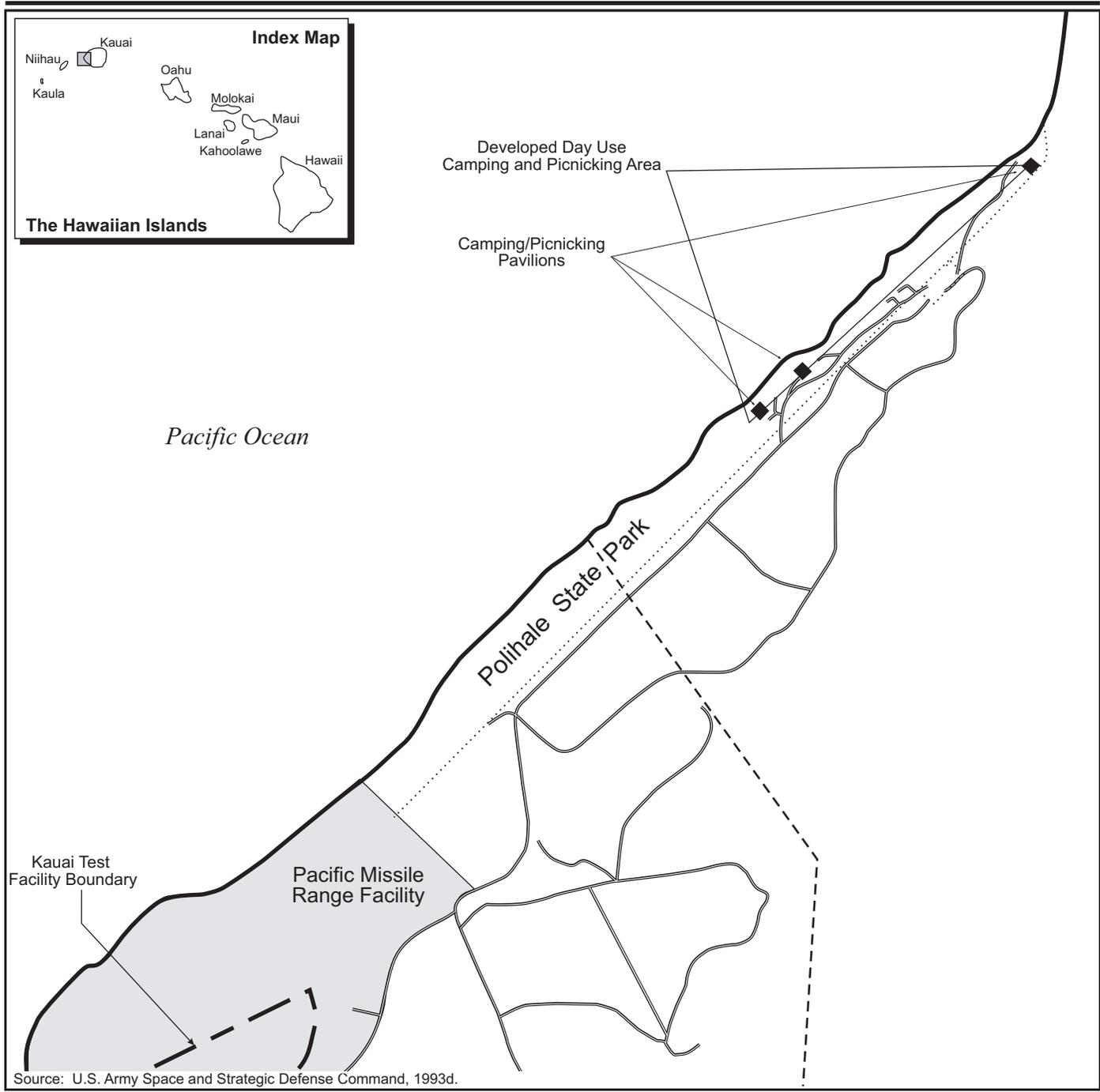
The U.S. Navy takes every reasonable precaution during the planning and execution of operations and test and development activities to prevent injury to human life or property.

Figure 3-5 shows the boundaries of Polihale State Park north of PMRF. Figure 3-6 provides the azimuth limits for launches from PMRF. PMRF has severely restricted public access since September 2001 for security reasons. The potential for future public access to the installation's beaches, when not used during military operations, will continue to be evaluated. (U.S. Department of the Navy, 2002)

Range Safety

Range Control is in charge of surveillance, clearance, and real-time range safety. Range Safety Approval and Range Safety Operation Plan documents are required for all weapons systems using PMRF. PMRF sets requirements for minimally acceptable risk criteria to occupational and non-occupational personnel, test facilities, and non-military assets during range operations.

PMRF conducts missile flight safety in accordance with Naval Air Warfare Center Weapons Division Instruction 5100.2, which includes analysis of missile performance capabilities and limitations, of hazards inherent in missile operations and destruct systems, and of the electronic characteristics of missiles and instrumentation. It also includes computation and review of missile trajectories and hazard area dimensions, review and approval of destruct systems proposals, and preparation of the Range Safety Approval and Range Safety Operational Plans required of all programs at PMRF. These plans are prepared by PMRF, for each program and must be in place prior to project initiation.



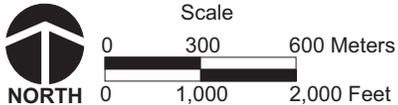
EXPLANATION

- Restrictive Easement Boundary
- Polihale State Park Boundary
- — — — — Kauai Test Facility

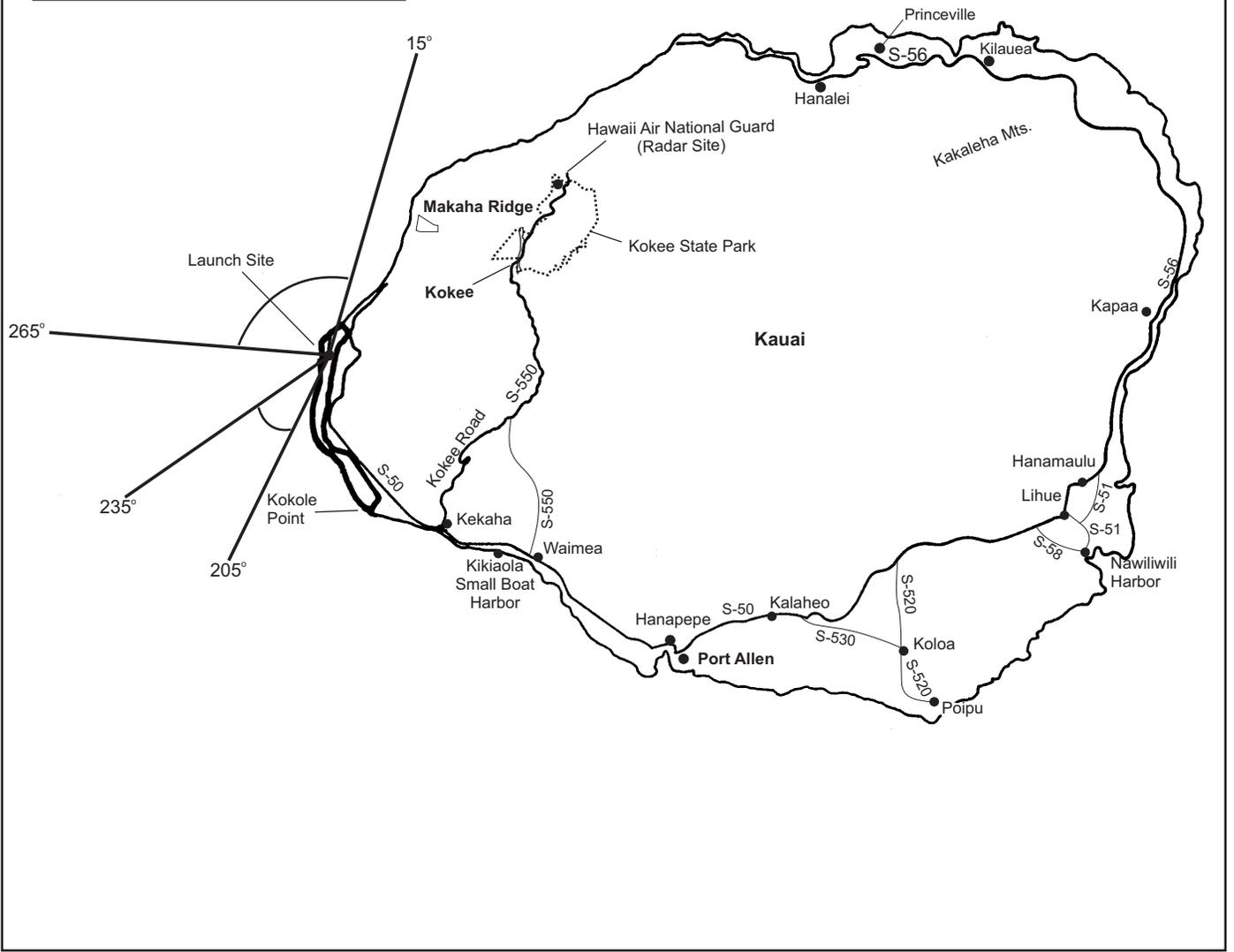
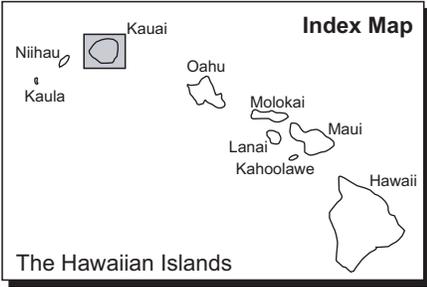
Polihale State Park

Kauai, Hawaii

Figure 3-5

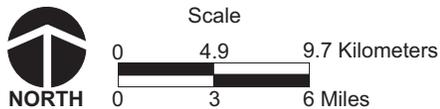


10-30-02 Polihale Park



- EXPLANATION**
- Pacific Missile Range Facility Boundary
 - Flight Corridor Azimuth Limits
 - Kokee State Park Boundary

**Kauai Test Facility
Flight Corridor Azimuth
Limits**



Kauai, Hawaii

Figure 3-6

PMRF Safety is responsible for establishing ground hazard areas and LHAs over water beyond which no debris from early flight termination is expected to fall. Hazard areas are determined by size and flight characteristics of the missile, as well as individual flight profiles of each flight test. Nonessential personnel are routinely evacuated from LHAs. The LHA size is determined by simulating a missile's capability to travel off course in any direction about the launch point for a specified period of time. The analysis assumes that at the end of this period, the missile flight is terminated by the flight termination system and the associated debris falls to the ground or into the water. The outer perimeter is plotted and defines the boundaries of the LHA. Actual LHAs are determined by the Range Safety Officer for each flight test. Data processed by ground-based or onboard missile computer systems may be used to recognize malfunctions and terminate missile flight. Before an operation is allowed to proceed, the Range Safety Officer provides a safety clearance using input from ship sensors, visual surveillance from aircraft and range safety boats, radar data, and acoustic information. Other safety areas under PMRF's control include radars, explosives, and airspace.

The Range Control Officer using PMRF assets is solely responsible for determining range status and setting range firing conditions. The Range Safety Approval and the Range Safety Operation Plan documents are required for all weapons systems using PMRF. PMRF uses RCC 321-02, *Common Risk Criteria for National Test Ranges*, which sets requirements for minimally acceptable risk criteria to occupational and non-occupational personnel, test facilities, and non-military assets during range operations. Under RCC 321-02, individuals of the general public shall not be exposed to a probability of fatality greater than 1 in 10 million for any single mission and 1 in 1 million on an annual basis. (Range Commanders Council, 2002)

Radiation Safety

All programs that produce ionizing radiation must secure approval from the Radiation Safety Officer and the Radiation Safety Committee of the Naval Air Warfare Center, Weapons Division, before such operations can be conducted at PMRF. The Radiation Safety Officer reviews proposals, identifies radiation sources and their intended use, and recommends essential conditions to ensure safety to the Radiation Safety Committee. The committee then approves, conditionally approves with additional requirements, or denies the request for the use of radioactive materials.

EMR zones are designated around transmitter sites and tracking radars. PMRF uses a combination of establishing safety zones and conducting sector blanking in occupied areas to avoid potential EMR exposure. To ensure exposure risks to personnel are minimal, the Navy conducts regular radiation hazard surveys before any modifications to a unit are made or when new radar equipment is installed. In addition, all radar units have red (radar unit is on) and blue (radar unit is emitting EMR) warning lights. EMR generated from PMRF radar units does not expose the public to any hazardous radiation.

3.1.8 INFRASTRUCTURE—PACIFIC MISSILE RANGE FACILITY

Infrastructure addresses transportation routes and those facilities and systems that provide power, water, wastewater treatment, and the collection and disposal of solid waste.

Region of Influence

The ROI includes the transportation and utility systems that could potentially be affected by the Proposed Action at PMRF.

Affected Environment

Transportation

Imiloa Road is a two-lane roadway that provides direct access to PMRF from State Highway 50 (Kaunualii Highway). It intersects Kaunualii Highway, which is a primary circulation route connecting PMRF with Kekaha and Lihue (figure 3-6). Kaunualii Highway, in the vicinity of Imiloa Road, is a two-lane road with a posted speed limit of 80 kilometers (50 miles) per hour.

Kaunualii Highway (Route 50) provides access to PMRF from the southwest. A 1999 DOT traffic summary of Kaunualii Highway at Akialoa Road estimated the average daily traffic flow toward PMRF to consist of 1,694 vehicles (Hawaii State Department of Transportation, Hawaii Planning Branch, 2002).

Utilities

The PMRF Public Works Office maintains base facilities and oversees the facility's environmental program. Ongoing operations and maintenance activities involve potable water supply, wastewater treatment, solid waste disposal, electrical supply, and propane gas supply.

Water. At PMRF, potable water comes from the Kauai Department of Water and the State Department of Land and Natural Resources. The total average consumption of Kauai County water by PMRF facilities in 1996 was approximately 193,699 liters (51,170 gallons) per day for the period from 19 July through 19 September. Usage from this source is typically less than one-half of the quantity received from the State. The maximum daily delivery capacity of water from the State is 320,000 gallons per day. The amount of water provided to PMRF from the county is limited to 310,403 liters (82,000 gallons) per day. (U.S. Department of the Navy, 1998; Pacific Missile Range Facility, 2002)

Kauai Board of Water Supply water comes from high-level water tunnels above the Mana Plain. It is stored in two 476,960-liter (126,000-gallon) tanks at Kokole Point and serves the southern portions of the base. The Department of Land and Natural Resources obtains its water from the Mana well, approximately 305 meters (1,000 feet) south of the Kamokala Ridge magazine. This water is pumped to PMRF and stored in one 378,540-liter (100,000-gallon) tank and one 1,589,868-liter (420,000-gallon) tank, both near the Main

Gate of the installation. Water from this source serves the central and northern portions of the base. (U.S. Department of the Navy, 1998; Pacific Missile Range Facility, 2002)

Wastewater. PMRF has two wastewater treatment facilities: (1) a treatment plant 0.8 kilometer (0.5 mile) south of the Main Gate, and (2) an oxidation pond south of the family housing area. Effluent is discharged to a leach field situated between the runway and the coast. The average flow for the period 6 June 1995 to 31 May 1996 was 35,961 liters (9,500 gallons) per day. This flow represented 37 percent of the design capacity of 98,420 liters (26,000 gallons) per day.

The oxidation pond in the southern portion of the base receives approximately 94,635 liters (25,000 gallons) per day of wastewater from Navy family housing and community/personnel support facilities. The capacity of the oxidation-leach pond is 204,412 liters (54,000 gallons) per day. No records are kept of the total daily flow for the stabilization pond. PMRF also has approximately 24 septic tank/leachfield systems and cesspools serving individual buildings in the northern part of the main base. (U.S. Department of the Navy, 1998)

Solid Waste. PMRF disposed of 1.31 million kilograms (1,448 tons) of refuse in the Kekaha landfill from October 2000 to September 2001 (Zenger, 2002). The PMRF operations and maintenance contractor collects this refuse and delivers it to the county-operated sanitary landfill at Kekaha, which is the only operating landfill on Kauai.

PMRF has a recycling program for aluminum cans, glass, and paper. Collection points are widely distributed at PMRF facilities, and items are collected twice a week. The aluminum cans are sold; a nominal fee is paid to a commercial collector for the glass items; and the paper is placed in regular recycled-paper dumpsters for collection by a commercial vendor. Green waste is collected and chipped for compost and use on the base.

Electricity. Kauai Electric Company provides commercial power to PMRF on Kauai. Power to the main base and northern complex area is supplied at 12.5 kilovolts (kV) from Kauai Electric Company's Mana substation. The power is reduced to 4.16 kV for distribution on-station by a 2,000-kilovolt ampere (kVA) transformer, which serves the Operations Building Area, and by a 750-kVA transformer which serves the remainder of the base. The present peak power load of the northern complex area is 1,500 kVA. (U.S. Department of the Navy, 1998; Pacific Missile Range Facility, 2002)

Kauai Electric Company typically averages 50 or more power outages a year. Due to this unreliability, Range Operations receives electricity from the PMRF power plant, with commercial power used as a backup. The power plant contains two 600-kilowatt (kW) and three 300-kW generator units. Primary power to the southern area of the base is supplied by a 12.5-kV feed system from Kauai Electric. The 4.16-kV feeder from the 2000-kVA transformer connects to switches in the main PMRF power plant, which serves as backup to the Kauai Electric Company system. (Pacific Missile Range Facility, 2002; U.S. Department of the Navy, 1998)

3.1.9 LAND USE—PACIFIC MISSILE RANGE FACILITY

Land use can be defined as the human use of land resources for various purposes including economic production, natural resources protection, or institutional uses. Land uses are frequently regulated by management plans, policies, ordinances, and regulations that determine the types of uses that are allowable or protect specially designated or environmentally sensitive uses. Potential issues typically stem from encroachment of one land use or activity on another, or an incompatibility between adjacent land uses that leads to encroachment.

Region of Influence

The ROI for land use includes the areas used during construction and operation of the Proposed Action facilities.

Affected Environment

The combined efforts of state, county, and PMRF's Master Plan regulate land use within the boundaries of PMRF. Within PMRF's Master Plan, the land use management program intends to improve efficiency of land use by minimizing land use conflicts. The plan also addresses the security of essential mission activities from encroachment, and the protection of both human and natural environments. (U.S. Department of the Navy, 2000)

The State of Hawaii Land Use Law classifies all lands into one of four categories: urban, rural, agricultural, or conservation. According to the National Coastal Zone Management Act of 1972, federal agencies are to conduct activities in a manner consistent with the State of Hawaii's coastal zone management programs. The coastal zone of Hawaii includes all non-federal property within the state (U.S. Department of the Navy, 2000). As part of the Coastal Zone Management Act, the County of Kauai has established guidelines for the review of development proposed for special management areas. Polihale State Park and a small area east of PMRF/Main Base North Gate have been assigned as a special management area. Any development in these areas would require a special management use permit.

According to the State Land Use Classification, PMRF/Main Base is located within a conservation district. Conservation districts are managed by the Hawaii Department of Land and Natural Resources. However, as PMRF/Main Base is a federal facility, state and local land laws are preempted. Land within PMRF is not designated as agricultural land. PMRF is surrounded by Polihale State Park to the north, a landfill to the south, and the Pacific Ocean to the west. At present, no land use conflicts with the surrounding land exist. (U.S. Department of the Navy, 2000) PMRF has severely restricted public access since September 2001 for security reasons. The potential for future public access to the installation's beaches, when not used during military operations, will continue to be evaluated. (U.S. Department of the Navy, 2002)

The prevailing land use on PMRF, in terms of area, is the explosive safety and airfield clear zones, which cover 39 percent of the base. Facilities located within these two zones include ordnance magazines, ordnance and weapons operating and support buildings,

runways, taxiways, and support structures. Operational areas are located throughout the base. The existing launch sites, KTF, and underground fuel storage areas are located to the north. In the central portion of the installation is the Air Operations Area. Communication antenna fields are located to the south. Supply and maintenance areas are located adjacent to the flightline in the main base and also adjacent to the operation area in the northern portion of the base. Administration and personnel support areas are located in the central and the southern portions, respectively. These areas provide space for family housing, administration, bachelor housing, utilities, exchange retail, and recreation facilities. (U.S. Department of the Navy, 2000)

U.S. Coast Guard Regulation 33 CFR 165.1406 established a safety zone offshore from the facility under the authority of 33 United States Code (USC) 1231 and 50 USC 191 for Strategic Target System launches. Entry into the current safety zone is prohibited at all times to prevent the interference with submerged cables. Special permission for transit through the area is obtained on an individual basis by prior arrangement with the local Captain of the Port or U.S. Coast Guard District Commander, who controls entry and exit, 33 CFR 165.1406.

3.1.10 NOISE—PACIFIC MISSILE RANGE FACILITY

Noise is typically defined as unwanted sound. Characteristics of sound include amplitude, frequency, and duration. Sound waves can vary over a large range of amplitudes, frequencies, and duration. The decibel (dB) is a logarithmic unit that accounts for the large variations in amplitude and is the accepted standard unit for the measurement of sound. Sound levels that incorporate frequency-dependent amplitude adjustments by the American National Standards Institute (American National Standards Institute, 1996) are called weighted sound levels. Noise measurements that are weighted to emphasize the frequencies within human sensitivity are called A-weighted (dBA). These measurements are typically used when measuring sources of noise such as transportation or equipment. C-weighted decibels use much the same process, except they emphasize low frequency sound.

Noise levels often change with time; therefore, in order to compare levels over different periods of time, several descriptors were developed that take into account this variance. Two common descriptors include the maximum sound level (L_{max}) and the average day-night sound level (L_{dn}).

Occupational Safety and Health Administration regulation 29 CFR 1910.95 establishes a maximum noise level of 90 dBA for a continuous 8-hour exposure during a workday and higher sound level for a shorter time of exposure in the workplace. The relationship allows a 5-dBA increase in level for a 50 percent reduction in exposure time. Exposure to impulse or impact noise should not exceed a 140-dBA peak sound pressure, according to the Occupational Safety and Health Administration regulation 29 CFR 1910.95. This 140 dBA is an advisory level, not a mandatory one. In addition, when information indicates that an employee's exposure may equal or exceed an 8-hour time-weighted average of 85 dB, the employer shall develop and implement a monitoring program.

Region of Influence

The minimum ROI for noise analysis is the area within the $L_{\max} = 85$ dB contours generated by program activities, which can be up to approximately 12 kilometers (7.5 miles) from the THAAD launch site.

Affected Environment

Sources of noise currently on PMRF include airfield operations (high performance aircraft, cargo or passenger aircraft, helicopter operations), base operations (including exercise support), and missile, rocket, and drone launches.

Near the runway at PMRF, the noise levels average 75 dBA. Noise levels around 65 dBA or less are found at locations away from the runway. These levels are typical of a commercial area. Infrequent, short-term launch noise from PMRF and KTF has come from Strategic Target System, Strypi, and ZEST missile launches. The Strategic Target System noise is 126 dB at 175 meters (575 feet) from the launch pad to 97 dB at the ground hazard area boundary (3,048 meters [10,000 feet] from the launch pad). The Strypi noise is 120 dB at 346 meters (1,135 feet) from the launch pad to 109 dB at the ground hazard boundary (830 meters [2,722 feet]). Noise associated with the ZEST program is 124.8 dB at 221 meters (725 feet) from the launch pad to 109.0 dB at 907 meters (2,975 feet). (U.S. Army Strategic Defense Command, 1992) Noise levels generated from the 320 rocket boosters launched from KTF from 1962 through 1990 were not monitored.

The nearest on-base housing area is located approximately 8 kilometers (5 miles) south of KTF. The nearest off-base residential area is Kekaha, which is approximately 13 kilometers (8 miles) south of KTF. Both these locations are outside the ROI. The portions of the ROI that extend beyond the boundaries of the PMRF include sugar cane fields to the east and the ocean to the west.

3.1.11 SOCIOECONOMICS—PACIFIC MISSILE RANGE FACILITY

Socioeconomics describes a community by examining its social and economic characteristics. Several demographic variables are analyzed in order to characterize the community, including population size, the means and amount of employment, and income creation. In addition, socioeconomics analyzes the fiscal condition of local government and the allocation of the assets of the community, such as its schools, housing, public services, and healthcare facilities.

Region of Influence

The ROI for socioeconomic analysis is Kauai, which includes 11 inhabited census tracts.

Affected Environment

The socioeconomic character of Kauai was discussed in detail in the PMRF Enhanced Capability EIS (U.S. Department of the Navy, 1998). The following paragraphs summarize pertinent data from the EIS as well as provide updated information where applicable.

The population of Kauai County was 58,463 in 2000, a change of approximately 9.5 percent over a 9-year period (State of Hawaii, 2000).

Tourism, tourism-related services, and the U.S. Government have continued to be the main employment generators on Kauai. Currently, the three largest employers are the County of Kauai, PMRF, and Wilcox Health Systems. It is estimated that over 176,000 people are employed in tourism and travel in the State of Hawaii. This figure represents over 31 percent of the workforce. Official visitors to PMRF (18,041 in 2000) have a significant beneficial economic impact, contributing over \$7 million to the Kauai visitor industry (State of Hawaii, 2000).

PMRF is the largest Federal Government employer on Kauai. PMRF employs 870 people, 765 of whom are civilian, and has an annual payroll of approximately \$45 million. PMRF has an annual average daily temporary duty count of 39 personnel supporting mission activities. The actual peak temporary duty population could be higher than this average. Most of these personnel stay in off-station locations.

3.1.12 WATER RESOURCES—PACIFIC MISSILE RANGE FACILITY

This section describes the existing water resource conditions at each of the proposed sites. Water resources include surface water, groundwater, and flood hazard areas.

Region of Influence

The ROI includes the water resources within and surrounding the property boundaries of PMRF.

Affected Environment

Surface Water

PMRF/Main Base is relatively flat and lacks any incised natural drainage networks, or perennial or ephemeral streams. Manmade canals that drain the agricultural areas east of the PMRF primarily contain all surface water within the PMRF boundary. Primary manmade channels to control surface runoff include the northern Nohili Ditch, and the southern and central Kawaele Drainage (U.S. Department of the Navy, 2000). Water within the numerous drains and irrigation ponds is typically brackish, failing to meet drinking water standards because of high chloride levels, but it has near neutral to slightly alkaline pH (U.S. Army Strategic Defense Command, 1992). Similar characteristics are exhibited by surface water in the southern half of PMRF/Main Base. Apart from these drainages, the rain sinks rapidly into the permeable sand so that no surface drainage has been established. The drainage ditches are designed to move water away from the agricultural fields during irrigation and rainfall, and to leach salts from the soil (U.S. Department of the Navy, 2000).

Groundwater

Three geological formations (bedrock, alluvium, and sand dunes) make up hydraulically connected aquifers within the ROI. The bedrock is highly permeable, containing brackish water that floats on seawater. (U.S. Army Strategic Defense Command, 1992) The overlying sediments act as a caprock because of their overall low permeability. Although the sediments are saturated, they are not exploitable as an aquifer because of unfavorable hydraulic characteristics. The groundwater in the sediments originates as seepage from irrigation percolation and rainfall in the basalt aquifer, especially where the sediments are thin near the inland margin of the Mana Plain.

The dune sand aquifer on which PMRF/Main Base lies consists of brackish groundwater that floats on seawater recharged by rainfall and by seepage from the underlying sediments. This water is too brackish for plants and animals to consume and consequently is not used. Because the area's groundwater typically increases in salinity closer to the coast, potable sources are generally found along the base of cliffs. The nearest fresh groundwater sources are in the Napali formation at the inland edge of the coastal plain along the base of the Mana Cliffs. (U.S. Department of the Navy, 2000)

Flood Hazard Areas

Special Flood Hazard Areas are defined as areas with a 1 percent or greater chance of equaling or exceeding an established flood level in any given year, or 100-year floodplains. According to Federal Emergency Management Agency flood maps, the planned launch site and blockhouse are located just inside the 100-year flood plain and may be vulnerable to extremely rare storm surge tides. (Missile Defense Agency, 2002)

3.2 REAGAN TEST SITE, U.S. ARMY KWAJALEIN ATOLL

USAKA is located in the RMI, approximately 3,889 kilometers (2,100 nautical miles) southwest of Honolulu, Hawaii. Kwajalein is the world's largest coral atoll surrounding the world's largest lagoon. Eleven of the 100 islands of the atoll are leased by the United States from the RMI government. Radar, optics, telemetry, and communications equipment on eight islands provide instrumentation for ballistic missile and missile interceptor testing and space operations support.

USAKA/RTS is a Class II installation (Active) of the U.S. Army and is designated a subordinate activity of the U.S. Army Space and Missile Defense Command (USASMDC), Washington, D.C. Command of the installation with regard to its National Range mission is exercised under the guidance and control of the Chief of Research and Development, Department of the Army. USAKA/RTS Activities include the following:

- Kwajalein—Base headquarters, meteorological rocket launches, radars, optical sensing, communications, range support, base operations, community support

- Roi-Namur—Kiernan Reentry Measurement System radar tracking, launches limited to the Speedball facility, optical sensing, range support, base operations, community support
- Meck—Launches, optical sensing, range support

3.2.1 AIR QUALITY—REAGAN TEST SITE, U.S. ARMY KWAJALEIN ATOLL

A general description of air quality and the relationship of inert and reactive pollutants in regards to the ROI is provided in the beginning paragraphs of section 3.1.1.

Region of Influence

For inert pollutants (all pollutants other than ozone and its precursors), the ROI is generally limited to an area extending no more than a few kilometers (miles) downwind from the source.

The ROI for ozone may extend much further downwind than the ROI for inert pollutants; however, as the project areas have no heavy industry and very few automobiles, tropospheric ozone and its precursors are not of concern. Consequently, for the air quality analysis, the ROI for project operational activities is within the immediate island areas where receptors are located.

3.2.1.1 Kwajalein

Affected Environment

Climate

Kwajalein Atoll is located less than 1,000 kilometers (600 miles) north of the equator and has a tropical marine climate characterized by relatively high annual rainfall and warm to hot, humid weather throughout the year. The mean annual temperature at Kwajalein is 28°C (82°F). The average annual precipitation is 256 centimeters (101 inches). The main rainfall season lasts from mid-May to mid-December, with about 30 centimeters (10 inches) of rainfall per month. Averaging between 70 and 85 percent, Kwajalein's relative humidity is relatively high throughout the year. Virtually constant cloud cover, light easterly winds, and frequent moderate to heavy rain showers prevail during the wet season.

Trade winds are dominant throughout the year and strongest from November to June. The prevailing winds blow from the east to the northeast with an average speed of 26 kilometers (16 miles) per hour in the winter and 10 kilometers (9 miles) per hour in the summer.

Existing Emissions Sources

The power plants are the primary source of air emissions on Kwajalein. The concentration of the criteria air pollutants was measured both upwind and downwind of power plants 1 and 1A. The concentrations of sulfur dioxide, lead, and PM-10 were found to be below their NAAQS both upwind and downwind. Since there are no short-term NAAQS for

nitrogen dioxide, the study compared the measured concentrations at Kwajalein to the 1-hour California ambient air quality standards for nitrogen dioxide; the concentrations at Kwajalein were below this standard. The concentrations measured at Kwajalein were below the 1-hour NAAQS for carbon monoxide, but downwind concentrations were greater than the 8-hour NAAQS for carbon monoxide.

The existing primary pollution sources include power plants (1A, and 1B), fuel storage tanks, solid waste incinerators, diesel fired commercial boilers, a concrete batching plant, and transportation. Rocket launches tend to be smaller sources of emissions. USAKA performs an Air Emissions Inventory on a biannual basis in accordance with the UES (table 3-2).

**Table 3-2: Summary of Emissions of Regulated Air Pollutants on Kwajalein
(metric tons [tons] per year)**

PM-10	Sulfur Dioxide	Carbon Monoxide	Nitrogen Dioxide	Volatile Organic Compounds
72.35 (79.75)	199.98 (220.44)	318.39 (350.96)	1,180.16 (1,300.90)	48.45 (53.41)

Source: Ronald Reagan Ballistic Missile Defense Test Site, 2002.

3.2.1.2 Meck

Affected Environment

Climate

Temperature, rainfall, humidity, and trade winds at Meck are similar to those described in section 3.2.1.1 for Kwajalein.

Existing Emission Sources

Existing pollution sources for Meck are similar to those listed for Kwajalein, including a power plant, a solid waste incinerator, fuel storage tanks, and transportation (table 3-3). Infrequent rocket launches also occur on Meck.

**Table 3-3: Summary of Emissions of Regulated Air Pollutants on Meck
(metric tons [tons] per year)**

PM-10	Sulfur Dioxide	Carbon Monoxide	Nitrogen Dioxide	Volatile Organic Compounds
2.12 (2.34)	18.67 (20.58)	31.42 (34.63)	118.30 (130.40)	5.13 (5.65)

Source: Ronald Reagan Ballistic Missile Defense Test Site, 2002.

3.2.1.3 Roi-Namur

Affected Environment

Climate

The climate of Roi-Namur is similar to that described for Kwajalein.

Existing Emission Sources

Existing pollution sources for Roi-Namur are similar to those listed for Kwajalein and Meck, including a power plant, a solid waste incinerator, fuel storage tanks and transportation on the island (table 3-4).

**Table 3-4: Summary of Emissions of Regulated Air Pollutants on Roi-Namur
(metric tons [tons] per year)**

PM-10	Sulfur Dioxide	Carbon Monoxide	Nitrogen Dioxide	Volatile Organic Compounds
6.69 (7.37)	58.99 (65.03)	98.29 (108.35)	373.79 (412.03)	11.28 (12.43)

Source: Ronald Reagan Ballistic Missile Defense Test Site, 2002.

3.2.2 AIRSPACE—REAGAN TEST SITE, U.S. ARMY KWAJALEIN ATOLL

A general description of airspace is provided in the first paragraph of section 3.1.2.

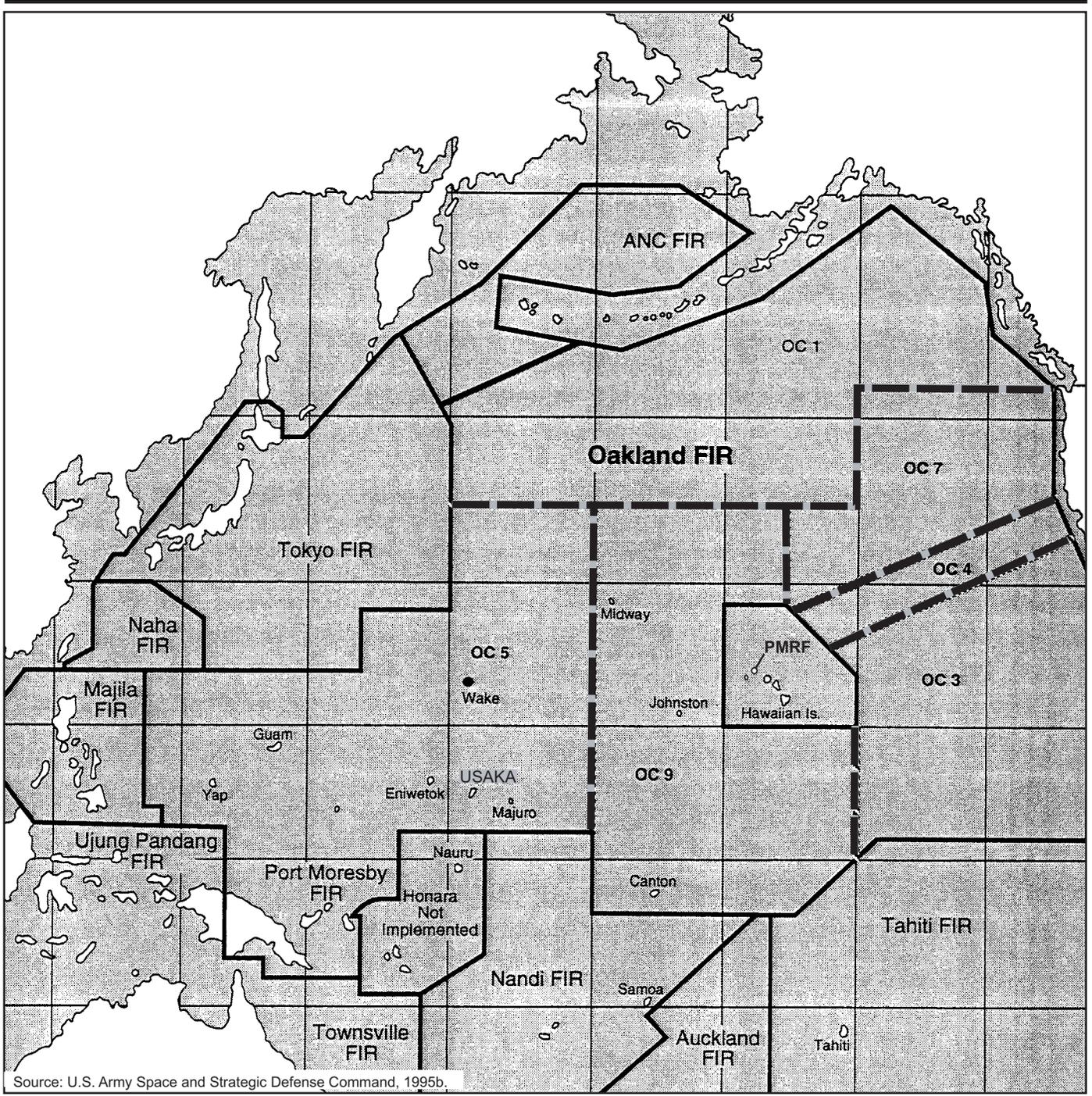
Region of Influence

The ROI for airspace includes the airspace over and surrounding the LHAs and the airspace beneath and surrounding the debris containment corridors.

Affected Environment

The USAKA Temporary Extended Test Range (ETR) is located in international airspace. Therefore, the procedures of the ICAO (outlined in ICAO Document 444, Rules of the Air and Air Traffic Services) are followed (International Civil Aviation Organization, 1985; 1994). ICAO Document 4444 is the equivalent air traffic control manual to the FAA Handbook 7110.65, Air Traffic Control. The ICAO is not an active air traffic control agency and has no authority to allow aircraft into a particular sovereign nation's Flight Information Region or Air Defense Identification Zone and does not set international boundaries for air traffic control purposes. The ICAO is a specialized agency of the United Nations whose objective is to develop the principles and techniques of international air navigation and to foster planning and development of international civil air transport.

The FAA acts as the U.S. agent for aeronautical information to the ICAO, and air traffic in the ROI is managed by the Oakland ARTCC in its Oceanic Control-5 Sector, the boundaries of which are shown in figure 3-7.



Source: U.S. Army Space and Strategic Defense Command, 1995b.

EXPLANATION

-  Oceanic Control Area Boundary
-  Sector Boundary
- FIR = Flight Information Region
- OC = Oceanic Control
- PMRF = Pacific Missile Range Facility

Airspace Managed by Oakland Oceanic Control Area Administrative Boundaries

Ocean Area



Not to Scale

Figure 3-7

En Route Airways and Jet Routes

Although relatively remote from the majority of jet routes that cross the Pacific, the USAKA Temporary ETR ROI and vicinity has several jet routes passing through it (figure 3-8). An accounting of the number of flights using each jet route is not maintained. However, in the past there have been 241 overflights of Oceanic Control Sector 5 during a 24-hour period (U.S. Army Space and Strategic Defense Command, 1994).

Although not depicted on either the North Pacific Route Chart, Southwest Area or Composite (National Ocean Service, 1994a;b), there are low altitude airways carrying commercial traffic between the various islands of the RMI, particularly between the Marshall Islands International Airport at Majuro and Bucholz Army Airfield on Kwajalein.

Airports/Airfields

Bucholz Army Airfield has had a reported 1,674 operations per month, an average of over 55 per day. Many of the 55 flights per day were aircraft and helicopter flights to other USAKA islands. Currently, Wake Island Airfield is maintained for MDA activities in a caretaker status, and flight activity through Bucholz Army Airfield is reduced. Dyess Army Airfield on Roi-Namur provides service to a variety of aircraft and helicopters for RTS activities.

3.2.3 BIOLOGICAL RESOURCES—REAGAN TEST SITE, U.S. ARMY KWAJALEIN ATOLL

A general definition of biological resources is provided in the first paragraph of section 3.1.3.

Region of Influence

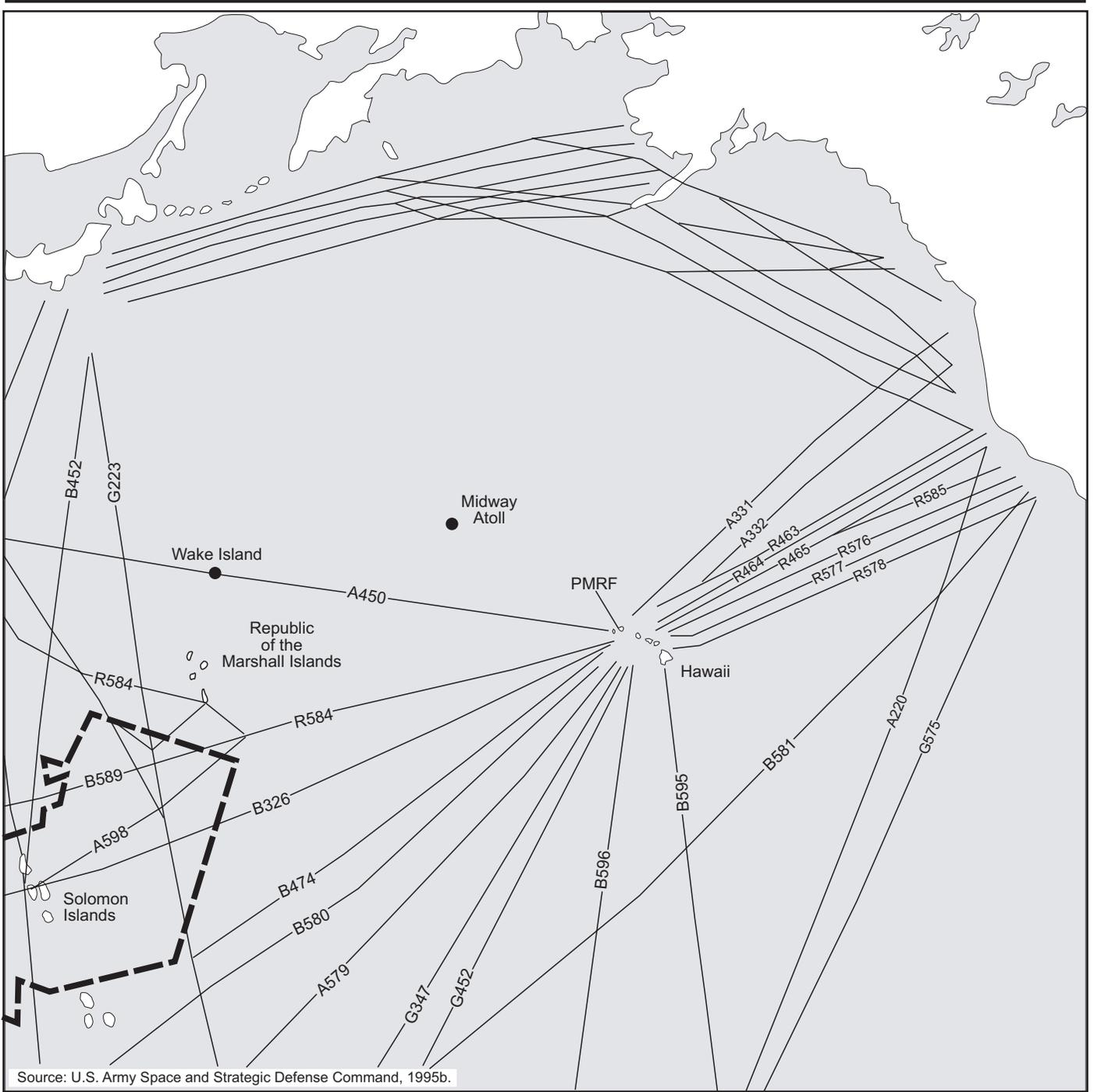
The ROI for biological resources includes the entire island and near-shore reef area for islands where target and interceptor missiles would be launched. For islands where only sensors would be placed, the ROI would be limited to the sites where program activities are conducted and the EMR hazard area. The ROI for the flight test corridor includes the missile over-flight area and the potential debris impact areas over the broad ocean area or Kwajalein Lagoon within the Mid-atoll Corridor.

3.2.3.1 Kwajalein

Affected Environment

Vegetation

Extensive development has eliminated most of the natural vegetation of Kwajalein. The island has been enlarged over the years with dredged landfill since the 1930s and consequently exhibits vegetation characteristic of heavily disturbed areas. Much of Kwajalein has been cleared and paved, including the large runway occupying the entire center (southern) portion of the island. Managed vegetation, nonnative grasses and



EXPLANATION

- —** Uncontrolled Airspace Boundaries
- PMRF = Pacific Missile Range Facility

High Altitude Jet Routes, Northern Pacific Ocean

Ocean Area

Figure 3-8

Not to Scale

weeds, dominate the open areas and are maintained by mowing. Small amounts of herbaceous strand that have adapted to the harsh saline conditions on the island still exist along the coast in some places. Patches of littoral shrubland such as tree heliotrope and beach naupaka are also present. (U.S. Army Strategic Defense Command, 1989; U.S. Army Space and Strategic Defense Command, 1993b; 1995b)

Previously existing lagoon and nearshore marine habitat along the lagoon shoreline is now buried under landfill. However, along the northern edge of the island on the lagoon floor are several small communities of the rare seagrass *Halophila minor*. (U.S. Army Strategic Defense Command, 1989; U.S. Army Space and Strategic Defense Command, 1993b; 1995b)

Essential Fish Habitat

Hundreds of species of coral, as well as 250 species of reef fish, can be found in the Marshalls' atolls, including Wotje and Aur. Food cultivation on these islands is limited; as a result, fish and seafood provide the bulk of nonvegetable dishes, with tuna a staple of the catch. (Pacific Island Travel, 2002) The multilateral fisheries agreement between the United States and South Pacific island governments, such as the Marshall Islands, seeks to protect the fisheries in the Exclusive Economic Zones. This has contributed to the adoption of the United Nations Agreement on Highly Migratory Fish Stocks and Straddling Fish Stocks, a treaty that promotes the long-term sustainable use of highly migratory species, such as tuna, by balancing the interests of coastal states and states whose vessels fish on the high seas. (U.S. Department of State, 2002)

Wildlife

Numerous small parcels of seabird roosting habitat have been identified on the western end of the island within the ROI. Large numbers of migrating shorebirds have been observed at Kwajalein, including the Pacific golden plover (*Pluvialis fulva*) and the ruddy turnstone (*Arenaria interpres*). (U.S. Army Strategic Defense Command, 1989; U.S. Army Space and Strategic Defense Command, 1993; 1995) Since 1996, the only seabird observed breeding on Kwajalein has been the white tern. Black noddies and great crested terns have been observed foraging in the main harbor and along the northwestern coastline respectively. (U.S. Department of the Army, 2001).

Five species of giant clam are found at USAKA along the surrounding reef on the lagoon side and ocean side, and between several of the islands. The largest species (*Tridacna gigas*), which was observed during the 1998 inventory (U.S. Department of the Army, 2001), has been significantly reduced in number, and the RMI government and the National Marine Fisheries Service are examining all species for listing as threatened or endangered. All species of mollusks from the family *Tridacnidae* are listed as protected under the Convention for the International Trade on Endangered Species (U.S. Fish and Wildlife Service, 2002). (U.S. Army Space and Strategic Defense Command, 1995b)

Threatened and Endangered Species

No threatened or endangered vegetation species have been identified on Kwajalein.

Sea turtles frequently enter the lagoon and are commonly seen in the harbors at Kwajalein, Roi-Namur, and in the waters surrounding Meck. Green and hawksbill (*Eretmochelys imbricata*) sea turtles have been observed on and offshore of Kwajalein. (U.S. Army Space and Strategic Defense Command, 1995b) Sea turtle nesting has occurred relatively recently on the island, but suitable turtle nesting habitat is limited and not within the ROI.

Other threatened and endangered marine species that may possibly occur in and around USAKA include the blue whale (*Balaenoptera musculus*), finback whale (*Balaenoptera physalus*), humpback whale (*Megaptera novaeangliae*), sperm whale (*Physeter coaptation*), leatherback sea turtle (*Dermochelys coriacea*), loggerhead sea turtle (*Caretta caretta*), and olive ridley sea turtle (*Lepidochelys olivacea*). However, these marine mammals are widely distributed, open-water species and are not likely to be found near USAKA. (U.S. Army Space and Strategic Defense Command, 1995b)

Environmentally Sensitive Habitat

Extensive dredge and fill activities since the 1930s have degraded the marine habitat surrounding Kwajalein, particularly on the lagoon side. A remnant of the original reef flat is located just north of Echo Pier, outside the harbor. (U.S. Army Strategic Defense Command, 1989; U.S. Army Space and Strategic Defense Command, 1993b; 1995b)

3.2.3.2 Meck

Affected Environment

Vegetation

Much of Meck has been cleared and paved. Very little native vegetation remains on the island. Small patches of herbaceous strand and littoral shrubland occur on the eastern and northwestern coasts. Nonnative grasses and weeds dominate the open areas and are maintained by mowing. A few native trees still exist on the northern end of the island within the ROI. The island has been enlarged with dredged fill material. (U.S. Army Strategic Defense Command, 1989; U.S. Army Space and Strategic Defense Command, 1993b; 1995b)

Wildlife

Seabirds have been observed nesting along the eastern perimeter of the runway. Habitat for seabird roosting exists to the southwest of the launch site in the fill area at the edge of the ROI. Black-naped terns regularly roost at the southeast corner of the runway. (U.S. Army Strategic Defense Command, 1989; U.S. Army Space and Strategic Defense Command, 1993b; 1995b) Black-naped terns were observed roosting on the southeastern tip of the island and in active colonies on the east side of the helicopter pad during the 1998 inventory (U.S. Department of the Army, 2002).

Threatened and Endangered Species

No threatened or endangered vegetation species have been identified on Meck. Sea turtles frequently enter the lagoon and are commonly seen feeding in the waters surrounding

Meck. Although some sandy beaches on the lagoon side of Meck provide potential sea turtle nesting habitat, no evidence of nesting has been observed.

Environmentally Sensitive Habitat

Extensive dredging and the deposition of fill on the lagoon reef flat have greatly altered the marine environment of Meck (figure 3-8). Most of the island is surrounded by riprap intended for shoreline protection. The only remaining undisturbed reef flats occur at the north and south tips of the island. Giant clams are found on the reef. (U.S. Army Strategic Defense Command, 1989; U.S. Army Space and Strategic Defense Command, 1993b; 1995b)

3.2.3.3 Roi-Namur

Affected Environment

Vegetation

Only a small portion (the southeastern tip) of Roi-Namur has been left relatively undisturbed since World War II. Most of the island is maintained (i.e., open grassy areas, golf course, runway, housing areas) and a sizable portion of the island is used for radar operations, has been recently cleared, and/or is used as a repository for plant debris/compost and is overgrown with vines (e.g., beach sunflower [*Wollastonia biflora*] and beach morning glory [*Ipomoea pes-caprae*]). Nonnative grasses and weeds dominate the open areas of the island and are maintained by mowing. A forested area with coconut palm in the overstory has been allowed to recover on the eastern shore since approximately 1945. Thick strands of small-leaved mangrove (*Pemphis acidula*) surround a small wetland in the center of the island. (U.S. Army Space and Strategic Defense Command, 1995b)

Although the harbor area on the lagoon side of the island has been dredged, the area supports the largest known community of the rare seagrass *Halophila minor* at Kwajalein Atoll. (U.S. Army Space and Strategic Defense Command, 1995b)

Wildlife

Nesting terns use the southern tip of the island, and assorted shorebirds roost in the shrubs along the western shore. Reef herons feed in the shore flats and tidepools east of the runway and along the eastern shore. The only seabird that appeared to be nesting during the 1998 inventory was the white tern (U.S. Department of the Army, 2001). The forested area on the east side supports habitat for a variety of nesting seabirds. (U.S. Army Space and Strategic Defense Command, 1995b) Great-crested terns, golden plovers, ruddy turnstones, whimbrels, and grey-tailed and wandering tattlers were observed during the 1998 inventory (U.S. Department of the Army, 2001).

Coconut crabs occur in the forested area on the east side of the island. Additional non-avian fauna includes rodents, lizards, and domestic dogs and cats. (U.S. Army Space and Strategic Defense Command, 1995b) The giant clam (*Tridacna gigas*) was observed during the 1998 inventory (U.S. Department of the Army, 2001).

Threatened and Endangered Species

No threatened or endangered vegetation species have been identified on Roi-Namur. (U.S. Army Space and Strategic Defense Command, 1995b)

Sea turtles frequently enter the lagoon and are commonly seen in the harbors at Roi-Namur. Some of the sandy beaches of Roi-Namur provide potential nesting habitat for the green and hawksbill sea turtles, which migrate to nesting beaches in late spring. At least two instances of nesting have been reported on Roi-Namur in recent years.

Environmentally Sensitive Habitat

Marine habitat of importance to biological resources on Roi-Namur includes the lagoon-facing and ocean-facing reef slopes and flats, inter-island reef flat, lagoon floor, seagrass beds, and intertidal zone. The reef flats at the east and west ends of Roi-Namur support coral and giant clams but do not exhibit high coral coverage due to the strong current. More active coral growth was observed on the southwestern corner of the island along the lagoon side. The seagrass beds along the lagoon side may serve as a juvenile fishery ground. (U.S. Army Space and Strategic Defense Command, 1995b)

3.2.4 CULTURAL RESOURCES—REAGAN TEST SITE, U.S. ARMY KWAJALEIN ATOLL

According to the UES, cultural resources are material remains of human activity that are significant in the history, prehistory, architecture, or archaeology of the RMI. They include prehistoric resources and historic resources (U.S. Army Space and Missile Defense Command, 1998).

Region of Influence

The ROI for cultural resources for the purposes of this EA, includes Kwajalein, Meck, and Roi-Namur. Kwajalein and Roi-Namur are designated as RMI National Historical Landmarks.

Affected Environment

Regional Cultural Resources

An exact date for the first habitation of the Marshall Islands (including USAKA) is not known because of a scarcity of physical evidence; however, it is believed to have occurred as early as 2,000 years ago. Archaeological evidence indicates long-term settlement for thousands of years on larger islands and shorter periods of time on smaller islets. Some islets appear to have never been inhabited and used only for gardens or for gathering resources.

The Marshall Islands were not unified under one entity until the European colonial period. Contact with inhabitants of the Marshall Islands was not substantial until the 1850s when Christian missionaries were sent to the islands from Hawaii. Between 1887 and 1914, Germany controlled the islands, first administered by German trading companies and later as a colony under the German Empire. In 1914, control of the Marshall Islands transferred

to the Japanese as a part of that country's expansion into the central Pacific during World War I.

Forming Japan's easternmost perimeter of defense, the Marshall Islands played a key role during World War II. By 1944, extensive American military campaigns (most notably Operation Flintlock) against the Japanese in the Marshall Islands resulted in the United States gaining control of the islands and developing a strategic foothold in the Pacific region. Because the Marshall Islands and other island nations in the region were politically, socially, and economically unstable at the end of World War II, the United Nations established the Trust Territory of the Pacific Islands (including the Marshall Islands) and granted administration of the islands to the United States as a Strategic Trust. This relationship continued uninterrupted until 1986, when the Trust was replaced by the Compact of Free Association, Public Law 99-239. (U.S. Army Space and Missile Defense Command, 2000a)

Historic Buildings and Structures

Since World War II, portions of Kwajalein Atoll (11 leased islands) have been continuously used by the U.S. military. Initially a refueling and communications base, USAKA has also been a support facility for the testing of nuclear weapons and a test site for the Nike-Zeus Anti-Ballistic Missile program. USAKA's current mission is ground and flight test support for Missile Defense programs. (U.S. Army Space and Strategic Defense Command, 1995b)

An inventory and evaluation of Cold War properties potentially eligible for inclusion in the U.S. National Register was prepared in 1996 (U.S. Army Space and Strategic Defense Command and Teledyne Brown Engineering, Huntsville 1996). The USAKA Commander and the RMI EPA may wish to reach agreement that certain Cold War resources are potentially eligible for inclusion in the RMI National Register of Historic Places. RMI National Register Criteria do not specifically recognize Cold War era properties; however, these resources can be nominated to the RMI National Register provided that they are at least 40 years of age. The Cold War Properties study identified a total of 27 structures (20 in the ROI) as historically important: 7 structures on Kwajalein, historically linked to the Zeus Acquisition Radar Complex; 5 structures on Roi-Namur, historically linked to the Kiernan Reentry Measurement Site Complex; 8 structures on Meck, historically linked to the Meck Island Launch Facilities District. The identification of significant Cold War properties does not "prohibit their use, modification, rehabilitation, or even removal for the purpose of accomplishing mission essential requirements." In cases where alterations or removal of a structure is desired, detailed historical and photographic recordation would be required. This study will satisfy this requirement for the majority of the structures proposed for nomination. (U.S. Army Space and Strategic Defense Command and Teledyne Brown Engineering, Huntsville 1996)

Native Populations/Traditional Resources

Traditional resources within the ROI are expected to be associated with the Marshallese culture; however, because of lengthy occupations of the Marshall Islands, German or Japanese traditional sites could also be present. Although a comprehensive survey and inventory of traditional cultural properties have not as yet been undertaken, such sites are

known to occur in the Marshall Islands, some of which have been identified on Arno and Majuro Atolls. (U.S. Army Space and Strategic Defense Command, 1995b)

Paleontological Resources

Geological studies indicate that the reefs and atolls of the Marshall Islands formed 70 to 80 million years ago; however, the natural processes from which atolls are built preclude the occurrence of paleontological remains. There are no National Natural Landmarks. (U.S. Army Space and Strategic Defense Command, 1995b)

3.2.4.1 Kwajalein

Affected Environment

Prehistoric and Historic Archaeological Resources

Kwajalein has been heavily disturbed by construction and operational activities. As a result of land filling since 1945, the island has increased by 26 percent (83 hectares [205 acres] of fill).

Several comprehensive cultural resources surveys have been conducted on Kwajalein. Subsurface prehistoric and historic remains have been identified in dispersed areas within the original island boundary. The types of prehistoric materials identified include shell adzes (cutting tools), coral tools, shell fishhooks, and human (Marshallese and Japanese) and faunal remains.

Historically, Kwajalein represented a permanent dwelling islet. Due to major alterations to the islet by Japanese and later by Americans, most traditionally used and frequented sites remain buried under various fill layers. Locations of pre- and early post-war Marshallese sites are approximate. Three former Marshallese cemeteries, three chiefly residences, and the location of a flower tree represented sacred sites due to their importance in religious belief and traditional power structure. Other special locations were set aside for chants, dancing, tattooing, and medical and magical purposes.

Studies have consistently revealed that there is a post-World War II layer of fill covering most of the island's surface (of varying depths) and that the probability of intact subsurface prehistoric and historic sites (within the original boundary of the island) is high.

World War II surface and subsurface features identified on Kwajalein are numerous and include gun mounts/emplacements for varying caliber weapons, pillboxes, concrete air raid shelters and ammunition bunkers, concrete piers, footings, foundations, and pads, personnel and communications trenches and anti-tank ditches, expended and unexpended ordnance, and foundations of numerous World War II buildings and structure (U.S. Army Space and Missile Defense Command, 2000a).

Historic Buildings and Structures

The majority of the buildings and structures on Kwajalein were constructed between 1944 and 1992. Existing Japanese structures predate 1945; however, exact construction dates

have not been verified. Facilities constructed before 1946 (including the Japanese structures) are associated with the World War II historic context and considered part of the Kwajalein Battlefield National Historic Landmark. Facilities constructed between 1946 and 1991 are associated with the Cold War historic context. Important Cold War era structures include the Zeus Acquisition Radar receiver building and antenna (Facility 987/988), the joint technical operations building (Facility 1010), the target track radars No. 4 and 5 (Facilities 1011/1012), and the discrimination radar building (Facility 1045) (U.S. Army Space and Strategic Defense Command and Teledyne Brown Engineering, Huntsville 1996). (U.S. Army Space and Strategic Defense Command, 1995b)

3.2.4.2 Meck

Affected Environment

Prehistoric and Historic Archaeological Resources

The entire surface of Meck has been disturbed by grading and construction for missile launch facilities. In addition, as a result of land filling, the island has increased in size by approximately 6 to 22 hectares (14 to 55 acres). Archaeological survey and testing of the entire island in both 1988 and 1994 failed to identify any prehistoric or historic archaeological sites or World War II features. (U.S. Army Space and Strategic Defense Command, 1995b)

Now buried under fill layers, Meck once served as an island where initiation ceremonies took place. Meck is also said to have served as the ancient residence location of the Rimeik clan. (U.S. Army Space and Strategic Defense Command, 1995b) Historically, Meck served as an islet of residence and a prime intermediate destination for intra-atoll voyages. (U.S. Army Space and Missile Defense Command, 2000a)

Historic Buildings and Structures

The majority of the buildings and structures on Meck were constructed between 1967 and 1991; as such, they are associated with the Cold War historic context. Important Cold War era properties include the system technology test facility building (Facility 5049), Meck Island Control Building (Facility 5050), Sprint launch stations No. 7 and 8 (Facilities 5057/5058), the Sprint ordnance area (Facility 5064/65), Spartan launch stations No. 21 and 22 (Facility 5071 and 5072), and the Spartan MAB (Facility 5080) (U.S. Army Space and Strategic Defense Command and Teledyne Brown Engineering, Huntsville 1996). The Sprint and Spartan silos on Meck are abandoned. The southern half of the island houses facilities related to power generation, maintenance, supply, and waterfront and air operations. The central and northern half of the island consists of research and development operations and launch complexes, including missile and payload assembly buildings. (U.S. Army Space and Strategic Defense Command, 1995b)

3.2.4.3 Roi-Namur

Affected Environment

Prehistoric and Historic Archaeological Resources

Disturbance to Roi-Namur since the time of the Japanese occupation has been substantial. Once three separate islands, Roi-Namur has been expanded through landfilling to create a

single island. No systematic cultural resources survey and testing have been conducted on Roi-Namur because of the extensive disturbance and the potential for subsurface unexploded ordnance. Recently, an 1,800 year-old Marshallese grave site was unearthed on Roi-Namur (Esher, 2002). (U.S. Army Space and Strategic Defense Command, 1995b)

Historic Buildings and Structures

All of the buildings and structures on Roi-Namur were constructed between 1940 and 1993. Existing Japanese structures may predate 1940; however, exact construction dates have not been verified. Facilities constructed before 1946 (including the Japanese structures) are associated with the World War II historic context and considered part of the Roi-Namur Battlefield National Historic Landmark. Facilities constructed between 1946 and 1991 are associated with the Cold War historic context. Important Cold War era structures on Roi-Namur include the TRADEX building (Facility 8060), the ALTAIR administration building and antenna (Facility 8110/8111), and the ALCOR administration building and antenna (Facilities 8140/8141) (U.S. Army Space and Strategic Defense Command and Teledyne Brown Engineering, Huntsville 1996). (U.S. Army Space and Strategic Defense Command, 1995b)

3.2.5 GEOLOGY AND SOILS—REAGAN TEST SITE, U.S. ARMY KWAJALEIN ATOLL

A general description of geology and soils is provided in section 3.1.5.

Region of Influence

The ROI encompasses the geology and soils contained within the boundaries of USAKA, specifically those aspects of the natural environment related to the earth that may be directly disturbed by the Alternative Action on Kwajalein, Meck, and Roi-Namur.

Affected Environment

Geology

The islands and reefs of RMI are typical mid-Pacific Ocean atolls that were created by prehistoric volcanic islands surfacing above the sea then slowly subsiding below the sea due to deflation of an underlying magma chamber (U.S. Army Space and Strategic Defense Command, 1994). As the volcanoes subsided below the average sea level, ring-shaped coral reefs surrounding a shallow central lagoon were formed.

Layers of reef rock are made up entirely of the remains of previous generations of marine organisms (reef corals, algae, mollusks, echinoderms) that secrete external skeletons of calcium and magnesium carbonate (U.S. Army Space and Missile Defense Command, 1995b). Atolls are formed by the accumulation of eroded reef debris and other oceanic sediments being deposited into a shallow central lagoon, resulting in the maximum

elevation of atoll islands generally being less than 4.6 meters (15 feet) above sea level (U.S. Army Space and Missile Defense Command, 1995b).

Soils

RMI soils are almost exclusively composed of calcium carbonate from the accumulation of reef debris and oceanic sediments deficient in three major constituents, nitrogen, potash, and phosphorous. As a result of the atoll building processes, low soil fertility is due to three major physical factors: coarse soil particles, minimal amounts of organic matter, and alkaline soil pH. Poor soil fertility on the islands is also due to human activities (e.g., forest cutting, slash and burn, copra plantations, war) (Esher, 2002). Few soil surveys have been made of RMI. However, because of their parallel geologic history and nominal disturbance, soils throughout the region are expected to be similar. (U.S. Army Space and Missile Defense Command, 1995b)

3.2.6 HAZARDOUS MATERIALS AND WASTE—REAGAN TEST SITE, U.S. ARMY KWAJALEIN ATOLL

A general description of hazardous materials and waste is provided in the first two paragraphs of section 3.1.6.

Region of Influence

The ROI for potential impacts related to hazardous materials and wastes would be limited to areas of the island to be used for launch activities, prelaunch site preparation, and in areas where hazardous materials are stored and handled.

3.2.6.1 Kwajalein

Region of Influence

At Kwajalein, the ROI for potential impacts is in areas where hazardous materials are stored and handled.

Affected Environment

Hazardous Materials Management

The use of hazardous materials at the USAKA, including Kwajalein, is limited primarily to materials used in facility infrastructure support and flight operations, with some additional quantities of hazardous materials used by various test operations, including missile launches, at the range. The use of these materials must conform with the UES, federal, DoD, U.S. Army, and U.S. Air Force hazardous materials management requirements (U.S. Army Space and Missile Defense Command, 2001b).

Hazardous materials used in base infrastructure support activities include various cleaning solvents (chlorinated and non-chlorinated), paints, cleaning fluids, pesticides, motor fuels, and other petroleum products. A hazardous material management plan is prepared for all hazardous materials or petroleum products shipped to USAKA. The hazardous material

management plan outlines the procedures for storage, use, transportation and disposal of the hazardous materials or petroleum products. These substances are shipped to USAKA via ship or by air. Upon arrival at USAKA, hazardous materials to be used by USAKA assets are distributed, as needed, to various satellite supply facilities, from which they are distributed to the individual users. This is coordinated through the base supply system. An activity-specific Hazardous Materials Procedure must be submitted to the Commander, USAKA for approval within 15 days of receipt of any hazardous material or before use, whichever comes first. Hazardous materials to be used by organizations utilizing the test range and its facilities (i.e., range users) are under the direct control of the user organization, which is responsible for ensuring that these materials are stored and used in accordance with local and federal requirements.

Users provide storage of all materials in accordance with established procedures applicable to individual operations. The use of all hazardous materials is subject to ongoing inspection by USAKA environmental compliance and safety offices to ensure the safe use of all materials. The majority of these materials are consumed in operational processes (including small losses to the air and water).

Flight operations involve the use of various grades of jet propellant, which are refined petroleum products (kerosenes). Fuels are stored in aboveground storage tanks located at several islands in USAKA. Fuels are transported to USAKA by ship. Significant quantities of waste fuels are not normally generated since fuels are used up in flight operations.

Hazardous Waste Management

Hazardous waste, whether generated by USAKA activities or range users, is handled in accordance with the procedures specified in the UES. Hazardous wastes are collected at individual work sites in labeled waste containers. Containers are kept at the generation site until full or until a specified time limit is reached. Once full, containers are collected from the generation point within 72 hours and are brought to a central collection area maintained on each island that is designed to contain any accidental spills of material, including spills of full containers.

From the collection areas, all hazardous waste is transferred to the USAKA Hazardous Waste Collection Point (Building 1521), located on Kwajalein. At the collection point any sampling of waste is performed (for waste from uncharacterized waste streams), and waste is prepared for final off-island shipment for disposal. All waste is shipped off-island within 90 days of accumulation in accordance with the UES. The treatment of hazardous wastes at USAKA without a Document of Environmental Protection is prohibited, and all hazardous wastes must be shipped off the island. In addition, the introduction of polychlorinated biphenyls is prohibited.

The UES requires preparation and implementation of a Kwajalein Environmental Emergency Plan for responding to releases of oil, hazardous materials, pollutants and contaminants to the environment. The Kwajalein Environmental Emergency Plan is a contingency plan similar to a spill prevention, control and countermeasure plan, but incorporates response provisions of a National Contingency Plan and the hazardous material management plan.

3.2.6.2 Meck

Region of Influence

At Meck the ROI would encompass those areas where hazardous materials are stored and handled (e.g., MAB, the launch site, and the flight test corridor). The flight test corridor consists of all areas beneath the proposed flight track where there is the potential for impact of missile components during planned activities or abnormal flight termination, and the broad ocean area or Mid-atoll Corridor where missile debris would impact.

Affected Environment

Hazardous Materials Management

Hazardous materials at Meck are handled and used in accordance with UES, federal, DoD, U.S. Army, and U.S. Air Force hazardous materials management requirements under the same environmental constraints and documentation requirements discussed in section 3.2.6.1.

Hazardous Waste Management

Hazardous waste generated at Meck is handled in accordance with the procedures specified in the UES as discussed in section 3.2.6.1.

3.2.6.3 Roi-Namur

Region of Influence

Two alternate radar sites on Roi-Namur are being considered. The ROI would encompass the geographic area in the immediate vicinity, including the radar radiation hazard area, of either of the selected radar sites.

Affected Environment

Hazardous Materials Management

If existing transformers at either of the radar sites cannot be used, then new transformers and an aboveground 20,000-liter (5,000-gallon) diesel fuel storage tank may be installed. The tank would have secondary containment in accordance with the UES and the Kwajalein Environmental Emergency Plan. Hazardous materials at Roi-Namur are handled and used in accordance with UES, federal, DoD, U.S. Army, and U.S. Air Force hazardous materials management requirements under the same environmental constraints and documentation requirements discussed in section 3.2.6.1.

Hazardous Waste Management

Hazardous waste generated at Roi-Namur is handled in accordance with the procedures specified in the UES as discussed in section 3.2.6.1. For the staging area on Roi-Namur, hazardous wastes are removed on the weekly barge to Kwajalein.

3.2.7 HEALTH AND SAFETY—REAGAN TEST SITE, U.S. ARMY KWAJALEIN ATOLL

A general description of health and safety is provided in the beginning of section 3.1.7.

Region of Influence

The ROI for health and safety at the RTS includes those areas of the islands where program activities would occur or that could be affected by program activities. The potential for health and safety impacts is greatest in areas where explosive devices and/or liquid fuels are stored and handled (Kwajalein and Meck) and where launch activities occur (Meck).

Affected Environment

At RTS, safety is integral to every mission. RTS maintains a fully redundant flight safety system with remote command destruct transmitters for contingency actions. RTS also provides a complete ground safety program to ensure that personnel and materials are protected from the time of ordnance receipt through missile build-up and launch. Aircraft within the region of tracking radars are subject to the publication of an appropriate NOTAM, which advises avoidance of the radar area during use.

All program operations must receive the approval of the RTS Safety Office. This is accomplished by the user through presentation of the proposed program to the Safety Office. All safety analyses, standard operating procedures, and other safety documentation applicable to those operations affecting USAKA must be provided, along with an overview of mission objectives, support requirements, and schedule. The Safety Office evaluates this information and ensures that all USAKA safety requirements, as specified in the RTS Safety Manual and supporting regulations, are followed.

Prior to operations, which may involve impact of objects within the range, an evaluation is made to ensure that populated areas, critical range assets, and civilian property susceptible to damage are outside predicted impact limits. RTS uses RCC 321-02 as described in section 3.1.7. A NOTMAR and a NOTAM are published and circulated in accordance with established procedures to provide warning to personnel (including natives of the RMI) concerning any potential hazard areas which should be avoided. Radar and visual sweeps of hazard areas are accomplished immediately prior to operations to assist in the clearance of noncritical personnel. Only mission-essential personnel are permitted in hazard areas.

Prior to flight operations, proposed trajectories are analyzed and a permissible flight corridor is established. A flight termination system, which effectively halts the continued powered flight of the hardware, is installed on all flight vehicles capable of impacting inhabited areas.

In addition to the above requirements, launch operations that originate out of RTS must also observe additional safety procedures. Any prelaunch hazardous operations (e.g., handling of explosives) must have established standard operating procedures, which have

received approval from the RTS Safety Office and must be conducted in accordance with USAKA safety directives (e.g., USAKA Regulation 385-75, *Explosive Safety*). At launch time, the launch vehicle can be armed only after all required safety evacuations, sufficient to ensure that no unauthorized personnel are present in hazardous areas, have been accomplished. Following arming, positive control of the hazard area on the launch island is established. Unauthorized entry into this hazard area will result in delay of the operation until the "ALL CLEAR" has been re-established. Launch operations are conducted by the user organization, with the support and oversight of the USAKA, including the USAKA Safety Office.

3.2.8 INFRASTRUCTURE—REAGAN TEST SITE, U.S. ARMY KWAJALEIN ATOLL

A general description of infrastructure is provided in the first paragraph of section 3.1.9.

3.2.8.1 Kwajalein

Region of Influence

The ROI includes the transportation and utility systems that could potentially be affected by the Alternative Action at Kwajalein.

Affected Environment

Transportation

There are approximately 21 kilometers (13 miles) of paved roads and 11 kilometers (6.5 miles) of unpaved roads on Kwajalein. Bicycles are the principal means of transportation and travel on the same paths used by pedestrians as well as on roads used by motor vehicles. Island shuttle buses provide vehicular transportation to and from work and school.

Marine transport facilities are concentrated at Kwajalein, which serves as a base for receiving cargo and fuel for USAKA. Passenger fleets, consisting of two high speed catamaran ferries, five landing craft mechanized vessels (LCM), two landing craft utility vessels (LCUs), and additional smaller boats, are also located at Kwajalein.

Kwajalein also has air transportation capabilities and houses the Bucholz Army Airfield, which serves as a refueling point for a wide variety of military and civilian aircraft. Aircraft ranging from Learjets to military C-5 transports use Kwajalein as an en route stop. USAKA Aviation and Marine services support transportation requests. USAKA also uses regularly scheduled UH-1 helicopter runs to Meck and shuttle flights to Roi-Namur.

Utilities

Utilities at USAKA/RTS are operated to meet the needs of the resident population of approximately 2,500 people, including dependants. This figure varies depending on mission status and construction activity.

Water. Drinking water on Kwajalein is supplied by a conventional package filter drinking water system for potable water production. The capacity of the system is 1,703,435 liters (450,000 gallons) per day. Three portable reverse osmosis water purifying units are used to process the lens well water to reduce suspended and dissolved solids content before treatment. Upgrades are in progress to improve this system's ability to meet standards. These upgrades include the addition of new reverse osmosis units for control of total trihalomethanes and haloacetic acids. Two 4-million liter (1-million gallon) tanks are used for potable water storage (Esher, 2002).

Drinking water quality is produced to meet the standards of the UES. These standards are essentially the same as the EPA standards for public systems that serve a population of 10,000 people.

Raw water is provided primarily by a rainwater catchment system along the runway. During dry seasons, additional water is provided by pumping the freshwater lens that forms an unconfined surficial aquifer beneath the island surface.

Wastewater. Wastewater is reclaimed by conventional secondary treatment followed by chemical (chlorine) disinfection. The reclaimed water is then used for non-potable applications, such as flushing toilets and vehicle washing. The non-potable water is the result of secondary treatment plus filtration and chlorination. USAKA is upgrading the plant with two new mixed media filters (Esher, 2002). Excess water is discharged in accordance with the UES toilet facilities and sewage disposal provisions or requirements.

Power. Electrical power is provided by power plants run by diesel generators. Power distribution is conventional with underground high-voltage transmission lines and above ground "user voltage" (110-220 volt alternating current) distribution lines. Generating capacities have not changed in several years. Table 3-5 lists the number of generators and output of the power plants.

Table 3-5: Power Plant Characteristics

	Number of Generators	Output Totals (kW)
Kwajalein Power Plant	7	29,200
Roi-Namur Power Plant	9	13,500
Meck Power Plant	5	2,800

Solid Waste. Solid waste is collected and taken to the landfill/incinerator facility for processing. Source separation is practiced to facilitate processing. Combustibles are incinerated at the facility, and the ash/inerts are removed for disposal at an adjacent landfill. Metals are shipped to Honolulu to be recycled. Glass, tires, and plant matter, including wood are shipped to Kwajalein for recycling. Glass is pulverized, tires are shredded and used as fuel in incinerators, and plant matter is chipped and composted. Some food waste is also sent to Kwajalein for composting. Glass, concrete rubble, and similar materials are processed for reuse as construction (including shoreline protection) and fill material at USAKA.

3.2.8.2 Meck

Region of Influence

The ROI includes the transportation and utility systems that could potentially be affected by the Alternative Action at Meck.

Affected Environment

Transportation

Meck has about 2 kilometers (1 mile) of paved road, a concrete pier that accepts both personnel and cargo, and a runway that no longer accepts fixed-wing aircraft but is capable of accepting helicopter transportation.

Meck is also serviced by regularly scheduled ferryboat and UH-1 helicopter runs. There is also an existing concrete landing ramp and a barge pier, which ensure access to the island by maritime craft or tactical sealift assets. This site is approved to support launcher and generator operations.

Utilities

Water. Drinking water on Meck is provided from a rainfall catchment basin and stored in tanks until needed. The water produced at Meck meets UES standards. A new water treatment plant was constructed in 2000. This plant is a package plant and maintains a capacity of 545,099 liters (144,000 gallons) per day.

Wastewater. Wastewater is collected and pumped to a septic system on the island. Residual sludge is collected from the septic tank as needed and periodically sent to Kwajalein for composting.

Power. Power is provided by diesel generators. The Meck power plant maintains five diesel generators with a total output of 2,800 kW. Standby diesel generators are maintained at numerous locations in case of a power shortage.

Solid Waste. The small amount of solid waste generated on Meck is collected and taken to the landfill/incinerator facility for processing. Source separation is practiced to facilitate processing. Combustibles are incinerated at the facility, and the ash/inerts are removed for

disposal at an adjacent landfill. As discussed above, metals are shipped to Honolulu, and glass, tires, and plant matter are sent to Kwajalein for recycling.

3.2.8.3 Roi-Namur

Region of Influence

The ROI includes the transportation and utility systems that could potentially be affected by the Alternative Action at Roi-Namur.

Affected Environment

Transportation

Roi-Namur has approximately 10 kilometers (8 miles) of paved roads and 2 kilometers (1 mile) of unpaved roads. Island shuttle buses provide vehicular transportation to and from work; many of the residents use bikes. Approximately 200 personnel currently commute by plane to Roi-Namur from Kwajalein daily to support normal operations.

Roi-Namur has a cargo pier, cargo/fuel pier, and marine ramp. Roi-Namur also has air transportation capabilities and is home to the Dyess Army Airfield, which provides service to a variety of aircraft and helicopters.

Utilities

Water. Drinking water on Roi-Namur is provided from a rainfall catchment basin and stored in tanks until needed. The water treatment facility is a package plant and has the ability to produce 817,649 liters (216,000 gallons) per day. The water produced at Roi-Namur meets the UES.

Wastewater. Wastewater is collected and pumped to a primary treatment system on the northwest end of the island. Since the volume collected cannot be processed adequately, sludge is collected and periodically sent to Kwajalein for composting.

Power. Electrical power is provided by diesel generators at a new central power plant. The new plant was completed in 2001 and has 9 diesel generators with a total output of 13,500 kW. Standby diesel generators are located at numerous locations in case of power outage.

Solid Waste. The solid waste generated on Roi-Namur is collected and taken to the landfill/incinerator facility for processing. Source separation is practiced to facilitate processing. Combustibles are incinerated at the facility, and the ash/inerts are removed for disposal at an adjacent landfill. Metals are sent to Kwajalein and then shipped to Honolulu to be recycled. Glass, tires, and plant matter, including wood are shipped to Kwajalein for recycling and are processed for reuse as construction (including shoreline protection) and fill material at USAKA.

3.2.9 LAND USE—REAGAN TEST SITE, U.S. ARMY KWAJALEIN ATOLL

A general description of land use is provided in the first paragraph of section 3.1.8.

Region of Influence

The ROI for land use includes the existing land use patterns on Kwajalein, Meck, and Roi-Namur.

3.2.9.1 Kwajalein

Affected Environment

Kwajalein is the headquarters of USAKA and has a land area of 303 hectares (748 acres). It is extensively developed with housing and community facilities toward the eastern end of the island; air operations, supply, and utilities near the center of the island; and research, development, and communications operations toward the western end of the island. The land uses on the island include flight operations, family housing, research and development operations, communications operations, supply (which includes high explosives magazine, petroleum, oils, and lubricants, and disposal), community support and unaccompanied personnel housing, outdoor recreation, utilities, maintenance, sanitary landfill, waterfront operations, and administration (U.S. Army Space and Missile Defense Command, 1995b).

3.2.9.2 Meck

Affected Environment

Meck has a land area of 22 hectares (55 acres). Facilities situated on the southern portion of the island are interrelated to power generation, maintenance and supply, waterfront and air operations. (U.S. Army Space and Missile Defense Command, 1995b) The remainder of the island is used for research and development operations that include missile launch complexes (U.S. Army Space and Strategic Defense Command, 1993b).

3.2.9.3 Roi-Namur

Affected Environment

Roi-Namur has a land area of approximately 161 hectares (398 acres). Kwajalein and Roi-Namur are the only USAKA islands with resident nonindigenous populations (U.S. Army Space and Strategic Defense Command, 1993b). The predominant land uses on the island are research and development operations, flight operations, outdoor recreation, community support/unaccompanied personnel housing, maintenance, utilities, high-explosive supply, supply, base support, and administration. (U.S. Army Space and Missile Defense Command, 1995b)

3.2.10 NOISE—REAGAN TEST SITE, U.S. ARMY KWAJALEIN ATOLL

A general description of noise is provided in the beginning of section 3.1.10.

Region of Influence

The minimum ROI for noise analysis is the area within the $L_{max} = 85$ dB contours generated by program activities on Kwajalein, Meck, and Roi-Namur.

3.2.10.1 Kwajalein

Affected Environment

Primary sources of noise on Kwajalein include aircraft, power plants, marine sandblasting and service, air conditioning units, and small diesel engine generators. Noise-sensitive receptors, such as family housing and schools, exist at various locations on Kwajalein.

3.2.10.2 Meck

Affected Environment

The primary sources of noise of Meck include the electrical power plant (350-kW diesel engine generators), helicopter operations, and air conditioning units. Missiles have been launched infrequently from Meck. The island has been developed as a launch facility and has no inhabitants occupied in unrelated activities; no noise-sensitive receptors have been identified on Meck.

3.2.10.3 Roi-Namur

Affected Environment

Primary noise sources on Roi-Namur are aircraft, power plant, air conditioning units, and (potentially) missile launches. All personnel on Roi-Namur who are involved with USAKA activities are provided with appropriate hearing protection to reduce exposure to allowable levels.

3.2.11 SOCIOECONOMICS—REAGAN TEST SITE, U.S. ARMY KWAJALEIN ATOLL

A general description of socioeconomics is provided in the first paragraph of section 3.1.11.

Region of Influence

The ROI for socioeconomics is limited to Kwajalein; Roi-Namur; Ebeye, the island where most Marshallese working on Kwajalein reside; Ennubirr (Third Island), the Marshallese home site off Roi-Namur; and Ennylabegan islands since these are the only locations that have the potential for program-related population, employment, income, and housing impacts.

Affected Environment

USAKA strictly regulates access to Kwajalein. The nonindigenous population fluctuates monthly depending on program activities, but totaled 2,512 in 2000. This number consisted of military, civil service, and contractor personnel and their dependents.

Housing for USAKA personnel is located on Kwajalein and Roi-Namur. On Roi-Namur, 231 personnel are housed in 231 rooms in eight buildings. There are also 10 two-bedroom trailers that can house a total of 20 personnel, bringing the total for unaccompanied personnel housing to 251. A dispensary is staffed by one medical technician. Construction workers are usually housed in temporary trailers provided by the construction contractor. Currently, Kwajalein can accommodate 134 transient personnel. Transient personnel are primarily housed in the Kwajalein Lodge (U.S. Army Space and Strategic Defense Command, 1994).

3.2.12 WATER RESOURCES—REAGAN TEST SITE, U.S. ARMY KWAJALEIN ATOLL

A general description of water resources is provided in the first paragraph of section 3.1.12. Generally, coral atolls lack surface water bodies or defined drainage channels due to extreme high porosity and permeability of the soils and surface sediments. With the exception of man-made impervious surfaces, abundant amounts of rainwater rapidly infiltrate directly into the ground (U.S. Army Space and Missile Defense Command, 1995).

Region of Influence

The ROI for potable water resources includes locations on Kwajalein, Meck, and Roi-Namur islands where potable water would be obtained to supply program requirements.

3.2.12.1 Kwajalein

Affected Environment

Potable water sources on Kwajalein are supplied by both groundwater wells and captured rainwater in catchment areas located adjacent to the airfield's runway. Water capture during periods of drought can be less than one-third of the daily demand. Groundwater occurs on Kwajalein as a lens of fresh to brackish water floating on deeper marine waters in the subsurface rock layers. Seasonal infiltration of rainwater recharges the aquifer. The fresh groundwater storage capacity has been estimated at about 1,060 million liters (279 million gallons), with fluctuations of greater than 20 percent in response to recharge or pumping. Raw water is stored in twelve 4-million liter (1-million gallon) aboveground storage tanks. (U.S. Army Space and Missile Defense Command, 1995b)

3.2.12.2 Meck

Affected Environment

The amount of fresh groundwater that may be available on Meck for potable water consumption has not been investigated. Potable water requirements are provided by a rainwater catchment area adjacent to the airfield runway. One 950,000-liter (250,000-gallon) tank and one 2-million liter (500,000 gallon) tank store raw water. (U.S. Army Space and Missile Defense Command, 1995b)

3.2.12.3 Roi-Namur

Affected Environment

Roi-Namur uses a combination of groundwater wells and the capture of rainwater in catchment basins to supply potable water. A calibrated model of the groundwater system indicates that at least 13 million liters (3.5 million gallons) per year of sustainable yield can be expected from the existing well system. (U.S. Army Space and Missile Defense Command, 1995b) Raw water is stored in one 3.8-million-liter (1-million-gallon) and two 2.8-million-liter (750,000-gallon) steel tanks (U.S. Army Kwajalein Atoll, 2000).

3.3 WAKE ISLAND

Wake Island is a possession of the United States under the control of the U.S. Air Force. It was a U.S. Army launch support facility operated under a caretaker permit from the U.S. Air Force, administered by the USASMDC. However, in October 2002, the U.S. Air Force resumed administration of Wake Island. MDA continues to operate the Wake Island Launch Center as a tenant organization. RTS maintains and operates the launch facilities and also provides instrumentation, communications, flight and ground safety, security, and other support. (U.S. Army Space and Missile Defense Command, 2000d)

3.3.1 AIR QUALITY—WAKE ISLAND

A general description of air quality and the relationship of inert and reactive pollutants in regards to ROI is provided in the beginning paragraphs of section 3.1.1.

Region of Influence

The ROI for air quality is the existing airshed surrounding Wake Island. This ROI encompasses the effects of both inert and reactive pollutants.

Affected Environment

Climate

The maritime climate of Wake Island is influenced by the persistent easterly trade winds. These winds blow steadily each month of the year with an annual average wind speed of 22.2 kilometers (13.8 miles) per hour.

Temperature also varies little throughout the year. February is typically the coolest month of the year with an average daily high of 27.6°C (81.7°F) and an average daily low of 21.9°C (71.5°F).

Average annual precipitation is approximately 89 centimeters (35 inches). Average annual humidity ranges from 69 to 80 percent, and the average amount of the daytime sky obscured by clouds is approximately 54 percent.

Regional Air Quality

Determination of standards and compliance issues for Wake Island is within the jurisdiction of EPA Region 9.

No ambient air quality monitoring data are available for Wake Island; however, there are no air pollution problems at Wake, due to the relatively small amount of air emissions and sources given the abundance of strong trade winds. The trade winds quickly disperse any local emissions. Also, since there are no other islands within several hundred miles of Wake, there are no other nearby sources of air pollution and there are no other communities to be affected by air pollution from emissions generated at Wake.

Existing Emission Sources

The small land area and nearly constant sea breezes ensure rapid and complete dispersion of emissions. The overall air quality at Wake is considered to be good. The principal pollution emission sources are derived from the power plant, motor vehicle exhaust, aircraft operations, fuel storage tanks, open burning of trash, and infrequent rocket launches. The small reverse osmosis unit at the water plant is a minor source of air emissions (U.S. Army Space and Missile Defense Command, 2000d).

3.3.2 AIRSPACE—WAKE ISLAND

A general description of airspace is provided in the first paragraph of section 3.1.2.

Region of Influence

The ROI for airspace at Wake Island includes the airspace above the island and surrounding area.

Affected Environment

En Route Airways and Jet Routes

Wake Island is located below international airspace that is managed by the Oakland ARTCC Oceanic Control-5 Sector (figure 3-7). One jet route passes over the island, but no summary of flights is maintained (figure 3-8). (U.S. Army Space and Missile Defense Command, 1999)

Airports/Airfields

One military flight is scheduled to Wake Island from Hickam Air Force Base, Hawaii, every 2 weeks. However, frequent military aircraft traffic uses Wake Island as a refueling point.

Air Traffic/Range Control

Since Wake Island is located in international airspace, the procedures of the ICAO (outlined in ICAO Document 444, Rules of the Air and Air Traffic Services) are followed (International Civil Aviation Organization, 1985; 1994). The FAA provides U.S. aeronautical information to the ICAO.

3.3.3 BIOLOGICAL RESOURCES—WAKE ISLAND

A general definition of biological resources is provided in the first paragraph of section 3.1.3.

Region of Influence

The ROI for biological resources includes the entire island and near-shore reef area for islands where target and interceptor missiles would be launched. The ROI for the flight test corridor includes the missile over-flight area and the potential debris impact areas over the broad ocean area.

Affected Environment

Vegetation

One-hundred percent coverage botanical surveys have been conducted at various sites on Wake Island as well as overview botanical surveys on both Wilkes and Peale islands. During the study, only naturally occurring plants that appeared to be surviving and proliferating on their own were recorded. (U.S. Army Space and Strategic Defense Command, 1994) Vegetation in the Peacock Point area is composed of scrub tree heliotrope, ironwood, and kou trees interspersed with dense stands of naupaka and cotton. The areas around Launch Sites 1 and 2 were previously cleared and now consist of low-growing weeds. The dominant vegetation of Wilkes Island is tree heliotrope and ironwood. Tree heliotrope and grass are the dominant vegetation on Peale Island. The launch pads were cleared of trees and bushes several years ago (U.S. Army Space and Missile Defense Command, 1999). The western third of Wilkes Island, which has been set aside as a large seabird colony, is regularly mowed to protect the seabirds from the feral (wild) cats that inhabit the island.

Wildlife

Approximately 32 species of birds have been observed in the ROI, including seabirds, shorebirds, land birds, and waterbirds. Thirty species are considered indigenous and two species (the domestic chicken and the domestic pigeon) are exotic. Migratory seabirds are the dominant wildlife on Wake Island and are protected under the Migratory Bird Treaty Act of 1918, as amended (16 USC 703-712). A population of albatrosses returns to Wake Island each year in November for the courtship and nesting season.

All seabirds present on the island (there are no breeding land birds) at the time of the survey, except for tropicbirds, lay their eggs in the open, either on bare ground or exposed in shrubs or small trees. (U.S. Army Space and Strategic Defense Command, 1994) Predation by feral cats and possibly rats (house [*Rattus rattus*] and Norway [*R. norvegicus*]) has been suspected in the repeated albatross nesting failure on Wake Island. There is an ongoing effort to control the feral cat population.

The main roosting and nesting areas are found on Wilkes and Peale islands, well removed from the airfield and the majority of base activities. However, there is always the possibility of nesting habitat for small groups of seabirds throughout the entire atoll.

Other than birds, the native terrestrial fauna at Wake Atoll is relatively limited and includes insects and several species of land crabs. No recent accounts of brown tree snakes, an invasive and detrimental species, have been reported on Wake Atoll; however, the potential for such an introduction at the atoll has been recognized.

During a 1998 marine biological survey, a total of 122 species of reef fish, 41 species of corals, 39 species of other macroinvertebrates (animals without a backbone large enough to be seen without a microscope), and 19 species of macroalgae (multi-celled) were recorded at Wake Atoll. The most common species of reef fish include surgeonfish, parrotfish, butterflyfish, wrass, and fairy basslet. Antler coral and star coral were two of the most common coral species observed during the survey. Giant clams and sea urchins were the most abundant macroinvertebrates observed. (U.S. Fish and Wildlife Service and National Marine Fisheries Service, 1999)

Essential Fish Habitat

If a foreign nation enters into a Pacific Insular Area Fisheries Agreement with the United States, its vessels may fish within the exclusive economic zone adjacent to the islands covered by the agreement. Wake Island is one of the Pacific Insular Areas. In addition, a policy is established that the fishery resources (including resident or migratory stocks) in the Exclusive Economic Zone adjacent to a Pacific Insular Area are to be used and managed for the benefit of the people of each Area. (U.S. Department of Commerce, 1997; National Oceanic and Atmospheric Administration Fisheries, 2002)

The DoD is advancing coral reef conservation by developing management policies for coral reef ecosystems held in trust by the Military Services throughout the world, including Wake Island/Atoll and its coral reef ecosystem. Protection of Wake's coral reefs is being addressed in the U.S. Air Force installation's Integrated Natural Resources Management Plan. (Defense Environmental Network and Information eXchange, 2000) Coral reef monitoring activities were formally extended to Wake Atoll. Despite extensive damage from World War II-era dredging and filling, the reef has recovered and is in healthy condition.

The Coral Reef Essential Fish Habitat on Wake Island ranges from the shoreline to the extent of the Exclusive Economic Zone, which is the 322-kilometer (200-mile) boundary around the island. In addition, Essential Fish Habitat ranges from the sea surface within this zone to a depth of 200 meters (656 feet).

Since commercial fisheries are excluded and spearfishing is not allowed at Wake, the island has one of the few reef systems with abundant schools, at natural population densities, of large fish such as bumphead parrotfish, jacks, and Napoleon wrasses (truck fish), otherwise overfished throughout most of their range in the Pacific Islands. (Defense Environmental Network and Information eXchange, 2000) Truck fish in particular are extremely abundant at the atoll, where the military presence also discourages poaching. A *Coral Reef Ecosystem Fishery Management Plan*, suggesting Wake Atoll as one of a number of Marine Protected Areas (areas of special value for the protection, conservation and management of significant coral reef areas), has been drafted. If enacted, a special

permit would be required to fish at Wake Atoll in depths of less than 92 meters (50 fathoms) (Western Pacific Regional Fishery Management Council, 2000).

Threatened and Endangered Species

No exclusively terrestrial plants and animals, federally listed as threatened or endangered, are currently known or reported from Wake.

Marine mammals that may occur in the open ocean area surrounding Wake Atoll and between Wake and Kwajalein Atolls include several species of cetaceans: the blue whale, the finback whale, the humpback whale, Cuvier's beaked whale, and the sperm whale. Bottlenose and spinner dolphins may also be present around Wake Atoll. Hawaiian monk seals have been occasionally sighted at Wake Island.

A detailed sea turtle assessment conducted in 1989 by the National Marine Fisheries Service indicated that potential sea turtle habitat exists along the outer reef face and deeper patch reefs of Wake Island. Although sea turtles are not known to nest on the atoll, they have been observed in the lagoon and the area off the outer reef. (U.S. Army Space and Strategic Defense Command, 1994) The green sea turtle is the only species confirmed to reside at the island. In addition to the green sea turtle, three other federally listed sea turtle species may occasionally visit the atoll: the loggerhead, leatherback, and the hawksbill. The federally threatened green sea turtle was observed multiple times in the near shore ocean and lagoon waters at Wake Atoll during a 1998 terrestrial survey; and while shoreline basking and nesting activities were not observed, it is conceivable that green sea turtles might haul out along the southern shoreline since the slope is not steep and offers (limited) basking opportunities. The federally endangered hawksbill sea turtle, although suspected to occur at Wake Atoll, was not recorded during the 1998 survey. (U.S. Army Space and Missile Defense Command, 1999)

Environmentally Sensitive Habitat

A bird nesting area is located at the old Very High Frequency Omni-directional Range/Tactical Air Navigation site on the western end of Wilkes Island. The area is mowed regularly to protect the seabirds from feral cats.

The reefs surrounding Wake Island support a variety of sea life. Approximately 309 species of reef fish have been identified. Potential sea turtle habitat exists at Wake Island along the outer reef face and the deeper patch reefs. Sea turtles are not known to nest on the island, but have been observed in the lagoon and the area off the outer reef. (U.S. Army Space and Missile Defense Command, 1999)

3.3.4 CULTURAL RESOURCES—WAKE ISLAND

A definition of cultural resources and the laws and regulations protecting them are provided in the first two paragraphs of section 3.1.4.

Region of Influence

The ROI for cultural resources (for the purposes of this EA, synonymous with the area of potential effect under cultural resources legislation) includes the southern portion of Wake Island.

Affected Environment

Prehistoric and Historic Archaeological Resources

William Wake, a British sea captain, discovered Wake Island in 1796. It was later claimed by the United States in January 1899. Except from December 1941 through February 1945 when the Japanese controlled the island during World War II, it has remained a U.S. possession. Currently, Wake Island is controlled by the U.S. Air Force and maintains a population of approximately 100. (U.S. Army Space and Missile Defense Command, 2000d)

The remoteness of the island and the lack of fresh water sources other than rainfall discouraged settlement by native Pacific populations, so there is little potential for prehistoric or traditional resources to be present. No unique paleontological or traditional use resources are known to exist on the island. (U.S. Army Space and Missile Defense Command, 1999)

Historic Buildings and Structures

Wake Island was designated a National Historic Landmark in 1985 in order to preserve both the battlefield where important World War II events occurred and Japanese and American structures from that period. These include command posts, blockhouses, pillboxes, power plants, storehouses, magazines, aircraft revetments, gun emplacements, rifle-pits, and earthworks (U.S. Army Space and Missile Defense Command, 2000d). The Pan American facilities and the U.S. Naval submarine and aircraft base are included in the historic property. Many of the Japanese structures were actually constructed by American civilian prisoners (construction workers). These structures include several pillboxes, bunkers and aircraft revetments. A comprehensive survey of Japanese earthen structures and field fortifications has not been conducted. (U.S. Army Space and Missile Defense Command, 1999)

3.3.5 GEOLOGY AND SOILS—WAKE ISLAND

A general description of geology and soils is provided in the first paragraph of section 3.1.5.

Region of Influence

The ROI encompasses the geology and soils contained within the boundaries of Wake Island, specifically those aspects of the natural environment related to the earth that may be directly disturbed by the Alternative Action.

Affected Environment

Geology

Wake Island is typical of mid-Pacific Ocean atolls formed when a volcano rises (seamount) above the sea surface and then subsides back below the surface due to deflation of the underlying magma chamber (described in section 3.2.5).

The maximum elevation on Wake Island is 6 meters (21 feet) above mean sea level, and the average elevation is likely only about 3 meters (10 feet). This makes the island very susceptible to damage from high waves generated by tropical storms and the high winds.

Soils

Wake Island soils are predominantly coarse-grained and almost exclusively composed of calcium carbonate. Therefore, they are of low fertility, lacking many of the nutrients required to support many plant species. Island building by wave-deposited reef debris also limits land elevation.

3.3.6 HAZARDOUS MATERIALS AND WASTE—WAKE ISLAND

For the purposes of the following analysis, the terms hazardous materials or hazardous waste will be defined according to those regulations and standards discussed in sections 3.1.6 and 3.2.6. Hazardous materials and hazardous waste management activities at Wake Island are governed by EPA and DOT regulations.

Region of Influence

The ROI for potential impacts related to hazardous materials and wastes would be limited to areas used for launch activities (launch area[s]), prelaunch site preparation (including missile storage), and the flight test corridor. The flight test corridor consists of all areas beneath the proposed flight track where there is the potential for impact of missile components during planned activities or abnormal flight termination.

Affected Environment

Hazardous Materials Management

Operations at Wake Island that use hazardous materials are limited to aircraft flight and maintenance activities, base operations and infrastructure support and missile launches. JP-5 jet fuel is the hazardous material used in greatest quantity at Wake. Fuel storage areas can accommodate up to 37.8 million liters (10 million gallons) of JP-5. In addition to JP-5, small quantities of lubricants and gasoline are stored in bulk for base operations and infrastructure support. These materials are transported by ship to Wake and transferred to the on site storage facilities. Aboveground storage tanks are double-walled or bermed. Distribution is based on need, and most of these materials are consumed in ongoing activities. Potential spills are managed and minimized through implementation of existing Spill Prevention Control and Countermeasures Plans.

Small quantities of other hazardous materials, including solvents, paints, cleaning fluids, pesticides, chlorine and other materials are also used for infrastructure support and aircraft maintenance activities. These materials are also transported by ship to Wake and transferred to on site storage areas.

Hazardous Waste Management

As “owner” of the installation, the U.S. Air Force holds the hazardous waste management permit. The permit lists the installation as a Large Quantity Generator, but the installation could easily qualify for Small Quantity Generator status based on actual amounts of hazardous wastes generated since 1994. The U.S. Air Force resumed operation of the airfield on 1 October 2002; however, MDA will continue to operate the Wake Island Launch Center portion of the installation as a tenant organization. Hence, no change in the regulatory status of hazardous waste management will occur.

Types of wastes generated include small quantities of used solvents, paints, cleaning fluids, asbestos-containing materials (generated during truck building maintenance activities) and pesticides. Waste is placed in DOT-E-9618-approved polyethylene overpack containers for added security until shipment to the United States for treatment or disposal.

In normal practice, a user of the Wake Island Launch Center facilities (e.g., the Target Office) would be responsible for disposal of its hazardous waste generated at the facility in accordance with U.S. Air Force policy. This could entail the user arranging to return wastes back to Hawaii under the U.S. Air Force permit for further disposition in accordance with the permit requirements and state and federal law. Hazardous waste shipments are normally consigned to the Wake Island Launch Center supply barge for shipment to Hawaii.

3.3.7 HEALTH AND SAFETY—WAKE ISLAND

A general description of health and safety is provided in the beginning paragraphs of section 3.1.7.

Region of Influence

The ROI for health and safety of workers includes the immediate work areas, radiation hazard areas, the launch site, and the flight corridor.

Affected Environment

All operations at Wake Island Launch Center are subject to applicable DoD health and safety regulations, which could include AR 385-10, *The Army Safety Program*; AR 385-64, *U.S. Army Explosives Safety Program*; and AR 420-90, *Fire and Emergency Services*. Safety and medical departments administer the safety program. RTS administers the missile safety program.

The primary existing hazards at Wake Island Launch Center are associated with missile launches, aircraft refueling, and infrastructure support.

The missile operations facilities have four range safety zones that are critical to missile testing: the explosive safety quantity-distance, the blast danger area, the launch danger area, and the Impact Limit Line zone. The explosive safety quantity-distance is a fixed number of 381 meters (1,250 feet); both blast danger and launch land areas are determined by range safety and based on calculated explosives velocities, TNT equivalent toxic propellant dispersion and fragment dispersion. The Impact Limit Line zone is a 3,052-meter (11,000-foot) distance in which a missile will not be allowed to impact. The distance of 3,052 meters (11,000 feet) was established by range safety as the worst case scenario.

3.3.8 INFRASTRUCTURE—WAKE ISLAND

A general description of infrastructure is provided in the first paragraph of section 3.1.8.

Region of Influence

The ROI includes the transportation and utility systems that could potentially be affected by the Alternative Action on Wake Island.

Affected Environment

Transportation

Air Transportation. Wake Island's runway is approximately 3,000 meters (9,850 feet) long and 46 meters (150 feet) wide, and is central to the missile launch support missions. In addition, the airfield supports trans-Pacific military operations and western Pacific military contingency operations, in-flight emergency airfield service, and emergency sealift capability. All aircraft operations and servicing activities are directed from base operations, which are manned 24 hours per day. Although there is only one flight scheduled every other week to transport passengers and cargo to Wake Island, approximately 800 aircraft per year use the Wake Island Airfield.

Ground Transportation. Transportation on Wake Island is provided by bus, or contractor- or government-owned vehicles. Bus transportation between the Base Operations Building and the Dining Hall/Billeting Office for aircrews and passengers is provided on an as-needed basis. A limited number of scooters are available for mission support and transient personnel.

The primary road is a two-lane paved road extending from the bridge connecting Peale and Wake Islands to the causeway between Wake and Wilkes Islands. Wake and Peale Islands are connected by a bridge restricted to automobiles and light trucks.

Marine Transportation. Wake Island is supplied by sea-going barges and ships. The civilian contractor maintains three small landing barges used to transfer material from ships

to the dockyard. The barges are required because the harbor is too small for sea-going vessels to enter. Off- and on-load fueling facilities built in the mid-1970s by the U.S. Navy have never been operated due to a reported electrical fault. The older off-load hydrants for gasoline and JP-5 fuels are operational and are currently used. (U.S. Army Space and Missile Defense Command, 1999)

Utilities

Water. The primary source of potable water is rainwater captured in two 6.9-hectare (17-acre) catchment basins of which only one is currently in use. The new reverse osmosis system is very small and used for supplemental water. Current demand for the population is calculated at 87,064 liters (23,000 gallons) per day. Average per-capita usage is approximately 613 liters (162 gallons) per day. Wake has the capability to store up to 22 million liters (5.8 million gallons) of water in six concrete 1,135,624-liter (300,000-gallon) tanks and two steel 7.6 million-liter (2 million-gallon) tanks. The water distribution system is currently capable of meeting the current demand, including water required for fire fighting operations.

Wastewater. Along with lagoon water, brackish wells provide water for the sanitary sewer system. A series of wet-well lift stations are used to collect and move sewage to a treatment plant where solids are collected and disposed. Wastewater is discharged to a septic tank system near Peacock Point at the far southeast end of Wake Island. (U.S. Army Space and Missile Defense Command, 1999)

Solid Waste. Solid waste generated on the island is disposed of in the island's landfill/burning pit located south of the runway on south central Wake Island, or it is burned in the incinerator. No trash sorting is performed; aluminum cans and glass are burned with waste paper, foliage, leaves, and cardboard packing materials. The incinerator, an Advanced Combustion Systems Model CA-150 with a design capacity of 68 kilograms (150 pounds) per hour, actually burns approximately 27 kilograms (60 pounds) per hour and is operated 2 to 4 hours per day, disposing of about 109 kilograms (240 pounds) per day of primarily wet garbage from mess operations. Residue from the incinerator goes into the landfill. (U.S. Army Space and Missile Defense Command, 1999)

Electricity. The electrical system is currently composed of five 800-kW, 1,150 horsepower, Worthington diesel engine generators capable of supplying a maximum of 2.6 MW to the island. An additional generator is in disrepair because of foundation failure and is used for replacement parts. Present power load requirement calls for two engines out of five running concurrently on a 2-week alternating schedule.

The original power plant, Building 1194, was constructed in 1960-61 to house four generators. Additions were made to the power plant in 1964 and 1967, increasing its capacity to the present six generators. Currently 4 MW of prime power is available, with 1.2 MW on standby.

3.3.9 LAND USE—WAKE ISLAND

A general description of land use is provided in the first paragraph of section 3.1.9.

Region of Influence

The ROI for land use includes the existing land use patterns on Wake Island that may potentially be affected by the Alternative Action.

Affected Environment

The MDA currently manages and operates a national test and range facility at Wake Island (U.S. Air Force assumed ownership of Wake in October 2002.). Wake Island is the main island containing the majority of the air base's operations and facilities. Housing and community facilities are located toward the northern end of the island. The central portion of the island contains support facilities (e.g., water catchment basins, water storage tanks, power plant). An aircraft runway is located on the southern portion of the island supplying additional support for current operations (U.S. Army Space and Missile Defense Command, 1999).

Peale Island is largely used by migratory birds as a nesting area; however, several recreational beach houses, a Thai Buddhist temple, and remnants of Pan American Airways facilities and World War II Japanese earthen defenses are located on the island.

A petroleum storage area is situated on the eastern portion of Wilkes Island, and an inactive asbestos disposal area is found toward the western end. The central section of Wilkes Island contains an unfinished submarine channel; no air base activities are established on this island (U.S. Army Space and Missile Defense Command, 1999).

The Missile Launch Facilities occupied by MDA comprise 73 hectares (180 acres) on Wake Island south of the airfield and west of Peacock Point. The missile launch operations area is in a good location, well removed from most incompatible land uses and adjacent to the operational land uses that support it.

Facilities required to support the MDA primary mission at Wake Island are as follows:

- Missile Launch Support Building (1601)—Located adjacent to the runway, this facility is a former FAA airport operations facility and control tower, renovated by the USASMDC to accommodate missile test/launch monitoring equipment and personnel. It measures 838 square meters (9,020 square feet).
- Missile Storage Facility (1607)—The missile storage facility is located in a World War II open aircraft revetment, subsequently enclosed by the U.S. Air Force and more recently renovated by the USASMDC to provide secure, covered, controlled-environment storage for missile components. A new missile storage facility is currently planned and awaiting approval and funding from MDA.
- MABs 1644 and 1654—The MABs, located southwest of the airfield, have access to the launch pads. MAB 1644 measures 342 square meters (3,685

square feet), and the MAB for the HERA (1654), which was constructed in 1995, measures approximately 344 square meters (3,700 square feet).

- Launch Pads 1 and 2—The launch complexes are located near the southern shoreline. Launch Pad 1 is fully operational and in very good condition (U.S. Army Space and Strategic Defense Command, 1997). Launch Pad 2 is configured for a vertical launch stool. Two launch equipment buildings have been constructed at each pad. Additional proposed construction includes the paving of interconnecting roads and construction of concrete pads incidental to the launch areas.

Both of the MABs are functional, but weather conditions require that the exterior of these buildings be re-clad every 6 or 7 years to reduce the effects of corrosion. MAB 1644 has recently been re-clad, and the HERA MAB (1654) was constructed in 1995.

Roads in the launch area are not paved, resulting in less than ideal conditions for maneuverability of long and heavy vehicles that are used in the transportation of missiles.

Seagoing barges and ships supply Wake Island. The marina complex is located on the eastern shore of the boat channel separating Wake and Wilkes islands. Sheet piling in the dock area and along the causeway has deteriorated in places and is deteriorating rapidly elsewhere. Dock repairs are scheduled for fiscal year 2002. Since the harbor is of insufficient size to handle seagoing vessels, three small landing barges are used to transfer material from ships to the dockyard. The cargo pier area, however, lacks a crane large enough to off-load heavy items. One small crane is available.

3.3.10 NOISE—WAKE ISLAND

A general description of noise is provided in the beginning paragraphs of section 3.1.10.

Region of Influence

The minimum ROI for noise analysis is the area within the $L_{max} = 85$ dB contours generated by program activities.

Affected Environment

Due to wind and surf, the natural background sound levels on Wake Island are relatively high. Man-made sources of noise are typically associated with aircraft operation and base maintenance activities (U.S. Army Space and Missile Defense Command, 2000d). No measurements of ambient sound levels are known to be available.

Although they are infrequent, missile launches are also a man-made source of noise on Wake Island. Maximum A-weighted sound pressure level contours during launches vary from about 115 dB near Launch Pad 2 to less than 95 dB on the western ends of Peale and Wilkes Islands. The 95 dB contour covers almost all of the Wake Island Launch Complex. Typical launch events are loud and brief. Except for diesel generators and air conditioning systems, other environmental noise sources do not exist on the island.

3.3.11 SOCIOECONOMICS—WAKE ISLAND

A general description of socioeconomics is provided in the first paragraph of section 3.1.11.

Region of Influence

Since Wake Island Launch Center is an isolated military installation, actions have little effect on outside employment, population in-migration, or local area expenditures. The ROI is limited to the island itself.

Affected Environment

The permanent island population is small and consists of approximately 100 people. This includes civilian contractor personnel. The number of non-permanent personnel fluctuates daily in relation to each mission.

There are a total of 382 available bedrooms on Wake Island. Unaccompanied personnel housing is concentrated in the personnel support district adjacent to the community and recreation facilities. The current situation allows for a combination of single- and double-occupancy room assignments. Three renovated billets are designed to accommodate two people per room during peak population periods related to missile launch operations. These three buildings have adequate housing for 90 persons at single room occupancy.

Three contingency billets are currently vacant and configured as open barracks without air conditioning or other interior improvements, could be renovated for occupancies. The Commander in Chief, Pacific Command, Joint Task Force has requested permission to use these billets for contingency operations.

3.3.12 WATER RESOURCES—WAKE ISLAND

A general description of water resources is provided in the first paragraph of section 3.1.12.

Region of Influence

Generally, coral atolls lack surface water bodies or defined drainage channels due to extreme high porosity and permeability of the soils, and lack of local relief. With the exception of man-made impervious surfaces, abundant amounts of rainwater rapidly infiltrate directly into the ground (U.S. Army Space and Missile Defense Command, 1995b). The ROI for potable water resources includes the entire Wake Atoll where potable water would be obtained to supply program requirements.

Affected Environment

Surface Water

There is no fresh surface water on the island other than that collected in catchment basins.

Groundwater

Wake Island contains some fresh groundwater, but the amount that may be available for potable water consumption has not been investigated. This groundwater is limited by topography and the relatively small area of the island. Potable water requirements are provided by rainwater catchment basins and a desalination plant. Several wells are used to provide brackish groundwater for nonpotable uses. (U.S. Army Strategic Defense Command, 1994)

3.4 BIGEN, AUR ATOLL

Bigen Island, Aur Atoll, is located in the Ratak (sunrise or eastern) Chain of Marshall Islands approximately 370 kilometers (230 miles) southeast of Kwajalein Atoll. It is the third largest (82 hectares [203 acres]) and northernmost island in Aur Atoll. The island may be reached by LCU via the West Opening, which is located approximately 3,200 meters (10,500 feet) south of Bigen Island. Vehicles can be deployed from the LCU only at low tide, when a coral rubble and sand spit at the southeastern side of the island is exposed.

3.4.1 AIR QUALITY—BIGEN, AUR ATOLL

A general description of air quality and the relationship of inert and reactive pollutants in regards to ROI is provided in the beginning paragraphs of section 3.1.1.

Region of Influence

The ROI for ozone may extend much further downwind than the ROI for inert pollutants; however, as the project areas have no heavy industry and no automobiles, tropospheric ozone and its precursors are not of concern. Consequently, for the air quality analysis, the ROI for project operational activities is a circular area with a 24-kilometer (15-mile) radius centered on the site of activity on the island.

Affected Environment

Climate

No climatological information specific to Bigen is known to be available; however, Pacific Islands located between the equator and latitude 30 degrees have similar climates. The maritime climate is subject to easterly trade winds that blow steadily from the northeast every month of the year with very little variation. Also the land surface of Bigen has little effect on the climate due to its small area of 73 hectares (180 acres) and low relief.

Regional Air Quality

No ambient air quality data is known to exist for Bigen. There should be no air pollution problems at Bigen since there are only minor sources of pollution, good air pollution dispersion from strong trade winds, and a lack of topographic features to slow dispersion. The ambient air quality is expected to be in compliance with the UES.

Existing Emission Sources

The only known sources of air pollution on Bigen are the intermittent fires associated with the processing of copra. This process produces minor amounts of carbon monoxide and PM-10.

There are no permanent inhabitants of Bigen, so there are no other man-made sources of air pollution.

3.4.2 AIRSPACE—BIGEN, AUR ATOLL

A general description of airspace is provided in the first paragraph of section 3.1.2. The airspace for Bigen is the same as that described in section 3.2.2 for RTS, USAKA except that it has no airfield.

3.4.3 BIOLOGICAL RESOURCES—BIGEN, AUR ATOLL

A general definition of biological resources is provided in the first paragraph of section 3.1.3. Biological surveys were conducted in September 2000.

Region of Influence

The ROI for biological resources includes the area within and adjacent to the proposed launch site on Bigen that could potentially be affected by ground disturbance, noise, emissions, and debris as a result of site preparation and launch.

Affected Environment

Vegetation

Bigen is a typical coral islet in Aur Atoll. The reefs and islands of Aur Atoll are the remains of coral reef rock and sediments lying on top of submarine volcanoes formed millions of years ago. The entire island is planted and maintained as a copra plantation. Much of the original vegetation has been cleared, and the remaining habitat is typical of a low coral atoll. (U.S. Army Space and Strategic Defense Command, 1995b)

Bigen has a dominant canopy of planted coconut palm with breadfruit and pandanus also appearing in the overstory. Understory vegetation is regularly cleared by the Marshallese through the use of controlled burns. (U.S. Army Space and Strategic Defense Command, 1995; U.S. Army Space and Missile Defense Command, 2000b)

The largest, and presumably oldest, trees on Bigen are *Pisonia grandis*. Pandanus (screwpine), breadfruit, beach morning-glory, shrub-like ironwood trees, and beach heliotrope are present. The beach heliotrope, an early successional species, was the most abundant shrub in the areas previously cleared for launch activity. Coconut plantations are cleared and burned often on Bigen. (U.S. Army Space and Missile Defense Command, 2000b)

Wildlife

Numerous geckos are located in the underbrush and near the copra processing areas. A few fairy terns are also present in the project area and may nest in some of the hollow limbs of the pandanus within the ROI. (U.S. Army Space and Strategic Defense Command, 1995b)

The azure-tailed skink is the most common terrestrial vertebrate observed on. They were found in all areas where cover was available (i.e., everywhere except beaches). Green tree skinks are present, but rare. Geckos were not seen during the site visit. Six species of birds (white tern, black noddy, brown noddy, Pacific golden plover, whimbrel, and Pacific Reef heron) were found on Bigen. White terns and black and brown noddys were the most abundant birds observed during the September 2000 site visit. All three species were observed roosting and/or nesting on Bigen. Locals on Bigen were apparently catching and eating some of the nesting birds since traps and white tern and noddy wings were found on the northern shore. No rats, mice, or domestic animals were seen on the island. Geckos, rats, and mice are nocturnal and not likely to be seen during the day. (U.S. Army Space and Missile Defense Command, 2000b)

Threatened and Endangered Species

Potential habitat for the green sea turtle and/or hawksbill turtle has been identified on the island. Five sea turtle nests (all disturbed) were located on the northern shore of Bigen (U.S. Army Space and Missile Defense Command, 2000b). Information obtained from the local inhabitants confirmed that they collected sea turtle eggs from the five to six nests per month during the nesting season. The areas would be difficult to reach, as the sea turtles would have to cross the fringe of reef flat and many lengths of beach are strewn with coral rubble. The potential habitat is not adjacent to the project sites. (U.S. Army Space and Strategic Defense Command, 1995b)

Environmentally Sensitive Habitat

While the reef flat surrounding the southwestern portion of Bigen is an active ecosystem, there appears to be very little coral growth or active marine life due to a build-up of silt along the perimeter of the island. The naturally occurring siltation may be due to a prevailing wind, resulting in silt along the shoreline. At low tide, several small seeps or springs can be observed. (U.S. Army Space and Strategic Defense Command, 1995b)

3.4.4 CULTURAL RESOURCES—BIGEN, AUR ATOLL

A definition of cultural resources according to the UES is provided in the first paragraph of section 3.2.4.

Region of Influence

The ROI for cultural resources includes Bigen in the Aur Atoll.

Affected Environment

Aur Atoll (most specifically Tabal and Aur islands) has supported a human population for many years, and records indicate inhabitants on the atoll as early as 1817. Statistics for the years 1935 and 1948 indicate atoll populations of approximately 279 and 388, respectively. Currently, the atoll has about 450 inhabitants (Discovery Communications Inc., 2002). Tabal and Aur islands are the only known permanently inhabited islands in the atoll. The remaining islands and islets are exploited for foods (coconut, breadfruit, pandanus) and for materials to make a variety of household products and crafts (e.g., pandanus used for mats, fans, etc.).

Bigen is currently, and has been in the past, exploited for foods (coconut, breadfruit, pandanus) and for materials to make a variety of household products and crafts (e.g., pandanus is used for mats and fans). Marshallese access to the food and craft resources is facilitated through the use of controlled burns. A cultural resources survey conducted on Bigen in December 1994 identified no historic properties. (U.S. Army Space and Missile Defense Command, 1995b)

Historic Buildings and Structures

With the exception of Marshallese copra processing areas (consisting of between one and four sheds or lean-tos, a house trailer and two old military vans that were provided to the landowner as part of the lease agreement with USAKA in 1995), there are no buildings or structures on Bigen. No World War II or Cold War features, structures, or artifacts or evidence of German or Japanese occupation were identified during the December 1994 survey. (U.S. Army Space and Missile Defense Command, 2000b; U.S. Army Space and Missile Defense Command, 1995b)

Five additional features and sites not reported in the December 1994 survey of Bigen were found in a more recent survey (U.S. Army Space and Missile Defense Command, 2000b). Most of the new sites were located in close proximity to the southern shore of the island. A contemporary housing area, composed of semi-traditional houses, was erected on a site of a historic and, possibly, prehistoric settlement. A Japanese cistern, probably constructed by occupational forces, was found. The several layers of coral spread that were found may be indicative of continuous use of the area, possibly to prehistoric times. Various abandoned garbage pits, an abandoned well, and an iroj burial ground (composed of an earthen mound and upright coral slabs) supports the theory of continuous use from prehistoric to historic times. In addition, a contemporary burial ground located north of the survey area is indicative of the importance of the island to the people of Aur Atoll. (U.S. Army Space and Missile Defense Command, 2000b)

3.4.5 GEOLOGY AND SOILS—BIGEN, AUR ATOLL

A general description of geology and soils is provided in the first paragraph of section 3.1.5.

Region of Influence

The ROI includes areas related to temporary remote launch sites established on Bigen, specifically the soils and underlying rock layers on the Bigen that could potentially be affected by launch activities.

Affected Environment

Because of their parallel geologic history and nominal disturbance, geology and soils throughout the RMI are expected to be similar. The description for geology and soils provided in section 3.2.5 is applicable to Bigen.

3.4.6 HAZARDOUS MATERIALS AND WASTE—BIGEN, AUR ATOLL

A general description of hazardous materials and waste is provided in the first two paragraphs of section 3.1.6. LPT launches would be conducted at Bigen. The transport and storage of liquid propellants and launches from Aur Atoll have been previously analyzed in the USAKA Temporary ETR EA (U.S. Army Space and Strategic Defense Command, 1995). Hazardous materials and hazardous waste management activities at Aur Atoll (Bigen) are governed by specific environmental regulations. For the purposes of the following analysis, the terms hazardous materials or hazardous waste will mean those substances as defined by those regulations and standards discussed in sections 3.1.6 and 3.2.6.

The USAKA UES applies to USAKA activities in the RMI, and the procedures and requirements of the UES are applied to the proposed activities at Bigen. Hazardous materials are transported and stored per the UES, and excess hazardous materials and hazardous waste generated is returned to USAKA for further management for disposal.

If a release of hazardous materials or waste occurs on the island, it will be cleaned up and the contaminated material returned to USAKA. If a large spill occurs, remediation will be performed in accordance with the UES and consultation with the RMI EPA.

Region of Influence

Since operations at Bigen would be limited to site preparation and launching of target missiles, the ROI for potential impacts related to hazardous materials/wastes would be limited to areas of the island to be used for launch activities and prelaunch site preparation. The flight test corridor consists of all areas beneath the proposed flight track where there is the potential for impact of missile components during planned activities or abnormal flight termination or the Mid-atoll Corridor where missile debris would impact would also be considered within the ROI.

Affected Environment

Hazardous Materials Management

The use of hazardous materials on Bigen for prior launch activities included:

- Liquid rocket propellants IRFNA and unsymmetrical dimethyl hydrazine (UDMH) if defueling operations are necessary
- Small amounts of cleaning solvents (e.g., acetone, isopropyl alcohol) for use during prelaunch activities
- Motor fuels (diesel) for fueling of vehicles and operation of generator equipment

These substances are transported to the Bigen via ship or by air. A hazardous material management plan would be prepared for all hazardous materials or petroleum products shipped to Bigen. The hazardous material management plan outlines the procedures for storage, use, transportation and disposal of the hazardous materials or petroleum products. Hazardous materials to be used by organizations utilizing the test range and its facilities (i.e., range users) would be under the direct control of the user organization, which is responsible for ensuring that these materials are stored and used in accordance with the hazardous materials management plan.

Past users provided storage of all materials in accordance with established procedures applicable to individual operations. The use of all hazardous materials is subject to ongoing inspection by RTS environmental compliance and safety offices to ensure the safe use of all materials. The majority of these materials are consumed in operational processes (including small losses to the air and water).

For prior prelaunch and launch operations, there was no handling of liquid propellants, nor any release/collection of propellants. Established USAKA procedures for liquid rocket propellant defueling were followed. Propellant transfers occur on a non-permeable surface, and all spills/wastes are collected and containerized.

Except for immediately reusable propellants, all past containerized materials/wastes were loaded aboard the transporting LCU for removal to Kwajalein. At Kwajalein, wastes are placed at the USAKA Hazardous Wastes Collection Point (Building 1521) in accordance with RTS hazardous waste management policy. Recyclable propellants are transported to Meck for storage at the Liquid Oxidizer/Fuels Storage Buildings, pending shipment to the mainland. From Kwajalein, materials/wastes are prepared and shipped to their final destination (recycle or disposal facility). Reusable propellants are reloaded into the target missile as appropriate (small quantities of waste propellants are generated, collected and containerized during refueling, similar to defueling operations).

Hazardous Waste Management

Hazardous wastes generated as a result of prior site preparation, prelaunch, and launch activities at Bigen consisted of hazardous materials used as discussed above that are spilled or otherwise collected during the work operations. Motor fuels and cleaning

solvents were collected and disposed of. For liquid rocket propellants the volumes of wastes from prior launches were small, since the high volatility of both IRFNA and UDMH resulted in the airborne evaporation of most spilled material. Any remaining liquid propellants are to be diluted with water and then containerized and handled similarly to motor fuel wastes.

3.4.7 HEALTH AND SAFETY—BIGEN, AUR ATOLL

A general description of health and safety is provided in the beginning paragraphs of section 3.1.7.

Region of Influence

The ROI for health and safety at Bigen includes all areas within the approximately 1,500-meter (5,000-foot) LHA for liquid-fuel missiles to be established around each launch site. The ROI for health and safety also includes all locations where explosive missile components or fuel storage devices are handled during prelaunch activities.

Affected Environment

Fuel handling on Bigen only occurs in rare, emergency situations. All fuel handling and launch activities are in accordance with standard operating procedures intended to ensure the safety of all personnel at the fuel transfer location. No Marshallese citizens or unprotected U.S. personnel are required on the island during launches. Launch safety operations on Bigen follow the general requirements and procedures discussed above that are established for USAKA.

3.4.8 INFRASTRUCTURE—BIGEN, AUR ATOLL

A general description of infrastructure is provided in the first paragraph of section 3.1.8.

Region of Influence

The ROI includes the transportation and utility systems that could potentially be affected by the Alternative Action at Bigen.

Affected Environment

Transportation

Bigen does not have any paved roads or any utility facilities. There are well-established footpaths on the islands that are used by coconut and breadfruit harvesters.

Bigen is not capable of accepting air traffic because it has neither a helipad nor airstrip. The airstrip on Tabal could be used for emergency purposes such as medical transport. The Tabal airstrip is approximately 2,000 meters (6,562 feet) in length with a crushed coral surface.

The island may be reached by LCU via the West Opening located approximately 3,200 meters (10,500 feet) south of Bigen. Vehicles can be deployed from the LCU only at low tide, when a coral rubble and sand spit at the southeastern side of the island is exposed. There are no roads, railways, or airports on Bigen.

Utilities

Bigen is without active, developed potable water systems, making it necessary for personnel working on this island to carry water for consumption and other uses. There is currently no source of electrical power on the island. The island is also without an established wastewater treatment and disposal facility. (U.S. Army Space and Strategic Defense Command, 1995b)

3.4.9 LAND USE—BIGEN, AUR ATOLL

A general description of land use is provided in the first paragraph of section 3.1.9.

Region of Influence

The ROI for land use includes the existing land use patterns on Bigen located in the Aur Atoll.

Affected Environment

Bigen has a land area of approximately 73 hectares (180 acres). Copra processing sheds are the only standing structures on the island. The island is primarily used for the harvesting of coconuts and breadfruit (U.S. Army Space and Missile Defense Command, 1995b). With the exception of occasional shallow pools of rainwater, no surface water exists. Bigen has no permanent inhabitants. Occasional harvesters are the only visitors to the island. (U.S. Army Space and Missile Defense Command, 2000b)

3.4.10 NOISE—BIGEN, AUR ATOLL

A general description of water resources is provided in the beginning paragraphs of section 3.1.10.

Region of Influence

The minimum ROI for noise analysis is the area within the $L_{max} = 85$ dB contours generated by program activities.

Affected Environment

Currently there are no permanent inhabitants and no continuous man-made sources of noise on Bigen. There are relatively high natural background sound levels from wind and surf present at Bigen.

The nearest inhabited islands are Tabal and Aur. Tabal is approximately 12 kilometers (7.5 miles) away, and Aur is about 23 kilometers (14 miles) away.

3.4.11 SOCIOECONOMICS—BIGEN, AUR ATOLL

A general description of socioeconomics is provided in the first paragraph of section 3.1.11.

Region of Influence

As described in section 3.2.11, the ROI for socioeconomics is limited mainly to Kwajalein and Ebeye since this location has the potential for program-related population, employment, income, and housing impacts.

Affected Environment

Bigen was inhabited in September 2000 by two or three family groups with a total of approximately 15 to 20 individuals. (U.S. Army Space and Missile Defense Command, 2000b)

3.4.12 WATER RESOURCES—BIGEN, AUR ATOLL

A general description of water resources is provided in the first paragraph of section 3.1.12 except that it does not have an airfield.

Region of Influence

Generally, coral atolls lack surface water bodies or defined drainage channels due to extreme high porosity and permeability of the soils and surface sediments and lack of relief. With the exception of manmade impervious surfaces, abundant amounts of rainwater rapidly infiltrate directly into the ground (U.S. Army Space and Missile Defense Command, 1995b). The ROI for potable water resources includes Bigen where potable water would be obtained (both surface and groundwater) to supply program requirements.

Affected Environment

Surface Water

Except for shallow pools of rainwater, there was no evidence of surface water in September 2000; three contemporary wells and one historic well were located during the survey.

Groundwater

The amount of fresh groundwater that may be available on Bigen for potable water consumption has not been investigated. However, the occurrence and quality of groundwater are expected to be similar to other atoll islands within the region. One well was identified during the September 2000 site visit. Its uses are to supply potable water

for the transient copra processing workers who are on the island an average of 4 days a month. (U.S. Army Space and Missile Defense Command, 2000b)

3.5 TOTON, WOTJE ATOLL

Toton Island, Wotje Atoll, in the Ratak Chain, is located approximately 322 kilometers (200 miles) east of Kwajalein Atoll. Situated in the south-central part of Wotje Atoll, Toton is irregular in shape (club-like) and approximately 1,000 meters (3,280 feet) long by 400 meters (1,312 feet) wide (approximately 40 hectares [98 acres]). The southeastern side of the island forms the northern boundary of the Schischmarev Strait, which is a deepwater pass into the atoll. Vehicles may be deployed onto the northwestern shore of the island at any time due to the presence of a sandy shoal and beach.

3.5.1 AIR QUALITY—TOTON, WOTJE ATOLL

A general description of air quality and the relationship of inert and reactive pollutants in regards to ROI is provided in the beginning paragraphs of section 3.1.1.

Region of Influence

Since the project area has no heavy industry or cars, the ROI for project operational activities is within the immediate island area where receptors may be located.

Affected Environment

Climate

Climate at Toton affects the dispersion and dilution of air pollutants and the resulting air quality. No climatological information specific to Toton is known to be available; however, Pacific Islands located at a latitude between the equator and 30° have similar climates. This maritime climate is dominated by the easterly trade winds that blow steadily from the northeast every month of the year with very little variation. Winds from other directions occur only rarely, such as during tropical storms. Furthermore, the land surface of Toton has little effect on the climate of the locality due to its small area and low average elevation. (Gale Research Company, 1981; Seinfeld, 1986)

Regional Air Quality

No ambient air quality data are known to exist for Toton. However, there should be no air pollution problems at Toton since there are only extremely minor sources of air pollution, and there should be good air pollution dispersion produced by strong persistent trade winds and lack of topographic features to inhibit dispersion. Therefore, the ambient air quality is expected to be in compliance with all NAAQS.

Air Pollutant Emission Sources

The only known sources of air pollution on Toton are the intermittent fires associated with the processing of copra. This activity produces minor amounts of carbon monoxide and

PM-10, both of which are criteria pollutants. As there are no permanent inhabitants, there are no other man-made sources of air pollutants.

3.5.2 AIRSPACE—TOTON, WOTJE ATOLL

A general description of airspace is provided in the first paragraph of section 3.1.2. The airspace for Toton is the same as that described in section 3.2.2 for RTS, USAKA, except that it does not have an airfield.

3.5.3 BIOLOGICAL RESOURCES—TOTON, WOTJE ATOLL

A general definition of biological resources is provided in the first paragraph of section 3.1.3.

Region of Influence

The ROI for biological resources includes the area within and adjacent to the proposed launch site on Toton that could potentially be affected by ground disturbance, noise, emissions, and debris as a result of site preparation and launch.

Affected Environment

Vegetation

The “jungle” on Toton is more extensive and diverse than on Bigen. Surface relief and/or the presence of forested wetlands on Toton may account for some of the difference. Ironwood trees up to 5 meters (16 feet) in height covered much of the southeastern shore of Toton. Beach heliotrope is also present on Toton. The coconut plantations on Toton contain a wider variety of plant species and considerably more grass than those on Bigen. (U.S. Army Space and Missile Defense Command, 2000b)

The varying topography of Toton, particularly as it relates to other islands in the Ratak Chain, allows division of the island into six distinct sections. Among these are areas of extreme coastal erosion; low-lying swamp area, heavily forested by *Pisonia grandis*, but including breadfruit, *Pandanus tectorius*, and *Neisosperma oppositifolium*; densely vegetated areas with little ground cover that are dominated by breadfruit, the largest (and presumably oldest) trees on the island; an area of undulating hills dramatically altered by burning and clearing activities where the open forest is chiefly composed of large coconut palms, breadfruit, and pandanus with a thick mat of grass; a similar area with flat to gradually rising landscape and many copra processing areas; and a coastal area with aeolean (wind-borne) deposits. (U.S. Army Space and Missile Defense Command, 2000b)

Wildlife

Few vertebrates were found on Toton. The azure-tailed skink was the most common terrestrial vertebrate observed on the island (U.S. Army Space and Missile Defense

Command, 2000b). They were found in all areas where cover was available (i.e., everywhere except beaches). Green tree skinks were present, but rare. Eight species of birds (white tern, black and brown noddy, Pacific golden plover, ruddy turnstone, wandering tattler, whimbrel, and Pacific Reef heron) were observed on Toton. White terns and black and brown noddys were the most abundant birds. No roosting or nesting activity was seen on Toton. As on Bigen, no domestic animals were seen, and no rats, mice, and geckos were observed (attributable to their nocturnal nature). The Ratak Micronesian pigeon, a federal species of concern, is found on Wotje Atoll, but was not observed during the 2000 site visit.

Threatened and Endangered Species

No sea turtle nests were found on Toton, although the weathered remains of a large plastron (the bony plate that forms the underside of a turtle's shell) were found in an old burn pit on the southeastern tip of the island. (U.S. Army Space and Missile Defense Command, 2000b)

3.5.4 CULTURAL RESOURCES—TOTON, WOTJE ATOLL

A definition of cultural resources is provided in section 3.2.4.

Region of Influence

The ROI for cultural resources includes Toton in the Wotje Atoll.

Affected Environment

In preparation for this EA, a recent non-intrusive archaeological reconnaissance survey was conducted on Toton, Wotje Atoll (U.S. Army Space and Missile Defense Command, 2000b). This survey was limited to immediately visible surface indicators of historic and possibly prehistoric sites. Additional prehistoric and traditional sites may be present; however, due to the dense vegetation found on Toton and a lack of communication with landowners, these sites have not been identified.

The survey revealed evidence of World War II battles such as ammunition and bomb craters, but there was little physical evidence of Japanese or German inhabitation.

Two modern-day copra processing and habitation sites showed evidence of extended use, which may lead to prehistoric deposits being located near these sites.

Two possible prehistoric food preparation sites were noted on the northern and southwestern shore; however, no prehistoric surface artifacts were found. (U.S. Army Space and Missile Defense Command, 2000b)

3.5.5 GEOLOGY AND SOILS—TOTON, WOTJE ATOLL

Region of Influence

The ROI includes areas related to temporary remote launch sites established on Toton. Physical or chemical composition of soils and underlying rock layers within the Toton vicinity could potentially be affected by site preparation and launch activities.

Affected Environment

Because of their parallel geologic history and nominal disturbance, geology and soils throughout the RMI are expected to be similar. The description for geology and soils provided in section 3.2.5 is applicable to Toton.

3.5.6 HAZARDOUS MATERIALS AND WASTE—TOTON, WOTJE ATOLL

A general description of hazardous materials and waste is provided in the first two paragraphs of section 3.1.6. Launches at Toton would involve the same activities as those analyzed for Bigen in section 3.4.6. For the purposes of the following analysis, the terms hazardous materials or hazardous waste will mean those substances defined by the environmental regulations discussed in sections 3.4.6.

Region of Influence

The ROI would encompass missile storage, the temporary launch site, areas where hazardous materials are stored and handled, and the flight test corridor. The flight test corridor consists of all areas beneath the proposed flight track where there is the potential for impact of missile components during planned activities or abnormal flight termination, and the broad ocean area or Mid-atoll Corridor where missile debris would impact.

Affected Environment

Activities on Toton are limited to the growth and harvesting of coconuts by natives on interior sections of the island. Harvesting practices may include currently undetermined hazardous materials, such as solvents and lubricants, used in small quantities. No hazardous materials/hazardous wastes are known to be present within the ROI.

3.5.7 HEALTH AND SAFETY—TOTON, WOTJE ATOLL

A general description of health and safety is provided in the beginning paragraphs of section 3.1.5.

Region of Influence

The ROI for health and safety at Toton includes all areas within the approximately 1,500-meter (5,000-foot) LHA for liquid-fuel missiles to be established around each launch site. The ROI for health and safety also includes all locations where explosive missile components or fuel storage devices are handled during prelaunch activities.

Affected Environment

At the present time there are no activities sponsored by the U.S. Army or other federal organization on Toton. Activities are limited to the growth and harvesting of coconuts by Marshallese natives on interior sections of the island. No significant activities presently occur in the ROI.

3.5.8 INFRASTRUCTURE—TOTON, WOTJE ATOLL

Region of Influence

The ROI includes the transportation and utility systems that could potentially be affected by the Alternative Action at Toton.

Affected Environment

Transportation

Toton may be accessed by an LCU; however, it can also be accessed by a Rigid Hull Inflatable Boat. There are no roads, railways, or airports found on Toton.

Utilities

Toton does not maintain water, wastewater, solid waste disposal, or electrical facilities.

3.5.9 LAND USE—TOTON, WOTJE ATOLL

Region of Influence

The ROI for land use includes the existing land use patterns on Toton located in the Wotje Atoll.

Affected Environment

Toton has a land area of approximately 40 hectares (99 acres). Copra processing sheds are the only standing structures on the island. Shallow pools of water have the potential to accumulate along a small swampy strip of land near the island's southeastern coast. Toton is used primarily for the harvesting of coconuts and breadfruit. Toton has no permanent residents; the only visitors are harvesters. (U.S. Army Space and Missile Defense Command, 2000b)

3.5.10 NOISE—TOTON, WOTJE ATOLL

Region of Influence

The minimum ROI for noise analysis is the area within the $L_{max} = 85$ dB contours generated by program activities.

Affected Environment

Currently there are no permanent inhabitants and no continuous man-made sources of noise on Toton. There are relatively high natural background sound levels from wind and surf present at Toton. The nearest inhabited island is Wotje, which is approximately 12 kilometers (10 miles) northeast of Toton.

3.5.11 SOCIOECONOMICS—TOTON, WOTJE ATOLL

A general description of socioeconomics is provided in the first paragraph of section 3.1.11.

Region of Influence

As described in section 3.2.11, the ROI for socioeconomics is limited mainly to Kwajalein and Ebeye since this location has the potential for program-related population, employment, income, and housing impacts.

Affected Environment

No permanent inhabitants live on Toton. The island is used for copra processing. A description of Kwajalein socioeconomics is provided in section 3.2.11.

3.5.12 WATER RESOURCES—TOTON, WOTJE ATOLL

Region of Influence

Generally, coral atolls lack surface water bodies or defined drainage channels due to extreme high porosity and permeability of the soils and surface sediments and lack of relief. With the exception of man-made impervious surfaces, abundant amounts of rainwater rapidly infiltrate directly into the ground (U.S. Army Space and Missile Defense Command, 1995b). The ROI for potable water resources includes Toton where potable water would be obtained to supply program requirements.

Affected Environment

The amount of fresh groundwater that may be available on Toton for potable water consumption has not been investigated. The occurrence and quality of groundwater are expected to be similar to other atoll islands within the region. Although no wells were identified during the September 2000 site visit, substantial precipitation and groundwater is indicated by a significant southwestern swampy area. (U.S. Army Space and Missile Defense Command, 2000b)

3.6 OPEN OCEAN (FLIGHT TEST CORRIDOR)

For purposes of this analysis, open ocean refers to those ocean areas beyond U.S. territorial limits as described for each launch alternative. Open ocean areas are subject to Executive Order 12114, *Environmental Effects Abroad of Major Federal Actions*. A limited

number of resources would potentially be impacted by the Proposed or Alternative Action, including airspace, biological resources, health and safety, transportation, and water resources.

3.6.1 AIRSPACE—OPEN OCEAN (FLIGHT TEST CORRIDOR)

A general description of airspace is provided in the first paragraph of section 3.1.2.

Region of Influence

The ROI is defined as those portions of the international airspace over the open Pacific Ocean that would potentially be affected by the Proposed or Alternative Action that would utilize.

Affected Environment

The affected airspace in the Ocean Area ROI is described below in terms of its principal attributes, namely controlled and uncontrolled airspace, special use airspace, en route airways and jet routes, and air traffic control. There are no military training routes in the ROI.

Controlled and Uncontrolled Airspace

Because the airspace beyond the territorial limit is in international airspace, the procedures of the ICAO are followed. The FAA acts as the U.S. agent for aeronautical information to the ICAO, and air traffic in the ROI is managed by the Honolulu and Oakland ARTCCs.

Special Use Airspace

The special use airspace in the Ocean Area ROI is described in sections 3.1.2 and 3.2.2.

En Route Airways and Jet Routes

The Ocean Area airspace use ROI has several en route high altitude jet routes (A331, A332, A450, R463, R464, R465, R 584, Corridor V 506, and Corridor G 10), which pass through the ROI. Most of the Ocean Area airspace use ROI is well removed from the jet routes that currently crisscross the North Pacific Ocean (figure 3-8).

As an alternative to aircraft flying above 8,839 meters (29,000 feet) following published, preferred instrument flight rules routes, the FAA is gradually permitting aircraft to select their own routes. This Free Flight program is an innovative concept designed to enhance the safety and efficiency of the National Airspace System. The concept moves the National Airspace System from a centralized command-and-control system between pilots and air traffic controllers to a distributed system that allows pilots, whenever practical, to choose their own route and file a flight plan that follows the most efficient and economical route. (Federal Aviation Administration, 1997)

Free Flight calls for limiting pilot flexibility in certain situations, such as to ensure separation at high-traffic airports and in congested airspace and to prevent unauthorized entry into special use airspace, as well as for any safety reason. Free Flight is being developed, tested, and implemented incrementally by the FAA and the aviation community. Safety remains the highest priority throughout the transition to full Free Flight. The annual air traffic rate is expected to grow by 3 to 5 percent for at least the next 15 years, but the current airspace architecture and management is not able to efficiently handle this increase. Implementation of Free Flight, which offers benefits in system safety, capacity, and efficiency, is key to advancing aviation by accommodating the nation's growing airspace needs. (Federal Aviation Administration, 1997)

Free Flight is a joint initiative of the global aviation industry and the FAA. Planning has been done primarily through the Radio Technical Commission for Aeronautics, Inc., an organization that serves in an advisory capacity to the FAA. International coordination is being accomplished through this organization's Government/Industry Free Flight Steering Committee, which contains international representation, and the FAA's membership in the ICAO. The phased approach for Free Flight, along with international aviation participation, contributes to building a seamless global airspace system. (Federal Aviation Administration, 1997)

Free Flight is already underway, and the plan for full implementation will occur as procedures are modified and technologies become available and are acquired by users and service providers. With the full implementation of this program, the amount of airspace in the ROI that is likely to be clear of traffic will decrease as pilots, whenever practical, choose their own route and file a flight plan that follows the most efficient and economical route, rather than following the published preferred instrument flight rules routes across the Pacific Ocean, as shown in figure 3-2.

Air Traffic Control

Control of oceanic air traffic in the United States is carried out from oceanic centers in Anchorage, Oakland, and New York. The Oakland Oceanic Flight Information Region is the world's largest, covering approximately 48.4 million square kilometers (18.7 million square miles) and handling over 560 flights per day. Traffic between the Continental United States and Hawaii flies on the Central East Pacific Composite Route System. (Federal Aviation Administration, 2000)

3.6.2 BIOLOGICAL RESOURCES—OPEN OCEAN (FLIGHT TEST CORRIDOR)

Marine biology of the Ocean Area consists of the animal and plant life that lives in and just above the surface waters of the sea and its fringes, the salient physical and chemical properties of the ocean, biological diversity, and the characteristics of its different ecosystems or communities.

Region of Influence

The Ocean Area ROI occupies approximately 7.1 million square kilometers (2.1 million square nautical miles) in the central north Pacific Ocean, or approximately 4 percent of the Pacific Ocean's total area. The average depth of the Ocean Area ROI is 3,932 meters (12,900 feet).

Affected Environment

The general composition of the ocean includes water, sodium chloride, dissolved gases, minerals, and nutrients. These characteristics determine and direct the interactions between the seawater and its inhabitants. The most important physical and chemical properties are salinity, density, temperature, pH, and dissolved gases. For oceanic waters, the salinity is approximately 35 parts of salt per 1,000 parts of seawater.

Most organisms have a distinct range of temperatures in which they may thrive. A greater number of species live within the moderate temperature zones, with fewer species tolerant of extremes in temperature.

Surface seawater often has a pH between 8.1 and 8.3 (slightly basic), but generally is very stable with a neutral pH. The amount of oxygen present in seawater will vary with the rate of production by plants, consumption by animals and plants, bacterial decomposition, and surface interactions with the atmosphere. Most organisms require oxygen for their life processes. Carbon dioxide is a gas required by plants for photosynthetic production of new organic matter. Carbon dioxide is 60 times more concentrated in seawater than it is in the atmosphere.

Coastal Zone

The coastal zone as used here is defined as that area which typically extends from the high tide mark on the land to the gently sloping, relatively shallow edge of the continental shelf, the submerged part of the continents.

Although it makes up less than 10 percent of the ocean's area, the coastal zone contains 90 percent of all marine species. The sharp increase in water depth at the edge of the continental shelf separates the coastal zone from the offshore zone. (U.S. Department of the Navy, 1998)

The coastal zone includes several different ecosystems including coral reefs, estuaries, and coastal wetlands. There are no estuaries or coastal wetlands in the Ocean Area ROI. Coral reefs are the world's oldest and most diverse and productive ecosystems—the marine equivalent of tropical rain forests. Species diversity associated among reef communities is probably the highest of all biological habitats in the sea. (U.S. Department of the Navy, 1998)

Ocean Zones

Classification of the Pacific Ocean zones is based upon depth and proximity to land. Using this methodology, there are four major divisions or zones in the ocean: the littoral zone, the coastal zone, the offshore zone, and the pelagic zone. Spanning across all zones is the benthic environment, or sea floor. This section discusses the pelagic zone and the benthic environment.

The pelagic zone is commonly referred to as the open ocean. The organisms that inhabit the open ocean typically do not come near land, continental shelves, or the seabed. Approximately 2 percent of marine species live in the open ocean.

The bottom of the sea floor is known as the benthic area. It comprises 98 percent of the species of animals and plants in the ocean. Less than 1 percent of benthic species live in the deep ocean below 2,000 meters (6,562 feet).

Biological Diversity

Marine life ranges from microscopic one-celled organisms to the world's largest animal, the blue whale. Marine plants and plant-like organisms can live only in the sunlit surface waters of the ocean, the photic zone, which extends to only about 101 meters (330 feet) below the surface. Beyond the photic zone, the light is insufficient to support plants and plant-like organisms. Animals, however, live throughout the ocean from the surface to the greatest depths.

The organisms living in pelagic communities may be drifters (plankton) or swimmers (nekton). The plankton consists of plant-like organisms and animals that drift with the ocean currents, with little ability to move through the water on their own. The nekton consists of animals that can swim freely in the ocean, such as fish, squids, and marine mammals. Benthic communities are made up of marine organisms, such as kelp, sea grass, clams, and crabs that live on or near the sea floor.

Threatened and Endangered Species

Species identified as threatened or endangered that exist in the Ocean Area ROI, listed in table 3-1, include the sei whale, blue whale, fin whale, humpback whale, sperm whale, Hawaiian monk seal, loggerhead sea turtle, green sea turtle, leatherback sea turtle, hawksbill sea turtle, and olive ridley sea turtle.

Nihoa

For launches from PMRF, the THAAD missile has the potential to overfly portions of the Hawaiian Islands National Wildlife Refuge. Of particular concern is overflight of Nihoa, a small island at the southeastern end of the Northwestern Hawaiian Islands, 444.5 kilometers (240 nautical miles) northwest of Oahu.

Nihoa serves as the only home for three endangered plants, including the Nihoa fan palm (*Pritchardia remota*); 72 documented insect species; and two small, endangered land birds

in the world's only remaining intact example of a Hawaiian coastal scrub community (U.S. Fish and Wildlife Service and Hawaii Department of Land and Natural Resources, Division of Aquatic Resources, 2002).

For many years the only regular inhabitants of Nihoa have been vast numbers of birds, including black-footed albatross, Bulwer's petrel and wedge-tailed shearwaters, red-tailed tropic birds, large frigate birds, three kinds of boobies, and five kinds of terns. Birds nest in a variety of places, from the ground to the crowns of the loulu palms. In addition to these seabirds, there are two species of native land birds: the Nihoa finch (*Telespyza ultima*) and the Nihoa miller bird (*Acrocephalus familiaris kingi*), both endemic species, found only on Nihoa, but related to species on Laysan. (Resture, 2002)

The current estimate of 200 remaining Nihoa Millerbirds, 1,000 Nihoa Finches, and the Nihoa fan palm rely on the absolute isolation and protection from invasive species and disturbance that the National Wildlife Refuge provides. (U.S. Fish and Wildlife Service and Hawaii Department of Land and Natural Resources, Division of Aquatic Resources, 2002) However, critical habitat has not been designated for either species on Nihoa. The area nevertheless contains important habitat for both birds and protection afforded by the Endangered Species Act still applies.

The amount of shallow reef habitat immediately surrounding Nihoa is small, and fewer fish and other species have colonized there and been able to survive. (U.S. Fish and Wildlife Service and Hawaii Department of Land and Natural Resources, Division of Aquatic Resources, 2002)

3.6.3 HEALTH AND SAFETY—OPEN OCEAN (FLIGHT TEST CORRIDOR)

A general description of health and safety is provided in the beginning paragraphs of section 3.1.7.

Region of Influence

The ROI for the flight corridor consists of all areas beneath the proposed flight track where there is the potential for impact of missile components during planned activities or abnormal flight termination and the broad ocean area or the Kwajalein Mid-atoll Corridor where missile debris would impact. The Ocean Area ROI is defined as that area of the Pacific Ocean that would be potentially affected by the target and interceptor debris.

Affected Environment

The affected health and safety environment for the Ocean Area is described below in terms of its principal attributes, namely range control procedures and verification of Ocean Area clearance procedures.

Range Control is charged with surveillance, clearance, and real-time range safety. The Range Control Officer using PMRF or RTS assets respectively is solely responsible for determining range status and setting "RED" (no firing) and "GREEN" (range is clear and

support units are ready to begin the event) range firing conditions. The Range Safety Approval and the Range Safety Operation Plan documents are required for all weapons systems using PMRF or RTS. PMRF and RTS use RCC 321-00, *Common Risk Criteria for National Test Ranges*. RCC 321-00 sets requirements for minimally-acceptable risk criteria to occupational and non-occupational personnel, test facilities, and non-military assets during range operations. Under RCC 321-00, individuals of the general public shall not be exposed to a probability of fatality greater than 1 in 10 million for any single mission and 1 in 1 million on an annual basis.

Range Safety officials ensure operational safety for projectiles, targets, missiles, and other hazardous operations into PMRF operational areas. The operational areas consist of two Warning Areas (W-186 and W-188) and one Restricted Area (R-3101) under the local control of PMRF. The Warning Areas are in international waters and are not restricted; however, the surface area of the Warning Areas is listed as "HOT" (actively in use) 24 hours a day. PMRF publishes dedicated warning NOTAMs and NOTMARs for special operations, multi-participant or hazardous weekend firings.

The range safety clearance procedures at PMRF are some of the most rigorous because of the extra sensors available. Before an operation is allowed to proceed, the range is verified cleared of non-participants using inputs from ship sensors, visual surveillance of the range from aircraft and range safety boats, radar data, surface and underwater sonic information obtained from a series of hydrophones within a portion of the open ocean utilized by PMRF, and surveillance from shore. If whales are present in the operations areas, activities are stopped until the mammals have cleared the area. In addition, all activities must be in compliance with DoD Directive 4540.1 (as enclosed by Chief of Naval Operations Instruction 3770.4A, *Use of Airspace by U.S. Military Aircrafts and Firing Over the High Seas*, 23 March 1981) which specifies procedures for conducting aircraft operations and for missile/projectile firing, namely that the missile/projectile "firing areas shall be selected so that trajectories are clear of established oceanic air routes or areas of known surface or air activity."

According to the USAKA Supplemental EIS, Flight Safety provides protection to USAKA personnel, inhabitants of RMI, and ships and aircraft operating in areas potentially affected by mission activities. Specific procedures, including regulations, directives, and flight safety plans, are required for the preparation and execution of missions involving aircraft, missile launches, and reentry payloads. USAKA controls all flight corridor operations as part of RTS. All operations are thus conducted in accordance with safety procedures, which are consistent with those implemented for RTS. There is no special use airspace over RTS or Wake.

3.6.4 NOISE—OPEN OCEAN (FLIGHT TEST CORRIDOR)

A general description of noise is provided in the beginning paragraphs of section 3.1.10.

Region of Influence

The ROI includes those areas that would potentially be affected by THAAD and target sea-launch noise.

Affected Environment

Baseline or ambient noise levels on the ocean surface—not including localized noise attributed to shipping—is a function of local and regional wind speeds. Studies of ambient noise of the ocean have found that the sea surface is the predominant source of noise, and that the source is associated with the breaking of waves. Wave breaking is further correlated to wind speed, resulting in a relationship between noise level and wind speed. (Federal Aviation Administration, July 2001)

Ambient noise in relation to underwater noise is also the existing background noise of the environment. Ambient noise strongly affects the distances to which animal and specific man-made sounds and other sounds of interest can be detected by marine mammals (Richardson et al., 1995). Common sources of background noise for large bodies of water are tidal currents and waves; wind and rain over the water surface; water turbulence and infrasonic noise; biological sources (e.g., marine mammals); and human-made sounds (e.g., ships, boats, low-flying aircraft). The ambient noise levels from natural sources typically vary by as much as 20 dB or more (Richardson et al., 1995) according to numerous factors including wind and sea conditions, seasonal biological cycles, and other physical conditions. Noise levels from natural sources can be as loud as 120 dB (re: 1 μ Pa at 1 meter [3.2 feet]) in major storms. (U.S. Department of the Air Force, 1998)

Noise associated with human sources varies with the characteristics of the specific noise source. The primary human-made noise source within the ROI is expected to be associated with ship and vessel traffic. This source may include transiting commercial tankers and container ships, commercial fishing boats, and military surface vessels and aircraft. Vessel noise is primarily associated with propeller and propulsion machinery. In general, noise levels increase with vessel size, speed, and load. Noise levels from large ships can reach levels of 180-190 dB (re 1 micropascal [μ Pa] at 1 meter [3.2 feet]), whereas smaller vessels range from approximately 100-160 dB (re 1 μ Pa at 1 meter [3.2 feet]) (U.S. Department of the Air Force, 1998). At distances greater than 1 meter (3.2 feet), noise levels received diminish rapidly with increasing distance (Richardson et al., 1995).

3.6.5 WATER RESOURCES—OPEN OCEAN (FLIGHT TEST CORRIDOR)

A general description of water resources is provided in the first paragraph of section 3.1.12.

Region of Influence

The ROI includes areas of the open ocean that may be affected by the Proposed or Alternative Action (debris from nominal and abnormal flight tests).

Affected Environment

Water quality in the open ocean is excellent, with high water clarity, low concentrations of suspended matter, dissolved oxygen concentrations at or near saturation, and low concentrations of contaminants such as trace metals and hydrocarbons. A description of

the open ocean's physical and chemical properties, including salinity, density, temperature, pH, and dissolved gases, is given in section 3.6.2.

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4.0

ENVIRONMENTAL CONSEQUENCES

4.0 ENVIRONMENTAL CONSEQUENCES

This chapter describes the potential environmental consequences of the proposed action and alternatives by comparing these activities with the potentially affected environmental components. Sections 4.1 through 4.6 provide discussions of the potential environmental consequences of, and possible mitigations for, these activities. The amount of detail presented in each section is proportional to the potential for impacts. Sections 4.7 through 4.15 provide discussions of the following with regard to proposed program activities: environmental effects of the No-action Alternative; adverse environmental effects that cannot be avoided; conflicts with federal, state, and local land use plans, policies, and controls for the area concerned; energy requirements and conservation potential; irreversible or irretrievable commitment of resources; relationship between short-term use of the human environment and the maintenance and enhancement of long-term productivity; natural or depletable resource requirements and conservation potential; Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations*, and Executive Order 13045 as amended by Executive Order 13229, *Federal Actions to Address Protection of Children from Environmental Health Risks and Safety Risks*.

To assess the potential for and significance of environmental impacts from the proposed program activities, a list of activities was developed (chapter 2.0) and the environmental setting was described, with emphasis on any special environmental sensitivities (chapter 3.0). Program activities were then assessed with the potentially affected environmental components to determine the environmental impacts of the proposed activities.

To help define the affected environment and determine the significance of program-related effects, written, personal, and telephone contacts were made with applicable agencies and installation offices. Chapter 7.0 provides a list of those contacted.

Activities associated with launching the THAAD and target missiles would result in a potential for impacts similar to or less than those discussed in prior NEPA documents listed in section 1.7. The results of analysis provided in these documents are summarized as applicable in the following paragraphs for specific resource sections and incorporated by reference.

4.1 PACIFIC MISSILE RANGE FACILITY

4.1.1 AIR QUALITY—PACIFIC MISSILE RANGE FACILITY

Potential issues related to the air quality of the area around PMRF include compliance with national and state air quality standards for criteria pollutants released during proposed activities. Air quality at PMRF could be impacted by site preparation activities and launch emissions. Potential impacts were determined based on whether or not (1) operations

within attainment areas could cause a detrimental change in attainment status of the area, or (2) increases in ambient air pollutant concentration could cause exceedances of the applicable ambient air quality standards.

4.1.1.1 Site Preparation Activities

The soils at PMRF are relatively fine grained and have been noted to be susceptible to wind erosion when cleared of vegetation. Proposed site preparation activities related to clearing and grubbing for the THAAD launcher hardstand, blockhouse, CLS and CSF, bypass road, fiber-optic cables, and radar hardstand would likely release fugitive dust for short periods. A conservative estimate for uncontrolled fugitive dust emissions from ground disturbing activities is 1.08 metric tons (1.2 tons) per 0.4 hectare (1 acre) per month of activity (U.S. Environmental Protection Agency, 1995). Normally, half of these emissions are assumed to be PM-10; however, the precise fraction depends upon the makeup of the local soil. Construction of THAAD-related facilities would likely disturb a total of less than 2 hectares (5 acres) on PMRF and thus could generate up to approximately 6.8 metric tons (7.6 tons) of PM-10 (table 4-1) over a period of approximately 6 months. Impacts from fugitive dust would be mitigated through the use of watering or a biodegradable dust suppressant.

Table 4-1: Construction Emissions at PMRF

Construction	Emissions (metric tons [tons])
Contractor Logistics Support Maintenance and Storage and Central Support Facility	3.0 (3.4)
THAAD Launcher and Mission Control Blockhouse	1.9 (2.1)
THAAD Radar and BMC2	1.9 (2.1)
Asphalt Paving	0.004 (0.005)

The air quality impacts would be localized and would only occur when construction activities were actually being conducted. No unusual amounts or types of air emissions would be anticipated due to construction. Vehicles would also be turned off when not in use to minimize exhaust emissions. The proposed THAAD buildings would run off commercial power and, if required, PMRF would supply backup power from existing on-base generators. No exceedances of the NAAQS and Hawaii air standards are anticipated from this level of construction. No amendments to PMRF's Title V permit would be required for site preparation activities. Hawaii is within an attainment area and a General Conformity Analysis is not required for the Proposed Action.

4.1.1.2 Flight Test Activities

As analyzed in the PMRF Enhanced Capability EIS (U.S. Department of the Navy, 1998), THAAD missile launches would have no adverse impact to the air quality of the surrounding area at PMRF. No missile proposed for launch would emit greater exhaust

than those already launched at PMRF. Table 1-3 lists the emission constituents for each THAAD launch.

Current power generators for PMRF operate in compliance with the PMRF Title V Covered Source Permit. THAAD facilities would use commercial power except during radar operation. Power would then be provided by the two 4,160-volt generators. The THAAD Project Office has applied for a Limited Non-Covered Source Permit for proposed generator use. Emergency generators are commonly run intermittently on PMRF to maintain their readiness. Hawaii air pollution regulations make specific exemption allowances for emergency generators. According to the PMRF Enhanced Capability EIS, no air quality impacts were anticipated from continued use of generators.

Air emission could pose a health threat; however, modeling conducted for the PMRF Enhanced Capability EIS determined that all exhaust concentrations from the termination of a missile shortly after lift off would be below applicable health-based standards at the edge of the ground hazard area. Also, personnel remaining outdoors within the LHA would wear appropriate safety equipment such as respirator masks.

Each launch is a discrete event and the total would not exceed the number of launches that can currently be performed annually at PMRF under existing agreements. As stated in the PMRF Enhanced Capability EIS, the logistics of the launch procedures would allow sufficient time between launches so that no exhaust from one launch would impact the ambient air quality during the next. The tempo of launch events would be managed by range operations to stay within the limits of current agreements.

4.1.1.3 Post Flight Test Activities

Post flight test activities would include the removal of all mobile equipment/assets brought to the range. This removal could result in small localized amounts of fugitive dust (PM-10), which would have a minor impact to air quality. Dust control measures discussed above would be implemented.

4.1.1.4 Cumulative Impacts

Air quality impacts as a result of site preparation, flight test, and post flight test activities would be minor and transitory due to the short construction and flight operation periods and strong prevailing winds. According to the PMRF Enhanced Capability EIS, no air quality impacts were anticipated from continued use of generators. Missile launches are short-term, discrete events, thus generally allowing time between launches for emission products to be dispersed. No other construction projects, which would occur in the same locations and timeframe, have been identified. The Proposed Action when combined with current and proposed launch activities discussed in section 2.6 would not increase the total number of annual launches currently allowed from PMRF and analyzed in the PMRF Enhanced Capability EIS and is not expected to result in cumulative impacts to air quality. All test and training activities are managed by range operations to ensure that the activities do not overlap and do not exceed the number of launches stipulated in existing

agreements. These combined activities would be performed at varying times and locations on PMRF.

4.1.2 AIRSPACE—PACIFIC MISSILE RANGE FACILITY

It is expected that there would be less than 50 additional aircraft operations at PMRF as a result of the Proposed Action, based on analysis in the PMRF EIS of similar missions, which would represent less than a 1 percent increase in total air operations. THAAD missile launches from PMRF would be conducted within the existing Special Use Airspace, Temporary Operating Area (see section 4.6.1), and the adjacent Warning Area controlled by PMRF. The missile launches represent precisely the kinds of activities for which Special Use Airspace was created: to accommodate national security and necessary military activities, and to confine or segregate activities considered to be hazardous to non-participating aircraft. Assessment of potential impacts to airspace are based on the following: if they have the potential to result in an obstruction to air navigation; modification to or new requirement for special use airspace; changes to existing air routes; or additional restricted access to regional airfields and airports.

4.1.2.1 Site Preparation Activities

Site preparation activities could involve additional flights in and out of the PMRF airfield. However, the Proposed Action would not restrict access to, nor affect the use of, existing airfields and airports in the ROI. Access to the PMRF airfield would not be affected. All arriving and departing aircraft and all participating military aircraft are under the control of PMRF Radar Control Facility; thus, there would be no airfield or airport conflicts in the ROI under the Proposed Action, and no impact.

4.1.2.2 Flight Test Activities

Special Use Airspace

Proposed THAAD missile launches from PMRF would not alter existing controlled and uncontrolled airspace in the PMRF ROI. Missiles would be well above Flight Level (FL) 600 (18,288 meters [60,000 feet]) and still be within the R-101 Restricted Area, which covers the surface to unlimited altitude, within 1 minute of the rocket motor firing. Aircraft are routinely excluded from the restricted area during missile launches. All other local flight activities occur at sufficient distance and altitude such that the THAAD missile launches would not require changes to or create a hazard to these flight activities.

En Route Airways Jet Routes

Local flight activities along the two en route low altitude airways, V-15 and V-16 (figure 3-7), would occur at sufficient distance and altitude such that the THAAD missile launches would have no substantial impact. Implementation of the altitude reservation (ALTRV) procedures, where the FAA provides separation between non-participating air traffic and the missile's flight path within the Temporary Operating Area, would have minimal impact on the two en route low altitude airways. There are no high altitude jet routes in the PMRF ROI.

Honolulu ARTCC would reroute instrument flight rules aircraft using the V-15 low altitude airway that passes through the southern part of Warning Area W-188. However, this is done routinely and results in the smooth transition of aircraft through the area with no adverse impact on en route airways or jet routes.

Airports and Airfields

The Proposed Action would not restrict access to, nor affect the use of, existing airfields and airports in the ROI. Operations at the PMRF airfield would continue unhindered. Access to the PMRF airfield and Kekaha airstrip would not be curtailed. Commercial and private aircraft would be notified in advance of launch activities by PMRF as part of their routine operations through NOTAM by the FAA. Thus, commercial and private craft would be able to reschedule or choose alternate routes before the flight experiments. All arriving and departing aircraft and all participating military aircraft are under the control of PMRF Radar Control Facility; thus, there would be no airfield or airport conflicts in the ROI, and no impact.

4.1.2.3 Post Flight Test Activities

As discussed in section 4.1.2.1, no airfield or airport conflicts in the ROI are anticipated for the additional flights that may be required for post flight test activities under the Proposed Action, and thus no impact is anticipated.

4.1.2.4 Cumulative Impacts

The PMRF Range Control Facility controls all arriving and departing aircraft and all participating military aircraft. All Proposed Action intercept activities would take place either in existing special use airspace that has been in existence since the early 1960s, and is cleared of non-participating aircraft, or within the new Temporary Operating Area. The Proposed Action when combined with current and proposed launch activities discussed in section 2.6 would not increase the total number of annual launches currently allowed from PMRF and analyzed in the PMRF Enhanced Capability EIS. These combined activities would be performed at varying times and locations on PMRF. The required scheduling process for the use of this airspace obviates the potential for cumulative impacts to airspace use from multiple programs on PMRF, such as THAAD activities combined with ongoing and planned Rim of the Pacific and Navy Theater Wide activities, and potential Ground-Based Midcourse Defense activities discussed in section 2.6. No incremental, additive cumulative impacts to airspace use have been identified.

4.1.3 BIOLOGICAL RESOURCES—PACIFIC MISSILE RANGE FACILITY

Potential impacts of construction, building modification, and missile launches on terrestrial and marine biological resources within the PMRF ROI have been addressed in detail in the Strategic Target System EIS, the Restrictive Easement EIS, the PMRF Enhanced Capability EIS, and several program-specific EAs. Based on the prior analyses done and the effects of past target and missile launch activities, the potential impacts of activities related to test flights of the THAAD missile on biological resources are expected to be minimal, as discussed below.

The analytical approach for biological resources involved evaluating the degree to which the launch proposed activities could impact the vegetation, wildlife, threatened or endangered species, and sensitive habitat within the affected area. Criteria for assessing potential impacts to biological resources are based on the following: the number or amount of the resource that would be impacted relative to its occurrence at the project site, the sensitivity of the resource to proposed activities, and the duration of the impact. Impacts are considered substantial if they have the potential to result in reduction of the population size of federally listed threatened or endangered species, degradation of biologically important unique habitats, substantial long-term loss of vegetation, or reduction in capacity of a habitat to support wildlife.

4.1.3.1 Site Preparation Activities

Vegetation

Ground clearance for construction of the proposed THAAD launch site, blockhouse, access roads, CLS and CSF buildings, and the radar hardstand, and realignment of South Sidewinder Road would result in vegetation removal and habitat loss. The proposed launch and blockhouse sites are within undeveloped grassy and kiawe areas, which cover most undeveloped areas on PMRF. No unique habitat would be disturbed, since the native strand vegetation along the shoreline would be avoided to the maximum extent practicable. The radar hardstand and road realignment would be constructed along a previously disturbed right of way. The CLS and CSF buildings and new access road would be constructed within the previously disturbed administrative area. No impacts to indigenous or native vegetation are expected.

Wildlife

Site preparation activities would not result in impacts to Essential Fish Habitat since no water bodies would be affected.

Construction noise and the increased presence of personnel could affect wildlife within the area. Construction ground disturbance and equipment noise-related impacts would include loss of habitat, displacement of wildlife, and short-term disruption of daily/seasonal behavior. No unique habitat would be disturbed, since the native strand vegetation along the shoreline would be avoided. Noise rather than the sight of machines appears to cause disturbance to wildlife. Typical noise levels at 15 meters (50 feet) from construction equipment range from 70 to 98 dBA. The combination of increased noise levels and human activity would likely displace some small mammals and birds that forage, feed, or nest within this 15-meter (50-foot) radius. Construction from April through June would have the potential to impact the majority of nesting or breeding bird species. However, construction-type activities are common on PMRF and additional similar habitat is adjacent to the areas proposed for the THAAD program locations.

Although construction activities could cause flushing (birds suddenly flying up), this is a common reaction to sudden natural sounds that only slightly increases the energy expenditure of individual birds. Wildlife in the immediate area (ring-necked pheasant, Laysan albatross, wedge-tail shearwater, and small rodents) could be startled by

construction noise and possibly leave the area permanently, temporarily avoid or leave the area during construction, or likely become accustomed to the increased noise and human presence. The presence of personnel may cause wildlife to avoid the area, at least temporarily, but would therefore reduce the potential for impacts from elevated noise levels. The disturbance from the short-term noise associated with construction is not expected to alter migration patterns.

Threatened and Endangered Species

No adverse impacts are anticipated to the Ohai and Lau'ehu since these plant species have not been identified within the areas proposed for disturbance.

Newell's Townsend's shearwater, Hawaiian dark-rumped petrel, Hawaiian (American) coot, Hawaiian black-necked stilt, Hawaiian common moorhen, and Hawaiian duck have been observed in the drainage ditches and ponds on PMRF. Impacts to these birds would be limited to startle or flushing reactions to site preparation noise and personnel presence. Proposed activities are unlikely to adversely affect, the long-term well-being, reproduction rates, or survival of these listed birds. Reflection from outdoor lighting could disorient the Newell's Townsend's shearwater, which may fly over PMRF at night (mainly between April and November). Any outdoor lighting associated with construction activities and permanent structures would be properly shielded, following U.S. Fish and Wildlife Service guidelines to minimize reflection and impact to these birds.

Site preparation noise and personnel presence are not anticipated to affect the Hawaiian hoary bat, which has been observed feeding offshore north of the ROI at the Polihale State Park. Site preparation activities are also not likely to affect marine species such as the Hawaiian monk seal and sea turtles. Construction of the radar hardstand and bypass road on south PMRF and the support buildings on central PMRF would be within areas not used by the monk seal or sea turtles. Any observed green sea turtle nests near the area proposed for the launch pad would be noted and avoided.

Environmentally Sensitive Habitat

No adverse impacts to the coastal dune systems are anticipated. Construction is not likely to directly impact any wetlands on base including those associated with the Nohili Ditch and the Kawaiele Ditch. Indirect disturbance to wetlands would be minimized by implementing appropriate techniques to control runoff and other Best Management Practices such as stabilizing fill slopes from erosion and the use of hay bales to filter sediment from storm water runoff from construction sites, which would minimize water quality impacts to wetlands that could occur adjacent to the site.

The bypass road proposed on the southern portion of PMRF near the THAAD radar site is near Unit H3, which has been designated as unoccupied critical habitat by the U.S. Fish and Wildlife Service. Construction of this bypass road would avoid Unit H3 to the extent practicable. Planned activities would not impact critical habitat in the northern portion of the range.

Construction noise and the increased presence of personnel could affect birds within the Kawaiiele Bird Sanctuary. However, as addressed above, the birds could be startled by construction noise and possibly temporarily avoid or leave the area during construction, but the short-term disturbance is not expected to be sufficient to alter migration patterns.

4.1.3.2 Flight Test Activities

Vegetation

Normal launch activities are not expected to impact vegetation. Analysis provided in the Strategic Target System EIS (U.S. Army Strategic Defense Command, 1992) concluded that although vegetation near the Strategic Target System launch pad could suffer some temporary distress from the heat generated at launch and from hydrogen chloride or aluminum oxide emissions, there is no evidence of any long-term adverse effect on vegetation from two decades of launches at PMRF. The continued presence of the adder's tongue, a species removed from the list of federal Candidate species, indicates that emissions from Strategic Target System missiles have not had a significant impact on sensitive vegetative species. Observation of plant communities at other launch sites such as KTF, Cape Canaveral, and Vandenberg Air Force Base indicate that vegetation continues to thrive in the immediate areas surrounding launch pads. Vegetation sampling conducted in the area near active launch pads at KTF has not indicated that hydrogen chloride emissions from launches conducted during the last 20 years resulted in any lasting effects (U.S. Army Space and Strategic Defense Command, 1993e). Titan missiles launched from Vandenberg Air Force Base generate approximately 132 metric tons (146 tons) of hydrogen chloride in exhaust emissions (Federal Aviation Administration, 1996). The Strategic Target System missile generates less than 2 metric tons (2 tons) of hydrogen chloride, less than 2 percent of the Titan emissions. In addition, the Titan missile systems add water to the exhaust products, which results in hydrochloric acid droplets being deposited directly upon adjacent plants (Federal Aviation Administration, 1996). Although hydrogen chloride is very soluble in water, it does not readily deposit onto dry surfaces when the relative humidity is below 100 percent (U.S. Department of the Air Force, 1998).

The amount of emissions produced by the THAAD missile would be less than 2 percent of the Strategic Target System emissions. Based on these analyses, the potential effects to vegetation from the launches involved in THAAD test flights are also expected to be minimal.

Wildlife

Noise

Disturbance to wildlife from the launches would be brief and is not expected to have a lasting impact nor a measurable negative effect on migratory bird populations. Wildlife such as waterfowl would quickly resume feeding and other normal behavior patterns after a launch is completed. Waterfowl driven from preferred feeding areas by aircraft or explosions usually return soon after the disturbance stops, as long as the disturbance is not severe or repeated within a short time frame (Federal Aviation Administration, 1996).

Potential noise effects on wildlife can be categorized as auditory and non-auditory. Auditory effects would consist of direct physical changes, such as eardrum rupture or

temporary threshold shift (TTS). Non-auditory effects could include stress, behavioral changes, and interference with mating or foraging success. The effects of noise on wildlife vary from serious to no effect in different species and situations. Behavioral responses to noise also vary from startling to retreat from favorable habitat. Animals can also be very sensitive to sounds in some situations and very insensitive to the same sounds in other situations. (Larkin, 1996) Informal observation at several launch facilities indicates the increased presence of personnel immediately before a launch tends to cause birds and other mobile species of wildlife to temporarily leave the area that would be subject to the highest level of launch noise. Therefore, no direct physical auditory changes are anticipated. Wildlife is known to exhibit a startle effect when exposed to short-term noise impacts, such as the launch of a target missile. Birds usually show signs of disturbance, such as the fluttering of wings, when the noise occurs, but quickly return to normal behavior after the event. Video camera observations of a wood stork colony located 0.8 kilometer (0.5 mile) south of the Space Shuttle launch pad at Kennedy Space Center showed the birds flew south away from the noise source and started returning within 2 minutes, with a majority of individuals returning in 6 minutes (National Aeronautics and Space Administration, 1997).

A rookery at Kennedy Space Center used by wood storks and other species of wading birds is located approximately 750 meters (2,461 feet) from a Shuttle launch pad. This rookery continues to be used successfully, even though it has received peak noise levels of up to approximately 138 dB. (American Institute of Aeronautics and Astronautics, 1993) As mentioned above, monitoring studies of birds during the breeding season indicate that adults respond to Space Shuttle noise by flying away from the nest, but they return within 2 to 4 minutes. Birds within 250 meters (820 feet) of Titan launch complexes at Cape Canaveral Air Station have shown no mortality or reduction in habitat use. Titan IV vehicles produce noise levels of approximately 170 dB in the immediate vicinity of the launch pad. This attenuates to 125 dB at a distance of 3 kilometers (2 miles) within about 30 seconds following launch. (U.S. Department of the Air Force, 1990)

No evidence has indicated that serious injuries would result, and no long-term adverse effects are anticipated. The brief noise peaks produced by the THAAD missile are comparable to levels produced by close range thunder (120 dB to 140 dB peak), and there is no species known to be susceptible to hearing damage following intermittent exposure to this common noise source (U.S. Department of the Air Force, 2001).

Emissions

Hydrogen chloride, which is emitted during THAAD launches, is known to affect wildlife. Birds flying through the exhaust plume may be exposed to concentrations that could irritate eye and respiratory systems (Federal Aviation Administration, 1996). However, results of monitoring conducted following a Strategic Target System launch from KTF at PMRF indicated little effect upon wildlife due to the low-level, short-term hydrogen chloride emissions (U.S. Army Space and Strategic Defense Command, 1993e). The program included marine surveys of representative birds and mammals for both prelaunch and postlaunch conditions. Studies on representative birds and mammals reviewed in the Final EIS for the Strategic Target System (U.S. Army Strategic Defense Command, 1992) also

indicated that low-level, short-term exposure to hydrogen chloride would not adversely affect threatened or endangered species or other wildlife. Aluminum oxide and hydrogen chloride do not bioaccumulate; therefore, no indirect effects to the food chain are anticipated.

An early flight termination or mishap could result in debris impact along the flight corridor, which may temporarily impact fishing activities in the immediate area. A launch mishap could result in the unlikely, but possible, limited emission of nitric acid through release of the hypergolic bi-propellants in the Divert and Attitude Control System. Only a maximum of 1.9 liters (0.5 gallon) would be involved. The reaction of the acid with water could initially cause spattering, a localized increase in water temperature, and local lowering of the pH value. However, the low levels of emission combined with the natural buffering capacity of seawater would neutralize the reaction in a relatively short period of time. Due to the small amount of propellant involved and the unlikelihood of a mishap, the project is not anticipated to adversely affect marine resources. The potential ingestion of toxins by fish species, which may be used for food sources, would be remote because of the diluting effect of the ocean water and the relatively small area that would be affected.

Electromagnetic Radiation

In terms of the potential for EMR impacts to wildlife, the power densities emitted from the THAAD radar are unlikely to cause any biological effects in animals or birds. The THAAD radar is not expected to radiate lower than 5 degrees, which would preclude EMR impacts to terrestrial species on the beach from either operation of the THAAD radar during flight tests or later during proposed tactical testing. The potential for main-beam (airborne) exposure thermal effects to birds exists. The potential for impacts to birds and other wildlife was addressed in the Ground-Based Radar Family of Radars EA. The analysis was based on the conservative assumption that the energy absorption rate of a bird's body was equal to its resting metabolic rate and that this could pose a potential for adverse effects. Birds in general typically expend energy at up to 20 times their resting metabolic rates during flight. Mitigating these concerns is the fact that radar beams are relatively narrow. To remain in the beam for any period requires that the bird flies directly along the beam axis, or that a hovering bird such as a raptor does so for a significant time. There is presently insufficient information to make a quantitative estimate of the joint probability of such an occurrence (beam stationary/bird flying directly on-axis or hovering for several minutes), but it is estimated to be insubstantial. Since birds are not likely to remain continuously within the radar beam, the likelihood of harmful exposure is not great. (U.S. Department of the Navy, 1998) The use of existing sensors is part of routine activities on PMRF as analyzed in the PMRF Enhanced Capability EIS.

Essential Fish Habitat

The potential impact to Essential Fish Habitat from nominal launch activities would mainly be from spent boosters and missile debris to waters off the coast within the Temporary Operating Area. Although spent boosters and intercept debris could affect any species close to the surface, the number of individuals injured or killed would not likely affect overall species' populations. The majority of propellant would be expended before booster

drop and impact and thus only trace amounts of propellant would be left, which would minimize the potential for toxic effects. (U.S. Department of the Air Force, 2001)

In the unlikely event of a launch mishap, scattered pieces of burning propellant could enter coastal water and potentially affect Essential Fish Habitat. Concentrations of toxic materials would be highest in this shallow water and have a greater chance of being ingested by feeding animals. However, the potential for a launch mishap is relatively slight and in most cases the errant missile would be moving at a rapid rate such that pieces of propellant and other toxic debris would strike the water further downrange. The debris would also be widely scattered, which would reduce the possibility of ingestion. As mentioned above, the number of individuals injured or killed would not likely affect overall species' populations. (U.S. Department of the Air Force, 2001)

Threatened and Endangered Species

The possibility of a spill or other accident involving hazardous materials impacting Ohai and Lau'ehu habitat is considered remote since these plants have only been observed north of PMRF. The northern boundary of PMRF is approximately 2.4 kilometers (1.5 miles) from the proposed THAAD launch site. Any spill or release of hazardous material would likely be restricted to a small, localized area near the source and would be cleaned up in accordance with PMRF's spill plan.

Impacts from launch noise to the Newell's Townsend's shearwater, Hawaiian dark-rumped petrel, Hawaiian (American) coot, Hawaiian black-necked stilt, Hawaiian common moorhen, and Hawaiian duck would be limited to startle or flushing reactions as discussed above. Reflection from outdoor lighting could disorient the Newell's Townsend's shearwater; however, any outdoor lighting associated with construction activities and permanent structures would be properly shielded, following U.S. Fish and Wildlife Service guidelines. As discussed above, impacts from EMR are considered unlikely.

No adverse impacts are anticipated to the Hawaiian hoary bat, which has been observed feeding offshore north of the project area at the Polihale State Park. The likelihood that debris from a spent booster or terminated launch would strike a Hawaiian monk seal is considered remote since the waters adjacent to PMRF are used infrequently by this species. The launch would be delayed if monk seals are observed on the beach portion of the LHA. Green sea turtles nests have been observed in the sand near the Nohili Ditch. Green sea turtles lay eggs only at night, once every 2 to 4 years. Thus the potential for debris to strike a green sea turtle near, or on, shore is remote. The THAAD radar would not radiate lower than 5 degrees, and would be 3 to 4 meters (11 to 12 feet) above mean sea level, which would preclude EMR impacts to terrestrial species or sea turtles on the beach from either operation of the THAAD radar on southern PMRF during flight tests or later during proposed tactical testing in the Nohili Ditch area. Access to green sea turtle

nesting beaches, primarily the beach area adjacent to the proposed location for the tactical radar would be restricted.

Radiofrequency radiation does not penetrate the surface of water to any great degree. The power density level just below the surface of the ocean would not exceed the permissible exposure level for uncontrolled environments. No impacts to marine mammals offshore are expected as a result of proposed radar operation on PMRF since these species would normally be found in the ocean outside the 400-meter (1,312-foot) exclusion zone. It is also highly unlikely that an individual whale would be on or substantially above the surface of the water for a significant amount of time within the main beam or side lobe areas during the particular time that the THAAD radar would be operating. No adverse impacts would occur to whales, other marine mammals, or sea turtles at least 1.3 centimeters (0.5 inch) below the surface. For these reasons, no effects are anticipated on the humpback whale, other marine mammals, or sea turtles that might be present in the vicinity of the THAAD radar. The potential for impacts to marine species is further discussed in section 4.6.2, Biological Resources—Open Ocean (Flight Test Corridor).

Based on prior analyses and the observed effects of past target and missile launch activities, the potential impacts of THAAD program activities on sensitive biological resources are expected to be minimal.

Environmentally Sensitive Habitat

The potential for spills during refueling of the Prime Power Unit or leaks from the closed Cooling Equipment Unit system would be offset by in-place, impermeable ground cover and/or spill-containment berms and thus would not adversely affect wetlands, the Hawaiian Islands Humpback Whale National Marine Sanctuary, reefs, or critical habitat.

The Hawaiian Islands Humpback Whale National Marine Sanctuary EIS and Management Plan (National Oceanic and Atmospheric Administration, 1997) recognizes that PMRF plays an important role in national defense training. The EIS includes missile launches as one of the DoD activities that currently occurs within the sanctuary boundaries. The proposed THAAD launches would have impacts within the parameters of ongoing missile programs.

Unexpected flight terminations or other launch mishaps have the potential to impact an area (Unit H3) that has been proposed as unoccupied critical habitat by fire, debris, and the resultant cleanup. However, the likelihood of a mishap occurring is very remote and vegetation would be expected to naturally become established after a fire.

According to analysis provided in the PMRF Enhanced Capability EIS, debris from shore-based missile launch programs is not expected to produce any measurable impacts on benthic resources beyond those currently experienced during natural conditions associated with storms. Based on the observed effects of past target and missile launch activities, the potential impacts of THAAD program activities on sensitive biological resources such as coral are expected to be minimal.

4.1.3.3 Post Flight Test Activities

THAAD program personnel would remove all mobile equipment/assets brought to the range at the conclusion of its testing activities at PMRF. All permanent facilities constructed in support of THAAD testing would remain and become part of the range's infrastructure and would be maintained per their operating procedures. Fencing which was erected for THAAD activities would be retained or removed according to the needs of the installation. The bypass road around the THAAD radar hazard area would be closed and South Sidewinder Road through the hazard area would be re-opened to traffic. Transportation for removal of THAAD equipment would be the same as when it was brought into the installation. These activities would result in impacts similar to, but less than, those caused by site preparation. Specific restoration actions, if necessary, would be determined on a case-by-case basis.

4.1.3.4 Cumulative Impacts

The anticipated number of THAAD missiles launched from PMRF could be up to 50 over a period of 4 years, typically ranging from 1 to 14 per year. The Proposed Action when combined with current and proposed launch activities discussed in section 2.6 would not increase the total number of annual launches currently allowed from PMRF and analyzed in the PMRF Enhanced Capability EIS. These combined activities would be performed at varying times and locations on PMRF and should have negligible cumulative impacts on biological resources. No significant cumulative impacts to biological resources have been identified as a result of prior launches from PMRF, including the Strategic Target System launches.

4.1.4 CULTURAL RESOURCES—PACIFIC MISSILE RANGE FACILITY

An undertaking is considered to have an effect on a historic property when it may alter characteristics of the property that may otherwise qualify the property for inclusion in the National Register. An effect is considered to be adverse when it diminishes the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Adverse effects on historic properties include but are not limited to: the physical destruction, damage, or alteration of all or part of the property; isolation of the property from, or alteration of the character of, the property's setting when that character contributes to the property's qualification for the National Register; or introduction of visual, audible, or atmospheric elements that are out of character with the property or alter its setting.

All THAAD activities will be performed in accordance with the 1999 *Memorandum of Agreement Among the United States Department of the Navy, Pacific Missile Range Facility; The Hawaii State Preservation Officer; and The Advisory Council on Historic Preservation Regarding Activities Proposed Within the Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement, Barking Sands, Kauai, Hawaii.*

4.1.4.1 Site Preparation Activities

Prehistoric and Historic Archaeological Resources

In accordance with the 1999 Memorandum of Agreement, an archaeological subsurface survey was conducted at the proposed location of the THAAD launch site. The archaeological survey concluded that cultural deposits extended from the coastal dune to the western boundary of the original proposed launch site and at least 5 meters (16 feet) into the present project site. The site was moved approximately 15 meters (50 feet) in accordance with the archaeologists' recommendations to avoid impacts to the Site 50-30-05-1829 deposits. The location of the CSF and the CLS was previously used for barracks during World War II as well; however, the only remains are concrete building slabs.

All design and construction activities would be coordinated with PMRF and would be constructed in accordance with existing installation policies. Since the project location was moved to avoid affecting the archaeological site, monitoring is not necessary. Personnel would be informed of the sensitivity of cultural resources and the types of penalties that could be incurred if sites are damaged or destroyed. If during construction of any THAAD component cultural items are discovered, Memorandum of Agreement Stipulation 1.G would apply, the Burial Treatment Plan (Attachment K of the Memorandum of Agreement) would need to be followed, and the Draft Archaeological Monitoring Plan (Attachment J of the Memorandum of Agreement) would need to be followed. Activities would cease in the immediate area and the appropriate individuals and agencies as stipulated in the Memorandum of Agreement would be notified through the host installation. Subsequent actions would follow the guidance provided. Therefore, no impacts to any known prehistoric and historic archaeological sites on PMRF are expected.

The proposed launcher hardstand location is relatively close to a habitation site that may contain midden deposits or charcoal fire places. This area is also near a light rail that is buried beneath the ground surface parallel to the shoreline that may have been used for munitions movement or gun emplacement during World War II.

The proposed fiber optic cable trench would be only 30 to 46 centimeters (12 to 18 inches) deep to minimize the potential for disturbance to subsurface items. If the proposed trench will be located in sensitive areas not previously surveyed by a qualified archaeologist, pre-construction surveys would be required and archaeological monitoring during the construction may also be required.

Historic Buildings and Structures

No impacts to historic buildings or structures during any THAAD activity are anticipated, since none have been proposed for modification.

Native Populations/Traditional Resources

The Nohili Dune has been determined to be a site eligible for the National Register as a traditional cultural property. Since the original launch pad location was moved, no impacts to traditional resources potentially located within the Nohili Dune during site preparation

are expected. As stated above, pre-construction surveys would be required and monitoring may be required if the proposed fiber optic cable trench is located in non-surveyed sensitive areas. Should any traditional resources be found, all activities would cease and the appropriate authorities would be contacted as discussed above.

4.1.4.2 Flight Test Activities

Potential impacts to archaeological resources could occur as a result of flight termination debris striking the ground where surface or subsurface deposits are located. However, the probability of this occurring is extremely remote. Personnel would be informed of the sensitivity of cultural resources and the types of penalties that could be incurred if sites are damaged or destroyed. No impacts to cultural resources are anticipated during operation of the Proposed Action at PMRF. However, if during operation at any THAAD component cultural items are discovered, activities would cease in the immediate area and the Hawaii State Historic Preservation Officer would be notified through the host installation. Subsequent actions would follow the guidance provided.

4.1.4.3 Post Flight Test Activities

At the conclusion of testing activities, THAAD program personnel would remove all mobile equipment/assets brought to the range using previously established hard surfaced roadways. Specific restoration actions, if necessary, would be determined on a case-by-case basis.

4.1.4.4 Cumulative Impacts

The Proposed Action when combined with current and proposed launch activities discussed in section 2.6 would not increase the total number of annual launches currently allowed from PMRF and analyzed in the PMRF Enhanced Capability EIS. These combined activities would be performed at varying times and locations on PMRF. Cumulative impacts to cultural resources on PMRF are not anticipated. Implementation of appropriate pre-construction surveys, fuel transport monitoring, consultation with the Hawaii State Historic Preservation Officer, compliance with the Memorandum of Agreement between the U.S. Department of the Navy, PMRF, and the Hawaii State Historic Preservation Officer, and adherence to other U.S. Navy and PMRF guidelines would minimize the potential for cumulative impacts to cultural resources.

4.1.5 GEOLOGY AND SOILS—PACIFIC MISSILE RANGE FACILITY

Geology and soils impacts were evaluated on the following criteria: potential for ground disturbance; substantial erosion or siltation from water and wind during construction and operation; contamination from launches. The Proposed Action could result in minor geology and soils impacts as a result of ground disturbance during construction activities and potential contamination of exhaust products and debris from missile launches.

4.1.5.1 Site Preparation Activities

Adverse impacts to soils are unlikely to occur as a result of new construction or other necessary prelaunch activities since the proposed sites are located in modern alluvial and dune sands unsuitable for any agricultural development (U.S. Department of the Navy, 1998). Soils at the construction sites may be subject to minor erosion from the wind during the construction period. However, soil disturbance from new construction would be of short duration and limited to the immediate vicinity of the construction site. Best Management Practices, such as frequent watering of excavated material and/or the use of soil additives to bond exposed surface soils, would reduce the potential for soil erosion.

4.1.5.2 Flight Test Activities

THAAD launches at PMRF would use solid fuel propellants. A qualified accident response team would be available near the launch locations to negate or minimize any adverse effects from an unlikely event such as a flight termination. Primary emission products from previous launches of a solid propellant missile include hydrogen chloride, aluminum oxide, carbon dioxide, carbon monoxide, nitrogen, and water.

Soil deposition of hydrogen chloride is expected to be minimal since relatively minute amounts of hydrogen chloride are released as a result of the booster ground cloud and the adverse emissions disperse rapidly. Typically, no solid propellant missile launches would occur during rain, and the launch system would not use a water deluge system for cooling and noise suppression (a deluge system could increase the potential for ground deposition). (U.S. Department of the Navy, 1998)

Potential deposition of aluminum oxide per launch is also expected to be minimal relative to the levels of aluminum naturally present in the soil. Soil deposition of measurable levels of aluminum oxide from a moving exhaust cloud is predicted to be negligible (U.S. Army Strategic Defense Command, 1992). Additionally, because the launch location is on the western side of the island, the launch trajectory is away from the island, and there are strong persistent wind conditions, it is expected that very little of these emissions will be deposited at PMRF. No measurable direct or indirect, short- or long-term effects on soil chemistry are expected.

In the unlikely event of an on-pad fire or early flight failure over land of a solid propellant missile, fuel would likely burn up before being extinguished. The remaining fuel would be collected and disposed of as hazardous waste. Such an incident would result in very contained localized soil contamination.

Soil testing in the surrounding area of existing launch sites has failed to show any significant soil contamination resulting in public health and safety risks, with most soil chemical levels at ambient conditions. Slight elevated levels of solid propellant particulates in the areas around the launch sites are possible; however, impacts would be localized and would not result in any health risk. (U.S. Department of the Navy, 1998)

Mitigation measures could include recurrent watering or covering of excavated material and/or the use of soil additives to bond exposed surface soils.

4.1.5.3 Post Flight Test Activities

Adverse impacts to soils other than slight compaction are unlikely to occur as a result of removal of all mobile THAAD equipment/assets brought to the range. All mobile THAAD equipment would be removed using previously established hard surfaced roadways.

4.1.5.4 Cumulative Impacts

The Proposed Action when combined with current and proposed launch activities discussed in section 2.6 would not increase the total number of annual launches currently allowed from PMRF and analyzed in the PMRF Enhanced Capability EIS. These combined activities would be performed at varying times and locations on PMRF. It is anticipated that the launches under the Proposed Action would not result in any cumulative impacts to soils.

4.1.6 HAZARDOUS MATERIALS AND WASTE—PACIFIC MISSILE RANGE FACILITY

The following criteria were used to identify the potential for impacts to hazardous materials and waste: amount of hazardous materials brought onto the installation that could result in exposure to the environment or the public through release or disposal practices; hazardous waste generation that could increase regulatory requirements; requirement for exotic or unusual materials. The Proposed Action would not use or produce substantial amounts of hazardous materials or hazardous waste at PMRF. Solid propellants and small encapsulated amounts of hypergolic fuels used with the THAAD interceptor will be self contained and not pose a risk of spill. The types of hazardous materials used and waste generated would be similar to those currently used and generated at PMRF. Fuel handling and replenishment for mobile generators would result in a minor potential impact. PMRF has well established procedures and facilities for handling, storing, managing, and transporting hazardous substances, as well as resources for responding to spills, fires and other hazardous conditions that could result from the Proposed Action.

4.1.6.1 Site Preparation Activities

Construction of the CLS maintenance and storage building, CSF building, and mission control blockhouse, the new THAAD launcher and radar hardstands, or the metal three-legged re-radiation tower would not likely result in the release of potentially hazardous material or waste.

Construction of new facilities would be conducted in accordance with the *Navy Occupational Safety and Health Program Manual*, Naval Operations Instruction 5100.23E. Construction is not likely to affect the current Installation Restoration Program activities on sites adjacent to the Proposed Action, such as the battery acid neutralization unit and various transformer sites. The types of hazardous materials used (paint, solvents, and

adhesives) and hazardous waste generated from construction activities would be routine and handled in accordance with federal and state regulations. The minimal amounts of hazardous waste generated by site preparation activities would be containerized and stored in accordance with PMRF's Hazardous Waste Management Plan.

All components of the THAAD element, missiles, THAAD radar, XM-1113 Wheeled Vehicles, and BMC2 shelters would be transported, handled, and stored at PMRF in accordance with applicable federal, state, U.S. Army, U.S. Navy, and U.S. Air Force safety regulations.

4.1.6.2 Flight Test Activities

The solid propellants associated with the Proposed Action would be similar to past missile systems launched from PMRF and would follow the same hazardous materials and hazardous waste handling procedures developed under existing plans described in the affected environment. The types of hazardous materials used and hazardous waste generated would be similar to current materials and would not result in any existing procedural changes to the hazardous materials and hazardous waste management plans currently in place.

Generators would be fueled in accordance with PMRF standard operating procedures and applicable management plans. The 18,927-liter (5,000-gallon) aboveground diesel fuel storage tank would have secondary containment in accordance with PMRF's Spill Prevention Control and Countermeasures Plan. During launches of the THAAD missile there is the potential for a mishap to occur, resulting in potentially hazardous debris and propellants falling within the ground hazard area. As addressed for previous launch programs on PMRF, the hazardous materials that result from a flight termination or mishap would be cleaned up, and any contaminated areas would be remediated in accordance with existing PMRF emergency response plans and hazardous materials and hazardous waste plans. All hazardous waste generated in such a mishap would be disposed of in accordance with appropriate state and federal regulations. Overall, no adverse impacts would result from hazardous materials used or hazardous waste generated under the Proposed Action.

4.1.6.3 Post Flight Test Activities

At the conclusion of testing activities at PMRF, THAAD program personnel would remove all mobile equipment/assets brought to the range. All permanent facilities constructed in support of THAAD testing would remain and become part of the range's infrastructure and would be maintained per their operating procedures. Any hazardous materials remaining would be used or disposed of in accordance with the U.S. Navy's Consolidated Hazardous Materials Reutilization and Inventory Management Program.

4.1.6.4 Cumulative Impacts

Hazardous materials used and waste generated as a result of the THAAD flight test activities would not exceed the existing hazardous waste permit conditions on PMRF. All

hazardous waste would be disposed of in accordance with the PMRF Hazardous Waste Management Plan. The Proposed Action when combined with current and proposed launch activities discussed in section 2.6 would not increase the total number of annual launches currently allowed from PMRF and analyzed in the PMRF Enhanced Capability EIS. These combined activities would be performed at varying times and locations on PMRF and therefore are not expected to result in cumulative hazardous materials and hazardous waste impacts on PMRF.

4.1.7 HEALTH AND SAFETY—PACIFIC MISSILE RANGE FACILITY

Health and safety impacts were evaluated on the following criteria: potential for impacts to personnel during construction; for transportation mishaps; leaks or spills of fuel and propellants; impacts to aircraft and boats/ships; and public and personnel safety from EMR and other launch-related activities. The Proposed Action at PMRF has the potential for minor impacts to worker safety during construction activities as well as public and range personnel safety related to the transport, storage, and launch of the THAAD missiles. THAAD missile intercept of target missiles may also impact the safety of these same groups. EMR from the THAAD radar during flight tests and the tactical radar also present the potential for impacts. In addition, potential impacts to the THAAD system could result from surface inundation from a tsunami.

4.1.7.1 Site Preparation Activities

Construction of new facilities on the base would be conducted in accordance with the *Navy Occupational Safety and Health Program Manual*, Naval Operations Instruction 5100.23E. Construction of new facilities is routinely accomplished for both military and civilian operations and should not result in impacts related to health and safety to workers. Safety concerns involved with transporting the missiles involve the transportation of hazardous materials, which includes DOT class 1.3 explosives and a small amount of hypergolic chemical located in the Divert and Attitude Control System. The MRP will serve as a limited duration secondary containment barrier for the hypergolic chemicals. The MRP will be equipped with passive and active sensors to detect any leak that may occur. Should a leak occur during transport, the aircraft will land at designated airfields where trained personnel will be standing by to deal with the leaking missile. Once the MRP arrives at PMRF, it will be stored until needed for flight-testing in an ammunition bunker with an established explosive safety quantity-distance.

4.1.7.2 Flight Test Activities

The area proposed for the THAAD launch site on PMRF is located just within a 100-year tsunami inundation zone (Missile Defense Agency, 2002). Most tsunamis that could affect PMRF come from sources around the rim of the Pacific Ocean. Because of the great distances involved, there is generally ample warning of an approaching tsunami. Tsunami watch and warning conditions of readiness are addressed in PMRF Instruction 3140.4E, *Warnings and Conditions of Readiness for Hazards or Destructive Weather/Tsunami*. The THAAD interceptor and support personnel would be moved to safety in the event of such warnings.

The current restrictive easement would be used to set up the LHA to ensure public safety during launch. The closure of the restrictive easement 30 times a year was analyzed in the PMRF Enhanced Capability EIS. To minimize safety risk to the public in these areas, PMRF security forces on the ground, in boats, and in helicopters (if necessary), would use sweep and search measures to ensure that all areas within the LHA are determined clear of people by 10 minutes before launch. In addition, security forces would set up control points along the road into the LHA to monitor and clear traffic during launch operations. There are no public buildings within this off-base area. All nonessential personnel on the installation would be cleared from the LHA, and launch personnel within the LHA would be provided personal protection equipment. Immediately after a successful launch, security forces would give the all clear signal, and the public would be allowed to re-enter the area. THAAD test flights would comply with evacuation procedures that have been established for other launches at PMRF. (U.S. Department of the Navy, 1998)

Commercial and private aircraft and ocean vessels would be notified in advance of launch activities by PMRF as part of their routine operations through NOTAM by the FAA and NOTMAR, respectively. Thus, commercial and private craft would be able to reschedule or choose alternate routes before the flight experiments.

Prior to installation of any new radar or telemetry unit, the U.S. Navy conducts an EMR hazard review that considers hazards of EMR on personnel, fuel, and ordnance. The review provides recommendations for sector-blanking and safety systems to minimize hazards of EMR to personnel, hazards of EMR to fuel, and hazards of EMR to ordnance exposures. Additional electromagnetic compatibility studies would be performed prior to the use of frequencies that have not been used before at the test sites.

The required radiation hazard keep-out area for the THAAD radar is approximately 400 meters (1,312 feet) to the front and sides of the radar face. Regarding hazards of EMR on personnel, the perimeter fence around the proposed primary radar site on southern PMRF would comply with the U.S. Navy requirement to have safety measures, in addition to hazard warning signs, for areas in which EMR levels could exceed ten times the controlled environment permissible exposure level. Flashing warning lights that automatically turn on when RF transmissions are occurring would also be installed. Navigation warnings and NOTAMs would be published to avoid EMR effects to aircraft. The probability of the THAAD radar affecting WWVH, the wastewater treatment plant, or the Morale, Welfare, and Recreation area is considered low, however any interference problems would be mitigated. Minimal impacts could occur to agricultural areas off base, which are not in the radar's primary operating sector. All fueling sites would be beyond the hazards of EMR to fuel separation distances. No hazards of EMR to ordnance have been identified.

To eliminate the possibility of a health threat to personnel from EMR, all civilian and base personnel would be excluded from the EMR hazard area during flight test and tactical radar operations. As identified in DoD Instruction 6055.11 and AR 11-9 guidelines, the radiation hazard zone would be indicated by warning signs, and a warning beacon would be illuminated when the radar is operating to keep all personnel out of this area.

4.1.7.3 Post Flight Test Activities

At the conclusion of testing activities, THAAD program personnel would remove all mobile equipment/assets brought to the range. All permanent facilities constructed in support of THAAD testing would remain and become part of the range's infrastructure and would be maintained per their operating procedures. No adverse health and safety impacts are expected from these activities.

4.1.7.4 Cumulative Impacts

As a major established test range, PMRF routinely provides safety support and infrastructure for multiple test and training programs. The Proposed Action when combined with current and proposed launch activities discussed in section 2.6 would not increase the total number of annual launches currently allowed from PMRF and analyzed in the PMRF Enhanced Capability EIS. These combined activities would be performed at varying times and locations on PMRF. PMRF range operations management would regulate the tempo of future test activities to ensure that established safety procedures and protocols are followed. As such, no cumulative impacts are anticipated from the THAAD program.

4.1.8 INFRASTRUCTURE—PACIFIC MISSILE RANGE FACILITY

Impacts to infrastructure were evaluated by using the following criteria: whether or not the proposed activities would have the potential to affect existing transportation level of service; to result in an increase in flights that would exceed current airport capacity; create the need for new utilities distribution facilities; or cause shortages in public supply utility systems.

The Proposed Action would have the potential to impact transportation if public transportation route capacities are exceeded between the port of Nawiliwili and the base. No impacts to public transportation would occur as a result of components being flown into the PMRF airfield. The Proposed Action has the ability to impact utility systems if new utility distribution facilities are required or if it would result in shortages to public supply.

4.1.8.1 Site Preparation Activities

Transportation

All elements of the THAAD element, including the missiles, THAAD radar, and support equipment would be transported from U.S. Government installations or contractor facilities to a designated air base or port for transport to PMRF by aircraft or ship. Materials arriving via ship or barge are commonly received at the port of Nawiliwili on the island of Kauai, and then trucked over roads to PMRF. Flying missile components and related equipment in to the airfield at PMRF by U.S. Air Force Air Mobility Command aircraft is also a normal activity at PMRF. All transportation within the continental United States and Hawaii would be performed in accordance with all applicable regulations and appropriate safety measures would be followed. Once the missiles arrive at the PMRF airfield they would be handled in accordance with the range's standard operating procedures. Transportation of THAAD

element components would be similar to that performed for other missile systems in use at PMRF and would not result in substantial impacts to the transportation system of PMRF or the surrounding area.

The vehicle access to the radar site and parking lot would be from the new bypass road constructed to route traffic on South Sidewinder Road around the personnel hazard zone generated by the radar. The existing WWVH access road would also be widened and resurfaced with asphalt concrete. Access to WWVH would not be impeded.

Utilities

Kauai Electric Company routinely provides commercial electrical power to PMRF for normal operations and transient programs. Commercial power would be used for nominal functions such as housekeeping purposes in the administrative buildings, data reduction trailers, and the two software maintenance trailers and is not expected to have any adverse effects on the utility supply.

4.1.8.2 Flight Test Activities

Transportation

Under the Proposed Action, there would be an average of 65 additional daily trips to PMRF. This traffic increase would be small and would represent less than a 4 percent increase of current daily traffic. This small increase in daily trips is not expected to have any adverse effects on the transportation system at PMRF.

Utilities

During times when the THAAD radar would be in operation, generators would supply all power to the THAAD facilities. The THAAD radar would involve the use of 3-phase, 4,160-volt, and 60-hertz electrical power, which would be provided by two 4,160-volt skid mounted generators. This demand is not anticipated to have any adverse effects on the affected environment nor on utilities. During launches, generators would supply electricity to the administrative buildings, the data reduction trailers, the software maintenance trailers, and to the radar.

The increase in the utility demands by approximately 65 people (water, wastewater, and solid waste) caused by THAAD flight test activities is expected to be minimal. On-base water and wastewater capacities are adequate to support the Proposed Action. Solid waste will be disposed of off base in the Kekaha Landfill.

4.1.8.3 Post Flight Test Activities

Post flight test activities such as the removal of THAAD mobile equipment would result in a minimal amount of solid waste from site cleanup.

4.1.8.4 Cumulative Impacts

PMRF base support continually schedules and manages overlapping program test activities. The Proposed Action when combined with current and proposed launch activities discussed in section 2.6 would not increase the total number of annual launches currently allowed from PMRF and analyzed in the PMRF Enhanced Capability EIS. These combined activities would be performed at varying times and locations on PMRF. The addition of approximately 65 transient personnel and their respective vehicles would represent a relatively minor impact on PMRF infrastructure and therefore would not result in an adverse effect.

4.1.9 LAND USE—PACIFIC MISSILE RANGE FACILITY

Impacts to land use were evaluated based upon the following: whether or not conflicts with adjacent land use, zoning, or other planning regulations, or incompatibility with existing land use, would result from construction and operation of THAAD facilities. PMRF has severely restricted public access since September 2001 for security reasons. The potential for future public access to the installation's beaches, when not in use for military operations, will continue to be evaluated.

4.1.9.1 Site Preparation Activities

Under the Proposed Action, the construction of new facilities and use of the existing facilities at PMRF to launch THAAD interceptor missiles are entirely consistent with the base's mission and would not conflict or be incompatible with any land use plans, management policies, or land controls of land currently occupied by PMRF.

4.1.9.2 Flight Test Activities

Overall, no adverse impacts to land use would occur from implementation of the Proposed Action. Activities similar to those being proposed were assessed in the PMRF Enhanced Capability EIS and found to be consistent with the Hawaii Coastal Zone Management Act. All correlated THAAD activities would be consistent to the maximum extent practicable with the existing restrictive easement, land use plans, and the Hawaii Coastal Zone Management Program. A Negative Determination is not required.

4.1.9.3 Post Flight Test Activities

THAAD post flight test activities would not conflict or be incompatible with any land use plans, management policies, or land controls of land currently occupied by or surrounding PMRF.

4.1.9.4 Cumulative Impacts

Construction and operation of proposed facilities, when combined with the activities discussed in section 2.6, would not change any existing land uses, and no cumulative impacts are expected. The Proposed Action when combined with current and proposed

launch activities discussed in section 2.6 would not increase the total number of annual launches currently allowed from PMRF and analyzed in the PMRF Enhanced Capability EIS. These combined activities would be performed at varying times and locations on PMRF and would not increase the total number of annual closures of the Restrictive Easement currently allowed and analyzed in the PMRF Enhanced Capability EIS.

4.1.10 NOISE—PACIFIC MISSILE RANGE FACILITY

The impacts of noise on human receptors were evaluated based on whether or not the noise event would exceed DoD or Occupational Safety and Health Administration guidelines. The Proposed Action could result in noise impacts from construction activities and missile flight testing. The analysis in this section is concerned with human receptors; noise effects on wildlife are discussed under biological resources.

4.1.10.1 Site Preparation Activities

Construction on PMRF would be temporary in nature and similar to any commercial construction site. Noise generated during construction should have minimal impact to off-base areas. It is expected that there would be less than 50 additional aircraft operations at PMRF, which would not affect the noise levels estimated in the current PMRF Air Installation Compatible Use Zone report.

4.1.10.2 Flight Test Activities

THAAD launch noise levels outside of the ground hazard area boundary for the proposed launch areas, where non-essential personnel and the public are excluded, would not exceed either DoD or Occupational Safety and Health Administration safety requirements. Personnel would wear hearing protection devices when applicable. Personnel and the public outside of the ground hazard area may be startled, awakened, or distracted by the launch noise, especially those in Polihale State Park. Strategic Target System launch noise was measured at Kekaha at 54 dBA, near ambient background levels for this location. THAAD launches from northern PMRF should also not affect the residential areas in Kekaha. As in the past, it is not expected that any noise complaints would be generated from THAAD launches at PMRF because of the infrequent nature and short duration of the launch itself.

Noise levels from a flight termination or explosion of the missile system would be greater than that of a normal launch; however, the potential for such a mishap is low.

4.1.10.3 Post Flight Test Activities

Noise generated during post flight test activities would have minimal impact to off-base areas. As mentioned under site preparation activities, it is expected that there would be less than 50 additional aircraft operations at PMRF, which would not affect the noise levels estimated in the current PMRF Air Installation Compatible Use Zone report.

4.1.10.4 Cumulative Impacts

The Proposed Action when combined with current and proposed launch activities discussed in section 2.6 would not increase the total number of annual launches currently allowed from PMRF and analyzed in the PMRF Enhanced Capability EIS. These combined activities would be performed at varying times and locations on PMRF. Given the temporary nature of a launch event and the scheduling procedures of launches on PMRF, proposed THAAD test flights would not result in cumulative impacts.

4.1.11 SOCIOECONOMICS—PACIFIC MISSILE RANGE FACILITY

The potential for impacts to regional and local socioeconomics was evaluated based on the following criteria: the increase in the local population due to construction and operation personnel immigration; number of jobs created; and number of houses/hotel rooms required.

Population and Income

The Proposed Action would help maintain the economy of Kauai, as the number of personnel involved in pre-launch and launch activities is limited to an average of 30 per day, with 65 peak personnel. This small contingent would mostly be transient, using local hotel and lodging facilities. The positive impacts of flight testing include spending in the local economy on lodging and subsistence.

Housing

The action would have minimal or no impact on the local housing market, which at present has an excess of supply. Rental housing may prove to be in shorter supply, but it has been assumed that the majority of visiting personnel would stay in local hotels, where the supply of rooms also exceeds demand.

Employment

The increase in activity at PMRF, though limited in scale, would increase employment opportunities and stabilize the existing PMRF workplace. Construction labor during the pre-launch phase is likely to be sourced locally. Launch personnel, by spending money in the local economy, would help protect existing jobs or generate new jobs. The overall impact, however, would be slight. The pre-launch and launch activities would have no impact on the agricultural sector of the Kauai economy.

Tourism and Commercial Fishing

During launches, some individuals and groups would be excluded from the waters in the LHA. Some of the activity restricted by the launch would be displaced to other locations. For the purposes of this analysis, it is assumed that three main groups would be excluded from the waters offshore of the PMRF THAAD launch site: residents, tourists, and commercial fishermen. Each test would exclude these potential visitors for approximately 4 hours. If the majority of residents and visitors that use the waters within the LHA do so between 10:00 a.m. and 4:00 p.m., then the average access time available in a year is

approximately 2,190 hours. If 14 tests are performed in one year, the action would exclude individuals for approximately 19 hours, or less than 1 percent of the total access time. Even in the event that none of those residents and visitors excluded from the LHA are prepared to accept as a substitute other areas outside the LHA, this percentage is too small to suggest adverse impact.

The exclusion of fishing vessels from the waters surrounding PMRF is carefully planned, with sufficient warning and access to a hotline information system, to allow fishermen to visit alternative waters. The short periods of exclusion caused by this action, therefore, would have no adverse impact on the commercial fishing industry.

Cumulative Impacts

The Proposed Action when combined with current and proposed launch activities discussed in section 2.6 would not increase the total number of annual launches currently allowed from PMRF and analyzed in the PMRF Enhanced Capability EIS. These combined activities would be performed at varying times and locations on PMRF. However, in terms of cumulative impacts, it is possible that the exclusion of commercial fishing vessels from the waters around PMRF due to THAAD flight tests when combined with other concurrent programs discussed in section 2.6 could add incrementally to current impacts to the commercial fishing industry. The counter-argument, however, states that the exclusion of commercial fishing vessels would help conserve fishing stocks and lead to long-term benefits for the industry. Visitors to Kauai, as a result of this action, would help support the tourist industry, which has been targeted as an economic priority.

4.1.12 WATER RESOURCES—PACIFIC MISSILE RANGE FACILITY

The impacts to water resources were evaluated based on whether the proposed activities would cause the following: a violation of applicable state or federal water quality standards, related storm water pollution prevention plans, or other applicable water quality-related plans, policies, or permit conditions; major changes in existing drainage and runoff patterns that alter the course of existing waterways or exceed the capacity of existing storm water drainage systems; or substantial degradation of water quality. The Proposed Action could result in impacts to water resources as a result of uncontrolled runoff related to construction activities and potential contamination of surface water by exhaust products and debris from missile launches.

4.1.12.1 Site Preparation Activities

The building modifications and new construction would not have an impact on PMRF's water resources. The topography, permeability, and subsequent standard best management practices to control erosion during new construction would limit the potential for impacts to localized water resources. Above ground diesel storage tanks would be installed in accordance with applicable design requirements for building within a 100-year tsunami inundation zone.

4.1.12.2 Flight Test Activities

Under nominal launch conditions, no water resource impacts are expected because nearly all rocket motor emissions would be rapidly dispersed to nontoxic levels away from the launch site. A qualified accident response team would be stationed at the launch site to negate or reduce the environmental effect in the unlikely event of an early adverse flight failure. Toxic concentrations of emission products and missile debris would be rapidly buffered and diluted by the alkaline sea and limited to within a few meters (feet) of the source.

4.1.12.3 Post Flight Test Activities

No adverse impacts to water resources on PMRF are expected from post flight activities, such as the removal of all mobile equipment/assets brought to the range.

4.1.12.4 Cumulative Impacts

The Proposed Action when combined with current and proposed launch activities discussed in section 2.6 would not increase the total number of annual launches currently allowed from PMRF and analyzed in the PMRF Enhanced Capability EIS. These combined activities would be performed at varying times and locations on PMRF. The amount of exhaust products that could potentially be deposited would be small and no cumulative impacts are expected.

4.2 REAGAN TEST SITE, U.S. ARMY KWAJALEIN ATOLL

4.2.1 AIR QUALITY—REAGAN TEST SITE, U.S. ARMY KWAJALEIN ATOLL

Some evaluative criteria for impacts to this resource are discussed in the PMRF section. Potential issues related to the air quality of the area around USAKA include compliance with national and UES air quality standards for criteria pollutants released during proposed activities. Air quality at USAKA could be impacted by site preparation activities and launch emissions.

4.2.1.1 Kwajalein—Air Quality

4.2.1.1.1 Site Preparation Activities

Air quality impacts could occur during construction associated with the Alternative Action. Minor impacts could result from fugitive dust (particulate matter) and construction equipment emissions. The primary THAAD radar hardstand location would be on Kwajalein near the western tip of the island on the lagoon side near the Grassy Knoll directly behind the Operations Center and Storage/Maintenance Building. If existing transformers can not be used, new transformers and a 5,000-gallon above ground storage tank would be installed if necessary to fuel the Primary Power Unit. Construction of these facilities would disturb approximately 0.4 hectare (1 acre) of land on the man-made portion of the island.

A conservative estimate for uncontrolled fugitive dust emissions from ground disturbing activities is 1.08 metric tons (1.2 tons) per 0.4 hectare (1 acre) per month of activity (U.S. Environmental Protection Agency, 1995). Normally, half of these emissions are assumed to be PM-10; however, the precise fraction depends upon the makeup of the local soil. The actual PM-10 emissions would be considerably less since soil particles on Kwajalein are coarse and are not readily converted to fugitive dust.

The air quality impacts would be localized and would only occur when construction activities were actually being conducted. No unusual amounts or types of air emissions would be anticipated due to construction. Standard dust reduction measures, such as wetting disturbed soils, would be implemented. Vehicles would also be turned off when not in use.

4.2.1.1.2 Flight Test Activities

Power for the THAAD radar would be supplied by the Kwajalein power plant. The operation of the THAAD radar at Kwajalein would cause an increase in power demand that could impact air quality; however, as analyzed in the Final Supplemental EIS for Proposed Actions at USAKA (U.S. Army Space and Strategic Defense Command, 1993b), this increase would be minor. There would be no substantial impact to regional air quality.

4.2.1.1.3 Post Flight Test Activities

Post flight test activities would include the removal of all mobile equipment/assets brought to the range. This removal could result in small amounts of localized vehicle emissions, which would have a minor impact to air quality.

4.2.1.2 Meck – Air Quality

THAAD launches at RTS would occur on Meck on an inactive runway. Meck is currently the center for all missile launches for RTS.

4.2.1.2.1 Site Preparation Activities

The THAAD launch equipment building would be installed on a trailer or truck within the fenced THAAD launch area. The mission control/technical support facility would be located in the rehabilitated southwest corner of Building 5098 on Meck. Only minor impacts to air quality from vehicle emissions would result from these activities.

4.2.1.2.2 Flight Test Activities

Flight test activities on Meck have previously been analyzed in the USAKA Final Supplemental EIS (U.S. Army Space and Strategic Defense Command, 1993) and the Theater Missile Defense ETR EIS (U.S. Army Space and Strategic Defense Command, 1994), including the launching of interceptors (THAAD, Patriot). Modeling analysis determined that the maximum concentrations of pollutants were not expected to degrade air quality standards by more than the sum of 25 percent, compliant with the goal of

maintaining the current ambient air quality at USAKA. The increases in activity would lead to increase in emissions; however, since each launch is a discrete, short-term event, the net increase would not lead to a significant air quality impact. The strong tradewinds prevent any localized emissions, including those from missile launches, from accumulating.

4.2.1.2.3 Post Flight Test Activities

Post flight test activities would include the removal of all mobile equipment/assets brought to the range. This removal could result in small amounts of localized vehicle emissions, which would have a minor impact to air quality.

4.2.1.3 Roi-Namur—Air Quality

The operation of the THAAD radar has been previously analyzed in the USAKA Temporary ETR EA (U.S. Army Space and Strategic Defense Command, 1995b), including the two alternate radar sites being considered for the proposed THAAD test flights. This analysis determined that even with the increase in power demand and the location of the Roi-Namur power plant, there would be no significant impact to the air quality of Roi-Namur. The first radar location would be located within the fenced area at the Sounding Rocket Launch Facility (also known as the “Speedball” site), on the northwest corner of Roi-Namur. The second site would be located on the southern side of Roi-Namur (known as the Army Optical Site).

4.2.1.3.1 Site Preparation Activities

Air quality impacts on Roi-Namur would be limited to combustion emissions from vehicles transporting the THAAD radar to the selected sites and installation of the re-radiation tower. As previously described in section 4.1.1.1, this impact would be localized and no unusual amounts or types of air emissions are anticipated.

4.2.1.3.2 Flight Test Activities

Power for the THAAD radar would be supplied by the Roi-Namur power plant. Potential impacts to air quality at Roi-Namur due to the operation of the radar and its associated power sources were analyzed in the USAKA Temporary ETR EA and determined to be insignificant (U.S. Army Space and Strategic Defense Command, 1995b). Impacts from using the new Roi-Namur power plant for operation of the current radar are also anticipated to be below UES pollutant thresholds.

4.2.1.3.3 Post Flight Test Activities

Post flight activities would include the removal of all mobile equipment/assets brought to the range. This removal could result in small amounts of localized vehicle emissions, which would have a minor impact to air quality.

4.2.1.4 Cumulative Impacts

The anticipated number of THAAD missiles launched from RTS could be up to 50 over a period of 4 years, typically ranging from 1 to 14 per year. The USAKA Supplemental EIS (U.S. Army Space and Strategic Defense Command, 1993b) evaluated the impacts from multiple launches of missiles per year for several years. Even for the highest level of activity analyzed, in which a maximum of 28 strategic missiles were launched in a single year from Meck, an exceedance of 25 percent of the USAKA Environmental Standard was not predicted to occur. Proposed THAAD activities at USAKA when combined with those discussed in section 2.6 are not expected to exceed the number analyzed or cause any cumulative impacts to air quality. Construction air quality impacts would be localized and would only occur during site preparation activities. The intermittent increase in power demand would cause no substantial impacts to regional air quality. Most of the emissions sources on USAKA are not continuous in nature. The strong tradewinds prevent any localized emissions, including those from missile launches, from accumulating.

4.2.2 AIRSPACE—REAGAN TEST SITE, U.S. ARMY KWAJALEIN ATOLL

Some evaluative criteria for impacts to this resource are discussed in the PMRF section. The Alternative Action has the potential to impact access to or use of existing airfields and airports in the ROI as a result of THAAD test flight activities, including missile launches and radar operation.

4.2.2.1 Site Preparation Activities

Although site preparation activities could involve flights in and out of Bucholz Army Airfield on Kwajalein, the Alternative Action would not restrict access to, nor affect the use of, existing airfields and airports in the ROI. Operations at the airfield would continue unhindered. Similarly, the existing airfield or airport arrival and departure traffic flows would not be affected. Access to the airfield would not be curtailed. All arriving and departing aircraft and all participating military aircraft are under the control of the Bucholz Army Airfield Control Tower; thus, there would be no airfield conflicts in the ROI under the Alternative Action, and no impact.

4.2.2.2 Flight Test Activities

The RTS is located under international airspace and, therefore, has no formal airspace restrictions governing it. Before launching a THAAD missile from Meck, NOTAMs would be sent. Commercial and private aircraft would be notified in advance of launch activities by RTS as part of their routine operations through NOTAMs by the FAA.

To satisfy airspace safety requirements in accordance with AR 385-62 the responsible commander would obtain approval from the Administrator, FAA, through the appropriate Army airspace representative as required by AR 95-2, *Air Traffic Control, Airspace, Airfields, Flight Activities, and Navigational Aids*. Provision will be made for surveillance of the affected airspace in accordance with AR 385-62, *Regulations For Firing Guided Missiles And Heavy Rockets For Training, Target Practice, And Combat*. In addition, safety

regulations dictate that launch operations would be suspended when it is known or suspected that any unauthorized aircraft have entered any part of the surface danger zone until the unauthorized entrant has been removed or a thorough check of the suspected area has been performed. NOTAMs would be issued to advise avoidance of the tracking radar areas during activation of the USAKA Temporary ETR, particularly in the vicinity of Kwajalein or Roi-Namur when the THAAD radar is transmitting.

Meck is approximately 30 kilometers (20 miles) north of Bucholz Army Airfield. Thus its interceptor missile launch sites, LHAs, and the water impact and debris containment areas for intercepts, both inside the Mid-atoll Corridor and the broad ocean area east of Kwajalein Atoll would be well north of Bucholz Army Airfield and its standard instrument approach and departure procedures.

4.2.2.3 Post Flight Test Activities

Flights required as part of the post flight test activities would not restrict access to, nor affect the use of, existing airfields in the ROI. Operations at the airfields would continue unhindered. Existing airfield or airport arrival and departure traffic flows would also not be affected and access to the airfield would not be curtailed. All arriving and departing aircraft and all participating military aircraft are under the control of the Bucholz Army Airfield Control Tower, thus there would be no airfield conflicts in the ROI under the Alternative Action, and no impact.

4.2.2.4 Cumulative Impacts

The anticipated number of THAAD missiles launched from RTS could be up to 50 over a period of 4 years, typically ranging from 1 to 14 per year. The USAKA Supplemental EIS (U.S. Army Space and Strategic Defense Command, 1993b) evaluated the impacts from multiple launches of missiles per year for several years, a maximum of 28 strategic missiles launched in a single year from Meck. THAAD flight tests when combined with the activities discussed in section 2.6 are not expected to exceed this number. Missile launches are short-term, discrete events and are actively managed by RTS range safety. The use of the required scheduling and coordination process for international airspace, and adherence to applicable DoD directives and U.S. Army regulations concerning issuance of NOTAMs and selection of missile firing areas and trajectories, lessens the potential for significant incremental, additive, cumulative impacts.

4.2.3 BIOLOGICAL RESOURCES—REAGAN TEST SITE, U.S. ARMY KWAJALEIN ATOLL

Potential impacts of construction, building modification, and missile launches on terrestrial and marine biological resources within the RTS ROI have been addressed in detail in the USAKA EIS, USAKA Supplemental EIS, Theater Missile Defense ETR EIS, and the USAKA Temporary ETR EA. Based on the prior analyses done and the effects of past target and interceptor launch activities, the potential impacts of activities related to test flights of the THAAD missile on biological resources are expected to be minimal, as discussed below.

Impacts are considered substantial if they have the potential to jeopardize the existence of federally listed threatened or endangered species, degradation of biologically important unique habitats, substantial long-term loss of vegetation, or reduction in capacity of a habitat to support wildlife. Impacts that could result from site preparation activities include vegetation disturbance and removal and disturbance to wildlife from the accompanying noise and presence of personnel. Impacts could also result from launch-related activities such as noise, air emissions, debris impacts, and the use of radar equipment.

4.2.3.1 Kwajalein—Biological Resources

4.2.3.1.1 Site Preparation Activities

Vegetation

The new Operations Center and Storage/Maintenance Building would be constructed on the man-made northwestern portion of Kwajalein, near the Grassy Knoll and adjacent to the THAAD radar site. This site is near the western tip of the island on the lagoon side. No native vegetation would be affected.

Wildlife

Personnel would be instructed to avoid areas designated as avian nesting or roosting habitat and to avoid all contact with any nest that may be encountered.

Construction noise and the increased presence of personnel could affect wildlife within the area. Construction ground disturbance and equipment noise-related impacts would include loss of habitat, displacement of wildlife, and short-term disruption of daily/seasonal behavior. Noise rather than the sight of machines appears to cause disturbance to wildlife. Typical noise levels at 15 meters (50 feet) from construction equipment range from 70 to 98 dBA. The combination of increased noise levels and human activity would likely displace some seabirds that forage, feed, or roost within this 15-meter (50-foot) radius. However, additional similar habitat is adjacent to the areas proposed for the THAAD program locations.

Threatened and Endangered Species

No threatened or endangered vegetation has been identified in the project areas. Personnel would be instructed to avoid areas designated as avian nesting or roosting habitat and to avoid all contact with any nest that may be encountered. Sea turtles or turtle nests would also be avoided. No site preparation activities would occur offshore and thus marine mammals would not be affected.

Environmentally Sensitive Habitat

Construction and site preparation activities would be performed on the western end of the island and would not impact the remnant of original reef flat north of Echo Pier.

4.2.3.1.2 Flight Test Activities

Vegetation

The potential for spills during refueling of the Prime Power Unit or leaks from the closed Cooling Equipment Unit system would be offset by in-place, impermeable ground cover and/or spill-containment berms. There would be no impacts to area vegetation.

Wildlife

Operation of the THAAD radar would be conducted in accordance with USAKA regulations. As discussed in section 4.1.3.2, several factors significantly reduce the potential EMR exposure for birds and other wildlife. The main radar beam would normally be located 5 degrees above horizontal, which limits the probability of energy absorption by wildlife on the ground. The radar beam is relatively small and would normally be in motion, making it extremely unlikely that a bird would remain within the most intense area of the beam for any meaningful length of time. The radiation hazard area would be visually surveyed for birds and other wildlife prior to the activation of the THAAD radar antenna unit. Although the potential for adverse effects on birds exists, the probability that it would occur with any frequency is judged to be low. (U.S. Department of the Navy, 1998)

Threatened and Endangered Species

No threatened or endangered vegetation has been identified in the project areas. Personnel would be instructed to avoid areas designated as avian nesting or roosting habitat and to avoid all contact with any nest that may be encountered. Sea turtles or turtle nests would also be avoided. The THAAD radar is not expected to radiate lower than 5 degrees, which would preclude EMR impacts to terrestrial species or basking sea turtles on the beach. No impacts to marine mammals are expected as a result of proposed radar operation on Kwajalein since these species would normally be found in the ocean outside the 400-meter (1,312-foot) exclusion zone. It is also highly unlikely that an individual whale would be on or substantially above the surface of the water for a significant amount of time within the main beam or side lobe areas during the particular time that the THAAD radar would be operating. No adverse impacts would occur to whales, other marine mammals, or sea turtles at least 1.3 centimeters (0.5 inch) below the surface.

Environmentally Sensitive Habitat

Operation of the THAAD radar and personnel occupying the Operations Center and Storage/Maintenance Building would not impact sensitive habitat such as coral reefs.

4.2.3.1.3 Post Flight Test Activities

Post flight activities would include the removal of all mobile equipment/assets brought to the installation. All permanent facilities constructed in support of THAAD testing would remain and become part of the installation's infrastructure and would be maintained per their operating procedures. These activities would result in impacts similar to, but less

than, those caused by site preparation. Specific restoration actions, if necessary, would be determined on a case-by-case basis.

4.2.3.2 Meck – Biological Resources

4.2.3.2.1 Site Preparation Activities

Vegetation

Trenching for fiber optic cables and fencing erected around the launch area would take place in an area on Meck that has had heavy ground disturbance in the past and would thus pose no impacts to area vegetation. The re-radiation tower would be erected on the west side of the Launch Equipment Building, also within this previously disturbed area. Meck has been extensively altered by human activity, and little native vegetation remains to serve as wildlife habitat. Several small areas suitable for seabird nesting and roosting are present on the island; however, proposed construction would be performed on the inactive runway. There would be no or negligible impacts to the island's vegetation.

Wildlife

As mentioned above, little native vegetation remains on Meck to serve as wildlife habitat. Disturbance to wildlife from the construction noise and temporary increase in personnel would be brief and is not expected to have a lasting impact nor a measurable negative effect on migratory bird populations.

Threatened and Endangered Species

No threatened or endangered vegetation has been identified in the project areas. Personnel would be instructed to avoid areas designated as avian nesting or roosting habitat and to avoid all contact with any nest that may be encountered. Sea turtles or turtle nests would also be avoided. No impacts to marine mammals are expected as a result of proposed site preparation activities.

Environmentally Sensitive Habitat

Proposed site preparation activities would be on land and would not impact sensitive habitat such as coral reefs.

4.2.3.2.2 Flight Test Activities

Vegetation

No impacts to vegetation would occur as a result of launch activities on Meck, since the THAAD launch site is located on the inactive runway.

Wildlife

Results of monitoring conducted following a Strategic Target System launch from KTF at PMRF indicated little effect upon wildlife due to the low-level, short-term hydrogen chloride emissions (U.S. Army Space and Strategic Defense Command, 1993a). The program

included marine surveys of representative birds and mammals for both prelaunch and postlaunch conditions. Studies on representative birds and mammals reviewed in the Final EIS for the Strategic Target System (U.S. Army Strategic Defense Command, 1992) also indicated that low-level, short-term exposure to hydrogen chloride would not adversely affect threatened or endangered species or other wildlife. The prevailing trade winds on Meck carry ground level concentrations of emissions away from the area (U.S. Army Space and Strategic Defense Command, 1993b). Aluminum oxide and hydrogen chloride do not bioaccumulate; therefore, no indirect effects to the food chain are anticipated.

An early flight termination or mishap could result in debris impact along the flight corridor, which may temporarily impact fishing activities in the immediate area. Due to the small amount of propellant involved and the few number of launches, the project is not anticipated to adversely affect trust marine resources. The potential ingestion of toxins by fish species, which may be used for food sources, would be remote because of the diluting effect of the ocean water and the relatively small area that would be affected. The primary flight test activity that may affect wildlife within the flight test corridor is the actual intercept of the target missile. Debris impact areas for both the interceptor and target vehicles would be located over the Mid-atoll Corridor of the Kwajalein Lagoon or the broad ocean area.

Any intercept debris from mishaps landing in the Kwajalein Lagoon in approximately 50 meters (164 feet) of water would be recovered. The debris is not expected to contain hazardous materials. Were hazardous materials to leach out of the intercept debris, the great volume of water in the Kwajalein Lagoon would dilute the contaminant to acceptable levels.

Disturbance to wildlife from the launches would be brief and is not expected to have a lasting impact nor a measurable negative effect on migratory bird populations. Wildlife such as waterfowl would quickly resume feeding and other normal behavior patterns after a launch is completed. Waterfowl driven from preferred feeding areas by aircraft or explosions usually return soon after the disturbance stops, as long as the disturbance is not severe or repeated (Federal Aviation Administration, 1996).

Threatened and Endangered Species

An early flight termination or mishap could result in debris impact along the flight corridor. Sensitive marine species are widely scattered, and the probability of debris striking a threatened or endangered species is considered remote.

Debris impact and booster drops in the broad ocean area are not expected to adversely affect marine mammal species protected by the Marine Mammal Protection Act of 1972. The probability is rather low that migratory whales or sea turtles would be within the area to be impacted by falling debris and boosters.

Environmentally Sensitive Habitat

Proposed nominal launch activities would not impact sensitive habitat such as coral reefs.

4.2.3.2.3 Post Flight Test Activities

Post flight activities would include the removal of all mobile equipment/assets brought to the installation. All permanent facilities constructed in support of THAAD testing would remain and become part of the installation's infrastructure and would be maintained per their operating procedures. These activities would result in impacts similar to, but less than, those caused by site preparation. Specific restoration actions, if necessary, would be determined on a case-by-case basis.

4.2.3.3 Roi-Namur—Biological Resources

4.2.3.3.1 Site Preparation Activities

The first potential radar location would be within the fenced area at the Sounding Rocket Launch Facility, or “Speedball” site, at the island’s northwest corner. The second site would be located on the island’s southern side, known as the Army Optical Site. Since the sites have been previously established as radar locations, site preparation activities would be minimal and other than impacts from the increased presence of personnel, no impacts to vegetation or wildlife are expected.

4.2.3.3.2 Flight Test Activities

Operation of the THAAD radar on Roi-Namur was analyzed in the USAKA Temporary ETR EA. According to this analysis, since the main radar beam would normally be located several degrees above horizontal, the probability of energy absorption by wildlife on the ground would be limited. The radar beam is relatively small and would normally be in motion making it unlikely that a bird would remain within the most intense area of the beam for any meaningful length of time. The radiation hazard area would be visually surveyed for birds and other wildlife prior to activation of the radar. Although the potential for adverse effects on birds exists, the probability that it would occur with any frequency is judged to be low (U.S. Department of the Navy, 1998).

Threatened and Endangered Species

The sandy beaches along the east, south, and western shores of Roi-Namur provide potential nesting habitat for the green and hawksbill sea turtles. Since the main radar beam would normally be located several degrees above horizontal, the probability of energy absorption by sea turtles on the beach would be limited. No impacts to marine mammals are expected as a result of proposed radar operation on Roi-Namur since these species would normally be found in the ocean outside the 400-meter (1,312-foot) exclusion zone. It is also highly unlikely that an individual whale would be on or substantially above the surface of the water for a significant amount of time within the main beam or side lobe areas during the particular time that the THAAD radar would be operating. No adverse impacts would occur to whales, other marine mammals, or sea turtles at least 1.3 centimeters (0.5 inch) below the surface.

Environmentally Sensitive Habitat

Operation of the THAAD radar would not adversely affect environmentally sensitive habitat on Roi-Namur.

4.2.3.3.3 Post Flight Test Activities

Post flight activities would include the removal of all mobile equipment/assets brought to the installation. All permanent facilities constructed in support of THAAD testing would remain and become part of the installation's infrastructure and would be maintained per their operating procedures. These activities would result in impacts similar to, but less than, those caused by site preparation. Specific restoration actions, if necessary, would be determined on a case-by-case basis.

4.2.3.4 Cumulative Impacts

The limited amount of construction planned on RTS would not likely result in cumulative impacts to biological resources. The anticipated number of THAAD missiles launched from RTS could be up to 50 over a period of 4 years, typically ranging from 1 to 14 per year. The USAKA Supplemental EIS (U.S. Army Space and Strategic Defense Command, 1993b) evaluated the impacts from multiple launches of missiles per year for several years, a maximum of 28 strategic missiles launched in a single year from Meck. THAAD flight tests when combined with the activities discussed in section 2.6 are not expected to exceed this number. No significant cumulative impacts to biological resources have been identified as a result of prior launch-related activities from RTS. These combined activities would be performed at varying times and locations on RTS and should have negligible cumulative impacts on biological resources.

4.2.4 CULTURAL RESOURCES—REAGAN TEST SITE, U.S. ARMY KWAJALEIN ATOLL

Some evaluative criteria for impacts to this resource are discussed in the PMRF section. To ensure the protection of any prehistoric, historic, or traditional resources already identified within the project area from unauthorized artifact collection or vandalism, personnel would be briefed before activities commence on the significance of these types of resources and the penalties associated with their disturbance or collection. If, during the course of program activities cultural and/or historic materials (particularly human remains) are discovered, work in the immediate vicinity of the cultural materials would be halted and the RMI Historic Preservation Officer consulted through the USAKA Environmental Office.

4.2.4.1 Kwajalein Island—Cultural Resources

4.2.4.1.1 Site Preparation Activities

The THAAD Operations Center and Storage/Maintenance Building would be constructed on the western end of Kwajalein Island. The radar site would be between the Operations Center and Storage/Maintenance Building and the lagoon shore. Both the building and the

hardstand would be constructed on the man-made portion of the island and thus would pose no threat to sub-surface archaeological resources. Personnel would be informed of the sensitivity of cultural resources on the island and the types of penalties that could be incurred if sites are damaged or destroyed.

Utility installation may present the potential for impacts to cultural resources. A new trench may be needed in order to supply power to the proposed radar site on the western end of Kwajalein Island. The trench would be approximately 1 meter (3 feet) deep to minimize the potential for disturbance to subsurface items. As described in the USAKA Temporary ETR EA, ground-disturbing activities associated with construction or possible trenching for the THAAD radar would be coordinated with and monitored by a qualified archaeologist. Pre-trenching/clearing photographs would be taken.

Many of the existing facilities on Kwajalein Island are associated with the National Historic Landmark. However, no historic buildings or structures on the island are currently proposed for modification and no adverse effects on historic resources are expected.

4.2.4.1.2 Flight Test Activities

Operation of the radar on Kwajalein is not expected to adversely affect cultural resources. Personnel would be informed of the sensitivity of cultural resources and the types of penalties that could be incurred if sites are damaged or destroyed.

4.2.4.2 Post Flight Test Activities

Once THAAD activities are concluded all mobile equipment/assets would be removed from the site. Specific restoration actions, if necessary, would be determined on a case-by-case basis.

4.2.4.3 Meck Island—Cultural Resources

4.2.4.3.1 Site Preparation Activities

Fiber optic installation would involve trenching 91 meters (300 feet) from the Mission Control Building to a government-furnished enclosure and 30 meters (100 feet) from the launcher to the enclosure. The trench would be approximately 1 meter (3 feet) deep to minimize the potential for disturbance to subsurface items. Because all trenching and postholes would be in areas that have had heavy ground disturbance in the past; no impacts due to the Alternative Action are anticipated. As described in the USAKA Temporary ETR EA, ground-disturbing activities associated with construction or possible trenching for the THAAD radar would be coordinated with and monitored by a qualified archaeologist. Pre-trenching/clearing photographs would be taken.

Existing facilities on Meck may ultimately be determined to possess Cold War significance; however, no buildings or facilities are currently proposed for modification and no adverse effects on historic resources are expected.

4.2.4.3.2 Flight Test Activities

Personnel would be informed of the sensitivity of cultural resources and the types of penalties that could be incurred if sites are damaged or destroyed.

There is the potential for damage to an existing potentially eligible historical structure from falling debris or from a missile due to a launch abort or launch mishap. This potential is extremely remote and not anticipated to have an effect on any cultural resources on Meck. There are no buildings found on Meck that are currently listed in the National Register.

4.2.4.3.3 Post Flight Test Activities

Once THAAD activities are concluded, all mobile equipment/assets would be removed from the site. Specific restoration actions, if necessary, would be determined on a case-by-case basis.

4.2.4.4 Roi-Namur Island—Cultural Resources

4.2.4.4.1 Site Preparation Activities

The proposed alternate radar sites are on the northwest corner of Roi-Namur at the Sounding Rocket Launch Facility and on the southern side of Roi-Namur. Ground disturbance is expected to be minimal; however, trenching may be required. As described in the USAKA Temporary ETR EA, ground-disturbing activities associated with construction or possible trenching for the THAAD radar would be coordinated with and monitored by a qualified archaeologist. Pre-trenching/clearing photographs would be taken.

Many of the existing facilities on Roi-Namur are associated with the National Historic Landmark. However, no historic buildings or structures on the island are currently proposed for modification and no adverse effects on historic resources are expected.

4.2.4.4.2 Flight Test Activities

Personnel would be informed of the sensitivity of cultural resources and the types of penalties that could be incurred if sites are damaged or destroyed. THAAD program activities on Roi-Namur would be related to radar operation, which is not expected to impact any cultural resources.

There is the potential for damage to an existing historical structure from falling debris or from a missile due to a launch abort or launch mishap on Meck. This potential is extremely remote since the launch would be from Meck, over 24 kilometers (15 miles) away, and not anticipated to have an effect on any cultural resources on Roi-Namur.

4.2.4.4.3 Post Flight Test Activities

Once THAAD activities are concluded all mobile equipment/assets would be removed from the site. Specific restoration actions, if necessary, would be determined on a case-by-case basis.

4.2.4.5 Cumulative Impacts

The anticipated number of THAAD missiles launched from RTS could be up to 50 over a period of 4 years, typically ranging from 1 to 14 per year. The USAKA Supplemental EIS (U.S. Army Space and Strategic Defense Command, 1993b) evaluated the impacts from multiple launches of missiles per year for several years, a maximum of 28 strategic missiles launched in a single year from Meck. THAAD flight tests when combined with the activities discussed in section 2.6 are not expected to exceed this number. No cumulative effects to cultural resources have been identified due to prior and current launch activities. The addition of THAAD flight tests to the activities discussed in section 2.6 is not expected to result in additive or cumulative impacts to cultural resources on RTS. Overall avoidance would further minimize cumulative impacts to cultural resources. Personnel will be instructed of the sensitivity of cultural resources and the penalties that could occur if sites are damaged or destroyed. Also, ongoing consultation with the RMI Historic Preservation Officer through the USAKA Environmental Office would continue.

4.2.5 GEOLOGY AND SOILS—REAGAN TEST SITE, U.S. ARMY KWAJALEIN ATOLL

Some evaluative criteria for impacts to this resource are discussed in the PMRF section. Since the geology and soils of the USAKA islands are similar, this resource is addressed as one location. The Alternative Action could result in geology and soils impacts as a result of ground disturbance during site preparation activities and potential contamination by exhaust products and debris from missile launches.

4.2.5.1 Site Preparation Activities

Proposed construction and other necessary prelaunch activities on the USAKA islands are not expected to result in any adverse geological or soil impacts. During the construction period, soils at the proposed construction sites may be slightly subject to erosion from the wind. However, soil disturbance from new construction would be of short duration and limited to the immediate vicinity of the construction site. Best Management Practices, such as regular watering of excavated material, would furthermore reduce the potential for soil erosion.

4.2.5.2 Flight Test Activities

THAAD interceptor launches from Meck will use solid fuel propellants. A qualified accident response team would be available near the launch locations to negate or minimize any adverse effects in an unlikely event such as a flight termination. Primary emission products from previous launches of a solid propellant missile include hydrogen chloride,

aluminum oxide, carbon dioxide, carbon monoxide, nitrogen, and water. (U.S. Army Space and Strategic Defense Command, 1995b)

As described in sections 4.1.1.2 and 4.2.1.2.2, deposition of aluminum oxide and hydrogen chloride are expected to be very minimal during nominal launches because they disperse rapidly in the air. The minimal amount of aluminum oxide and hydrogen chloride that could reach land would be in the form of dust that would not adversely affect the soil. Emission products from launches would be rapidly buffered by the soil, which is composed mainly of calcium carbonate. If the solid fuel continues to burn, it may start on-pad fires. Controlling fires may require ground-disturbing activities in the LHA. Identifiable unburned fuel or residual burned fuel would be recovered during the debris recovery process. The impact of this activity is expected to be short-term. The recovered fuel and residue would be disposed of following standard USAKA hazardous waste management procedures (U.S. Army Space and Strategic Defense Command, 1995b).

4.2.5.3 Post Flight Test Activities

Adverse impacts to soils, other than slight compaction, are unlikely to occur as a result of the removal of all mobile THAAD equipment/assets brought to the range.

4.2.5.4 Cumulative Impacts

The anticipated number of THAAD missiles launched from RTS could be up to 50 over a period of 4 years, typically ranging from 1 to 14 per year. The USAKA Supplemental EIS (U.S. Army Space and Strategic Defense Command, 1993b) evaluated the impacts from multiple launches of missiles per year for several years, a maximum of 28 strategic missiles launched in a single year from Meck. THAAD flight tests when combined with the activities discussed in section 2.6 are not expected to exceed this number. No cumulative adverse effects to soils are anticipated from THAAD activities when combined with those discussed in section 2.6. Emission products from nominal launches would be rapidly buffered by the soil, which is mainly composed of calcium carbonate.

4.2.6 HAZARDOUS MATERIALS AND WASTE—REAGAN TEST SITE, U.S. ARMY KWAJALEIN ATOLL

Some evaluative criteria for impacts to this resource are discussed in the PMRF section. The use of hazardous materials during these operations will be limited to small amounts of solvent cleaners (e.g., acetone, isopropyl alcohol), ethylene glycol coolant in the THAAD radar, and some handling and storage of motor fuels for use in motor vehicle and/or generator systems. The proper handling and use of such materials are routine in many types of military operations, including field exercises at these locations. The materials employed in tasks associated with proposed activities would be addressed under the Kwajalein Environmental Emergency Plan and Hazardous Materials Management Plan.

Solid fuel rockets such as the THAAD interceptor and some potential target missile are shipped fueled, and require no field fueling. A spill of solid fuel would only occur in the

event of a rupture of the missile, and would be handled by RTS Launch Ordnance personnel as an explosive ordnance incident in accordance with existing range procedures.

Some hazardous materials, such as the small propellant tanks for the exoatmospheric KV's Divert and Attitude Control System, are filled prior to transport and are not field serviced. The two Divert and Attitude Control System tanks capacity are approximately 3 liters (0.8 gallon); one contains a hypergolic fuel (monomethyl hydrazine) and the other a strong oxidizer (mixed oxides of nitrogen, consisting primarily of nitrogen tetroxide). The THAAD missile system will be deployed with a leak detector and spill kit in the event of a leak.

Liquid propellant for liquid-fueled target missiles, if used as part of the Alternative Action, would typically consist of a kerosene-type fuel and a very strong oxidizer, such as IRFNA or hydrogen peroxide.

4.2.6.1 Kwajalein—Hazardous Materials and Waste

4.2.6.1.1 Site Preparation Activities

Most of the THAAD activities at Kwajalein would be performed with existing facilities and infrastructure. Construction of an Operations Center and Storage/Maintenance Building, a new radar hardstand tower, and possible concrete pad for an aboveground storage tank, would not likely result in the release of a potentially hazardous material or waste. Construction of these new facilities, if necessary, would be conducted in accordance with EM-385-1-1, the Corps of Engineers Safety and Health Requirements Manual. All construction activities would follow the Kwajalein Environmental Emergency Plan and therefore would have a spill control plan.

Missile components would be brought to Kwajalein as the initial arrival point at the USAKA. Kwajalein would also serve as the supply point for consumable materials to be employed during target and interceptor vehicle preflight assembly and checkout operations, and consumable supplies needed for the maintenance of the THAAD radar and other sensor systems. Some of the materials in these supplies are considered to be hazardous materials (e.g., acetone and isopropyl alcohol for target systems, and contact cleaners for sensor systems). These materials would be stored on Kwajalein in appropriate warehouse facilities prior to issuance for use on other islands. These materials are similar to materials employed for other operations already occurring at Kwajalein (including standard facility maintenance activities), and represent only a small increase in the total amounts of materials to be handled at Kwajalein.

4.2.6.1.2 Flight Test Activities

Should a portable electrical power generator be required it would be fueled by diesel fuel dispensed from a new 18,927-liter (5,000-gallon) aboveground storage tank. The tank would be located on a concrete pad with secondary containment. Construction/installation and management of the aboveground storage tank system would comply with National Fire Protection Association and other applicable regulations specified in the Kwajalein

Environmental Emergency Plan and Hazardous Materials Management Plan. An area around the radar would be evacuated during operation.

4.2.6.1.3 Post Flight Test Activities

Hazardous wastes generated during activities on other island locations would be collected on Kwajalein for final disposition. Building 1521 serves as the USAKA Hazardous Waste Collection Point. Hazardous wastes produced at other locations under the Alternative Action could include small amounts of waste solvents (e.g., acetone, isopropyl alcohol) waste motor fuels, waste liquid rocket propellants, and collected solid propellant and other explosive materials from debris recovery out of the Kwajalein Atoll Lagoon. All of these hazardous wastes are similar to hazardous wastes already generated and handled at USAKA and Building 1521, and can be handled within the existing hazardous waste disposal operations. The quantities of all hazardous wastes that could be produced under the Alternative Action are not expected to substantially increase the quantity already being handled at USAKA.

4.2.6.2 Meck—Hazardous Materials and Waste

4.2.6.2.1 Site Preparation Activities

Meck would serve as the location for target missile build-out (and fueling operations for liquid-fueled target missiles), as well as a possible launch location for interceptor missiles. Most of the THAAD activities at Meck would be performed with existing facilities and infrastructure. Installation of trenches for fiber optic cable and fencing around the launch site would not result in the release of a potentially hazardous material or waste. These activities would be conducted in accordance with EM 385-1-1, the Corps of Engineers Safety and Health Requirements Manual and would follow the Kwajalein Environmental Emergency Plan.

The use of hazardous materials during the Alternative Action, other than liquid fueled target missile propellants, would be limited to small amounts of solvent and cleaners (acetone, isopropyl alcohol, etc.), sealants, and adhesives. The proper handling and use of such materials are routine in many types of military operations, including similar operations for other missile systems already performed at Meck. All tasks would be performed in accordance with standard operating procedures, and would include provisions for proper handling of hazardous materials/wastes and waste minimization.

Any liquid propellants (fuels and oxidizer) would arrive at USAKA packaged in approved storage/transportation containers and be immediately transported to Meck, where all storage of liquid fuels would occur. In accordance with RTS procedures, storage would take place in the shipping containers, which would be properly secured, with secondary containment, to collect spilled materials.

4.2.6.2.2 Flight Test Activities

During normal flight operations there would be no hazardous materials or waste issues associated with flight corridors. However, as a result of successful intercepts, debris from both the THAAD and target missiles would be produced. If an in-flight malfunction occurs, the range safety officer may initiate flight termination, resulting in missile debris being deposited beneath the flight path. Debris impacts from mishaps such as flight termination may occur within the Kwajalein Atoll Lagoon. Missile debris would be recovered following lagoon impacts as addressed above. Most debris would consist of metal parts and other solid fragments, although some quantities of hazardous wastes may also be recovered (primarily solid fuel fragments). The potential effects on the ocean environment from hazardous materials associated with missile debris are described in section 4.6.3.

The types of hazardous materials, other than propellants, that would be associated with the Alternative Action are similar to hazardous materials already in use at USAKA. The quantity of these materials that would be used represents a minor increase above those already in use. Therefore, any potential increase in hazardous materials use could easily be accommodated by the current hazardous materials control systems at USAKA. Similarly, the types of hazardous wastes that would be generated under the Alternative Action are similar to wastes already handled at USAKA. The quantity of hazardous waste that may be generated during the Alternative Action would represent a small increase over current conditions and could be easily accommodated within the existing hazardous waste management and disposal system.

The existing Kwajalein Environmental Emergency Plan and Hazardous Materials Management Plan would be modified to include these materials and wastes before they would be used and generated at Meck. In addition, personnel trained in the appropriate procedures to handle these materials, including spill containment and cleanup, would be on standby should a mishap occur. Personnel involved in these operations would wear protective clothing.

4.2.6.2.3 Post Flight Test Activities

At the conclusion of testing activities at Meck, THAAD program personnel would remove all mobile equipment/assets brought to island. All permanent facilities constructed in support of THAAD testing would remain and become part of the island's infrastructure. Any hazardous materials remaining would be used or disposed of in accordance with the UES.

4.2.6.3 Roi-Namur—Hazardous Materials and Waste

4.2.6.3.1 Site Preparation Activities

Most of the THAAD activities at Roi-Namur would be performed with existing facilities and infrastructure. Should this site be used for THAAD radar operation, power for the radar would be supplied by the existing power plant. No release of potentially hazardous material or waste is expected during transport or set up of the radar. Construction of any

new facilities, if necessary, would be conducted in accordance with the EM 385-1-1, Corps of Engineers Safety and Health Requirements Manual.

4.2.6.3.2 Launch Activities

The THAAD radar would be powered by the Roi-Namur power plant. Overall, no adverse impacts would result from hazardous materials used or hazardous waste generated under the Alternative Action on Roi-Namur.

4.2.6.3.3 Post Flight Test Activities

At the conclusion of testing activities at Roi-Namur, THAAD program personnel would remove all mobile equipment/assets brought to island. All permanent facilities constructed in support of THAAD testing would remain and become part of the island's infrastructure. Any hazardous materials remaining would be used or disposed of in accordance with the UES.

4.2.6.4 Cumulative Impacts

Adherence to the hazardous materials and waste management systems on USAKA precludes the potential accumulation of hazardous materials or waste. The UES establishes emergency response procedures that would aid in the evaluation and cleanup of any hazardous materials released. The anticipated number of THAAD missiles launched from RTS could be up to 50 over a period of 4 years, typically ranging from 1 to 14 per year. The USAKA Supplemental EIS (U.S. Army Space and Strategic Defense Command, 1993b) evaluated the impacts from multiple launches of missiles per year for several years, a maximum of 28 strategic missiles launched in a single year from Meck. THAAD flight tests when combined with the activities discussed in section 2.6 are not expected to exceed this number. The Alternative Action, when combined with activities discussed in section 2.6, is not expected to result in cumulative hazardous materials and hazardous waste impacts on USAKA.

4.2.7 HEALTH AND SAFETY—REAGAN TEST SITE, U.S. ARMY KWAJALEIN ATOLL

Some evaluative criteria for impacts to this resource are discussed in the PMRF section. The Alternative Action at RTS has the potential to impact worker safety during construction activities as well as public and range personnel safety related to the transport, storage, launch, and launch of the THAAD missiles. THAAD intercepts of target missiles may also impact the safety of these same groups. EMR from the THAAD radar during flight tests and the tactical radar also present the potential for impacts.

4.2.7.1 Kwajalein—Health and Safety

4.2.7.1.1 Site Preparation Activities

Under the Alternative Action Kwajalein would be used for temporary storage of target and interceptor missile components upon initial arrival at USAKA. Kwajalein would also be used as the storage location for all consumable materials (e.g., solvents/cleaners, small parts, tools) that would be used during test flight prelaunch and launch operations. The primary hazard related to these storage operations would be the potential for explosion/fire of solid fuel motors and/or small explosive actuation devices (used in missile control and flight termination systems). At Kwajalein, as at all other USAKA locations, all operations involving explosives (including packaging and handling for movement) would require implementation of a written procedure, which has been approved by Range Safety. These operations must be conducted under the supervision of an approved ordnance officer using explosive-certified personnel. All storage and handling of explosives is required to take place in facilities designed to handle explosives and which have been sited in accordance with the requirements of Kwajalein Missile Range Regulation 385-75, *Explosive Safety* (U.S. Army Kwajalein Atoll, 1993). The regulation specifies the required explosive safety quantity-distances for each facility to ensure safety in the event of explosion, based upon the maximum quantity of explosive material permitted for the facility. This will serve to prevent propagation of explosions to nearby facilities where explosives are also stored.

The explosive devices and materials proposed for use as part of the THAAD flight testing are very similar to those currently stored and in use at RTS. Storage operations would not entail any specialized procedures beyond those already in use. Storage facilities (magazines) are available at Kwajalein for proper storage of all explosive materials.

4.2.7.1.2 Flight Test Activities

Hazards associated with operation of the THAAD radar were analyzed in both the Ground-Based Radar Family of Radars EA (U.S. Army Space and Strategic Defense Command, 1993a) and the *Environmental Assessment for Theater Missile Defense Ground Based Radar Testing Program at Fort Devens, Massachusetts* (U.S. Army Space and Strategic Defense Command, 1994e). In both assessments it was concluded that due to the implementation of controlled areas, and limitations in the areas subject to illumination by the THAAD radar units, no safety hazard would be produced to affect either the public or the workforce. Operation of the radar would be in accordance with designated Army safety procedures, which have been developed to prevent inadvertent exposure to emitted radio frequency radiation. Under these procedures, EMR hazard zones are established within the beam's tracking space and near emitter equipment. Prior to activating the THAAD radar, visual survey of the area will be conducted to verify that all personnel are outside the hazard zone. Personnel may not enter these hazard zones while the radar unit is in operation. The radar is prevented from illuminating in a designated cutoff zone, in which operators and all other system elements would be located. Potential safety consequences associated with THAAD radar interference with other electronic and emitter units (flight navigation systems, tracking radars, etc.) were also examined and found to produce no safety hazard affecting either the public or the workforce.

The hazards associated with use of the THAAD radar at the USAKA were considered in the USAKA Final Supplemental EIS (U.S. Army Space and Strategic Defense Command, 1993b). The analysis considered both program operational requirements and restrictions and USAKA-required safety procedures (see section 4.6). It was concluded that the required implementation of all operational safety procedures would preclude any potential for adverse worker exposure to radio frequency radiation.

Prior to activating the THAAD radar, a visual survey of the area will be conducted to verify that all personnel are outside the hazard zone. Personnel may not enter these hazard zones while the radar unit is in operation. The radar is prevented from illuminating in a designated cutoff zone, in which operators and all other system elements would be located. For communication link equipment, associated radio frequency emissions are considered to be of sufficiently low power so that there is no exposure hazard. All sensor systems would be sited prior to operation to ensure that no occupied structures or accessible travel areas are within any hazard area necessitated by radio frequency emissions. Through the use of these procedures, it has been previously determined that proper exposure control would be achieved, and that operation of these systems would not present a significant health and safety hazard (U.S. Army Space and Strategic Defense Command, 1993b).

4.2.7.1.3 Post Flight Test Activities

At the conclusion of its testing activities on Kwajalein, THAAD program personnel would remove all mobile equipment/assets brought to the range. All permanent facilities constructed in support of THAAD testing would remain and become part of the island's infrastructure and would be maintained per their operating procedures. No adverse health and safety impacts are expected.

4.2.7.2 Meck—Health and Safety

4.2.7.2.1 Site Preparation Activities

All propellant storage and loading operations for liquid-fueled target missiles would be performed at Meck prior to transport to Bigen for launch. Propellants would arrive at USAKA packaged in approved storage/transportation containers and be immediately transported to Meck for storage. Oxidizer (IRFNA) would be stored in the existing fueling area building and fuel (UDMH) in the Liquid Fuel Storage Building. Each of these facilities has been designed for the bulk handling of liquid propellants. Under the Alternative Action the volumes of liquid propellants required for the flight test program are 9,500 kilograms (21,000 pounds) of oxidizer and 3,000 kilograms (7,000 pounds) of fuel. These facilities would be able to safely handle all required liquid propellant quantities. THAAD missiles would arrive pre-fueled, and thus no impacts to health and safety from handling or processing solid propellant are anticipated.

4.2.7.2.2 Flight Test Activities

The Alternative Action includes the launch of THAAD missiles from Meck for broad ocean area intercepts of the target missile. Hazards associated with launch operations would be limited to launch hazards on these islands and the nearby waters. An LHA would be established for each launch to ensure that unauthorized personnel are outside the area, which might be impacted by missile debris. Implementation of LHAs will ensure the safety of members of the public by avoiding impacts to populated islands.

4.2.7.2.3 Post Flight Test Activities

At the conclusion of testing activities on Meck, THAAD program personnel would remove all mobile equipment/assets brought to the range. All permanent facilities constructed in support of THAAD testing would remain and become part of the island's infrastructure and would be maintained per their operating procedures. No adverse health and safety impacts are expected.

4.2.7.3 Roi-Namur—Health and Safety

4.2.7.3.1 Site Preparation Activities

Site preparation at Roi-Namur would be limited to set-up of the THAAD radar system.

4.2.7.3.2 Flight Test Activities

Section 4.2.7.1.2 provides a description of operation of the THAAD radar on Kwajalein. At Roi-Namur, as at Kwajalein, hazards associated with the Alternative Action would be limited to worker exposure to radio frequency radiation, but also the potential exists for disturbance of unexploded ordnance, if trenching is necessary. USAKA has standard operating procedures for explosive safety in place and has explosive ordnance disposal personnel onsite. The radio frequency radiation hazard would be controlled through the implementation of programmatic and USAKA-required safety procedures, which would limit areas which might be illuminated by the radar, the periods during which the radar could be operated, and which would require that appropriate hazard zones be established and kept clear of personnel during radar operation. Based on the conclusions in previous assessments, and use of safety procedures to limit exposure hazards, the use of the THAAD radar at Roi-Namur is considered to present no safety hazards to the workforce.

4.2.7.3.3 Post Flight Test Activities

At the conclusion of its testing activities on Roi-Namur, THAAD program personnel would remove all mobile equipment/assets brought to the range. All permanent facilities constructed in support of THAAD testing would remain and become part of the island's infrastructure and would be maintained per their operating procedures. No adverse health and safety impacts are expected.

4.2.7.4 Cumulative Impacts

RTS is a restricted access area dedicated to research, test, and training military activities. Safety standards are high at USAKA and would serve to keep the cumulative safety impacts attributable to all USAKA operations within acceptable standards to both workers and the public. The anticipated number of THAAD missiles launched from RTS could be up to 50 over a period of 4 years, typically ranging from 1 to 14 per year. The USAKA Supplemental EIS (U.S. Army Space and Strategic Defense Command, 1993b) evaluated the impacts from multiple launches of missiles per year for several years, a maximum of 28 strategic missiles launched in a single year from Meck. THAAD flight tests when combined with the activities discussed in section 2.6 are not expected to exceed this number. The increased use of liquid propellants, explosives, and other prelaunch activities would represent a small increase in the potential safety risk at USAKA and no cumulative impacts are anticipated.

4.2.8 INFRASTRUCTURE—REAGAN TEST SITE, U.S. ARMY KWAJALEIN ATOLL

Some evaluative criteria for impacts to this resource are discussed in the PMRF section. THAAD activities would not impact current flight schedules. USAKA is a restricted access installation with controlled transportation logistics, thus no serious or lasting impacts to USAKA's ground transportation system are anticipated. For aircraft transportation, FAA regulations and Air Force Joint Manual 24-204, *Preparing Hazardous Materials for Military Shipment*, would be followed.

The Alternative Action has the ability to substantially impact utility systems if new utility distribution facilities are required or if it would result in shortages to current installation supply.

4.2.8.1 Kwajalein Island—Infrastructure

4.2.8.1.1 Site Preparation Activities

The proposed Operations Center and Storage/Maintenance Building and the Mission Control/Technical Support Facility would require electricity, water supply, wastewater removal, and solid waste removal for a maximum of 60 people. All of these can be easily supplied by the facilities on Kwajalein because they would constitute less than 3 percent of the amounts generated daily. Placement of utility lines (electricity, wastewater, and water) would be branched from existing nearby lines within fill material areas. Therefore, site preparation activities are not anticipated to have any adverse impacts on existing utilities.

4.2.8.1.2 Flight Test Activities

During launch, there will be a maximum of 60 people operating the radar and using the Operations Center and Storage/Maintenance Building. Unlike on PMRF, should the THAAD radar be located on Kwajalein, power would have to be supplied by the Kwajalein power plant, which can supply 29,200 kW for all activities on Kwajalein. The Kwajalein power

plant typically operates at 30 percent capacity. The amount of electricity that can be supplied by the Kwajalein power plant is more than adequate for THAAD activities, including the 3 phase, 4,160 volt, and 60-hertz electrical power requirements of the THAAD radar and the housekeeping requirements of the Operations Center and Storage/Maintenance Building. No adverse impacts to the ability of the power plant to supply service to the installation are expected.

4.2.8.1.3 Post Flight Test Activities

When THAAD activities have concluded, personnel will remove all mobile equipment placed at the site. Permanent facilities would be left in place for use in future programs. No impacts to infrastructure are anticipated.

4.2.8.2 Meck Island—Infrastructure

4.2.8.2.1 Site Preparation Activities

The site preparation activities would not require billeting of personnel on Meck. Utility systems on Meck (electricity, wastewater, and water) are of sufficient capacity to handle the additional temporary personnel. Up to 65 people would be typical of past operations.

4.2.8.2.2 Flight Test Activities

A maximum of 65 people would use the launch facilities constructed on Meck Island during launch activities. The temporary increase in utility demand caused by THAAD flight test activities is not expected to result in adverse affects to infrastructure on Meck, since the number of personnel required would be within the range routinely handled by USAKA.

4.2.8.2.3 Post Flight Test Activities

When THAAD activities have concluded, personnel will remove all mobile equipment placed at the site. Permanent facilities would be left in place for use in future programs. No impacts to infrastructure are anticipated.

4.2.8.3 Roi-Namur Island—Infrastructure

4.2.8.3.1 Site Preparation Activities

Utility systems on Roi-Namur (electricity, wastewater, and water) are of sufficient capacity to handle the additional temporary site preparation personnel. Up to 65 people would be typical of past operations. No impacts are anticipated.

4.2.8.3.2 Flight Test Activities

The Roi-Namur Power Plant would supply power for the THAAD radar. The amount of electricity that can be supplied by the Roi-Namur power plant is more than adequate for THAAD activities, including the 3 phase, 4,160 volt, and 60-hertz electrical power

requirements of the THAAD radar. The new power plant has the same capacity of the old plant (13,500 kW), but greater reliability because of new generators.

4.2.8.4 Post Flight Test Activities

When THAAD activities have concluded, personnel would remove all mobile equipment placed at the site. Permanent facilities would be left in place for use in future programs. No impacts to infrastructure are anticipated.

4.2.8.5 Cumulative Impacts

The anticipated number of THAAD missiles launched from RTS could be up to 50 over a period of 4 years, typically ranging from 1 to 14 per year. The USAKA Supplemental EIS (U.S. Army Space and Strategic Defense Command, 1993b) evaluated the impacts from multiple launches of missiles per year for several years, a maximum of 28 strategic missiles launched in a single year from Meck. THAAD flight tests when combined with the activities discussed in section 2.6 are not expected to exceed this number. USAKA continually schedules and manages overlapping program test activities such as those discussed in section 2.6. The addition of approximately 65 transient personnel and limited amount of new construction would represent a relatively minor impact on USAKA infrastructure and therefore would not result in an adverse effect.

4.2.9 LAND USE—REAGAN TEST SITE, U.S. ARMY KWAJALEIN ATOLL

Some evaluative criteria for impacts to this resource are discussed in the PMRF section. The Alternative Action could potentially impact land use if construction and operation of THAAD facilities would create conflicts with adjacent land use plans.

4.2.9.1 Kwajalein—Land Use

4.2.9.1.1 Site Preparation Activities

For the Alternative Action, THAAD missile components and the target missile system components would arrive at Kwajalein from the continental United States. Temporary storage of these components/systems would be accomplished using facilities that currently handle similar items. The use of existing facilities on Kwajalein would not change the land use and management of the island. Construction of the THAAD radar hardstand, Operations Center and Storage/Maintenance Building, and Storage/Maintenance Building would occur in locations designated by the USAKA Master Plan, thus preventing any conflict with any land use plans, policies, or controls. The island is under U.S. Army management, and it would continue to be used for missile research.

4.2.9.1.2 Flight Test Activities

The proposed activities are entirely consistent with the mission of the island and would not conflict with any land use plans, policies, or controls of USAKA.

4.2.9.1.3 Post Flight Test Activities

All mobile THAAD equipment/assets brought to RTS would be removed after flight tests are complete. All permanent facilities constructed in support of THAAD testing would remain and become part of the installation's infrastructure and would be maintained in accordance with its operating procedures. These activities would not conflict with any land use plans, policies, or controls of USAKA.

4.2.9.2 Meck—Land Use

4.2.9.2.1 Site Preparation Activities

The minor construction and use of existing facilities for the Alternative Action on Meck would not change the land use or affect management of the island. The island is under U.S. Army management, and would continue to be used for range activities.

4.2.9.2.2 Flight Test Activities

THAAD missile launches are entirely consistent with the mission of the island and would not conflict with any land use plans, policies, or controls of USAKA. The establishment and activation of an LHA would require the temporary clearance of the adjoining Pacific Ocean in front of the launch site. Temporary clearance of this LHA would have no impacts on recreational or commercial use of these waters since the area off the island is not used by commercial fishermen or for recreational use by residents of USAKA (all of whom work for the U.S. Government or U.S. Government contractors). As part of USAKA range safety practices, the Mid-atoll Corridor, in which Meck is located, is maintained as a closed area. All boat traffic is prohibited for a period encompassing any flight test activity. (U.S. Army Space and Strategic Defense Command, 1995b)

4.2.9.3 Post Flight Test Activities

All mobile THAAD equipment/assets brought to RTS would be removed after flight tests are complete. All permanent facilities constructed in support of THAAD testing would remain and become part of the installation's infrastructure and would be maintained in accordance with its operating procedures. These activities would not conflict with any land use plans, policies, or controls of USAKA.

4.2.9.4 Roi-Namur—Land Use

4.2.9.4.1 Site Preparation Activities

The use of existing facilities for operation of the THAAD radar on Roi-Namur would not change the land use or affect management of the island. The island is under U.S. Army management, and would continue to be used for range activities.

4.2.9.4.2 Flight Test Activities

The proposed operation of the THAAD radar is entirely consistent with the mission of the island and would not conflict with any land use plans, policies, or controls of USAKA.

4.2.9.5 Post Flight Test Activities

All mobile THAAD equipment/assets brought to Roi-Namur would be removed after flight tests are complete. All permanent facilities constructed in support of THAAD testing would remain and become part of the installation's infrastructure and would be maintained in accordance with its operating procedures. These activities would not conflict with any land use plans, policies, or controls of USAKA.

4.2.9.6 Cumulative Impacts

The anticipated number of THAAD missiles launched from RTS could be up to 50 over a period of 4 years, typically ranging from 1 to 14 per year. The USAKA Supplemental EIS (U.S. Army Space and Strategic Defense Command, 1993b) evaluated the impacts from multiple launches of missiles per year for several years, a maximum of 28 strategic missiles launched in a single year from Meck. THAAD flight tests when combined with the activities discussed in section 2.6 are not expected to exceed this number. USAKA continually schedules and manages overlapping program test activities. Construction and operation of proposed facilities, when combined with the activities discussed in section 2.6, would not change any existing land uses, and no cumulative impacts are expected.

4.2.10 NOISE—REAGAN TEST SITE, U.S. ARMY KWAJALEIN ATOLL

Some evaluative criteria for impacts to this resource are discussed in the PMRF section. The Alternative Action could result in noise impacts from construction activities and missile flight testing. The analysis in this section is concerned with human receptors; noise effects on wildlife are discussed under biological resources.

4.2.10.1 Kwajalein—Noise

4.2.10.1.1 Site Preparation Activities

Noise generated during construction of the Operations Center and Storage/Maintenance Building and the radar hardstand should have minimal impact to sensitive noise receptors on Kwajalein (housing area) or on Ebeye, the nearest inhabited island, since these receptors are located approximately 1.6 kilometers (1 mile) and 7 kilometers (4 miles) away respectively. Construction would be temporary in nature and similar to other construction on the island.

4.2.10.1.2 Flight Test Activities

The temporary storage of liquid propellant on Kwajalein and use of the Operations Center and Storage/Maintenance Building would essentially have no potential for causing noise and thus no potential to impact the local noise environment.

Potential noise impacts from the operation of the original THAAD radar generators were addressed in the USAKA Final Supplemental EIS (U.S. Army Space and Strategic Defense Command, 1993b). The EIS concluded that the resulting sound levels would cause neither workplace standards to be violated nor noise sensitive receptors on Kwajalein to experience maximum short-term noise levels greater than 92 dBA. Since all personnel involved with radar activities would be provided with noise protection as appropriate to reduce exposure, no impacts to personnel are expected from operation of the generators required to operate the current THAAD radar. No impacts are anticipated to impact sensitive noise receptors on Kwajalein (housing area) or on Ebeye, the nearest inhabited island, since these receptors are located approximately 1.6 kilometers (1 mile) and 7 kilometers (4 miles) away respectively.

4.2.10.1.3 Post Flight Test Activities

Noise generated during removal of all mobile equipment/assets should have minimal impact to the noise environment on or off the installation.

4.2.10.2 Meck—Noise

4.2.10.2.1 Site Preparation Activities

Noise generated during installation of the launch equipment building on a trailer or truck and the small amount of trenching required should have no noise impact to sensitive noise receptors on Gugegue, the nearest inhabited island, which is 26 kilometers (16 miles) away.

4.2.10.2.2 Flight Test Activities

The Theater Missile Defense ETR EIS (U.S. Army Space and Strategic Defense Command, 1994) concluded that up to 48 defensive missile launches per year would not result in significant noise impacts. Up to 50 THAAD launches could be launched from Meck over a 4-year period, typically ranging from 1 to 14 per year. Potential noise impacts from the launches of strategic launch vehicles and the operation of their support equipment on Meck were also addressed in the USAKA Final Supplemental EIS (U.S. Army Space and Strategic Defense Command, 1993b). The EIS concluded that the resulting sound pressure levels would cause neither workplace standards to be violated nor noise sensitive receptors to experience maximum short-term noise levels greater than 92 dBA. Noise levels of 92 dBA would be experienced approximately 7 kilometers (4.5 miles) away from the THAAD launch site. Sensitive noise receptors are located beyond this noise contour and thus would not be affected.

4.2.10.2.3 Post Flight Test Activities

Noise generated during removal of all mobile equipment/assets should have minimal impact to the noise environment on or off the installation.

4.2.10.3 Roi-Namur—Noise

4.2.10.3.1 Site Preparation Activities

Site preparation activities on Roi-Namur would be minimal since the alternative THAAD radar sites have already been established. No noise impacts to noise sensitive receptors on Roi-Namur or Ennubirr, the nearest inhabited island, are anticipated.

Flight Test Activities

The THAAD radar would be powered by the Roi-Namur power plant and thus no additional impacts to noise sensitive receptors on Roi-Namur are anticipated.

4.2.10.3.2 Post Flight Test Activities

Noise generated during removal of all mobile equipment/assets should have minimal impact to the noise environment on or off the installation.

4.2.10.4 Cumulative Impacts

The anticipated number of THAAD missiles launched from RTS could be up to 50 over a period of 4 years, typically ranging from 1 to 14 per year. The USAKA Supplemental EIS (U.S. Army Space and Strategic Defense Command, 1993b) evaluated the impacts from multiple launches of missiles per year for several years, a maximum of 28 strategic missiles launched in a single year from Meck. THAAD flight tests when combined with the activities discussed in section 2.6 are not expected to exceed this number. Given the temporary nature of a launch event and the scheduling procedures of launches on Meck, proposed THAAD test flights when combined with the potential activities discussed in section 2.6 would not result in cumulative impacts.

4.2.11 SOCIOECONOMICS—REAGAN TEST SITE, U.S. ARMY KWAJALEIN ATOLL

Some evaluative criteria for impacts to this resource are discussed in the PMRF section.

4.2.11.1 Site Preparation Activities

Personnel involved in site preparation activities on Kwajalein, Meck, and Roi-Namur would commute from Kwajalein, and thus any potential for socioeconomic impact would be limited to Kwajalein and potentially Ebeye and Enubirr. A total of approximately 50 to 55 personnel would be required to support proposed THAAD activities. Thirty-five would be required for site preparation and launch operations. According to analysis provided in the

USAKA Temporary ETR EA and the Theater Missile Defense ETR EIS, up to 60 program-related personnel would be well within the normal month-to-month fluctuation in numbers of temporary personnel and would not significantly impact current population levels.

4.2.11.2 Flight Test Activities

According to analysis provided in the USAKA Temporary ETR EA and the Theater Missile Defense ETR EIS, up to 60 program-related personnel would be well within the normal month-to-month fluctuation in numbers of temporary personnel on Kwajalein.

Approximately 20 to 25 personnel would be required to support radar activities on Kwajalein or Roi-Namur, and 35 would be required to support launch activities. Lodging and food service on Kwajalein would be sufficient to support the THAAD program personnel. Local retail stores should also be adequate for launch personnel needs. The THAAD flight test program would result in a slight economic benefit for the islands.

4.2.11.3 Post Flight Test Activities

According to analysis provided in the USAKA Temporary ETR EA and the Theater Missile Defense ETR EIS, up to 60 program-related personnel would be well within the normal month-to-month fluctuation in numbers of temporary personnel and would not significantly impact current population levels. Therefore, approximately 35 personnel involved in post THAAD flight activities are also not expected to impact current population levels. Post flight test personnel would continue to provide a slight economic benefit to Kwajalein.

4.2.11.4 Cumulative Impacts

The anticipated number of THAAD missiles launched from RTS could be up to 50 over a period of 4 years, typically ranging from 1 to 14 per year. The USAKA Supplemental EIS (U.S. Army Space and Strategic Defense Command, 1993b) evaluated the impacts from multiple launches of missiles per year for several years, a maximum of 28 strategic missiles launched in a single year from Meck. THAAD flight tests when combined with the activities discussed in section 2.6 are not expected to exceed this number. The scheduling procedures in place at the installation minimize the potential for cumulative socioeconomic impacts from multiple programs, such as those discussed in section 2.6. The potential for cumulative population, employment, income, and housing impacts from the personnel associated with the THAAD flight tests would not be substantial since the number is well within the normal month-to-month fluctuation in numbers of temporary personnel on Kwajalein.

4.2.12 WATER RESOURCES—REAGAN TEST SITE, U.S. ARMY KWAJALEIN ATOLL

Some evaluative criteria for impacts to this resource are discussed in the PMRF section.

4.2.12.1 Kwajalein—Water Resources

4.2.12.1.1 Site Preparation Activities

Construction of the Operations Center and Storage/Maintenance Building and THAAD radar hardstand would not impact groundwater wells or catchment areas located adjacent to the airfield's runway and approximately 1.6 kilometers (1 mile) away.

4.2.12.1.2 Flight Test Activities

According to the USAKA Temporary ETR EA, the amount of generator emissions produced during operation of the THAAD radar and associated equipment would be minimal and would not degrade the quality of the water collected from the rainwater catchments, which are approximately 1.6 kilometers (1 mile) away. In addition the prevailing winds carry the emissions to the southwest away from the catchment near the runway.

4.2.12.1.3 Post Flight Test Activities

All mobile THAAD equipment/assets brought to RTS would be removed after flight tests are complete. All permanent facilities constructed in support of THAAD testing would remain and become part of the installation's infrastructure and would be maintained in accordance with its operating procedures. These activities would not impact water resources on the island.

4.2.12.2 Meck—Water Resources

4.2.12.2.1 Site Preparation Activities

No impacts to water resources on the island are anticipated as a result of installation of the launch equipment building on a trailer or truck and the small amount of trenching required to support THAAD test flight activities. The Meck catchment is protected and controls are in place to prevent its contamination.

4.2.12.2.2 Flight Test Activities

According to the USAKA Supplemental EIS, no water quality impacts are expected from normal launch activities. Under nominal launch conditions, no impacts to the rainwater catchment area adjacent to the airfield runway are expected because aluminum oxide and hydrogen chloride disperse rapidly in the air and would be further dispersed by the persistent winds. USAKA has a water quality monitoring program in place, which includes testing of drinking water. The Meck water treatment plant processes catchment water to include chlorination, thus any addition of hydrogen chloride would thus be inconsequential.

4.2.12.2.3 Post Flight Test Activities

All mobile THAAD equipment/assets brought to RTS would be removed after flight tests are complete. All permanent facilities constructed in support of THAAD testing would remain and become part of the installation's infrastructure and would be maintained in

accordance with its operating procedures. These activities would not impact water resources on the island.

4.2.12.3 Roi-Namur—Water Resources

4.2.12.3.1 Site Preparation Activities

Installation of the THAAD radar on existing locations on Roi-Namur would not result in impacts to water resources on the island.

4.2.12.3.2 Flight Test Activities

The THAAD radar would be powered by the Roi-Namur power plant, which would have no impacts to water resources.

4.2.12.3.3 Post Flight Test Activities

All mobile THAAD equipment/assets brought to RTS would be removed after flight tests are complete. All permanent facilities constructed in support of THAAD testing would remain and become part of the installation's infrastructure and would be maintained in accordance with its operating procedures. These activities would not impact water resources on the island.

4.2.12.4 Cumulative Impacts

The anticipated number of THAAD missiles launched from RTS could be up to 50 over a period of 4 years, typically ranging from 1 to 14 per year. The USAKA Supplemental EIS (U.S. Army Space and Strategic Defense Command, 1993b) evaluated the impacts from multiple launches of missiles per year for several years, a maximum of 28 strategic missiles launched in a single year from Meck. THAAD flight tests when combined with the activities discussed in section 2.6 are not expected to exceed this number. It is anticipated that the launches under the Alternative Action, when combined with the activities discussed in section 2.6, would not result in any cumulative impacts to water resources on RTS. The amount of exhaust products from the proposed THAAD launches that could potentially be deposited would be small and the emissions are dispersed rapidly by the strong prevailing winds.

4.3 WAKE ISLAND

4.3.1 AIR QUALITY—WAKE ISLAND

Some evaluative criteria for impacts to this resource are discussed in the PMRF section. Potential issues related to the air quality of the area around Wake include compliance with national air quality standards for criteria pollutants released during proposed activities. Air quality at Wake could be impacted by site preparation activities and launch emissions.

4.3.1.1 Site Preparation Activities

Air quality impacts could occur during the construction of a second launch stool at Wake Island. Exact details of the installation including location and size have not yet been determined; however, it is assumed that construction activities would be similar to those described in the *Wake Island Environmental Assessment*. (U.S. Army Space and Strategic Defense Command, 1994b) Air quality impacts could include fugitive dust particles from soil disturbance and emissions from equipment and vehicles. A conservative estimate for fugitive dust emissions from ground disturbing activities is 1.08 metric tons (1.2 tons) per 0.4 hectare (1 acre) per month of activity (U.S. Environmental Protection Agency, 1995).

4.3.1.2 Flight Test Activities

According to the Wake Island Environmental Assessment (U.S. Army Space and Strategic Defense Command, 1994b), launch operations make up the largest source of uncontrolled emissions into the atmosphere. These emissions are produced during lift-off in the ground cloud and along the launch trajectory.

Target launches from Wake Island previously analyzed in the Wake Island EA include the SR19-AJ-1 and the M57A-1 for normal launches and early termination scenarios. The use of portable generators being used to provide electricity to range support equipment was also considered were found to produce no significant impact to air quality. The Wake Island Launch Center EA concluded that no adverse impacts to air quality or exceedance of the NAAQS for carbon monoxide (the only exhaust constituent listed as a critical pollutant and regulated by the NAAQS) would result from the addition of LPT launches on Wake Island. Tables 1-5 and 1-8 list the emission constituents for the target missiles that could be used during THAAD test flights, including the SR 19-AJ-1 rocket motor and LPT.

The results of the analysis from the Wake Island EA concluded that for both normal launches and early termination scenarios, relevant NAAQS guidelines would not be exceeded for distances greater than 1.0 kilometer (0.6 mile) from the launch site. Therefore no significant impacts to air quality would be expected from the launch of a solid propellant target missile.

THAAD element test activities associated with the MDA lethality program may include development and testing of NBC material simulants within a laboratory or other indoor and outdoor test facilities. These activities are analyzed in the *Programmatic Environmental Assessment, Theater Missile Defense Lethality Program* (U.S. Army Space and Strategic Defense Command, 1993c). The only currently proposed chemical simulant that could be part of the target payload would be small quantities of tributyl phosphate. Tributyl phosphate is a non-flammable, non-explosive, colorless, odorless liquid typically used as a solvent in commercial industry. The Occupational Safety and Health Administration set an 8-hour time-weighted average of 5 milligrams per cubic meter exposure to tributyl phosphate. All personnel would wear appropriate safety equipment when in contact with tributyl phosphate such as full-faced respirator masks. The release of simulant would occur at a high altitude over the open ocean during a nominal flight test, removed from populated areas.

4.3.1.3 Post Flight Test Activities

Post flight test activities would include the removal of all mobile equipment/assets brought to Wake Island. This removal could result in small amounts of localized fugitive dust (particulate matter), which would have a minor, if any, impact to air quality.

4.3.1.4 Cumulative Impacts

In terms of cumulative impacts, the NAAQS guidelines are not predicted to be exceeded as a result of THAAD flight tests in combination with those activities discussed in section 2.6. Most of the emissions sources on the island are not continuous in nature. The strong tradewinds prevent any localized emissions, including those from missile launches, from accumulating.

4.3.2 AIRSPACE—WAKE ISLAND

Some evaluative criteria for impacts to this resource are discussed in the PMRF section.

4.3.2.1 Site Preparation Activities

The delivery of any project associated materials and equipment by aircraft is a routine activity on Wake Island that follows standard applicable military requirements. All THAAD-related flights would be scheduled and coordinated in accordance with ICAO procedures, which would minimize the potential for conflicts to regional airspace use.

4.3.2.2 Flight Test Activities

Wake Island is located in international airspace. Therefore, no formal airspace restrictions surround it. The only air traffic control facility available is the control tower. According to the Wake Island Launch Center EA, missile launches are short-term discrete events and missiles launched with trajectories of 87 degrees elevation would remain clear of the route for the one military aircraft that makes regularly scheduled trips to the island and should pose no impacts. Launch activities would be coordinated with the Central Air Reservation Facility and the Oakland ARTCC Oceanic Control-5 Sector and would be governed by procedures of the ICAO. This coordination would minimize the potential for impacts to regional airspace. NOTAMs would be issued as necessary to provide information to all aircraft transiting the area.

4.3.2.3 Post Flight Test Activities

Post-flight activities would involve the removal of any temporary equipment. If equipment removal is performed by aircraft, then standard military requirements would be followed and flights would be coordinated through U.S. Air Force Air Mobility Command. No impacts to regional airspace would be expected.

4.3.2.4 Cumulative Impacts

In terms of cumulative impacts, no cumulative impacts to airspace are predicted as a result of THAAD flight tests in combination with those activities discussed in section 2.6. Implementation of international NOTAMs, timely coordination with the FAA, and use of the required scheduling process for international airspace would minimize the potential for cumulative impacts to regional airspace.

4.3.3 BIOLOGICAL RESOURCES – WAKE ISLAND

Some evaluative criteria for impacts to this resource are discussed in the PMRF section. Potential impacts of construction, building modification, and missile launches on terrestrial and marine biological resources within the Wake ROI have been addressed in detail in the Theater Missile Defense ETR EIS, Wake EA, and Wake Island Launch Center EA. Based on the prior analyses done and the effects of past target and missile launch activities, the potential impacts of activities related to test flights of the THAAD missile on biological resources are expected to be minimal, as discussed below.

The Alternative Action has the potential to impact biological resources due mainly to launches of target missiles.

4.3.3.1 Site Preparation Activities

Vegetation

The site(s) for the launch activities are previously cleared, improved locations. No substantial impacts to vegetation are anticipated. Any spill or release of hazardous material would likely be restricted to a small localized area near the source. Standard operating procedures and spill plans would reduce any potential impact to vegetation.

Wildlife

Disturbance to wildlife, including migratory birds, from construction noise and increased personnel would be short-term and is not expected to have a lasting impact nor a measurable negative effect, since migratory birds primarily nest at the end of Peale and Wilkes islands outside of the typical 70 to 98 dBA noise levels at 15 meters (50 feet) from construction equipment.

Any spill or release would likely be restricted to a small localized area near the source. Standard operating procedures and spill plans would reduce any potential impact to wildlife in the vicinity of the spill.

Essential Fish Habitat

No impacts are anticipated to Essential Fish Habitat in the vicinity of Wake Island from the proposed limited site preparation activities, which would all be on land.

Threatened and Endangered Species

No exclusively terrestrial threatened and endangered species are known or reported to exist on Wake Island. No impacts as a result of site preparation activities are expected to the federally threatened green sea turtle or the federally endangered hawksbill sea turtle. According to information provided in the Wake Island Launch Center EA, although the green sea turtle has been observed in the nearshore ocean and lagoon waters, neither sea turtle species has been observed basking or nesting on the island, the only land-based behaviors of these species.

Environmentally Sensitive Habitat

Site preparation activities are not expected to impact sensitive habitat such as bird nesting sites or the reefs surrounding Wake Island, because the activities would not be performed in these habitats.

4.3.3.2 Flight Test Activities

Vegetation

As discussed in section 4.1.3.2, nominal launch activities are not expected to result in impacts to vegetation. Observations of vegetation at other launch locations indicate that vegetation continues to thrive in the immediate areas surrounding launch pads. Based on these observations and resultant analyses, the potential effects to vegetation from the proposed target missile launches are also expected to be minimal.

Wildlife

Potential impacts could result from launch related activities such as launch noise and emissions. Impacts to wildlife on and in the vicinity of Wake Island would be similar to those discussed for PMRF in section 4.1.3.2 and are not expected to have a lasting impact nor a measurable negative effect on wildlife, including migratory birds. According to the Wake Island Launch Center EA, several previous studies have shown that intermittent noises (other than noises at or near the threshold of pain) have little if any apparent effect on most animals, including birds. Birds acclimate quickly to most non-constant noises in their environment and after an initial flushing return to their nest. Other wildlife also typically exhibits a momentary startle effect.

Procedures are in place which require cargo handling personnel to inspect arriving aircraft/crafts for pest species of plants and animals. Program personnel would be briefed on methods of pest detection. Therefore, any short-term potential increase in sea and air traffic associated with the THAAD launches is not expected to increase the transportation of non-native pest species to the atoll.

A launch mishap on the launch pad could impact wildlife species such as, migratory birds (red-tailed tropicbird, blackfooted albatross, and the Laysan albatross), which nest within the LHA. Implementation of launch safety procedures helps to minimize the potential for on-pad failure or explosion and thus the potential for impacts to the mentioned species.

Threatened and Endangered Species

The LHA extends into the ocean area several hundred meters (feet) where federally protected green sea turtles might be found. Of the internationally protected species, sea turtles and marine mammals would have the greatest risk, although remote, of incidental impact from falling missile debris in the booster drop area or in the event of an aborted flight. The likelihood that debris from a spent booster or terminated launch would strike a sea turtle or marine mammal is remote since the potential for a launch mishap is small and the marine species tend to be widely scattered.

Essential Fish Habitat

The potential impact to Essential Fish Habitat from nominal launch activities would mainly be from missile debris to waters off the coast. Although this could affect individuals close to the surface, overall species populations would not be substantially impacted. The potential ingestion of toxins, such as the small amount of propellant or simulant remaining in the spent boosters or on pieces of debris, by fish species, which may be used for food sources, would be remote because of the diluting effect of ocean water and the relatively small area that could potentially be affected.

Environmentally Sensitive Habitat

The Alternative Action is not expected to have a lasting impact nor a measurable negative effect on the bird nesting area on the western end of Wilkes and Peale islands. Nominal launch activities would not affect sea turtle nesting habitat. Nominal launches are not expected to have a negative effect on nearby reefs since debris would be located further out in the open ocean.

4.3.3.3 Post Flight Test Activities

THAAD program personnel would remove all mobile equipment/assets brought to the island at the conclusion of its testing activities on Wake Island. All permanent facilities constructed in support of THAAD testing would remain and become part of Wake Island Launch Center's infrastructure and would be maintained in accordance with its operating procedures. These activities would result in impacts similar to, but less than, those caused by site preparation. Specific restoration actions, if any, would be determined on a case-by-case basis.

4.3.3.4 Cumulative Impacts

Adherence to the standard procedures in place to minimize the introduction of invasive species would reduce the potential for cumulative impacts of these species to existing vegetation and wildlife on the island. No substantial cumulative impacts have been identified as a result of previous launches from Wake Island Launch Center. The Alternative Action in combination with the activities discussed in section 2.6 should also result in negligible cumulative impacts to biological resources.

4.3.4 CULTURAL RESOURCES—WAKE ISLAND

Some evaluative criteria for impacts to this resource are discussed in the PMRF section. To ensure the protection of any prehistoric, historic, or traditional resources already identified within the project area from unauthorized artifact collection or vandalism, personnel would be briefed before activities commence on the significance of these types of resources and the penalties associated with their disturbance or collection.

4.3.4.1 Site Preparation Activities

At the end of World War II, there were extensive earthworks and many Japanese and American structures remaining on Wake Atoll. Many of these features are no longer visible as a result of construction on the island and the destructive forces of nature. However, there is potential for evidence of these cultural resources to be present below the current ground surface.

The Alternative Action, which involves no new major construction and minimal ground disturbance, would not impact the subsurface resources or other historic properties and thus would not alter the historic character of the site.

4.3.4.2 Flight Test Activities

Target missile launches as part of the THAAD flight test program are expected to have no substantial impact to the island's cultural resources. While incidental collection of cultural resources could affect cultural resources on the island, personnel would be briefed on the penalties that could be incurred if sites are damaged or destroyed; therefore, no impacts from proposed activities are anticipated.

The potential for damage to an existing historical structure from falling debris or from a missile due to a launch abort or launch mishap is considered remote because of the unlikely possibility of a launch abort or mishap. For these reasons, significant impacts to cultural resources are not expected.

4.3.4.3 Post Flight Test Activities

As mentioned in section 4.1.3.3, once THAAD activities are concluded, all mobile equipment/assets would be removed from the site. Specific restoration actions, if necessary, would be determined on a case-by-case basis.

4.3.4.4 Cumulative Impacts

Personnel would be instructed of the sensitivity and the penalties that could occur if these sites are damaged or destroyed. Known cultural resources would be avoided. Compliance with current Wake procedures would minimize the potential for cumulative impacts from THAAD flight tests in combination with activities discussed in section 2.6.

4.3.5 GEOLOGY AND SOILS—WAKE ISLAND

Some evaluative criteria for impacts to this resource are discussed in the PMRF section. The Alternative Action could result in geology and soils impacts as a result of ground disturbance during construction activities and potential contamination of exhaust products and debris from missile launches.

4.3.5.1 Site Preparation Activities

As determined in the Wake Island EA, the minimal site preparation that would be required to support target missile launches from the island would not result in any significant impact to island soils (U.S. Army Space and Strategic Defense Command, 1994a).

4.3.5.2 Flight Test Activities

No significant deposition of rocket motor emission products would occur from nominal launches during dry weather. As described above, hydrogen chloride and aluminum oxide would be deposited if launches of solid propellant targets were conducted during a period of rain; however, the majority of these emission products would rapidly infiltrate into the soil and migrate to the sea environment where they would be diluted and buffered to a level that would not significantly affect the environment. Minor amounts of aluminum oxide may be complexed into the carbonate soil, but this is expected to pose no impact.

Nominal launches of liquid targets would primarily produce nitrogen, carbon monoxide, carbon dioxide, and water. These gases and water vapor are not expected to adversely alter soil chemistry. Depending on the amount of liquid propellant or oxidizer released, soils contaminated during a mishap may require removal to prevent subsequent explosion or fire.

In the event of an early flight termination, burning fuel and tributyl phosphate, if a simulant is used, may reach the ground. If solid fuel continues to burn it may start fires.

Controlling fires may require ground-disturbing activities in the LHA. Identifiable unburned fuel or residual burned fuel would be recovered if practicable. The impact of this activity is expected to be minimal and short-term. The recovered fuel and residue would be disposed of following standard Wake Island Launch Complex waste management procedures.

4.3.5.3 Post Flight Test Activities

Adverse impacts to soils other than slight compaction are unlikely to occur as a result of removal of all mobile equipment/assets associated with THAAD flight tests brought to the range. Transportation for removal of this equipment would be the same as when it was brought into the installation.

4.3.5.4 Cumulative Impacts

In the unlikely event that debris associated with a launch failure landed on the island, the debris would be removed, thus posing no cumulative impact. No substantial accumulation

of emission products would occur in the soil. No cumulative impacts to geology and soils are predicted as a result of THAAD flight tests in combination with those activities discussed in section 2.6.

4.3.6 HAZARDOUS MATERIALS AND WASTE—WAKE ISLAND

Some evaluative criteria for impacts to this resource are discussed in the PMRF section. Hazardous materials and waste management at the Wake Island Launch Complex is described in section 3.2.6.

4.3.6.1 Site Preparation Activities

Solid fueled and/or liquid fueled target missiles may be used at the Wake Island Launch Complex. Fuel for target missiles will comprise the largest amount of hazardous materials. Fuel for solid fuel target missiles are explosives, and the missiles are shipped fueled. Propellants (fuels and oxidizers) for liquid fueled target missiles are also hazardous materials. Liquid fuels are flammables, typically kerosene-type materials of petroleum or coal origin. Oxidizers may be IRFNA or hydrogen peroxide, and are extremely corrosive bases. Liquid fueled target missiles would be fueled prior to launch at the Wake Island Launch Complex. Fuel and oxidizer are loaded in separate operations to preclude contact.

If liquid fueled target missiles are used at the Wake Island Launch Complex, propellants (fuels and oxidizers) for liquid fueled target missiles will be transported to the Wake Island Launch Complex and stored until fueling operations are performed. Response to any spill that may occur will be addressed in accordance with the spill response plan prepared by the THAAD element for the specific missile used, with support from the Wake Island Launch Complex Fire Department. Spill cleanup materials will be containerized and shipped to Hawaii for disposal.

Small quantities of solvents and cleaning materials may be required during preparation and launch activities. Such materials would be similar to hazardous materials already in use at Wake Island Launch Center and would be transported to the island, stored and distributed through existing standard requirements. The small quantities that could be associated with site preparation activities such as installation of a second launch stool would not represent a substantial increase over the quantities of materials currently used.

All storage areas for hazardous materials or wastes would have spill containment structures. Existing spill prevention procedures would be implemented to further decrease the risk of accidental release of potentially hazardous substances to the environment. The disposal of hazardous waste would be in accordance with applicable U.S. laws and regulations.

Construction of new facilities, if required, would be conducted in accordance with the U.S. Army Corps of Engineers Safety and Health Requirements Manual. The hazardous materials used and hazardous waste generated from construction activities would be minor

and handled in accordance with applicable regulations. All construction activities would follow a spill control plan.

4.3.6.2 Flight Test Activities

Minimal quantities of hazardous waste would be produced by launch activities and would mostly consist of materials such as used or excess solvents and cleaners. These materials are similar to wastes already generated and handled at Wake Island. Management of this waste is the responsibility of the THAAD element and would be accomplished within the existing waste management system in accordance with applicable regulatory requirements. The small quantities of waste that could be generated would not represent a significant increase in the amount of hazardous waste currently generated and no significant impacts from hazardous materials or wastes would be expected.

During launches of either solid or liquid propellant missiles there is the potential for a mishap to occur resulting in potentially hazardous debris and propellants falling within the ground hazard area. As addressed for previous launch programs on Wake Island, the hazardous materials that result from a flight termination would be cleaned-up and any contaminated areas remediated. All hazardous waste generated in such a mishap would be disposed of in accordance with appropriate regulations. Overall, no adverse impacts would result from hazardous materials used or hazardous waste generated under the Alternative Action.

4.3.6.3 Post Flight Test Activities

At the conclusion of testing activities all mobile equipment/assets brought to the range would be removed. All permanent facilities constructed in support of THAAD testing would remain and become part of the range's infrastructure and would be maintained per their operating procedures. Specific restoration actions, if necessary, would be determined on a case-by-case basis in coordination with existing procedures.

Adherence to the existing hazardous materials and waste management systems on Wake Island would preclude the potential accumulation of hazardous materials or waste. The base has implemented an emergency response procedure that would aid in the evaluation and cleanup of any hazardous materials released.

4.3.6.4 Cumulative Impacts

The Alternative Action would require minimal amounts of hazardous materials, and all hazardous waste would be shipped off island. No cumulative impacts to hazardous materials and waste management are predicted as a result of THAAD flight tests in combination with those activities discussed in section 2.6.

4.3.7 HEALTH AND SAFETY—WAKE ISLAND

Some evaluative criteria for impacts to this resource are discussed in the PMRF section. The Alternative Action at Wake has the potential to impact worker safety during

construction activities as well as personnel safety related to the transport, storage, launch, and intercept of the THAAD missiles.

4.3.7.1 Site Preparation Activities

THAAD preflight activities, including the transportation and storage of potentially hazardous materials, are considered to be routine operation and would be conducted in accordance with applicable U.S. Army and Occupational Safety and Health Administration health and safety regulations. No substantial health and safety impacts are expected.

4.3.7.2 Flight Test Activities

Missile launch operations within the military have been conducted for many years. Safety requirements have been developed based upon U. S. Army and other applicable health and safety regulations. While risks associated with launch activities will always be present, the use of standard safety procedures minimize the risks.

THAAD testing activities would not entail any increased hazards, since these activities are considered to be a routine and safe operation. During missile fueling, personnel would be required to wear appropriate protective clothing. In the event of an accident, there is the potential for hazards associated with debris impact, explosion, and release of potentially toxic combustion products. In accordance with the Range Safety Manual, an LHA would be established around the launch facility. Any essential personnel inside this area would remain within facilities rated to provide adequate blast protection. All non-essential personnel would be evacuated to outside the impact limit line. Therefore, the risk of a health and safety impact resulting from such a failure is not considered substantial.

Proposed activities associated with the MDA test program could include packaging of simulants within sub-munitions, transportation of simulants and sub-munitions, laboratory and outdoor testing, and disposal of any wastes produced as a result of test activities. Handling procedures for the simulants would follow material safety data sheet recommendations or other appropriate task-specific guidance. Although potential human health effects may result from exposure to any chemical (or simulant), these simulants are safe to use under existing, established laboratory, range, and installation operating procedures. Any hazardous materials used in testing would be handled and disposed of in accordance with existing compliant procedures.

4.3.7.3 Post Flight Test Activities

No health and safety impacts are expected from the removal of mobile equipment/assets brought to the range for THAAD testing activities. Removal activities would be considered routine and would be conducted under a standard of care considered appropriate for such procedures.

4.3.7.4 Cumulative Impacts

The increased use of liquid propellants, explosives, and other prelaunch activities would represent a small increase in the potential safety risk at Wake. No cumulative impacts to health and safety are predicted as a result of THAAD flight tests in combination with those activities discussed in section 2.6.

4.3.8 INFRASTRUCTURE—WAKE ISLAND

Some evaluative criteria for impacts to this resource are discussed in the PMRF section.

4.3.8.1 Site Preparation Activities

The Alternative Action would require minimal routine launch preparation activities, which are expected to have no impact to infrastructure.

4.3.8.2 Flight Test Activities

If the Alternative Action is implemented, the number of personnel on the island would increase during THAAD test activities, but proper scheduling and coordination of activities would prevent the island's accommodations and infrastructure from being overtaxed. During mission surges, the island population can reach 250, but normally averages 120 transient personnel. Water conservation practices would continue to be implemented. The paved roadway network on Wake has been adequately maintained to move equipment and personnel. Currently one flight is scheduled every other week to transport passengers and cargo; however, all aircraft operations and service activities are directed from base operations, which is manned 24 hours a day.

4.3.8.3 Post Flight Test Activities

At the conclusion of testing activities, THAAD program personnel would remove all mobile equipment/assets brought to the range. Permanent facilities would be left in place for use in future programs. No impacts to infrastructure are anticipated.

4.3.8.4 Cumulative Impacts

Different missile test programs may have ongoing activities at Wake Island Launch Center at the same time. The scheduling coordinator at USASMDC would ensure that adequate facilities are available for all personnel. Even with different test programs present at Wake Island Launch Center simultaneously, sufficient housing, utilities, and transportation would be available without stressing the infrastructure, which is capable of supporting at least 300 transient personnel. No cumulative impacts to infrastructure are predicted as a result of THAAD flight tests in combination with those activities discussed in section 2.6.

4.3.9 LAND USE—WAKE ISLAND

Some evaluative criteria for impacts to this resource are discussed in the PMRF section.

4.3.9.1 Site Preparation Activities

The Alternative Action would involve minimal routine launch preparation activities to launch target missiles with no expected impact to current land use.

4.3.9.2 Flight Test Activities

The utilization of the existing facilities on Wake Island to launch target missiles would not change the overall land use and management of the island. The island would continue to be used for missile testing and research. The Alternative Action is entirely consistent with the island's mission and would not conflict with any land use plans, policies, or controls for the island. The establishment and activation of an LHA would require the temporary clearance of the adjoining Pacific Ocean to the south of the launch pads. Temporary clearance of this LHA would have no impacts on recreational or commercial use of these waters since commercial fishermen do not use the area off Wake Island and any recreational use by island residents (all of whom work for the U.S. Government) is limited.

4.3.9.3 Post Flight Test Activities

At the conclusion of testing activities, THAAD program personnel would remove all mobile equipment/assets brought to the range. Permanent facilities would be left in place for use in future programs. No impacts to land use are expected.

4.3.9.4 Cumulative Impacts

Since the Alternative Action would be using existing facilities and all missile flight tests must be scheduled and approved by the USAKA Safety Office, the possibility of substantial adverse, land use impacts from THAAD-related activities is unlikely. No cumulative impacts to land use are predicted as a result of THAAD flight tests in combination with those activities discussed in section 2.6.

4.3.10 NOISE—WAKE ISLAND

Some evaluative criteria for impacts to this resource are discussed in the PMRF section.

4.3.10.1 Site Preparation Activities

Site preparation on Wake Island would be minimal and temporary in nature. Noise generated during site preparation should have minimal impact to personnel.

4.3.10.2 Flight Test Activities

The Wake Island EA used analysis for launch vehicle noise predictions for targets, which was based upon empirical data from both solid- and liquid-fueled rocket motors to determine the maximum sound levels produced. It was determined that at the launch site the noise level could reach 120 dB, main base buildings would be subjected to maximum levels between 105 and 110 dB, and base housing would experience maximum levels

between 100 and 105 dB. These maximum levels would last for several seconds and then taper off as the vehicle moves away from the launch site.

Also of concern are sonic booms that would occur with each launch after the rocket exceeds the speed of sound. However, any sonic boom would be directed toward the front of the vehicle downrange of Wake Island over the Pacific Ocean.

4.3.10.3 Post Flight Test Activities

Noise generated during removal of all mobile equipment/assets brought to the island would be a routine occurrence that would have only a minimal impact to personnel.

4.3.10.4 Cumulative Impacts

Noise from the proposed minor site preparation activities would be short-term and not substantially above background noise levels. Noise generated from target launches would also be short-term, lasting approximately 1 minute, and the same intensity as other launches that typically occur at Wake Island Launch Center. No cumulative impacts to noise are predicted as a result of THAAD flight tests in combination with those activities discussed in section 2.6 since the construction and launch noise is not continuous and personnel would be provided with hearing protection.

4.3.11 SOCIOECONOMICS—WAKE ISLAND

Some evaluative criteria for impacts to this resource are discussed in the PMRF section. Because of the Island's location, socioeconomic issues are essentially confined to the availability of housing. Demographic, employment, income, and fiscal impacts are not factors.

4.3.11.1 Site Preparation Activities

Transient personnel required for site preparation activities would be housed in existing billets, in which 150 rooms (which sleep two persons per room) are available, which can more than accommodate the limited and temporary increase in transient personnel. Consequently, no impact to housing and thus to socioeconomic resources is anticipated.

4.3.11.2 Flight Test Activities

Flight testing activities would require up to 50 temporary duty personnel per launch event. These personnel would be housed in existing billets, which can more than accommodate the limited and temporary increase in transient personnel. Therefore, no impact to housing and thus to socioeconomic resources is anticipated from flight test activities.

4.3.11.3 Post Flight Test Activities

Approximately 15 temporary duty personnel would remain on Wake Island for post-flight activities. These personnel would continue to be housed in existing billets. No impact to housing and thus to socioeconomic resources is anticipated.

4.3.11.4 Cumulative Impacts

Proper scheduling by the Wake coordinator would prevent the island's housing and other accommodations from being overtaxed. No cumulative impacts to socioeconomics are predicted as a result of THAAD flight tests in combination with those activities discussed in section 2.6.

4.3.12 WATER RESOURCES—WAKE ISLAND

Some evaluative criteria for impacts to this resource are discussed in the PMRF section.

4.3.12.1 Site Preparation Activities

No hazardous materials or hazardous waste would be stored in the vicinity of the water catchment area. Groundwater on Wake is limited, of poor quality, and only used for nonpotable purposes. An accidental spill or release of fuels or hazardous materials during handling or storage could adversely impact water resources. However, handling and storage of such materials is considered routine at Wake and utilization of standard operating procedures would minimize the occurrence of such an event. Containment berms around storage areas and implementation of best management practices during handling and storage of materials would restrict any such release or spill to a small localized area near the source and reduce the significance of any potential impact to water resources.

4.3.12.2 Flight Test Activities

The limited quantities of any hazardous waste that could be produced by launch activities would consist mostly of used or excess solvents and cleaners and would not represent a substantial increase in the quantities of hazardous waste currently generated. Existing spill prevention procedures would be implemented to decrease the risk of accidental release of potentially hazardous substances to water resources and containment berms would be placed around storage areas.

Debris from on-pad failure or explosion could adversely impact water resources. However, implementation of launch standard operating procedures would reduce the potential for on-pad failure or explosion and thus the potential risk of impact to water resources.

4.3.12.3 Post Flight Test Activities

All mobile equipment/assets brought to Wake Island would be removed at the conclusion of THAAD testing activities. All permanent facilities constructed to support THAAD

testing would remain. The removal of mobile equipment and maintenance of remaining structures would be conducted according to existing standard operating procedures under a standard of care considered routine at Wake and is not expected to adversely impact water resources.

4.3.12.4 Cumulative Impacts

It is anticipated that the launches under the Alternative Action, when combined with the activities discussed in section 2.6, would not result in any cumulative impacts to the limited water resources on Wake or the sanitary septic field located adjacent to the launch area. The amount of exhaust products from the proposed THAAD launches that could potentially be deposited would be small and the emissions are dispersed rapidly by the strong prevailing winds.

4.4 BIGEN, AUR ATOLL

Activities for THAAD-related flight testing would be the same as or similar to those analyzed in the USAKA Temporary ETR EA.

4.4.1 AIR QUALITY—BIGEN, AUR ATOLL

Some evaluative criteria for impacts to this resource are discussed in the PMRF section. Potential issues related to the air quality of the area around Bigen include compliance with UES air quality standards for criteria pollutants released during proposed activities by major stationary sources. Air quality at Bigen could be impacted by launch emissions.

4.4.1.1 Site Preparation Activities

Re-establishment of the target launch site would require the movement of mobile equipment onto and around Bigen. According to the USAKA Temporary ETR EA, no impacts to air quality were anticipated from the original establishment of the launch site.

4.4.1.2 Flight Test Activities

Potential impacts to air quality would include combustion emissions from portable generators, exhaust products from the target missile, and plumes of volatilized liquid propellants from accidental spills. The USAKA Temporary ETR EA determined that for both a nominal launch and an early flight termination of an LPT the 1-hour NAAQS (accepted as applicable under the UES) for carbon monoxide would not be exceeded for distances equal to or greater than 1 kilometer (0.6 mile). The nearest inhabited island to Bigen is Tabal, which is 12 kilometers (7.5 miles) away, not downwind, and would not be affected.

The USAKA Temporary ETR EA also determined that areas that may experience concentrations equal to or greater than emergency exposure levels from spills of full containers of liquid fuel (200 liters [55 gallons]) and oxidizer (800 liters [200 gallons])

would extend approximately 90 meters (300 feet) and 0.8 kilometer (0.5 mile) respectively. Only essential personnel would be on Bigen or on boats in the nearby waters during project activities. These personnel would follow health and safety measures appropriate to handling liquid fuels and oxidizers, which would minimize the potential for spills.

4.4.1.3 Post Flight Test Activities

Post flight test activities would include the removal of all mobile equipment/assets brought to the island. This removal could result in small amounts of localized fugitive dust (particulate matter), which would have a minor impact to air quality.

4.4.1.4 Cumulative Impacts

Missile launches and the use of launch support equipment are air pollution sources that are brief and discrete events in time. Air pollutants would not accumulate at Bigen because winds would effectively disperse them between the limited number of launches from activities discussed in section 2.6.

4.4.2 AIRSPACE—BIGEN, AUR ATOLL

Some evaluative criteria for impacts to this resource are discussed in the PMRF section.

4.4.2.1 Site Preparation Activities

Site preparation activities on Bigen could involve additional flights in and out of Bucholz Army Airfield on Kwajalein. The Alternative Action would not restrict access to, nor affect the use of, existing airfields and airports in the ROI. Operations at the airfield would continue unhindered. Similarly, the existing airfield or airport arrival and departure traffic flows would not be affected. Access to the airfield would not be curtailed. All arriving and departing aircraft and all participating military aircraft are under the control of the Bucholz Army Airfield Control Tower, thus there would be no airfield conflicts in the ROI under the Alternative Action, and no impact.

4.4.2.2 Flight Test Activities

The proposed flight trajectory from Bigen north-northwest to the broad ocean area east of USAKA or inside the Kwajalein Mid-atoll Corridor is north of the Pacific oceanic air route between Majuro Atoll and Kwajalein. It is also well to the northwest of the air routes between Kwajalein and Pohnpei and Kosrae. Target missiles launched from Bigen in a northwest direction would be in compliance with the DoD Directive that specifies that missile firing areas be selected so that trajectories are clear of established oceanic air routes or areas of known surface or air activity.

Bigen is located under international airspace and therefore has no formal airspace restrictions governing it. NOTAMs would be sent prior to launches from Bigen. Nonparticipating aircraft would be advised to avoid the tracking radar areas and the associated EMR emissions.

4.4.2.3 Post Flight Test Activities

Additional flights required as part of the post flight test activities on Bigen would not restrict access to, nor affect the use of, existing airfields and airports in the ROI. Operations at airfield would continue unhindered. Existing airfield or airport arrival and departure traffic flows would also not be affected and access to the airfield would not be curtailed. All arriving and departing aircraft and all participating military aircraft are under the control of the Bucholz Army Airfield Control Tower, thus there would be no airfield conflicts in the ROI under the Alternative Action, and no impact.

4.4.2.4 Cumulative Impacts

Since all arriving and departing aircraft are under the control of the Bucholz Army Airfield Control Tower, no cumulative impacts to airspace scheduling from the limited number of launches from activities discussed in section 2.6 are anticipated.

4.4.3 BIOLOGICAL RESOURCES—BIGEN, AUR ATOLL

Some evaluative criteria for impacts to this resource are discussed in the PMRF section. Potential impacts of site preparation and missile launches on terrestrial and marine biological resources within the Bigen ROI were addressed in detail in the USAKA Temporary ETR EA. Based on the prior analysis done and the effects of past target launch activities, the potential impacts of activities related to test flights of target missiles in support of THAAD flight tests on biological resources are expected to be minimal, as discussed below.

Biological resources on and in the vicinity of Bigen could be impacted mainly by launches of target missiles. The primary proposed activities that may have a potential effect on the vegetation and wildlife of Bigen include preflight activities, vehicle fueling, and launch of the target missile.

4.4.3.1 Site Preparation Activities

Vegetation

Equipment and materials would be transported to the temporary launch site using either an existing path through the interior of the island or the beach area. Use of the interior island path may require additional transplantation of coconut palm seedlings.

Vegetation within the LHA was originally cleared in areas maintained by the Marshallese as a copra plantation for safety and to establish line-of-sight communication with the LCU during prior target missile launches (U.S. Army Space and Strategic Defense Command, 1995b). Any additional clearing operations would be no different from the maintenance activities normally performed at the site by the Marshallese.

Utility lines between the support site and the temporary launch site would again be placed on the ground or hung from trees in a non-intrusive manner along the established pathway and completely removed at the conclusion of the project as required for earlier launches.

Wildlife

Site preparation noise and the increased presence of personnel could affect wildlife within the area. The combination of increased noise levels and human activity would likely temporarily displace some wildlife within a 15-meter (50-foot) radius of the construction site. However, wildlife species are limited to skinks, birds such as the fairy tern, white tern, and brown noddy, and crabs. Additional habitat is adjacent to the areas proposed for use by the THAAD program.

Threatened and Endangered Species

The area on the northern shore of the island where disturbed sea turtle nests were observed would be avoided. No other threatened or endangered species have been identified on Bigen.

Environmentally Sensitive Habitat

As discussed in the USAKA Temporary ETR EA, the reef flat surrounding Bigen is an active ecosystem with very little recent coral growth or marine life. This lack of growth may be due to a build-up of natural siltation. Any additional siltation from project activities would be minimal. Should excessive siltation result from project activities, those activities would be halted while appropriate silt screens were installed. Standard operating procedures at the USAKA call for the use of one or two silt curtains or scheduling of the activities during conditions when the silt curtain would be most effective (U.S. Army Space and Strategic Defense Command, 1995b).

4.4.3.2 Flight Test Activities

Vegetation

All vehicle fueling operations and minor mechanical repairs would be performed on impermeable barriers using containment measures routinely used by USAKA. Spill control kits would be available on Bigen and bulk fuel would be stored aboard the LCU. However, as described in the USAKA Temporary ETR EA, empty bulk liquid storage containers would be placed on the island for use in the event that de-fueling of the LPT vehicle became necessary. Defueling would use a closed-loop system and would occur on an impermeable surface. In the event of a leak or spill, the material would be collected, containerized, and transported to Kwajalein for disposal in accordance with the UES.

Fire from a launch mishap or early flight termination could impact vegetation near the launch site. However, there is very little ground cover near the proposed launch sites, and the Marshallese maintain the area with frequent controlled burns.

Wildlife

Launch noise and the increased presence of personnel could affect wildlife within the area. The combination of increased noise levels and human activity would likely displace some wildlife. However, additional habitat adjacent to the areas proposed for use by the THAAD element is available to the limited wildlife species on the island. Birds acclimate quickly to most non-constant noises in their environment and after an initial flushing return to their nest. Other wildlife also typically exhibits a momentary startle effect.

Threatened and Endangered Species

The LHA extends into the ocean area several hundred meters (feet) where federally protected sea turtles might be found. Of the internationally protected species, sea turtles and marine mammals would have the greatest risk, although remote, of incidental impact from falling missile debris in the booster drop area or in the event of an aborted flight. No impacts are expected to the sea turtle nesting areas on the northern shore of the island. The likelihood that debris from a spent booster or terminated launch would strike a sea turtle or marine mammal is remote since the potential for a launch mishap is small and the marine species tend to be widely scattered.

Environmentally Sensitive Habitat

There is potential for the reef flat adjacent to the candidate launch sites to be affected in the event of a mishap; however, the reef system is not extensive, and there is very little evidence of coral growth or marine activity.

4.4.3.3 Post Flight Test Activities

Removal of the mobile equipment/assets brought to the island would result in impacts similar to, but less than, those caused by site preparation. Specific restoration activities, if necessary, would be determined on a case-by-case basis.

4.4.3.4 Cumulative Impacts

The limited amount of construction planned on Bigen would not likely result in cumulative impacts to biological resources. No significant cumulative impacts to biological resources have been identified as a result of prior launch-related activities from Bigen. The Alternative Action when combined with current and proposed launch activities discussed in section 2.6 would be performed at varying times on Bigen and should have negligible cumulative impacts on biological resources.

4.4.4 CULTURAL RESOURCES—BIGEN, AUR ATOLL

Some evaluative criteria for impacts to this resource are discussed in the PMRF section. Activities on Bigen would be coordinated with the RMI Historic Preservation Office and conducted in accordance with RMI guidance.

4.4.4.1 Site Preparation Activities

Site preparation would require minimal ground disturbance associated with re-establishing the temporary launch site. No historic structures are present on the island. No impacts to cultural resources are expected.

4.4.4.2 Flight Test Activities

Personnel would be informed of the sensitivity of cultural resources and the types of penalties that could be incurred if sites are damaged or destroyed. If during operations cultural items are discovered, activities would cease in the immediate area and the proper authorities would be notified through RTS. Subsequent actions would follow the guidance provided.

4.4.4.3 Post Flight Test Activities

As mentioned in section 4.1.3.3, once THAAD activities are concluded all mobile equipment/assets would be removed from the site. Specific restoration actions, if necessary, would be determined on a case-by-case basis.

4.4.4.4 Cumulative Impacts

The Alternative Action when combined with current and proposed launch activities discussed in section 2.6 would be performed at varying times on Bigen and should have negligible cumulative impacts on cultural resources. Personnel would be informed of the sensitivity of cultural resources and the types of penalties that could be incurred if sites are damaged or destroyed.

4.4.5 GEOLOGY AND SOILS—BIGEN, AUR ATOLL

Some evaluative criteria for impacts to this resource are discussed in the PMRF section. The Alternative Action could result in geology and soils impacts as a result of ground disturbance during site preparation activities and potential contamination of exhaust products and debris from missile launches.

4.4.5.1 Site Preparation Activities

Adverse impacts to soils are unlikely to occur as a result of necessary prelaunch activity. Any soil disturbance would be temporary and confined to the immediate launch area. Best Management Practices would be used to reduce the potential for soil degradation.

4.4.5.2 Flight Test Activities

The launching of target missiles potentially has the ability to emit fuel residues, or create spills that may contaminate the soil in the vicinity of the test launch. However, all vehicle fueling operations and minor mechanical repairs would be performed on impermeable

barriers using containment measures. Spill control kits would be available on Bigen, and bulk fuel would be stored aboard the LCU.

4.4.5.3 Post Flight Test Activities

Adverse impacts to soils, other than slight compaction, are unlikely to occur as a result of the removal of all mobile equipment/assets brought to the island.

4.4.5.4 Cumulative Impacts

The Alternative Action when combined with current and proposed launch activities discussed in section 2.6 would be performed at varying times on Bigen and should have negligible cumulative impacts on geology and soils.

4.4.6 HAZARDOUS MATERIALS AND WASTE—BIGEN, AUR ATOLL

Some evaluative criteria for impacts to this resource are discussed in the PMRF section. Hazardous materials and hazardous waste generated at Bigen will be managed in accordance with the USAKA UES, as described in section 3.4.6.

4.4.6.1 Site Preparation Activities

Under the Alternative Action, a temporary launch site would be re-established on Bigen for the launch of target missiles. Construction of the temporary launch site would not likely result in the release of a potentially hazardous material or waste. Construction of the launch area would be conducted in accordance with the U.S. Army Corps of Engineers Safety and Health Requirements Manual (1996).

Routine procedures established in accordance with applicable federal, UES, U.S. Army safety regulations, and U.S. Air Force regulations for handling and storing LPTs would be followed in handling and storage of the missile prior to launch. The proper handling and use of many types of cleaning solvents are routine in many types of military operations, including field exercises at primitive locations. In the case of prelaunch activities for target missile systems, the cleaning solvents would be employed in tasks addressed under standard operating procedures and Kwajalein Environmental Emergency Plan. Motor fuels are also handled routinely during military activities world-wide. Storage would be accomplished using existing containers, and transfers accomplished using standard pumping and fueling equipment. All fueling operations would be accomplished on impermeable barriers designed to collect all spills, to prevent any release to the environment.

4.4.6.2 Flight Test Activities

For normal launch operations there would be no handling of liquid propellants, nor any release/collection of propellants. Certain emergency actions may occur which would require the defueling of a target missile. Spill control kits would be present on Bigen, and a Spill Prevention and Response Plan would be formulated and implemented if necessary.

Unloaded propellants would be containerized into approved containers. Propellant transfers would occur on a non-permeable surface, and all spills/wastes would be collected and containerized.

Except for immediately reusable propellants, all containerized materials/wastes would be loaded aboard the transporting LCU for removal to Kwajalein for appropriate disposal.

Emergency response personnel trained in the appropriate procedures to handle these materials will be on stand by should a mishap occur. All personnel involved in these operations would wear protective clothing and receive specialized training in spill containment and cleanup.

As addressed in the USAKA Temporary ETR EA for previous launch programs on Bigen, any hazardous materials that result from a flight termination would be recovered from land and lagoon areas. All hazardous waste generated in such an event would be disposed of in accordance with appropriate regulations. Overall, no adverse impacts would result from hazardous materials used or hazardous waste generated under the Alternative Action.

4.4.6.3 Post Flight Test Activities

At the conclusion of testing activities, THAAD program personnel would remove all mobile equipment/assets brought to the range. Transportation for removal of THAAD equipment would be the same as when it was brought into the installation. Specific restoration actions, if necessary, would be determined on a case-by-case basis.

Adherence to the existing hazardous materials and waste management systems on Bigen would preclude the potential accumulation of hazardous materials or waste.

4.4.6.4 Cumulative Impacts

The Alternative Action when combined with current and proposed launch activities discussed in section 2.6 is not expected to result in cumulative hazardous material or hazardous waste impacts. Unused materials and wastes would be shipped back to USAKA for disposition in accordance with the UES, as described in section 3.4.6. Should a spill occur and complete cleanup not be possible at the time of occurrence, remediation would be performed in consultation with the RMI government, utilizing the UES as the basic requirements document. A liquid fuel spill could result in residual contamination; however, an oxidizer spill would probably quickly react with the sand (principally calcium carbonate from coral, sea shells, etc.) that comprises the island surface and not result in residual contamination.

4.4.7 HEALTH AND SAFETY – BIGEN, AUR ATOLL

Some evaluative criteria for impacts to this resource are discussed in the PMRF section.

4.4.7.1 Site Preparation Activities

As described in the USAKA Temporary ETR EA, hazardous site preparation activities would involve transportation of missile components to Bigen and pre-launch set-up. All handling and use of explosive materials under the jurisdiction of RTS, such as operations at Bigen, must be conducted in accordance with the requirements of RTS Regulation 385-75, *Explosive Safety*. This regulation specifies that all operations involving explosives (including packaging and handling for movement) would require implementation of a written procedure, which has been approved by the USAKA Safety Office. These procedures must specify adequate means for preventing static electrical build-up/discharge, fire safety, and handling techniques to prevent accidental detonation/ignition of the explosives.

In accordance with 385-75, all operations involving the handling of explosives must be conducted under the supervision of an approved ordnance officer, and all personnel involved must be explosive-certified. All storage and handling of explosives is required to take place in facilities or locations designed to handle explosives and which have been sited in accordance with the requirements of 385-75. The regulation specifies the required explosive safety quantity-distances for each facility to ensure safety in the event of explosion, based upon the maximum quantity of explosive material permitted for the facility. This will serve to prevent propagation of explosions to nearby facilities where explosives are also stored.

As described in the USAKA Temporary ETR EA, all LPT fueling operations would be completed at Meck prior to transport to Bigen for launch. Fueled target missiles would be handled in accordance with approved standard operating procedures. Such handling is routinely accomplished and would not be expected to present a significant potential for fuel release. Fuel handling at Bigen would be accomplished only in rare, emergency situations. All handling would be accomplished in accordance with standard operating procedures intended to ensure the safety of all personnel at the fuel transfer location.

4.4.7.2 Flight Test Activities

During launch there is the potential for missile malfunction, resulting in explosion, fire, and debris impact in the vicinity of the launch site. To provide protection for mission-essential personnel involved in launch operations, all launch activities occurring at Bigen would require the establishment of LHAs for each test flight mission. Safety requirements during launch activities at Bigen would require that no Marshallese citizens or unprotected U.S. personnel be on the island during launch activities.

According to the USAKA Temporary ETR EA, for purposes of planning for target missile launch activities, a preliminary LHA radius of 1,500 meters (5,000 feet) for liquid-fuel targets, which provides a sufficient area to encompass any mission-specific LHAs. Launch safety operations on Bigen would follow the general requirements and procedures described above.

4.4.7.3 Post Flight Test Activities

At the conclusion of its testing activities THAAD program personnel would remove all mobile equipment/assets brought to the range. Transportation for removal of equipment would be the same as when it was brought into the installation. Specific restoration actions, if necessary, would be determined on a case-by-case basis. Adherence to the existing health and safety management systems established by RTS on Bigen would preclude potential impacts to personnel.

4.4.7.4 Cumulative Impacts

Safety standards established by RTS are high and would serve to keep the cumulative safety impacts attributable to all THAAD-related operations and activities discussed in section 2.6 within acceptable standards to both workers and the public. The Alternative Action when combined with current and proposed launch activities discussed in section 2.6 would be performed at varying times on Bigen and should have negligible cumulative impacts on health and safety.

4.4.8 INFRASTRUCTURE—BIGEN, AUR ATOLL

Some evaluative criteria for impacts to this resource are discussed in the PMRF section.

4.4.8.1 Site Preparation Activities

According to procedures established in the USAKA Temporary ETR EA, all personnel would live on the LCU or in 10-person man camps. Bottled potable water would be brought ashore by LCM on a daily or as-needed basis. Two portable biological toilets would be installed temporarily. Garbage would be removed by LCM on a daily or as-needed basis. Three 60-kW generators would be used for power.

Existing access routes would be utilized as much as possible. No infrastructure facilities or any established transportation system (water or air) are on the island.

4.4.8.2 Flight Test Activities

No impacts to infrastructure or transportation from Alternative Action activities at Bigen Island would occur since there are no infrastructure facilities or any established transportation system (water or air) on the island.

4.4.8.3 Post Flight Test Activities

When THAAD activities have concluded, personnel will remove all mobile equipment placed at the site. Permanent facilities will be left in place for use in future programs. Equipment related to THAAD test flights would be transported out as it was brought in. Specific restoration actions, if necessary, would be determined on an as-needed basis.

4.4.8.4 Cumulative Impacts

THAAD flight test activities and those currently planned in section 2.6 on Bigen would be scheduled by RTS to avoid the potential for cumulative impacts to available infrastructure.

4.4.9 LAND USE—BIGEN, AUR ATOLL

Some evaluative criteria for impacts to this resource are discussed in the PMRF section.

4.4.9.1 Site Preparation Activities

The Alternative Action would require personnel to occupy Bigen for approximately 30 days for each launch and would involve minimal site preparation activities to establish a temporary launch site for target missiles. Necessary land use agreements have been entered into with the owners of the island.

4.4.9.2 Flight Test Activities

Based on the temporary nature of the launch site, the anticipated minimal disturbance, and the advance notification to land owners, impacts to the land use of the islands would be minor. The establishment and activation of an LHA would require the temporary clearance of the adjoining Pacific Ocean and Aur Lagoon.

4.4.9.3 Post Flight Test Activities

The Alternative Action would involve minimal post flight test activities, which would consist of removal of all mobile equipment/assets brought to the range. Necessary land use agreements have been entered into with the owners of the island, and no impacts are anticipated.

4.4.9.4 Cumulative Impacts

All constructed facilities required for the Alternative Action are temporary and would be removed post flight. Currently no future or ongoing projects exist on Bigen that would have a significant impact on land use when added to the Alternative Action. Therefore, no cumulative impacts are anticipated.

4.4.10 NOISE—BIGEN, AUR ATOLL

Some evaluative criteria for impacts to this resource are discussed in the PMRF section.

4.4.10.1 Site Preparation Activities

Noise generated during re-establishment of the temporary launch sites should have no impact to sensitive noise receptors on Tabal and Aur, the nearest inhabited islands.

4.4.10.2 Flight Test Activities

There are no permanent inhabitants on Bigen. According to the USAKA Temporary ETR EA, noise from the target launches would be barely audible to the nearest noise sensitive communities on Tabal and Aur. Impacts to personnel would be minimized by the use of personal noise protection devices.

4.4.10.3 Post Flight Test Activities

Noise generated during removal of all mobile equipment/assets should have minimal impact to the noise environment on the island.

4.4.10.4 Cumulative Impacts

The Alternative Action when combined with current and proposed launch activities discussed in section 2.6 would be performed at varying times and should have no cumulative noise impacts since there are no permanent inhabitants on Bigen and no impacts have been identified to neighboring islands.

4.4.11 SOCIOECONOMICS—BIGEN, AUR ATOLL

Some evaluative criteria for impacts to this resource are discussed in the PMRF section.

4.4.11.1 Site Preparation, Flight Test, and Post Flight Test Activities

According to procedures established in the USAKA Temporary ETR EA, personnel involved in site preparation, flight test activities, and post flight activities would either commute via small boats to their living quarters on the LCU or live on Bigen in man camps. Bigen landowners could experience a small beneficial socioeconomic impact as a result of the Alternative Action. The temporary duty personnel associated with the Alternative Action would be within the normal fluctuation of transient personnel at USAKA. Substantial income impacts are not anticipated. Confirmed lodging requests on Kwajalein must be scheduled in advance, which minimizes impacts to lodging availability.

4.4.11.2 Cumulative Impacts

The potential for cumulative socioeconomic impacts from the THAAD flight test program in combination with activities discussed in section 2.6 is considered insubstantial due to the temporary nature of the planned activities.

4.4.12 WATER RESOURCES—BIGEN, AUR ATOLL

Some evaluative criteria for impacts to this resource are discussed in the PMRF section.

4.4.12.1 Site Preparation Activities

There is no permanent surface water on Bigen. Potable water for mission personnel would be transported from Kwajalein. Standard methods to control erosion during new construction would limit the potential for impacts to ground or seawater.

4.4.12.2 Flight Test Activities

The release of liquid fuel on Bigen would be the result of an on-pad or early flight failure; however, this would likely result in most or all of the fuel being consumed by combustion before reaching groundwater. Liquid-propellant spill containment kits along with a qualified accident response team would be stationed at the launch site to negate or minimize environmental effects in the unlikely event of an early flight failure.

4.4.12.3 Post Flight Test Activities

Removal of the mobile equipment/assets brought to the island would not impact water resources since there is no permanent surface water on Bigen.

4.4.12.4 Cumulative Impacts

The Alternative Action when combined with current and proposed launch activities discussed in section 2.6 would be performed at varying times on Bigen and should have negligible cumulative impacts to water resources.

4.5 TOTON, WOTJE ATOLL

Launches from Toton would involve the same activities as those described and analyzed in the USAKA Temporary ETR EA and above in section 4.4 for Bigen, Aur Atoll.

4.5.1 AIR QUALITY—TOTON, WOTJE ATOLL

Some evaluative criteria for impacts to this resource are discussed in the PMRF section. Potential issues related to the air quality of the area around Toton include compliance with UES air quality standards for criteria pollutants released during proposed activities. Air quality at Toton could be impacted by site preparation activities and launch emissions.

4.5.1.1 Site Preparation Activities

Construction activities would include establishment of a temporary launch site, including a temporary 30-meter by 30-meter (100-foot by 100-foot) cleared and level launch area. Specific launch and launch control sites have not been identified on Toton. Construction equipment and fugitive dust emissions could be air quality impact concerns.

Air quality impacts would only occur during construction activities and would be localized. There would be no unusual amounts or types of air emission due to construction.

4.5.1.2 Flight Test Activities

Air quality impacts for flight test activities on Toton would be similar to those described in section 4.4.1.2 for Bigen. The nearest inhabited island is Wotje, which is approximately 12 kilometers (10 miles) northeast of Toton.

4.5.1.3 Post Flight Test Activities

There are no known air quality impacts during the post flight test activities.

4.5.1.4 Cumulative Impacts

Missile launches and launch support equipment are air pollution sources that are brief and discrete events. Due to the effective wind dispersion on Toton, air pollutants do not accumulate. The Alternative Action when combined with current and proposed launch activities discussed in section 2.6 would be performed at varying times on Toton and should have no cumulative impacts on air quality.

4.5.2 AIRSPACE—TOTON, WOTJE ATOLL

Some evaluative criteria for impacts to this resource are discussed in the PMRF section. Impacts to airspace above Toton would be the same as described for Bigen airspace in section 4.4.2.

4.5.2.1 Site Preparation Activities

Site preparation activities on Toton could involve additional flights in and out of Bucholz Army Airfield on Kwajalein. All arriving and departing aircraft and all participating military aircraft would be under the control of the Bucholz Army Airfield Control Tower, thus there would be no airfield conflicts in the ROI under the Alternative Action, and no impact.

4.5.2.2 Flight Test Activities

Target missiles launched from Toton in a northwest direction would be in compliance with the DoD Directive that specifies that missile firing areas be selected so that trajectories are clear of established oceanic air routes or areas of known surface or air activity.

Toton is located under international airspace and therefore has no formal airspace restrictions governing it. NOTAMs would be sent prior to launches from Toton. Nonparticipating aircraft would be advised to avoid the tracking radar areas and the associated EMR emissions.

4.5.2.3 Post Flight Test Activities

All arriving and departing aircraft and all participating military aircraft are under the control of the Bucholz Army Airfield Control Tower, thus there would be no airfield conflicts in the ROI under the Alternative Action for equipment/asset removal from Toton, and no impact.

4.5.2.4 Cumulative Impacts

The Alternative Action when combined with current and proposed launch activities discussed in section 2.6 would be performed at varying times on Toton and should have no cumulative impacts on airspace since all arriving and departing aircraft are under the control of the Bucholz Army Airfield Control Tower.

4.5.3 BIOLOGICAL RESOURCES – TOTON, WOTJE ATOLL

Some evaluative criteria for impacts to this resource are discussed in the PMRF section. The potential for impacts to biological resources would be similar to those on Bigen, described in section 4.4.3.

4.5.3.1 Site Preparation Activities

Vegetation

Equipment and materials would be transported to the temporary launch site using either an existing path through the interior of the island or the beach area. Use of the interior island path may require the removal of a small number of trees and/or the transplantation of coconut palm seedlings. The existing pathway extends through a planted and maintained coconut palm plantation.

Utility lines between the support site and the temporary launch site would be placed on the ground or hung from trees in a non-intrusive manner along the established pathway and completely removed at the conclusion of the project as required for earlier launches. No vegetation or habitat would be damaged.

Wildlife

Construction noise and the increased presence of personnel could affect wildlife within the area. The combination of increased noise levels and human activity would likely displace some wildlife within a 15-meter (50-foot) radius of the construction site. However, wildlife species are limited to skinks, birds such as the white tern and brown noddy, and crabs and additional habitat is adjacent to the areas proposed for use by the THAAD element.

Threatened and Endangered Species

No threatened or endangered species have been observed on the island. Personnel visiting Toton should be informed that giant clams are protected in the Marshall Islands and not be allowed to collect or disturb them.

Environmentally Sensitive Habitat

Any siltation from project activities would be minimal. Should excessive siltation result from project activities, those activities would be halted while appropriate silt screens were installed. Standard operating procedures at the USAKA call for the use of one or two silt curtains or scheduling of the activities during conditions when the silt curtain would be most effective (U.S. Army Space and Strategic Defense Command, 1995b).

4.5.3.2 Flight Test Activities

Vegetation

All vehicle fueling operations and minor mechanical repairs would be performed on impermeable barriers using containment measures routinely used by USAKA. Spill control kits would be available on Toton. Bulk fuel would be stored aboard the LCU. However, empty bulk liquid storage containers would be placed on the island for use in the event that defueling of the LPT vehicle became necessary. Defueling would use a closed-loop system and would occur on an impermeable surface. In the event of a leak or spill the material would be collected, containerized, and transported to Kwajalein for disposal in accordance with the USAKA hazardous waste management policy. Fire from a launch mishap or early flight termination could impact vegetation near the launch site. However, vegetation would be cleared near the proposed launch site.

Wildlife

As discussed above, launch noise and the increased presence of personnel could affect wildlife within the area. The combination of increased noise levels and human activity would likely displace some wildlife. However, additional habitat adjacent to the areas proposed for use by the THAAD element on Toton is available to the limited wildlife species on the island. Birds acclimate quickly to most non-constant noises in their environment and after an initial flushing return to their nest. Other wildlife also typically exhibits a momentary startle effect.

Threatened and Endangered Species

As discussed above, very little is known of the numbers and distribution of sensitive marine species, including marine mammals and sea turtles. The LHA extends into the ocean area several hundred meters (feet) where federally protected sea turtles might be found. Sea turtles and marine mammals would have the greatest risk, although remote, of incidental impact from falling missile debris in the booster drop area or in the event of an aborted flight. No sea turtle nesting areas have been observed on the island. The likelihood that debris from a spent booster or terminated launch would strike a sea turtle or marine mammal is remote. While the taking of a protected species would be a significant impact, the probability of such an occurrence is considered remote.

4.5.3.3 Post Flight Test Activities

Removal of the mobile equipment/assets brought to the island would result in impacts similar to, but less than, those caused by site preparation. Specific restoration activities, if necessary, would be determined on a case-by-case basis.

4.5.3.4 Cumulative Impacts

The limited amount of construction planned on Toton would not likely result in cumulative impacts to biological resources. The Alternative Action when combined with current and proposed launch activities discussed in section 2.6 would be performed at varying times on Toton and should have negligible cumulative impacts on biological resources.

4.5.4 CULTURAL RESOURCES—TOTON, WOTJE ATOLL

Some evaluative criteria for impacts to this resource are discussed in the PMRF section. Activities on Toton would be coordinated with the RMI Historic Preservation Office and conducted in accordance with RMI guidance.

4.5.4.1 Site Preparation Activities

Site preparation would require minimal ground disturbance associated with establishing a temporary launch site. No historic structures are present on the island. No impacts to cultural resources are expected. However, if during site preparation, cultural items are discovered, activities would cease in the immediate area and the proper authorities would be notified through RTS. Subsequent actions would follow the guidance provided.

4.5.4.2 Flight Test Activities

As described in section 4.4.4.2, personnel would be informed of the sensitivity of cultural resources and the types of penalties that could be incurred if sites are damaged or destroyed. No impacts to cultural resources are anticipated during operation of the Alternative Action on Toton. However, if, during flight test activities, cultural items are discovered, activities would cease in the immediate area and the proper authorities would be notified through the host installation. Subsequent actions would follow the guidance provided.

4.5.4.3 Post Flight Test Activities

As mentioned in section 4.1.3.3, once THAAD activities are concluded all mobile equipment/assets would be removed from the site. Specific restoration actions, if necessary, would be determined on a case-by-case basis.

4.5.4.4 Cumulative Impacts

The Alternative Action when combined with current and proposed launch activities discussed in section 2.6 would be performed at varying times on Toton and should have

negligible cumulative impacts on cultural resources. Personnel would be informed of the sensitivity of cultural resources and the types of penalties that could be incurred if sites are damaged or destroyed. Also, consultation with the proper authorities would further minimize any cumulative impacts to cultural resources.

4.5.5 GEOLOGY AND SOILS—TOTON, WOTJE ATOLL

Some evaluative criteria for impacts to this resource are discussed in the PMRF section. The Alternative Action could result in geology and soils impacts as a result of ground disturbance during site preparation activities and potential contamination of exhaust products and debris from missile launches.

4.5.5.1 Site Preparation Activities

New construction on Toton would include a minimal 30-meter by 30-meter (100-foot by 100-foot) cleared and leveled launch area.

Adverse impacts to soils are unlikely to occur as a result of new construction or other necessary prelaunch activity. Soils at the proposed launch pads may be subject to minor erosion from the wind during the short construction period. However, soil disturbance would be temporary and confined to the immediate launch area. Best Management Practices would be used to reduce the potential for soil degradation.

4.5.5.2 Flight Test Activities

The launching of target missiles potentially has the ability to emit fuel residues, or create spills that may contaminate the soil in the vicinity of the test launch.

4.5.5.3 Post Flight Test Activities

Adverse impacts to soils, other than slight impaction, are unlikely to occur as a result of the removal of all mobile equipment/assets brought to the island.

4.5.5.4 Cumulative Impacts

The Alternative Action when combined with current and proposed launch activities discussed in section 2.6 would be performed at varying times on Toton and should have no cumulative impacts on geology and soils.

4.5.6 HAZARDOUS MATERIALS AND WASTE—TOTON, WOTJE ATOLL

Some evaluative criteria for impacts to this resource are discussed in the PMRF section. The Alternative Action would include prelaunch set-up and launch of missiles from Toton that would involve the same activities discussed in section 4.4.6. The use of hazardous materials, other than propellants, during these operations would be limited to small amounts of solvent cleaners (e.g., acetone, isopropyl alcohol), and some handling and

storage of motor fuels for use in motor vehicle and/or generator systems. The proper handling and use of such materials are routine in many types of military operations, including field exercises at locations such as Toton. The materials employed in tasks associated with proposed activities would be addressed under the Kwajalein Environmental Emergency Plan and Hazardous Materials Management Plan.

4.5.6.1 Site Preparation Activities

Construction of the temporary launch site would not likely result in the release of a potentially hazardous material or waste. Construction of the launch area would be conducted in accordance with the EM 385-1-1, U.S. Army Corps of Engineers Safety and Health Requirements Manual and the UES.

The target missile systems would arrive at Toton already fueled. Routine procedures established in accordance with applicable federal, state, and U.S. Army safety regulations and U.S. Air Force regulations for handling and storing LPTs would be followed in handling and storage of the missile prior to launch as described in section 4.4.6.1. All fueling operations would be accomplished on impermeable barriers designed to collect all spills, to prevent any release to the environment.

4.5.6.2 Flight Test Activities

For normal prelaunch and launch operations there would be no handling of liquid propellants, nor any release/collection of propellants. Certain emergency actions may occur which would require the defueling of a target missile. Spill control kits would be present on Toton, and a Spill Prevention and Response Plan would be formulated and implemented if necessary. Unloaded propellants would be containerized into approved containers. Additionally, small quantities of waste propellants could be produced during defueling operations due to leakage, post-operation line drainage, and/or small quantity spills. Propellant transfers would occur on a non-permeable surface, and all spills/wastes would be collected and containerized.

Wastes from the small amounts of the hazardous materials used would be containerized in accordance with the Kwajalein Environmental Emergency Plan and Hazardous Materials Management Plan and sent to Kwajalein for final disposition. This is in accordance with the established USAKA policy on hazardous wastes. Recyclable propellants would be transported to Meck for storage pending shipment to the mainland.

The collection and disposal of motor fuels and cleaning solvents are routinely accomplished. It is anticipated that the volume of wastes of liquid rocket propellants would be small, since the high volatility of IRFNA would result in the airborne loss of most spilled material. Any remaining liquid propellants (IRFNA or hydrogen peroxide) would be containerized and handled similarly to motor fuel wastes.

The existing spill plans, emergency response plans, and hazardous materials and hazardous waste plans would be modified to include these materials before they would be used at

Toton. In addition, emergency response personnel trained in the appropriate procedures to handle these materials would be on stand by should a mishap occur. All personnel involved in these operations would wear protective clothing and receive specialized training in spill containment and cleanup.

During launches of either solid or liquid propellant missiles there is the potential for a mishap to occur resulting in missile potentially hazardous debris and propellants falling within the ground hazard area. The hazardous materials that result from a flight termination would be recovered on Toton in the same manner addressed for previous launch programs on Bigen. All hazardous waste generated in such an event would be disposed of in accordance with appropriate regulations. Overall, no adverse impacts would result from hazardous materials used or hazardous waste generated under the Alternative Action.

4.5.6.3 Post Flight Test Activities

At the conclusion of testing activities, THAAD program personnel would remove all mobile equipment/assets brought to Toton. Transportation for removal of THAAD equipment would be the same as when it was brought into the installation. Specific restoration actions, if necessary, would be determined on a case-by-case basis.

Adherence to the existing hazardous materials and waste management systems developed for launches from Bigen would preclude the potential accumulation of hazardous materials or waste. Established emergency response procedure would aid in the evaluation and cleanup of any hazardous materials released.

4.5.6.4 Cumulative Impacts

The Alternative Action when combined with current and proposed launch activities discussed in section 2.6 would be performed at varying times on Toton and should have negligible cumulative impacts on hazardous materials and hazardous waste management on Toton.

4.5.7 HEALTH AND SAFETY—TOTON, WOTJE ATOLL

Some evaluative criteria for impacts to this resource are discussed in the PMRF section.

4.5.7.1 Site Preparation Activities

As described in the USAKA Temporary ETR EA and in section 4.4.7, hazardous site preparation activities would involve transportation of missile components to Toton and pre-launch set-up. All handling and use of explosive materials under the jurisdiction of RTS, such as operations at Toton, must be conducted in accordance with the requirements of RTS Regulation 385-75, *Explosive Safety*.

All LPT fueling operations would be completed at Meck prior to transport to Toton for launch. Fueled target missiles would be handled in accordance with approved standard

operating procedures. Such handling is routinely accomplished and would not be expected to present a significant potential for fuel release. Fuel handling on Toton would be accomplished only in rare, emergency situations. All handling would be accomplished in accordance with standard operating procedures intended to ensure the safety of all personnel at the fuel transfer location.

4.5.7.2 Flight Test Activities

To provide protection for mission-essential personnel involved in launch operations, all launch activities occurring on Toton would require the establishment of LHAs for each test flight mission. Safety requirements during launch activities at Toton would require that no Marshallese citizens or unprotected U.S. personnel be on the island during launch activities.

According to the USAKA Temporary ETR EA, for purposes of planning for target missile launch activities, a preliminary LHA radius of 1,500 meters (5,000 feet) for liquid-fuel targets, which provides a sufficient area to encompass any mission-specific LHAs. Launch safety operations on Toton would follow the general requirements and procedures described above.

4.5.7.3 Post Flight Test Activities

At the conclusion of its testing activities THAAD program personnel would remove all mobile equipment/assets brought to the range. Transportation for removal of equipment would be the same as when it was brought into the installation. Specific restoration actions, if necessary, would be determined on a case-by-case basis. Adherence to the existing health and safety management systems established by RTS on Toton would preclude potential impacts to personnel.

4.5.7.4 Cumulative Impacts

Safety standards established by RTS are high and would serve to keep the cumulative safety impacts attributable to all THAAD-related operations and activities discussed in section 2.6 within acceptable standards to both workers and the public. The Alternative Action when combined with current and proposed launch activities discussed in section 2.6 would be performed at varying times on Toton and should have no cumulative impacts to health and safety.

4.5.8 INFRASTRUCTURE—TOTON, WOTJE ATOLL

Some evaluative criteria for impacts to this resource are discussed in the PMRF section.

4.5.8.1 Site Preparation Activities

Transportation

According to procedures established in the USAKA Temporary ETR EA, all personnel would live on the LCU or in 10-person man camps. Bottled potable water would be brought

ashore by LCM on a daily or as-needed basis. Two portable biological toilets would be installed temporarily. Garbage would be removed by LCM on a daily or as-needed basis. Three 60-kW generators would be used for power.

Existing access routes would be utilized as much as possible. No impacts to infrastructure or transportation from Alternative Action activities on Toton would occur since there are no infrastructure facilities or any established transportation system (water or air) on the island.

4.5.8.2 Flight Test Activities

No impacts to infrastructure or transportation from Alternative Action activities on Toton would occur since there are no infrastructure facilities or any established transportation system (water or air) on the island.

4.5.8.3 Post Flight Test Activities

When THAAD activities have concluded, personnel will remove all mobile equipment placed at the site. Permanent facilities will be left in place for use in future programs. Equipment related to THAAD test flights would be transported out as it was brought in. Specific restoration actions, if necessary, would be determined on an as-needed basis.

4.5.8.4 Cumulative Impacts

THAAD flight test activities and those currently planned on Toton (as described in section 2.6) would be scheduled by RTS to avoid the potential for cumulative impacts to available transportation and infrastructure.

4.5.9 LAND USE—TOTON, WOTJE ATOLL

Some evaluative criteria for impacts to this resource are discussed in the PMRF section.

4.5.9.1 Site Preparation Activities

The Alternative Action would require personnel to occupy Toton for approximately 30 days for each launch and would involve minimal site preparation activities to establish a temporary launch site for target missiles. Necessary land use agreements have been entered into with the owners of the island.

4.5.9.2 Flight Test Activities

Based on the temporary nature of the launch site, the anticipated minimal disturbance, and the advance notification to land owners, impacts to the land use of the islands would be minor. The establishment and activation of an LHA would require the temporary clearance of the adjoining Pacific Ocean and Wotje Lagoon.

4.5.9.3 Post Flight Test Activities

At the conclusion of its testing activities THAAD program personnel would remove all mobile equipment/assets brought to the range. Transportation for removal of equipment would be the same as when it was brought into the installation. Specific restoration actions, if necessary, would be determined on a case-by-case basis.

4.5.9.4 Cumulative Impacts

All constructed facilities required for the Alternative Action are temporary and will be removed post flight. Currently no future or ongoing projects exist on Toton that when added to the Alternative Action would have a significant impact on land use. Therefore, no cumulative impacts are anticipated.

4.5.10 NOISE—TOTON, WOTJE ATOLL

Some evaluative criteria for impacts to this resource are discussed in the PMRF section. Launches from Toton would involve the same activities as those described and analyzed in 4.4.1 for Bigen, Aur Atoll and would have similar effects to sensitive noise receptors.

4.5.10.1 Site Preparation Activities

Construction occurring on Toton would be temporary in nature and similar to any commercial construction site. Noise generated during construction should have a minimal impact.

4.5.10.2 Flight Test Activities

Noise impacts for flight-test activities would be similar to those described in section 4.4.10.2 for Bigen. The nearest noise sensitive communities would be on Wotje, which is approximately 12 kilometers (10 miles) northeast of Toton.

4.5.10.3 Post Flight Test Activities

Noise generated during removal of all mobile equipment/assets should have minimal impact to the noise environment on the island.

4.5.10.4 Cumulative Impacts

Current RTS procedures would be used during launches and operation of noise producing equipment, during both construction and flight test activities, to provide hearing protection to workers for all planned program activities. The Alternative Action when combined with current and proposed launch activities discussed in section 2.6 would be performed at varying times on Toton and should have negligible cumulative noise impacts.

4.5.11 SOCIOECONOMICS—TOTON, WOTJE ATOLL

Some evaluative criteria for impacts to this resource are discussed in the PMRF section.

4.5.11.1 Site Preparation, Flight Test, and Post Flight Test Activities

According to procedures established in the USAKA Temporary ETR EA, personnel involved in site preparation, flight test activities, and post flight activities would either commute via small boats to their living quarters on the LCU or live on Toton in man camps. Toton landowners could experience a small beneficial socioeconomic impact as a result of the Alternative Action. The temporary duty personnel associated with the Alternative Action would be within the normal fluctuation of transient personnel at USAKA. Substantial income impacts are not anticipated. Confirmed lodging requests on Kwajalein must be scheduled in advance, which minimizes impacts to lodging availability.

4.5.11.2 Cumulative Impacts

The potential for cumulative socioeconomic impacts from the THAAD flight test program in combination with activities discussed in section 2.6 is considered insubstantial due to the temporary nature of the planned activities.

4.5.12 WATER RESOURCES—TOTON, WOTJE ATOLL

Some evaluative criteria for impacts to this resource are discussed in the PMRF section.

4.5.12.1 Site Preparation Activities

There is no permanent surface water on Toton. Potable water for mission personnel would be transported from Kwajalein. Standard methods to control erosion during new construction would limit the potential for impacts to ground or seawater.

4.5.12.2 Flight Test Activities

The release of liquid fuel on Toton would be the result of an on-pad or early flight failure; however, this would likely result in most or all of the fuel being consumed by combustion before reaching groundwater. Liquid-propellant spill containment kits along with a qualified accident response team would be stationed at the launch site to negate or minimize environmental effects in the unlikely event of an early flight failure.

4.5.12.3 Post Flight Test Activities

Removal of the mobile equipment/assets brought to the island would not impact water resources since there is no permanent surface water on Toton.

4.5.12.4 Cumulative Impacts

The Alternative Action when combined with current and proposed launch activities discussed in section 2.6 would be performed at varying times on Toton and should have no cumulative impacts to water resources since there is no permanent surface water on the island.

4.6 OPEN OCEAN (FLIGHT TEST CORRIDOR)

THAAD test flights would occur within the large open area of the Pacific Ocean. Missile intercepts in this area would result in only temporary, minor, and very localized emissions. No substantial hazardous materials and waste management impacts are expected since residual fuel and missile components/debris would fall into the ocean where it would be either diluted (fuel) or sink to the bottom as unrecoverable debris (components).

4.6.1 AIRSPACE—OPEN OCEAN (FLIGHT TEST CORRIDOR)

Some evaluative criteria for impacts to this resource are discussed in the PMRF section. Only the proposed test flight operations (land, sea, and air launches) have the potential for impacts to airspace use in the ocean environment. Typically, a missile would be at very high altitude passing through FL 600 (approximately 18,290 meters [60,000 feet]) in just a matter of minutes after launch, and thus well above the airspace subject to the rules and regulations of the ICAO Convention. However, the designation and activation of booster drop areas in the launch corridor could have airspace use impacts.

Special Use Airspace

The airspace in the ROI outside territorial limits lies in international airspace and, consequently, is not part of the National Airspace System. Because the area is in international airspace, the procedures of ICAO, outlined in ICAO Document 444, *Rules of the Air and Air Traffic Services*, are followed. ICAO Document 444 is the equivalent air traffic control manual to FAA Handbook 7110.65, *Air Traffic Control*. The FAA acts as the U.S. agent for aeronautical information to the ICAO, and air traffic in the over-water ROI is managed by the Honolulu and Oakland ARTCCs.

After launch, typically the target missiles would be above FL 600 within minutes of the rocket motor firing. As such, all other local flight activities would occur at sufficient distance and altitude so that the target missile and interceptor missiles would be little noticed. However, activation of the proposed stationary ALTRV procedures, where the FAA provides separation between non-participating aircraft and the missile flight test activities in the Temporary Operating Area, would impact the controlled airspace available for use by non-participating aircraft for the duration of the ALTRV—usually for a matter of a few hours, with a backup day reserved for the same hours. Because the airspace in the Temporary Operating Area is not heavily used by commercial aircraft, and is far removed from the en route airways and jet routes crossing the North Pacific, the impacts to controlled/uncontrolled airspace would be minimal.

For sea-launch target launches, it may be necessary to establish a 3.7-kilometer (2-nautical-mile) radius temporary Warning Area, extending from the surface up to 18,290 meters (60,000 feet) mean sea level above the mobile launch platform. Such a restricted area would marginally reduce the amount of navigable airspace in the Open Ocean ROI, but because the airspace is not heavily used by commercial aircraft, and is far removed from the en route airways and jet routes crossing the North Pacific, the impacts to controlled and uncontrolled airspace would be minimal. Missile intercepts and intercept debris would

generally occur outside special use airspace areas. As such, the Proposed Action would not represent a direct special use airspace impact. Similarly, the use of ALTRV procedures as authorized by the Central Altitude Reservation Function or appropriate ARTCC (in this case the Oakland ARTCC) for airspace utilization under prescribed conditions in the Temporary Operating Area would not impact Special Use Airspace. According to the FAA Handbook, 7610.44, ALTRVs may encompass certain rocket and missile activities and other special operations that may be authorized by FAA approval procedures.

PMRF would coordinate with the Oakland ARTCC military operations specialist assigned to handle such matters, and the airspace coordinator at the Honolulu Center Radar Approach using ALTRV request procedures. After receiving the proper information on each test flight, a hazard pattern that would not encroach on any landmass would be constructed and superimposed on a chart depicting the area of operations. This plotted area is then faxed to the military operations specialist at Oakland ARTCC requesting airspace. When approval of the request of the airspace is received from the military operations specialist at Oakland ARTCC, PMRF would submit an ALTRV request to Central Altitude Reservation Function who publishes the ALTRV 72 hours before the flight test.

As discussed in section 4.2.2.2, to satisfy airspace safety requirements in accordance with AR 385-62 the responsible commander would obtain approval from the Administrator, FAA, through the appropriate Army airspace. Provision will be made for surveillance of the affected airspace and in addition, safety regulations dictate that launch operations would be suspended when it is known or suspected that any unauthorized aircraft have entered any part of the surface danger zone until the unauthorized entrant has been removed or a thorough check of the suspected area has been performed. NOTAMs would be issued to advise avoidance of the tracking radar areas during flight tests, particularly in the vicinity of Kwajalein or Roi-Namur when the THAAD radar is transmitting.

En Route Airways and Jet Routes

The airways and jet routes that crisscross the Ocean Area airspace use ROI have the potential to be affected by the Proposed Action. However, target missile launches would be conducted in compliance with DoD Directive 4540.1 that specifies procedures for conducting missile and projectile firing, namely "firing areas shall be selected so that trajectories are clear of established oceanic air routes or areas of known surface or air activity."

Before conducting a missile launch, NOTAMs would be sent in accordance with the conditions of the directive specified in Operations Naval Instruction 3721.20. In addition, to satisfy airspace safety requirements, the responsible commander would obtain approval from the Administrator, FAA, through the appropriate U.S. Navy airspace representative. Provision is made for surveillance of the affected airspace either by radar or patrol aircraft. Safety regulations also dictate that hazardous operations be suspended when it is known that any non-participating aircraft has entered any part of the danger zone, until the non-participating entrant has left the area or a thorough check of the suspected area has been performed.

In addition to the reasons cited above, no adverse impacts to the ROI's over-water airways and jet routes are identified because of the required coordination with the FAA. The procedures for scheduling each piece of airspace are performed in accordance with letters of agreements with the controlling FAA facility, and the Honolulu and Oakland ARTCCs. Schedules are provided to the FAA facility as agreed between the agencies involved. Aircraft transiting the Open Ocean ROI on one of the low-altitude airways and/or high-altitude jet routes that would be affected by flight test activities, would be notified of any necessary rerouting before departing their originating airport and would therefore be able to take on additional fuel before takeoff. Real-time airspace management involves the release of airspace to the FAA when the airspace is not in use or when extraordinary events occur that require drastic action, such as weather requiring additional airspace.

The FAA ARTCCs are responsible for air traffic flow control or management to transition air traffic. The ARTCCs provide separation services to aircraft operating on instrument flight rules flight plans and principally during the en route phases of the flight. They also provide traffic and weather advisories to airborne aircraft. By appropriately containing hazardous military activities within the over-water Warning Areas or by using ALTRV procedures in the Temporary Operating Area, non-participating traffic is advised or separated accordingly, thus avoiding substantial adverse impacts to the low altitude airways and high altitude jet routes in the ROI.

If a 3.7-kilometer (2-nautical-mile) radius temporary Warning Area, extending from the surface to 18,200 meters (60,000 feet) mean sea level is proposed over the mobile launch platform, it would marginally reduce the amount of navigable airspace in the Open Ocean Area ROI, would not have an impact on the en route airways and jet routes in the Open Ocean. It would be far removed from the en route airways and jet routes crossing the North Pacific.

Airports and Airfields

There are no airports or airfields in the PMRF Ocean Area airspace use ROI. Consequently, there would be no impacts to airports and airfields.

Interceptor missile launch sites, LHAs, and the water impact and debris containment areas for intercepts, both inside the Mid-atoll Corridor and the broad ocean area east of Kwajalein Atoll would be well north of Bucholz Army Airfield and its standard instrument approach and departure procedures.

Cumulative Impacts

All sea-based missile launches, missile intercepts, and debris impact would take place in international airspace. Testing would request clearance of various areas of airspace, and may cause rerouting or rescheduling of flights. However, most impacts would be in remote areas that would have little effect on air traffic. There is no airspace segregation method such as warning or restricted area to insure that the area would be cleared of non-participating aircraft. Flight tests with intercepts in the vicinity of en route airways and jet routes, when combined with other missile test programs, could lead to cumulative impacts

to airspace in the form of flight delays. Missile launches are short-term, discrete events, however, and using the required scheduling process for international airspace would minimize the potential for cumulative impacts.

4.6.2 BIOLOGICAL RESOURCES—OPEN OCEAN (FLIGHT TEST CORRIDOR)

Potential impacts of construction, building modification, and missile launches on terrestrial and marine biological resources within the open ocean ROI were addressed in detail in the PMRF Enhanced Capability EIS, USAKA EIS, USAKA Supplemental EIS, Theater Missile Defense ETR EIS, and USAKA Temporary ETR EA. Based on the prior analysis done and the effects of past interceptor and target launch activities, the potential impacts of activities related to THAAD test flights on biological resources are expected to be minimal, as discussed below.

Some evaluative criteria for impacts to this resource are discussed in the PMRF section. The proposed flight test operations would have no discernible or measurable effect on the ocean's overall physical and chemical properties, and thus would have no impacts to the overall marine biology of the Ocean Area ROI for both PMRF and RTS. Moreover, the proposed test flight operations would have no discernible effect on the biological diversity of either the pelagic or benthic marine environments. The proposed activities would take place in the open ocean, or pelagic zone, which is far removed from land and contains approximately 2 percent of marine species. The potential for impacts exists from the target missile booster's fall to the ocean surface and from the target payload fall to the ocean surface. Potential adverse effects could occur from launch noise levels, sonic boom overpressures, shock wave impact or direct contact, ingestion of toxic solutions generated from the unburned propellant mixed with seawater, and ingestion of pieces of unburned propellant.

Hazardous Materials Deposition

The National Aeronautics and Space Administration conducted a thorough evaluation of the effects of missile systems that are deposited in seawater. It concluded that the release of hazardous materials aboard missiles into seawater would not be significant. Materials would be rapidly diluted and, except for the immediate vicinity of the debris, would not be found at concentrations identified as producing any adverse effects. The Pacific Ocean depth in the vicinity of the launch area is thousands of meters (feet) deep, and consequently impact from the fuel is expected to be minimal. Any area affected by the slow dissolution of the propellant would be relatively small due to the size of the rocket motor or propellant pieces relative to the quantity of seawater. (Federal Aviation Administration, 1996)

Under nominal launch conditions when the relative humidity is less than 100 percent, deposition of hydrogen chloride gas on the surface of the sea would not be significant. Analyses for the most conservative case, where rain would be present soon after test firing the advanced solid rocket motor, concluded that acid deposition to surface water would not result in any impacts to larger surface water bodies in the area. This analysis was based on the buffering capacity of fresh water which is considerably lower than the buffering capacity of sea water; therefore, it is expected that even for the most

conservative case condition where all of the hydrogen chloride emission falls over the open ocean area, the pH level would not be depressed by more than 0.2 standard units for more than a few minutes. (U.S. Department of the Navy, 1998)

Mathematical modeling results of advanced solid rocket motor tests indicated the maximum deposition of aluminum oxide would measure about 1.6 milligrams per square meter. Aluminum oxide is not considered toxic under natural conditions but may contribute potentially harmful species of soluble aluminum forms under acidic conditions. It is difficult to quantify the portion of aluminum oxide that reacts with hydrogen chloride to form additional toxic aluminum species. The most conservative approach assumes that all of the aluminum oxide deposited has reacted with hydrogen chloride. With this extremely conservative assumption, the deposition of about 1.6 milligrams per square meter of aluminum oxide equals approximately 0.0054 milligram per liter aluminum at a water depth of 0.15 meter (0.5 foot). This analysis is based on the assumption that it would not be raining at the time of the test event or within 2 hours after the event. (U.S. Department of the Navy, 1998)

No solid propellant would remain in the spent Air Launched Target rocket motors that impact in the ocean. The residual aluminum oxide and burnt hydrocarbon coating the inside of the motor casings would not present any toxicity concerns. However, residual amounts of hydraulic fluid contained in the first-stage motor, and the contents of various batteries onboard the rocket motors and the reentry vehicle, may mix with the seawater causing contamination. The release of such contaminants could potentially harm marine life that comes in contact or ingests the toxic solutions. (Missile Defense Agency and U.S. Department of the Air Force, 2002)

It is also expected that even in the most conservative scenario of an on-ship or early flight failure where all of the propellant is ignited and all of the hydrogen chloride and aluminum oxide are deposited, any toxic concentration of these products would be buffered and diluted by sea water to non-toxic levels within minutes. Consequently, any impacts from accidental release would be very transient. (U.S. Department of the Navy, 1998)

THAAD element test activities associated with the MDA lethality program may include development and testing of NBC material simulants within a laboratory or other indoor and outdoor test facilities. These activities are analyzed in the *Programmatic Environmental Assessment, Theater Missile Defense Lethality Program* (U.S. Army Space and Strategic Defense Command, 1993c). Proposed simulants could include water, tri-butyl phosphate, diatomaceous earth, and other materials. The majority of the tributyl phosphate, which is currently the only proposed simulant in the target missiles, would be destroyed at intercept. It is expected that, similar to the use of triethyl phosphate, the remainder would be quickly dispersed in the atmosphere with no substantial concentration reaching surface water. Decoys such as chaff and small spheres could also be part of the target missile payloads. These small decoys, which would not be recovered, would be fabricated from non-hazardous materials and as such are not expected to result in adverse impacts to marine species.

Debris

Debris impact and booster drops in the broad ocean area could occur within the 322-kilometer (200-mile) limit of the Exclusive Economic Zone of affected islands. The natural buffering capacity of seawater and the strong ocean currents would neutralize reaction to any release of the small amount of liquid propellant contained within the Divert and Attitude Control System or LPM. Analysis in the *Marine Mammal Technical Report*, prepared in support of the Point Mugu Sea Range EIS, determined that there is a very low probability that a marine mammal would be killed by falling missile boosters, targets, or debris as a result of tests at the Point Mugu Sea Range (less than 0.0149 marine mammals exposed per year). Large pieces of falling debris from targets may strike and injure or kill marine mammals. As a general guideline, pieces of debris with an impact kinetic energy of 15 joules (11 foot-pounds) or higher are hazardous to humans (Pacific Missile Range Facility, Barking Sands, 1998). The potential for an object or objects dropping from the air to affect marine mammals or other marine biological resources is less than 10^{-6} (1 in 1 million). The probability of a spent missile landing on a cetacean or other marine mammal is remote. (Department of the Navy, Naval Air Warfare Center Weapons Division, 2002)

This probability calculation was based on the size of the area studied and the density of the marine mammal population in that area. The analysis concluded that the effect of this missile debris and intact missiles coming down in the open ocean would be negligible. The range area at Point Mugu is smaller (93,200 square kilometers [27,183 square nautical miles]) than the PMRF range area (144,000 square kilometers [42,000 square nautical miles]) and the density of marine mammals at Point Mugu is larger than the density found at PMRF. It is reasonable to conclude that the probability of a marine mammal being injured or killed by missile or debris impact from Navy testing at PMRF is even more remote than at Point Mugu, since the area at PMRF is larger and the density of marine mammals is smaller. Following formal consultation, the National Marine Fisheries Service concluded that the Proposed Action is not likely to adversely affect any marine mammal species. (Department of the Navy, Naval Air Warfare Center Weapons Division, 2002; U.S. Department of the Navy, 1998)

Following the Air Launched Target missile launch, the Booster Extraction System would continue a slow descent by parachute until impacting the water. Although the impact would occur at a reasonably slow velocity, the falling 1,225-kilogram (2,700-pound) pallet could strike and injure or kill a marine mammal or sea turtle. As previously discussed, however, the probability of striking an animal within the ROI is extremely remote. Like the pallet, the parachutes also have negative buoyancy and thus do not float. In addition, metal hardware attached to the parachutes would aid in their sinking to the ocean bottom. (U.S. Department of the Air Force, 2002)

The Missile Defense Agency would handle an unexploded missile, in the case of a failed intercept resulting in a whole body impact, on a case-by-case basis. Potential recovery would be based on the difficulty of recovery and a requirement for analysis of the missile. The parts of solid rocket motor propellant expelled from a destroyed or exploded rocket motor that fall into the ocean would most likely sink to the ocean floor at depths of thousands of feet. At such depths the propellant parts would be out of the way of feeding marine mammals. (U.S. Department of the Navy, 1998)

Shock Wave Impacts

Missiles and targets, in the case of an unsuccessful intercept, would hit the water with speeds of 91 to 914 meters (300 to 3,000 feet) per second. It is assumed that the shock wave from their impact with the water is similar to that produced by explosives. At close ranges, injuries to internal organs and tissues would likely result. However, the taking of, or injury to, any marine mammal by direct impact or shock wave impact would be extremely remote (less than 0.0006 marine mammals exposed per year). The splashdown of the first- and second-stage target missile boosters and defensive missile boosters, and the target vehicle's and defensive missile's payloads, in the case of an unsuccessful intercept, is planned to occur in open ocean waters thousands of meters (feet) deep at considerable distance from the nearest land. (U.S. Department of the Navy, 1998)

Noise

Of particular concern is the potential for impacts to marine mammals, from both acoustic and non-acoustic effects. Potential acoustic effects include behavioral disturbance (including displacement), acoustic masking (elevated noise levels that drown out other noise sources), and (with very strong sounds) temporary or permanent hearing impairment. Potential non-acoustic effects include physical impact by falling debris, entanglement in debris, and contact with or ingestion of debris or hazardous materials.

Injury by the shock wave resulting from impact of a large, fast-moving object (such as a missile booster or target vehicle) with the water surface could be considered either an acoustic or non-acoustic effect. In particular, the U.S. Navy acknowledges that acoustic emissions from various products and activities could be interacting with marine mammals' hearing. Federal regulations promulgated under the Marine Mammal Protection Act have recognized that some criterion of measurement is necessary. Furthermore, the National Marine Fisheries Service considers TTS a reversible decrease in hearing sensitivities that result from exposure to loud sound, as a potential measure for evaluating impacts of sound emissions.

TTS is used as a measure of temporary reduction in hearing sensitivity. For sound levels at or somewhat above the TTS threshold, hearing sensitivity recovers rapidly after exposure to the noise ends. Much greater single noise exposures would be required to result in permanent hearing damage, while lesser noise levels would involve only minor behavioral responses with no effect on hearing sensitivity.

Sonic Boom Overpressure Impacts

The missiles could generate a sonic boom upon reentry. Each missile would propagate a unique sonic boom contour depending upon its mass, shape, velocity, and reentry angle, among other variables. The location of the possible impact point would vary depending upon the particular flight test profile. It is therefore difficult to produce the specific location, extent, duration, or intensity of sonic boom impacts upon marine life. These noise levels would be of very short duration.

The noise level thresholds of impact to marine life in general, and marine mammals in particular, are currently the subject of scientific analysis. There is the possibility that underwater noise levels resulting from missile reentry sonic booms could affect some marine mammals or sea turtles in the open ocean. In addition, since different species of marine mammals have varying sensitivity to different sound frequencies and may be found at different locations and depths in the ocean, it is difficult to generalize sound impacts to marine mammals from missile impacts in the broad ocean area. Available information is generally insufficient to determine independently of experience whether, and at what distances, underwater sounds from various man-made sources will result in harassment that will adversely affect the behavior of different species of marine mammals. Also, there are currently no consistent standard protocols for measuring and reporting the levels and other characteristics of underwater noise that may adversely affect marine mammals. Should consensus emerge from the scientific analysis about the effects of underwater noise upon marine mammals, it would then be possible to predict the consequences of a particular sonic boom contour upon marine mammals in the vicinity.

Shock Wave Impact or Direct Contact

The first-, second-, and third-stage target missile boosters and the target vehicle's payload, which all fall to the ocean surface, would impart a considerable amount of kinetic energy to the ocean water upon impact. Missiles and targets would hit the water with speeds of 91 to 914 meters (300 to 3,000 feet) per second. It is assumed that the shock wave from their impact with the water would be similar to that produced by explosives. At close ranges, injuries to internal organs and tissues would likely result. However, injury to any marine mammal by direct impact or shock wave impact would be extremely remote (less than 0.0006 marine mammals exposed per year). The splashdown of the target missile boosters and payload is planned to occur in open ocean waters thousands of meters (feet) deep at considerable distance from the nearest land. (U.S. Army Space and Missile Defense Command, 2001a)

Analysis (Naval Air Warfare Center Weapons Division Point Mugu, 1998) has determined that there is a very low probability that a marine mammal would be killed by falling missile boosters, targets, or debris as a result of tests at the Point Mugu Sea Range (less than 0.0149 marine mammals exposed per year). This probability calculation was based on the size of the area studied and the density of the marine mammal population in that area. The analysis concluded that the effect of missile debris and intact missiles coming down in the open ocean would be negligible.

Standard range warning and checking procedures would check for visible large concentrations of marine mammals in the area of the target launch, trajectory, and first stage impact area. Patrol and surveillance aircraft would be dispatched before launch to search the water surface. If contacts are made and confirmed, the Flight Safety officer would determine whether to continue on schedule, delay the test flight, or postpone it until another day.

Ingestion of Pieces of Unburned Propellant

The concentration and toxicity of dissolved solid rocket motor fuel in the ocean, from the unexpended rocket motor, or portions of it, is expected to be negligible and without any substantial effect.

The parts of solid rocket motor propellant expelled from a destroyed or exploded rocket motor that fall into the ocean would most likely sink to the ocean floor at depths of thousands of feet. At such depths the propellant parts would be out of the way of feeding marine mammals.

Entanglement with the Submerged Parachute

The parachutes used to extract and prepare the Air Launched Target missile for launch would sink to the ocean bottom, along with the pallet. Like the pallet, the parachutes also have negative buoyancy and thus do not float. In addition, metal hardware attached to the parachutes would aid in their sinking to the ocean bottom, thus further minimizing the potential for entanglement. Entanglement of a marine mammal or sea turtle and potential drowning would be very unlikely since a parachute would either have to land directly on an animal, or an animal would have to swim blindly into it before it sinks to the ocean floor. The potential for a marine mammal or sea turtle to be in the same area and have physical contact with a parachute is remote. (U.S. Department of the Air Force, 2002)

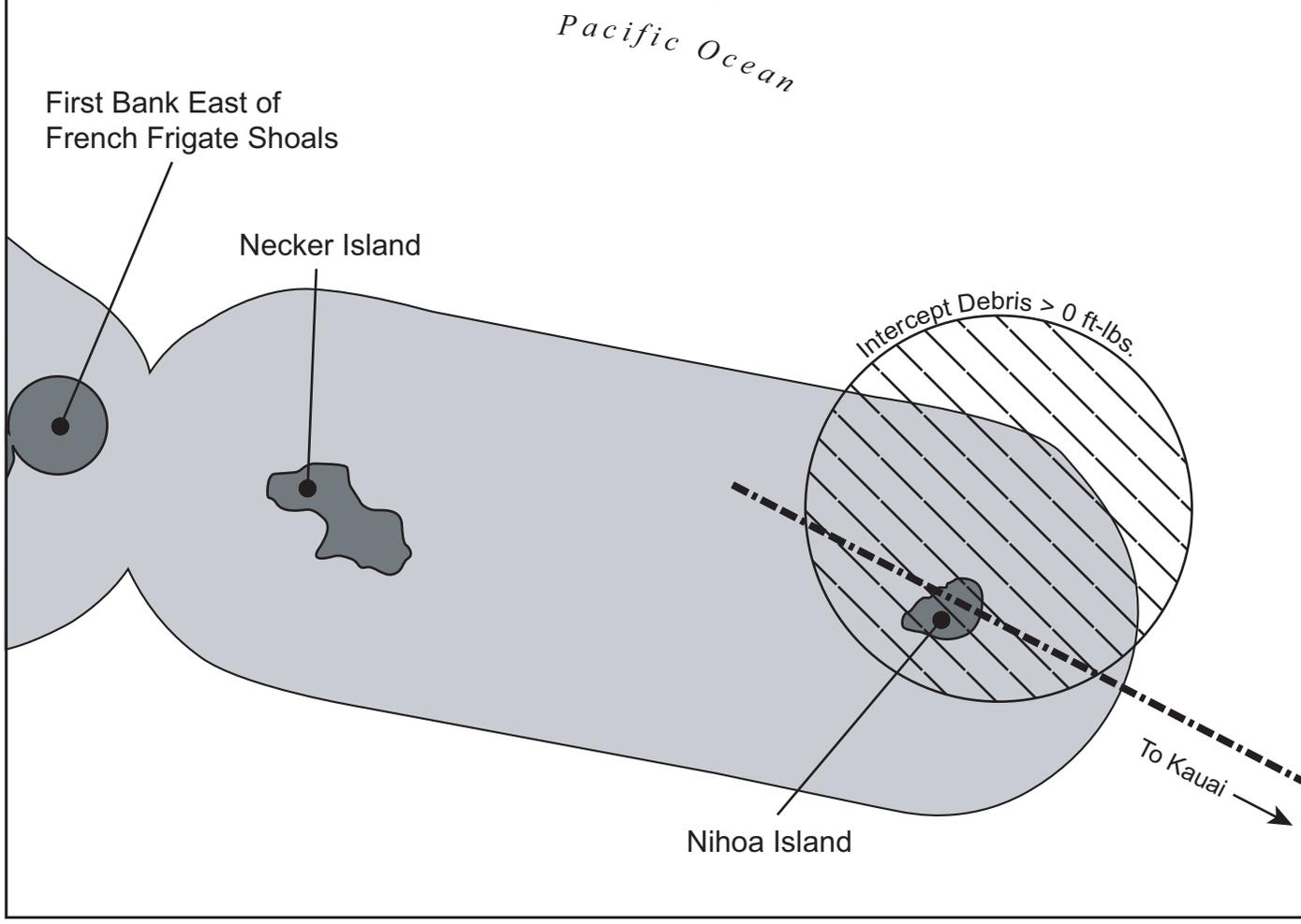
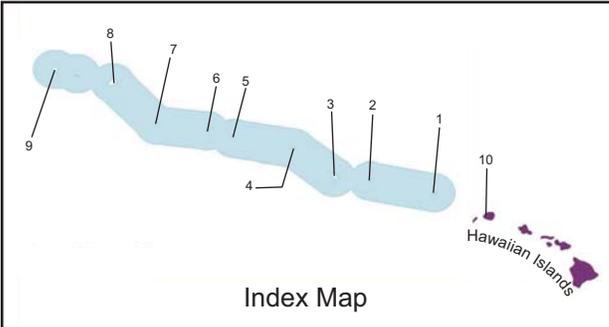
Potential Impacts to Nihoa

Some current flight trajectories could result in the THAAD missile flying over portions of the Hawaiian Islands National Wildlife Refuge. Of particular concern is overflight of Nihoa at the southeastern end of the Northwestern Hawaiian Islands, 386 kilometers (240 nautical miles) northwest of Oahu.

The Nihoa Millerbird, the Nihoa Finch, and the Nihoa fan palm rely on the absolute isolation and protection from invasive species and disturbance that the refuge provides. The Northwestern Hawaiian Islands Passerine Recovery Plan describes essential habitat for both bird species as all land to the mean lower low water line on Nihoa, an area of approximately 62 hectares (153 acres). However, the U.S. Fish and Wildlife Service has not designated any critical habitat for either species. (Virginia Polytechnic and State University, 2002a; b)

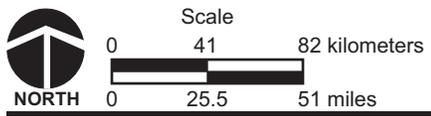
The THAAD project office has performed a debris analysis to identify weight of the debris that could potentially impact Nihoa (figures 4-1 through 4-4). Results indicate that debris greater than 0.5 foot-pounds is not expected to impact Nihoa, and thus no substantial adverse impacts. A kinetic energy at impact of 11 foot-pounds represents the critical threshold (50 percent) of person injury. The trajectory could be altered if necessary to further minimize the potential for impacts to the vulnerable species on the island.

1. Nihoa Island
2. Necker Island
3. French Frigate Shoals
4. Gardner Pinnacles
5. Maro Reef
6. Laysan Island
7. Lisianski Island
8. Pearl and Hermes Atoll
9. Kure Atoll
10. Kauai



EXPLANATION

- Northwestern Hawaiian Island Coral Reef Reserve Area
- Northwestern Hawaiian Island Coral Reef Reserve Preservation Area
- Intercept Debris > 0 ft-lbs.
- Launch Azimuth = 297° out of Kauai

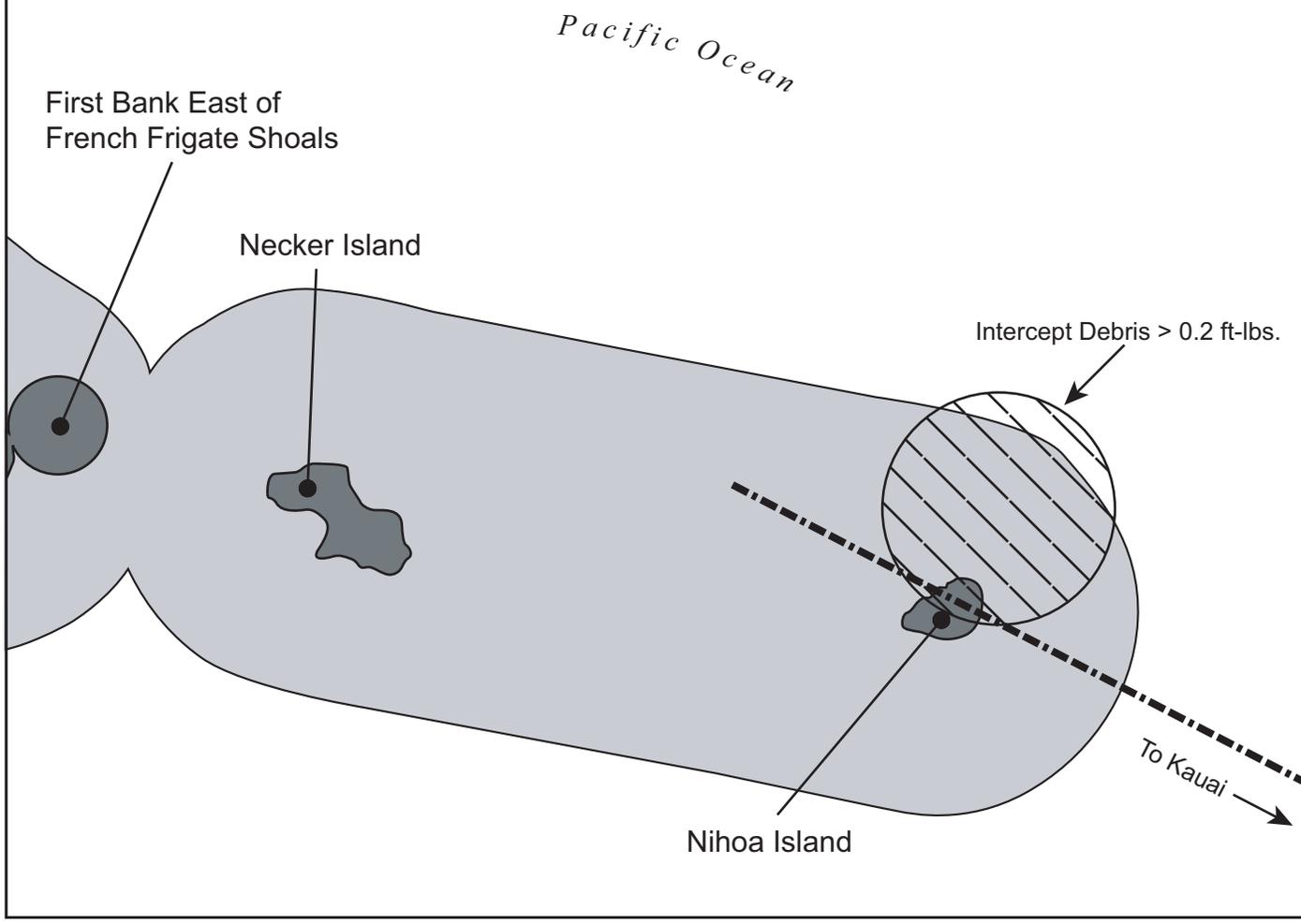
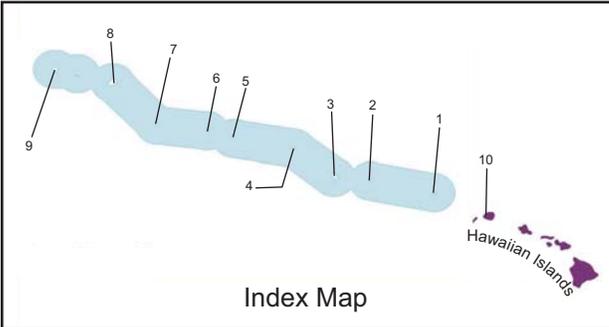


Representative > 0 Foot-Pound Debris Footprint, THAAD Launched From Pacific Missile Range Facility

Figure 4-1

10-30-02 Debris 0 ft-lbs

1. Nihoa Island
2. Necker Island
3. French Frigate Shoals
4. Gardner Pinnacles
5. Maro Reef
6. Laysan Island
7. Lisianski Island
8. Pearl and Hermes Atoll
9. Kure Atoll
10. Kauai



EXPLANATION

- Northwestern Hawaiian Island Coral Reef Reserve Area
- Northwestern Hawaiian Island Coral Reef Reserve Preservation Area
- Intercept Debris > 0.2 ft-lbs.
- Launch Azimuth = 297° out of Kauai

Representative > 0.2 Foot-Pound Debris Footprint, THAAD Launched From Pacific Missile Range Facility

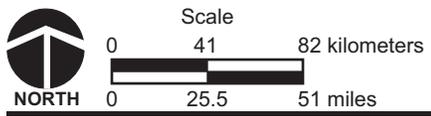
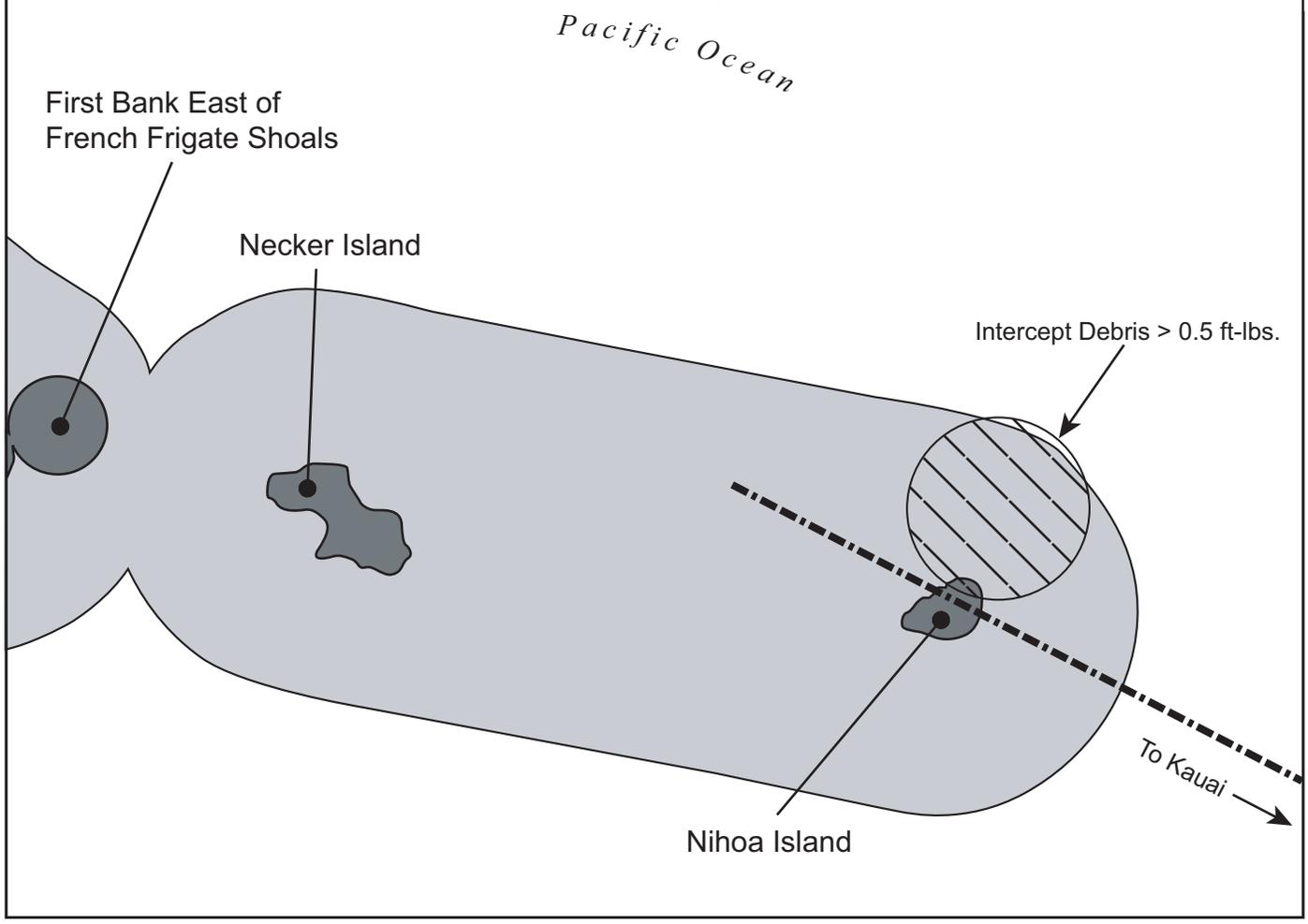
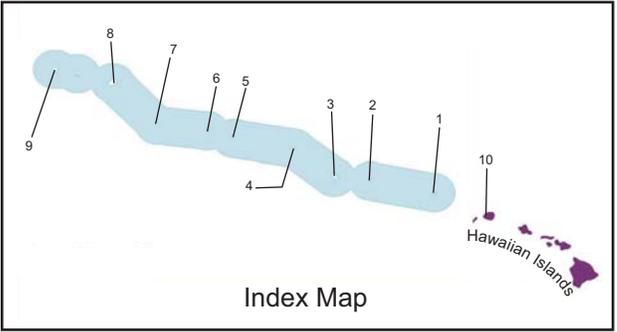


Figure 4-2

10-30-02 Debris 02 ft-lbs

1. Nihoa Island
2. Necker Island
3. French Frigate Shoals
4. Gardner Pinnacles
5. Maro Reef
6. Laysan Island
7. Lisianski Island
8. Pearl and Hermes Atoll
9. Kure Atoll
10. Kauai



EXPLANATION

- Northwestern Hawaiian Island Coral Reef Reserve Area
- Northwestern Hawaiian Island Coral Reef Reserve Preservation Area
- Intercept Debris > 0.5 ft-lbs.
- Launch Azimuth = 297° out of Kauai

Representative > 0.5 Foot-Pound Debris Footprint, THAAD Launched From Pacific Missile Range Facility

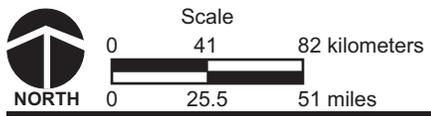
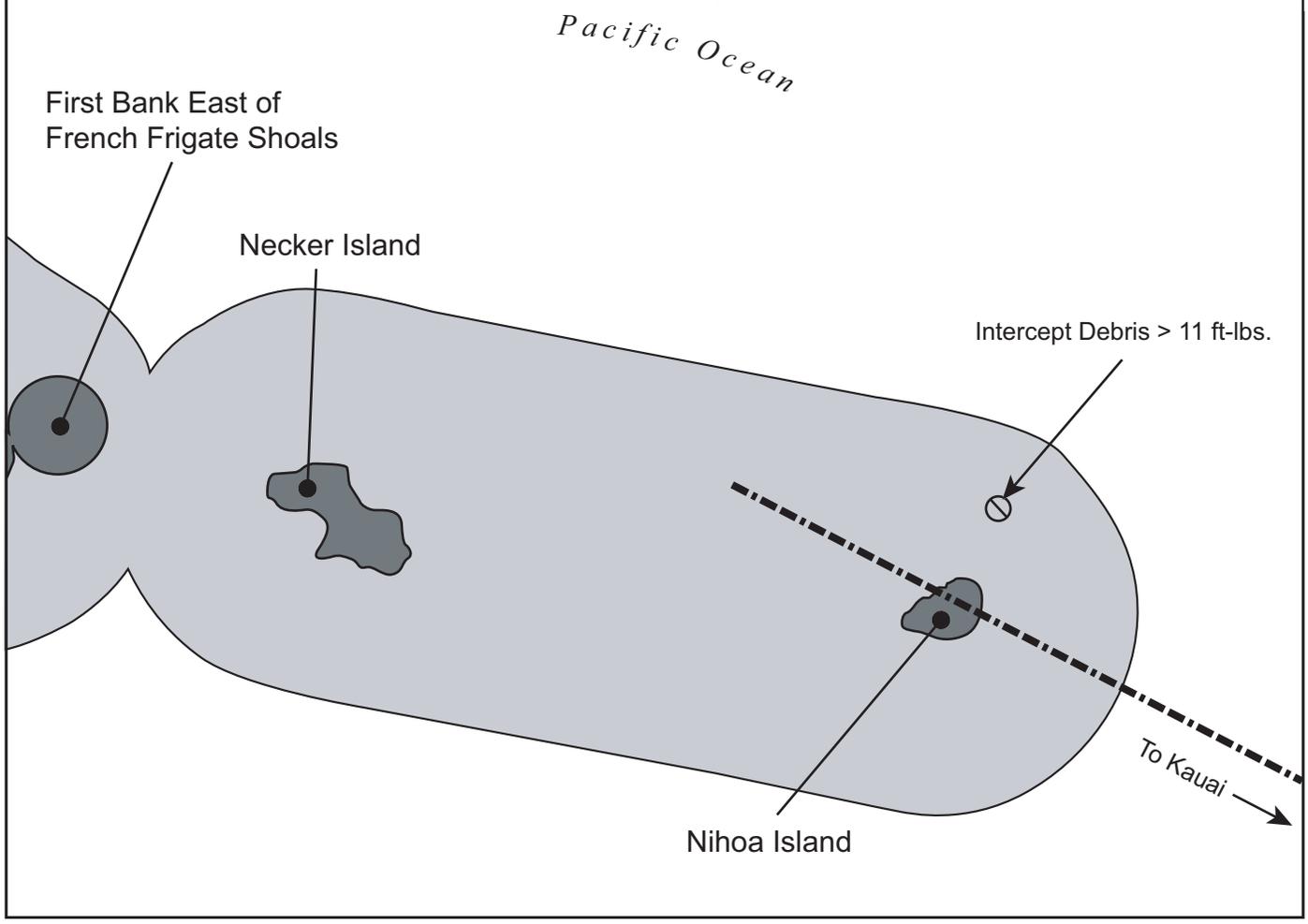
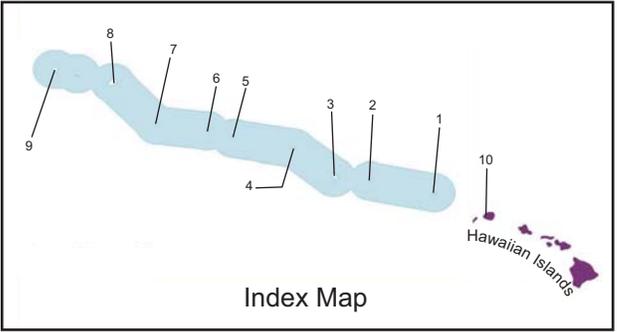


Figure 4-3

10-30-02 Debris 05 ft-lbs

1. Nihoa Island
2. Necker Island
3. French Frigate Shoals
4. Gardner Pinnacles
5. Maro Reef
6. Laysan Island
7. Lisianski Island
8. Pearl and Hermes Atoll
9. Kure Atoll
10. Kauai



EXPLANATION

- Northwestern Hawaiian Island Coral Reef Reserve Area
- Northwestern Hawaiian Island Coral Reef Reserve Preservation Area
- Intercept Debris > 11 ft-lbs.
- Launch Azimuth = 297° out of Kauai

Representative > 11 Foot-Pound Debris Footprint, THAAD Launched From Pacific Missile Range Facility

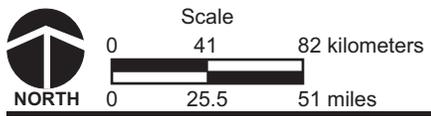


Figure 4-4

10-30-02 Debris 11 ft-lbs

Cumulative Impacts

No substantial impacts to the open ocean area and its wildlife have been identified from current and past missile test activities. Prior analysis has not identified a significant potential for cumulative impacts. Although approximately 14 THAAD test flight events per year would take place in the open ocean area, these would be discrete, short-term events and no adverse cumulative impacts are anticipated.

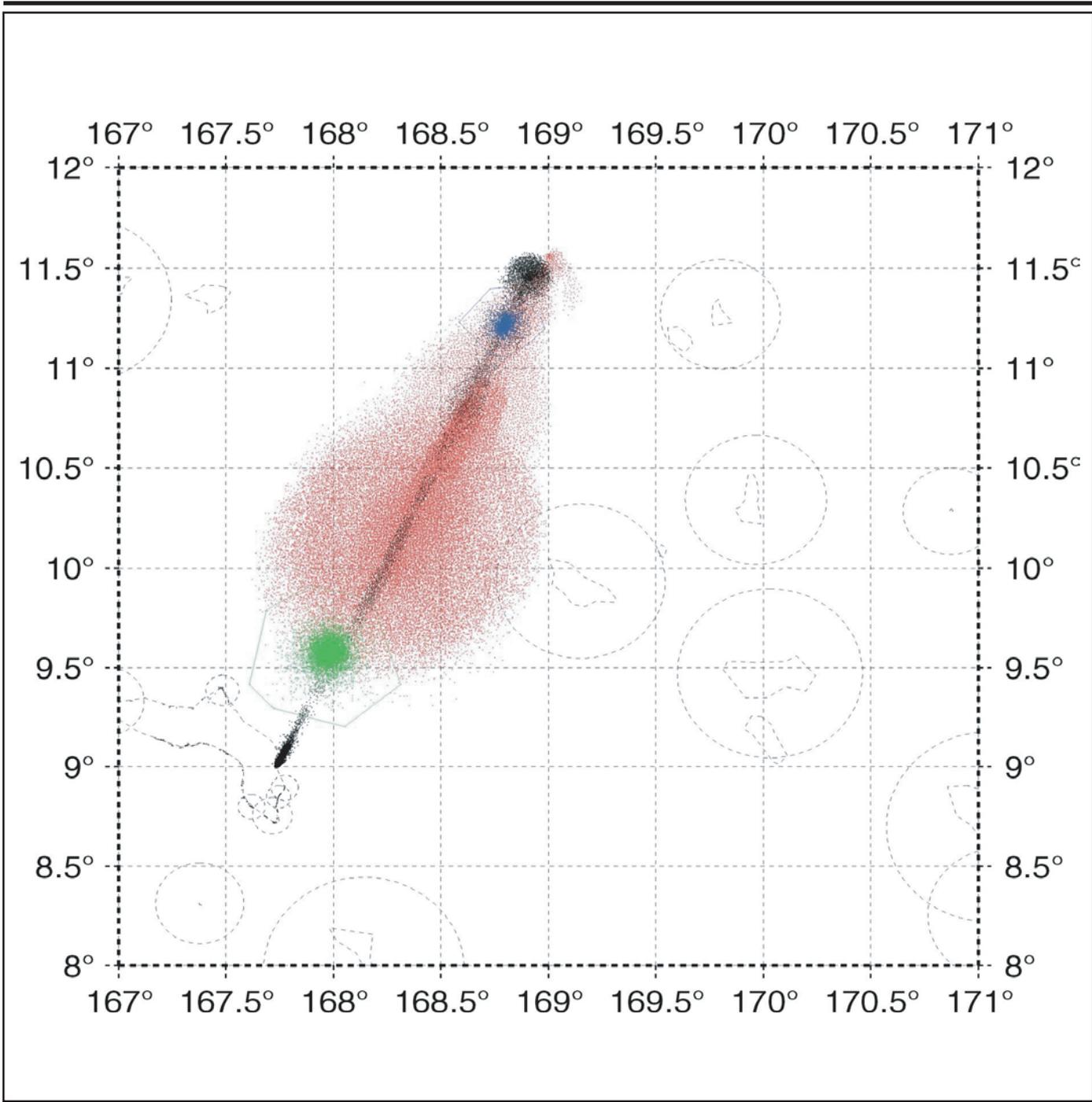
4.6.3 HEALTH AND SAFETY—OPEN OCEAN (FLIGHT TEST CORRIDOR)

Some evaluative criteria for impacts to this resource are discussed in the PMRF section. Every reasonable precaution is taken during the planning and execution of test and development activities to prevent injury to human life or property. Each test range conducts missile flight safety, which includes analysis of missile performance capabilities and limitations, of hazards inherent in missile operations and destruct systems, and of the electronic characteristics of missiles and instrumentation. It also includes computation and review of missile trajectories and hazard area dimensions, review and approval of destruct systems proposals, and preparation of the Range Safety Approval and Range Safety Operational Plans required of all programs.

Impact zones in the open ocean area would be delineated. The location and dimensions of the impact zones would vary for each test flight scenario. Figures 4-5 through 4-8 depict debris from scenarios that could potentially affect islands northwest of PMRF. Impact zones for each test flight would be determined by range safety personnel based on detailed launch planning and trajectory modeling. This planning and modeling would include analysis and identification of a flight corridor. Flights would be conducted when trajectory modeling verifies that flight vehicles and debris would be contained within predetermined areas, all of which would be over the open ocean and far removed from land and populated areas. Appropriate NOTMARs and NOTAMs would be issued before proceeding with a launch. Consequently, the Proposed Action would have no adverse impacts to public health and safety in the open ocean area.

Furthermore, prior warning of flight testing and training would enable commercial shipping to follow alternative routes away from test areas.

Safety programs described in the USAKA Supplemental EIS include ground safety for general operations and flight safety for the protection of USAKA personnel, inhabitants of the RMI, and traffic in areas where tests are being conducted. Each mission would have an approved flight safety plan that would define the areas affected by the mission, the caution and hazard areas, and precautions to protect inhabited. Flight safety plans would also include requirements for warning messages, evacuation, and surveillance. Missions affecting the broad ocean area would require the implementation of current range safety measures, such as aircraft and ship clearance for the caution area. NOTAMs and NOTMARs would be published as required. Figures 4-5 through 4-8 depict representative debris patterns from four RTS launch scenarios.



EXPLANATION

THAAD launched from Meck Island

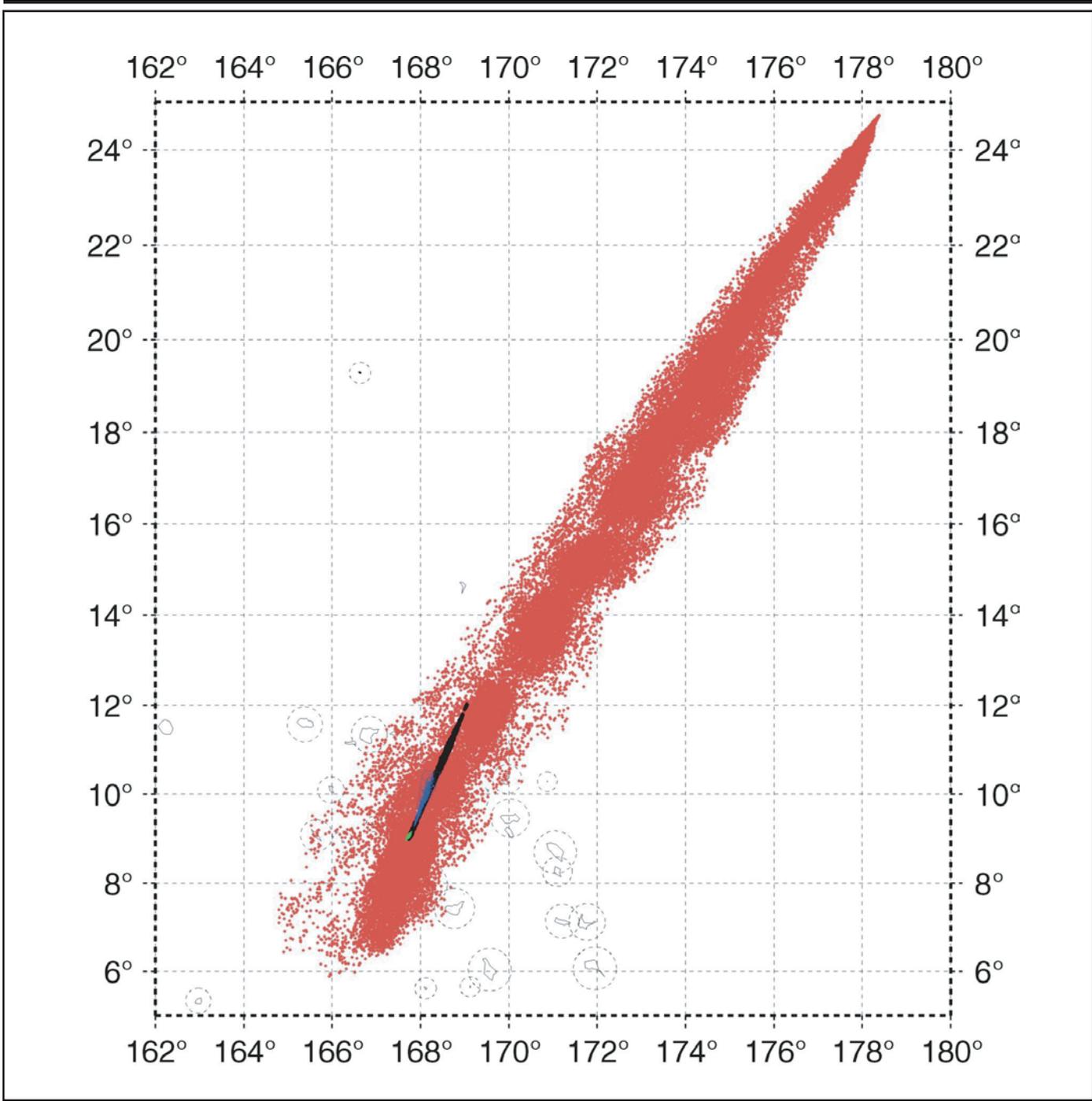
**Short Range Air
Launched Target with
Modified Ballistic
Reentry Vehicle-1
Debris Pattern**

Reagan Test Site



Not to Scale

Figure 4-5



EXPLANATION

THAAD launched from Meck Island

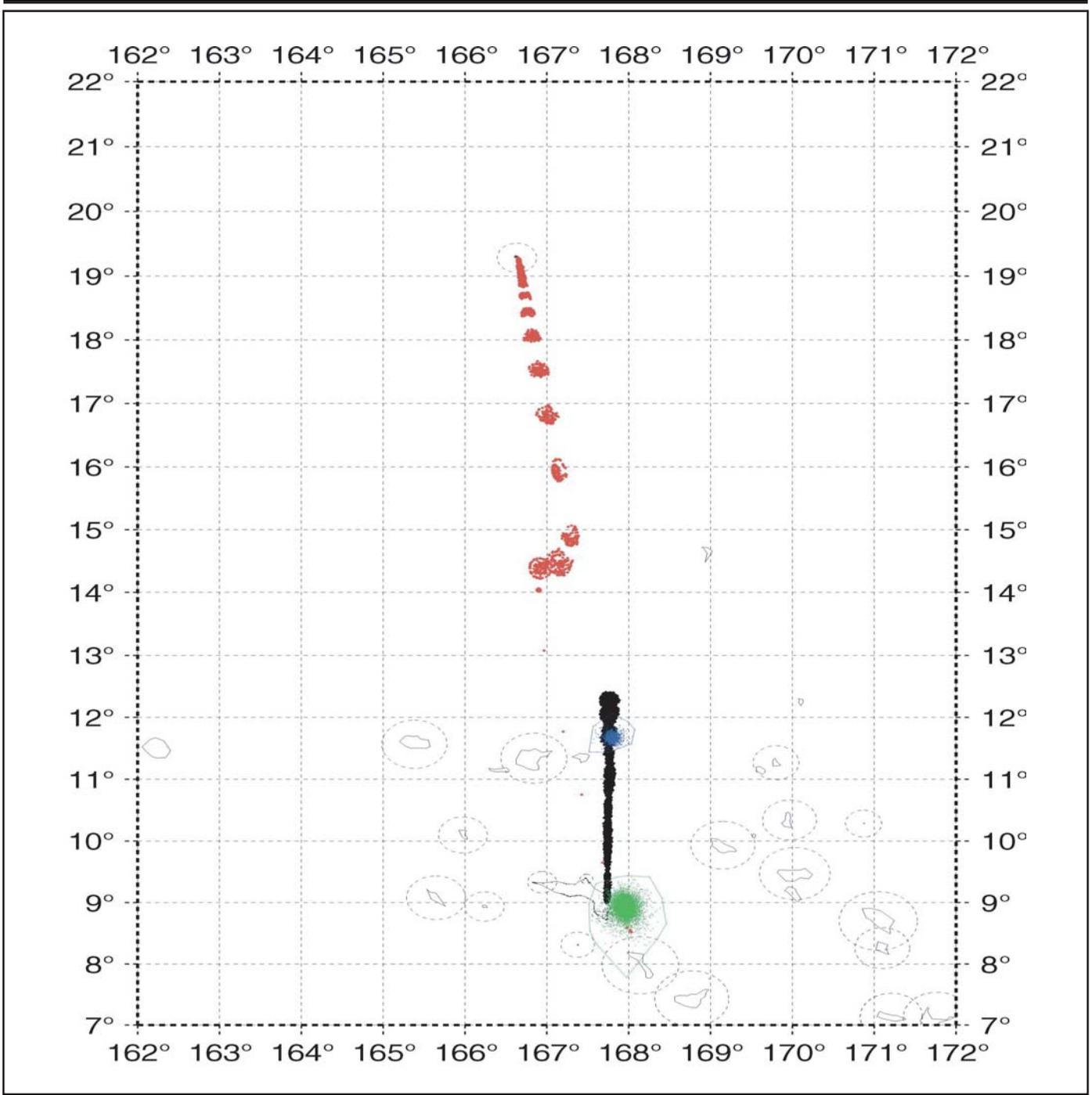
**Long Range Air
Launched Target with
Modified Ballistic
Reentry Vehicle-4
Debris Pattern**

Reagan Test Site



Not to Scale

Figure 4-6



EXPLANATION

THAAD launched from Meck Island

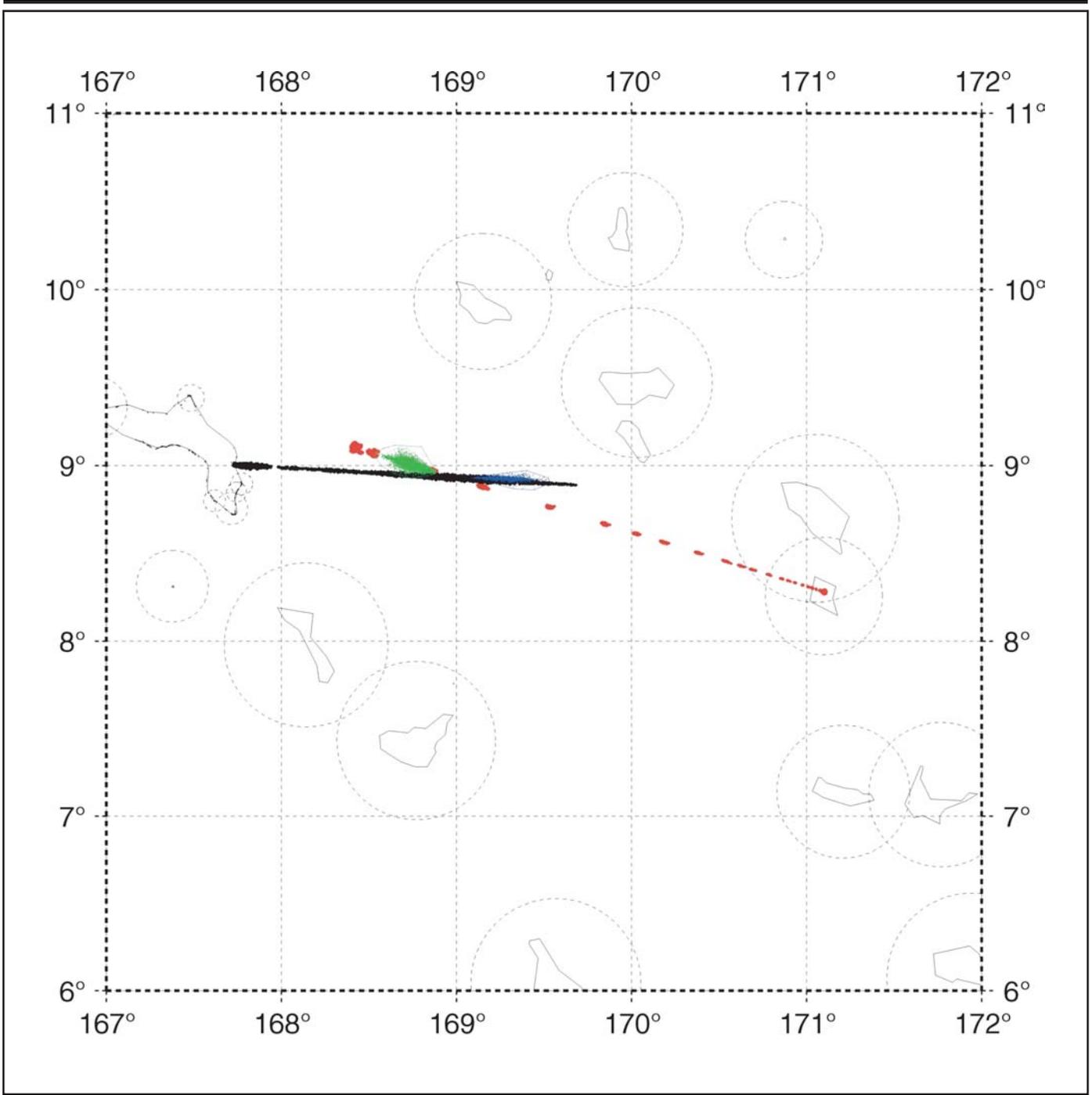
Hera Modified Ballistic Reentry Vehicle-2 Debris Pattern

Reagan Test Site



Not to Scale

Figure 4-7



EXPLANATION

THAAD launched from Meck Island

Foreign Material Acquisition Debris Pattern

Reagan Test Site



Not to Scale

Figure 4-8

Cumulative Impacts

The Proposed Action would result in up to 50 launches over a 4-year period. Each of these launches would result in the impact of boosters and the payload into the open ocean. The Proposed Action would result in an increase in missile activities in the open ocean area. As such, there could be a cumulative impact to health and safety in the open ocean area. However, the Proposed Action also requires the administration of NOTAMs and NOTMARs to warn aircraft and surface vessels of the potentially hazardous areas and allows them ample time to avoid the hazards. As such, any cumulative health and safety impact in the open ocean area due to the Proposed Action would be minimal.

4.6.4 NOISE—OPEN OCEAN (FLIGHT TEST CORRIDOR)

Noise impacts are discussed above in the biological resources section.

4.6.5 WATER RESOURCES—OPEN OCEAN (FLIGHT TEST CORRIDOR)

Impacts to water resources are discussed above in the biological resources section.

4.7 ALTERNATIVE TO THE PROPOSED ACTION—ACTIVITIES AT BOTH PACIFIC MISSILE RANGE FACILITY AND RONALD REAGAN TEST SITE/U.S. ARMY KWAJALEIN ATOLL

This alternative would involve the activities described in the Proposed Action, test flights at PMRF and some or all of the alternative actions at RTS. If both PMRF and RTS were selected for THAAD flight testing, the full suite of facilities and targets as described in section 2.1 would be required. Activities at RTS could range from no new facilities with all THAAD operations done in a tactical manner, to the complete range of new facilities and targets as described in section 2.2.

Impacts at PMRF and related target launch locations for this alternative would be the same as those discussed above. Impacts at RTS and related target launch locations for this alternative would be the same or less than those discussed above.

4.8 ENVIRONMENTAL EFFECTS OF THE NO-ACTION ALTERNATIVE

If the No-action Alternative is selected, no environmental consequences associated with the THAAD Pacific Flight Test program are anticipated. PMRF, RTS, and Wake Island would continue to launch missiles as analyzed in prior EAs.

4.9 ADVERSE ENVIRONMENTAL EFFECTS THAT CANNOT BE AVOIDED

Adverse environmental effects that cannot be avoided include removal of vegetation at the proposed new construction sites, minor short-term noise impacts to and startling of wildlife, and minor increased generation of hazardous materials at program-related sites. Pollutants would also be released to the atmosphere through generation of power, missile exhaust, and fugitive dust from construction or other ground disturbing activities. Any hazardous waste generated would be managed in compliance with DoD, and other applicable federal, state, and local regulations.

4.10 CONFLICTS WITH FEDERAL, STATE, AND LOCAL LAND USE PLANS, POLICIES, AND CONTROLS FOR THE AREA CONCERNED

The proposed program activities at PMRF would be consistent with the existing land use. PMRF maintains federal jurisdiction for on-base land use: therefore, state and local land use laws are preempted. Activities similar to those being proposed were assessed in the PMRF Enhanced Capability EIS and found to be consistent with the Hawaii Coastal Zone Management Act. All correlated THAAD activities would be consistent to the maximum extent practicable with the existing restrictive easement, land use plans, and the Hawaii Coastal Zone Management Program. A Negative Determination is not required.

Activities at all islands within the RTS/USAKA are compatible with the mission and land uses for each island. All activities would comply with federal laws and regulations, the Compact of Free Association between the RMI and the United States, and with regional and local land uses, policies, and regulation agreements. No formal land use plans developed by the RMI are known for Aur or Wotje Atoll. Because program personnel and equipment are only expected to be on either Atoll for about 30 days per launch event, and copra harvesters are typically only on Bigen and Toton 3 to 4 days per month, the 60-day advance notice that would be provided to land owners prior to program activities is expected to obviate any land use conflicts.

The proposed activities would occur in areas of Wake Island already being used for similar purposes and would be limited to the DoD-operated installation. The activities are compatible with the mission and land uses for Wake Island.

4.11 ENERGY REQUIREMENTS AND CONSERVATION POTENTIAL

Anticipated energy requirements of the THAAD Pacific Test Flight program would be well within the energy supply capacity of all facilities. Energy requirements would be subject to any established energy conservation practices.

4.12 IRREVERSIBLE OR IRRETRIEVABLE COMMITMENT OF RESOURCES

The Proposed Action is not expected to result in the loss or impact on threatened or endangered species, and no loss of cultural resources, such as archaeological or historic sites. Moreover, there would be no changes in land use or preclusion of development of underground mineral resources that were not already constrained.

The amount of materials required for any program-related activities would be small. Although the proposed activities would result in some irreversible or irretrievable commitment of resources such as various construction materials, minerals, and labor, this commitment of resources is not significantly different from that necessary for many other defense research and development programs carried out over the past several years. Proposed activities would not commit natural resources in significant quantities.

4.13 RELATIONSHIP BETWEEN SHORT-TERM USE OF THE HUMAN ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Proposed THAAD element activities would take advantage of existing facilities and infrastructure to the extent practicable. The temporary use of land on Toton for a launch site would not eliminate options for continued and future use of the island for copra processing. The uses of the sites at all other locations, which were or are to support missile and rocket launches, would not be altered. Therefore, the Proposed Action does not eliminate any options for future use of the environment for the locations under consideration.

4.14 NATURAL OR DEPLETABLE RESOURCE REQUIREMENTS AND CONSERVATION POTENTIAL

Other than various structural materials and fuels, the program would require no significant natural or depletable resources.

4.15 FEDERAL ACTIONS TO ADDRESS ENVIRONMENTAL JUSTICE IN MINORITY POPULATIONS AND LOW-INCOME POPULATIONS (EXECUTIVE ORDER 12898)

Proposed activities would be conducted in a manner that would not substantially affect human health and the environment. This EA has identified no effects that would result in disproportionately high or adverse effect on minority or low-income populations in the area. The activities would also be conducted in a manner that would not exclude persons from participating in, deny persons the benefits of, or subject persons to discrimination because of their race, color, national origin, or socioeconomic status.

4.16 FEDERAL ACTIONS TO ADDRESS PROTECTION OF CHILDREN FROM ENVIRONMENTAL HEALTH RISKS AND SAFETY RISKS (EXECUTIVE ORDER 13045, AS AMENDED BY EXECUTIVE ORDER 13229)

This EA has not identified any environmental health and safety risks that may disproportionately affect children, in compliance with Executive Order 13045, as amended by Executive Order 13229.

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5.0 REFERENCES

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7.0
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7.0 AGENCIES AND INDIVIDUALS CONTACTED

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National Marine Fisheries Service
Pacific Islands Area Office

Pacific Missile Range Facility
Kekaha, HI

Reagan Test Site
U.S. Army Kwajalein Atoll

THAAD Project Office

U.S. Fish and Wildlife Service
Honolulu, HI

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APPENDIX A
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DISTRIBUTION LIST

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Pearl Harbor, HI

Department of Defense, Missile Defense Agency
Washington DC

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Reagan Test Site
U.S. Army Kwajalein Atoll

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APPENDIX B
CORRESPONDENCE



DEPARTMENT OF DEFENSE
MISSILE DEFENSE AGENCY
7100 DEFENSE PENTAGON
WASHINGTON, DC 20301-7100

TE

MAR 25 2002

Rear Admiral Robert T. Conway, Jr.
Commander, Navy Region Hawaii
517 Russell Avenue, Suite 110
Pearl Harbor, Hawaii 96860

Dear Admiral Conway:

The Missile Defense Agency (MDA) is preparing an environmental assessment (EA) to analyze the impacts resultant from establishment of enhanced launch capabilities at the Ronald Reagan Ballistic Missile Defense Test Site (RTS) and/or the Pacific Missile Range Facility (PMRF) and performance of Terminal Missile Defense launches as part of the Theater High Altitude Area Defense (THAAD) test flights. I request the United States Navy (USN) to act as a cooperating agency because program activities could be conducted at PMRF and because of your specialized expertise in this program.

Proposed activities associated with this effort would include: construction of test support facilities and infrastructure at RTS and/or PMRF; launches of THAAD interceptor missiles from RTS and/or PMRF; location and operation of the THAAD radar system at RTS, PMRF, and/or Roi-Namur; land launches of target missiles from Wake Island, Toton Island, Wotje Atoll and/or Bigen Island; and, sea-based and air-based launches of target missiles from the broad Pacific Ocean area.

In the interest of an effective and efficient National Environmental Policy Act process, I ask the USN to assist MDA in the identification and evaluation of key environmental, safety, and occupational health (ESOH) issues as early as practicable.

Please direct any questions to Mr. Crate J. Spears, my ESOH point of contact, at (703) 697-4123, e-mail: crate.spears@mda.osd.mil.

Sincerely,

A handwritten signature in cursive script, appearing to read "Patricia Sanders", is positioned above the typed name.

PATRICIA SANDERS
Deputy for Test and Assessment



DEPARTMENT OF THE NAVY

COMMANDER
NAVY REGION HAWAII
517 RUSSELL AVENUE, SUITE 110
PEARL HARBOR, HAWAII 96860-4884

IN REPLY REFER TO:

5090

Ser N465/00140

23 APR 2002

Ms. Patricia Sanders
Department of Defense
Missile Defense Agency
7100 Defense Pentagon
Washington DC 20301-7100

Dear Ms. Sanders:

As the Navy's regional coordinator for all shore-based naval personnel and shore activities located in Hawaii as well as Midway Island, Kure Island and the islands of Wake, Johnston, Palmyra and Kingman Reef, Commander, Navy Region Hawaii, is pleased to offer assistance to the Missile Defense Agency as a cooperating agency to the environmental assessment associated with the possible enhancement of launch capabilities at the Pacific Missile Range Facility, Barking Sands, Kauai.

The Navy Region Hawaii point of contact is Ms. Lisa Chan of the Navy Region Hawaii Environmental Department. She may be reached at (808) 471-1171 extension 229 or chanla@pwcpearl.navy.mil.

Sincerely,

A handwritten signature in black ink that reads "J. T. Sommer".

J. T. SOMMER
Commander, CEC, U. S. Navy
Director
Regional Environmental Department
By direction of
Commander, Navy Region Hawaii



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
U.S. ARMY SPACE AND MISSILE DEFENSE COMMAND
POST OFFICE BOX 1500
HUNTSVILLE, ALABAMA 35807-3801

MAY 10 2002

Environmental Division

Michael Molina
U.S. Fish and Wildlife Service
P.O. Box 50088
300 Ala Moana Boulevard, Room 3122
Honolulu, Hawaii 96850

Dear Mr. Molina:

The U.S. Army Space and Missile Defense Command, for the Missile Defense Agency, is preparing an Environmental Assessment (EA) in compliance with the National Environmental Policy Act (NEPA) and the Council on Environmental Quality regulations implementing NEPA. This EA is in support of the Theater High Altitude Area Defense (THAAD) missile flight tests over the Pacific Ocean. The purpose of the THAAD flight tests is to validate system design and the operational effectiveness of THAAD missiles and radar over a realistic distance of 50 to 2,400 kilometers (31 to 1,491 miles) against target missiles emulating ballistic threats.

The flight tests would involve THAAD interceptor missile launches and THAAD radar operation from a site at the Pacific Missile Range Facility, Kauai. The Ronald Reagan Ballistic Missile Test Site, U.S. Army Kwajalein Atoll, Republic of the Marshall Islands (RMI) would serve as an alternative location for these activities.

Solid and/or liquid propellant target missiles would be launched by various techniques including air-based launches, sea-based launches, and/or land launches. The launch of air- and sea-based targets would occur in the open ocean away from populated areas. Target missiles would be land launched from Wake Island; Bigen Island, Aur Atoll; RMI; or Toton Island, Wotje Atoll, RMI.

Under certain proposed flight test scenarios, there is a potential for intercept debris of small size to deposit in portions of the Hawaiian Islands National Wildlife Refuge. Of particular concern is Nihoa Island, a small island at the southeastern end of the Northwestern Hawaiian Islands, 444.5 kilometers (240 nautical miles) northwest of O'ahu. Nihoa Island serves as the only home for three endangered plants, including the Nihoa fan palm (*Pritchardia remota*); 72 documented insect species; and two small, endangered land birds, the Nihoa finch (*Telespyza ultima*) and the Nihoa miller bird (*Acrocephalus familiaris kingi*), in the only remaining intact example of a Hawaiian coastal scrub community in the world. The Northwestern Hawaiian Islands Passerine Recovery Plan describes essential habitat for both bird species as all land to the mean lower low water line on

Nihoa Island, an area of approximately 62 hectares (153 acres). However, no critical habitat has been designated for either species.

A proposed rule to designate critical habitat for 76 listed plant species on the islands of Kauai and Niihau was published in the *Federal Register* in November 2000. This proposed rule included land in the northwestern end of PMRF near Polihale Park as critical habitat for the endangered Ohai (*Sesbania tomentosa*) and Lau'ehu (*Panicum niihauense*). In January 2002, the USFWS proposed critical habitat for additional plant species on Kauai and Niihau, revising the total of plants to 83, which includes additional land in the southern portion of PMRF for protection of Lau'ehu (*Panicum niihauense*). The USFWS re-evaluated the dune habitat on PMRF and determined that it was not essential for the conservation of Ohai (*Sesbania tomentosa*). According to the Federal Register, your office may exclude some or all of the PMRF lands based on consideration of management plans being produced by PMRF.

In order to complete the NEPA process, we are requesting an informal Endangered Species Act Section 7 compliance list from your office. Enclosure 1 contains a table of threatened and endangered plant and wildlife species that was derived from information provided for previous EAs. We would appreciate your concurrence with this list for the proposed site locations in your jurisdiction.

Please review this information and provide comments by June 7, 2002 to Deputy Commanding General, U.S. Army Space and Missile Defense Command, SMDC-EN-V/Mr. Thomas Craven, P.O. Box 1500, Huntsville, AL 35807-3801 or by data facsimile 256-955-5074. If you have any questions or comments, please contact Mr. Craven at 256-955-1533.

Sincerely,


Edwin P. Janasky
Colonel, U.S. Army
Deputy Chief of Staff,
Engineer

Enclosure



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
U.S. ARMY SPACE AND MISSILE DEFENSE COMMAND
POST OFFICE BOX 1500
HUNTSVILLE, ALABAMA 35807-3801

MAY 30 2002

Environmental Division

John Naughton
Habitat Conservation
National Marine Fisheries Service
Pacific Islands Area Office
1601 Kapiolani Boulevard, Suite 1110
Honolulu, Hawaii 96814

Dear Mr. Naughton:

The U.S. Army Space and Missile Defense Command, for the Missile Defense Agency, is preparing an Environmental Assessment (EA) in compliance with the National Environmental Policy Act (NEPA) and the Council on Environmental Quality regulations implementing NEPA. This EA is in support of the Theater High Altitude Area Defense (THAAD) missile flight tests over the Pacific Ocean. The purpose of the THAAD flight tests is to validate system design and the operational effectiveness of THAAD missiles and radar over a realistic distance of 50 to 3,000 kilometers (31 to 1,864 miles) against target missiles emulating ballistic threats.

The flight tests would involve THAAD interceptor missile launches and THAAD radar operation from a site at the Pacific Missile Range Facility, Kauai. The Ronald Reagan Ballistic Missile Test Site, U.S. Army Kwajalein Atoll, Republic of the Marshall Islands (RMI) would serve as an alternative location for these activities.

Solid and/or liquid propellant target missiles would be launched by various techniques including air-based launches, sea-based launches, and/or land launches. The launch of air- and sea-based targets would occur in the open ocean away from populated areas. Target missiles would be land launched from Wake Island, Bigen Island, Aur Atoll, RMI, or Toton Island, Wotje Atoll, RMI.

Enclosure 1 contains a table of threatened and endangered plant and wildlife species that was derived from information provided for previous EAs. In order to complete the NEPA process, I have requested an informal Endangered Species Act Section 7 compliance list from the National Marine Fisheries Service. For that purpose, I have provided a letter to Margaret Dupree requesting concurrence or additional information on the protected species information in Enclosure 1.

The EA will also consider the long-term conservation and protection of the coral reef ecosystem and related marine resources and species of the Northwestern Hawaiian Islands as required by Executive Order 13196, *Final Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve*. The EA will also investigate the potential

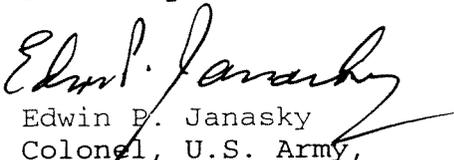
for adverse impact to Essential Fish Habitat in accordance with the Magnuson-Stevens Fishery Conservation and Management Act.

Under certain proposed flight test scenarios, there is a potential for intercept debris of small size to deposit in portions of the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve. For example, current analyses predict that the largest debris, which would have kinetic energy of 0.2 ft-lb, would have a 1 in a trillion chance or less of impacting Nihoa Island. For comparison, the kinetic energy of a BB fired from a BB gun has kinetic energy of 1.5 foot-pounds. The possibility of impacting on the coral reef reserve would still be small but slightly higher, about 1 in 100 million. Also, because of the small size of the debris and the high altitude of the intercept, the debris would not be hot enough to be of concern if it impacted Nihoa.

Intercepts of the target missiles by the THAAD interceptor missiles would occur within the Temporary Operating Area currently used by the Pacific Missile Range Facility. The 1998 Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement examined the use of this area for this and other purposes. That document examined missile testing and intercept activities and found no significant impact to federally listed species, marine mammals, or other marine resources. The U.S. Navy consulted with your office on that document and received concurrence. Based on those analyses and current preliminary analyses for the THAAD testing, there appears to be no adverse effect to essential fish habitat or coral reef ecosystems.

Please review this information and provide comments by June 13, 2002 to Deputy Commanding General, U.S. Army Space and Missile Defense Command, SMDC-EN-V/Mr. Thomas Craven, P.O. Box 1500, Huntsville, AL 35807-3801 or by data facsimile 256-955-5074. If you have any questions or comments, please contact Mr. Craven at 256-955-1533.

Sincerely,


Edwin P. Janasky
Colonel, U.S. Army,
Deputy Chief of Staff,
Engineer

Enclosure

Table 1: Listed Species Known or Expected to Occur
in the Vicinity of the Proposed Action

Scientific Name	Common Name (Location)	Status	
		State	Federal
Reptiles			
<i>Caretta caretta</i>	Loggerhead sea turtle (PMRF, RTS, Wake)	E	T
<i>Chelonia mydas</i>	Green sea turtle (PMRF, RTS, Wake, Bigen, Toton,)	E	T
<i>Dermochelys coriacea</i>	Leatherback sea turtle (PMRF, RTS, Wake)	E	E
<i>Eretmochelys imbricata</i>	Hawksbill sea turtle (PMRF, RTS, Wake, Bigen, Toton)	E	E
<i>Ledidochelys olivacea</i>	Olive ridley (PMRF, RTS)	E	T
Birds			
<i>Anas wyvilliana</i>	Hawaiian duck (PMRF)	E	E
<i>Ducula oceania ratakensis</i>	Ratak Micronesian pigeon (Wotje)	-	SOC
<i>Fulica americana alai</i>	Hawaiian (American) coot (PMRF)	E	E
<i>Gallinula chloropus sandvicensis</i>	Hawaiian common moorhen (PMRF)	E	E
<i>Himantopus mexicanus knudseni</i>	Hawaiian black-necked stilt (PMRF)	E	E
<i>Pterodroma phaeopygia sandwichensis</i>	Dark-rumped petrel (PMRF)	E	E
<i>Puffinus auricularis newelli</i>	Newell's shearwater (PMRF)	E	T
Mammals			
<i>Balaenoptera borealis</i>	Sei whale (Open Ocean)	E	E
<i>Balaenoptera musculus</i>	Blue whale (Open Ocean)	E	E
<i>Balaenoptera physalus</i>	Fin whale (Open Ocean)	E	E
<i>Lasiurus cinereus spp. semotus</i>	Hawaiian hoary bat (PMRF)	E	E
<i>Megaptera novaeangliae</i>	Humpback whale (Open Ocean)	E	E
<i>Monachus schauinslandi</i>	Hawaiian monk seal (PMRF)	E	E
<i>Physeter macrocephalus</i>	Sperm whale (Open Ocean)	E	E
Plants			
<i>Panicum niihauense</i>	Lau'ehu (PMRF)	E	E
<i>Sesbania tomentosa</i>	Ohai (PMRF)	E	E

NOTES:

-	Not listed	T	Threatened
SOC	Species of concern	E	Endangered

PMRF = Pacific Missile Range Facility

RTS = Ronald Reagan Ballistic Missile Test Site, U.S. Army

Kwajalein Atoll



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
U.S. ARMY SPACE AND MISSILE DEFENSE COMMAND
POST OFFICE BOX 1500
HUNTSVILLE, ALABAMA 35807-3801

MAY 30 2002

Environmental Division

Margaret Dupree
National Marine Fisheries Service
Pacific Islands Area Office
1601 Kapiolani Boulevard, Suite 1110
Honolulu, Hawaii 96814

Dear Ms. Dupree:

The U.S. Army Space and Missile Defense Command, for the Missile Defense Agency, is preparing an Environmental Assessment (EA) in compliance with the National Environmental Policy Act (NEPA) and the Council on Environmental Quality regulations implementing NEPA. This EA is in support of the Theater High Altitude Area Defense (THAAD) missile flight tests over the Pacific Ocean. The purpose of the THAAD flight tests is to validate system design and the operational effectiveness of THAAD missiles and radar over a realistic distance of 50 to 3,000 kilometers (31 to 1,864 miles) against target missiles emulating ballistic threats.

The flight tests would involve THAAD interceptor missile launches and THAAD radar operation from a site at the Pacific Missile Range Facility, Kauai. The Ronald Reagan Ballistic Missile Test Site, U.S. Army Kwajalein Atoll, Republic of the Marshall Islands (RMI) would serve as an alternative location for these activities.

Solid and/or liquid propellant target missiles would be launched by various techniques including air-based launches, sea-based launches, and/or land launches. The launch of air- and sea-based targets would occur in the open ocean away from populated areas. Target missiles would be land launched from Wake Island, Bigen Island, Aur Atoll, RMI, or Toton Island, Wotje Atoll, RMI.

In order to complete the NEPA process, I am requesting an informal Endangered Species Act Section 7 compliance list from your office. Enclosure 1 contains a table of threatened and endangered plant and wildlife species that was derived from information provided for previous National Environmental Policy Act documents. I would appreciate your concurrence with this list for the proposed site locations in your jurisdiction.

Under certain proposed flight test scenarios, there is a potential for intercept debris of small size to deposit in portions of the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve. For example, current analyses predict that the largest debris, which would

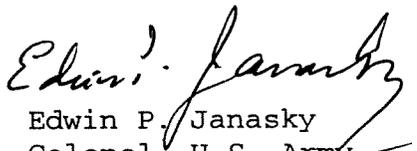
have kinetic energy of 0.2 ft-lb, would have a 1 in a trillion chance or less of impacting Nihoa Island. For comparison, the kinetic energy of a BB fired from a BB gun has kinetic energy of 1.5 foot-pounds. The possibility of impacting on the coral reef reserve would still be small but slightly higher, about 1 in 100 million. Also, because of the small size of the debris and the high altitude of the intercept, the debris would not be hot enough to be of concern if it impacted Nihoa.

Intercepts of the target missiles by the THAAD interceptor missiles would occur within the Temporary Operating Area currently used by the Pacific Missile Range Facility. The 1998 Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement examined the use of this area for this and other purposes. That document examined missile testing and intercept activities and found no significant impact to federally listed species, marine mammals, or other marine resources. The U.S. Navy consulted with your office on that document and received concurrence. Based on those analyses and current preliminary analyses for the THAAD testing, there appears to be no adverse effect to Federally listed marine species, marine mammals, essential fish habitat or coral reef ecosystems.

I have also provided a letter to John Naughton, Habitat Conservation, requesting information on essential fish habitat and the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve.

Please review this information and provide comments by June 13, 2002 to Deputy Commanding General, U.S. Army Space and Missile Defense Command, SMDC-EN-V/Mr. Thomas Craven, P.O. Box 1500, Huntsville, AL 35807-3801 or by data facsimile 256-955-5074. If you have any questions or comments, please contact Mr. Craven at 256-955-1533.

Sincerely,


Edwin P. Janasky
Colonel, U.S. Army
Deputy Chief of Staff,
Engineer

Enclosure

**Table 1: Listed Species Known or Expected to Occur
in the Vicinity of the Proposed Action**

Scientific Name	Common Name (Location)	Status	
		State	Federal
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Birds			
<i>Anas wyvilliana</i>	Hawaiian duck (PMRF)	E	E
<i>Ducula oecania ratakensis</i>	Ratak Micronesian pigeon (Wotje)	-	SOC
<i>Fulica americana alai</i>	Hawaiian (American) coot (PMRF)	E	E
<i>Gallinula chloropus sandvicensis</i>	Hawaiian common moorhen (PMRF)	E	E
<i>Himantopus mexicanus knudseni</i>	Hawaiian black-necked stilt (PMRF)	E	E
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<i>Puffinus auricularis newelli</i>	Newell's shearwater (PMRF)	E	T
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<i>Balaenoptera musculus</i>	Blue whale (Open Ocean)	E	E
<i>Balaenoptera physalus</i>	Fin whale (Open Ocean)	E	E
<i>Lasiurus cinereus spp. semotus</i>	Hawaiian hoary bat (PMRF)	E	E
<i>Megaptera novaeangliae</i>	Humpback whale (Open Ocean)	E	E
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Plants			
<i>Panicum niihauense</i>	Lau'ehu (PMRF)	E	E
<i>Sesbania tomentosa</i>	Ohai (PMRF)	E	E

NOTES:

- Not listed
- SOC Species of concern
- PMRF = Pacific Missile Range Facility
- RTS = Ronald Reagan Ballistic Missile Test Site, U.S
- T Threatened
- E Endangered



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
U.S. ARMY SPACE AND MISSILE DEFENSE COMMAND
POST OFFICE BOX 1500
HUNTSVILLE, ALABAMA 35807-3801

'01 JUL 2002

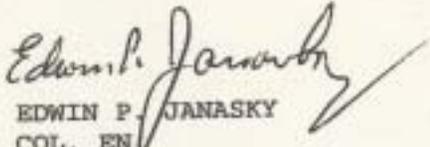
SMDC-EN-V (200)

MEMORANDUM FOR Navy Region Hawaii, Environmental Department, Ms. Lisa Chan,
517 Russell Avenue, Suite 110, Pearl Harbor, Hawaii 96860-4884

SUBJECT: Description of Proposed Action and Alternatives (DOPAA) for Theater
High Altitude Area Defense (THAAD) Pacific Test Flights Environmental
Assessment

1. The U.S Army Space and Missile Defense Command, for the Missile Defense Agency, is preparing an environmental assessment for THAAD test flights in the Pacific region. In the 23 April 2002 letter from Commander J.T. Sommer, Navy Region Hawaii, to Patricia Sanders of the Missile Defense Agency, Navy Region Hawaii agreed to be a cooperating agency for the THAAD Pacific Test Flights Environmental Assessment. You were identified as the point of contact for that action.
2. Enclosed for your information and use are two copies of the DOPAA for the THAAD Pacific Test Flights Environmental Assessment. Also enclosed are two compact discs which contain the DOPAA.
3. Within the next 3 weeks, you will be receiving the Draft Environmental Assessment for review and comment as a cooperating agency.
4. If you have any questions or comments, please contact Thomas M. Craven of the Environmental Division. He can be contacted at 256-955-1533 or tom.craven@smdc.army.mil.

Encl


EDWIN P. JANASKY
COL, EN
Deputy Chief of Staff,
Engineer

CF:
Missile Defense Agency, MDA-TER/Mr. Crate Spears, Federal Office Building #2,
7100 Defense Pentagon, Washington, DC 20301-7100



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
Pacific Islands Area Office
1601 Kapiolani Boulevard, Suite 1110
Honolulu, Hawaii 96814-0047

July 3, 2002

Deputy Commanding General
U.S. Army Space and Missile Defense Command
SMDC-EN-V/Mr. Thomas Craven
P.O. Box 1500
Huntsville, AL 35807-3801
FAX 256 955-5074

Dear Mr. Craven:

This responds to your request received June 3, 2002, for a list of threatened and endangered marine species under the jurisdiction of the National Marine Fisheries Service (NMFS) that may be found in the proposed areas for the purpose of Theater High Altitude Area Defense (THAAD) missile flight tests over the Pacific Ocean. We provide the following information under our statutory authorities under the Endangered Species Act of 1973, as amended, 16 U.S.C. 1531 *et seq.*

Endangered Species

Leatherback turtle (*Dermochelys coriacea*)
Hawksbill sea turtle (*Eretmochelys imbricata*)
Humpback whale (*Megaptera novaeangliae*)
Sperm whale (*Physeter macrocephalus*)
Hawaiian Monk Seal (*Monachus schauinslandi*)
Sei whale (*Balaenoptera borealis*)
Blue whale (*Balaenoptera musculus*)
Fin whale (*Balaenoptera physolus*)

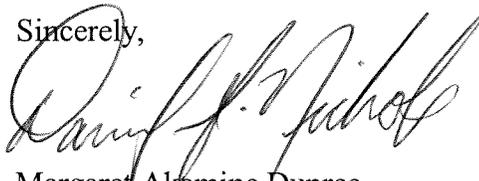
Threatened species

Green sea turtle (*Chelonia mydas*)
Olive Ridley Sea turtle (*Lepidochelys olivacea*)
Loggerhead sea turtle (*Caretta caretta*)



I can be reached at (808) 973-2937 or fax (808) 973-2941, should you have further questions regarding protected species in Hawaiian waters and/or the section 7 process.

Sincerely,

A handwritten signature in cursive script, appearing to read "David J. Nichols".

FOR

Margaret Akamine Dupree
Protected Species Division



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
U.S. ARMY SPACE AND MISSILE DEFENSE COMMAND
POST OFFICE BOX 1500
HUNTSVILLE, ALABAMA 35807-3801

22 JUL 2002

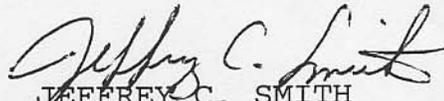
SMDC-EN-V (200)

MEMORANDUM FOR Navy Region Hawaii, Environmental Department,
Ms. Lisa Chan, 517 Russell Avenue, Suite 110, Pearl Harbor,
Hawaii, 96860-4884

SUBJECT: Preliminary Draft Theater High Altitude Area Defense
(THAAD) Pacific Test Flights Environmental Assessment

1. Enclosed are copies of the Preliminary Draft THAAD Pacific Flight Test Environmental Assessment for review. Also enclosed for your use are copies of the document on compact discs.
2. Comments on the Preliminary Draft THAAD Pacific Flight Test Environmental Assessment should be received by this office no later than 8 August 2002. Please provide your comments on the form which is provided electronically on the compact discs. A paper copy of the comment form is enclosed with each paper copy of the Environmental Assessment.
3. Point of contact is Thomas M. Craven, 256-955-1533, DSN 645-1533 or e-mail: tom.craven@smdc.army.mil.

Encl


JEFFREY C. SMITH
COL, EN
Deputy Chief of Staff,
Engineer



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
U.S. ARMY SPACE AND MISSILE DEFENSE COMMAND
POST OFFICE BOX 1500
HUNTSVILLE, ALABAMA 35807-3801

05 SEP 2002

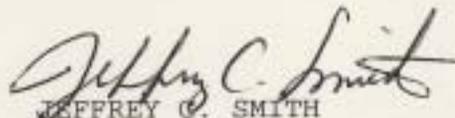
SMDC-EN-V (200)

MEMORANDUM FOR SEE DISTRIBUTION

SUBJECT: Theater High Altitude Area Defense (THAAD) Pacific Flight
Test Coordinating Draft Environmental Assessment

1. Enclosed for your use and information is the THAAD Pacific Flight
Test Coordinating Draft Environmental Assessment (CDEA).
2. The CDEA was provided to appropriate state and federal resource
agencies for comments. It was also provided to the Republic of the
Marshall Islands Environmental Protection Authority and the Ministry
of Internal Affairs, Historic Preservation Office. Comments are due
NLT 7 Oct 02.
3. Point of contact is Thomas M. Craven, 256-955-1533,
DSN 645-1533, e-mail tom.craven@smdc.army.mil.

Encl


JEFFREY C. SMITH
Colonel, EN
Deputy Chief of Staff,
Engineer

DISTRIBUTION:

Missile Defense Agency, MDA-TERC, Mr. Crate Spears, Federal Office
Building #2, 7100 Defense Pentagon, Washington, DC 20301-7100
Missile Defense Agency, Theater High Altitude Area Defense Project
Office, MDA-THT, Mr. Mario Flores, P.O. Box 1500, Huntsville, AL
35807-3801
U.S. Navy Region Hawaii, Environmental Department, Ms. Lisa Chan,
517 Russell Avenue, Suite 110, Pearl Harbor, HI 96860-4884
Pacific Missile Range Facility, Mr. Robert Inoyue, P. O. Box 128,
Kekaha, Hawaii 96752-0128
Pacific Missile Range Facility, Mr. William Hughes, P. O. Box 128,
Kekaha, Hawaii 96752-0128
U.S. Army Kwajalein Atoll, Mr. Thomas Kane, P.O. Box 26, APO AP 96555



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
U.S. ARMY SPACE AND MISSILE DEFENSE COMMAND
POST OFFICE BOX 1500
HUNTSVILLE, ALABAMA 35807-3801

Environmental Division

Mr. John Naughton
Habitat Conservation
National Marine Fisheries Service
Pacific Islands Area Office
1601 Kapiolani Boulevard, Suite 1110
Honolulu, Hawaii 96814

Dear Mr. Naughton:

In compliance with the National Environmental Policy Act (NEPA) and the Council on Environmental Quality regulations implementing NEPA, the U. S. Army Space and Missile Defense Command, on behalf of the Missile Defense Agency (MDA), is preparing the *Theater High Altitude Area Defense (THAAD) Pacific Test Flights Environmental Assessment (EA)*. The THAAD Project Office of MDA proposes to conduct THAAD missile flights over the Pacific Ocean.

The Proposed Action would involve THAAD interceptor missile launches and THAAD radar operation from a site at the Pacific Missile Range Facility (PMRF), Kauai, Hawaii. The Ronald Reagan Ballistic Missile Test Site (RTS), U.S. Army Kwajalein Atoll, Republic of the Marshall Islands (RMI) would serve as an alternative location for THAAD launches. A second alternative would involve the use of both PMRF and RTS for testing. The Proposed Action and alternatives would require the construction of test support facilities and site preparation for launch activities.

Solid and/or liquid propellant target missiles would be launched by various techniques including air-based launches, sea-based launches, and/or land launches. The launch of air- and sea-based targets would occur in the open ocean away from populated areas. Target missiles could be land launched from Wake Island; Bigen Island, Aur Atoll, RMI; or Toton Island, Wotje Atoll, RMI. The intercepts would occur over the broad Pacific Ocean.

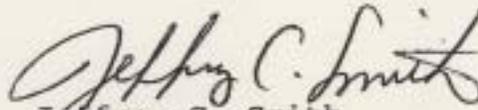
The EA considers the long-term conservation and protection of the coral reef ecosystem and related marine resources and species

of the Northwestern Hawaiian Islands as required by Executive Order 13196, *Final Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve*. The EA also investigates the potential for adverse impact to Essential Fish Habitat in accordance with the Magnuson-Stevens Fishery Conservation and Management Act; to marine mammals in accordance with the Marine Mammal Protection Act; and federally listed species in accordance with the Endangered Species Act.

This coordinating draft EA is being distributed to various agencies, including your office, for review and comment prior to preparing the Final EA for public review. It is our desire to ensure that any concern you might have about our efforts to identify natural resources and assess potential impacts is fully addressed.

Please review this information and provide comments by October 7, 2002 to U.S. Army Space and Missile Defense Command, SMDC-EN-V/Mr. Thomas Craven, P.O. Box 1500, Huntsville, AL 35807-3801 or by data facsimile 256-955-5074, or by e-mail to tom.craven@smdc.army.mil. If you have any questions or comments, please contact Mr. Craven at 256-955-1533.

Sincerely,



Jeffrey C. Smith
Colonel, U.S. Army
Deputy Chief of Staff,
Engineer

Enclosure

Copy Furnished:

Margaret Dupree, National Marine Fisheries Service, Pacific Area
Islands Office, 1601 Kapiolani Blvd, Suite 1110, Honolulu, HI
96814-4700



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
U.S. ARMY SPACE AND MISSILE DEFENSE COMMAND
POST OFFICE BOX 1500
HUNTSVILLE, ALABAMA 35807-3801

Environmental Division

Mr. Lenest Lanki
Historic Preservation Office
Ministry of Internal Affairs
P.O. Box 1454, Majuro Atoll
Republic of the Marshall Islands 96960

Dear Mr. Lanki:

In compliance with the U.S. Army Kwajalein Atoll Environmental Standards, the National Environmental Policy Act (NEPA) and the Council on Environmental Quality regulations implementing NEPA, the U. S. Army Space and Missile Defense Command, on behalf of the Missile Defense Agency (MDA), is preparing the *Theater High Altitude Area Defense (THAAD) Pacific Test Flights Environmental Assessment (EA)*. The THAAD Project Office of MDA proposes to conduct THAAD missile flights over the Pacific Ocean.

The Proposed Action would involve THAAD interceptor missile launches and THAAD radar operation from a site at the Pacific Missile Range Facility (PMRF), Kauai, Hawaii. The Ronald Reagan Ballistic Missile Test Site (RTS), U.S. Army Kwajalein Atoll, Republic of the Marshall Islands (RMI) would serve as an alternative location for THAAD launches. A second alternative would involve the use of both PMRF and RTS for testing. The Proposed Action and alternatives would require the construction of test support facilities and site preparation for launch activities.

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The following individuals performed biological and archaeological surveys on Bigen and Toton Islands on

September 11-13, 2000: Mr. Thomas Craven, USASMDC, Team Leader; Mr. Mark Hubbs, Teledyne Solutions Inc., Environmental Analyst; Dr. Robert Esher, EDAW Inc., Biologist; Dr. Boris Deunert, EDAW Inc., Archaeologist; and Mr. Thomas Patrick, USAKA, Marshallese Liaison and Interpreter.

Biological surveys were conducted by walking the perimeter of the island looking for birds and other species of concern, then making forays into the interior to locate nesting areas, identify unique habitats, and carefully examine proposed launch sites. The presence of sea turtles was determined by examining sandy areas, especially beneath shrubs, for crawls and/or nests. On Bigen, the locals were also questioned about sea turtles.

Archaeological survey methods were modified to suit local conditions: the basic technique involved a series of pedestrian lagoon-ocean transects, cross-cutting the islets in regular intervals. Survey teams of two to five members carefully inspected selected areas on both islands. Photographic and written records were made of all significant findings. In addition, the general location of items of cultural interest (e.g., artifacts, features or deposits) was recorded on hand drawn maps. Attention was also paid to modern activities such as copra processing and contemporary housing sites and associated features. Only the southern part of Bigen and the western half of Toton Island were surveyed.

Bigen Island was inhabited by two or three family groups with approximately 15 to 20 individuals. A small village of huts was located near the shore. There was also a house trailer and two old mil vans that had been provided to the landowner as part of the lease agreement with USAKA in 1995. Aside from the area previously cleared for launches, much of the eastern half of the island was planted in coconut palms.

Mr. Craven and Dr. Esher conducted the biological survey. The vegetation on both islands was similar. The "jungle" on Toton was more extensive and diverse than on Bigen, even though the trees appeared to be younger. Beach heliotrope was the most abundant shrub in the areas previously cleared for launch activity on Bigen Island. The coconut plantations on Toton Island contained a wider variety of plant species and considerably more grass than did those on Bigen Island. Few vertebrates were found on either island. Five disturbed sea turtle nests were located on the northern shore of Bigen Island. Information obtained from the local inhabitants confirmed that they collected sea turtle eggs during the nesting season. No sea

turtle nests were found on Toton, although the weathered remains of a large turtle were found in an old burn pit on the southeastern tip of the island.

White tern, black and brown noddy, Pacific golden plover, whimbrel, and Pacific reef heron were birds found on Bigen Island. White tern; black and brown noddy, Pacific golden plover, ruddy turnstone, whimbrel, and wandering taddler were identified on Toton Island.

Dr. Duenert and Mr. Hubbs conducted the archaeological survey. The surveys on both Bigen and Toton were non-intrusive archaeological reconnaissance surveys. The surveys were limited to immediately visible surface indicators of historic and possibly prehistoric sites. Additional prehistoric and traditional sites may be present, but have not been identified during this campaign, due to the dense vegetation especially encountered on Toton Island and the lack of prior communication with landowners and possible informants.

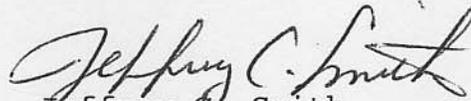
Bigen Island had been surveyed in 1994. While the 1994 survey was restricted to the three proposed launch areas, the present survey included all land area south of 8° 21' 54". The existing road from the coral rubble/sand spit (landing site) to the launch site was much wider than was originally proposed. It did not follow the old pedestrian path, but rather cut through previously undisturbed areas and ran very close to an iroj burial ground. Two large areas in the southern part of the island had been cleared of vegetation with heavy equipment. The three proposed launch sites occupied the southwestern clearing and the launch observation site was located in the southeastern opening. Five additional features and sites not reported in the 1994 survey of Bigen Island were found in the current survey. Most of the new sites were located in close proximity to the southern shore of the island. A contemporary housing area, composed of semi-traditional houses, was erected on a site of a historic and, possibly, prehistoric settlement. A Japanese cistern, probably constructed by occupational forces, was found. The several layers of "coral spread" that were found may be indicative of continuous use of the area, possibly to prehistoric times. Various abandoned garbage pits, an abandoned well, and an iroj burial ground (composed of an earthen mound and upright coral slabs) supports the theory of continuous use from prehistoric to historic times. In addition, a contemporary burial ground located north of the survey area is indicative of the importance of the island to the people of Aur Atoll.

Toton Island revealed evidence of World War II battles (i.e. ammunition and bomb craters), but little physical evidence of Japanese or German occupation. Physical evidence of temporary Japanese occupation was present in two steam-driven, copper-clad, wooden hull landing crafts, and as a set of iron wheels and axle possibly from a searchlight. Two contemporary copra-processing and habitation sites showed evidence of extended use. Prehistoric deposits may be found in close proximity to these sites. Two possible prehistoric food preparation sites were identified at the northern and southwestern shore. Coral spread at two sites pointed to temporary dwellings. Various smaller depressions throughout the island resulted from harvesting arrowroot. No prehistoric surface artifacts were found.

This coordinating draft EA is being distributed to various agencies, including your office, for review and comment prior to preparing the Final EA for public review. It is our desire to ensure that any concern you might have about our efforts to identify natural resources and assess potential impacts is fully addressed.

Please review this information and provide comments by October 7, 2002 to U.S. Army Space and Missile Defense Command, SMDC-EN-V/Mr. Thomas Craven, P.O. Box 1500, Huntsville, AL 35807-3801 or by data facsimile 256-955-5074, or by e-mail to tom.craven@smdc.army.mil. If you have any questions or comments, please contact Mr. Craven at 256-955-1533.

Sincerely,



Jeffrey C. Smith
Colonel, U.S. Army
Deputy Chief of Staff,
Engineer

Enclosure



DEPARTMENT OF THE ARMY
U.S. ARMY SPACE AND MISSILE DEFENSE COMMAND
POST OFFICE BOX 1500
HUNTSVILLE, ALABAMA 35807-3801

REPLY TO
ATTENTION OF

Environmental Division

Mr. John Bungitak, General Manager
Republic of the Marshall Islands
Environmental Protection Authority
P.O. Box 1322, Majuro Atoll
Republic of the Marshall Islands 96960

Dear Mr. Bungitak:

In compliance with the U.S. Army Kwajalein Atoll Environmental Standards, the National Environmental Policy Act (NEPA) and the Council on Environmental Quality regulations implementing NEPA, the U. S. Army Space and Missile Defense Command, on behalf of the Missile Defense Agency (MDA), is preparing the *Theater High Altitude Area Defense (THAAD) Pacific Test Flights Environmental Assessment (EA)*. The THAAD Project Office of MDA proposes to conduct THAAD missile flights over the Pacific Ocean.

The Proposed Action would involve THAAD interceptor missile launches and THAAD radar operation from a site at the Pacific Missile Range Facility (PMRF), Kauai, Hawaii. The Ronald Reagan Ballistic Missile Test Site (RTS), U.S. Army Kwajalein Atoll, Republic of the Marshall Islands (RMI) would serve as an alternative location for THAAD launches. A second alternative would involve the use of both PMRF and RTS for testing. The Proposed Action and alternatives would require the construction of test support facilities and site preparation for launch activities.

Solid and/or liquid propellant target missiles would be launched by various techniques including air-based launches, sea-based launches, and/or land launches. The launch of air- and sea-based targets would occur in the open ocean away from populated areas. Target missiles could be land launched from Wake Island; Bigen Island, Aur Atoll, RMI; or Toton Island, Wotje Atoll, RMI. The intercepts would occur over the broad Pacific Ocean.

Biological surveys were conducted on September 11-13, 2000 by walking the perimeter of the islands looking for birds and other

species of concern, then making forays into the interior to locate nesting areas, identify unique habitats, and carefully examine proposed launch sites. The presence of sea turtles was determined by examining sandy areas, especially beneath shrubs, for crawls and/or nests. On Bigen, the locals were also questioned about sea turtles.

Bigen Island was inhabited by two or three family groups with approximately 15 to 20 individuals. A small village of huts was located near the shore. There was also a house trailer and two old mil vans that had been provided to the landowner as part of the lease agreement with USAKA in 1995. Aside from the area previously cleared for launches, much of the eastern half of the island was planted in coconut palms.

The vegetation on both islands was similar. The "jungle" on Toton was more extensive and diverse than on Bigen, even though the trees appeared to be younger. Beach heliotrope was the most abundant shrub in the areas previously cleared for launch activity on Bigen Island. The coconut plantations on Toton Island contained a wider variety of plant species and considerably more grass than did those on Bigen Island. Few vertebrates were found on either island. Five disturbed sea turtle nests were located on the northern shore of Bigen Island. Information obtained from the local inhabitants confirmed that they collected sea turtle eggs during the nesting season. No sea turtle nest was found on Toton, although the weathered remains of a large turtle were found in an old burn pit on the southeastern tip of the island.

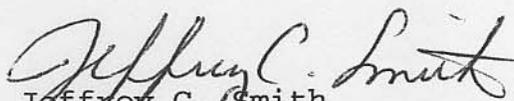
White tern, black and brown noddy, Pacific golden plover, whimbrel, and Pacific reef heron were birds found on Bigen Island. White tern; black and brown noddy, Pacific golden plover, ruddy turnstone, whimbrel, and wandering taddler were identified on Toton Island.

Based on the survey results and the temporary, non-intrusive nature of this program, no significant impacts are expected to occur on Bigen or Toton islands from implementation of the program as described in the attached Coordinating Draft EA.

This coordinating draft EA is being distributed to various agencies, including your office, for review and comment prior to preparing the Final EA for public review. It is our desire to ensure that any concern you might have about our efforts to identify natural resources and assess potential impacts is fully addressed.

Please review this information and provide comments by October 7, 2002 to U.S. Army Space and Missile Defense Command, SMDC-EN-V/Mr. Thomas Craven, P.O. Box 1500, Huntsville, AL 35807-3801 or by data facsimile 256-955-5074, or by e-mail to tom.craven@smdc.army.mil. If you have any questions or comments, please contact Mr. Craven at 256-955-1533.

Sincerely,



Jeffrey C. Smith
Colonel, U.S. Army
Deputy Chief of Staff,
Engineer

Enclosure



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
U.S. ARMY SPACE AND MISSILE DEFENSE COMMAND
POST OFFICE BOX 1500
HUNTSVILLE, ALABAMA 35807-3801

Environmental Division

Mr. Michael Molina, Marine Biologist
U.S. Fish and Wildlife Service
Division of Ecological Services
P.O. Box 50088
300 Ala Moana Boulevard, Room 3122
Honolulu, HI 96850

Dear Mr. Molina:

In compliance with the National Environmental Policy Act (NEPA) and the Council on Environmental Quality regulations implementing NEPA, the U. S. Army Space and Missile Defense Command, on behalf of the Missile Defense Agency (MDA), is preparing the *Theater High Altitude Area Defense (THAAD) Pacific Test Flights Environmental Assessment (EA)*. The THAAD Project Office of MDA proposes to conduct THAAD missile flights over the Pacific Ocean.

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Under certain flight test scenarios, there is the potential for intercept debris to be deposited on Nihoa Island in the Hawaiian Islands National Wildlife Refuge. This is of particular concern since Nihoa Island is the only remaining intact example of a Hawaiian coastal scrub community in the world. Although the Northwestern Hawaiian Islands Passerine Recovery Plan describes essential habitat for both small, endangered land birds bird species, no critical habitat has been designated for either species. Preliminary results

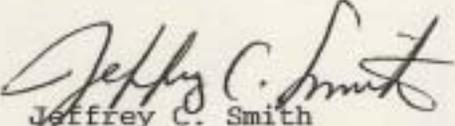
of an intercept debris analysis indicate that the probability of debris greater than 0.2 foot-pounds is about one in a trillion.

A proposed rule to designate critical habitat for 76 listed plant species on the islands of Kauai and Niihau included land in the northwestern end of PMRF near Polihale Park as critical habitat for the endangered Ohai (*Sesbania tomentosa*) and Lau'ehu (*Panicum niihauense*). In January 2002, the USFWS proposed critical habitat for additional plant species on Kauai and Niihau, revising the total of plants to 83, which includes additional land in the southern portion of PMRF for protection of Lau'ehu (*Panicum niihauense*). The USFWS re-evaluated the dune habitat on PMRF and determined that it was not essential for the conservation of Ohai (*Sesbania tomentosa*). The bypass road proposed on the southern portion of PMRF near the THAAD radar site is near Unit H3, which has been designated as unoccupied critical habitat. Construction of this bypass road would avoid Unit H3 to the extent practicable. Planned activities would not impact critical habitat in the northern portion of the range. Unexpected flight terminations or other launch mishaps have the potential to impact this critical habitat by fire, debris, and the resultant cleanup. However, the likelihood of a mishap occurring is small and appropriate measures would be in place to minimize adverse effects.

This coordinating draft EA is being distributed to various agencies, including your office, for review and comment prior to preparing the Final EA for public review. It is our desire to ensure that any concern you might have about our efforts to identify natural resources and assess potential impacts is fully addressed.

Please review this information and provide comments by October 7, 2002 to U.S. Army Space and Missile Defense Command, SMDC-EN-V/Mr. Thomas Craven, P.O. Box 1500, Huntsville, AL 35807-3801 or by data facsimile 256-955-5074, or by e-mail to tom.craven@smdc.army.mil. If you have any questions or comments, please contact Mr. Craven at 256-955-1533.

Sincerely,


Jeffrey C. Smith
Colonel, U.S. Army
Deputy Chief of Staff,
Engineer

Enclosure



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
U.S. ARMY SPACE AND MISSILE DEFENSE COMMAND
POST OFFICE BOX 1500
HUNTSVILLE, ALABAMA 35807-3801

Environmental Division

Mr. Gilbert Coloma-Agaran
Department of Land and Natural Resources
Historic Preservation Division
Kakuhihewa Building, Room 555
601 Kamokila Boulevard
Kapolei, Hawaii 96707

Dear Mr. Coloma-Agaran:

In compliance with the National Environmental Policy Act (NEPA) and the Council on Environmental Quality regulations implementing NEPA, the U. S. Army Space and Missile Defense Command, on behalf of the Missile Defense Agency (MDA), is preparing the *Theater High Altitude Area Defense (THAAD) Pacific Test Flights Environmental Assessment (EA)*. The THAAD Project Office of MDA proposes to conduct THAAD missile flights over the Pacific Ocean.

Most of the activities for the THAAD missile flights were initially analyzed in the December 1998 Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement. Since that analysis, the proposed use of Ni'ihua for Theater Missile Defense launch site activities has been dropped from consideration for this proposed action.

The current Proposed Action would involve THAAD interceptor missile launches and THAAD radar operation from a site at the Pacific Missile Range Facility (PMRF), Kauai, Hawaii. The Ronald Reagan Ballistic Missile Test Site (RTS), U.S. Army Kwajalein Atoll, Republic of the Marshall Islands (RMI) would serve as an alternative location for THAAD launches. A second alternative would involve the use of both PMRF and RTS for testing. The Proposed Action and alternatives would require the construction of test support facilities and site preparation for launch activities.

Solid and/or liquid propellant target missiles would be launched by various techniques including air-based launches, sea-based launches, and/or land launches. The launch of air-

and sea-based targets would occur in the open ocean away from populated areas. If the RTS alternative is selected, target missiles could be land launched from Wake Island; Bigen Island, Aur Atoll, RMI; or Toton Island, Wotje Atoll, RMI. The intercepts would occur over the broad Pacific Ocean.

The EIS examined the environmental effects of launching TMD interceptor and target missiles and conducting intercept tests over the board ocean area north and west of PMRF. It also looked at support activities, such as radar, command and control and administrative functions at PMRF, including potential construction of support facilities. Section 106 consultation was completed for these activities and the PMRF has a programmatic agreement in the form of a November 1998 Memorandum of Agreement with the State Historic Preservation Officer. Procedures in that Memorandum of Agreement would be followed if PMRF is chosen as the preferred alternative.

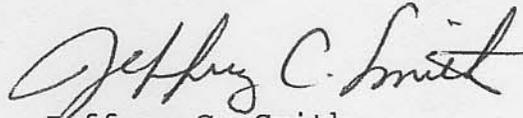
Recently, in accordance with Stipulation I(c) of the Memorandum of Agreement, the Pacific Naval Facilities Engineering Command Environmental Planning, Cultural Resource Branch, sponsored an archaeological survey of the area around the proposed location for the THAAD launch site. The tests concluded that cultural deposits extended from the coastal dune to the western boundary of the original proposed launch site and at least 5 meters (16 feet) into the present project site. The site was moved approximately 15 meters (50 feet) in accordance with the archaeologists' recommendations to avoid impacts to the Site 50-30-05-1829 deposits. Since the original launch pad location was moved, no impacts to traditional resources potentially located within the Nohili Dune during site preparation are expected. Personnel would be informed of the sensitivity of cultural resources and the types of penalties that could be incurred if sites are damaged or destroyed.

This Coordinating Draft EA is being distributed to various agencies, including your office, for review and comment prior to preparing the Final EA for public review. It is our desire to ensure that any concern you might have about our efforts to identify natural and cultural resources and assess potential impacts is fully addressed.

Please review this information and provide comments by October 7, 2002 to U.S. Army Space and Missile Defense Command, SMDC-EN-V/Mr. Thomas Craven, P.O. Box 1500, Huntsville, AL 35807-3801 or by data facsimile 256-955-5074, or by e-mail to

tom.craven@smdc.army.mil. If you have any questions or comments,
please contact Mr. Craven at 256-955-1533.

Sincerely,

A handwritten signature in cursive script that reads "Jeffrey C. Smith".

Jeffrey C. Smith
Colonel, U.S. Army
Deputy Chief of Staff,
Engineer

Enclosure



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
U.S. ARMY SPACE AND MISSILE DEFENSE COMMAND
POST OFFICE BOX 1500
HUNTSVILLE, ALABAMA 35807-3801

September 5, 2002

Environmental Division

Mr. Jeyan Thirugnanam
Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, Hawaii 96813

Dear Mr. Thirugnanam:

In compliance with the National Environmental Policy Act (NEPA) and the Council on Environmental Quality regulations implementing NEPA, the U. S. Army Space and Missile Defense Command, on behalf of the Missile Defense Agency (MDA), is preparing the *Theater High Altitude Area Defense (THAAD) Pacific Test Flights Environmental Assessment (EA)*. The THAAD Project Office of MDA proposes to conduct THAAD missile flights over the Pacific Ocean.

The activities for the THAAD missile flights were initially analyzed in the December 1998 Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement. Since that analysis, the proposed use of Ni'ihua for Theater Missile Defense launch site activities has been dropped from consideration for this proposed action.

The EIS examined the environmental effects of launching TMD interceptor and target missiles and conducting intercept tests over the broad ocean area north and west of PMRF. It also looked at support activities, such as radar, command and control and administrative functions at PMRF, including potential construction of support facilities. The enclosed Environmental Assessment continues that analysis with site-specific information.

The Proposed Action would involve THAAD interceptor missile launches and THAAD radar operation from a site at the Pacific Missile Range Facility (PMRF), Kauai, Hawaii. The Ronald Reagan Ballistic Missile Test Site (RTS), U.S. Army Kwajalein Atoll, Republic of the Marshall Islands (RMI) would serve as an alternative location for THAAD launches. A second alternative would involve the use of both PMRF and RTS for testing. The

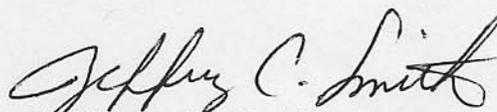
Proposed Action and alternatives would require the construction of test support facilities and site preparation for launch activities.

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This coordinating draft EA is being distributed to various agencies, including your office, for review and comment prior to preparing the Final EA for public review. It is our desire to ensure that any concern you might have about our efforts to identify environmental resources and assess potential impacts is fully addressed.

Please review this information and provide comments by October 7, 2002 to U.S. Army Space and Missile Defense Command, SMDC-EN-V/Mr. Thomas Craven, P.O. Box 1500, Huntsville, Alabama 35807-3801 or by data facsimile 256-955-5074, or by e-mail to tom.craven@smdc.army.mil. If you have any questions or comments, please contact Mr. Craven at 256-955-1533.

Sincerely,



Jeffrey C. Smith
Colonel, U.S. Army
Deputy Chief of Staff,
Engineer

Enclosure



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region / Pacific Islands Area Office
1601 Kapiolani Boulevard, Suite 1110
Honolulu, Hawaii 96814-0047

October 16, 2002

Deputy Commanding General
U.S. Army Space and Missile Defense Command
SMDC-EN-V/Mr. Thomas Craven
P.O. Box 1500
Huntsville, AL 35807-3801
FAX: (256) 955-5074

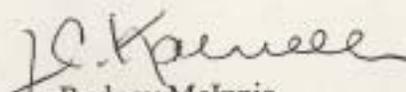
Dear Mr. Craven:

This responds to your request for comments regarding the proposed Theater High Altitude Area Defense (THAAD) Pacific Test Flights coordinating draft Environmental Assessment. Testing would involve THAAD interceptor missile launches and THAAD radar operation from a site at the Pacific Missile Range Facility (PMRF) located on the island of Kauai, Hawaii. Target missiles will be launched by a variety of techniques including air launches, sea launches, and/or land launches.

We have reviewed Coordinating Draft Environmental Assessment, including the description of the activity, the conditions you have established for conducting the operations, and the determination of impacts. Our review of the available information on THAAD Pacific flight tests leads us to conclude that the proposed action is not likely to adversely affect threatened or endangered species under the jurisdiction of the National Marine Fisheries Service (NOAA Fisheries). This concludes consultation responsibilities under Section 7 of the Endangered Species Act for this action. Consultation should be reinitiated, however, if new information reveals impacts of the identified activity that may affect listed species, a new species is listed, new critical habitat is designated, or the activity is subsequently modified (to include selection of a different preferred alternative).

We look forward to continued cooperation with you in conserving endangered and threatened resources. If you have any questions, please contact Margaret Akamine Dupree or David Nichols at (808) 973-2937 or fax (808) 973-2941.

Sincerely,


Rodney McInnis
Acting Administrator, Southwest Region



B-34

cc: Leona Stevenson



United States Department of the Interior

FISH AND WILDLIFE SERVICE

Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122
Box 50088
Honolulu, Hawaii 96850

OCT 17 2002

In Reply Refer To:
PI-02-199

Jeffrey C. Smith
Colonel, U.S. Army
Deputy Chief of Staff, Engineer
U.S. Army Space and Missile Defense Command
P.O. Box 1500
Huntsville, Alabama 35807-3801

Re: Draft Environmental Assessment - Theater High Altitude Area Defense (THAAD)
Pacific Test Flights

Dear Colonel Smith:

The U.S. Fish and Wildlife Service (Service) has reviewed the Coordinating Draft Environmental Assessment (DEA) for the above referenced action. The project is sponsored by the Department of the Army, U.S. Army Space and Missile Defense Command. The purpose of the proposed project is to evaluate the performance and interceptor capabilities of ballistic missiles and support radar components. The following comments have been prepared pursuant to the National Environmental Policy Act of 1969 [42 U.S.C. 4321 *et seq.*; 83 Stat. 853], as amended; the Fish and Wildlife Coordination Act of 1934 [16 U.S.C. 661 *et seq.*; 48 Stat. 401], as amended; the Endangered Species Act of 1973 [16 U.S.C. 1531 *et seq.*; 87 Stat. 884], as amended (ESA); and other authorities mandating U.S. Fish and Wildlife Service concern for environmental values. Based on these authorities, the Service offers the following comments for your consideration.

GENERAL COMMENTS

The proposed project involves high altitude missile flight tests at the Pacific Missile Range Facility (PMRF), Kauai, Hawaii; the Ronald Reagan Ballistic Missile Defense Test Site (RTS), Republic of the Marshall Islands (RMI); Wake islet, Wake Atoll; Toton islet, Wotje Atoll; Bigen islet, Aur Atoll. Flight tests include launching interceptor and target missiles from a variety of platforms including air, sea, and land launches. Ballistic missile exercises operate over a range between 31 and 1,860 miles and simulate launches that may threaten U.S. interests.

The DEA evaluates three alternatives, including the preferred alternative Theater High Altitude Area Defense Test Flights (THAAD), the THAAD at Reagan Test Site and a no-action alternative. We agree that the preferred alternative, which involves conducting flight tests from the PMRF facility, is not anticipated to significantly impact fish and wildlife resources and habitat.

Flight test materials and equipment would be transported to PMRF by aircraft and ship, via the PMRF airfield or Nawiliwili Port, Kauai. Preflight activities, such as missile assembly and fueling, would occur in the vicinity of the launch site. A support building, required to provide maintenance, repair, and storage of THAAD components, would be constructed of reinforced concrete between the Nohili Road and Lii Road. A Central Support Facility would be constructed to provide office and administrative space for up to 60 personnel, and be located between Nohili Road and Lii Road at the PMRF administration area. Finally, a Mission Control Blockhouse would be constructed about 1,250 feet from the launcher hardstand and house a mission control room. The THAAD launcher hardstand, a 150 foot by 150 foot concrete pad, would be constructed at the North PMRF site, south of the Sandia National Laboratories Kauai Test Facility at the end of Naupaka Way. Radar sites, supporting a 160 foot by 220 foot hardstand, may be located at either the South PMRF facility or south of the Nohili Ditch.

Flight test activities involve launching THAAD interceptor missiles by personnel located within the Mission Control Blockhouse. About 50 interceptor missiles may be launched over a four year period, averaging between 1 - 14 launches per year. During standard range warning procedures, personnel would check for concentrations of marine mammals in the area of the target launch trajectory and landing location and follow established range safety guidelines. Prior to activating THAAD radar, a visual survey of the area would be conducted to verify that personnel and wildlife are outside the hazard zone. Target Missiles would be launched from sea-borne platforms, including either the Mobile Aerial Target Support System (MATSS) or the Mobile Launch Platform (MLP). Both vessels are not powered and must be towed to the target launch site. Target missiles may also be launched from air-borne platforms, such as the C-17 Globemaster or the C-130 Hercules. A Pallet Release/Flight Termination System is composed of a pallet and up to eight parachutes, designed to clear the target missile from the plane. Once clear, the target missile would be released from the pallet, and engines would be ignited. The parachute and pallet would drop into the ocean and sink. The interceptor missile is designed to collide with the target missile and destroy it. Missile debris would fall into the ocean and would be confined to the established operating area west and north of PMRF.

We believe the DEA identifies most of the existing species and habitats at the proposed project site and assesses most of the potential project-related impacts to these resources. However, we feel the document could be improved by providing more detail of fish and wildlife resources and habitat that may occur within the project area. We recommend that the following specific recommendations be incorporated into the Draft Environmental Assessment (DEA).

SPECIFIC COMMENTS

Pg 3-11. Affected Environment - Threatened and Endangered Species:

Paragraph 3, Sentence 1: The DEA states "The federal threatened and state endangered green sea turtle (*Chelonia mydas*) basks and nests on PMRF adjacent to the Nohili Ditch." We recommend that the DEA describe the number of green sea turtles that may occur in the vicinity of Nohili Ditch, discerning the number of adults that may bask and nest, annually, at this location. Also, we recommend that the DEA describe the approximate average number of nests and hatchlings per nest that may occur at this location on an annual basis. The importance of the nesting grounds near Nohili Ditch should be described in the DEA in context with the recovery of green sea turtles.

Pg 3-13. Environmentally Sensitive Habitat:

Paragraph 3: This section does not contain a discreet description of the Hawaiian Islands National Wildlife Refuge (NWR) and the Midway Atoll NWR. We recommend that both NWRs, and their associated boundaries, be described and illustrated in the DEA.

Pg 3-34. Biological Resources - Reagan Test Site, U.S. Army Kwajalein Atoll:

Paragraph 4: The DEA states "A general description of biological resources is provided in the first paragraph of section 3.1.3." We recommend a detailed description of the fish and wildlife resources be described in this section that: (1) all species of concern (SOC) and their habitat that may be affected by the proposed project be described in the DEA (as identified in the USAKA Environmental Standard); (2) describes measures to avoid or minimize project-related impacts to these resources.

We recommend that the DEA incorporate descriptions of vegetation types for project-affected islets from the 1999 reference "Botanical Survey of the United States of America Kwajalein Atoll (USAKA) Islands by Art Whistler, Lyon Arboretum, Honolulu and Orlo Steele, Botany Department, University of Hawaii" prepared for Oak Ridge Institute for Science and Education and The U.S. Army Environmental Center. June 1999.

Pg 3-36. Wildlife:

Paragraph 3: The DEA states "Five species of giant clam are found at USAKA along the surrounding reef on the lagoon side and ocean side, and between several of the islands. The largest species (*Tridacna gigas*), which was observed during the 1998 inventory has been significantly reduced in number.." We recommend that the DEA indicate that all species of mollusks from the family TRIDACNIDAE are listed as protected under the Convention for the International Trade on Endangered Species (CITES).

Pg 3-36. Threatened and Endangered Species:

Paragraph 6 - Sentence 1: The DEA states "Green and hawksbill (*Eretmochelys imbricate*) sea turtles have been observed on and offshore of Kwajalein." We recommend that the scientific name for green sea turtles, *Chelonia mydas*, appear in parentheses

italicized after the word Green. Also, we recommend italicizing the scientific name for Hawksbill turtle (*Eretmochelys imbricata*) and replacing the "e" in 'imbricate' with an "a."

Pg 3-59. Environmentally Sensitive Habitat:

Paragraph 3 - Sentence 1: The DEA states "The reefs surrounding Wake Island support a variety of sea life." We recommend that the DEA provide a detailed description of coral reef resources and habitat that are documented to occur at Wake Atoll. The DEA should identify resources described in the reference "Baseline Marine Biological Survey, Peacock Point Outfall and Other Point-Source Discharges, Wake Atoll, Pacific Ocean" as prepared by the U.S. Fish and Wildlife Service and the National Marine Fisheries Service. March 1999.

Pg 3-69. Biological Resources - Bigen, Aur Atoll:

Paragraph 4: We recommend that the DEA provide a detailed description of the biological resources and habitat that are documented to occur at Aur Atoll. The DEA should identify resources described in the reference "The Marshall Islands - Living Atolls Amidst the Living Sea" - The National Biodiversity Report of the Republic of the Marshall Islands by the National Biodiversity Team of the Republic of the Marshall Islands. 2000.

Pg 3-77. Toton, Wotje Atoll:

Paragraph 2: We recommend that the DEA provide a detailed description of the biological resources and habitat that are documented to occur at Wotje Atoll. The DEA should identify resources described in the reference "The Marshall Islands - Living Atolls Amidst the Living Sea" - The National Biodiversity Report of the Republic of the Marshall Islands by the National Biodiversity Team of the Republic of the Marshall Islands. 2000.

Pg 4-105. Entanglement with the Submerged Parachute:

Paragraph 5 - Sentence 3: The DEA states "The two 3.1-meter (43 foot) diameter target vehicle main parachutes would be recovered if possible." We are concerned that the parachute and associated line may pose a threat to federally protected fish and wildlife resources. The debris may attract and entangle seabirds that could result in injury or mortality; or drift and become entangled upon coral reefs and abrade or scour them, resulting in the degradation of the benthic community; or sink and entangle organisms, such as sharks or bottomfish. Therefore, we recommend that all parachutes and associated line be recovered to avoid or minimize negative impacts to fish and wildlife resources.

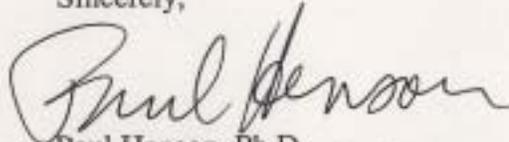
Based on the incorporation of the above recommendations, significant adverse impacts to fish and wildlife resources are not anticipated as a result of proposed project-related activities.

SUMMARY

We recommend that the Draft EA for public review provide an improved description of fish and wildlife resources and analyses that may occur within the proposed project area. We offer several references that may assist you to further describe these resources. Finally, we recommend that all parachutes and associated line be recovered after each launch. Based on the incorporation of the above recommendations, significant adverse impacts to fish and wildlife resources are not anticipated as a result of proposed project-related activities.

The Service appreciates the opportunity to comment on the DEA. If you have any questions regarding these comments, please contact Marine Ecologist Kevin Foster by telephone at (808) 541-3441 or by facsimile transmission at (808) 541-3470.

Sincerely,



Paul Henson, Ph.D
Field Supervisor

cc: FWS-Refuges, Honolulu
NMFS-PIAO, Honolulu
USEPA-Region IX, Honolulu
DAR, Honolulu
CZMP, Honolulu
CWB, Honolulu

-----Original Message-----

From: Kevin_B_Foster@r1.fws.gov [mailto:Kevin_B_Foster@r1.fws.gov]

Sent: Thursday, October 31, 2002 3:36 PM

To: Craven, Tom M Mr USASMDC

Cc: Michael_Molina@r1.fws.gov

Subject: Re: US Fish and Wildlife Service Review of Coordinating Draft THAAD EA

Tom,

Per our conversation concerning Service comments on the above referenced document, I concur with your plans to minimize impacts to fish and wildlife resources concerning launch related activities. Specifically, you indicated that parachutes to be used to launch missiles from airborne platforms will be weighted with sufficient weight that would sink the entire parachute to the bottom of the ocean in a rapid manner. Thus, this action would avoid impacts to fish and wildlife resources, previously described in our letter to you. We have no further concerns with this project.

Thanks for altering your methods in the THAAD project to avoid and minimize impacts to fish and wildlife resources under USFWS jurisdiction.

Aloha,

Kevin B. Foster
U.S. Fish and Wildlife Service
300 Ala Moana Blvd., Rm 3-122
Honolulu, Hawaii 96850
Telephone 808/541-3441
Fax 808/541-3470
Email kevin_b_foster@fws.gov



DEPUTIES
ERIC T. HIRANO
LINNELL NISHIOKA

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING, ROOM 555
601 KAMOKILA BOULEVARD
KAPOLEI, HAWAII 96707

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
COMMISSION ON WATER RESOURCE
MANAGEMENT
CONSERVATION AND RESOURCES
ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND
STATE PARKS

November 1, 2002

Jeffrey C. Smith, Colonel,
U.S. Army Deputy Chief of Staff, Engineer
Department of the Army
U.S. Army Space and Missile Defense Command
P.O. Box 1500
Huntsville, Alabama 35807-3801

LOG NO: 31052 ✓
DOC NO: 0210NM20 ✓

Dear Colonel Smith:

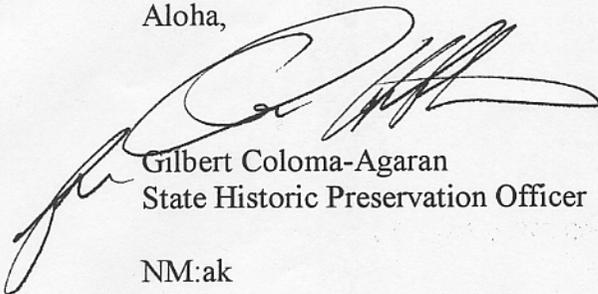
**SUBJECT: NEPA Compliance and Coordinating Draft EA on the Theater
High Altitude Area Defense Pacific Test Flights at PMRF (2002)
Mana, Waimea, Kauai**

Thanks you for submitting the above document. Tom Craven of your staff explained the document and stated that the project had already undergone 106 consultations. He indicated that, as stipulated in the MOA, an archaeological survey was conducted by Navy staff archaeologists. Evidently the original THAAD launch site was moved due to potential impacts to cultural deposits. It is our understanding that the MOA will be followed during this project, and no historic sites will be impacted.

Unfortunately, we have not received this archaeological report for this project. So we have not yet commented under the National Historic Preservation Act. Please inform the U.S. Navy to submit the report to our office for review and comment. We will review the report promptly once we receive it.

If you have any questions, please call Nancy McMahon at 808.742.7033.

Aloha,



Gilbert Coloma-Agaran
State Historic Preservation Officer

NM:ak



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
U.S. ARMY SPACE AND MISSILE DEFENSE COMMAND
POST OFFICE BOX 1500
HUNTSVILLE, ALABAMA 35807-3801

SMDC-EN-V (200)

06 NOV 2002

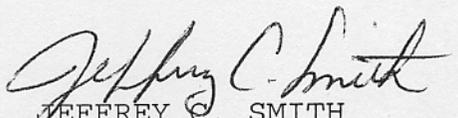
MEMORANDUM FOR Program Executive Office-Theater Surface
Combatants/Lyn Carroll, 1331 Isaac Hull Ave SE, Stop: 2315,
Bldg 197, 1E3138, Washington Naval Yard, DC, 20376-2315

SUBJECT: Theater High Altitude Area Defense (THAAD) Pacific
Test Flights Final Environmental Assessment (EA)

1. Enclosed for your information and use is the Staffing Final
EA and Draft Finding of No Significant Impact for the above
cited EA. This EA is currently being staffed through the
Missile Defense Agency for public release and review. Current
plans are to have the public review period from 5 Dec 02 through
7 Jan 03.

2. Point of contact is Mr. Thomas M. Craven, 256-955-1533,
e-mail tom.craven@smdc.army.mil.

Encl


JEFFREY C. SMITH
COL, EN
Deputy Chief of Staff,
Engineer

CF (w/o encl):

Missile Defense Agency, MDA-TERC/Mr. Crate Spears,
Federal Office Building #2, 7100 Defense Pentagon,
Washington, DC 20301-7100



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
U.S. ARMY SPACE AND MISSILE DEFENSE COMMAND
POST OFFICE BOX 1500
HUNTSVILLE, ALABAMA 35807-3801

08 NOV 2002

SMDC-EN-V (200)

MEMORANDUM FOR

Missile Defense Agency, Theater High Altitude Area Defense
Project Office, MDA-THT/Mr. Mario Flores, P.O. Box 1500,
Huntsville, AL 35807-3801

U.S. Navy Region Hawaii, Environmental Department, Ms. Lisa
Chan, 517 Russell Avenue, Suite 110, Pearl Harbor, HI
96860-4884

Pacific Missile Range Facility, Mr. Robert Inoyue, P.O. Box
128, Kekaha, HI 96752-0128

Pacific Missile Range Facility, Mr. William Hughes, P.O. Box
128, Kekaha, HI 96752-0128

U.S. Army Kwajalein Atoll, Mr. Thomas Kane, P.O. Box 26 APO AP
96555

SUBJECT: Theater High Altitude Area Defense (THAAD) Pacific Flight
Test Final Environmental Assessment (EA) and Draft Finding of No
Significant Impact (FONSI)

1. Enclosed for your information and use are the THAAD Pacific Flight
Test Final EA and Draft FONSI.
2. SMDC has transmitted the documents to Missile Defense Agency for
review and permission to release for public review. The current plan
is to provide the 30-day public review period between 5 Dec 02 and
7 Jan 03.
3. Point of contact is Mr. Thomas M. Craven, 256-955-1533, DSN
645-1533, e-mail tom.craven@smdc.army.mil.

2 Encls


JEFFREY C. SMITH
Colonel, EN
Deputy Chief of Staff,
Engineer

CF (w/o encls):

Missile Defense Agency, MDA-TERC/Mr. Crate Spears, Federal
Office Building #2, 7100 Defense Pentagon, Washington, DC
20301-7100

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APPENDIX C
SAFETY SYSTEMS FOR THAAD LAUNCHES

APPENDIX C

SAFETY SYSTEMS FOR THAAD LAUNCHES

Safety Systems for THAAD Launches

The primary method for preventing adverse safety and health effects associated with missile launches involves the physical isolation of the area immediately surrounding the launch site, before launch. At no time shall individuals of the public be exposed to a probability of fatality greater than 1 in 10 million for any single mission and 1 in 1 million on an annual basis. This standard maximum risk to the public is less on an annual basis than the risks from accidents occurring in the home or in public. (Range Commanders Council, 1997)

Before launch, exclusion areas are established to contain potentially hazardous debris from a launch anomaly. Non-mission-essential personnel are excluded from this area during launch operations. Personnel working within the exclusion area are protected in blockhouses or bunkers, or behind berms. The Safety Officer monitors the flight continuously and always retains the capability to terminate the flight if necessary. In addition to the ground hazard area, a launch hazard area (LHA) is established on the overwater areas where any potentially hazardous debris from a flight termination or missile stage could fall. The LHA would be determined for each type of test. The LHA is cleared of non-participating aircraft and vessels by establishing warning and restricted areas, publishing Notices to Airmen through the Federal Aviation Administration and Notices to Mariners through the U.S. Coast Guard.

The launch of the air- and sea-based target missiles would occur in the open ocean away from populated areas. Prior to each launch, the area would be determined clear of any unauthorized ships and aircraft. The launch and flight of the air- and sea-based target missiles would occur over the open ocean in areas determined clear of the public.

In addition to the standard safety procedures followed by launch personnel, several fail-safe features are also built into the THAAD missiles proposed for use. One of these is the flight termination system that normally consists of a small charge that ruptures the missile casing, which terminates an off-course flight or other anomaly.

Electromagnetic radiation generated by radar on naval ships would occur over the open water in areas verified clear of the public and would not present a public safety risk. Ship personnel are protected from electromagnetic radiation by maintaining safety areas around the radar units and using computer programs to block electromagnetic radiation hazards on the ship.

Flight safety along the missile flight line is calculated using probabilistic risk analyses. Range safety officers create a computerized simulation to determine how the missile would fly during a normal flight. The flight safety analysis is then enhanced by identifying all the

known factors, from experience or theory, that could go wrong and cause the flight to fail. These are called "failure modes." The simulation then determines the effect each failure mode or combinations of failure modes would have on the missile's planned flight path.

The flight path when the missile is being powered by its rocket motors is divided into 2-second intervals. Then the effect each failure mode or combination of failure modes would have is determined if it occurred in the first 2 seconds; then if it occurred in the second 2-second interval; or in the third 2-second interval, and so on throughout the flight, interval by interval.

An assessment is then made as to which of these failure modes or combinations of failure modes could make the missile deviate from the planned flight path. The possible deviations are identified with respect to three criteria:

- Deviations that would take the missile outside the missile-impact limits established for the planned flight path
- Deviations that would reverse the missile's direction of flight
- Deviations that would cause the missile to fly at angles that would create forces that would cause the missile to break up

Based on the deviations determined in the previous paragraph, the simulation determines how often the component or components involved in the failure mode (such as a motor nozzle, the on-board computer, etc.) are likely to fail and cause enough of a deviation to create a hazard to humans, property, and protected geographic areas. Such hazards would require the flight safety officer to activate the flight termination system.

Each target missile is equipped with a flight termination system. The flight termination system consists of shaped charges, activated by a radio signal from the flight safety officer, which cut the rocket motors into pieces, immediately terminating the thrust of the motors. The simulation determines the pieces of debris that result from termination, their size and weight, and how the pieces are likely to distribute themselves as they fall. These failure simulations generate on the order of 20 million potential missile or debris impact points along the planned flight path.

An assumption is made that the vehicle failed at a specified 2-second interval, in a specified mode, and that the flight safety officer activated the flight termination system. For each combination of varied parameters, the probability that a debris fragment would impact in a specified unit of area on the earth's surface (3 square meters [32 square feet] for a person, and 93 square meters [1,000 square feet] for a small fishing vessel, for example) at a specific point of latitude and longitude are determined. The result of these calculations for a given point on the Earth is called a probability density function.

For a given spot on the Earth, calculations are made for (1) the probability of the failure mode occurring by multiplication, (2) the number of each type of fragment that results

from flight termination. Then the probability density functions are integrated numerically (summed) over all failure times.

Using this technique, the expected probability of impact at each region of interest on the Earth's surface can be determined, and then compared with the acceptable risks as outlined by Range Commanders Council Standard 321.00. The information in the list below regarding Acceptable Range Risk Levels is drawn from that document.

Acceptable Range Risk Levels for Personnel

The General Public are all people not declared mission essential, including the public, plus range personnel not essential to a mission, visitors, press, and personnel/dependents living on the base/facility.

- Individuals shall not be exposed to a probability of fatality greater than 1 in 10 million for any single mission. This includes those persons onboard ships (including boats and watercraft of all sizes).
- Individuals shall not be exposed to a probability of fatality greater than 1 in 1 million per year of range operation.
- The collective risk for the general public shall not exceed a probability of fatality greater than 1 in 300,000 for any single mission. This includes those onboard ships.

On the day of launch, additional potential factors such as wind direction, speed and altitude are factored into the calculations of risk for that day. If the expected risk to the public does not exceed the levels in the table, a "GO" decision would be made for launch. On the other hand, if the probable risk is higher, a "NO GO for launch" decision would be made.

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APPENDIX D
RELEVANT EXISTING DOCUMENTATION

Table D-1: Relevant Existing Documentation

Date/Document Title	Locations of Actions	Missiles Analyzed	Sensors Analyzed	Activities Analyzed
<i>1989 Proposed Actions at U.S. Army Kwajalein Atoll Environmental Impact Statement/1989</i>	U.S. Army Kwajalein Atoll (USAKA) Launches from Meck, Omelek, and Roi-Namur; Construction on Kwajalein	Exoatmospheric Reentry Interceptor System (ERIS), Space Based Interceptor (SBI), High Endoatmospheric Defense Interceptor (HEDI) Strategic Target System	Kiernan Reentry Measurement System (KREMS), Ground-based Radar (GBR), Airborne Optical Adjunct (AOA), High Altitude Learjet Observatory and Infrared Instrumentation System (HALO/IRIS), Mid-Course Sensors Experiment, Optical Aircraft Measurement System (OAMP), Ground-based Surveillance and Tracking System (GSTS)	Demonstration/validation interceptor and target launches, concept development activities, construction
<i>1992 Theater Missile Defense Countermeasures Mitigation Program Environmental Assessment</i>	Wake Island, USAKA, Hanscom AFB, MA; Orbital Sciences Corp, AZ; Hill AFB, UT	TCMP-TALOS (First stage) and M56A-1 (Minuteman I second stage) or ARIES	On-board video cameras, satellite and air-borne optical sensors, ground- and sea-based optical and radar sensors	Development and flight tests of TCMP vehicle and experimental payloads (nondestructive RV and decoys)
<i>1993 Ground-based Radar (GBR) Family of Radars Environmental Assessment</i>	Raytheon, MA for manufacture; White Sands Missile Range (WSMR), NM; Fort Bliss, NM; USAKA	N/A	Theater Missile Defense (TMD) Ground-based Radar (GBR) and GBR-Test	Fabrication and testing of the GBR to demonstrate discrimination capabilities and validation of the technology
<i>1993 U.S. Army Kwajalein Atoll Temporary Supplemental Environmental Impact Statement/1993</i>	Launches from Meck, Omelek, Illeginni, and Roi-Namur Sensors on Gagan, Gellinam, Eniwetak, Ennylabegan, Kwajalein, Legan, Meck, Omelek	THAAD, Patriot, Terrier, Nike Hercules, ERINT SR-19, M55A1, M56A1, Castor I, M57A1, Talos, Antares II, Black Brant VB, Orbus I, NIHKA (liquid), Meteorological and sounding rockets	KREMS, GBE, AOA, HALO/IRIS, OAMP, GSTS	Up to 172 annual launches, construction of new launch facilities and other facilities, installation of new sensor systems and fiber-optic communication
<i>1994 Environmental Assessment for TMD GBR Testing Program at Fort Devens, Massachusetts</i>	Fort Devens, MA	N/A	TMD-GBR	System testing as part of demonstration/validation of the GBR program, full power antenna radar tests

Table D-1: Relevant Existing Documentation (Continued)

Date/Document Title	Locations of Actions	Missiles Analyzed	Sensors Analyzed	Activities Analyzed
1994 <i>Theater High Altitude Area Defense (THAAD) Initial Development Program Environmental Assessment</i>	WSMR, NM; Lockheed Missiles and Space Inc, AI and CA; Rockwell, CA; Arnold Engineering and Development Center, TN; Holloman AFB, NM; Naval Surface Warfare Center, MD; Phillips Laboratory, CA; United Technologies Corp., CA; and Stanford Research Institute, CA	THAAD	N/A	THAAD test launches and construction of target launch facilities in the Firing in Extension Area north of WSMR
1994 <i>Theater Missile Defense Extended Test Range Environmental Impact Statement</i>	WSMR, NM; Eglin AFB, FL; Western Range (Vandenberg AFB, CA); USAKA; Wake Island	THAAD, ERINT, Patriot, Corps SAM, PAC-3, ATACMS Hera family (M56A-1, SR19-AJ-1, Castor IV, Castor IVB, M57A-1, Orbis I)	TMD-GBR, Patriot radar	Extended range tests of target and interceptor missiles and sensor systems (ground-, sea-, based), 100 flight tests; construction, use of simulants (TEP, diatomaceous earth)
1994 <i>Wake Island Environmental Assessment</i>	Wake Island	THAAD, ERINT, Patriot, Corps SAM, PAC-3, ATACMS Hera, (M56A-1, SR19-AJ-1, Castor IV, Castor IVB, M57A-1, Orbis I)	TMD-GBR. KMRSS, AN/MPS-36 C-band tracking radar, telemetry receivers, optical sensors, Patriot radar (AN/MPQ-53)	Long distance missile flight tests in support of TCMP tests (75 to 100 surface-to-air and surface-to-surface defensive missiles), use of simulants (TEP), ground- and sea-based tests, use of MLS
1995 <i>Theater Missile Defense Flight Test Environmental Assessment</i>	WSMR, NM	THAAD, Patriot (PAC-2, PAC-3), SM-2 Block IV A (Navy Standard missile) Hera	TMD-GBR, transportable Rapid Optical Beam Steering (ROBS) laser radar, Patriot radar, fixed WSMR sensors	Demonstration launch of Hera from LC 94, 53 Hera missiles launched against interceptors (represents 12 THAAD intercept engagements)
1995 <i>U.S. Army Kwajalein Atoll Temporary Extended Test Range Environmental Assessment</i>	Kwajalein, Meck, Roi-Namur, Illeginni, Gellinam, Legan, Omelek, and Aur islands	Patriot Hera, liquid target missile	THAAD radar, Patriot radar, USAKA Range sensors	Construction of temporary target launch site on Bigen Island, launch of liquid and/or solid target missiles, Patriot missile launches from Meck or Illeginni, intercept over Kwajalein Lagoon or open ocean

Table D-1: Relevant Existing Documentation (Continued)

Date/Document Title	Locations of Actions	Missiles Analyzed	Sensors Analyzed	Activities Analyzed
1998 <i>Air Drop Target System Program Programmatic Environmental Assessment</i>	No Specific Area	SR-19-AJ-1 rocket motor	C-band Beacon Tracking	Air launch of target booster
1998 <i>Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement</i>	PMRF, Niihau, Kaula, Kaena Point, Maui Space Surveillance System, Tern Island, Johnston Atoll, Open Pacific Ocean	Interceptor missiles (SM-2 Block IV, THAAD, PAC-3, PAC-2, AMRAAM, MEADS) Solid and liquid propellant target missiles (Strategic Target System, Hermes, Patriot as a target, Storm, Hera; Lance, FMA)	Precision tracking, surveillance, and identification-friend-or-foe radars;	Ground-, air-, and sea-launches
1998 <i>Theater Missile Defense Extended Test Range Supplemental Environmental Impact Statement</i>	Eglin AFB, FL; Florida Keys; Gulf of Mexico	THAAD, SM-2 Block IV, SM-3, PAC-2, PAC-3, MEADS Hera, Storm II, Patriot as a Target, Lance, HERMES, Black Brandt 9, Pegasus	GBR, airborne sensors, ship-based sensors, and space-based sensors	Ground-, air-, and sea-launches; intercepts in Gulf of Mexico
2000 <i>Wake Island Supplemental Environmental Assessment</i>	Wake Island	Liquid propellant target missile	Not listed	Minimal new site preparation, liquid propellant transfer and fueling, liquid propellant missile launches

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ACRONYMS AND ABBREVIATIONS

ACRONYMS AND ABBREVIATIONS

ALTRV	Altitude Reservation
ARTCC	Air Route Traffic Control Center
BMC2	Battle Management, Command and Control
C	Celsius
CFR	Code of Federal Regulations
CLS	Contractor Logistics Support
CSF	Central Support Facility
dB	Decibel
dBA	A-weighted Decibel
DoD	Department of Defense
DOT	Department of Transportation
EA	Environmental Assessment
EIS	Environmental Impact Statement
EMR	Electromagnetic Radiation
EPA	Environmental Protection Agency
ETR	Extended Test Range
F	Fahrenheit
FAA	Federal Aviation Administration
FL	Flight Level
F/T	Flight Test
HEMTT	Heavy Expanded Mobility Tactical Truck
HMMWV	High Mobility Multi-Purpose Wheeled Vehicle
ICAO	International Civil Aviation Organization
IR	Infrared
IRFNA	Inhibited Red Fuming Nitric Acid
KTF	Kauai Test Facility
KV	Kill Vehicle
kV	Kilovolt
kVA	Kilovolt Ampere
kW	Kilowatt
LCM	Landing Craft Mechanized
LCU	Landing Craft Utility
L _{dn}	Day-Night Sound Level
LHA	Launch Hazard Area
LHS	Load Handling System
L _{max}	Maximum Sound Level
LPT	Liquid Propellant Target
MAB	Missile Assembly Building
MATSS	Mobile Aerial Target Support System
MDA	Missile Defense Agency
MLP	Mobile Launch Platform
μPa	Micropascal
MRP	Missile Round Pallet
MW	Megawatt
NAAQS	National Ambient Air Quality Standards

NBC	Nuclear, Biological, Chemical
NEPA	National Environmental Policy Act
NOTAM	Notice to Airmen
NOTMAR	Notice to Mariners
PM-10	Particulate Matter with an Aerodynamic Diameter of Less than or Equal to 10 Micrometers
PMRF	Pacific Missile Range Facility
RCC	Range Commanders Council
RMI	Republic of the Marshall Islands
ROI	Region of Influence
RTS	Ronald Reagan Ballistic Missile Defense Test Site
THAAD	Theater High Altitude Area Defense
TNT	2,4,6-Trinitrotoluene
TTS	Temporary Threshold Shift
UDMH	Unsymmetrical Dimethyl Hydrazine
UES	United States Army Kwajalein Atoll Environmental Standards
USAKA	United States Army Kwajalein Atoll
USASMDC	United States Army Space and Missile Defense Command
USC	United States Code