Pacific Missile Range Facility
Intercept Test Support

Environmental Assessment/
Overseas Environmental Assessment

April 2010

Commander
Pacific Missile Range Facility
P.O. Box 128
Kekaha, Kauai, Hawaii 96752-0128

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1a. REPORT SECURITY CLASSIFICATION Unclassified	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION/AVAILABILITY OF REPORT Distribution Statement A. Approved for public release; distribution is unlimited.
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S)	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION U.S. Army Space and Missile Defense Command/U.S. Army Forces Strategic Command (USASMDC/ARSTRAT) 6b. OFFICE SYMBOL *(If applicable)* SMDC-ENN	7a. NAME OF MONITORING ORGANIZATION
6c. ADDRESS *(City, State, and ZIP Code)* P.O. Box 1500 Huntsville, Alabama 35807-3801	7b. ADDRESS *(City, State, and ZIP Code)*
8a. NAME OF FUNDING/SPONSORING ORGANIZATION Commander, Pacific Missile Range Facility 8b. OFFICE SYMBOL *(if applicable)*	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c. ADDRESS *(City, State, and ZIP Code)* P.O. Box 128 Kekaha, Kauai, Hawaii 96752-0128	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO. / WORK UNIT ACCESSION NO.

11. TITLE *(Include Security Classification)*
Pacific Missile Range Facility Intercept Test Support Environmental Assessment/Overseas Environmental Assessment (Unclassified)

12. PERSONAL AUTHOR(S)
Pacific Missile Range Facility Intercept Test Support Team, Mr. David Hasley, Chairman

13a. TYPE OF REPORT	13B. TIME COVERED	14. DATE OF REPORT *(Year, Month, Day)*	15. PAGE COUNT
Environmental Assessment	FROM ________ TO ________	2010, April 21	424

16. SUPPLEMENTARY NOTATION

17. COSATI CODES			18. SUBJECT TERMS *(Continue on reverse if necessary and identify by block number)*
FIELD	GROUP	SUB-GROUP	Environmental Assessment

19. ABSTRACT *(Continue on reverse if necessary and identify by block number)*

The U.S. Navy has prepared this Environmental Assessment/Overseas Environmental Assessment (EA/OEA) to evaluate and disclose the environmental consequences of updating the capabilities of the Pacific Missile Range Facility (PMRF), Kauai, HI to support future tests of Ballistic Missile Defense intercept technologies.

The Proposed Action for this EA/OEA is to further enhance the intercept capabilities of missile defense tests at PMRF. The Proposed Action would support and maintain future Department of Defense (Army, Navy), Missile Defense Agency, and other potential customers' research, development, test, and evaluation activities, and associated range capabilities (including hardware and infrastructure improvements).

The Proposed Action would also include testing defensive missile systems such as the Aegis Ashore Missile Defense program, which would adapt the Aegis Standard Missile and AN/SPY-1 Radar for land-based operations. These programs would involve the placement of additional land-based systems at PMRF, including required missile launcher, radar, and support facilities.

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT [X] UNCLASSIFIED/UNLIMITED [ ] SAME AS RPT. [ ] DTIC USERS	21. ABSTRACT SECURITY CLASSIFICATION Unclassified

22a. NAME OF RESPONSIBLE INDIVIDUAL	22b. TELEPHONE *(Include Area Code)*	22c. OFFICE SYMBOL
Mr. David Hasley	(256) 955-4170	SMDC-ENN

DD Form 1473, JUN 86 **Previous editions are obsolete** **SECURITY CLASSIFICATION OF THIS PAGE**
UNCLASSIFIED

Executive Summary

EXECUTIVE SUMMARY

Introduction

The United States (U.S.) Department of the Navy (Navy) has prepared this Environmental Assessment (EA)/Overseas Environmental Assessment (OEA) to evaluate and discuss the environmental consequences of updating the capabilities of the Pacific Missile Range Facility (PMRF), Kauai, HI to support future tests of Ballistic Missile Defense (BMD) intercept technologies. This EA/OEA is in compliance with the National Environmental Policy Act (NEPA) of 1969 (42 United States Code § 4321 et seq.); the Council on Environmental Quality Regulations for Implementing the Procedural Provisions of NEPA (Title 40 Code of Federal Regulations [CFR] §§ 1500-1508 [2005]); Department of the Navy Procedures for Implementing NEPA (32 CFR § 775 [2005]); and Executive Order 12114, Environmental Effects Abroad of Major Federal Actions. The NEPA process ensures that environmental impacts of proposed major Federal actions are considered in the decision-making process. Executive Order 12114 requires environmental consideration for actions that may significantly harm the environment of the global commons (e.g., environment outside U.S. Territorial Seas). This EA/OEA satisfies the requirements of both NEPA and Executive Order 12114.

Background

PMRF is located in Hawaii on and off the western shores of the island of Kauai and includes broad ocean areas to the north, south, and west. The relative isolation of PMRF, a year-round tropical climate, and an open ocean area relatively free of human interference are significant factors in PMRF's excellent record of safely conducting testing and training activities. PMRF has a mission to provide training for Navy and other Department of Defense (DoD) personnel using existing equipment and technologies for real-world requirements to maintain and achieve required states of readiness. PMRF is a Major Range and Test Facility Base and as such supports the full spectrum of DoD Test and Evaluation requirements, such as research, development, test, and evaluation (RDT&E) programs developed by the DoD (Navy, Army) and the Missile Defense Agency (MDA). PMRF also is the world's largest instrumented, multi-environment, military test range capable of supporting subsurface, surface, air, and space operations.

PMRF consists of 1,100 square nautical miles (nm^2) of instrumented underwater ranges, 42,000 nm^2 of controlled airspace, and a Temporary Operating Area (TOA) covering 2.1-million nm^2 of ocean area. The TOA was established to support missile defense testing and extends primarily north and west of Kauai. The range and speed of the weapon and missile systems tested at PMRF require the large TOA to contain debris and expended materials from test missions.

To ensure safe operations, PMRF requests use of the airspace from the Federal Aviation Administration (FAA) during missile defense testing. The FAA issues a Notice to Airmen (NOTAM) to prevent aircraft from flying into specific areas of airspace until testing is complete.

Purpose and Need

The purpose of the Proposed Action is to provide PMRF with the enhanced capability to further test and evaluate Navy and DoD BMD systems, as well as train personnel in the use of these systems.

More specifically, the purpose of the Proposed Action is to:

- Enhance PMRF's range capability and support facilities in order to support future requirements of testing existing and new BMD programs at PMRF.
- Evaluate airspace needed to accommodate more complex intercept engagement scenarios for missile defense test programs.
- Upgrade base activities and facilities to support future fleet training, land-based training, RDT&E activities, and base operations and maintenance activities as required.
- Provide additional capabilities to ensure safe conduct and evaluation of training and RDT&E missions in a modern, multi-threat, multi-dimensional environment, for future programs, which would continue as fully integrated range services, at PMRF.

The ability to provide complex missile defense testing scenarios is a major concern and goal of the U.S. Navy; therefore, the implementation of the Proposed Action is needed because missile defense tests are becoming increasingly more complicated with multiple engagements, longer time of flight, intercepts at higher altitudes, and increased closing velocities.

PMRF needs these additional enhancements to deliver quality data products to improve the customers' abilities to achieve readiness and other national defense objectives. Targets which simulate the characteristics of incoming hostile missiles are required. To be effective, future testing and engagement scenarios will need to be conducted in a more realistic fashion. PMRF needs these additional enhancements to deliver quality data products to improve the nation's abilities to achieve readiness and other national defense objectives.

Proposed Action

The Proposed Action for this EA/OEA is to further enhance the intercept test capabilities of PMRF. This enhancement includes the construction and modification of PMRF facilities to test new land-based interceptor systems and the enhancement of current intercept test capabilities of PMRF. The Proposed Action would support and maintain DoD (Army, Navy), MDA, and other potential customers' RDT&E operations, and associated range capabilities (including hardware and infrastructure improvements).

Under the Proposed Action, existing range and land-based operations and training, and the ongoing maintenance of the technical and logistical facilities would continue. In this context, increased flexibility in missile defense testing would represent a small incremental change in ongoing activities, although the area used would be increased, with longer engagement distances, higher altitudes, and longer-range targets and interceptors.

The Proposed Action would also include testing of defensive missile systems such as the Aegis Ashore Missile Defense program which will adapt the Aegis Standard Missile and AN/SPY1 Radar for land-based operation. These programs would involve the placement of new land-launched systems at PMRF, including required missile launcher, radar, and support facilities. PMRF identified sites available for use by the Aegis Ashore Missile Defense program. The Missile Defense Agency's siting process narrowed the potential sites to the following:

- Launch Site (The interceptor launch area could be constructed on PMRF/Main Base at one of the three following sites on northern PMRF):
  - Aegis site,
  - Exoatmospheric Discrimination Experiment (EDX) site, or
  - Kauai Test Facility (KTF) Pad 1
- Aegis Ashore Test Center (AN/SPY-1 Radar, Administrative Support Building, Launch Control Center, and support facilities at one of the following sites):
  - Adjacent to the Calibration Laboratory (east side) or
  - Adjacent to the Hawaii Air National Guard (HIANG) (south side)
- BMD System Communications Support Complex Site at one of the following sites:
  - South of the proposed Aegis Ashore Test Center at the HIANG PMRF site or
  - Golf Site south of the Terminal High Altitude Area Defense (THAAD) radar pads
- Administrative Support Building at the THAAD administrative area on central PMRF

No-Action Alternative

The No-action Alternative for this EA/OEA is a continuation of current and previously analyzed and approved activities. The No-action Alternative is the combination of the programs and actions analyzed in the 2008 Final Hawaii Range Complex Environmental Impact Statement/Overseas Environmental Impact Statement and any additional PMRF programs analyzed since April 2008, as they relate to BMD test systems, sensors, and facilities. If this alternative is selected, PMRF would continue existing range training and operation activities, and base operations and maintenance activities. Any mitigation measures developed for these activities would continue to be implemented.

Impact Assessment Methodology

Thirteen broad areas of environmental analysis were originally 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, land use, noise, socioeconomics, transportation, utilities, and water resources. These areas were analyzed as applicable for the proposed location or activity.

Results

Under the Proposed Action, a limited number of small, lightweight fragments resulting from some missile intercepts could potentially drift beyond current PMRF-controlled areas. Intercepts at higher altitudes would not necessarily generate more debris fragments, but the greater altitude would cause the small, lightweight fragments to be widely dispersed over a larger area, including land areas. The enhanced testing could result in the dispersion of small, lightweight fragments over land areas on Kauai, Niihau, and the Northwestern Hawaiian Islands (NWHI), over the open ocean between individual islands, or over part of the channel between Kauai and Oahu depending on the actual test parameters. The fragments would not be harmful to people on the ground, and PMRF would continue to ensure the protection of the public from any intercept or other missile debris through the application of established standard range safety procedures and risk standards, including Range Commanders Council (RCC) Standard 321, *Common Risk Criteria Standards for National Test Ranges, Subtitle: Inert Debris*. The RCC Standards are guidelines that provide definitive and quantifiable measures to protect mission-essential personnel and the general public. These guidelines address flight safety hazards (including inert debris) and consequences potentially generated by range operations. The fragments would be light-weight and widely dispersed and thus it is highly improbable that there would be any harm to vegetation or wildlife.

The pattern of the fragments could result in effects to all or parts of the airspace over Kauai, Niihau, the NWHI, over the open ocean between individual islands, or over part of the channel between Kauai and Oahu depending on the actual test parameters.

PMRF would notify the FAA that a test is being planned that could temporarily affect airspace. The FAA would review the request and advise regarding windows of opportunity for the testing in order to minimize or avoid effects. These windows would determine whether the test could be performed, since a minimum of 2 hours (includes launch, intercept, and fragment settlement) of time would be required for a test. PMRF would then request altitude reservations from the FAA, which, if approved, would issue NOTAMs covering this additional temporary airspace. Each individual test is coordinated with FAA prior to altitude reservation request. If Medevac or other emergency flights are requested prior to a missile launch, the launch would be delayed until the medical emergency flight is over.

Table ES-1 summarizes the conclusions of the impact analyses made for each of the areas of environmental consideration.

Table ES-1: Summary of Environmental Impacts

Resource Category	Pacific Missile Range Facility (PMRF)	Kamokala Magazines (Magazines 12 and 13)	Niihau	Northwestern Hawaiian Islands (NWHI)	Open Ocean
Air Quality	No-action: No significant impacts are expected. No change in regional air quality is anticipated from training, missile launches, and facilities enhancements. Proposed Action: Temporary localized increase in air emissions from construction and launches/operations; no effect to region's current attainment status. Air emissions from new generators needed to generate up to 4 megawatts of power could require the current Title V permit for PMRF/Main Base or Kauai Test Facility to be modified. A portion of this energy may come from carbon-neutral or non-carbon sources to reduce green house gas emissions.	No-action: No impact; continuation of current and previously analyzed and approved activities. Proposed Action: No potential to adversely affect air quality.	No-action: No impact; continuation of current and previously analyzed and approved activities. Proposed Action: No potential to adversely affect air quality.	No-action: Not applicable. Proposed Action: No potential to adversely affect air quality.	No-action: Continuation of temporary localized minor emissions from missile/target intercept. Proposed Action: No potential to adversely affect air quality.
Airspace (offshore and onshore)	No-action: Any potential impacts are minimized through standard operating procedures, compliance with DoD directives, and close coordination with the Federal Aviation Administration. Mitigation includes Notices to Airmen (NOTAMs). Proposed Action: Additional airspace impacted by fine, small fragments with potential to damage engines of small jets and helicopters and skin penetration of larger high-speed aircraft. These small fragments have the potential to affect arriving and departing flights at area airports (e.g., Lihue or Princeville) and air traffic (helicopter tours) in the area for approximately 1 hour from intercept. Mitigation would include coordination with the FAA to identify windows of opportunity to minimize effects and NOTAMS.	No-action: No impact; continuation of current and previously analyzed and approved activities. Proposed Action: No potential to adversely affect airspace.	No-action: Impacts limited to occasional flights by the island's helicopter. Proposed Action: Additional airspace impacted by fine, small fragments with potential to damage engines of small jets and helicopters and skin penetration of larger high-speed aircraft. These small fragments have the potential to affect arriving and departing flights in the area for approximately 1 hour from intercept. Mitigation would include coordination with the FAA to identify windows of opportunity to minimize effects and NOTAMS.	No-action: Impacts limited to overflight of the NWHI, including the Papahānaumokuākea Marine National Monument. NOTAMs issued prior to all tests that could result in impacts to these islands. Proposed Action: Additional airspace impacted by fine, small fragments with potential to damage engines of small jets and helicopters and skin penetration of larger high-speed aircraft. These small fragments have the potential to affect arriving and departing flights at area airports (e.g., Midway) and air traffic (helicopter tours) in the area for approximately 1 hour from intercept. Mitigation would include coordination with the FAA to identify windows of opportunity to minimize effects and NOTAMS.	No-action: Any potential impacts are minimized through SOPs, compliance with DoD directives, and close coordination with the FAA. Proposed Action: Additional airspace impacted by fine, small fragments with potential to damage engines of small jets and helicopters and skin penetration of larger high-speed aircraft. These small fragments have the potential to affect arriving and departing flights at area airports (e.g., Lihue, Princeville, Midway) and air traffic (helicopter tours) in the area for approximately 1 hour from intercept. Mitigation would include coordination with the FAA to identify windows of opportunity to minimize effects and NOTAMS.

Table ES-1: Summary of Environmental Impacts (Continued)

Resource Category	Pacific Missile Range Facility (PMRF)	Kamokala Magazines (Magazines 12 and 13)	Niihau	Northwestern Hawaiian Islands	Open Ocean
Biological Resources (offshore and onshore)	No-action: Training and missile launches will have no significant impacts on terrestrial biological resources; compliance with SOPs will continue to minimize the effects on vegetation and wildlife, as well as limit the potential for introduction of invasive plant species. Proposed Action: Short-term noise-related impacts to wildlife; no impacts to Essential Fish Habitat; minimal effects expected to vegetation (no unique habitat or indigenous or native vegetation would be disturbed) and wildlife (outdoor lighting associated with construction activities and permanent structures would be properly shielded), including threatened or endangered species during testing; no direct impacts to wetlands. Potential ingestion of toxins by fish species, which may be used for food sources, would be remote due to buffering capacity of seawater. Radar would not be directed toward the ground; unlikely that environmental exposures will ever consist of continuous, constant values of power density; unlikely that a bird would remain within the radar beam for any considerable length of time.	No-action: No impact. Proposed Action: No potential to adversely affect biological resources.	No-action: Training activities and major exercises take place in current operating areas, with no planned expansion. Compliance with relevant Navy policies and procedures during these activities minimize the effects on vegetation and wildlife, as well as limit the potential for introduction of invasive plant species. Temporary, short-term startle effects from noise to wildlife and birds would continue. No impacts from electromagnetic radiation generation to wildlife are expected. Proposed Action: Fine, low-energy fragments are not anticipated to affect vegetation or wildlife, including candidate, threatened, or endangered species.	No-action: Some current flight trajectories can result in missiles flying over portions of the Papahānaumokuākea Marine National Monument; debris is not expected to severely harm threatened, endangered, migratory, or other endemic species. The probability for debris to hit birds, seals, or other wildlife is extremely low. Quantities of falling debris will be very low and widely scattered so as not to present a toxicity issue. Falling debris will also have cooled down sufficiently so as not to present a fire hazard for vegetation and habitat. If feasible, consideration is given to alterations in the missile flight trajectory, to further minimize the potential for debris impacts. Proposed Action: Falling debris from missile tests with trajectories that have the potential to affect land on the NWHI will cool down sufficiently prior to impact thus not a fire hazard for vegetation; potential ingestion of toxins by fish species, which may be used for food sources, would be remote due to buffering capacity of seawater, some fish may be injured or killed if present at the initial point of large debris contact; probability of marine mammals being struck by debris from missile testing would be remote.	No-action: Potential for impacts on deep water corals from Navy training and RDT&E activities is very limited; activities identified have minimal effects on fish; unlikely that direct hit from a piece of missile launch debris would impact a sea turtle or marine mammal at the surface; DoD and PMRF follow launch and range safety policies and procedures to ensure that any potential risks to marine mammals are minimized. Proposed Action: Potential ingestion of toxins by fish species, which may be used for food sources, would be remote due to buffering capacity of seawater, some fish may be injured or killed if present at the initial point of large debris contact; probability of marine mammals being struck by debris from missile testing would be remote; the radar main beam would not be directed at the surface of the ocean; highly unlikely that an individual whale or turtle would be on or substantially above surface of the water for a significant amount of time within side lobe areas during the particular time that radar would be operating.

Table ES-1: Summary of Environmental Impacts (Continued)

Resource Category	Pacific Missile Range Facility (PMRF)	Kamokala Magazines (Magazines 12 and 13)	Niihau	Northwestern Hawaiian Islands	Open Ocean
Cultural Resources (offshore and onshore)	No-action: No impact if areas with known cultural resources are avoided. Proposed Action: Significant impacts are not anticipated. Consultation with the Hawaii State Historic Preservation Officer and Native Hawaiian organizations and individuals; close coordination with the PMRF Environmental Engineer; and adherence to U.S. Navy guidelines and the PMRF Integrated Cultural Resources Management Plan would further minimize any potential for impacts.	No-action: There are no identified archaeological or Native Hawaiian resources of significance at this location; however, the magazines themselves (caves) have been determined eligible for inclusion in the NRHP. No impact. Proposed Action: No potential to adversely affect cultural resources. The two magazines (12 and 13) built in 2002 are not historic properties. As a result, any alterations can proceed as needed.	No-action: As a privately owned island, resources on Niihau are protected by the landowners and proponents, and stipulations are included in contracts for various projects to ensure that sensitive cultural resources areas are either avoided or disturbance minimized. Proposed Action: No significant impacts anticipated. Debris analyses of the types, quantities, weights, and sizes associated with the intercepts indicate that the potential to significantly impact land and offshore resources of Niihau is extremely remote. In addition, trajectories can be altered under certain circumstances to further minimize the potential for impacts.	No-action: Missile defense activities, including THAAD, have the potential to generate fine, small fragments that fall within areas of the NWHI and the Papahānaumokuākea Marine National Monument; potential to impact land resources of any type is very low and extremely remote; trajectories can be altered under certain circumstances to further minimize the potential for impacts. Future missions will include consideration of missile flight trajectory alterations, if feasible, to minimize the potential for debris within these areas; NWHI impacts are not expected. Proposed Action: No significant impacts anticipated. Debris analyses of the types, quantities, weights, and sizes associated with the intercepts indicate that the potential to significantly impact land and offshore resources of the NWHI is extremely remote. In addition, trajectories can be altered under certain circumstances to further minimize the potential for impacts.	No-action: No significant impacts were identified. Cultural resources within open ocean (typically shipwrecks) are submerged at considerable depth, and the potential for them to be disturbed is extremely remote. Proposed Action: No significant impacts anticipated. Debris analyses of the types, quantities, weights, and sizes associated with the intercepts indicate that the potential to significantly impact resources in the open ocean is extremely remote. In addition, trajectories can be altered under certain circumstances to further minimize the potential for impacts. As feasible, mission flight trajectories will be altered to minimize the potential for debris within these areas.
Geology and Soils	No-action: Testing will continue to have minimal direct impact on the beach and inland areas, and soils are not being permanently affected. Proposed Action: Minor localized soil erosion during construction. No additional impact.	No-action: No impact. Proposed Action: No potential to adversely affect geology and soils.	No-action: No potential to adversely affect resource. Proposed Action: No potential to adversely affect geology and soils.	No-action: Not applicable. Proposed Action: No potential to adversely affect geology and soils.	No-action: Not applicable. Proposed Action: No potential to adversely affect geology and soils.

Table ES-1: Summary of Environmental Impacts (Continued)

Resource Category	Pacific Missile Range Facility (PMRF)	Kamokala Magazines (Magazines 12 and 13)	Niihau	Northwestern Hawaiian Islands	Open Ocean
Hazardous Materials and Waste	No-action: No impacts. Proposed Action: Minor amounts of hazardous contaminants to surface soils at launch site. All hazardous materials/waste would be managed in accordance with DoD *Hazardous Waste Management Plans* and *Spill Prevention, Control, And Countermeasure Plans*.	No-action: No impact; storage of and transportation of ordnance to Kamokala Magazines are conducted in accordance with established Department of Transportation, DoD, and Navy safety procedures. Proposed Action: No additional impacts.	No-action: PMRF currently has appropriate plans in place to manage hazardous materials and waste on Niihau. Proposed Action: Not addressed because there is no potential to adversely affect Niihau.	No-action: Not applicable. Proposed Action: Not addressed because there is no potential to adversely affect NWHI.	No-action: Hazardous materials will continue to be controlled in compliance with DoD plans. Fragments of expended training materials, e.g., missiles, could be deposited on the ocean floor. The wide dispersal and low frequency of events minimizes the impact. Proposed Action: No additional impact.
Health and Safety	No-action: Impacts will continue to be minimized through compliance with RCC, Navy and Department of Energy standard operating procedures, range safety, policies, and plans. Proposed Action: Minimal increase in personnel and public health and safety risks during construction and operation; all civilian and base personnel excluded from electromagnetic hazard area during radar operations. Personnel and public excluded from the ground hazard area during launch. See Airspace impacts.	No-action: No impact. Compliance with existing health and safety plans and procedures will continue to minimize impacts. Proposed Action: No additional impacts.	No-action: No adverse impacts; PMRF takes every reasonable precaution during planning and execution of operations, training exercises, and test and development activities to prevent injury to human life or property at Niihau. Compliance with RCC and existing health and safety plans to minimize impacts. Radar and electronic warfare sites are located away from the public. Proposed Action: Debris with the potential to cause injury to unprotected individuals would be expected to fall within the ground hazard area and ocean impact zones. The acceptable level of risks to people will not change.	No-action: Not applicable. Proposed Action: Prior to launch, regions with a significant probability of impacts by intercept debris and stage impact areas will be determined clear of the public and non-essential personnel, because debris is expected to fall within these areas. See Airspace impacts.	No-action: Potential impact minimized through compliance with RCC, standard operating procedures, and DoD Directives, and the use of NOTAMs and NOTMARs. Proposed Action: Prior to launch, regions with a significant probability of impacts by intercept debris and stage impact areas will be determined clear of the public and non-essential personnel, because debris is expected to fall within these areas.

Table ES-1: Summary of Environmental Impacts (Continued)

Resource Category	Pacific Missile Range Facility (PMRF)	Kamokala Magazines (Magazines 12 and 13)	Niihau	Northwestern Hawaiian Islands	Open Ocean
Land Use	No-action: No adverse effects on coastal use or resources documented in Navy's Coastal Consistency Determination in accordance with the Coastal Zone Management Act; closure of public recreational areas during hazardous activities will continue. Proposed Action: No additional impact.	No-action: No impact. Proposed Action: No potential to adversely affect land use.	No-action: No impact. No improvements or upgrades performed Proposed Action: No potential to adversely affect land use.	No-action: No impact. Proposed Action: No potential to adversely affect land use.	No-action: Not applicable. Proposed Action: No potential to adversely affect resource.
Noise	No-action: Due to the design of the interceptor missile, the low test frequency, and the short duration of each test, as well as the distance from population centers, noise impacts from launch tests are contained within test boundaries and do not cause annoyance in populated areas. Proposed Action: Noise generated during construction would have minimal effect on sensitive noise receptors. No additional impact.	No-action: No impact. Proposed Action: Analyzed as part of PMRF.	No-action: No impact. PMRF overflights generate high noise levels. However, these are discrete events, relatively few in number, and restricted as to the actual geographic locations in which they are allowed to occur. The land-based training generates relatively low levels of noise in isolated areas. Proposed Action: No potential for adverse noise effects.	No-action: Not applicable. Proposed Action: No potential for adverse noise effects.	No-action: Potential impact minimized through standard operating procedures and compliance with DoD Directives, and the use of NOTAMs and NOTMARs, thereby precluding any acoustical impacts on sensitive human receptors. Proposed Action: Point of intercept of airborne targets would result in a negligible level of increased sound in the open ocean where typically no sensitive sound human receptors are present.
Socio-economics (offshore and onshore)	No-action: Beneficial impact on the economy and community on Kauai. Proposed Action: Slight beneficial economic impact from temporary increase in jobs associated with Proposed Action.	No-action: Analyzed as part of PMRF. Proposed Action: Analyzed as part of PMRF.	No-action: No Impact. The activities of PMRF personnel, while on Niihau, are strictly controlled by an existing protocol. Proposed Action: No potential for adverse socioeconomic impacts.	No-action: Not applicable. Proposed Action: No potential for adverse socioeconomic impacts.	No-action: Minimal impact due to issuance of NOTMARs and NOTAMs. Proposed Action: No additional impacts to socioeconomics.
Transporta-tion (onshore and offshore)	No-action: No impact; Transportation of ordnance and liquid propellants is conducted in accordance with established procedures. Proposed Action: Transportation system is adequate to handle demand.	No-action: Analyzed as part of PMRF. Proposed Action: Analyzed as part of PMRF.	No-action: Not applicable Proposed Action: No potential to adversely transportation.	No-action: Not applicable. Proposed Action: No potential to adversely affect transportation.	No-action: Minimal impact due to issuance of NOTMARs and NOTAMs. Proposed Action: No additional impacts to transportation.

Table ES-1: Summary of Environmental Impacts (Continued)

Resource Category	Pacific Missile Range Facility (PMRF)	Kamokala Magazines (Magazines 12 and 13)	Niihau	Northwestern Hawaiian Islands	Open Ocean
Utilities	No-action: No impact. Proposed Action: Commercial electricity and generators will be used. An upgrade to power capacity is possible.	No-action: Analyzed as part of PMRF. Proposed Action: Analyzed as part of PMRF.	No-action: Not applicable. Proposed Action: No potential to adversely affect utilities.	No-action: Not applicable. Proposed Action: No potential to adversely affect utilities.	No-action: Not applicable. Proposed Action: No potential to adversely affect utilities
Water Resources	No-action: No impact; emissions from launches and exercises do not significantly affect water resources; compliance with SOPs will minimize impact on beach and inland areas. Proposed Action: No additional impact.	No-action: Analyzed as part of PMRF. Proposed Action: Analyzed as part of PMRF.	No-action: Not applicable. Proposed Action: No potential to adversely affect water resources.	No-action: Not applicable. Proposed Action: No potential to adversely affect water resources.	No-action: No significant impacts due to the small quantities of materials relative to the extent of the sea ranges and large volumes of water in which they will be dispersed. Proposed Action: No additional impact.

Acronyms and Abbreviations

ACRONYMS AND ABBREVIATIONS

AAQS	Ambient Air Quality Standards
AATC	Aegis Ashore Test Center
ACAM	Air Conformity Applicability Model
AICUZ	Air Installation Compatible Use Zone
ALTRV	Altitude Reservation
API	Agricultural Preservation Initiative
APZ	Accident Potential Zone
ARDEL	Advanced Radar Detection Laboratory
ARTCC	Air Route Traffic Control Center
AST	Aboveground Storage Tank
ATCAA	Air Traffic Control Assigned Airspace
BARSTUR	Barking Sands Tactical Underwater Range
BCSC	BMD System Communications Support Complex
BMD	Ballistic Missile Defense
BSURE	Barking Sands Underwater Range Extension
CFR	Code of Federal Regulations
CHRIMP	Consolidated Hazardous Material Reutilization and Inventory Management Program
CNEL	Community Noise Equivalent Level
CO	Carbon Monoxide
DACS	Divert and Attitude Control System
dB	Decibel
dBA	A-weighted Decibel(s)
DLNR	Department of Land and Natural Resources
DNL	Day-Night Average Sound Level
DoD	Department of Defense
DOE	Department of Energy
DOT	Department of Transportation
EA	Environmental Assessment
EDX	Exoatmospheric Discrimination Experiment
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EMR	Electromagnetic Radiation

EPCRA	Emergency Planning and Community Right-to-Know Act
ESA	Endangered Species Act
ESQD	Explosive Safety Quantity-Distance
ETOP	Extended Twin-Engine Aircraft Operations
°F	Degrees Fahrenheit
FAA	Federal Aviation Administration
FACSFACPH	Fleet and Area Control and Surveillance Facility Pearl Harbor
FAR	Federal Aviation Regulation
FL	Flight Level
FMP	Fishery Management Plan
FONSI	Finding of No Significant Impact
FTF	Flexible Target Family
FTS	Flight Termination System
FY	Fiscal Year
GHG	Greenhouse Gas
GMD	Ground-based Midcourse Defense
GPD	Gallons Per Day
GPS	Global Positioning System
HAR	Hawaii Administrative Rules
HERF	Hazard of Electromagnetic Radiation to Fuel
HERO	Hazard of Electromagnetic Radiation to Ordnance
HERP	Hazard of Electromagnetic Radiation to Personnel
HIANG	Hawaii Air National Guard
HMX	Cyclotetramethylenetetranitramine
HP	Horsepower
HRC	Hawaii Range Complex
HRS	Hawaii Revised Statutes
HTPB/AP	Hydroxyl-terminated Polybutadiene/Ammonium Perchlorate
HUD	U.S. Department of Housing and Urban Development
HVAC	Heating, Ventilation, and Air Conditioning
ICAO	International Civil Aviation Administration
ICRIMP	Integrated Cultural Resources Management Plan
IFR	Instrument Flight Rules
IRP	Installation Restoration Program
IUCN	International Union for Conservation of Nature and Natural Resources (World Conservation Union)

JBPHH	Joint Base Pearl Harbor-Hickam
KIUC	Kauai Island Utility Cooperative
KTF	Kauai Test Facility
kV	Kilovolt(s)
kW	Kilowatt(s)
L_{dn}	Day-Night Average Sound Level
LEB	Launch Equipment Building
L_{eq}	Energy Equivalent Sound Level
L_{max}	Maximum Sound Level
LOS	Level of Service
MBTA	Migratory Bird Treaty Act
MDA	Missile Defense Agency
mg/kg	Milligrams Per Kilogram
mi	Mile(s)
mi^2	Square Mile(s)
MLP	Mobile Launch Platform
MMPA	Marine Mammal Protection Act
MRTFB	Major Range and Test Facility Base
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MW	Megawatt(s)
mW/in^2	Milliwatts per Square Inch
NAAQS	National Ambient Air Quality Standards
NAVSEAOP	Naval Sea Systems Command Publication
NEPA	National Environmental Policy Act
nm	Nautical Mile(s)
nm^2	Square Nautical Mile(s)
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOTAM	Notice to Airmen
NOTMAR	Notice to Mariners
NO_x	Nitrogen Dioxides
NRHP	National Register of Historic Places
NWHI	Northwestern Hawaiian Islands
OEA	Overseas Environmental Assessment
OEIS	Overseas Environmental Impact Statement
ORMP	Ocean Resources Management Plan

OSHA	Occupational Safety and Health Administration
OPNAVINST	Office of the Chief of Naval Operations Instruction
PL	Public Law
PM-10	Particulate Matter with an Aerodynamic Diameter Less Than or Equal to 10 Microns
PM-2.5	Particulate Matter with an Aerodynamic Diameter Less Than or Equal to 2.5 Microns
PMRF	Pacific Missile Range Facility
PMRFINST	Pacific Missile Range Facility Instruction
ppm	Parts Per Million
PVC	Polyvinyl Chloride
RCC	Range Commanders Council
RDT&E	Research, Development, Test, and Evaluation
RF	Radiofrequency
RIMPAC	Rim of the Pacific
RSOP	Range Safety Operation Plan
SHPO	State Historic Preservation Officer
SM	Standard Missile
SOP	Standard Operating Procedure
SPLASH	Structure of Populations, Levels of Abundance and Status of Humpbacks
SWTR	Shallow Water Test Range
THAAD	Terminal High Altitude Area Defense
TOA	Temporary Operating Area
U.S.	United States
U.S.C.	United States Code
USCG	United States Coast Guard
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
UST	Underground Storage Tank
VFR	Visual Flight Rules
VLS	Vertical Launch System
VOC	Volatile Organic Compound
WPRFMC	Western Pacific Regional Fishery Management Council

Table of Contents

TABLE OF CONTENTS

APPENDICES

FIGURES

TABLES

THIS PAGE INTENTIONALLY LEFT BLANK

1.0 Purpose of and Need for Action

1.0 PURPOSE OF AND NEED FOR ACTION

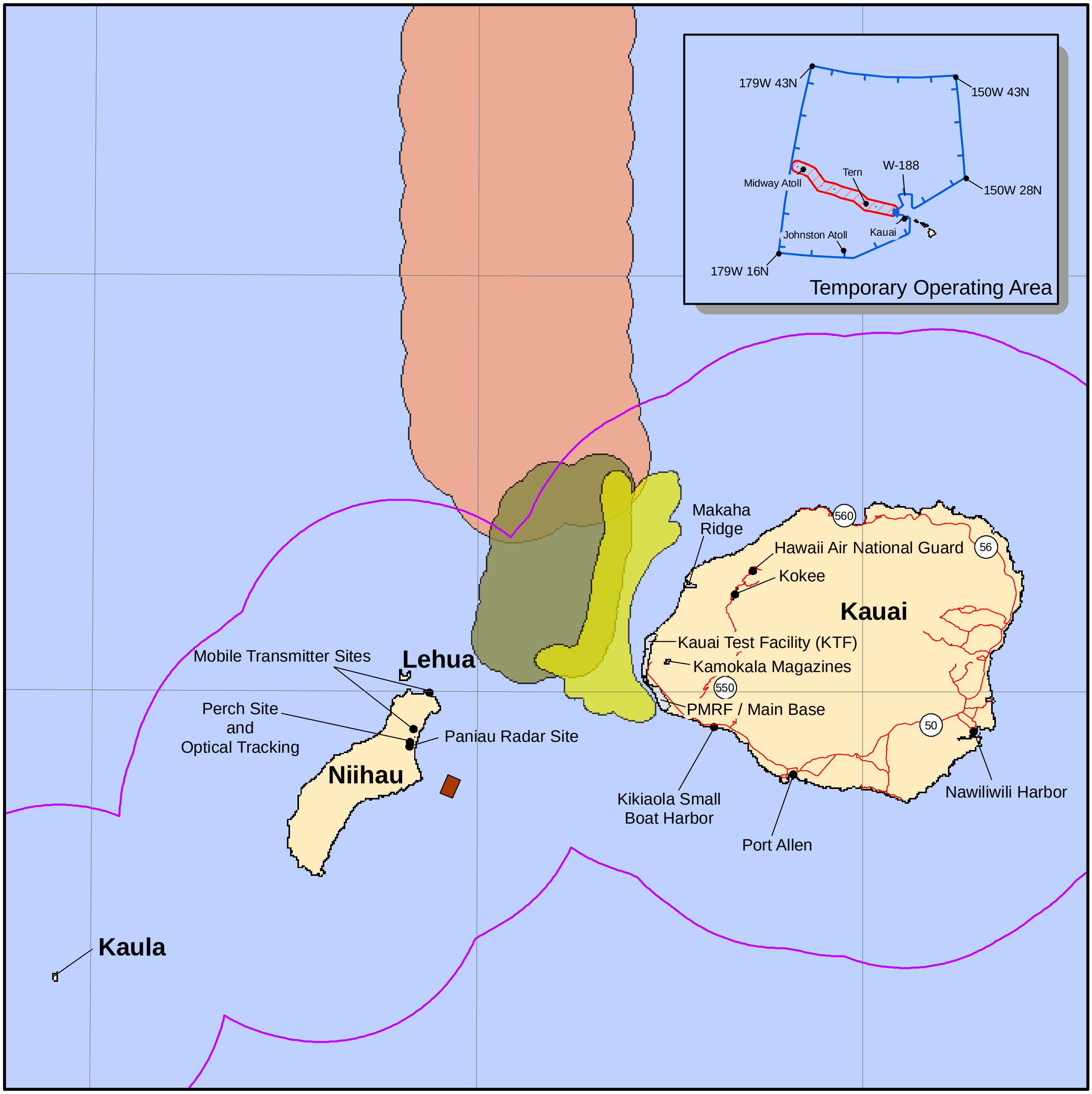
1.1 INTRODUCTION

The United States (U.S.) Department of the Navy (Navy) has prepared this Environmental Assessment (EA)/Overseas Environmental Assessment (OEA) to evaluate and discuss the environmental consequences of updating the capabilities of the Pacific Missile Range Facility (PMRF), Kauai, HI to support future tests of Ballistic Missile Defense (BMD) intercept technologies. This EA/OEA is in compliance with the National Environmental Policy Act (NEPA) of 1969 (42 United States Code [U.S.C.] § 4321 et seq.); the Council on Environmental Quality Regulations for Implementing the Procedural Provisions of NEPA (Title 40 Code of Federal Regulations [CFR] §§ 1500-1508 [2005]); Department of the Navy Procedures for Implementing NEPA (32 CFR § 775 [2005]); and Executive Order 12114, Environmental Effects Abroad of Major Federal Actions. The NEPA process ensures that environmental impacts of proposed major Federal actions are considered in the decision-making process. Executive Order 12114 requires environmental consideration for actions that may significantly harm the environment of the global commons (e.g., environment outside U.S. Territorial Seas). This EA/OEA satisfies the requirements of both NEPA and Executive Order 12114.

1.2 BACKGROUND

PMRF (Figure 1.2-1) has supported various missile test and evaluation programs since 1993 by conducting launches of targets and conducting flight tests of intercepting missiles. In December 1998, the Navy finalized the PMRF Enhanced Capability Environmental Impact Statement (EIS), which was a comprehensive analysis to support decisions by the Navy concerning potential range enhancements at PMRF. The 1998 PMRF Enhanced Capability EIS analyzed the continuation of existing activities and enhanced capabilities that allowed PMRF to test missile defense systems being developed and to train using those systems. These enhancements included upgrading the existing radar and communications facilities and the addition of a missile storage magazine. Since then, the Navy has assessed further enhancements to range capabilities in follow-on environmental documents.

In 2000, the Mountaintop Surveillance Sensor Test Integration Center EA analyzed a facility to provide a ground-based test capability at PMRF to evaluate and compare new and updated radar and sensor technologies. The test facility was designed to provide an environment representing an operational surveillance and tracking radar for airborne, sea, and land conditions. In 2002, the Terminal High Altitude Area Defense (THAAD) Pacific Flight Tests EA analyzed interceptor missile launches and THAAD radar operation at PMRF. The Ground-based Midcourse Defense (GMD) Extended Test Range EIS prepared in 2003 analyzed more complex long-range interceptor flight tests in the Pacific Region.



EXPLANATION

- Road
- 12-Nautical Mile Line
- Kingfisher Range
- Shallow Water Training Range (SWTR)
- Barking Sands Tactical Underwater Range (BARSTUR)
- Barking Sands Underwater Range Expansion (BSURE)
- Installation Area
- State/Private Land

NORTH

0 5 10 20 Nautical Miles

Pacific Missile Range Facility and Support Locations

Kauai, Niihau, and Kaula, Hawaii

Figure 1.2-1

Various targets and target launch alternatives, as well as a programmatic assessment, were evaluated between 2004 and 2007. Specifically, in 2004 the Missile Defense Agency (MDA) prepared the Mobile Launch Platform EA to evaluate the potential environmental impacts of activities associated with using the Mobile Launch Platform for testing sensors, launching target missiles, and launching interceptor missiles. Additionally, in 2007, MDA finalized the Ballistic Missile Defense System Programmatic Final EIS to evaluate the impacts to the environment from the development, testing, deployment, and planning for decommissioning activities for an integrated BMD system.

In 2008, the Navy finalized the Hawaii Range Complex EIS/Overseas EIS (OEIS) that addressed ongoing and proposed activities within the Navy's existing Hawaii Range Complex (HRC), which includes PMRF, and represented current and anticipated future use of the "existing footprint" of the HRC. The overall purpose of the 2008 EIS/OEIS was to achieve and maintain fleet readiness using the HRC to support and conduct current, emerging, and future training and research, development, test, and evaluation (RDT&E) activities; and enhance training resources through investment on the ranges.

The Proposed Action for this PMRF Intercept Test Support EA/OEA is to further enhance the intercept test capabilities of missile defense tests at PMRF. It includes the construction and modification of PMRF facilities to test new land-based interceptor systems and the enhancement of current intercept test capabilities of PMRF. This EA/OEA builds upon previous analyses and assesses the potential environmental impacts of new enhancements, technologies, and capabilities, which includes changes to interceptor testing scenarios within the PMRF range and the Temporary Operating Area (TOA) (Figure 1.2-1 insert). It also includes the temporary use of airspace outside these areas that is needed to accommodate more complex engagement scenarios for missile testing. The Proposed Action would support and maintain future Department of Defense (DoD) (Navy, Army, etc.) and MDA RDT&E operations; and mission requirements for newer interceptors or future targets, sensors, associated facilities (including hardware and infrastructure improvements), and movement of fuel to support those tests.

1.3 PACIFIC MISSILE RANGE FACILITY

PMRF is located in Hawaii on and off the western shores of the island of Kauai and includes broad ocean areas to the north, south, and west (Figure 1.2-1). The relative isolation of PMRF, a year-round tropical climate, and an open ocean area relatively free of human interference are significant factors in PMRF's excellent record of safely conducting testing and training activities. PMRF has a mission to provide training for Navy and other DoD personnel using existing equipment and technologies for real world requirements to maintain and achieve required states of readiness. PMRF is a Major Range and Test Facility Base (MRTFB) and, as such, supports the full spectrum of DoD Test and Evaluation requirements.

PMRF is the world's largest instrumented, multi-environment, military test range capable of supporting subsurface, surface, air, and space operations. PMRF consists of 1,100 square nautical miles (nm^2) of instrumented underwater ranges, 42,000 nm^2 of controlled airspace, and a TOA covering 2.1-million nm^2 of ocean area. These assets are more fully described in the discussion below.

The capabilities of PMRF have been analyzed for its potential uses of areas on Kauai, offshore areas (within 12 nautical miles [nm] of land), and open ocean areas (beyond 12 nm). PMRF facilitates training, tactics development, and test and evaluations for air, surface, and sub-surface weapons systems and advanced technology systems. PMRF is the only range in the world where subsurface, surface, air, and space vehicles can operate and be tracked simultaneously. PMRF is the Navy's lead range in the Pacific for Aegis Combat System Ship Qualification Training; PMRF puts new Aegis platforms through extensive testing and training prior to initial deployment. PMRF provides a realistic test and training environment for newer test interceptors and defensive systems. Figure 1.3-1 shows the existing launch facilities at PMRF. PMRF has developed the capability to launch an array of missile types (Figure 1.3-2).

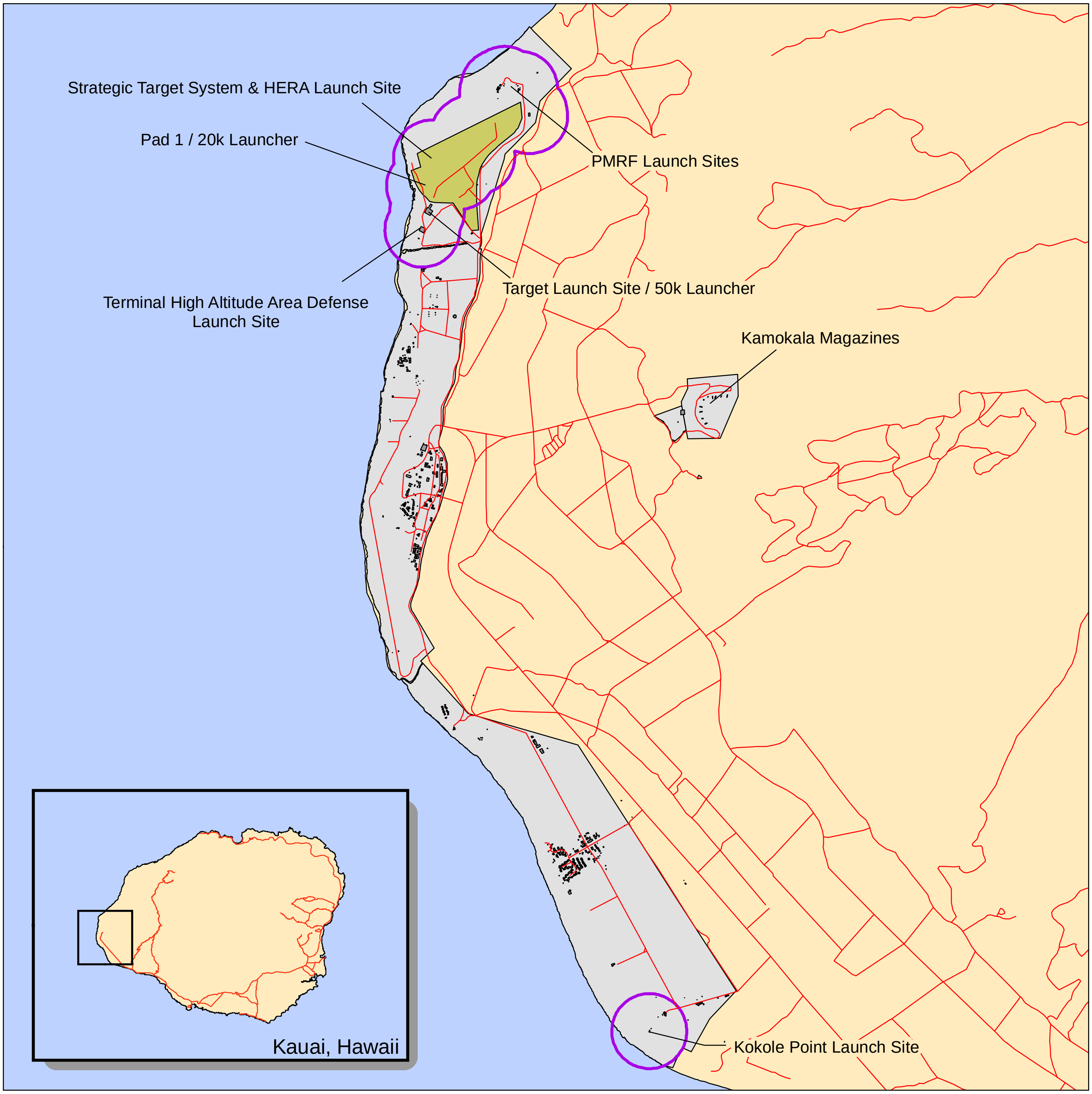
PMRF's Range Control maintains real time surveillance, clearance, and range safety at all PMRF areas including PMRF/Main Base. PMRF sets requirements for acceptable risk criteria to operational and non-operational personnel, test facilities, and non-military assets during range operations, as discussed in Section 2.1.1.1, Section 2.2.1.1, and Appendix D (Missile Launch Safety and Emergency Response). For all range operations at PMRF, the Range Control Officer requires a Range Safety Operation Plan, which is generated by PMRF Range Safety personnel prior to range operations.

Missile flight safety procedures require that the public and nonessential mission personnel be excluded from hazardous areas to protect them in the unlikely event of an early flight termination. The U.S. Government is required by DoD policy to be able to exclude nonparticipants from hazardous areas. The off-base portion of the respective missile ground hazard areas is located adjacent to PMRF/Main Base within a restrictive easement that was acquired from the State of Hawaii by the U.S. Government (See Appendix E for a copy of the lease agreement). PMRF holds this restrictive easement on 2,110 acres of land for safety purposes. The restrictive easement allows PMRF to clear the area up to 30 times per year. The ground hazard area within the restrictive easement boundary is a modified arc of approximately 10,000 feet. The modified arc is described such that the radius is approximately 10,000 feet to the northeast, approximately 9,100 feet to the east, and approximately 9,000 feet to the south.

Operations support services are also provided in other remote training areas on other Hawaiian islands, such as Niihau and Maui. PMRF is also linked to other range and data-processing facilities, and transmits real-time test and exercise data and video anywhere in the world.

The TOA, established to support missile defense testing and extending primarily north and west of Kauai, is illustrated in Figure 1.2-1. The range and speed of the weapon and missile systems tested at PMRF require the large TOA to contain potentially harmful or lethal debris and expended materials from test missions within the Open Ocean.

To ensure safe operations, PMRF requests altitude reservations for use of the airspace from the Federal Aviation Administration (FAA) during missile defense testing. Once approved, the FAA issues Notices to Airmen (NOTAMs) covering this temporary airspace to let pilots know to avoid specific areas of airspace until testing is complete.



EXPLANATION

- Road
- Existing Explosive Safety Quantity Distance
- Kauai Test Facility
- Existing Structure
- PMRF Installation Area
- State/Private Land

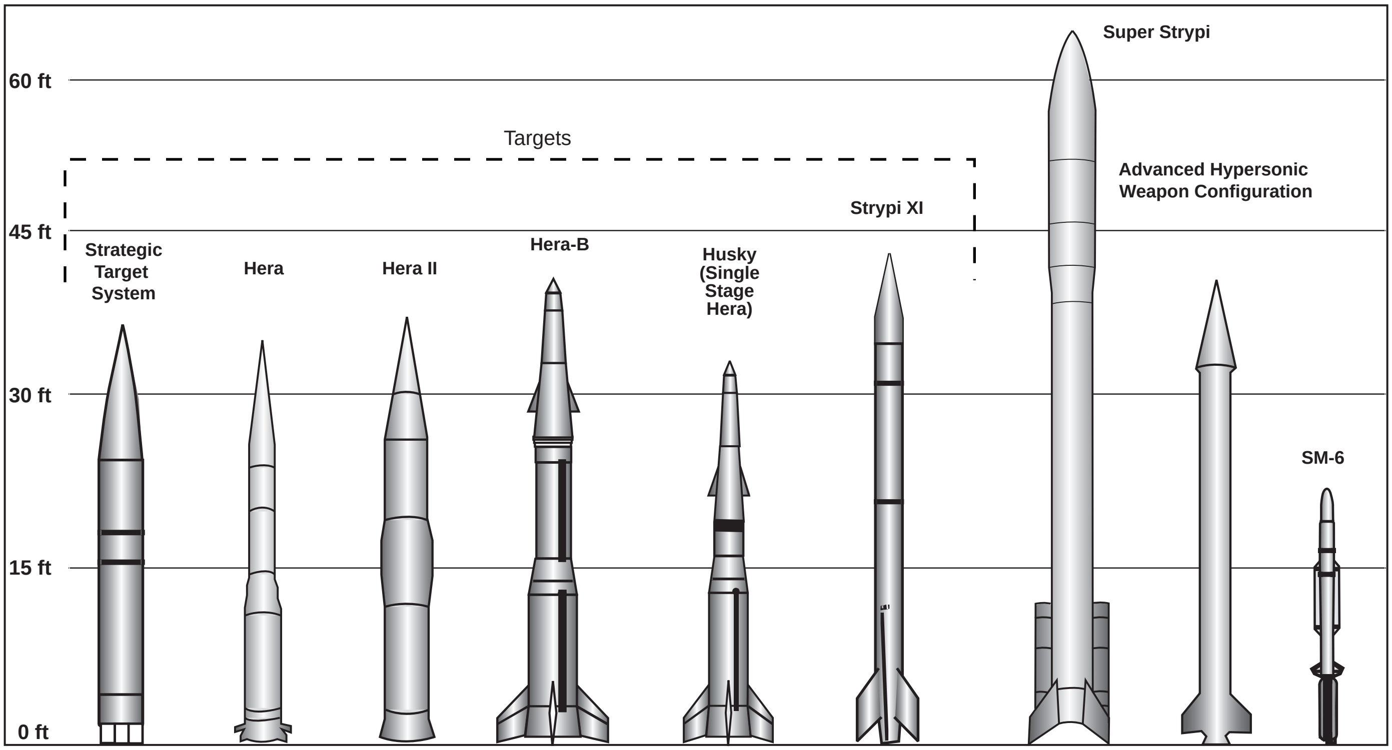
NORTH

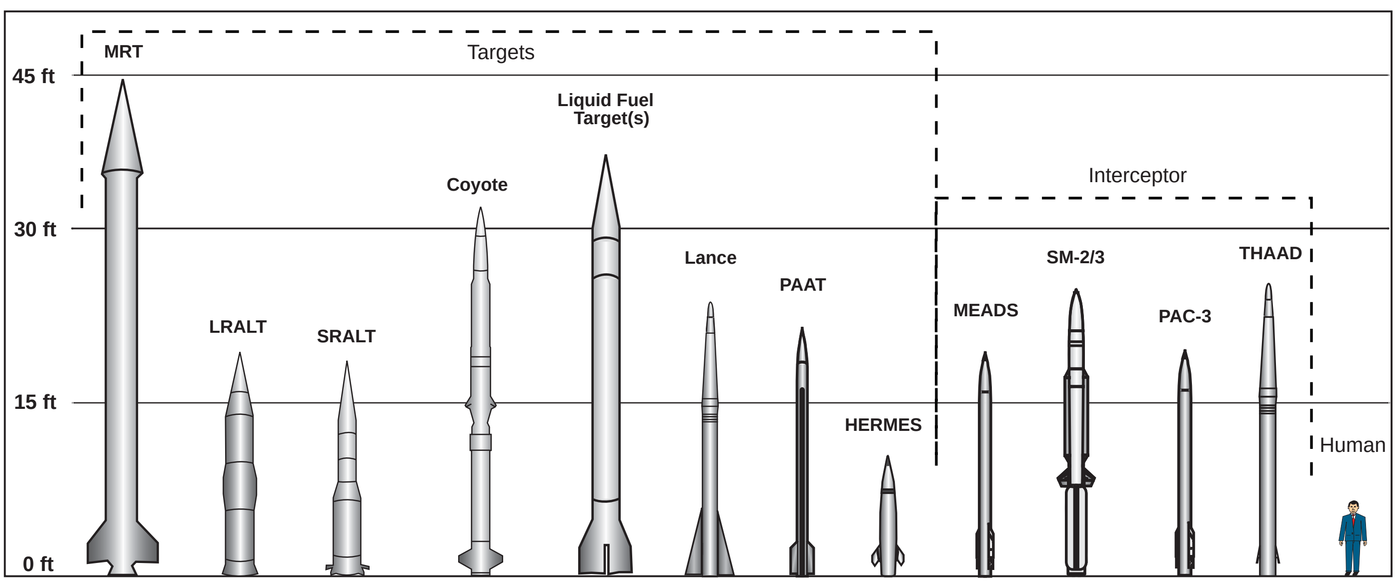
0 0.5 1 2 Miles

Existing Pacific Missile Range Facility and Kauai Test Facility Launch Facilities

Kauai, Hawaii

Figure 1.3-1





EXPLANATION

SM - Standard Missile
MRT - Medium-Range Target
LRALT - Long-Range Air Launched Target
SRALT - Short-Range Air Launched Target
PAAT - Patriot as a Target
PAC-3 - Patriot Advanced Capability-3
THAAD - Terminal High Altitude Area Defense
MEADS - Medium Extended Air Defense System

Relative Target and Interceptor Missile Heights

Figure 1.3-2

PMRF Range Control and the FAA are in direct communication in real time to ensure the safety of all aircraft using the airways and the Warning Areas established as part of Special Use Airspace. Section 3.1.1.1.2 provides further airspace details. Warning Areas are located in international airspace, thus the procedures of the International Civil Aviation Organization (ICAO) are followed. The FAA acts as the U.S. agent for aeronautical information to the ICAO, and air traffic in the region of influence is managed by the Honolulu Control Facility.

PMRF transports ordnance, including propellants (e.g., missiles), by cargo aircraft when available or by truck from Nawiliwili Harbor to PMRF along Highway 50. The barges carrying explosives are met at Nawiliwili Harbor by trained ordnance personnel and special vehicles for transit to and delivery at PMRF. All ordnance is transported in accordance with U.S. Department of Transportation (DOT) regulations. PMRF has established PMRF Instruction 8023.G, and follows other guidelines (NAVSEA OP 5 Volume 1 Seventh Revision Table 7-5 and DoD 6055.9-STD Table C9.T16) that cover the handling and transportation of ammunition, explosives, and hazardous materials on the facility. Explosive materials are normally flown into PMRF; however, an event waiver from the U.S. DOT is required to ship (by truck or barge) anything higher than Hazardous Class 1.4 from Nawiliwili and commercial piers on Oahu (Bran, 2009).

1.4 BALLISTIC MISSILE DEFENSE CAPABILITIES

MDA was established to manage and integrate all missile defense programs and technologies into one BMD system. MDA is responsible for developing and testing conceptual BMD systems. Two of the priorities of missile defense are: (1) to defend the United States and its deployed forces, allies, and friends; and (2) to employ a BMD system that consists of layers of defenses to intercept ballistic missiles in all phases of their flight (boost, midcourse, and terminal) against all ranges of threats (short, medium, intermediate, and long). The Navy's Aegis testing program for ships off-shore and the Army's THAAD (interceptor missile launches and radar operation) test program are active test operations at PMRF. Testing and training activities for such programs require a multi-threat environment with complex, simulated hostile conditions, both in coastal areas and over a large ocean area. Updates and improvements in the Aegis and THAAD systems will subsequently be integrated and deployed with other Navy or MDA systems, or combined with other developing BMD system programs for integrated testing and training. Due to continuing emerging threats to our Nation and allies, PMRF is continuing to maintain and develop programs that ensure the safe conduct and evaluation of training and improve the ability of the DoD to achieve readiness and other national defense objectives.

1.5 PURPOSE AND NEED

Purpose

The overall purpose of the Proposed Action is to provide PMRF with the enhanced capability to further test and evaluate DoD and Navy BMD systems, as well as train personnel in the use of these systems.

More specifically, the purpose of the Proposed Action is to:

- Enhance PMRF's range capability and support facilities in order to support future requirements of testing existing and new BMD programs at PMRF
- Evaluate airspace needed to accommodate more complex intercept engagement scenarios for missile defense test programs
- Upgrade base activities and facilities to support future fleet training, land-based training, RDT&E activities, and base operations and maintenance activities as required
- Provide additional capabilities to ensure safe conduct and evaluation of training and RDT&E missions in a modern, multi-threat, multi-dimensional environment, for future programs, which would continue as fully integrated range services, at PMRF.

Need

The variety of emerging missile threats to national security requires the Navy and MDA to maintain and develop technologies that are capable of protecting this nation. The ability to provide complex testing scenarios is a major concern and goal of the Navy; therefore, the implementation of the Proposed Action is needed because missile defense tests are becoming increasingly more complicated with multiple engagements, longer time of flight, intercepts at higher altitudes, and increased closing velocities.

PMRF needs the proposed enhancements to deliver quality data products to improve the customers' abilities to achieve readiness and other national defense objectives. The Navy needs to successfully meet current and future national and global defense challenges by developing a robust capability to research, develop, test, and evaluate systems within the PMRF operating areas. This allows the Navy to deploy world-wide naval forces equipped and trained to meet existing and emergent threats, and to enhance its ability to operate jointly with other components of the armed forces of the United States and its allies.

1.6 RELATED ENVIRONMENTAL DOCUMENTATION

Environmental documents for some of the programs, projects, and installations within the geographical scope of this EA that have undergone environmental review for NEPA and Executive Order 12114 compliance include:

- *Advanced Radar Detection Laboratory, Environmental Assessment*, August 2009
- *Hawaii Range Complex Environmental Impact Statement/Overseas Environmental Impact Statement*, May 2008
- *Flexible Target Family Environmental Assessment*, December 2007
- *Ballistic Missile Defense System Programmatic Final Environmental Impact Statement,* February 2007
- *Mobile Sensors Environmental Assessment,* September 2005
- *Mobile Launch Platform Environmental Assessment,* June 2004
- *Ground-Based Midcourse Defense (GMD) Extended Test Range (ETR) Environmental Impact Statement,* July 2003
- *Theater High Altitude Area Defense (THAAD) Pacific Test Flights Environmental Assessment,* December 2002
- *Development and Demonstration of the Long Range Air Launch Target System Environmental Assessment,* October 2002
- *North Pacific Targets Program Environmental Assessment,* April 2001
- *Mountaintop Surveillance Sensor Test Integration Center (MSSTIC) Facility Kauai, Hawaii Environmental Assessment,* May 2000
- *Pacific Missile Range Facility Enhanced Capability Final Environmental Impact Statement,* December 1998
- *Air Drop Target System Program Programmatic Environmental Assessment,* May 1998
- *Hawaiian Islands Humpback Whale National Marine Sanctuary Final Environmental Impact Statement/Management Plan,* February 1997
- *AltAir Short Range Ballistic Target Test Demonstration Environmental Assessment, Point Mugu, CA,* November 1996
- *Final Environmental Impact Statement for the Restrictive Easement Kauai, Hawaii, October 1993*
- *Kauai Test Facility (KTF) Environmental Assessment,* July 1992
- *Strategic Target System Environmental Impact Statement,* May 1992
- *Supplement to the Strategic Target System Environmental Assessment,* July 1991
- *Environmental Assessment for the Standard Missile,* February 1991

- *Exoatmospheric Discrimination Experiment (EDX) Environmental Assessment*, September 1990
- *Strategic Target System Environmental Assessment,* July 1990

1.7 COOPERATING AGENCY

MDA is a cooperating agency in the preparation of this EA/OEA. MDA assisted with development of this EA/OEA by providing information describing proposed testing of BMD system components (including Aegis Ashore Missile Defense and THAAD) and specialized expertise applicable to MDA's mission.

1.8 PUBLIC NOTIFICATION AND REVIEW

In accordance with Council on Environmental Quality, DoD, and Navy regulations for implementing NEPA, PMRF is soliciting comments on this EA/OEA and the Draft Finding of No Significant Impact (FONSI) from interested and affected parties. A Notice of Availability for the EA/OEA and Draft FONSI was published in the following newspapers and bulletins:

- The Garden Island, Kauai
- Honolulu Star Bulletin, Oahu
- Honolulu Advertiser, Oahu
- The Environmental Notice, Office of Environmental Quality Control, Oahu

Copies of the EA/OEA and Draft FONSI were placed in local libraries in the State of Hawaii and were available over the Internet. Appendix A lists agencies, organizations, and libraries that received a copy of the EA/OEA and Draft FONSI.

1.9 DECISIONS TO BE MADE

Following the public review period (as specified in the newspaper notices), the Navy will consider public and agency comments received in deciding whether to (1) sign the FONSI, which would allow the Proposed Action to proceed; or (2) conduct additional environmental analysis (if needed); or (3) select the No-action Alternative.

2.0 Description of the Proposed Action and Alternatives

2.0 DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

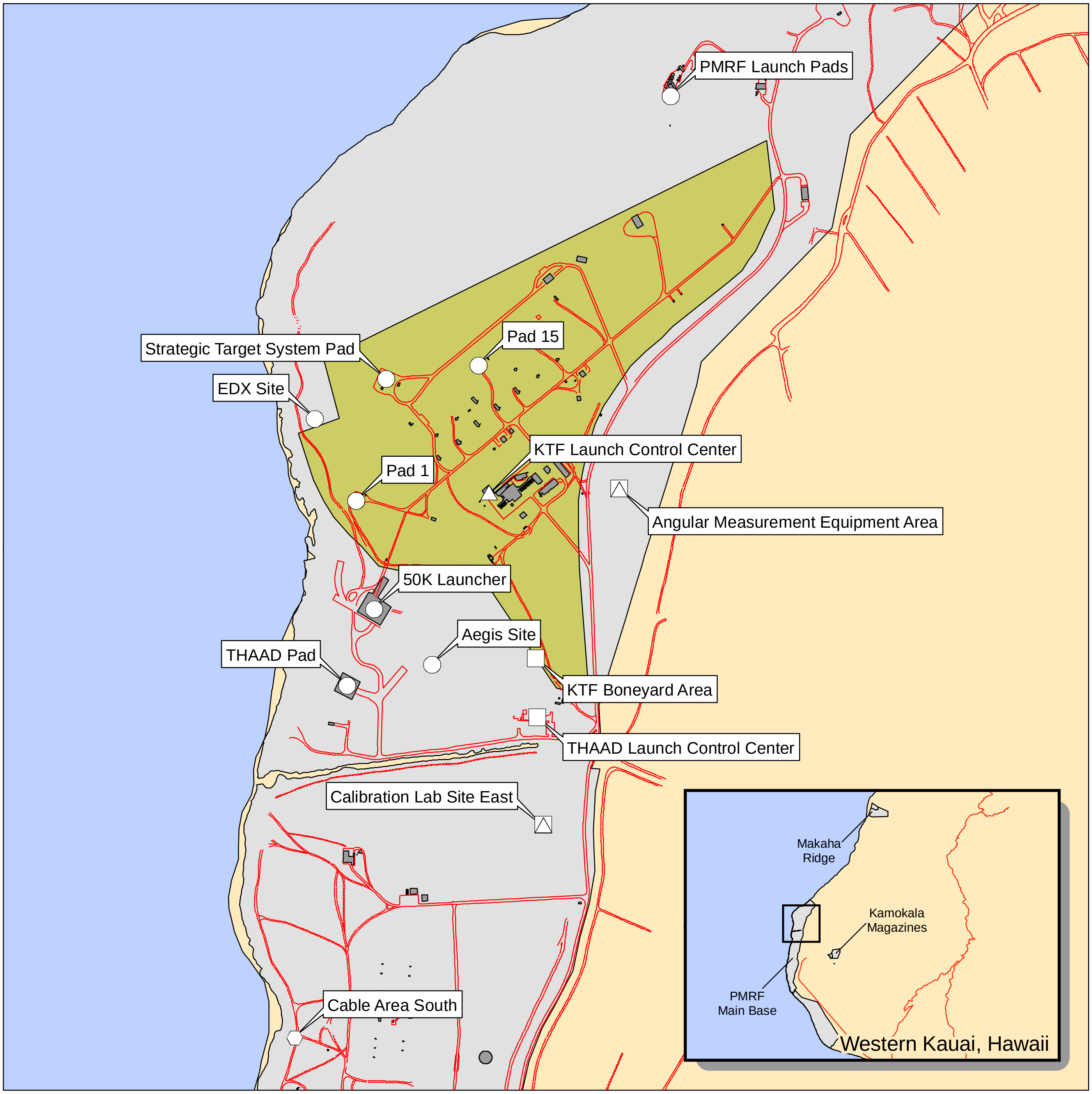
Two actions to support the Pacific Missile Range Facility's (PMRF's) intercept test activities are analyzed in this Environmental Assessment (EA)/Overseas Environmental Assessment (OEA)—the No-action Alternative and the Proposed Action. Within this chapter, Section 2.1 describes the No-action Alternative and Section 2.2 describes the Proposed Action at PMRF. This EA/OEA is an installation specific document for PMRF; therefore, no other alternative sites were considered for further study. Section 2.3 describes the alternative sites considered for the Aegis Ashore Missile Defense program portion of the Proposed Action at PMRF that were not carried forward for analysis in this document.

2.1 NO-ACTION ALTERNATIVE

The No-action Alternative is the combination of the programs and actions analyzed in the 2008 Final Hawaii Range Complex (HRC) Environmental Impact Statement/ Overseas Environmental Impact Statement (EIS/OEIS) and any additional PMRF programs analyzed since April 2008, as they relate to intercept test systems, sensors, and facilities. If this alternative is selected, PMRF would continue existing range training and operation activities, and base operations and maintenance activities as described in Sections 2.1.1 and 2.1.2. The general locations of the No-action Alternative activities are shown in Figure 1.2-1. Figures 2.1-1 through 2.1-6 depict locations at PMRF where various types of range activities are or can be performed. Existing PMRF infrastructure, such as roads, potable water supply, fire protection, sanitary waste collection and disposal, communication, and power distribution would be used as necessary.

2.1.1 RANGE TRAINING AND OPERATION ACTIVITIES—NO-ACTION ALTERNATIVE

PMRF provides major range services for training, tactics development, and evaluation of air, surface, and subsurface weapons systems for the Navy, other Department of Defense (DoD) agencies, foreign military forces, and private industry. It also maintains facilities and provides services to support naval operation, and other activities and units designated by the Chief of Naval Operations.



EXPLANATION

Potential Launch Control Area	Existing Structure
Potential Launch Site	Kauai Test Facility
Potential Radar Site	Installation Area
Potential Admin Building / Lab	State/Private Land
Road	

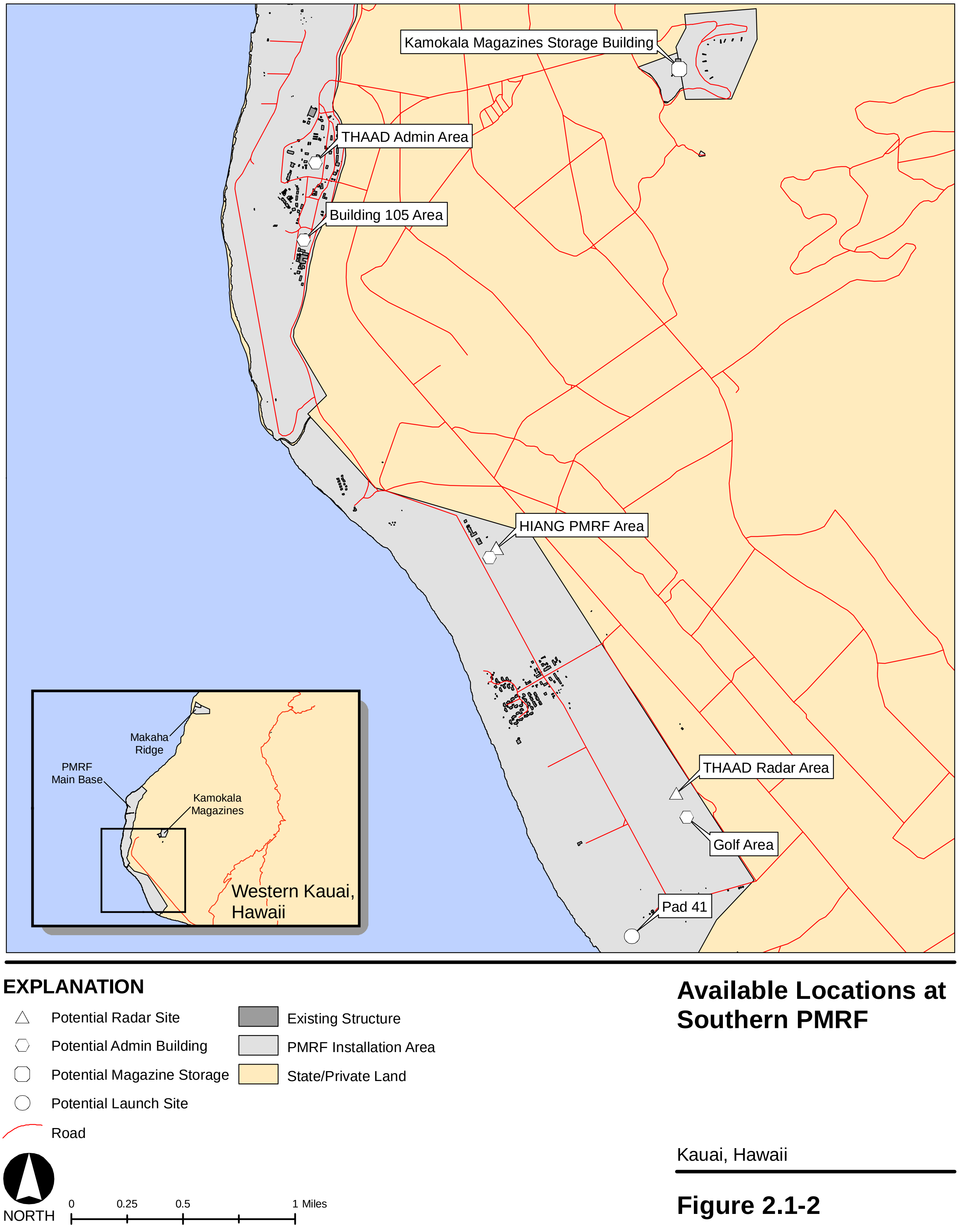
NORTH

0 500 1,000 2,000 Feet

Available Locations at Northern PMRF

Kauai, Hawaii

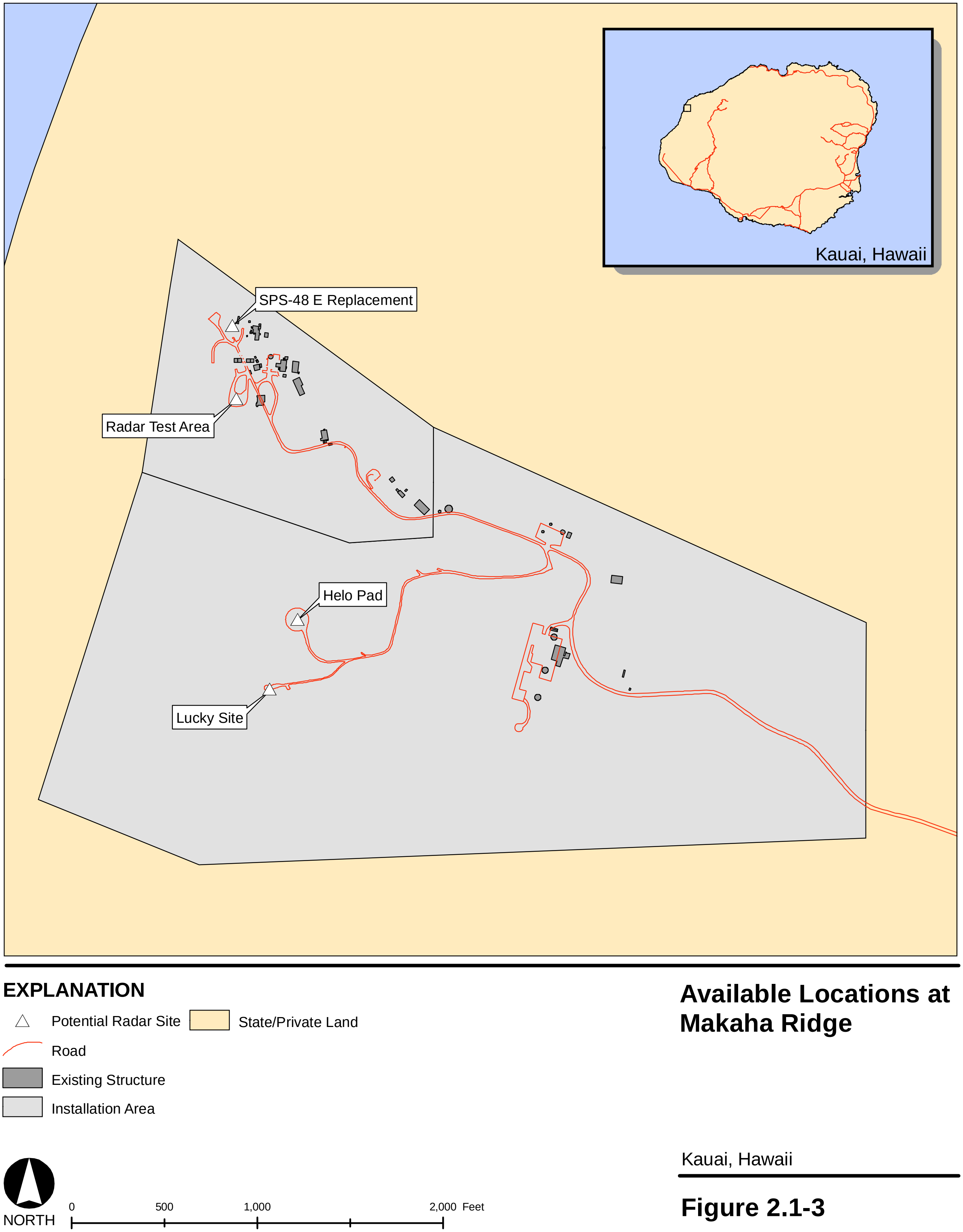
Figure 2.1-1



Available Locations at Southern PMRF

Kauai, Hawaii

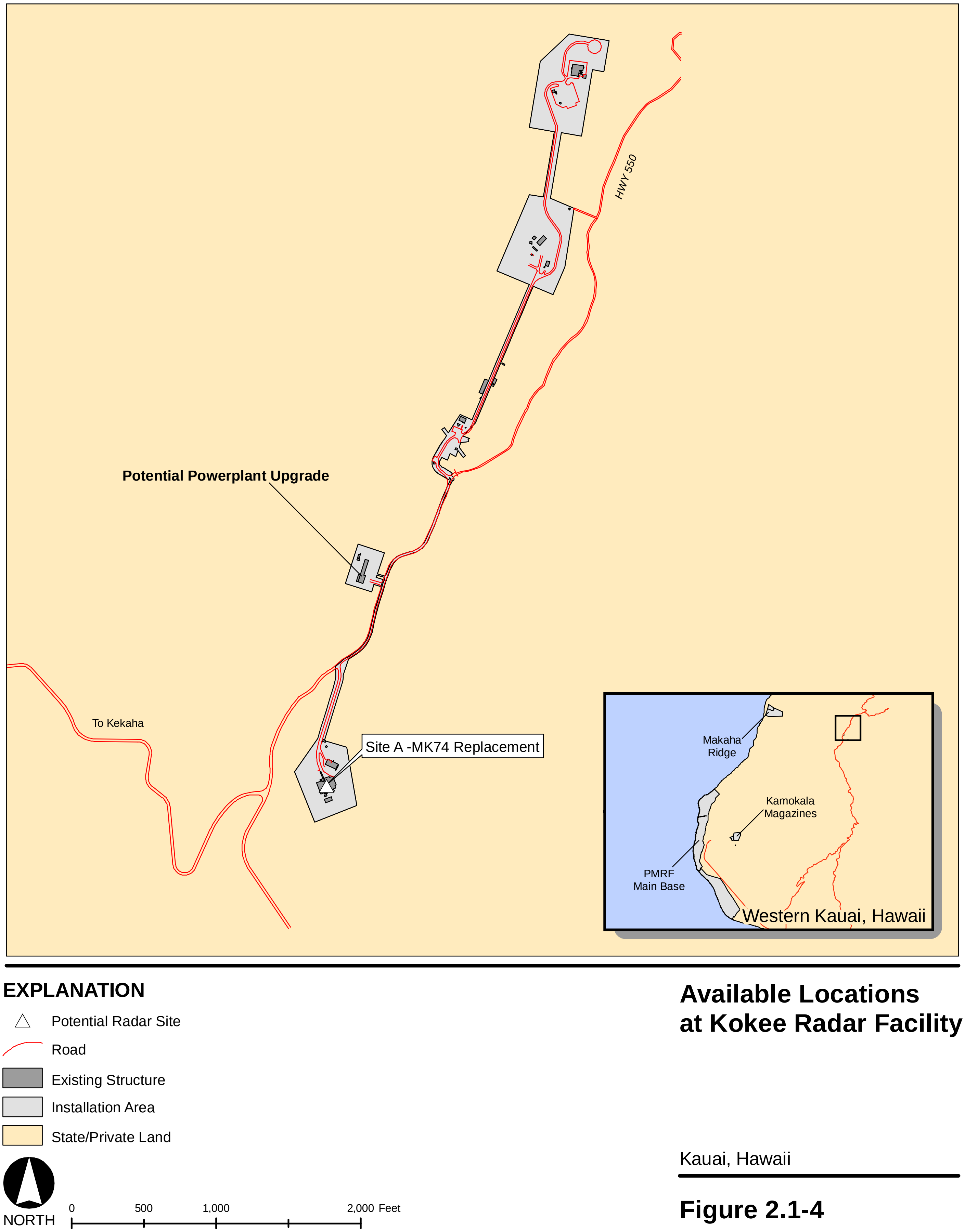
Figure 2.1-2



Available Locations at Makaha Ridge

Kauai, Hawaii

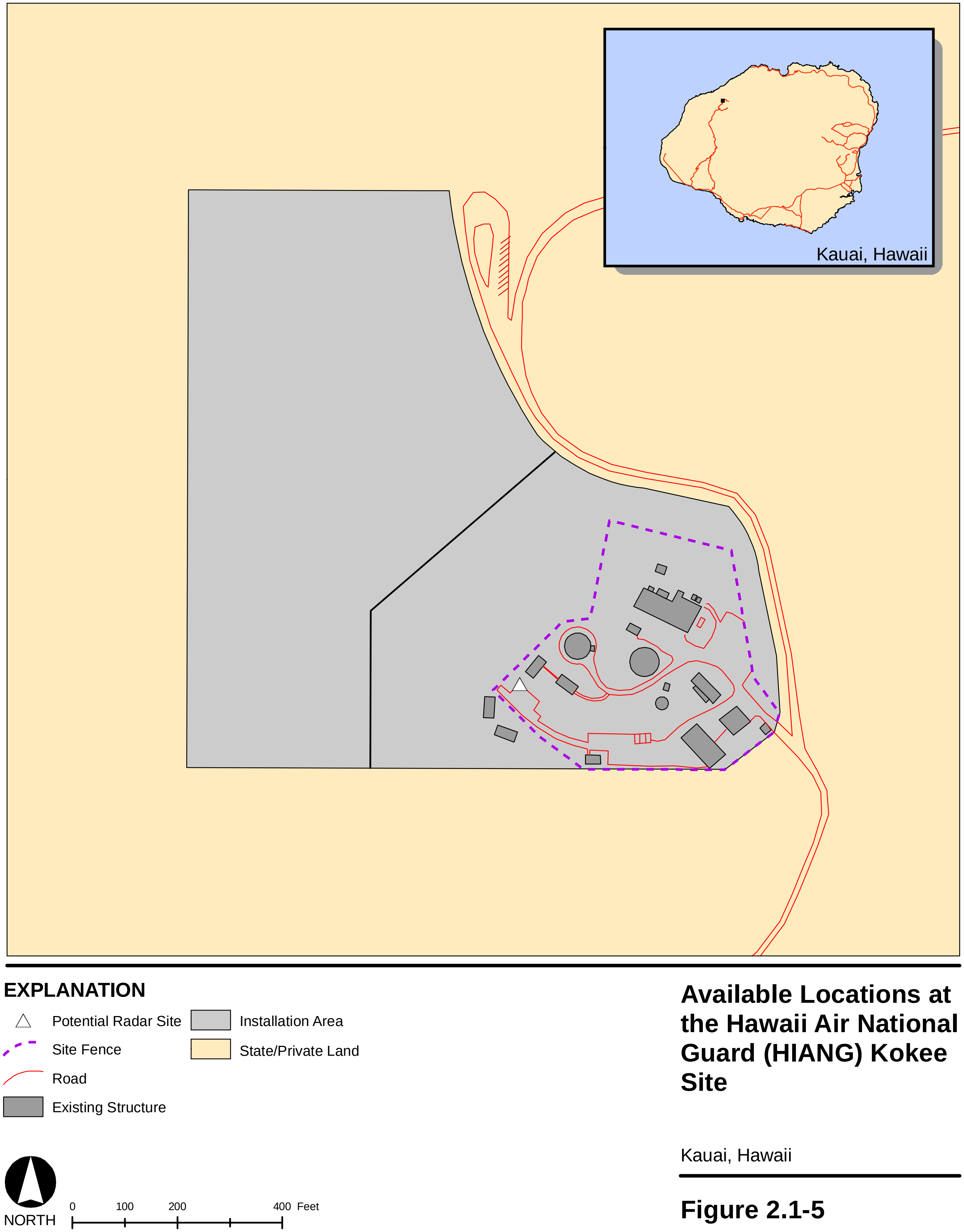
Figure 2.1-3



Available Locations at Kokee Radar Facility

Kauai, Hawaii

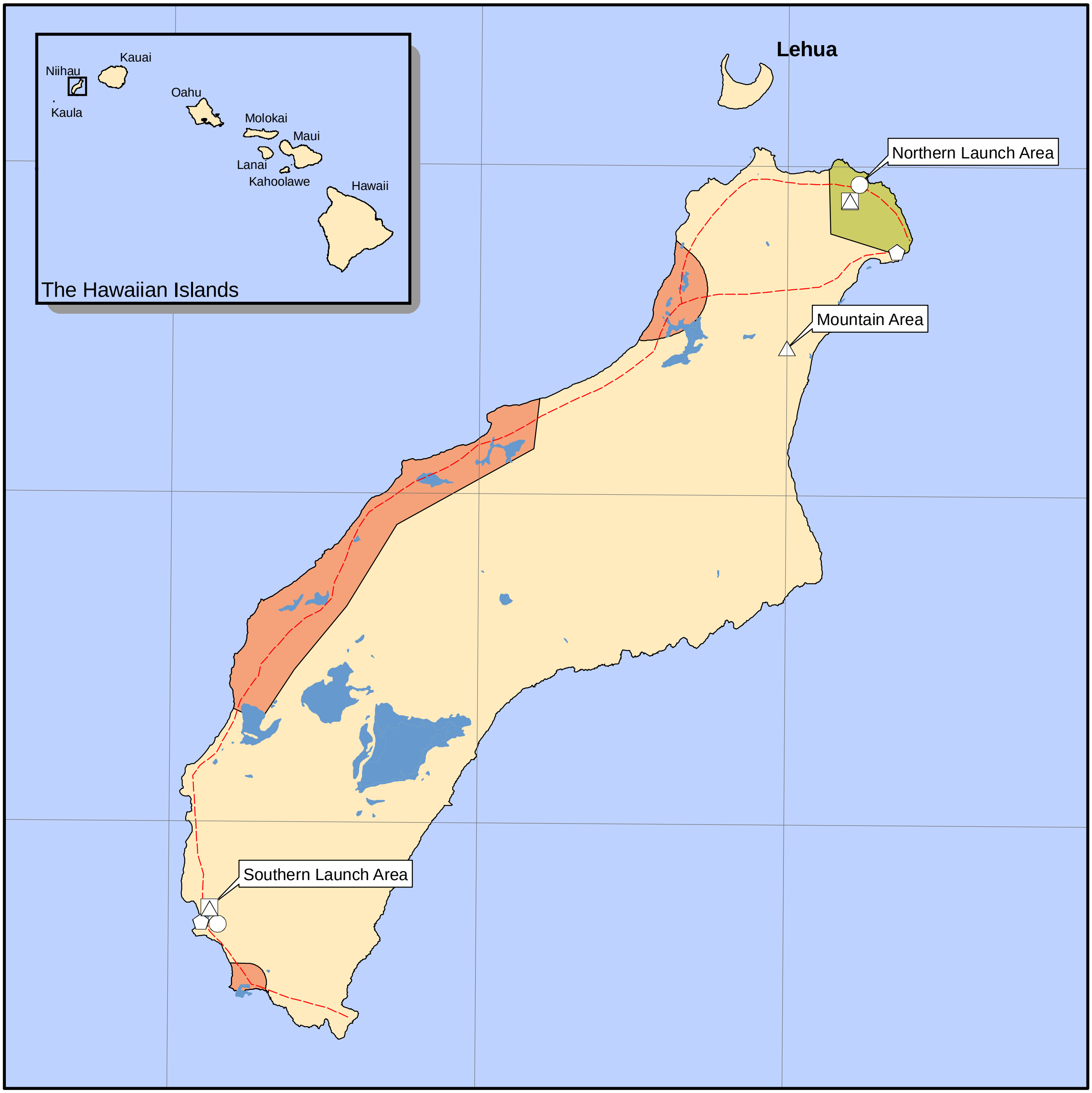
Figure 2.1-4



Available Locations at the Hawaii Air National Guard (HIANG) Kokee Site

Kauai, Hawaii

Figure 2.1-5



EXPLANATION

- Existing Logistics Landing Site
- Potential Launch Control Area
- Potential Launch Site
- Potential Radar Site
- Dirt Road
- Wetland Area
- Keep-Out Zone
- Leased Area
- Private Land

NORTH

0 1 2 4 Miles

Available Locations at Niihau

Niihau, Hawaii

Figure 2.1-6

Range Support Sites

The PMRF/Main Base provides radar tracking and surveillance, Global Positioning System (GPS) data processing, a communication network, and command and control from the Range Operations Center. Airfield facilities at PMRF/Main Base support up through C5-type cargo aircraft, tactical aircraft, and helicopters, both U.S. and allied. PMRF/Main Base provides a target support and red-label (live ordnance) area, an ordnance and launching area, and a torpedo shop for torpedo operations and recovery.

The Makaha Ridge site provides radar tracking and surveillance, primary telemetry receiving and recorders, frequency monitoring, target control, and electronic warfare and networked operations. Kokee supports tracking radars, telemetry, communications, and command and control systems. Kamokala Magazines provide secure ordnance storage with 10 ordnance magazines and 2 missile storage buildings approved for Class 1.1 explosives (capable of withstanding instantaneous mass detonation).

Port Allen provides pier docking space, protected anchorage, and small-boat launch facilities for PMRF's range support boats. Operations and maintenance facilities for these support boats are also located at Port Allen. Kikiaola Small Boat Harbor also provides a small-boat launch capability for PMRF.

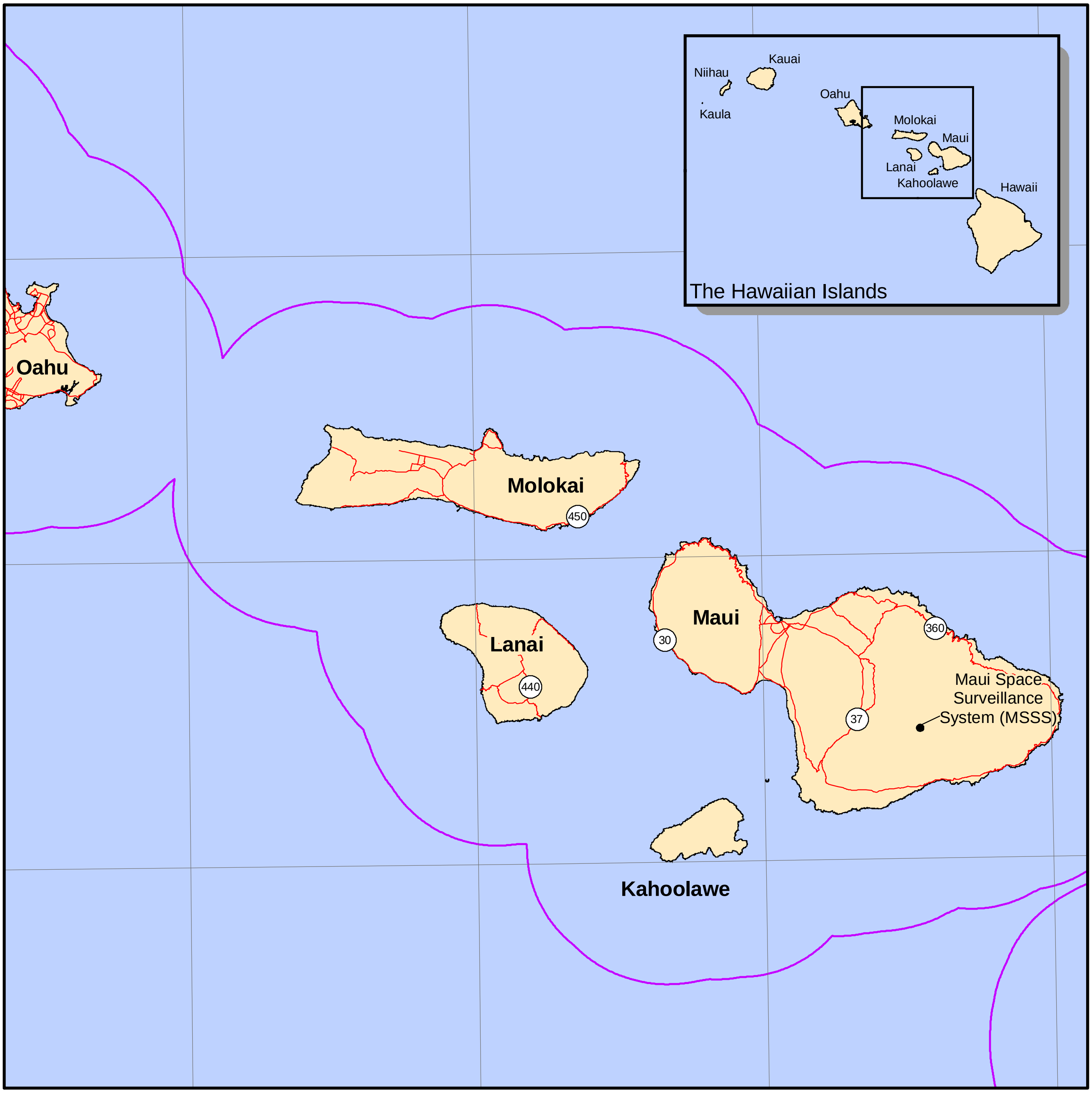
Under agreements with the Navy, the owners of the privately-owned island of Niihau provide support and sites for a remotely operated PMRF surveillance radar, a Test Vehicle Recovery Site, an electronic warfare site, multiple electronic warfare portable simulator sites, a marker for aircraft mining exercise programs, and a helicopter terrain-following flight training course. Downed pilot survival training, helicopter low-altitude terrain flight training, and special warfare exercises are held on Niihau, along with low-altitude cruise missile terrain-following exercises.

External Support Agencies and Facilities

A variety of external agencies and locations provide range support to range users, coordinated through the PMRF Program Manager. Figure 2.1.1-1 shows locations of support facilities on the island of Maui. In addition, Sandia National Laboratories currently operates the Kauai Test Facility (KTF) for the Department of Energy (DOE) and, through inter-service support agreements, provides PMRF with missile launch services for target systems and upper atmosphere measurements.

The Air Force Maui Optical Station, the Maui Optical Tracking and Identification Facility, and the Ground-based Electro-Optical Deep Space Surveillance system are located at the Maui Space Surveillance System Site atop Mount Haleakala on the island of Maui. These facilities provide a unique vantage point for observing sub-orbital vehicles. The Air Force Maui Optical Station is also used at times as a base for the PMRF Operations Conductor assisting the Commander Submarine Force, U.S. Pacific Fleet in conducting open-ocean submarine training activities south of Maui.

The Hawaii Air National Guard (HIANG) provides operations and maintenance of the Hawaii Digital Microwave System, and a radar at the HIANG Kokee site.



EXPLANATION

Road

12-Nautical Mile Line

Land

NORTH

0 10 20 40 Nautical Miles

Maui External Support Facilities

Maui, Hawaii

Figure 2.1.1-1

2.1.1.1 Range Safety and Range Control

Range Safety

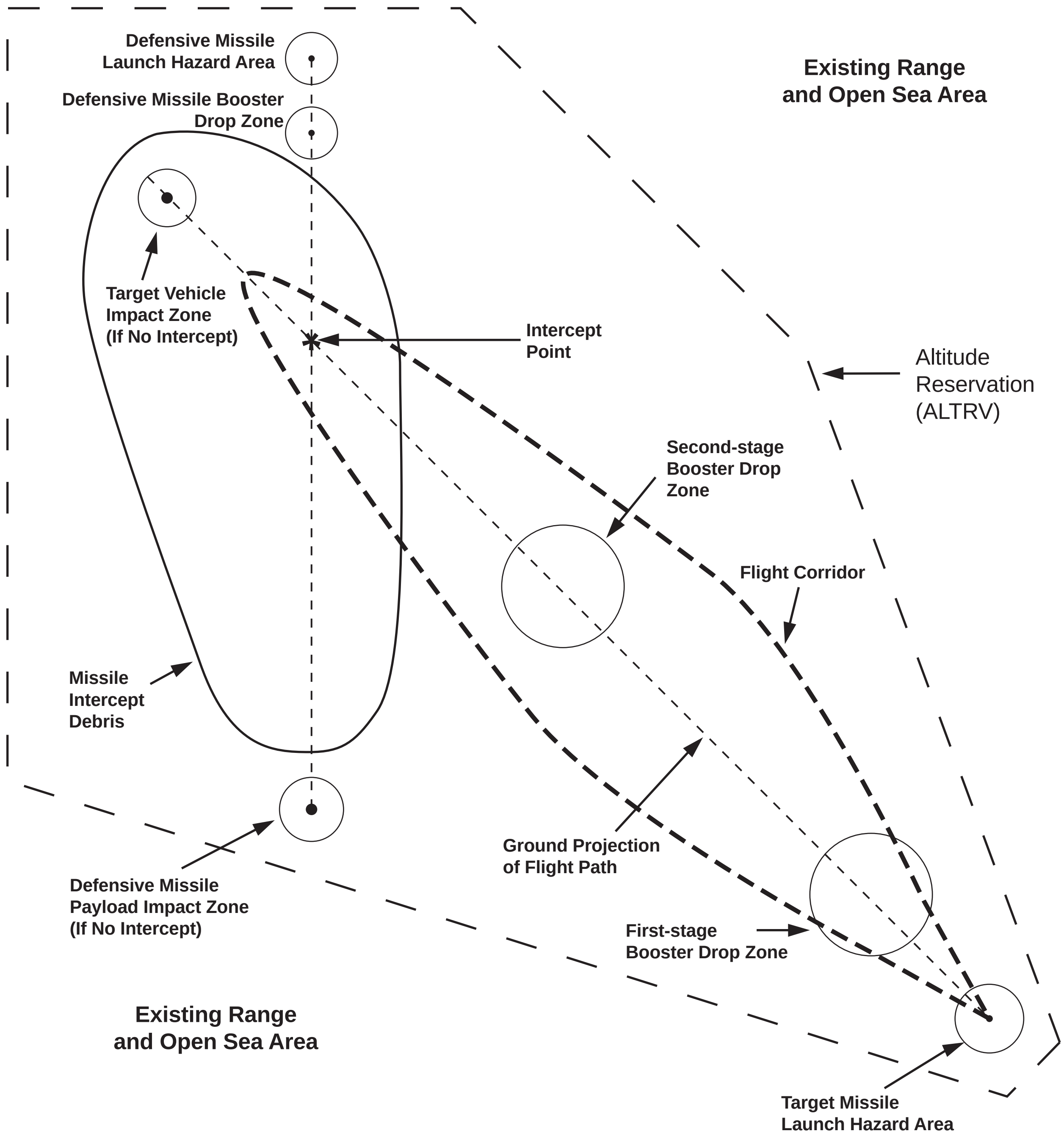
Range Safety at PMRF includes missile flight control, laser safety, ionizing radiation safety, toxic and thermal hazards safety, directed energy safety, and explosive and ordnance safety. PMRF transports ordnance including propellants (e.g., missiles) by cargo aircraft when available or by truck from Nawiliwili Harbor to PMRF along Highway 50. The barges carrying explosives are met at Nawiliwili Harbor by trained ordnance personnel and special vehicles for transit to and delivery at PMRF. All ordnance is transported in accordance with U.S. Department of Transportation (DOT) regulations. PMRF has established PMRF Instruction (PMRFINST) 8023.G, and follows other guidelines (NAVSEA OP 5 Volume 1 Seventh Revision Table 7-5 and DoD 6055.9-STD Table C9.T16) that cover the handling and transportation of ammunition, explosives, and hazardous materials on the facility. Explosive materials are normally flown into PMRF; however, an event waiver from the U.S. DOT is required to ship (by ship or barge) anything higher than Hazardous Class 1.4 from Nawiliwili and commercial piers on Oahu (Bran, 2009). Range users are required to provide specific information about their programs so that a safety analysis of all types of hazards can be completed and appropriate remedial procedures taken before initiation of hazardous activities. PMRF establishes and maintains appropriate Explosive Safety Quantity Distances (ESQDs) around facilities where ordnance is stored and handled.

For missile and weapons system tests, PMRF Safety establishes criteria for the safe execution of the test operation in the form of Range Safety Approval and Range Safety Operation Plan documents, which are required for all weapon and target systems using PMRF. Missile hazards are identified and minimized prior to flight testing as required by applicable military standards. PMRF Range Safety currently uses the Range Commanders Council (RCC) risk management criteria.

Missiles are launched from fixed or mobile land-based launchers, sea-based platforms, and air-based platforms, and flown on trajectories that emulate threat missile flight paths. Trajectories and range vary depending on the test or training exercise scenario, including Ballistic Missile Defense (BMD) system testing.

Protection of the public on the ground, in aircraft, or on boats and ships is accomplished by adhering to the RCC risk management criteria. These criteria require that PMRF operations maintain a very low probability for any harmful or lethal intercept debris, or spent stages, targets, or defensive missiles, to impact outside of pre-established impact zones over the open ocean. Some targets (such as the Long Range Air Launched Target) can overfly uninhabited portions of the Papahānaumokuākea Marine National Monument, but not within the limit lines or at a risk higher that RCC 321-07 allows.

Figure 2.1.1.1-1 shows a conceptual target and defensive missile (interceptor) launch hazard area, booster drop zones, intercept debris impact zones, and intact target and interceptor missile impact zones for potential intercept scenarios. When a missile flight test is planned within the Temporary Operating Area (TOA) (see Figure 1.2-1 insert), there are certain prescribed areas where missile components and debris are expected to impact. These areas are the “booster drop zone” and the “debris impact area.” Prior to conducting missile



Conceptual Impact Zones of Current Air, Sea, and Land Intercept Scenarios (No-action Alternative)

NOT TO SCALE

Figure 2.1.1.1-1

operations, these areas are determined clear of non-participating ships, aircraft, and personnel; or that the encroaching parties are not exposed to risks beyond what is acceptable according to established standards, such as RCC 321 criteria. There are other areas where debris may land if the test does not proceed as planned. These established areas of the test event may be subject to the risk of mishap, such as an explosion or flight termination. An example of this type of area is the launch hazard area. Clearance areas are defined by the PMRF Range Safety Office to encompass the areas where people, ships or aircraft would be at unacceptable levels of risk should a launch anomaly occur.

Each missile flight test event is modeled using computer predictions of the behavior of the missiles. This modeling predicts what the missile may do in a number of situations where the missile, or parts of the missile, may fall to earth. The models incorporate a number of variables such as the missile mass, velocity, trajectory, and altitude that may affect the missile in flight. The more specific, or accurate, the variables are, the more accurate the prediction of the missile's behavior can be. Modeling that is done during early mission planning takes into account anticipated seasonal weather conditions, including average winds. Modeling done on the day of test is based on weather measurements made that day. Winds measured on the actual day of the launch/test are used to refine launch predictions/criteria.

Ground hazard areas and launch hazard areas (over water) are established to limit the region that may be impacted by hazardous debris from an early flight termination. The hazard area is determined by size and flight characteristics of the missile, individual flight profile of each exercise or flight test, and reaction time between recognition of a flight malfunction and decision to terminate flight.

The Range Safety Office communicates the extent, date, and duration of the required impact zones, once they are defined, to the Federal Aviation Administration (FAA) and the U.S. Coast Guard to verify that designated land, air, and sea-surface areas are clear of non-participants. Other areas under the flight path, but not in a predicted impact or debris area are monitored prior to the test event to determine the location of air and sea traffic. If the Range Safety Office determines that the aircraft and ship traffic are in safe positions, the test will proceed. Fire suppression, hazardous materials emergency response, and emergency medical teams are available during launch operations.

Prior to conducting each missile operation, Range Safety officials request the issuing of Notices to Airmen (NOTAMs) from the FAA and Notices to Mariners (NOTMARs) from the U.S. Coast Guard. These notices identify all hazards areas to avoid.

Each flight test requires collection and analysis of data on the target, the interceptor, and the intercept itself. All exercise and test assets must be tracked in real-time to permit safe conduct of the test event. Tracking data is also required for post-exercise or test reconstruction and analysis. Telemetry receivers, optical sensors, and radar support both collection and analysis. Data are transmitted from the target and interceptor to ground stations during flight for recording and analysis. Ground-based optical sensors, radar, and telemetry are supplemented by ship-based and/or airborne sensors.

The PMRF Range Safety Office is responsible for establishing ground hazard areas, launch hazard areas, and over water range areas that exclude the public when risks would exceed acceptable levels defined in the safety standard RCC 321, *Common Risk Criteria Standards for National Test Ranges, Subtitle: Inert Debris* and as adopted in PMRF Instruction 8020.16*, Missile/Rocket Flight Safety Policy*. The ground and launch hazard areas for missile launches are determined by size and flight characteristics of the missile, as well as individual flight profiles of each flight test. Data processed by ground-based or onboard missile computer systems are used to recognize malfunctions and terminate missile flight if necessary to ensure that all lethal debris would remain within the established ground and launch hazard areas. Before a launch is allowed to proceed, the Range Commander is provided input from ship sensors, visual surveillance from aircraft and range safety boats, radar data, acoustic information, and other surveillance sources to determine that no unauthorized personnel or craft are within the respective hazard areas. If unauthorized personnel or craft are found within a hazard area, an evaluation is made on whether the encroaching parties are exposed to risks beyond what is acceptable according to existing standards, such as RCC 321. If not, the test may still proceed. The Navy has agreements with the State of Hawaii to allow PMRF to exclude people from State areas around PMRF during tests for safety reasons.

Range Safety—RCC Standards

While range safety is location, facility, and mission-dependent, the DoD has established advisory standards and protocols to eliminate or acceptably minimize potential health and safety risks/hazards. The RCC Standards are guidelines that provide definitive and quantifiable measures to protect mission–essential personnel and the general public. These guidelines address flight safety hazards (including inert debris) and consequences potentially generated by range operations. RCC Standards are further described in Appendix D. All risks to aircraft generated by testing activities at PMRF are within RCC standards and in coordination with the FAA. PMRF requests the use of airspace during missile defense testing from the FAA. The four key RCC standards applied for missile launches are as follows:

- RCC Standard 319, *Flight Termination Systems Commonality Standard*
- RCC Standard 321, *Common Risk Criteria Standards for National Test Ranges, Subtitle: Inert Debris*
- RCC Document 323, *Range Safety Criteria for Unmanned Air Vehicles*
- RCC Standard 324, *Global Positioning and Inertial Measurements Range Safety Tracking Systems Commonality Standard*

These documents are regularly updated to reflect advances in research that improve the fidelity of risk assessment and developments to new test situations.

The PMRF Range Safety Office is an active participant in the RCC Range Safety Group, and the Range mandates specific policies that follow these guidance documents, as specified in PMRF Instruction 8020.16, *Missile/Rocket Flight Safety Policy*.

Safety regulations are directed at preventing the occurrence of potentially hazardous accidents and minimizing or mitigating the consequences of hazardous events. This is accomplished by employing system safety concepts and risk assessment methodology to identify and resolve potential safety hazards.

The range safety process is predicated on risk management, minimization of accident impacts, and protection of population centers. Risk values related to missile launch activities are categorized in two ways: (1) probability of vehicle failure, including all credible failure modes that could lead to debris impact events; and (2) the expected adverse consequences that could result from impact events. The consequence estimation is quantified by two key measures: (1) the probability of individual injury, defined as the probability of a person at a given location being injured; or (2) the expected number of injuries (collective risk), defined as the average number of persons that may be injured in a launch (typically a very small number, such as a few injuries per million operations).

Range safety is accomplished by establishing:

- Requirements and procedures for storage and handling of propellants, explosives, and hazardous materials
- Evaluation of mission plans to assess risks and methods to reduce risk
- Performance and reliability requirements for the Flight Termination System (FTS) on the missile which is employed, as required, for safety assurance
- A real-time tracking and control system at the range
- Mission rules that are sufficient to provide the necessary protection to people both in and outside the boundaries of the launch facility.

Procedures and analyses to protect the public can be generally divided into five aspects:

- Ground safety procedures—handling of propellants, ordnance, noise, hazardous operations, toxics, etc.
- Pre-flight mission analysis—vehicle, trajectory, etc.
- FTS verification
- In-flight safety actions
- Emergency response

PMRF uses probabilistic risk assessment criteria from RCC standards, including RCC 321, to evaluate the acceptability of each mission.

Range Control

Range Control is responsible for hazard area surveillance and clearance, and the control of all Range operational areas. The PMRF Range Control Officer 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 Control Officer coordinates the control of PMRF airspace with the FAA and other military users, and communicates with the operations conductors and all participants entering and leaving the range areas. The Range Control Officer also communicates with other agencies, such as the FAA Air Route Traffic Control Center (ARTCC) in Honolulu, the PMRF/Main Base airfield control tower, the 169th Air Control Squadron at Kokee, and the Fleet Area Control and Surveillance Facility at Ford Island, Pearl Harbor (FACSFACPH).

Special Use Airspace and Operational Areas

Two Warning Areas (W-186 and W-188) and one Restricted Area (R-3101) under the local control of PMRF are used for operations. The Warning Areas are in international waters and are not restricted; however, the surface areas of the Warning Areas are listed as “HOT” (actively in use) 24 hours a day. For special operations, multi-participant, or hazardous weekend firings, PMRF publishes dedicated warning NOTMARs and NOTAMs.

Ground Safety Area

Missile and flight safety procedures require that the public and nonessential mission personnel be excluded from hazardous areas to protect them in the unlikely event of an early flight termination. The Navy is required by DoD policy to be able to exclude nonparticipants from hazardous areas. The off-base portion of the respective ground hazard areas for PMRF is located within a restrictive easement that was acquired from the State of Hawaii by the U.S. Government. Ground hazard areas were established around each launch site to ensure public safety in the event of an unplanned impact of debris on land as a result of missile launch activities. The current restrictive easement agreement with the State of Hawaii expires in 2030 (Appendix E).

2.1.1.2 Testing and Training

PMRF conducts military exercises including ballistic missile tracking, radar tracking, radar calibration, and KTF support operations. The number of exercises and operations (including intercept tests), conducted at PMRF, and the number of hours the range is scheduled, vary daily, monthly, and annually. Peaks in activity are related to large-scale events, such as the Hollywood Exercise (submarine prospective commanding officer training) and the biennial Rim of the Pacific (RIMPAC) military training exercises.

Fleet training exercises, the associated land-based operations that support them, and the separate land-based training conducted at PMRF are expected to remain within the existing range of frequency for the foreseeable future, with the usual weekly, monthly, and yearly variability. The level of Research, Development, Test, and Evaluation (RDT&E) activities, however, is expected to increase.

Fleet Activities

Although task force elements routinely train simultaneously in all aspects of naval warfare, fleet operations and training conducted at the PMRF range are grouped into the following exercises: missile operations (including intercept tests), air operations, gunnery, bombing, mining, electronic warfare, anti-submarine warfare, submarine operations, and underwater tracking. These elements are described in the following sections. Any ship, submarine, or aircraft in the U.S. and allied inventories may be used during fleet operations and training.

Land-based Testing and Training

In addition to the fleet activities described above, PMRF conducts a number of land-based operations to support fleet exercises, as well as a number of land-based testing and training exercises. The Army, HIANG, Army National Guard, and Marine Corps use PMRF for land-based military training. Training and test and evaluation operations vary from relatively simple to very complex. A simple operation may consist of a small-unit amphibious landing and ground maneuvers. More complex operations may involve several combat systems, multiple targets, multiple platforms, and multinational military units operating in underwater, surface, and air environments. An example of the latter operation is the RIMPAC exercise.

Joint Task Force exercises include amphibious landings using air-cushioned landing craft restricted to beach areas, and amphibious assault vehicles, which are allowed to cross the nearby road and travel toward the airfield. The Army National Guard conducts about one exercise per year, which usually involves landing on a field and working a field problem. The HIANG conducts mobility training exercises at the airfield. Land-based training exercises include Mobile Inshore Undersea Warfare exercises, downed pilot survival training, helicopter low altitude training, and special (recon) warfare exercises. These are small events lasting several hours to 10 days.

Target and Interceptor Missile Launches

Targets (drones, missiles) emulate the expected threat and are realistic in physical size and performance characteristics. Target missiles include ballistic target vehicles and maneuvering target vehicles that can be launched from fixed ground locations, mobile launch platforms, aerial platforms, or sea-based platforms.

Surface-launched aerial target missiles are fired from the PMRF launch pad facility on the north end of PMRF. In addition, the KTF launches research-related rockets and ballistic targets for tracking exercises from sites at the north and south ends of PMRF. The DOE operates KTF as a tenant of PMRF. Launches from the PMRF launch pad and the KTF sites use the existing restrictive easement boundary and other ground hazard area boundaries.

Air launches of solid propellant targets in the Missile Defense Agency's (MDA's) Flexible Target Family (FTF) are from Government supplied C-17 cargo aircraft. No air launches of liquid propellant FTF targets occur. Air launches can be staged from PMRF. Following arrival of the target shipment at the appropriate staging location, the solid propellant target is secured to the pallet, and final functional tests are performed. Additionally, a small amount of hydrazine is loaded into the attitude control system for the SR19, Castor IVB, SR19/SR19, and LV-2 targets. Following pre-launch staging activities, the C-17 flies to a predetermined drop point over the broad ocean area. (Missile Defense Agency, 2007)

Solid Propellant Target Missiles

Most solid propellant rocket motors used were originally developed for other DoD missile programs. Many are existing surplus motors that are currently stored at DoD bases and depot facilities. These missiles use single and multi-stage solid propellant boosters. Solid propellants are composed of three basic components: a fuel element, an oxidizer element, and a binder that holds the fuel and oxidizer together in solid form. Some target missile components, such as fairing and interstage adapters, are developed and fabricated specifically for the target missiles. Most guided target system launch vehicles contain an FTS to terminate the flight of the launch vehicle if an unsafe condition develops during flight (such as an off-course flight). The FTS is activated by Range Safety personnel. An explosive charge onboard the missile is detonated, which ruptures the rocket motor casing. The resulting loss of pressure terminates the motor's thrust. The target missile then falls into the ocean.

Liquid Propellant Target Missiles

Most liquid propellant rocket motors used are motors that were originally developed for other DoD missile programs, or are foreign-made motors or rockets. Many are existing surplus motors that are currently stored at DoD bases and depot facilities. Some target missile components, such as fairings and interstage adapters, are developed and fabricated specifically for the target missiles. The target system launch vehicles may contain an FTS to safely terminate the flight of the launch vehicle, if necessary.

The liquid propellants used in these target missiles consist of a fuel and an oxidizer, and in some cases, an initiator component. Examples of liquid propellants used at PMRF are unsymmetrical dimethyl hydrazine, and kerosene as the fuel component; nitrogen tetroxide or inhibited red fuming nitric acid as the oxidizer component; and an organic amine as the initiator component.

Target Missile Payloads

Target missiles normally carry guidance and control electronics, radio transmitters and receivers, and a power supply (including lithium, nickel-cadmium, or other types of batteries). In certain test applications, they may also carry a payload section for simulated biological or chemical munitions, packaged either in bulk or in submunitions. The payload section can also carry a high-explosive warhead.

Simulants are used in target missiles to determine the effectiveness of defensive missiles against threat missiles carrying chemical and biological agents as payloads. To adequately imitate this threat in testing, it is necessary to use materials that are similar to the physical characteristics of actual chemical and biological agents, but without the toxic effects.

The use of triethyl phosphate (U.S. Department of the Navy, 1998a) and tributyl phosphate (U.S. Department of the Navy, 2008) in payloads of target missiles launched from PMRF has been analyzed in previous environmental documents. The use and environmental effects of simulants have also been analyzed in other PMRF-related documents (U.S. Department of the Navy, 1998a; U.S. Army Space and Missile Defense Command, 2002; U.S. Army Space and Missile Defense Command, 2003). Up to 115 gallons of simulant may be carried in a target missile payload. Triethyl phosphate is a colorless liquid with a mild odor and is very stable at ordinary temperatures. It has been approved for use in food packaging and is not regulated by the Occupational Safety and Health Administration. Tributyl phosphate is typically used as a component of aircraft hydraulic fluid, an industrial solvent, and plasticizer. It is a non-flammable, non-explosive, colorless, and odorless liquid.

Missile element test activities associated with the MDA lethality program could include development and testing of nuclear, biological, or chemical material simulants. These activities were analyzed in the *Programmatic Environmental Assessment, Theater Missile Defense Lethality Program* (U.S. Army Space and Strategic Defense Command, 1993b). Small quantities of tributyl phosphate and various glycols may also be included in a target payload. The release of simulants occurs at a high altitude over the open ocean during a nominal flight test.

Other simulants approved for use in target missile payloads launched from PMRF include water and diatomaceous earth. 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 filtering agent and has been adapted to almost all industrial filtration applications.

Interceptor Missiles

Defensive interceptor missile systems destroy threat missiles and/or reentry vehicles in flight. These missiles use single and multi-stage solid propellant boosters. Solid propellants are composed of three basic components: a fuel element, an oxidizer element, and a binder that holds the fuel and oxidizer together in solid form. At PMRF the Navy Standard Missile (SM) (SM-2 BLK IV, Block IVA, SM-3 and further variants) would continue to be used to support engagements against missile targets. These SM variants are launched in the wide-open ocean or littoral areas from Aegis cruisers or destroyers that are equipped with the Navy’s Aegis Combat System, including a vertical launch system (VLS). The Aegis Combat System was designed as a total weapon system from detection to intercept.

Aegis, which means shield, is the combat system found on guided missile destroyers and cruisers. Aegis was designed and developed as a complete system, capable of engaging in simultaneous warfare on several fronts—air, surface, subsurface, and strike. The Aegis weapons system is composed of the AN/SPY-1 Radar System, the Command and Decision System, Weapon Control System, Aegis Display System, Fire Control System, and Operation Readiness Test System. Aegis BMD is the term used to describe cruisers and destroyers fitted with the necessary hardware and software required to engage a ballistic missile. Using SMs, Aegis BMD destroyers and cruisers can intercept short- to intermediate-range ballistic missile threats in the exoatmospheric (outside the Earth’s atmosphere) mid-course phase of flight. The currently deployed SM-3 is now part of MDA’s sea-based Aegis BMD system. SM-3 missiles use a direct hit-to-kill kinetic (non-explosive) warhead.

The Army’s Terminal High Altitude Area Defense (THAAD) missile is part of the MDA BMD system. THAAD is an anti-missile system designed to intercept and destroy threat missiles in the final phase of their trajectories. The THAAD missile system is an easily transportable defensive weapon system that is designed to intercept hostile exoatmospheric and endoatmospheric (inside the Earth’s atmosphere) ballistic missiles during the terminal phase of their flight. This system provides the upper tier of a layered defensive shield to protect high-value strategic or tactical sites such as airfields or population centers. Elements of the THAAD program include the interceptor missile, launcher, radar, and battle management, command and control components, and support equipment. THAAD PMRF test operations include midcourse tracking of ballistic missiles with THAAD missiles launched from an existing launch site. The intercept occurs in the TOA. (U.S. Army Space and Missile Defense Command, 2002)

Interceptor Missile Payloads

Interceptor missile payloads destroy threat missiles and/or re-entry vehicles in flight. The kill mechanism in interceptor missiles may consist of explosive warheads that destroy the target by detonating near it, or kinetic-kill vehicles that destroy the target by colliding with it at high speed. Payloads may separate from the defensive missile prior to target intercept or may remain attached to the rocket motor. (U.S. Army Space and Strategic Defense Command, 1994)

Some interceptor missile payloads may contain an FTS that is separate from the rocket motor FTS. The purpose of the payload FTS is to destroy or render the payload harmless in the event of a mission failure (such as an off-course flight) (U.S. Army Space and Strategic Defense Command, 1994).

Interceptor missile system payloads may also contain radar and optical sensors, guidance and control electronics, radio transmitters and receivers, small solid rocket motors for separating payloads from boosters, and power supplies that may include lithium, nickel, cadmium, or other types of batteries. Defensive missile payloads may be equipped with divert and attitude control systems (DACS) that steer the payload after separation from the launch vehicle. The DACS may use inert gas systems such as nitrogen, small liquid hypergolic propellant systems, or consist of miniature solid-propellant rocket motors (U.S. Army Space and Strategic Defense Command, 1994).

Missile Launch Preparation

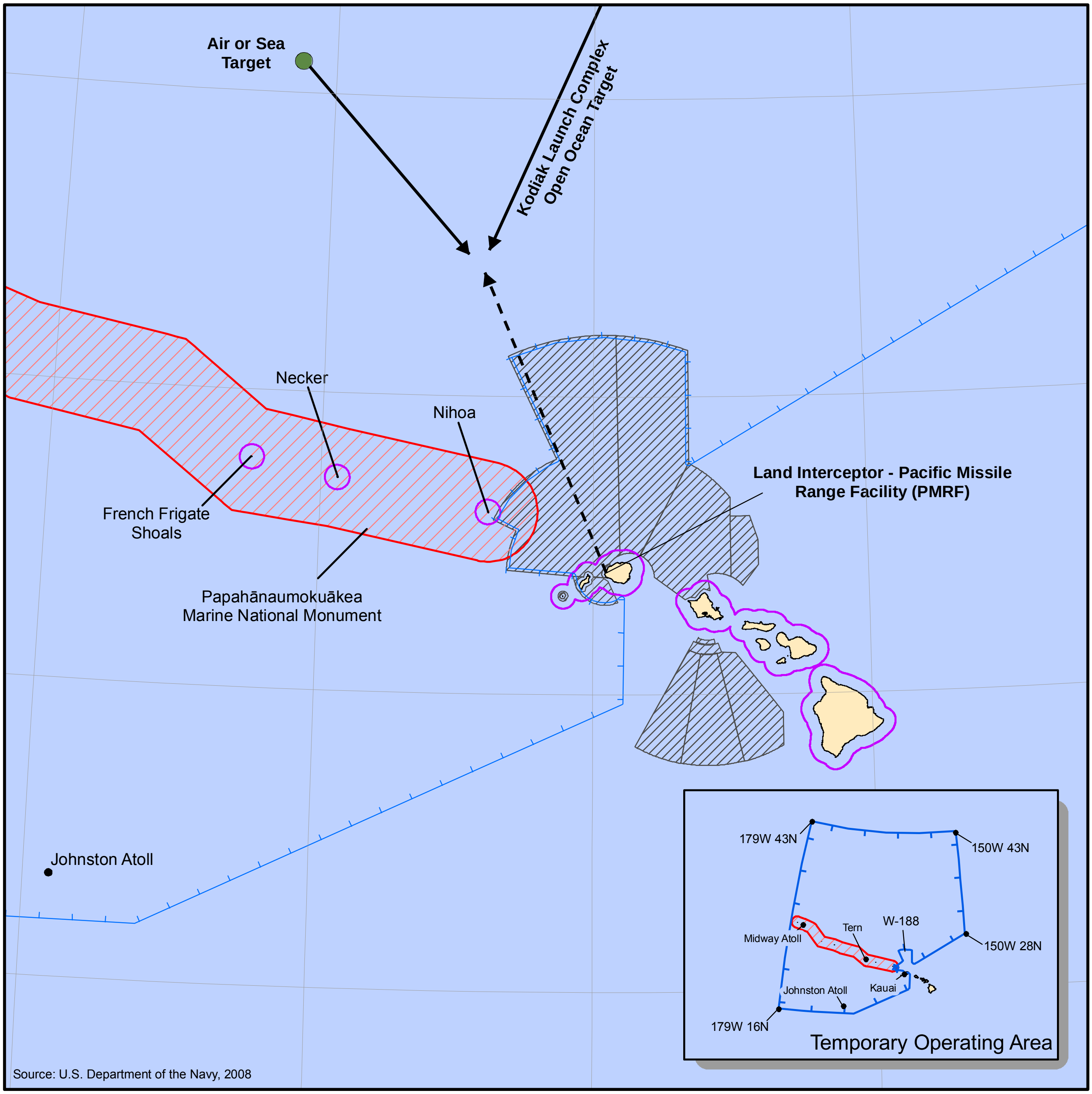
Missiles and support equipment come to PMRF by aircraft or DoD/DOT-approved over-the-road common carrier truck from Government storage depots or contractor facilities. They are then placed in secure storage until assembly and launch preparation. Applicable safety regulations are followed in transporting and handling hazardous materials. PMRF establishes and maintains appropriate ESQDs around facilities where ordnance is stored and handled.

Missile Launch and Flight

Figure 1.3-1 shows the existing launch facilities at PMRF and the KTF. Targets are launched from PMRF, mobile sea-based platforms, or military cargo aircraft. During missile defense RDT&E engagements, a ballistic missile target vehicle can be launched from PMRF, a ship, or aircraft and intercepted by a ship- or land-launched missile (THAAD from PMRF) (Figure 2.1.1.2-1). Mobile launch platforms (MLPs) include an Aegis ship for SM interceptors and the MLP for target missiles. Target missiles can also be launched from military aircraft such as the C-17. These missiles can fly short-, medium-, or long-range trajectories.

Under the No-action Alternative, PMRF and Niihau are the only locations available for BMD launching of land-based interceptors. Currently only PMRF is being used for launches.

Other RDT&E related missile defense operations include preparing security, range instrumentation and communications checks, radar calibrations, and range surveillance/ clearance. As part of the required clearance before an exercise, the booster drop, whole body, and intercept debris areas must be inspected visually and determined to be clear.



EXPLANATION

- Air or Sea Target
- Temporary Operating Area (TOA)
- 12-Nautical Mile Line
- Papahānaumokuākea Marine National Monument
- Land
- Existing Warning Area

NORTH

0 50 100 200 Nautical Miles

Pacific Missile Range Facility Open Ocean Conceptual Intercept Scenarios - Land

Hawaiian Islands

Figure 2.1.1.2-1

Missile Intercepts

In a successful intercept, both missiles would be destroyed by the impact. Momentum would carry debris along the respective paths of the two missiles until the debris falls to earth. The debris would consist of a few large fragments (up to approximately 110 pounds) of each missile, medium fragments (down to approximately 11 pounds), and mostly small fragments. The majority of the interceptor debris, including small lightweight fragments, falls into the open ocean area. Protection of the public on land, in aircraft, and on ships is accomplished by ensuring that there is a very low probability for harmful intercept debris, or spent stages, targets, and defensive missiles, to impact outside of designated impact zones over the open ocean. Prior to exercising closure of hazard areas for missile tests, Range Safety officials (FAA and Coast Guard) issue NOTAMs and NOTMARs identifying areas to remain clear of and the time frames for avoidance. The Range Safety officials then verify that the areas are clear of both surface vessels and aircraft.

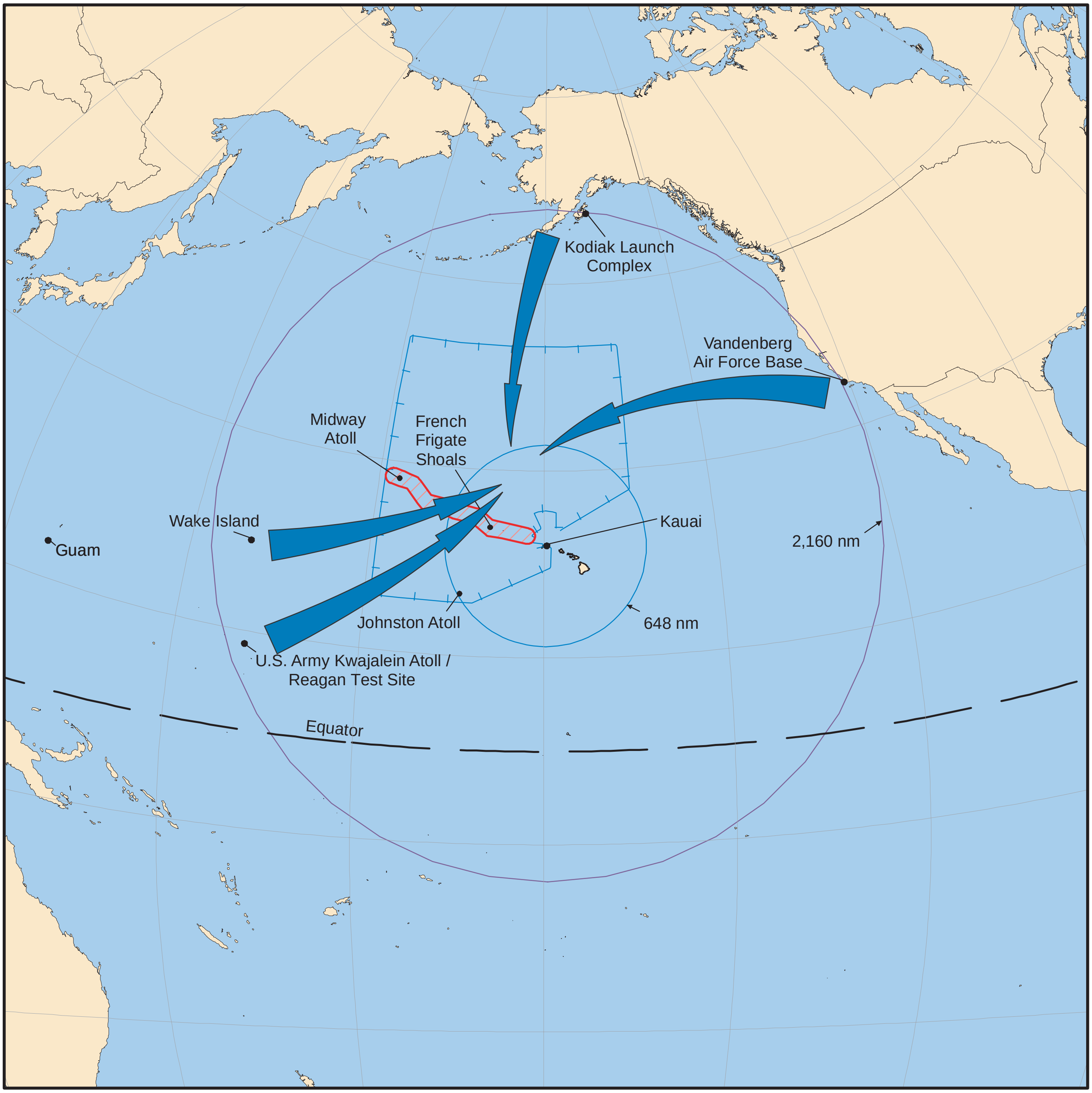
If a vessel (ship or fishing boat) is seen in an impact area, operators are requested to leave the area. Launches are put on hold until the impact area is clear of traffic or it is determined that the encroaching parties are not exposed to risks beyond what is acceptable based on the application of existing standard range safety procedures and risk standards, including RCC Standard 321, Common Risk Criteria for National Test Ranges, Subtitle: Inert Debris. If aircraft are seen in an impact area, safety regulations dictate that hazardous activities will be suspended when it is known that any non-participating aircraft has entered any part of the danger zone. Activities do not resume until the non-participating aircraft has left the area or a thorough check of the suspected area has been performed.

Target missiles, as part of the BMD system testing program, are also launched from the Kodiak Launch Complex in Alaska. These target missiles have impact points in the broad ocean area to the north of PMRF. Target missiles can also be launched into the broad ocean area north of PMRF from U.S. Army Kwajalein Atoll/Reagan Test Site, Vandenberg Air Force Base, and Wake Island. Figure 2.1.1.2-2 shows the existing missile flight corridors from these other ranges.

Figure 2.1.1.1-1 shows a conceptual view of current typical target-missile launch hazard areas, including booster drop zones, and intact-target-vehicle (if no intercept) impact zones. Impact zones are areas where missile hardware and debris impacts are planned. Location and dimensions of the impact zones may change for each target flight scenario, depending on the characteristics of the specific training target or test missile.

Mobile Platform Sea-based Target Launches

Target launches from mobile sea-based platforms follow the same procedures as described above for fixed ground-based target launches, except that launches are conducted from a mobile sea-based vessel or other platform, such as the MLP. The MLP also holds recording, communications, and measuring equipment, and provides a safe shelter for support personnel. MDA's MLP is designed to operate in several Pacific Ocean locations including PMRF's TOA. The MLP has no means of independent propulsion and must be towed by a tug. Targets that can be launched from the MLP include both solid and liquid target missiles. Interceptors that can be launched from the MLP contain solid propellant. (Missile Defense Agency, 2004)



EXPLANATION

- Temporary Operating Area (TOA)
- 648-Nautical Mile (nm) Buffer
- 2,160-Nautical Mile (nm) Buffer
- Papahānaumokuākea Marine National Monument
- Land
- Flight Corridor

NORTH

0 500 1,000 2,000 Nautical Miles

Target Flight Corridors into the Temporary Operating Area

Open Ocean

Figure 2.1.1.2-2

Target missiles are loaded onto the MLP either at Joint Base Pearl Harbor-Hickam (JBPHH) or San Francisco, California. In the case of liquid propellant target missiles, the missile propellant is typically loaded with the missile on its launcher en route to the desired location. The MLP then proceeds to the desired launch position. Some target missiles, such as the Lance, are fueled prior to loading on the MLP. Operators of the MLP are trained in emergency response procedures for all target missiles, including spill response procedures for liquid propellant. At JBPHH, storage for liquid propellants and target vehicles is at the Naval Magazine, Lualualei Magazines.

Aerial Platform-based Target Launches

Air-launched targets are launched from specifically configured cargo aircraft. A target missile is built on a standard cargo pallet and specialized sled. The integrated target/pallet assembly is loaded into a C-17 or similar aircraft and flown to a predetermined drop point. The target/pallet assembly is pulled from the aircraft by parachute and dropped over the ocean. The target separates from the pallet and then descends via parachutes. The parachutes release the target, and motor ignition occurs during free-fall. After firing, the target follows a flight path to interception or to splash down within a designated ocean impact area. The target is fitted with an FTS to terminate the flight if unsafe conditions develop. (Ballistic Missile Defense Organization, 1998)

The pallet, two main parachutes, and associated expendable parachute hardware fall into the ocean and sink, and are not recovered. If the target fails to ignite, the missile will fall to the ocean and sink to the bottom.

A C-17 or similar aircraft supporting the air-launched target is based at a military airfield within range of the flight test area. Launch preparation is as described for the ground-based target launches above, and is performed at PMRF, although a U.S. Mainland site may also be used.

2.1.1.3 Sensor Systems

PMRF instrumentation measurement systems provide precision air and surface radar tracking, land-based and airborne surface and air radar surveillance, underwater tracking, and telemetry data recording and display. These systems simultaneously support participants, targets, and weapons in underwater, surface, and air environments.

Sensor Instrumentation Operations

Sensor systems are used to acquire, record, and process data on targets and defensive missiles in order to detect and track targets, direct defensive missiles, and assess whether a target has been destroyed. Sensor systems are composed of sensor elements and signal processing components. Technologies used in sensor elements may include, but are not limited to, optical (visual and infrared), acoustic, and radar.

Optical and acoustic sensors are passive sensors that do not emit energy but only measure energy emitted by the target. Radar sensor systems are active sensors that emit radiofrequency energy and measure the reflected energy from the target.

Signal processing components receive the raw data collected by the sensor elements and process it, using computer hardware and software, into usable information such as target location, velocity, and attitude. These and other relevant characteristics can then be used to plan and control intercept engagements.

Radar Systems

Precision tracking, surveillance, and Identification-Friend-or-Foe radars are located at PMRF/Main Base, Makaha Ridge, and Kokee on Kauai; and on Niihau. Two Coherent Signal Processing radars are located at Makaha Ridge. A third transportable Coherent Signal Processing radar is located on the Mobile At-sea Sensor System.

Several tracking radars use optical tracking systems: two at PMRF/Main Base, four at Makaha Ridge, and two at Kokee. Two PMRF range aircraft are equipped with airborne search radars. The tracking, surveillance, and Identification-Friend-or-Foe radar resources combine to provide coverage throughout the PMRF warning areas.

The MDA currently operates the THAAD radar, the AN/TPY-2 radar, and has previously operated the Transportable System X-Band radar at a site on the southern half of PMRF/Main Base.

The Advanced Radar Detection Laboratory is under construction on northern PMRF. This radar is both an S- and X-band radar.

Optical Systems

PMRF has a surveillance monitoring subsystem that supports Range Safety and Base Security functions and a Northrop-Grumman Ship System optical subsystem. Optical tracking is provided at the Perch Site on Niihau. Cameras are located at various points throughout PMRF facilities, providing remote, unmanned surveillance. Four video cameras are also installed at the PMRF Launch Complex.

Weather instrumentation at each optical site provides data that is used to ensure weather conditions are within acceptable operating limits for optical sensors.

Telemetry Systems

Telemetry systems equipment is used to receive data transmitted by missiles in flight. Makaha Ridge has two 20-foot parabolic dish telemetry tracking antennas and three 45-foot parabolic dish tracking antennas that receive telemetry signals from low-flying missiles. An additional 10-foot dish is located at Kokee. This tracking antenna can receive telemetry signals from a low-flying missile or is used to track high altitude exoatmospheric re-entry vehicles.

Makaha Ridge houses receivers, recorders, and telemetry, processing, and display equipment that displays and records the telemetry data. The data are transmitted from Kokee to Makaha Ridge and/or to PMRF/Main Base for processing.

PMRF also uses an airborne relay system to extend the range of aerial target (drone) flights by re-transmitting command and control, and telemetry, signals between the ground station and the aerial target. This multiple aircraft, GPS-integrated system is an Ultra High Frequency command and control and telemetry system for multiple aerial target control. It consists of two ground station facilities, an airborne relay, and target transponders. A transponder on the aerial target allows tracking and communications with the target during over-the-horizon or extended range flights.

2.1.1.4 Communications System Operations

Communication systems at PMRF include ground, radio, microwave, and underwater communications; time generation; distribution and display systems; and closed-loop television systems. These are range communications systems and/or base communication systems. The range communications use specialized telecommunications, radio, video, microwave, and underwater equipment to fulfill range operational requirements. The base communications provide administrative communications with Government agencies and commercial businesses.

Range Telecommunications Systems

The range communications systems transmit voice and data signals between range sites and areas. Transmission media include wire, radio, microwave, and fiber optics. Microwave circuits link into the HIANG Hawaii Regional Operations Center facility at Wheeler Army Airfield, Oahu. Voice and data circuits transmit through MDA Pacific Range Support Team Network and access other U.S. mainland and Western Pacific ranges. Defense Information Systems Agency leases provide data circuits on fiber optic cable to link PMRF, Oahu, Maui, and U.S. mainland sites. The Defense Research and Engineering Network links PMRF to sites on Oahu, Maui, and the U.S. mainland using Synchronous Optical Networking.

Primary radio communications for operations are provided by High Frequency /Very High Frequency/ Ultra High Frequency radios at Kokee, Makaha Ridge, and Mount Kaala, Oahu. Communication with local fishermen and surface craft is by a citizen's band radio in the Range Operations Control Center.

Microwave systems provide voice and data communications between PMRF/Main Base, Makaha Ridge, Kokee, and the HIANG facility at Kokee. Two other links remotely control operation of the surveillance radar at Niihau, return radar data to PMRF/Main Base, and provide data and voice to the Perch Sensor Site.

Aerial and surface targets used on the Range are controlled by the System for Navy Target Control, an integrations target control and data measuring system that can control up to four targets simultaneously with four remote trackers at Makaha Ridge and two target control consoles in the Range Operations Control Center.

The PMRF/Main Base telephone communication system consists of an administrative phone system that is tied into long-haul commercial facilities.

Frequency monitoring on Oahu and Makaha Ridge protect range and Range User frequencies during operations. The monitoring facilities on Oahu are at Mauna Kapu.

2.1.2 PMRF BASE OPERATIONS AND MAINTENANCE—NO-ACTION ALTERNATIVE

Operations conducted at PMRF include ordnance storage; aerial, surface, and subsurface targets support; range boat target and weapon recovery; marine project support; airfield operations; diving support; visual imaging; instrument calibration support; and meteorology and oceanography activities. All of these complement PMRF's multi-environment range and are described in the following paragraphs.

2.1.2.1 Ordnance

Ordnance facilities include the Underwater Weapons Area, missile assembly buildings and launch pads, and the Kamokala Magazines and missile storage buildings. Secondary ordnance holding and service storage areas are also available on the base.

Shipment of ordnance to PMRF is either through the Fleet Industrial and Supply Center, JBPHH, or by aircraft landing on the PMRF airfield. Surface shipments from JBPHH are by barge to Nawiliwili Harbor, Lihue, and are off-loaded and shipped by commercial truck to PMRF. Ordnance arriving on aircraft is off-loaded at PMRF into ordnance vehicles and delivered to their destination. Ground shipping of hazardous materials is performed in accordance with DoD and U.S. DOT rules and regulations. Ordnance, usually delivered by a commercial shipper, is also handled in accordance with DoD Explosives Safety Board standards, such as DoD Directive 6055.9, DoD Explosives Safety Board, and DoD Component Explosives Safety Responsibilities, dated 29 July 1996.

A Red Label Area on PMRF/Main Base handles incoming and outgoing ordnance and is centered in a remote area. A soft pad in the Red Label recovery area is used by helicopters for setting down targets and weapons recovered from the range.

PMRF/Main Base has three ready-service areas for ordnance. Magazine 2Y1 is used to hold a limited service stock of explosive devices for the flight line and storage for flight-crew emergency supplies. These devices include smokes, squibs, and life-jacket flares. The ESQD for this magazine is 75 feet. Magazine 2Y2 is used temporarily to hold ordnance, such as SMOKEY SAMS and small arms ammunition. The ESQD for this magazine is 400 feet. A ready-service locker holds explosive devices that must be segregated from ordnance in the missile assembly building. This includes target drone igniters. The PMRF Launch Complex contains permanently installed launchers for various targets and weather rockets. Provisions for portable launchers are also available. Launch capabilities include an anti-ship missile target launcher, a permanent target drone launcher, tie-downs for two portable target drone launchers, and two meteorological rocket launchers. The Launch Complex also has a balloon launcher and wind tower for monitoring weather. A missile assembly building is located east of the launch pad.

2.1.2.2 Range Boats Support

Range boat activities include the following: range surveillance and clearance, underwater target launch, underwater targets and weapons recovery, electronic warfare support, test vehicle launch and recovery, aerial target recovery, acoustic test support, diver operations support, launch/recovery of Light Airborne Multi-Purpose System, and search and rescue operations.

PMRF has several range boats, including a twin-screw, diesel-powered Torpedo Weapons Recovery boat; and the two Weapons Recovery Boats, both capable of carrying, launching, and recovering underwater targets. Both types of range boats carry oceanographic measuring devices, discussed in the Oceanography section below, and simulators and jammers for electronic warfare support. The surface search radar installed in the boats can be used to simulate electronic warfare radar threats.

Range boat operations occur at Port Allen, PMRF, and Kikiaola Small Boat Harbor (located on the southwest coast of Kauai). Emergency berthing is allowed during inclement weather at the more protected pier in Nawiliwili Harbor. Fuel for the range boats is supplied from aircraft refueling trucks parked at the facility.

2.1.2.3 Air Support Operations

Air support operations at PMRF include the following: visual and radar range surveillance; electronic warfare threat simulation; logistics support; torpedo, aerial, and underwater target recovery; underwater torpedo target launches; search and rescue; personnel transfers by the range aircraft and helicopters; and instrumentation platform for video, photographic, and electronic warfare devices.

In addition to helicopter and fixed-wing aircraft landing associated with PMRF's mission, the airfield serves as a training facility for landings and takeoffs.

2.1.2.4 Visual Imaging

Surface and airborne range operational photography and video support is provided by the Visual Imaging Service Center in the Photo Lab located on PMRF/Main Base.

Range Video Services

Real-time video of range operations is received from airborne and surface platforms by fiber optic cables, radiofrequency transmitters, and a microwave downlink. Range video assets can be deployed on airborne (helicopter), sea-based (range boats), and land-based (video tracker and fixed mounted) systems. Real-time down-range video coverage of operations extends 65 nautical miles to the north and west of PMRF using airborne platforms. Surface platforms are capable of 55-nautical mile real-time video coverage to the north and west of PMRF.

Optical Services

Optical services include high quality instrumentation photography from both fixed mounts and mobile equipment. The Versatile Track Mount/Stabilized High-output Optical Tracking System is a mobile trailer-mounted system used primarily to track and record missile launches and intercepts from PMRF.

2.1.2.5 Meteorology and Oceanography

Radiosonde (an instrument carried by weather balloons that measures humidity, temperature, and pressure and transmits this information back to the ground) observations are made from the surface to 100,000 feet in altitude. Atmospheric weather conditions are monitored at the PMRF Weather Station by radar to detect potential thunderstorms and adverse flight conditions in the local area. Bathythermograph (an instrument designed to record water temperatures as a function of depth) recordings, measurements from meteorological centers and open ocean buoys, and other observations from range boats provide oceanographic data at PMRF.

2.1.2.6 Other Support Facilities

On-base housing includes family housing, bachelor enlisted quarters, transient quarters, and beach cottages, all located in the southern part of PMRF. Food services at PMRF are provided at the PMRF Galley for military and government civilians, Shenanigans All Hands Club, and Subway.

Emergency services provided on-base include a crash/fire center and a dispensary. The crash/fire center activities include aircraft fire fighting and rescue in support of airfield operations, plus structure and brush fire fighting, and fire prevention instruction. The dispensary provides limited emergency medical care for active duty personnel. It also houses a dental clinic staffed only during the quarterly visits to PMRF by the Naval Regional Dental Clinic, JBPHH.

2.1.2.7 Ongoing Maintenance and Operations

Ongoing support operations at PMRF include the maintenance and upgrade of facilities (including tenant facilities, family housing, and guest quarters), utilities, and transportation infrastructure (air, ground, and marine), as well as hazardous materials and hazardous waste management.

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/recycling, electrical supply, and propane gas supply.

Transportation

The transportation infrastructure is provided by the PMRF airfield, the Kikiaola Small Boat Harbor, the Port Allen Marine Facility, and through local roads on Kauai.

Recreation

The areas accessible for fishing/surfing/recreation and socializing run from Shenanigans (all-hands club) up to KiniKini Ditch (south end of runway). Under PMRF Instruction 5530.7, normal access is allowed 7 days a week from 5:00 a.m. to 10:00 p.m. except during heightened force protection conditions or operational periods. The recreation area near Majors Bay offers approximately 2 mi of beach access.

Hazardous Materials and Hazardous Waste Management

Hazardous materials and hazardous waste management activities at PMRF are governed by specific environmental regulations. PMRF has established management procedures to implement these regulations.

Hazardous materials on PMRF are managed by the operations and maintenance contractor. Typical materials used on the installation and stored at this location include cleaning agents, solvents, and lubricating oils. Transportation of hazardous materials is regulated by the U.S. DOT and guidelines from 49 CFR. Hazardous waste disposal at PMRF operates in accordance with the Resource Conservation and Recovery Act. The *Hazardous Waste Management Plan*, prepared by the PMRF operations and maintenance contractor, identifies requirements for safe storage and segregation of hazardous waste, proper safety equipment, spill or accident reporting procedures, and personnel training. PMRF accumulates hazardous wastes for less than 90 days and disposes of them through the Defense Reutilization and Marketing Office at JBPHH. PMRF manages the environmental restoration of contaminated sites through the Installation Restoration Program. Other environmental management programs are in place for the Installation Restoration Program, underground storage tanks, asbestos, pesticides, polychlorinated biphenyls management, radon, medical/biohazardous waste management, ordnance, lead-based paint management, and hazardous materials.

2.2 PROPOSED ACTION

Under the Proposed Action, baseline activities on PMRF would continue (including THAAD and ship-based Aegis launches); modification and construction of facilities would be performed; and adjustments to testing and training scenarios would occur, to further enhance the capability of PMRF to support more complex missile defense intercept tests that are more representative of evolving threats. Existing range and land-based operations and training, and the ongoing maintenance of facilities, would continue. The increased flexibility in missile defense testing would represent a small, incremental change in ongoing activities. Missile tests would involve longer-range targets and interceptors, longer engagement distances, and higher altitudes for engagement. These enhanced missile tests could result in greater dispersion of small, lightweight fragments from successful missile intercepts that are potentially hazardous to some aircraft within the airspace over the open ocean and land areas of Kauai, Niihau, and the Northwestern Hawaiian Islands (NWHI). The fragments would not be harmful to people on the ground, and PMRF would continue to ensure the protection of the public from any intercept or other missile debris through the application of established standard range safety procedures and risk standards, including RCC Standard 321, *Common Risk Criteria Standards for National Test Ranges, Subtitle: Inert Debris*. In addition the fragments are not anticipated to be harmful to vegetation or wildlife.

The Proposed Action would also include testing of defensive missile systems such as the Aegis Ashore Missile Defense program, which will adapt the Aegis SM and AN/SPY-1 Radar for land-based operations. These activities would involve the placement of additional land-launched systems at PMRF, including the installation of missile launchers, radars, and support facilities (Table 2.2-1 and Figure 2.2-1). The Aegis Ashore Missile Defense program would construct a removable or permanent Interceptor Launch Area that would include a launch pad, a launch equipment building, and a land-based Aegis launch system. Three lighting and instrumentation towers would be erected at the Interceptor Launch Area for mounting video and sensor equipment necessary to monitor missile launch and early flight.

The program would also establish a removable or permanent Aegis Ashore Test Center (AATC) on PMRF. The AATC would include launch (fire) control, AN/SPY-1 radar, two boresight towers, mission analysis secure rooms, radar maintenance area, and fire water tank/pumps. A transportable BMD System Communications Support Complex (BCSC) would also be required. PMRF identified the available sites for the Aegis Ashore Missile Defense program shown in Figures 2.1-2 through 2.1-8. These sites have been analyzed or are currently used for range activities. A siting study was conducted to narrow the list of viable sites, which are shown in Table 2.2-1 and on Figures 2.2-1 through 2.2-8. Section 2.3 describes those sites that were considered but were not carried forward for analysis as part of the Proposed Action. Other programs, such as Early Intercept BMD, could use PMRF for future communication and sensor testing.

Range Support Sites

The Proposed Action would continue to use the radar tracking and surveillance, GPS data processing, communication network, and command and control provided by PMRF/Main Base. The airfield facilities at PMRF/Main Base would be used for delivery of equipment, components, and personnel required by the Proposed Action.

The Makaha Ridge, Kokee, and Niihau sites would continue to provide radar tracking and surveillance, primary telemetry receiving and recorders, frequency monitoring, target control, communications, and command and control systems for the Proposed Action. A new land-based AN/SPY-1 radar could be sited at PMRF/Main Base. Kamokala Magazines would provide secure, air-conditioned (after being upgraded) ordnance and missile storage. Range clearance boats would continue to be launched from Port Allen or Kikiaola Small Boat Harbor.

Niihau support and sites described in Section 2.1.1 would continue to be used as specified in agreements between the Navy and the owners of the privately-owned island.

External Support Agencies and Facilities

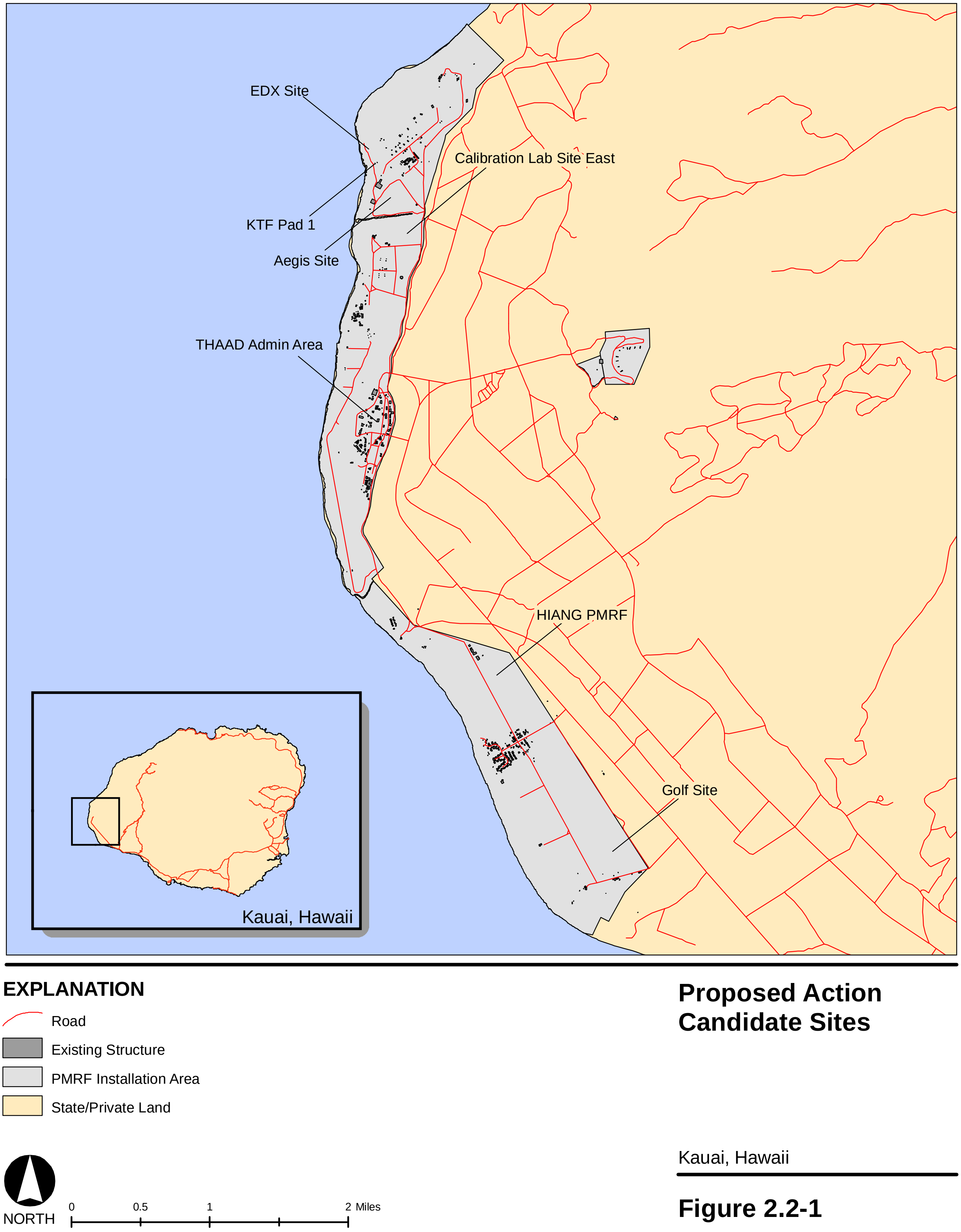
The external agencies and locations described in Section 2.1.1 would continue to provide range support to range users, coordinated through the PMRF Program Manager. Sandia National Laboratories, which currently operates KTF, would continue to provide PMRF with missile launch services for target systems and upper atmosphere measurements.

Table 2.2-1: Proposed Action Locations

AVAILABLE SITES / LOCATIONS* / ACTIONS	TARGETS	AIR	SEA	LAUNCH PAD	INTERCEPTORS	LAUNCH PAD	LAUNCH CONTROL	INSTRUMENTATION	SEA	RADAR	TELEMETRY	COMMUNICATIONS	FACILITIES	MAB	ADMIN./LAB. BLDG.	MAG. STORAGE	FUEL STORAGE	AIRFIELD	HELOPAD	MOORING	ROADS	REAL ESTATE	LEASE/ACQUIRE	EASEMENT	PROPELLANT TRANSPORTATION	AIR	SEA	ROAD
AIR		X																								X		
SEA																												
AEGIS						X	X			X																		
Mobile Sensor System			X						X		X	X																
MLP			X						X																			
SHIP/BARGE																											X	
LAND																												X
PMRF/Main Base																												
PMRF Launch Pads																												
Pad 15																												
Strategic Target System Pad																												
KTF LCC																												
EDX Site						X																						
KTF Pad 1						X																						
50K Launcher																												
THAAD Pad																												
Aegis Site						X																						
THAAD LCC																												
Angular Measurement Equipment Area																												
KTF Boneyard Area																												
Calibration Lab Site East							X			X					X													
Cable Area South																												
THAAD Admin Area															X													
Bldg 105 Area																												
HIANG PMRF							X			X		X			X													
THAAD Radar Pad 2																												
Golf Area												X																
Pad 41																												
KAMOKALA MAGAZINES																												
STORAGE BUILDING (2)																X												
MAKAHA RIDGE																												
SPS-48 E Replacement																												
Radar Test Area																												
Helo Pad																												
Lucky Site																												
KOKEE																												
SITE A -MK74 Replacement																												
HIANG Area																												
PORT ALLEN																												
NAWILIWILI HARBOR																												
NIIHAU																												
NORTHERN LAUNCH AREA																												
MOUNTAIN AREA																												
SOUTHERN LAUNCH AREA																												

* Gray squares represent locations presented by PMRF for various types of range activity locations.

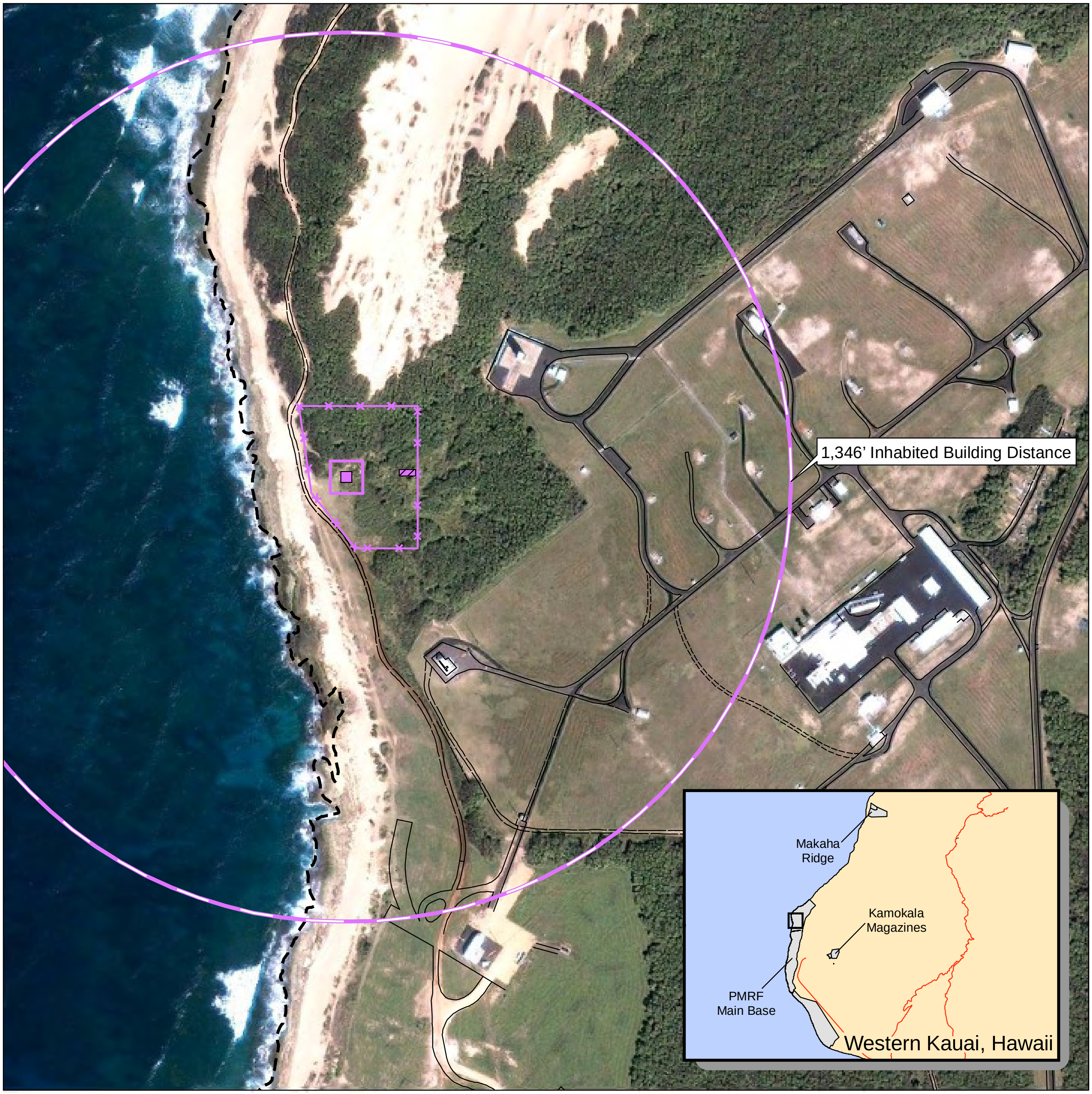
* Xs represent those alternative locations and activities analyzed for potential use in this EA/OEA



Proposed Action Candidate Sites

Kauai, Hawaii

Figure 2.2-1



EXPLANATION

- 34'x34' Launch Site
- 100'x100' Asphalt Pavement
- Launcher Support Building
- 200' Standoff Fenceline
- 1,346' Inhabited Building Distance

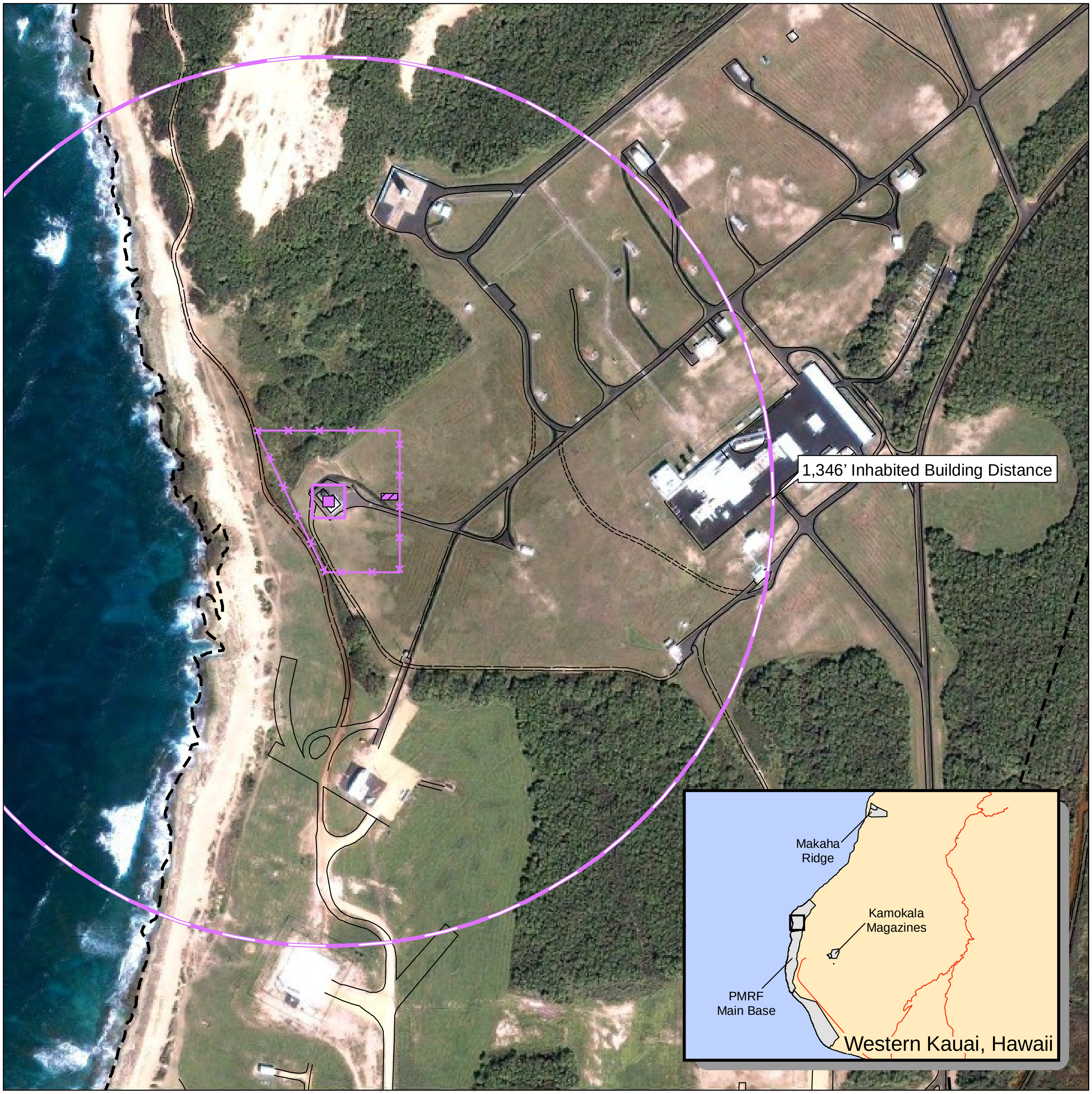
NORTH

0 250 500 1,000 Feet

EDX Candidate Interceptor Launch Site Layout

Kauai, Hawaii

Figure 2.2-2



EXPLANATION

- 34'x34' Launch Site
- 100'x100' Asphalt Pavement
- Launcher Support Building
- 200' Standoff Fenceline
- 1,346' Inhabited Building Distance

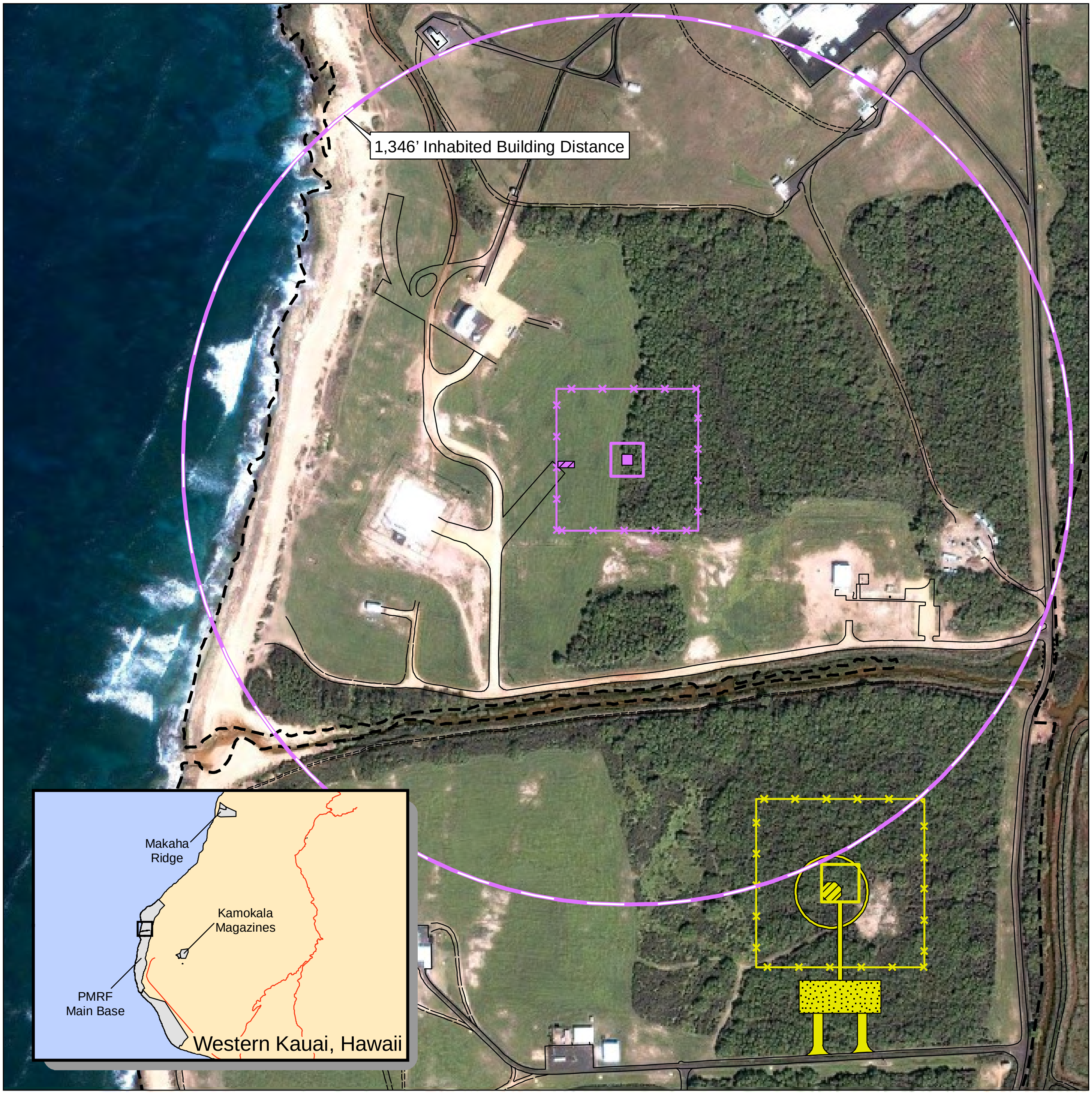
NORTH

0 250 500 1,000 Feet

KTF Pad 1 Candidate Interceptor Launch Site Layout

Kauai, Hawaii

Figure 2.2-3



EXPLANATION

Aegis-34'x34' Launch Site
Aegis-100'x100' Asphalt Pavement
Aegis-200-ft Standoff Fenceline
Aegis-Launcher Support Building
Aegis-1,346' Inhabited Building Distance
Aegis Ashore Test Center
Test Center Radar
Test Center Fenceline
Test Center 110' Arc
Test Center Parking
Test Center Roadway

Note: 110' arc represents distance where Hazards of Electromagnetic Radiation to Personnel (HERP) may occur.

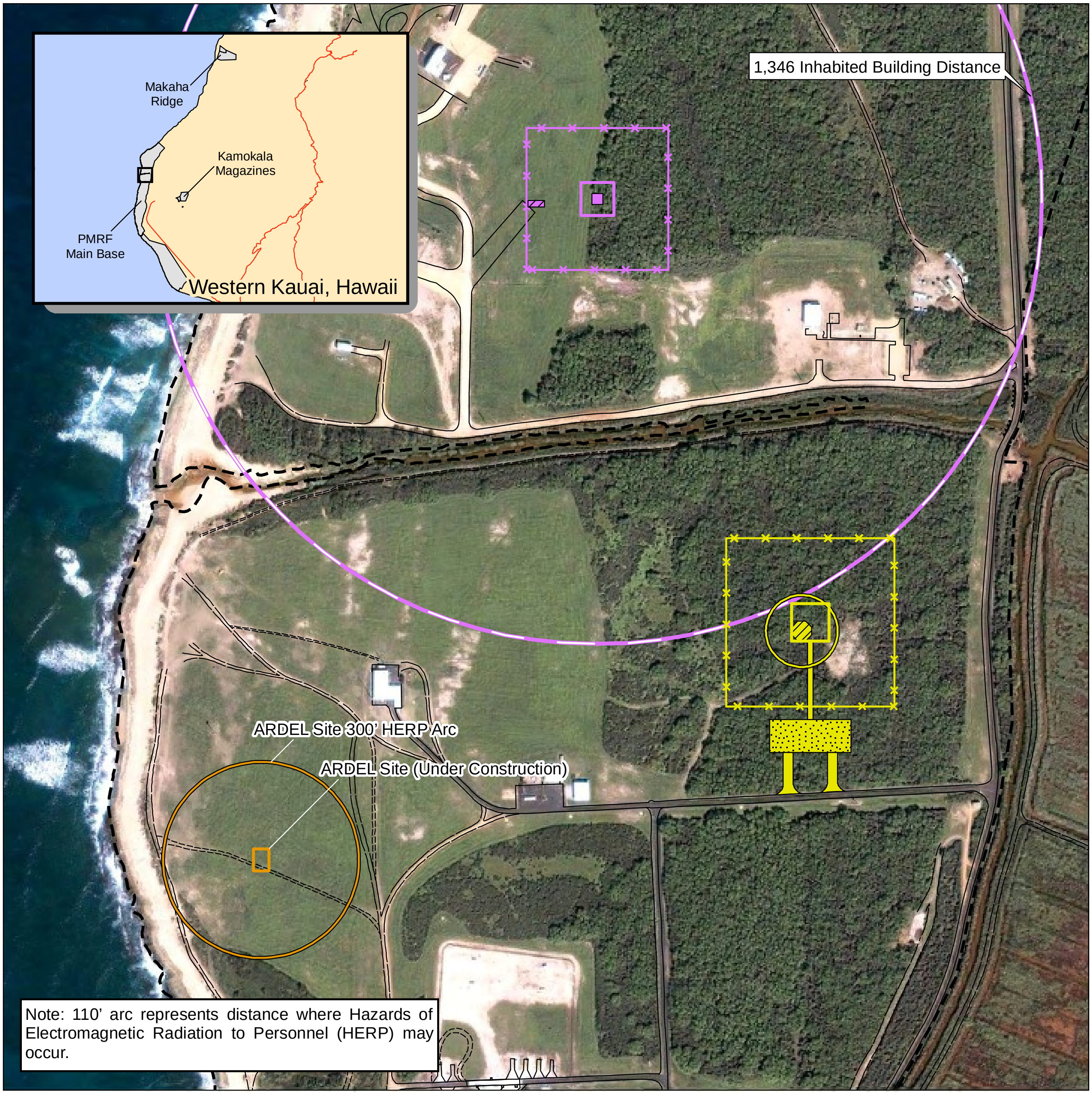
NORTH

0 250 500 1,000 Feet

Aegis Candidate Interceptor Launch Site Layout

Kauai, Hawaii

Figure 2.2-4



EXPLANATION

- Aegis Ashore Test Center/Radar
- Test Center Radar
- Test Center Fenceline
- Test Center 110' Arc
- Test Center Parking
- Aegis Candidate Interceptor Launch Pad 200' Standoff Fenceline
- Aegis Candidate Interceptor Launch Pad 34'x34' Launch Site
- Aegis Candidate Interceptor Launch Pad 100'x100' Asphalt Pavement
- Aegis Candidate Interceptor Launch Pad Launcher Support Building
- Aegis Candidate Interceptor Launch Pad 1,346' Inhabited Building Distance
- Test Center Roadway

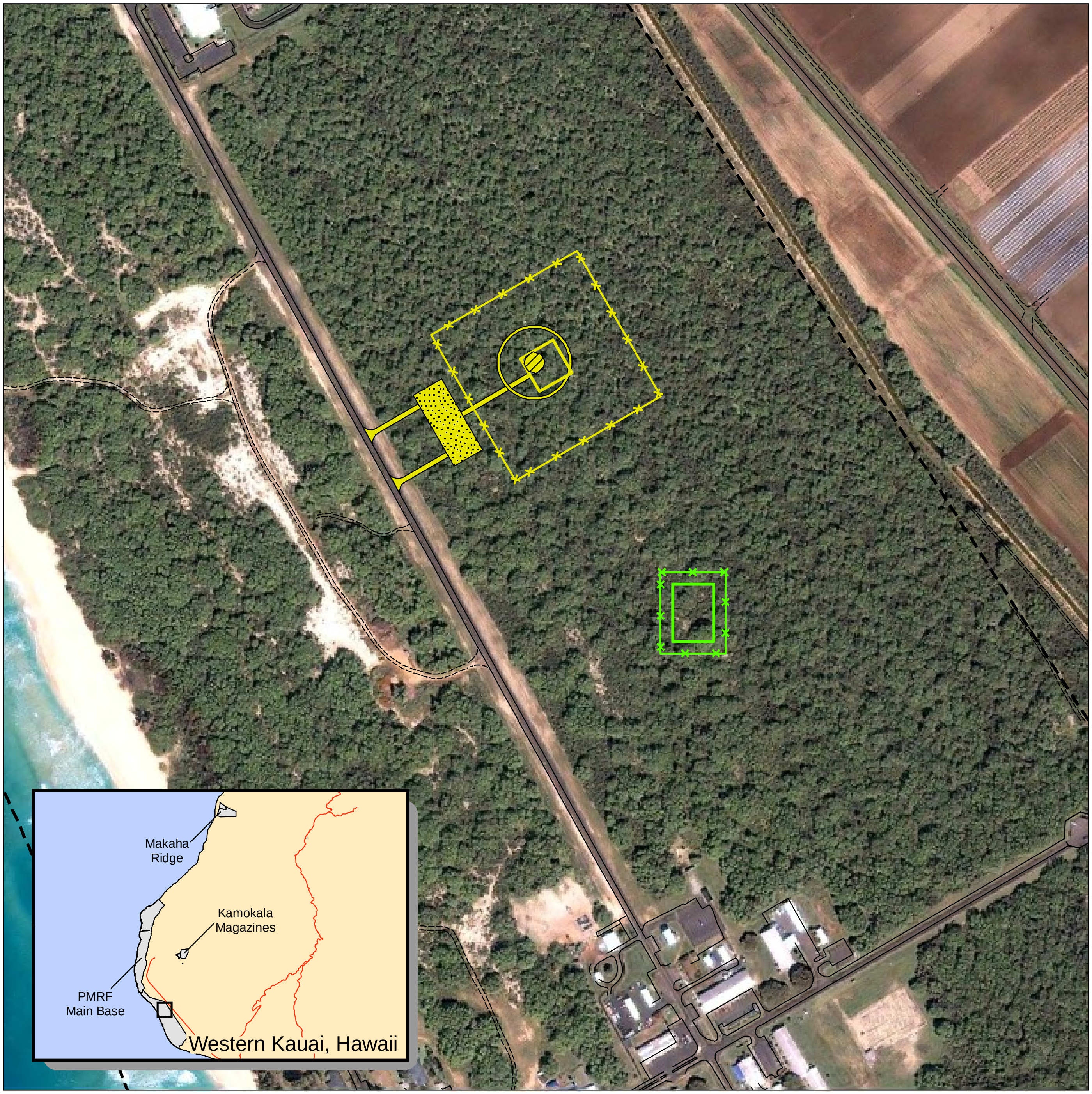
NORTH

0 250 500 1,000 Feet

Calibration Lab Site East Candidate Test Center Site

Kauai, Hawaii

Figure 2.2-5



EXPLANATION

- Aegis Ashore Test Center/Radar
- Test Center Radar
- Test Center Fenceline
- Test Center 110' Arc
- Test Center Parking
- Test Center Roadway
- BMD System Communications Support Complex (BCSC) Concrete Hardstand
- BCSC Fenceline

Note: 110' arc represents distance where Hazards of Electromagnetic Radiation to Personnel (HERP) may occur.

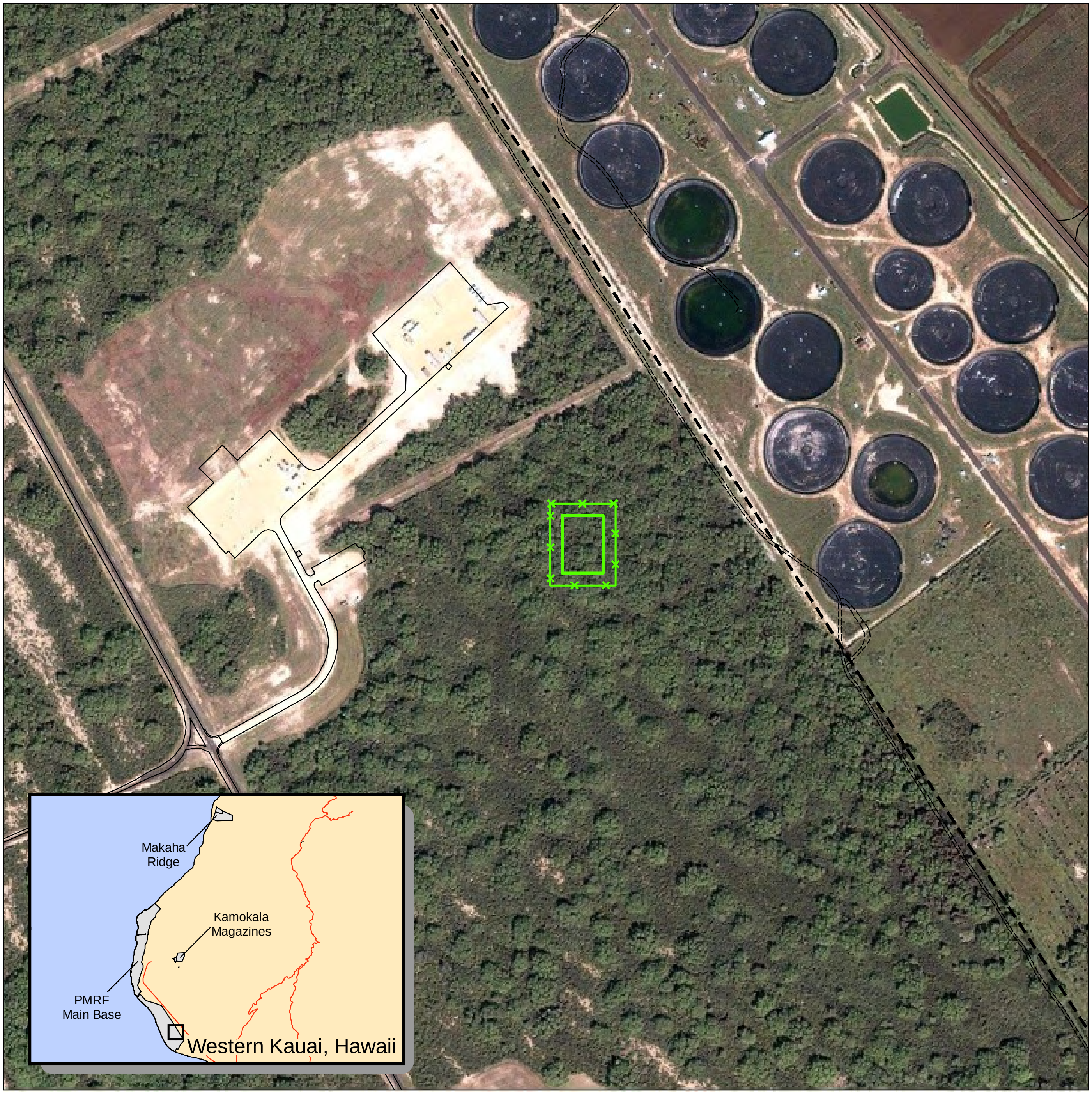
NORTH

0 250 500 1,000 Feet

Hawaii Air National Guard (HIANG) PMRF Candidate Test Center Site

Kauai, Hawaii

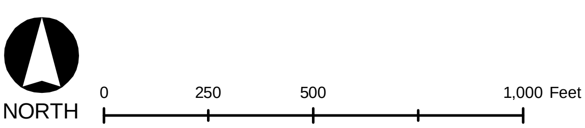
Figure 2.2-6



EXPLANATION

Golf BMD System Communications Support Complex (BCSC) Concrete Hardstand

Golf BCSC Fenceline



Golf Candidate Communications Support Complex

Kauai, Hawaii

Figure 2.2-7

EXPLANATION

Candidate Mission Support Site

NORTH

0 250 500 1,000 Feet

THAAD Admin Area Candidate Mission Support Site

Kauai, Hawaii

Figure 2.2-8

2.2.1 RANGE TRAINING AND OPERATION—PROPOSED ACTION

2.2.1.1 Range Safety and Range Control

Range Safety at PMRF includes missile flight control, laser safety, ionizing/nonionizing radiation safety, toxic and thermal hazards safety, directed energy safety, and explosive and ordnance safety. Range users would be required to provide specific information about their programs so that a safety analysis of all potential hazards are completed, and appropriate mitigation procedures/practices are established before initiation of hazardous activities. For missile and weapons system tests, PMRF Safety would continue to establish criteria for the safe execution of test operations in the form of Range Safety Approval and Operational Plan documents, which are required for all weapon and target systems using PMRF.

The ground hazard areas for proposed launch activities would continue to be located within the confines of the current Restrictive Easement lease (Appendix E). Launches that would require closure of the Restrictive Easement area would be limited to the current 30 per year. If new interceptor programs cannot operate within these confines, additional environmental review and potential documentation would be required.

Under the Proposed Action, missiles (target or intercept) used in more complex threat scenarios would be launched from fixed or mobile launchers. Trajectories and distance would vary depending on the test scenario. During some of these flight tests (up to four per year), small, lightweight fragments resulting from missile intercept could potentially drift beyond current PMRF-controlled areas. Intercepts at higher altitudes would not necessarily generate more debris fragments, but the greater altitude would cause the small, lightweight fragments to be widely dispersed over a larger area, including inhabited land areas. The fragments would not be harmful to individuals on the ground, and PMRF would continue to ensure the protection of the public from any intercept or other missile debris through the application of standard range safety procedures and risk standards, including RCC Standard 321, Common Risk Criteria Standards for National Test Ranges, Subtitle: Inert Debris.

The small, lightweight fragments would have the potential to damage jet engines and high-speed aircraft. Since the fragments could take up to approximately 1 hour to settle, they have the potential to affect airport arrivals and departures (e.g., Lihue, Princeville, or Midway) and other air traffic (including helicopter tours) in the area during this time. PMRF, in coordination with the FAA, would identify airspace where such fragments would occur and take the necessary precautions to temporarily exclude aircraft from the area immediately after an intercept test for approximately an hour. The pattern of the fragments could result in effects to all or parts of the airspace over Kauai, Niihau, the NWHI, over the open ocean between individual islands, or part of the channel between Kauai and Oahu depending on the actual test parameters. PMRF would notify the FAA that a test is planned that could temporarily affect aircraft. The FAA would review the request and advise regarding windows of opportunity for the testing in order to minimize or avoid effects. These windows would determine whether the test could be performed, since a minimum of 2 hours of time would be required for a test. PMRF would then request altitude reservations (ALTRVs) from the FAA, who would issue NOTAMs covering this additional temporary airspace if approved. Intercept tests would be scheduled at times that would avoid periods of high air traffic based on FAA approval and to further avoid aircraft such as helicopters performing tours, which are conducted from sunrise through sunset. Intercept tests could be performed at night as long as mission requirements can be met.

PMRF Flight Safety would conduct an analysis of the risk associated with each proposed intercept test activity prior to conducting tests and would constrain test activities to ensure risk and debris dispersion criteria are met. If Medevac or other emergency flights are requested prior to target or interceptor launch, the mission would hold until the medical emergency requiring the flight is over. Range Control would communicate with the operations officers/managers and all participants entering and leaving the range areas. The Range Control Officer would also communicate with other agencies, such as the FAA Honolulu Control Facility, the PMRF/Main Base airfield control tower, the 169th Aircraft Control and Warning Squadron within the 154th Wing at Kokee, and the FACSFACPH, as required. PMRF Flight Safety would continue to ensure protection of aircraft through the application of standard range safety procedures and risk standards, including RCC Standard 321, Common Risk Criteria Standards for National Test Ranges, Subtitle: Inert Debris.

Planned and future trajectories could result in overflight of the NWHI, including the Papahānaumokuākea Marine National Monument. NOTAMs and NOTMARs would be issued prior to all tests that could result in impacts to these islands and open ocean areas. Since a limited number of agency personnel (e.g., U.S. Fish and Wildlife Service, National Marine Fisheries Service) may actually be on one or more of the NWHI, PMRF Safety Office personnel would continue to ensure protection of these personnel by following established protocol through the application of established standard range safety procedures and risk standards, including RCC Standard 321.

2.2.1.2 Testing and Training

Target Missile Systems

As stated in the No-action Alternative, target missiles emulate the expected threat and are realistic in physical size and performance characteristics. Targets include ballistic and maneuvering target vehicles that may be launched from fixed or relocatable ground locations, aerial platforms, or sea-based platforms.

Target systems for intercept testing would include those existing systems described in the No-action Alternative and future target systems. A typical target missile would consist of a booster system, guidance and control electronics, and payload/front end. The target missile would either deliver the payload by itself or with a booster attached. A typical launch vehicle would have stabilizer fins and/or cold-gas (nitrogen) thrusters to control roll, pitch, and yaw during flight.

No new target launch sites or target systems are included in the Proposed Action. Figure 2.1.1.2-1 shows representative target missile corridors. Any new target systems developed or acquired by MDA for testing at PMRF would be analyzed in future environmental documentation, as required.

Interceptor Missile Systems

Future interceptor missiles could be launched from Navy ships or land locations (Figures 2.2-2 through 2.2-4). PMRF/Main Base and KTF could be locations for launching land-based interceptors. All of the land-based interceptor missiles require a cleared, level, compacted area to set up and operate. These missiles would use single- and multi-stage solid propellant boosters. Flight test profiles would vary in trajectory, range, and altitude. Other DoD interceptor missile programs may choose to take advantage of PMRF's enhanced capability. An example is the Aegis Ashore Missile Defense program. The components of this system are the Aegis Weapon System and the SM-3 missile. Future variants of SM-3 missiles may include a hypergolic third stage and DACS. Systems such as the Aegis BMD system were developed to provide defense against ballistic missiles in the exoatmospheric midcourse phase of flight. It builds upon the Aegis Weapon System and the SM. Launches of the SMs were most recently analyzed in the 2008 HRC Final EIS/OEIS.

Testing of the land-based BMD system, based on modifications to the Aegis Weapon System and the SM-3, is proposed to occur at PMRF. From two to four launches of the Aegis land-based system could occur annually. The SM-3 interceptor missile would be launched to intercept a target missile in its midcourse phase of flight.

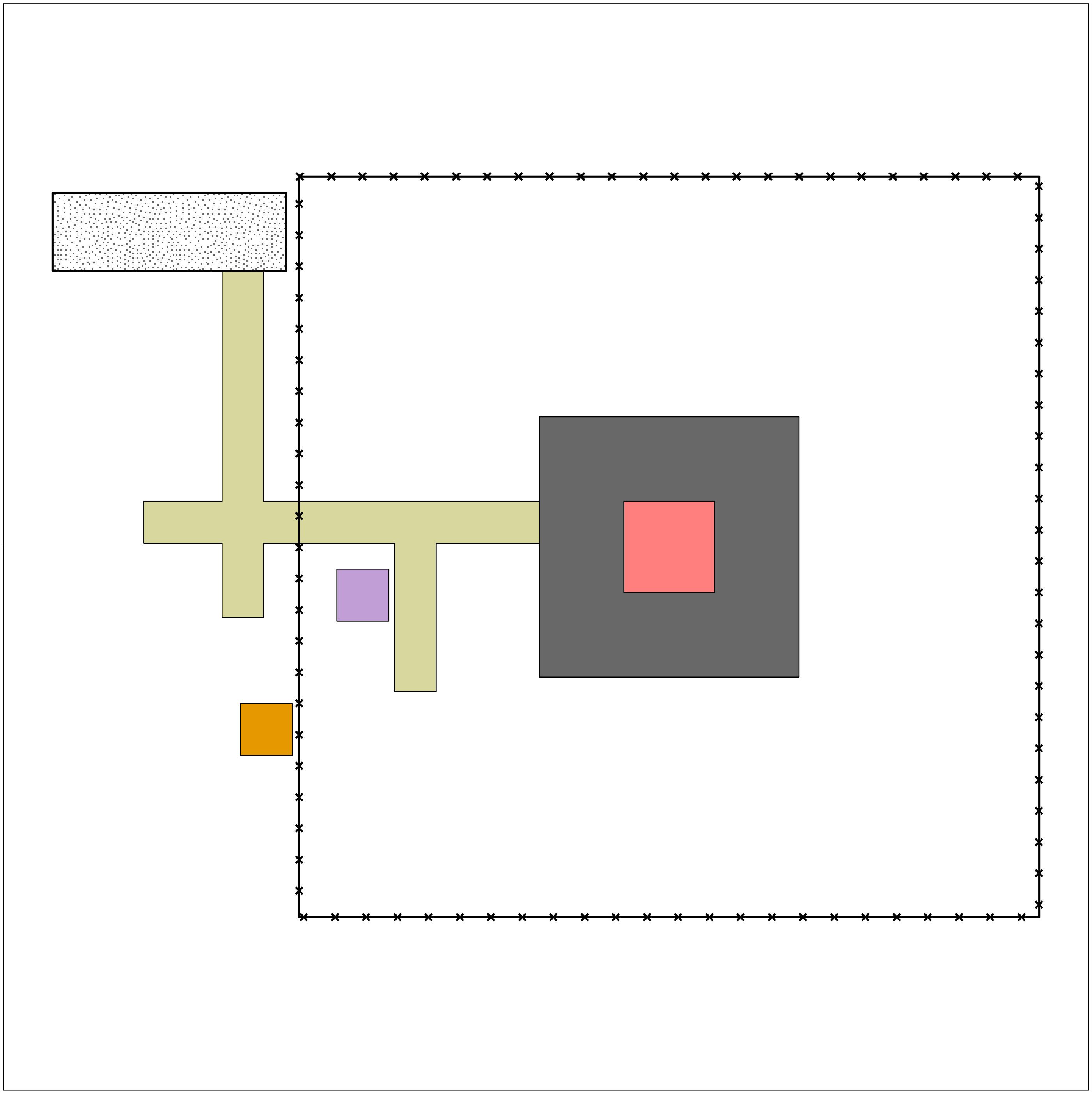
2.2.1.3 Sensor Systems

Sensor systems that may be used in Navy and MDA BMD system testing include existing shore-based, ship-based, and airborne sensors used at PMRF. Some sensors planned for use would be standard range assets, both portable and fixed, routinely used to support missile flight tests. Other airborne sensors, ship-based sensors, and space-based sensors may also be used for surveillance and mission support.

A four-faced, land-based version of the AN/SPY-1 radar (currently a four-faced, ship-based, multifunctional phased-array radar) with a 360-degree field of view is proposed for siting on PMRF (Figures 2.2-5 and 2.2-6). This radar is able to perform search, track, and missile guidance functions simultaneously for multiple targets. The AN/SPY-1 radar system is the primary air and surface radar for the Aegis Combat System.

2.2.1.4 Construction Requirements

PMRF/Main Base is the proposed location for a removable or permanent Aegis Ashore BMD system elements, which include land-based interceptor missiles, a new radar, and support components (Table 2.2.1.4-1). The notional systems layouts are depicted in Figure 2.2.1.4-1 and Figure 2.2.1.4-2. Specific requirements differing from the generic requirements are noted. Table 2.2-1 provides an overview of facility requirements associated with system elements and support components. Table 2.2.1.4-1 provides an overview of construction activity by location.



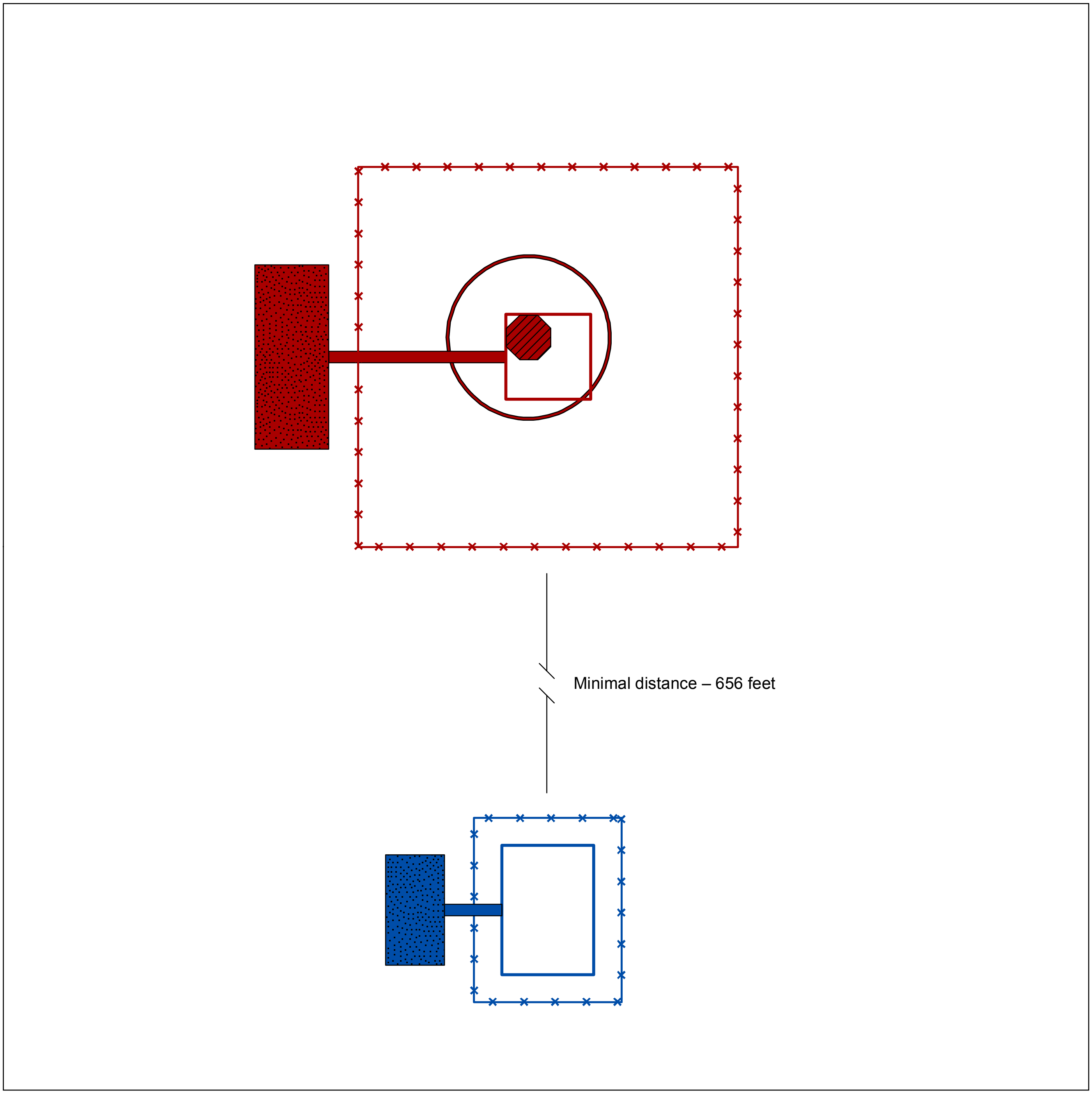
EXPLANATION

- 35'x35' Launch Site
- 20'x20' Generator Pad
- 100'x100' Asphalt Pavement
- Parking Lot
- Driveway
- Pre-Engineered Building
- 285'x285' Fenceline

Not To Scale

Notional Aegis Ashore Launch Layout

Figure 2.2.1.4-1



EXPLANATION

- Aegis Ashore Test Center (AATC) Radar
- AATC Radar
- AATC Roadway
- AATC Fenceline
- AATC Parking
- AATC 110-Foot Arc
- Notional BMD System Communications Support Complex (BCSC) Hardstand
- Notional BCSC Parking
- Notional BCSC Roadway
- Notional BCSC Fenceline

Note: 110' arc represents distance where Hazards of Electromagnetic Radiation to Personnel (HERP) may occur.

Not To Scale

Notional Test Center and Communications Support Complex Hardstand Layout

Figure 2.2.1.4-2

Table 2.2.1.4-1: Potential Proposed Action Construction Activities

Potential Locations	Potential Existing Building Modifications	Potential New Construction
PMRF/Main Base	• Upgrade existing power sources	• Interceptor Launch Area ▪ Launch Pad ▪ Launch Equipment Building ▪ Vertical Launch System (VLS) ▪ Lighting and Instrumentation towers • Test Center ▪ Launch Control Center ▪ Mission Support Component ▪ Ancillary sensors/Support Component ▪ AN/SPY-1 Radar ▪ Boresight towers • Fuel Storage • BMD System Communications Support Complex (BCSC)
Kamokala Magazines (12 and 13)	• Upgrade Heating, Ventilation, and Air Conditioning (HVAC)	• None

Facilities—Target Missiles

There are no known new facilities required for target launches from PMRF at this time, but existing developed and undeveloped locations are available for use.

Facilities—Defensive Missiles

The facility requirements for land-based defensive missile launches would include the following:

The proposed Aegis Ashore Missile Defense program would use power supplied by Kauai Island Utility Cooperative and generators. Up to 4 megawatts (MW) of power for missile testing would be required. The 4-MW power requirement is based on the Interceptor Launch Area requiring 0.056 MW of power, the AATC requiring 3.0 MW, and the BSCS requiring approximately 0.876 MW of power. The Aegis Ashore Missile Defense programs would use new generators during a missile test. New generators may consist of, but not be limited to, a 500 kilowatt (kW) backup generator at the Interceptor Launch Area, two 2.5-MW backup generators at the AATC, and two 438-kW generators at the BCSC. The use of new generators may require modifications to the current PMRF air permit or an application by the user for a new permit. Table 2.2.1.4-2 provides the power requirements for four Aegis Ashore Missile Tests.

Table 2.2.1.4-2. Power Requirements for an Aegis Ashore Missile Test

Facility	Power Requirements
Interceptor Launch Area	0.056 MW • 0.005 MW + HVAC– Enclosure/Tilt Fixture • 0.0375 MW – MK41 VLS • 0.0065 MW + HVAC – Launch Equipment Building (LEB) • 0.003 MW – Storage Building • 0.004 MW – Lighting and Instrumentation Towers (2)
Aegis Ashore Test Center	3.0 MW • 2.5 MW – Radar(s) • 0.5 MW – Launch Control Center and Mission Support
BMD System Communication Support Complex	≈ 0.876 MW (approximately)
	Total Power Requirements ≈ 4.0 MW (approximately)

As part of the Proposed Action, a removable or permanent Interceptor Launch Area, a removable or permanent AATC (which includes the Launch Control Center, AN/SPY-1 Radar, and mission support components), and a transportable BCSC would be constructed at PMRF/Main Base.

Interceptor Launch Area

The removable or permanent Interceptor Launch Area would include a launch pad, a launch equipment building (LEB), and a standard MK41 VLS. Figure 2.2.1.4-1 presents a notional layout of the Interceptor Launch Area.

The launch site would be a concrete pad, approximately 35 feet by 35 feet, surrounded by asphalt pavement. The disturbed area required for the launch area would be approximately 10,000 square feet. The interceptor launch area could be constructed on PMRF/Main Base at one of the three following sites, as shown on Figures 2.2-2 through 2.2-4:

- Exoatmospheric Discrimination Experiment (EDX) launch site
- KTF Pad 1
- Aegis Launch Area

An LEB would house the support equipment for the VLS. The LEB would be approximately 20 feet by 20 feet (400 square feet) and located within 250 feet of the launcher. The LEB would require an approximately 3- to 5-ton heating, ventilation, and air conditioning unit for the MK41 VLS enclosure. The launch pad would be surrounded by an asphalt paved area for equipment movement, and a security fence around the outer perimeter of the paved area.

Three, 35-foot tall lighting and instrumentation towers would be erected at the Interceptor Launch Area for mounting video and sensor equipment necessary to monitor missile launch and early flight. Tower pads would be constructed of reinforced concrete and designed per geotechnical engineer recommendations. Pad elevation would be 1 foot above the 100-year flood elevation.

The Interceptor Launch Area would have exterior lighting necessary to satisfy safety and security requirements to allow technical and security personnel to move about the area at night when required. In addition, area flood lights would be provided to allow technical operations (missile loading, missile unloading, pad instrumentation work, flight test operations, etc.) to take place at night if required. Lighting would be installed in accordance with a PMRF requirement that all flood lights be downward facing so as not to adversely affect Newell Shearwaters and other nocturnal birds traversing the area on their way to or from the ocean.

The Interceptor Launch Area would require 0.056 MW of power. This power requirement would be supplied by commercial power or from a backup generator during test operation. Fuel for the backup generator would be stored in an adjacent 10,000-gallon fuel tank with secondary containment systems. See Table 2.2.1.4-2 for a summary of power requirements for the Interceptor Launch Area.

In the event of a restrained firing or potential overheating of a missile within the launch facility, a deluge system consisting of a blast of water would be part of the VLS cell. The launch site would also need a water supply and pump for a deluge system capable of producing 320 gallons per minute for up to 2 minutes. Water would be supplied from the PMRF water system or would be stored in a 640-gallon water tank. Water from the deluge would be captured in the plenum at the bottom of the launch structure, tested for contaminants, and then properly disposed. Should the spent deluge water contain hazardous materials, it would be disposed of as hazardous waste.

Aegis Ashore Test Center Site

The AATC site would contain the Mission Support, the AN/SPY-1 Radar, and the Launch Control Center components. The removable or permanent AATC could be constructed on PMRF/Main Base at one of the following sites, shown on Figures 2.2-5 and 2.2-6. Figure 2.2.1.4-2 presents a notional layout of the test center.

- Adjacent to the Calibration Laboratory (East side)
- Adjacent to the HIANG PMRF (South side)

The removable or permanent AATC would be a new facility that is part of an approximately 31,500-square foot, multi-story building. Parking would be needed for 100 vehicles. The building would require a concrete pad foundation, a steel frame, and metal panel exterior. The structure could also be erected using pre-fabricated modular units. The floor area for the AATC would house radar equipment, and personnel. This building would also provide office space for post-test data analysis, training, restrooms, and meeting rooms. An average of 300-500 additional personnel visit and work at PMRF for up to 4 weeks in support of specific missions (e.g., THAAD, Aegis, Aegis Ashore Missile Defense). During routine operations approximately 100 personnel would be assigned to the AATC. The building would be connected to existing waterlines for both potable water and fire protection. Sanitary sewer service would be provided by a new sewer line installed from the facility to the nearest existing sewer collection line.

The proposed AN/SPY-1 radar would require a structural steel frame capable of supporting up to four phased radar arrays on the tower portion of the AATC, plus the two floor levels below the radar arrays for supporting equipment. The frame would be enclosed with a metal panel exterior. The proposed radar would require 2.5 MW of power, which could be provided by available commercial power and backup dedicated diesel engine generators and fuel tank(s) during test operations. There is a potential for Ancillary Sensors to be used on the roof of the AATC. One hundred and ten-foot arcs are the distances from the AN/SPY-1 where Hazards of Electromagnetic Radiation to Personnel may occur.

For the purposes of system calibration, alignment, test, and evaluation, two boresight towers facing one ocean-facing AN/SPY-1 array would be required. One mainbeam tower located approximately 900 feet from the array face and up to 135 feet in height would face the center of the AN/SPY-1 array. The sidelobe tower would be sited 30-45 degrees off angle from the mainbeam tower; 435 feet away and 80 feet in height.

A permanent and weather tight shelter would be located adjacent to the base of each tower. The shelter would be approximately 8 feet x 8 feet x 10 feet and would house the power supplier, power amplifiers, and other test/tool equipments necessary to establish connectivity between tower-mounted horns and the Launch Control Center.

The Launch Control Center would be located in the AATC. The Launch Control Center would require 0.5 MW of power which would be commercially supplied or from backup generators during launch events. Fuel for the backup generators would be stored in fuel tank(s) with secondary containment systems. Combined with the power required for the radar (2.5-MW) and the Launch Control Center (0.5 MW) the total power requirement for the AATC would be 3 MW. See Table 2.2.1.4-2 for a summary of power requirements for the AATC.

A removable or permanent Mission Support facility could be constructed on PMRF/Main Base adjacent to the THAAD Administrative Building (Figure 2.2-8). If the Calibration Lab Site East Test Center is selected, administrative personnel should be located outside of the launch ground hazard area.

BMD System Communications Support Complex Site

The transportable BCSC would consist of mobile vans and conex boxes. The complex could be located at one of the following sites, shown in Figures 2.2-5 and 2.2-6. Figure 2.2.1.4-2 presents a notional layout of the BCSC.

- South of the AATC at the HIANG PMRF site
- Golf Site south of the THAAD radar pads

The transportable BCSC could be located a minimum of 656 feet south of the AATC at the HIANG PMRF site (Figure 2.2-6). The BCSC could also be located at the Golf Site as shown in Figure 2.2-7, which is 656 feet south of the THAAD radar pads. Additionally, if the Calibration Laboratory (east side) site is used for the AATC, this complex could be located adjacent to the HIANG PMRF site (south side). This complex would require a concrete or crushed coral hardstand area approximately 22,000 square feet in size. The hardstand area would be bordered by compact gravel or crushed coral and enclosed by a 200-foot by 250-foot fence and gates. The BCSC site would be powered by diesel generators. A 10,000-gallon fuel tank with secondary containment would be available to supply the generator van for power to the site. The amount of power available to operate the BCSC is approximately 0.876 MW, which would be provided by generators during testing. See Table 2.2.1.4-2 for a summary of power requirements for the BCSC.

Missile Storage Component

The missiles would be stored in the Kamokala Magazines (12 and 13). Air conditioning would be added to these magazines, which were built in 2002.

Facilities—Instrumentation

The existing radar, telemetry, and communications facilities at PMRF/Main Base, Makaha Ridge, and Kokee would be used. Under the Proposed Action no upgrades to the existing radar (e.g., THAAD), telemetry, and communication facilities would be required at these locations.

Facilities—Communications, Command, and Control

In addition to the BCSC described above, the existing communications, command, and control facilities at PMRF and KTF, identified in Section 2.1.1.4, would be used.

Multiple command and control FTSs, as well as range safety monitoring software and display, could be updated as required. Transmitters and receivers and other communications equipment could also be upgraded.

The Early Intercept BMD program is evaluating locating a receive-only communication system consisting of a 40-foot van with downlink antennas and a drone-based sensor system (Airborne Infrared) with an accompanying ground station on PMRF. The proposed location for these is the Golf Site for the receive-only communication system and a site adjacent to the existing runway using existing facilities for the drone system.

2.2.2 BASE OPERATIONS AND MAINTENANCE—PROPOSED ACTION ALTERNATIVE

PMRF would continue to provide ordnance/missile storage; aerial, surface, and subsurface targets support; range boat target and weapon recovery; marine project support; airfield operations; visual imaging; instrument calibration support; and meteorology and oceanography activities. In addition, facilities at PMRF would be available to military and contractor personnel.

Existing PMRF infrastructure, such as roads, potable water supply, fire protection, sanitary waste collection and disposal, communication, and power distribution would be used and extended or modified, as necessary. Ongoing operation, maintenance, and upgrade of PMRF's facilities, such as tenant facilities, family housing, guest quarters, utilities, and transportation infrastructure, as well as hazardous materials and waste management, would continue. Existing missile storage, warehousing, and administration space would be used if available, and additional facilities would be constructed if needed. Additional environmental reviews would be completed, as necessary, prior to the construction of any new support facilities.

2.3 ALTERNATIVES CONSIDERED BUT NOT CARRIED FORWARD

As part of the siting analysis to determine where the Aegis Ashore Missile Defense program facilities could be located, PMRF identified the areas shown in Table 2.2-1. The siting study narrowed the list of potential sites to those analyzed in this EA/OEA. The following sites were considered as alternatives, but will not be carried forward for analysis in this document.

- Makaha Ridge—This site was eliminated as a radar site because of potential interference with the existing instrumentation.
- Kokee Site A—This site was eliminated as a location for the AATC because there is not sufficient ground area for the facility, and it would also be too far away from the BCSC.
- Kokee HIANG Site—This site was eliminated as a location for the AATC for the same reasons Kokee Site A was eliminated.
- Niihau—This site was eliminated from consideration as an alternative for the Aegis Ashore Missile Defense portion of the Proposed Action because of concerns associated with construction of facilities and transporting personnel and boosters to the island. However, Niihau is included in the PMRF/Main Base analysis for impacts to airspace, and health and safety.

3.0
Affected Environment

3.0 AFFECTED ENVIRONMENT

This section describes the environmental characteristics that may be affected by the Proposed Action at the Pacific Mission Range Facility (PMRF) and provides a baseline for understanding potential environmental impacts. Available reference materials, including Environmental Assessments (EAs), Environmental Impact Statements (EISs), installation plans, and scientific articles were reviewed. Questions were directed to installation and facility personnel and private individuals. Site visits were conducted where necessary to gather the baseline data presented below. Appendix C details the main Federal Acts that provide guidance on avoiding or minimizing impacts on resources. Appendix D provides further explanation of PMRF missile launch safety and emergency responses.

Thirteen broad areas of environmental consideration were assessed during the preparation of this EA/Overseas Environmental Assessments (OEA). These areas are air quality, airspace, biological resources, cultural resources, geology and soils, hazardous materials and waste, health and safety, land use, noise, socioeconomics, transportation, utilities, and water resources. All 13 environmental resources were addressed unless the Proposed Action had no potential to adversely affect such resources. The resources are discussed according to the following locations: Kauai, Northwestern Hawaiian Islands (NWHI), and Open Ocean Area.

U.S. Navy operations at Port Allen and the Kikiaola Small Boat Harbor were previously analyzed in the 2008 Hawaiian Range Complex (HRC) EIS/Overseas EIS (OEIS). A review of the 13 resources against program operations at Port Allen and the Kikiaola Small Boat Harbor determined there were no significant impacts under the No-action Alternative, and none are anticipated under the Proposed Action. Port Allen is a State of Hawaii harbor facility operating under the jurisdiction of the State Department of Transportation (DOT). Port Allen hosts PMRF's Range Support Boats and maintenance facilities and provides pier space, protected anchorage, and small-boat launch facilities. Use of Port Allen does not require control of the airspace above this land area. There are no reports of emissions from Navy operations affecting the air quality for Port Allen. Because no ground disturbance or building modifications would occur, there would be no significant impact to biological resources, cultural resources, or geology and soils. Additionally, there are no known significant archaeological sites at Port Allen. All operations adhere to Navy policy, statutory and regulatory requirements for hazardous materials and hazardous waste, range safety guidelines, and noise. The site is compatible with existing surrounding land uses, and land use does not conflict with recreational activities occurring in or adjacent to the harbor. Any transportation and utility issues associated with Port Allen are included within the PMRF/Main Base discussion. There is no adverse socioeconomic impact from operation of the site, and the site does not block any prominent public vistas. Operations at the site would not generate any waste streams that could impact local water quality.

Kikiaola Small Boat Harbor hosts Range Support Boats and small-boat launch facilities. PMRF's Seaborne Powered Targets are also launched from Kikiaola. The Navy does not require control of the airspace above this land area. Any emissions from naval operations associated with the use of range support boats and small-boat-launch facilities do not affect the air quality of the area. Additionally, all operations adhere to Navy policy, statutory and regulatory requirements for hazardous materials and hazardous waste, range safety guidelines, and noise. There are no ground-disturbing activities or building modifications that could affect biological, cultural, and geology and soils resources. Additionally, there are no current or proposed activities that could affect land use, including recreation and tourism-related-activities. The work force assigned to the site would not affect local transportation levels of service or utilities. There is no adverse socioeconomic impact from operating the site, and the site does not block any prominent public vistas. Operations at the site would not generate any waste streams that could impact local water quality. As a result, Port Allen and the Kikiaola Small Boat Harbor are not analyzed further in this document.

3.1 KAUAI

Kauai is the oldest and fourth largest of the Main Hawaiian Islands. It covers approximately 550 square miles (mi^2) and was formed by the volcano Waialeale located at its center. The town of Lihue is Kauai's county seat and is home to the state and county buildings. The islands of Kauai, Niihau, and Kaula combine to form Kauai County. Current and proposed interceptor test support activities on Kauai addressed in this EA/OEA would support PMRF range operations (Kauai Test Facility [KTF], Makaha Ridge, Kokee, Hawaii Air National Guard [HIANG] Kokee, and Kamokala Magazines). PMRF also conducts range operations on the nearby islands of Niihau and Kaula. PMRF plans to continue using all sites.

3.1.1 KAUAI—ONSHORE

3.1.1.1 PMRF/Main Base—Onshore

The Main Base portion of PMRF is located on the west side of Kauai. The majority of PMRF's facilities and equipment are at the Main Base, which occupies a land area of 1,925 ceded acres and lies just south of Polihale State Park. PMRF/Main Base is generally flat and approximately 0.5 miles (mi) wide and 6.5 mi long with a nominal elevation of 15 feet above mean sea level.

This section describes the environmental resources that would be affected by the No-action Alternative and the Proposed Action for PMRF/Main Base.

3.1.1.1.1 Air Quality—PMRF/Main Base—Onshore

Region of Influence

For inert pollutants (all pollutants other than ozone and its precursors: volatile organic compounds (VOCs) and nitrogen oxides), the region of influence is generally limited to an area extending several miles downwind from the source. The region of influence for ozone may extend much farther downwind than the region of influence for inert pollutants. As the project area has no heavy industry and very few automobiles, ozone and its precursors are not of concern. The region of influence for greenhouse gas (GHG) emissions is global.

Affected Environment

Climate

Weather is an important factor in the disbursement of air pollutants. PMRF/Main Base is located just south of the Tropic of Cancer and its climate is classified as mild and semi-tropical. Typical temperatures for the area are highs from 78 to 85 degrees Fahrenheit (°F) and lows from 65-74°F. The trade winds are from the northeast and are typically light—mean trade winds between 16 to 18 knots. Precipitation in the area averages 41 inches annually. Most of the rain falls during the October through April wet season. Relative humidity is approximately 60 percent during the day throughout the year.

Regional Air Quality

Air quality data in Hawaii are collected by the Hawaii State Department of Health, Clean Air Branch. In 2008, the state maintained 14 air monitoring stations on 3 islands (none on Kauai). Between 2004 and 2008, none of the monitored ambient air concentrations in the State exceeded the annual average ambient air quality standards (AAQS) (Hawaii State Department of Health, Clean Air Branch, 2008). An air conformity analysis is not required for the Proposed Action because as of 2008, the State of Hawaii was in attainment for all National Ambient Air Quality Standards (NAAQS).

Hawaii's 2007 Greenhouse Gas Emissions Inventory states that in both 1990 and 2007, emissions from transportation and electric power sources accounted for the vast majority (more than 85 percent) of GHG emissions in Hawaii. At 91 percent of the total in 2007, carbon dioxide is the largest single contributor to GHG emissions from in-state sources. Oahu accounts for 71 percent of Hawaii's GHG emissions; Kauai contributes 5 percent (Hawaii Department of Business, Economic Development & Tourism, 2008).

Existing Emission Sources

PMRF and KTF power is supplied by Kauai Island Utility Cooperative (KIUC) during non-testing times. KIUC currently relies on highly refined oil products (diesel and naphtha) for over 90 percent of its energy supply (Kauai Island Utility Cooperative, 2008). The only major stationary sources of air emissions at PMRF are generators used by and permitted for PMRF/Main Base, KTF, and the Terminal High Altitude Area Defense (THAAD) missile programs during testing events and when electrical demand is high.

Stationary emission sources at PMRF include three 320 kilowatt (kW) and the two 600-kW generators that serve as a backup to the KIUC power system. These generators are covered under the PMRF Title V Covered Source Permit. The Title V permit controls the nitrogen dioxide and sulfur dioxide emissions from each generator by restricting the hours of use and limiting the sulfur content of the diesel fuel supplied for the generators to 0.5 percent by weight.

Stationary emission sources at KTF include two standby 300-kW diesel engine generators that are permitted for operation by the State of Hawaii under a Non-covered Source Permit. (Sandia National Laboratories, 2009)

Permitted sources for the THAAD program include two 2,000-kW diesel engine generators, one 200-kW diesel generator, one 546-horsepower (HP) diesel engine generator, one backup 551-HP diesel engine generator, and three deployable power generation and distribution systems (total of six 690-HP diesel engines). The permit specifies operational limits either by hours per year or maximum gallons of fuel used (Hawaii Department of Health, 2008).

Mobile sources from PMRF-associated testing include aircraft, missile launches, diesel-fueled vehicles, and vehicular traffic. Aircraft are operated and supported at PMRF Airfield. Missile launches are a source of mobile emissions at PMRF. Currently, there are as many as 46 missile launches per year from PMRF and KTF which includes launches for the Missile Defense Agency (MDA) programs (THAAD and Aegis) and target launches for Fleet training. These systems use both solid and liquid propellants. The most common exhaust components for typical missiles include aluminum oxide, carbon dioxide, carbon monoxide, hydrogen, hydrogen chloride, nitrogen, water, ferric chloride, ferric oxide, nitric oxide, chlorine, and sulfur dioxide.

As a means of reducing GHG and other air emissions in the long term, the Navy's energy policy includes energy targets by 2020. The targets of significance to this EA/OEA include: (1) by 2020, half of the Navy's energy consumption (ashore and afloat) will come from alternative sources; (2) by 2020, half of Navy installations will be net-zero energy consumers, using solar, wind, ocean, and geothermal power generated on base; (3) by 2015, the Navy will cut in half the amount of petroleum used in Government vehicles through phased adoption of hybrid, electric, and flex fuel vehicles; and (4) effective immediately, Navy contractors will be held contractually accountable for meeting energy efficiency targets.

3.1.1.1.2 Airspace—PMRF/Main Base—Onshore

Region of Influence

The region of influence for airspace includes the airspace over and surrounding the islands of Kauai and Niihau. Figure 3.1.1.1.2-1 shows a view of the airspace within the PMRF/Main Base region of influence, including the PMRF Aircraft Operational Areas, the R-3101 Restricted Area, and surrounding airspace off the western and northwestern coast of Kauai. For airspace onshore, the region of influence also includes KTF, Makaha Ridge, Kokee, HIANG Kokee, Kaula, and Niihau. Additionally, the region of influence could include the airspace over Kauai, Niihau, and part of the channel between Kauai and Oahu depending on the actual activity or test.

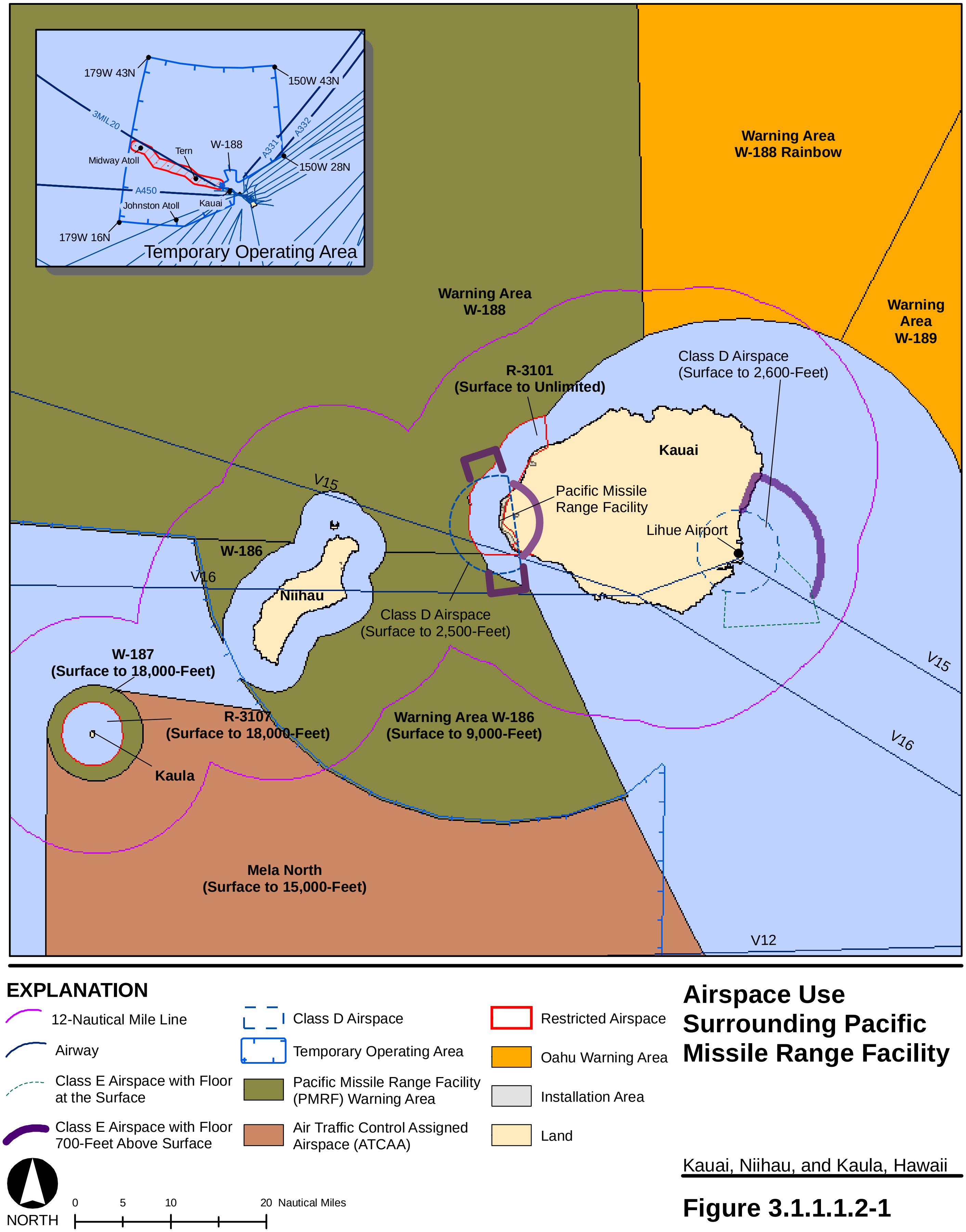
Affected Environment

The airspace in the PMRF region of influence is described below in terms of its principal attributes: controlled and uncontrolled airspace, special use airspace, en route airways and jet routes, airports and airfields, and air traffic control. There are no military training routes in the region of influence.

Controlled and Uncontrolled Airspace

The airspace outside the special use airspace identified below is international airspace controlled by Honolulu Control Facility and Oakland Air Route Traffic Control Center (ARTCC). Class D airspace, generally that airspace surrounding those airports that have an operational control tower, surrounds the PMRF/Main Base airfield with a ceiling of 2,500 feet. It is surrounded to the north, south, and east by Class D airspace with a floor 700 feet above the surface (see Figure 3.1.1.1.2-1). Lihue Airport, located approximately 20 nautical miles (nm) east of PMRF, includes Class D, surface Class E, and additional Class E airspace with a floor 700 feet above the surface.

There is no Class B (U.S. terminal control areas) airspace (which usually surrounds the nation's busiest airports) or Class C (operational control tower and radar approach control) airspace in the region of influence.



Airspace Use Surrounding Pacific Missile Range Facility

Kauai, Niihau, and Kaula, Hawaii

Figure 3.1.1.1.2-1

Special Use Airspace

A restricted area is airspace designated under 14 Code of Federal Regulations (CFR) Part 73 within which the flight of aircraft, while not wholly prohibited, is subject to restriction. A warning area is airspace of defined dimensions, extending from 3 nm outward from the coast of the United States that contains activity that may be hazardous to nonparticipating aircraft. The purpose of such warning areas is to warn nonparticipating pilots of the potential danger. A warning area may be located over domestic or international waters or both. (14 CFR 1.1, 2006)

The special use airspace in the region of influence (see Figure 3.1.1.1.2-1) consists of Restricted Area R-3101, which lies immediately above PMRF/Main Base and to the west of Kauai, portions of Warning Area W-188 north of Kauai, and Warning Area W-186 southwest of Kauai, all controlled by PMRF. Restricted Area R-3107 over Kaula, a small uninhabited rocky islet 19 nm southwest of Niihau that is used for fixed- and rotary-wing aircraft gunnery practice, and which lies within the W-187 Warning Area, is also special use airspace within the region of influence. Restricted Area R-3107 and Warning Area W-187 are scheduled through the Navy Fleet and Area Control and Surveillance Facility Pearl Harbor (FACSFACPH). PMRF and FACSFACPH each coordinate with the Federal Aviation Administration (FAA) Honolulu Control Facility regarding special use airspace. The Honolulu Control Facility is the location in which the ARTCC, the Honolulu control tower, and the Combined Radar Approach Control are collocated.

Special Airspace Use Procedures

Other types of airspace, and special airspace use procedures used by the military to meet its particular needs, include Air Traffic Control Assigned Airspace (ATCAA) and Altitude Reservation (ALTRV) procedures: (1) ATCAA, or airspace of defined vertical and lateral limits, is assigned by air traffic control to provide air traffic segregation between specified activities being conducted within the assigned airspace and other instrument flight rules (IFR) air traffic. ATCAAs are usually established in conjunction with Military Operations Areas, and serve as an extension of Military Operations Area airspace to the higher altitudes required. These airspace areas support high altitude operations such as intercepts, certain flight test operations, and air refueling operations; (2) ALTRV Procedures are used as authorized by the Central Altitude Reservation Function, an air traffic service facility, or appropriate ARTCC, under certain circumstances, for airspace utilization under prescribed conditions. An ALTRV receives special handling from FAA facilities. According to FAA Handbook 7610.4H, Chapter 3, ALTRVs are classified as either moving or stationary, with the latter normally defining the fixed airspace area to be occupied as well as the specific altitude(s) and time period(s) the area will be in use. ALTRVs may encompass certain rocket and missile activities and other special operations as may be authorized by FAA approval procedures.

To ensure safe operations, PMRF requests use of specific areas of airspace from the FAA during missile defense testing. The FAA issues a notice to airmen (NOTAM) to avoid specific areas of airspace until testing is complete. The NOTAM System is a telecommunication system designed to distribute unanticipated or temporary changes in the National Airspace System or until aeronautical charts and other publications can be amended. This information is distributed in the Notice to Airmen Publication. The NOTAM Publication is divided into four parts: (1) NOTAMs expected to be in effect on the date of publication, (2) revisions to Minimum En Route Instrument Flight Rules Altitudes and Changeover Points, (3) international—flight prohibitions, potential hostile situations, foreign notices, and oceanic airspace notices, (4) special notices and graphics such as military training areas, large-scale sporting events, air shows, and airport specific information—Special Traffic Management Programs. Notices in Sections 1 and 2 are submitted through the National Flight Data Center, ATA-110. Notices in sections 3 and 4 are submitted and processed through Air Traffic Publications, ATA-10. Air Traffic Publications, ATA-10 issues the NOTAM Publication every 28 days. To further ensure aircraft safety, if aircraft are seen in an impact area, safety regulations dictate that hazardous activities will be suspended when it is known that any non-participating aircraft has entered any part of the training danger zone until the non-participating entrant has left the area or a thorough check of the suspected area has been performed. Models run sequentially or in parallel are designed to compute risks based on estimating both the probabilities and consequences of launch failures as a function of time into the mission. Databases include data on mission profile, launch vehicle specifics, local weather conditions, and the surrounding population distribution. Given a mission profile, the risks would vary in time and space. Therefore, a launch trajectory optimization is performed by the range for each proposed launch, subject to risk minimization and mission objectives constraints. The debris impact probabilities and lethality are then estimated for each launch considering the geographic setting, normal jettisons, failure debris, and demographic data to define destruct lines to confine and/or minimize the potential risk of injury to humans or property damage.

En Route Airways and Jet Routes

Although relatively remote from the majority of jet routes that crisscross the Pacific, the airspace use region of influence has two IFR en route low altitude airways used by commercial air traffic that pass through the region of influence: V15, which passes east to west through the southernmost part of Warning Area W-188, and V16, which passes east to west through the northern part of Warning Area W-186 and over Niihau (see Figure 3.1.1.1.2-1). An accounting of the number of flights using each airway is not maintained.

The airspace use region of influence, located to the west, northwest, and north of Kauai, is far removed from the low altitude airways carrying commercial traffic between Kauai and Oahu and the other Hawaiian islands, all of which lie to the southeast of Kauai. There is a high volume of island helicopter sightseeing flights along the Na Pali coastline and over the Waimea Canyon, inland and to the east of PMRF, particularly out of Port Allen near Hanapepe on Kauai's southern coastline and other tourist and resort towns on the island. However, these do not fly over PMRF or into Restricted Area R-3101 (National Aeronautical Charting Office, 2007).

Airports and Airfields

In addition to helicopter and fixed-wing aircraft landings associated with PMRF's mission, the PMRF airfield serves as a training facility for landings and takeoffs. Lihue Airport is located 20 nm east of PMRF and is the primary airport on Kauai. It handles overseas and interisland flights. Princeville Airport is used mainly by private planes. It is 3 nm east of the business district of Hanalei. An airstrip is also still located at Port Allen, and it is considered a general aviation airport by the FAA. Although there is no airport on Niihau, Niihau Helicopters, Inc. was incorporated in 1986 and provides flights to and from the island.

There is a heliport, used by PMRF personnel, located at the Makaha Ridge Instrumentation Site, as well as a heliport at Kokee Park used by State Park personnel. The standard instrument approach and departure procedure tracks for Kauai's principal airport at Lihue are all to the east and southeast of the island itself. (National Aeronautical Charting Office, 2007)

Air Traffic Control

Use of the airspace by the FAA and PMRF is established by a Letter of Agreement between the two agencies which requires PMRF to notify the FAA by 2:00 p.m. the day before range operations would infringe on the designated airspace. Range Control and the FAA are in direct real-time communication to ensure safety of all aircraft using the airways, jet routes, and special use airspace. Within the special use airspace, military activities in Warning Areas W-186 and W-188 are under PMRF control, and the PMRF Range Control Officer is solely authorized and responsible for administering range safety criteria, the surveillance and clearance of the range, and the issuance of range RED (no firing) and GREEN (clearance to fire) status (Pacific Missile Range Facility, Barking Sands, Hawaii, 1991). Warning Area W-187 is scheduled through the FACSFACPH.

As Warning Areas are located in international airspace, the procedures of International Civil Aviation Organization (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 region of influence is managed by the Honolulu Control Facility.

3.1.1.1.3 Biological Resources—PMRF/Main Base—Onshore

Region of Influence

The region of influence for biological resources includes the area within the PMRF/Main Base property boundary used for testing and training. Within the region of influence, human activities have altered most of the natural terrestrial environment.

Affected Environment

Native or naturalized vegetation, wildlife, and the habitats in which they occur are collectively referred to as biological resources. For the purpose of discussion, biological resources have been divided into the areas of vegetation, wildlife, threatened and endangered species, and environmentally sensitive habitat.

Vegetation

There are six recognized vegetation types on the undeveloped portions of PMRF/Main Base: kiawe-koa haole scrub, a`ali`i-nama scrub, pohinahina, naupaka dune, strand, drainage-way wetlands, and ruderal vegetation. Kiawe/koa haole and a`ali`i-nama scrub are the dominant vegetation in the undeveloped portions of the PMRF/Main Base region of influence. Kiawe/koa haole is the dominant type present on the relatively undisturbed areas of the sand dunes, associated with PMRF and Polihale State Park, as well as along the cliff face in the restrictive easement area. Because of the restrictions on off-highway vehicle activities, the sand dune related vegetation within the PMRF boundary is less disturbed than the vegetation in Polihale State Park (Pacific Missile Range Facility, 2001). A well-developed native strand community exists along the shoreline. (Pacific Missile Range Facility, 2001; 2007) Common plants that inhabit the sandy beach habitat on Kauai include beach naupaka, pohinahina, pohuehue, milo, and hau (Maragos, 1998).

Drainage-way wetlands vegetation occupies only a small area on PMRF/Main Base. Ruderal (disturbed, weedy) vegetation is present along roadsides and other areas where man has disturbed the natural vegetation, and much of this vegetation is mowed on a regular basis. Beach naupaka, pohuehue, and pohinahina are common at northern PMRF and KTF. The southern half of PMRF has stands of `a`ali`i, but the dominant woody vegetation through much of Barking Sands consists of kiawe (known as mesquite on the mainland) and koa haole scrub. Coastal dune vegetation covers much of the dunes north of KTF, which is located in the northern portion of the base. (Pacific Missile Range Facility, 2001)

Threatened and Endangered Plant Species

Table 3.1.1.1.3-1 provides species listed under the Endangered Species Act (ESA) as candidate, threatened, or endangered known or expected to occur within the PMRF/Main Base region of influence. There are no known plant species listed as threatened or endangered on PMRF/Main Base. (Pacific Missile Range Facility, 2001; 2007)

Table 3.1.1.1.3-1. Listed Species Known or Expected to Occur in the Vicinity of PMRF/Main Base

Scientific Name	Common Name	Federal Status
Plants[1]		
Panicum niihauense	Lau`ehu	E
Sesbania tomentosa	Ohai	E
Reptiles		
Chelonia mydas	Green sea turtle	T
Birds		
Anas wyvilliana	Koloa maoli (Hawaiian duck)	E
Branta sandvicensis	Nene (Hawaiian goose)	E
Fulica alai	`Alae ke`oke`o (Hawaiian coot)	E
Gallinula chloropus sandvicensis	Alae ula (Hawaiian common moorhen)	E
Himantopus mexicanus knudseni	Ae`o (Hawaiian black-necked stilt)	E
Oceanodroma castro	Band-rumped storm-petrel	C
Phoebastria albatrus	Short-tailed albatross**	E
Pterodroma sandwichensis	`Ua`u (Hawaiian dark-rumped petrel)	E
Puffinus auricularis newelli	`A`o (Newell's Townsend's shearwater)	T
Mammals		
Lasiurus cinereus spp. *semotus*	Hawaiian hoary bat	E
Monachus schauinslandi	Hawaiian monk seal	E

Source: U.S. Fish and Wildlife Service, 2005a; b; 2007a; U.S. Department of the Interior, Office of Environmental Policy and Compliance Pacific Southwest Region, 2007

Notes: [1] Critical habitat has been designated on the installation for these plants.

** Observed in May 2000

Key to Federal Status:
C = Candidate
T = Threatened
E = Endangered

Two Federally listed plant species have been observed north of, but not on, PMRF/Main Base. Ohai (*Sesbania tomentosa*), a spreading shrub, is a Federally endangered species that has been observed in the sand dunes to the north of PMRF/Main Base in Polihale State Park and could potentially occur on the installation, including KTF. Lau`ehu (*Panicum niihauense*), an endangered species of rare grass, has been observed near Queens Pond also north of PMRF/Main Base. (Pacific Missile Range Facility, 2001; 2007; U.S. Department of the Navy, 1998a)

Wildlife

Birds identified at PMRF/Main Base include non-native, migratory and species endemic to Hawaii. The pueo, or Hawaiian short-eared owl, is the only endemic non-migratory bird species that occurs in the region and is not federally threatened or endangered. Non-native bird species on Kauai are usually common field and urban birds such as the zebra dove and Japanese white-eye and the ring-necked pheasant, northern cardinal, northern mockingbird, and house finch. (Pacific Missile Range Facility, 2001; 2006b)

Several species of migratory seabirds and shorebirds covered by the Migratory Bird Treaty Act (MBTA) are present during some portion of the year. Brown boobies, sanderlings, wandering tattlers, ruddy turnstones, and Pacific golden plovers are commonly observed at PMRF/Main Base. The black-footed albatross, a seabird that is state-listed as threatened (Pacific Missile Range Facility, 2007), has also been observed on PMRF. Wedge-tailed shearwaters nest in the Nohili dunes area. A nesting colony of wedge-tailed shearwaters is also located near the beach cottages. Nesting colony restoration efforts begun in 2006 included removing non-native trees and planting naupaka seedlings and native beach vegetation (pohinahina), ilima, and akiaki seeds. The Navy built a fenced-in, 1-acre compound near the middle of PMRF to foster wedge-tailed shearwater nesting and to keep out unwanted “guests.” There were an estimated 276 breeding pairs in the compound in 2006 (U.S. Navy NAVFAC Pacific Environmental Planning, 2007). The Navy also installed polyvinyl chloride (PVC) pipe segments into the compound to provide some artificial burrows that would not collapse. (Currents, 2007)

The Laysan albatross, also protected under the MBTA, uses ruderal vegetation areas on the base for courtship and nesting (Pacific Missile Range Facility, 2001; 2006b). The Laysan albatross is being discouraged from nesting at PMRF to prevent interaction between the species and aircraft using the runway. Albatross on the airfield are relocated to Kilauea National Wildlife Refuge in order to prevent bird/aircraft strikes. During the nesting season, PMRF staff in cooperation with the U.S. Department of Agriculture’s Animal and Plant Health Inspection Service and the Kauai National Wildlife Refuge Complex relocates viable PMRF albatross eggs to Kilauea Point and other north shore nest sites, under a U.S. Fish and Wildlife Service (USFWS) permit, to replace eggs that would never hatch. All of the resulting chicks are accepted by new surrogate parents and should now return to the north shore when old enough to mate. With no chicks to feed, the adult albatross return to the open sea. This surrogate parenting program continued through the 2009/2010 nesting season with continued improvements and fine-tuning, through coordination and discussion with all three engaged agencies. It is anticipated to continue as long as viable eggs are available at PMRF/Main Base. Twenty-three eggs were placed with surrogate parents during the 2009/2010 season (Naval Facilities Engineering Command Pacific, 2010). (Burger, 2007a; U.S. Fish and Wildlife Service, 2005b; U.S. Department of the Navy, 1998a; U.S. Army Space and Missile Defense Command, 2001)

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, 1998a; U.S. Army Space and Missile Defense Command, 2001) PMRF has an ongoing feral animal-trapping program to protect the albatross as well as the wedge-tailed shearwater and other birds on base (Burger, 2007a). However, in recent years the primary predation documented in the wedge-tailed shearwater colonies has been from barn owls. A total of 101 barn owls have been culled on Barking Sands since 2005—concentrated in the scrub in the vicinity of the Beach Cottage colony. (Burger, 2010b) Reptiles observed on PMRF/Main Base during recent surveys were the house gecko, mourning gecko, and snake-eyed skink. The only amphibian observed was the marine toad. (Pacific Missile Range Facility, 2006c; U.S. Department of the Navy, 1998a; U.S. Army Space and Missile Defense Command, 2001)

<u>Threatened and Endangered Wildlife Species</u>

Seven Federally listed bird species are potentially present or confirmed in the PMRF area (Table 3.1.1.1.3-1).

The band-rumped storm-petrel (*Oceanodroma castro*) has recently been listed as a candidate species. Band-rumped storm-petrels nest in burrows or natural cavities in a variety of high-elevation, inland habitats, and breed on Kauai at elevations around 1,950 feet. In Hawaii the breeding population is unknown, but likely very small. The population on Kauai is estimated at between 171 and 221 breeding pairs. Historically, the species was abundant and widespread throughout the Main Hawaiian Islands. Like most seabirds this storm-petrel lays a single egg per season, between May and June, and nestlings fledge in October. (Hawaii Department of Land and Natural Resources, 2005)

According to the Navy and USFWS, the endangered nene (*Branta sandvicensis*) is present on PMRF/Main Base (U.S. Department of the Interior, Office of Environmental Policy and Compliance Pacific Southwest Region, 2007). An active nene nest was found at PMRF on the northeast edge of the HIANG complex on 23 November 2009, less than 1 mi from the south end of the active runway. The unbanded female was incubating three eggs and the banded male was guarding the nest from approximately 3.3 feet away. Approximately 20 additional adult nenes were also observed, many of them less than 0.3 mi from the south end of the active runway. Currently, the U.S. Department of Agriculture, Animal and Plant Inspection Service, Wildlife Services works with the Navy to haze nene from areas near the runway under an Agent Designation Letter issued by USFWS. There is concern by the Navy and Wildlife Services that additional nests may be initiated in the future. Thus the Navy requested formal consultation with USFWS on translocations of nesting nene and goslings from PMRF Main Base to decrease Bird-Aircraft Strike Hazards. This translocation was needed to avoid natal site imprinting. Nesting adults and their goslings were moved from PMRF Main base to Hanalei National Wildlife Refuge on the north shore of Kauai. The refuge contains approximately 50 acres of fenced wetland area, and a predator control program currently operated by USFWS. In their Biological Opinion, the USFWS determined that the level of anticipated take associated with the translocation of this specific nest only is not likely to jeopardize the survival and recovery of nene (U.S. Fish and Wildlife Service, 2009). If additional nests occur on PMRF Main Base, further consultation would likely be required. To attempt to prevent additional nesting by nene at PMRF Main Base, the Navy will continue its current communications work with base visitors and staff on the importance of not feeding the birds. In addition, Wildlife Services will continue to haze nene from PMRF Main Base. (Naval Facilities Engineering Command Pacific, 2009; U.S. Fish and Wildlife Service, 2009)

Kauai provides the majority of Hawaii's habitat for the threatened Newell's shearwater. The Newell's shearwater (*Puffinus auricularis newelli*) nests from April to November in the interior mountains of Kauai. Fledglings 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. PMRF personnel have retrofitted their outdoor lighting with hoods that direct the lights downward to prevent confusing the seabirds, which can be disoriented by upward- and outward-shining lights (Honolulu Advertiser, 2006). (Telfer et al. 1987; Day et al. 2003; Poot et al. 2008; Audubon, 2006; Hawaii Department of Land and Natural Resources, no date[a]) In an increasing effort to protect shearwaters, this program is under review. PMRF is exploring additional programs such as green lightbulbs, reduction of wattage used in lightbulbs, hoods and deflectors, as well as turning off all but the most mission-critical lighting during the fledging season (Burger, 2009a; 2010b).

The Hawaiian dark-rumped petrel (*Pterodroma phaeopygia sandwichensis*), which is endangered, arrives in February and may traverse the area from its nesting grounds to the sea. On rare occasion, grounded dark-rumped petrel fledglings have been collected as part of the Newell's shearwater recovery program on Kauai. Most birds have been found near the mouth of Waimea Canyon, indicating that some birds still breed in the vicinity. Dark-rumped petrels are nocturnal over land and are active from about 1 hour after sunset until about 1 hour before sunrise. Nesting occurs from mid-February until late November. Chicks begin hatching in late June and fledge in late October to November, slightly earlier than that of the Newell's Townsend's shearwater. (Audubon, 2006; Virginia Tech Conservation Management Institute, 1996)

The Hawaiian coot (*Fulica alai*), Hawaiian black-necked stilt (*Himantopus mexicanus knudseni*), Hawaiian common moorhen (*Gallinula chloropus sandvicensis*), and Hawaiian duck (*Anas wyvilliana*) are endangered waterbirds that have been observed in the drainage ditches and ponds on PMRF/Main Base. The Hawaiian coot, black-necked stilt, and common moorhen (U.S. Fish and Wildlife Service, 2006c) nest on Kauai year-round. (U.S. Department of the Navy, 1998a)

In March of 2000, a juvenile endangered short-tailed albatross was observed at PMRF, resting in the grass on the mountain side of the PMRF runway (U.S. Fish and Wildlife Service, 2004).

The Hawaiian hoary bat (*Lasiurus cinereus* spp. *semotus*) is listed as a Federal and state endangered species. It has been recorded at PMRF; a group of four was observed foraging around the sewage treatment ponds, and another group of five bats was seen just offshore of northern PMRF/Main Base. It has also been observed at the Polihale State Park north of the base. (Pacific Missile Range Facility, 2001; 2007) The Navy is currently considering a program to use monitoring devices to determine what, if any, population of Hawaiian hoary bats may be resident (Burger, 2010b).

Two marine wildlife species Federally and state listed as threatened or endangered commonly occur on PMRF/Main Base. Endangered Hawaiian monk seals regularly haul out on the PMRF

Main Base beach. The first Hawaiian monk seal birth recorded on a Kauai beach since 1993 occurred on PMRF in 1999 (Marine Mammal Commission, 2003; Pacific Missile Range Facility, 1999). Two and three pups were born on Kauai beaches in 2003 and 2004 respectively (Kauai Monk Seal Watch Program, 2003; National Oceanic and Atmospheric Administration, 2006b; National Marine Fisheries Service, 2007a). Three pups were born on Kauai in 2005 and four pups were born in 2006 (National Oceanic and Atmospheric Administration, 2006b; National Marine Fisheries Service, 2007a). Pups are born between February and August. Sitings of Hawaiian monk seal haul outs are documented by the PMRF Environmental Office.

Threatened green sea turtles are regularly observed basking on shore in the vicinity of Nohili Ditch; the predominant area where basking/haul-out activity on PMRF/Main Base is observed. The PMRF Natural Resources Manager monitors sea turtle activity at PMRF. Green sea turtles have not nested anywhere along the beachfront in the last 10 years. In the past 3 years only one apparent "false nesting" has been observed. (Burger, 2007b) Security patrols reports include a record of the presence and locations of turtles. Any records of green sea turtle sitings are maintained by the PMRF Environmental Office. (Pacific Missile Range Facility, 2001; 2007)

Environmentally Sensitive Habitat

Wetlands

Wetlands are associated with (1) the Mana base pond located outside the industrial area of the facility boundaries; (2) Kawaiele wildlife sanctuaries that include a State Waterbird Refuge for Hawaii's four endangered waterbird species; and (3) agricultural drains from the Nohili and Kawaiele ditches within PMRF/Main Base. (National Wetlands Inventory, 2007) The freshwater discharge at Nohili Ditch appears to be at least partially responsible for the preferred turtle foraging habitat since it stimulates filamentous algae growth on the nearshore reef bench (Commander, Navy Region Hawaii, 2007).

Two wetlands (classified as marine system, subtidal subsystem, reef class, coral subclass, subtidal) exist along part of the coastline west of KTF. (Pacific Missile Range Facility, 2001)

Critical Habitat

A proposed rule to designate critical habitat for 76 listed plant species on the islands of Kauai and Niihau published in November 2000 (U.S. Fish and Wildlife Service, 2000) included KTF and other land in the northwestern end of PMRF near Polihale Park as critical habitat for the endangered ohai and lau`ehu. In January 2002, the USFWS proposed critical habitat for additional plant species on Kauai and Niihau, including the southern portion of PMRF for protection of lau`ehu. (U.S. Fish and Wildlife Service, Pacific Region, 2002; U.S. Fish and Wildlife Service, 2002) The USFWS reevaluated the dune habitat on PMRF, and habitat on Navy land at Makaha Ridge, and determined that these lands were not essential for the conservation of ohai or dwarf iliau (*Wilkesia hobdyi*, found on Makaha Ridge). Although lau`ehu does not grow on PMRF/Main Base, the USFWS has determined that land on PMRF adjacent to Polihale State Park and dune areas along the southern portion of the range (adjacent to Kokole Point) contain primary constituents necessary for the recovery of lau`ehu (Figure 3.1.1.1.3-1). The USFWS designated these areas as unoccupied critical habitat because there are not enough other areas outside the base that contain the elements to achieve the USFWS's goal of 8 to 10 populations. (Pacific Missile Range Facility, 2001; 2007; U.S. Fish and Wildlife Service, 2003a)

EXPLANATION

Road
Installation Area
Kauai Test Facility
Land
Critical Habitat
Wetland Area

NORTH

0 0.5 1 2 Miles

Critical Habitat - Western Kauai, Hawaii

Kauai, Hawaii

Figure 3.1.1.1.3-1

3.1.1.1.4 Cultural Resources—PMRF/Main Base—Onshore

Region of Influence

The region of influence for terrestrial cultural resources at PMRF/Main Base/KTF encompasses several specific areas of the installation to be used for the construction of new facilities and infrastructure features, as described in Section 2.2.1. Surveys for prehistoric and historic archaeological and Native Hawaiian sites across PMRF indicate that the proposed construction locations are surficially devoid of cultural remains; however, the entirety of PMRF is sensitive for subsurface archaeological and Native Hawaiian materials, particularly burials (International Archaeological Research Institute, Inc. 2005).

There are also a number of historic buildings and structures situated at PMRF; however, with the exception of minor power and heating, ventilating and air conditioning (HVAC) upgrades to non-historic properties, there are no modifications proposed for any existing facilities.

Affected Environment

Archaeological Resources (Prehistoric and Historic)

Brief Prehistory/Early History

PMRF/Main Base and KTF are situated in a region known as Mana. Throughout prehistory, large areas of the Mana Plain were covered by the great Mana swamp, allowing Native Hawaiians to canoe as far south as Waimea (Von Holt, 1985; State of Hawaii, 1993). It is believed that these wet conditions encouraged the independent invention of aquaculture on Kauai and the construction of stone and earthen ponds for growing staples such as taro, yam, and sweet potatoes (Kikuchi, 1987). 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 (Hawaii Visitors Bureau, 1993), and by the 1930s, nearly all of the Mana swamp had been filled to produce this crop.

Brief Military History

In 1940, 549 acres in Mana were deeded to the U.S. War Department for an Army Air Corps flight training field. The Navy was given permission to use the facilities in 1944; however, after the Air Force was established (1947), it assumed control of the facility (redesignated Barking Sands Air Force Base), and continued operations through the Korean War years. In 1953, the base was re-named Bonham Air Force Base and in 1961, the U.S. Departments of the Air Force and Navy were operating the facility under a joint use agreement. In 1964, 1,884 acres of the Mana Plain were officially transferred to the Navy, and by 1966 the facility was renamed PMRF (International Archaeological Resources Institute, Inc., 2005).

Throughout the Cold War years (1946-1991), PMRF supported both offensive and defensive Cold War missions, including offensive weapons managed by the Navy, air defense weapons managed by HIANG, and research into Ballistic Missile Defense (BMD) systems. PMRF also supported atmospheric nuclear testing by the Atomic Energy Commission, which led to the establishment of the KTF in the early 1960s. PMRF is currently the largest instrumented multi-environment test range in the world. (International Archaeological Resources Institute, Inc., 2005)

Native Hawaiian (Traditional) Information

Mana is an area specifically referred to in Hawaiian literature and oral tradition as a leina-a-ka-uhane, a place (generally cliffs or seacoast promontories) where the spirits of men, after death, plunge into eternity and are divided into one of three spiritual realms: the realm of the wandering spirits; the realm of the ancestral spirits; or the realm of the endless night (Han, et al., 1986; Fornander, 1917). Typical of Native Hawaiian mortuary practices, burial sites believed to be associated with the Mana leina-a-ka-uhane have been identified throughout the area.

Large portions of PMRF have been systematically surface surveyed for archaeological resources; however, subsurface features may still be present (West and Desilets, 2005). Previous investigations have identified a variety of prehistoric and historic resources, including burial sites, heiaus (temples), campsites, house sites, lithic (stone) scatters, aquaculture ponds, and modern military-associated sites, any or all of which could be potentially eligible for inclusion in the National Register of Historic Places (NRHP). (International Archaeological Resources Institute, Inc., 2005)

Historic Buildings and Structures

Several architectural evaluations have been conducted for PMRF, including PMRF/Main Base, Kamokala Ridge, and Port Allen (Drolet et al., 1996; Rechtman, et al., 1998). The evaluations covered pre-military facilities and features, as well as World War II and Cold War era resources. Numerous buildings and structures were recommended eligible for inclusion in the NRHP; however, none are affected by the activities described within this EA/OEA. (International Archaeological Resources Institute, Inc., 2005)

Traditional Resources

Traditional resources can include archaeological sites, burial sites, ceremonial areas, natural features (e.g., caves, mountains, water sources, trails, plant habitat, or gathering areas), or any other natural area important to a culture for religious or heritage reasons. As such, many of the cultural materials identified within the region of influence could also be considered traditional resources. In addition to Native Hawaiians, several other cultures have also inhabited the island of Kauai. These include the Japanese, Korean, Portuguese, Chinese, and Filipino. A Japanese cemetery is located within the boundary of PMRF, and cemeteries associated with each of the other cultures are located near Kekaha, Hanapepe, and Waimea. (International Archaeological Institute, Inc. 2005)

Burials

Burials are the most significant cultural resources concern within the sandy soils of PMRF. There have been numerous inadvertent discoveries of human remains in both the coastal and back bay areas of the installation, all of which have been handled in accordance with specific guidance incorporated into the PMRF Integrated Cultural Resources Management Plan (ICRMP) and reiterated in Chapter 4 of this EA/OEA (International Archaeological Research Institute, Inc. 2005).

Consultation and Coordination

In accordance with Section 106 of the National Historic Preservation Act, the Hawaii State Historic Preservation Officer (SHPO) and Native Hawaiian Organizations (Burger, 2009b) have been afforded an opportunity to comment on the activities within this EA/OEA. A copy of the EA/OEA was provided to the Hawaii SHPO for review and comment on 12 February 2010, and concurrence was provided as of 10 March 2010 (see Appendix B).

3.1.1.1.5 Geology and Soils—PMRF/Main Base—Onshore

Geology and soils include those aspects of the natural environment related to the earth, which may be affected by the Proposed Action. This resource is described in terms of existing information on the land forms, geology, and associated soil development as it may be subject to erosion, flooding, mass wasting, mineral resource consumption, contamination, and alternative land uses resulting from proposed construction and launch activities.

Region of Influence

Geology and soils are considered resources that may be adversely affected by proposed training and research, development, test and evaluation (RDT&E) activities. These resources are described in terms of existing information on land forms, geology, and associated soil development. The areas on the island of Kauai that are mentioned in the Proposed Action description comprise the region of influence.

Affected Environment

Physiography

PMRF/Main Base is situated on a strip of low-lying coastal terrace called the Mana Plain. The plain bounds 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 margin occupied by PMRF/Main Base. The plain does not form cliffs at the PMRF/Main Base shoreline. Local relief is formed by low beach barrier dunes, mildly undulating blanket sands, and the more prominent Nohili Dune located in the northern portion of PMRF/Main Base, adjacent to the northwestern side of KTF at Nohili Point. Ground elevations over the facility average between 10 feet to 20 feet, rising to 100 feet at Nohili Dune. PMRF/Main Base is not traversed by perennial or ephemeral streams. Surface runoff is controlled by manmade channels located at Nohili Ditch on northern PMRF/Main Base, Kawaiele Drainage in central PMRF/Main Base, and a drainage channel just south of Kawaiele Drainage.

Geology

Kauai is the result of a massive shield volcano, part of the chain of similar volcanoes that migrated northwest to southeast to form the Hawaiian archipelago. Kauai is the oldest of the eight main islands. Volcanic rocks exposed in the western half of the island are composed of Pliocene basaltic flows of the Waimea Volcanic Series. The volcanic terrain forms an abrupt, crescent-shaped scarp at the eastern boundary of the Mana Plain, the result of wave action from a higher sea stand. The surface of the volcanic basement complex plunges beneath the Mana Plain at approximately 5 degrees (U.S. Army Strategic Defense Command, 1992). (Pacific Missile Range Facility, 2007)

The Mana Plain is composed of alluvium, lagoon, beach, and dune deposits that overlie the volcanic basement. This sedimentary sequence forms a wedge that thickens east to west, attaining an approximate thickness of 200 feet at the eastern base boundary, increasing to about 400 feet at the coast (U.S. Army Strategic Defense Command, 1992). Older and younger terrestrial alluvium interfingers with gypsum-bearing clayey lagoonal deposits and marine offshore deposits at depth. Sediments are characteristically red and brown near volcanic outcrops, changing to tan and gray calcareous sand near the coast.

The surface of the Mana Plain typically consists of loose sand associated with younger (Modern) alluvium and flattened dunes with little relief (U.S. Army Strategic Defense Command, 1992). The dune sands can be of substantial thickness along the coastal margin where they have been reported to be in excess of 42 feet thick at the Kokole Point housing area (U.S. Army Strategic Defense Command, 1992). The dunes are composed of loose fine sand and silty sand that is weakly to strongly indurated (hardened) a few meters below ground surface. This indurated surface can form resistant remnants, or fossil dunes, fronting the beach along some reaches of the PMRF shoreline. The beach berm is about 10 feet high and is breached only where drainage canals have been excavated at Nohili and Kawaiele (U.S. Army Strategic Defense Command, 1992; Pacific Missile Range Facility, 2007).

Coral reefs developed on the eroded platform around the island when the sea was about 5 feet above its current level (U.S. Army Strategic Defense Command, 1992). Wave action has eroded the coral surface, creating a primary source for beach sand which is actively being deposited and reworked along the shoreline. Beach sand is generally medium to coarse grained.

Soils

The dominant soil within the PMRF area has been mapped as Jaucas loamy fine sand, 0 to 8 percent slopes. The U.S. Department of Agriculture describes this soil as occurring on old (inactive) beaches and on windblown sand deposits. It is pale brown to very pale brown sand, and in some cases it is more than 5 feet deep. In many places, the surface layer is dark brown as a result of accumulated organic matter and alluvium. The silt is neutral to moderately alkaline through its profile. It has an available water capacity of 0.05 to 0.07 inch per foot of soil (U.S. Army Strategic Defense Command, 1992). The soils are permeable, and infiltration is rapid. Wind erosion is severe where vegetation has been removed. (Pacific Missile Range Facility, 2007)

Areas of active dunes and beaches are along the ocean margin of PMRF/Main Base. Dune lands consist of hills and ridges of sand drifted and piled by the wind. The hills and ridges are actively shifting, or so recently stabilized that no soil horizons have developed. The sand is chiefly calcareous, derived from coral and seashells (U.S. Army Strategic Defense Command, 1992; Pacific Missile Range Facility, 2007)

See Section 3.1.1.1.6 for discussion of any known hazardous soil conditions as a result of prior missile testing at PMRF and KTF.

3.1.1.1.6 Hazardous Materials and Waste—PMRF/Main Base—Onshore

Region of Influence

The region of influence for hazardous materials and hazardous waste would be limited to areas of PMRF/Main Base, including KTF, to be used for launch preparation, launch, and post-launch activities and in areas where hazardous materials are stored and handled.

Affected Environment

Hazardous Materials

PMRF manages hazardous materials through the Navy's Consolidated Hazardous Materials Reutilization and Inventory Management Program (CHRIMP). CHRIMP mandates procedures to control, track, and reduce the variety and quantities of hazardous materials in use at facilities. The CHRIMP concept established Hazardous Materials Minimization Centers as the inventory controllers for Navy facilities. All departments, tenant commands, and work centers must order hazardous materials from these centers, where all such transactions are recorded and tracked. The exception to this is KTF, which obtains its hazardous materials through Department of Energy (DOE) channels. Hazardous materials on PMRF are managed by the operations and maintenance contractor through CHRIMP. Hazardous materials managed through the CHRIMP program other than fuels are stored in Building 338. Typical materials used on PMRF/Main Base and stored at Building 338 include cleaning agents, solvents, and lubricating oils.

PMRF has management plans for oil and hazardous materials outlined in the *PMRF Spill Prevention Control and Countermeasures Plan* and the *Installation Spill Contingency Plan.* These plans regulate both PMRF/Main Base as well associated sites and tenant organizations, including KTF, Makaha Ridge, Kokee, Kamokala Magazines, and Port Allen.

The only chemicals stored in large quantities at PMRF include jet fuel, diesel fuel, propane, gasoline, aqueous fire fighting foam, chlorine, used oil, paint/oils, and paint. PMRF/Main Base has nine 50,000-gallon underground storage tanks (USTs) located at the Fuel Farm, one 30,000-gallon UST located at the Power Plant, two 5,000-gallon USTs at the Navy Exchange, three 5,000-gallon USTs at the gasoline station, and one 1,000-gallon UST at the Calibration Lab. There are two 6,000-gallon diesel aboveground storage tanks (ASTs) and one 1,000-gallon AST at Makaha Ridge, three 200-gallon ASTs near building 510 and one 1,000-gallon AST near building 450. (Burger, 2006) There is one UST and one 10,000-gallon AST at KTF. (Sandia National Laboratories, 2006)

Hazardous Waste Management

Hawaii lacks permitted hazardous waste disposal facilities; therefore, hazardous waste generated at PMRF is shipped to the mainland for disposal. PMRF/Main Base is designated a large-quantity hazardous waste generator by the U.S. Environmental Protection Agency (USEPA). There are two accumulation points on base for hazardous wastes: Building 392 and Building 419. At present, both buildings are not used at their maximum hazardous waste accumulation capacity. Hazardous wastes are collected and containerized for direct offsite disposal within 90 days through the Defense Reutilization and Marketing Office at Joint Base Pearl Harbor-Hickam, which also provides for the transportation and disposal of the wastes to the final disposal facility.

Management and disposal procedures for used oils and fuels are outlined in the PMRF's Hazardous Waste Management Plan. PMRF maintains a Used Oil Transporter/Processor Permit through the Hawaii Department of Health. Limited facilities for treatment and processing of recycled materials exist on Oahu.

KTF is designated a small-quantity hazardous waste generator by the USEPA. There is one hazardous waste accumulation point on KTF; however, KTF has not generated enough hazardous waste for disposal since becoming a small quantity generator in 1994. (Sandia National Laboratories, 2006)

Installation Restoration Program and Other Environmental Contamination

PMRF/Main Base has 19 Installation Restoration Program (IRP) sites. Two fire fighting training pits, the battery acid disposal site, three former oil change pits, a battery acid neutralization unit and the torpedo post run facility require no further action based on the results of past investigations and approval by the Hawaii Department of Health. Three landfills (5, 6, and 7), tanker truck pod facility, former missile (Regulus) defueling pit, and the former oil/fuel pipeline are scheduled to be investigated in Fiscal Year (FY) 2011. A site investigation is complete at four transformer sites and the reclamite asphalt rejuvenation burial areas. A recommendation for a No Further Action determination was sent to the Hawaii Department of Health for these sites.

In another study initiated by the Navy, soil samples at the Vandal launch site on PMRF were obtained to determine if metals, namely lead, were present at concentrations exceeding the 400 milligrams per kilograms (mg/kg) cleanup goal established by the Hawaii Department of Health for residential use. No site soil samples had lead concentrations exceeding 400 mg/kg prior to the 1994 Vandal launches. After five 1994 launches, two sites contained lead concentrations exceeding 400 mg/kg. Both of these sites were located within 50 feet of the launch site. Concentrations of lead 100 feet away in the same direction were only 30 and 75 mg/kg. None of the lead concentrations outside this 100-foot range were above the reporting limit. (U.S. Department of the Navy, Naval Facilities Engineering Command, Pearl Harbor, 1996) KTF also tested for lead and found levels up to 270 mg/kg (U.S. Army Strategic Defense Command, 1992).

KTF has no active Environmental Restoration sites. Three sites were identified in 1995 and were given a No Further Action determination by USEPA in 1996 (Sandia National Laboratory, 2006). In a study initiated by the DOE, soil samples were obtained to determine if elevated aluminum concentrations occur at PMRF/Main Base and/or KTF as a result of missile emissions. The study suggested that if there has been an increase in the amount of aluminum in the soil at PMRF/Main Base as a result of missile emissions, the total concentration is still less than background levels in nearby soils.

3.1.1.1.7 Health and Safety—PMRF/Main Base—Onshore

Region of Influence

The region of influence for potential impact related to the health and safety of workers includes work areas associated with range operations, testing, training, and other (e.g., construction) activities. The population of concern includes the workers employed at PMRF/Main Base, including KTF, but also encompasses the contractor, military, and government civilian personnel directly involved with range operation, training, and RDT&E activities.

The region of influence for potential impacts related to public health and safety includes the areas of Kauai County and the island of Kauai and Niihau affected by range operations, training, and RDT&E activities. These areas include the PMRF overwater training areas. The population of concern consists of visitors to Kauai and permanent residents living in Kauai County.

Affected Environment

PMRF takes every reasonable precaution during the planning and execution of the range activities to prevent injury to human life or property. In addition to explosive, physical impact, and electromagnetic hazards, potential hazards from chemical contamination, ionizing and non-ionizing radiation, radioactive materials, fire, and lasers are studied by PMRF Range Safety Office to determine safety restrictions.

Range Safety

Range Control is responsible for hazard area real time surveillance, clearance, and range safety at all PMRF areas including PMRF/Main Base. PMRF sets requirements for minimally acceptable risk criteria to occupational and non-occupational personnel, test facilities, and non-military assets during range operations. For all range operations at PMRF, the Range Control Officer requires a safety plan. A Range Safety Operation Plan is generated by PMRF Range Safety personnel prior to range operations.

The PMRF Range Safety Office is responsible for establishing ground hazard areas and launch hazard areas over water beyond which no debris from early flight termination is expected to fall. The ground and launch hazard areas for missile launches are determined by size and flight characteristics of the missile, as well as individual flight profiles of each flight test. Data processed by ground-based or onboard missile computer systems may be used to recognize malfunctions and terminate missile flight. Before a launch is allowed to proceed, the range is determined cleared 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. All range users must: (1) provide a list of project materials, items, or test conditions that could present hazards to personnel or material through toxicity, combustion, blast, acoustics, fragmentation, electromagnetic radiation (EMR), radioactivity, ionization, or other means; (2) describe radiation, toxic, explosive, or ionization problems that could accumulate as a result of their tests; (3) provide aerodynamic and flight control information, and destruct system information and parameters; (4) submit plans, specifications, and procedural or functional steps for events and activities involving explosives to conform to criteria in the PMRF instruction; and (5) provide complete operational specifications of any laser to be used and a detailed description of its planned use. (U.S. Department of the Navy, 1998a)

Missile Flight Analysis

PMRF conducts missile flight safety, which takes into account potential hazards from chemical contamination, ionizing and non-ionizing radiation, radioactive materials, and lasers in accordance with Naval Air Warfare Center Weapons Division Instruction. Missile flight safety 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, launch azimuths, kinetic energy intercept debris impact areas, and hazard area dimensions, review and approval of destruct systems proposals, and preparation of the Range Safety Operation Plan required of all programs at PMRF. These plans are prepared by the PMRF Safety Office for each mission and must be approved by the Commanding Office prior to any launch.

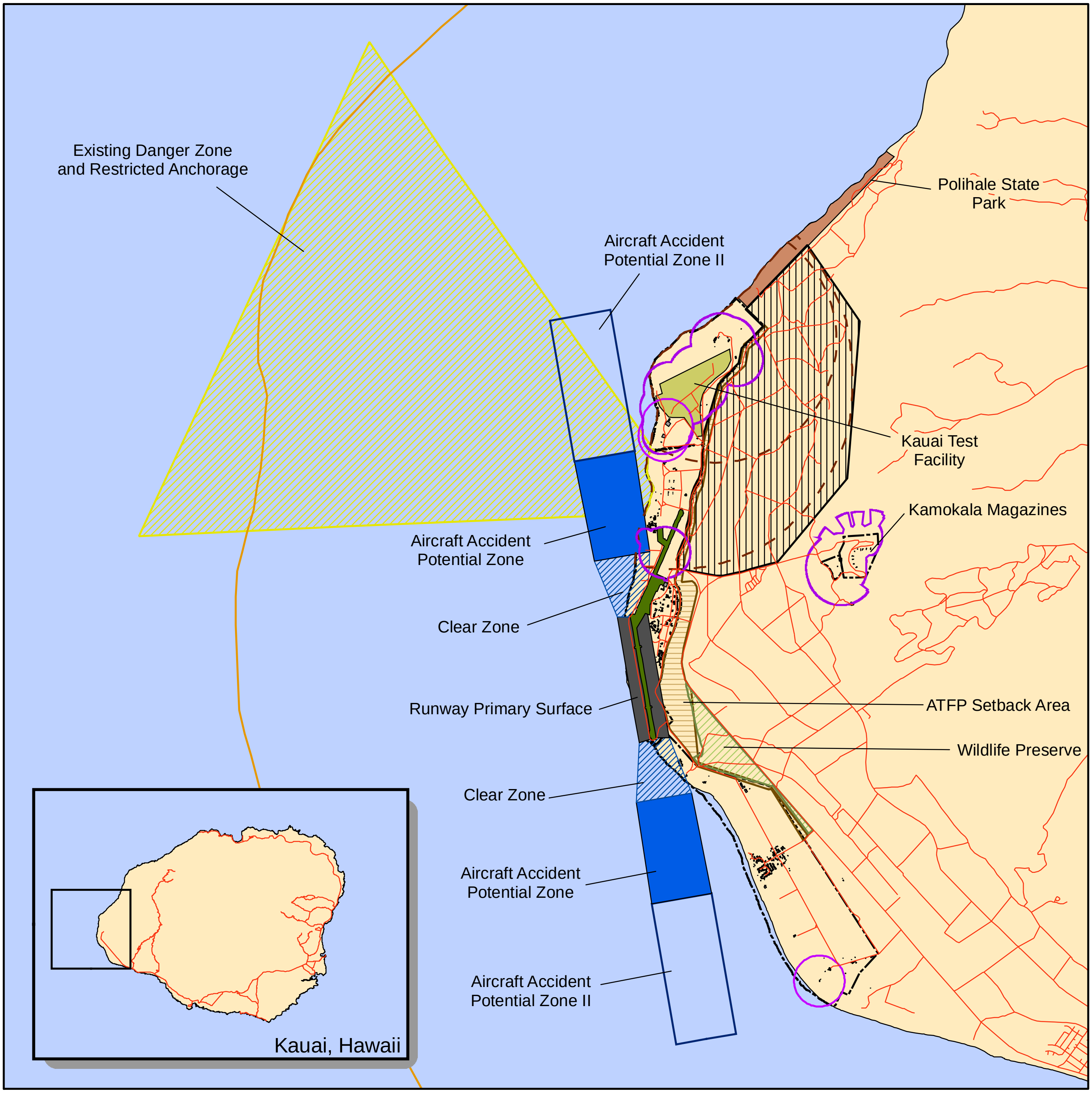
Risk Management

The Range Control Officer using PMRF assets is solely responsible for determining range status and setting RED (no firing—unsafe condition due to a fouled firing area) 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 (U.S. Department of the Navy, 1998a). PMRF uses RCC 321, *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, the general public shall not be exposed to a probability of casualty greater than 1 in 1 million for each individual during any single mission and a total expectation of collective casualty must be less than 100 in 1 million for a single mission. (Range Commanders Council, Range Safety Group, 2007). Figure 3.1.1.1.7-1 shows the PMRF health and safety areas including the ground hazard areas associated with missile launch activities at PMRF/Main Base.

To ensure the protection of all persons and property, standard operating procedures (SOPs) have been established and implemented for the ground hazard areas. These SOPs include establishing road control points and clearing the area using vehicles and helicopters (if necessary). Road control points are established 3 hours prior to launches. This allows security forces to monitor traffic that passes through the ground hazard areas. At 20 minutes before a launch, the ground hazard area is cleared of the public to ensure that, in the unlikely event of early flight termination, no injuries or damage to persons or property would occur. After the Range Safety Officer declares the area safe, the security force gives the all-clear signal, and the public is allowed to reenter the area. (U.S. Department of the Navy, 1998a) No inhabited structures are located within the off-base sections of the ground hazard area. The potential for launch-associated hazards are further minimized through the use of the PMRF Missile Accident Emergency Team. This team is assembled for all launches from PMRF facilities and on-call for all PMRF launches in accordance with PMRFINST 5100.1F.

Ordnance Management and Safety

Ordnance safety includes procedures to prevent premature, unintentional, or unauthorized detonation of ordnance. Any program using a new type of ordnance device for which proven safety procedures have not been established requires an Explosive Safety Approval from the Department of Defense (DoD) Explosives Safety Board before the ordnance is allowed on PMRF or used on a test range. This approval involves a detailed analysis of the explosives and of the proposed training and RDT&E activities, procedures, and facilities for surveillance and control, an adequacy analysis of movement and control procedures, and a design review of the facilities where the ordnance items will be handled.



EXPLANATION

- Road
- 3-Nautical Mile Line
- Existing ESQD Arc
- 6,000-Foot and Modified 10,000-Foot Ground Hazard Area
- Restrictive Easement
- Airfield Area
- Aircraft Accident Potential Zone II
- Aircraft Accident Potential Zone
- Clear Zone
- Runway Primary Surface
- Wildlife Preserve
- Kauai Test Facility
- ATFP Setback Area
- Restricted Anchorage
- Polihale State Park
- Installation Area
- Existing Structure
- Land

NORTH

0 0.5 1 2 Miles

Pacific Missile Range Facility Health and Safety Areas

Kauai, Hawaii

Figure 3.1.1.1.7-1

Ordnance is stored at the Kamokala Magazine area (both in the caves and in two newer magazines constructed in 2002), except for the Strategic Target System, which is stored in a specially constructed facility on KTF. No mishaps involving the use or handling of ordnance have occurred at PMRF.

PMRF/Main Base has defined Explosive Safety Quantity-Distance (ESQD) arcs. The arcs are generated by launch pads, the Kamokala Magazine ordnance storage area, the Interim Ordnance Handling Pad, and the Missile Assembly/Test Buildings 573 and 685. Only the ESQD arcs generated by the Interim Ordnance Handling Pad and Building 573 are covered by a waiver or exemption. The Sandia Launcher site can accommodate a 1,250-foot ESQD arc.

A 1,250-foot ESQD Red Label Area, to handle incoming and outgoing ordnance items, is centered on the airfield taxiway; 1,250 feet from Building 412 (see Figure 3.1.1.1.7-1). A soft pad in the Red Label recovery area is used by helicopters for setting down targets and weapons recovered from the range. The 800-foot ESQD surrounding the soft pad falls totally within the Red Label ESQD area.

Ocean Area Clearance

Range Safety officials manage operational safety for projectiles, targets, missiles, and other hazardous activities 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. For special operations, multi-participant or hazardous weekend firings at PMRF, the U.S. Coast Guard and FAA publish dedicated warnings of Notices to Mariners (NOTMARs) and NOTAMs, respectively, 1 week before hazardous operations. NOTMARs provide notice to commercial ship operators, commercial fisherman, recreational boaters, and other area users that the military will be operating in a specific area, allowing them to plan their activities accordingly. NOTAMs provide notice to aircraft that the military will be operating in a specific area, allowing them to avoid the corresponding area of airspace until testing activities are complete. These temporary clearance procedures for safety purposes have been employed regularly over time without incident. In addition, a 24-hour recorded message is updated on the hotline daily by Range Operations to inform the public when and where hazardous operations will take place.

Prior to a hazardous operation proceeding, the range is determined to be cleared using inputs from ship sensors, visual surveillance of the range from aircraft and range safety boats, radar data, and acoustic information from a comprehensive system of sensors and surveillance from shore.

Transportation Safety

PMRF transports ordnance including propellants (e.g., missiles) by cargo aircraft when available or by truck from Nawiliwili Harbor to PMRF along Highway 50 (see Figure 2.1-1). The barges carrying explosives are met at Nawiliwili Harbor by trained ordnance personnel and special vehicles for transit to and delivery at PMRF. All ordnance is transported in accordance with U.S. DOT regulations. PMRF has established PMRF Instruction (PMRFINST) 8023.G, and follows other guidelines (NAVSEA OP 5 Volume 1 Seventh Revision Table 7-5 and DoD 6055.9-STD Table C9.T16) that cover the handling and transportation of ammunition, explosives, and hazardous materials on the facility. Typically explosives are flown into PMRF; however, an event waiver from the U.S. DOT is required to ship anything higher than Hazardous Class 1.4 from Nawiliwili and commercial piers on Oahu (Bran, 2009).

To minimize the potential for any liquid propellant mishap on the island of Kauai, PMRF has developed the following transportation procedures:

- Trained spill response teams would be on standby for the transportation of all missile liquid propellants. Truck shipments on Kauai would have trained escorts.
- All shipments would be scheduled to avoid peak traffic periods for roads and to avoid high-use times for harbors.
- Local fire and police, and local area state transportation officials will be notified in advance of shipments, and informed by experienced personnel (and trained, if necessary) of existing safety procedures to be used during transportation on Kauai.
- Notice of shipment to State and local officials
- Propellant vapor leak check and liquid propellant container inspection prior to off-loading propellant from ship and after loading propellant into trucks

Range Control and the FAA are in direct communication in real time to ensure the 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, as discussed in Section 3.1.1.1.2.

Fire and Crash Safety

The Navy has developed standards that dictate the amount of fire/crash equipment and staffing that must be present based on the number and types of aircraft stationed on base, and the types and total square footage of base structures and housing. PMRF Crash/Fire is located in the base of the Air Traffic Control Tower, Building 300 and provides ambulance and Class II Emergency Medical Technician services. Personnel are trained to respond to activities such as aircraft fire fighting and rescue in support of airfield operations, hazardous material incidents, confined space rescue, and hypergolic fuel releases, plus structure and brush fire fighting, fire prevention instruction and fire inspections.

3.1.1.1.8 Land Use—PMRF/Main Base—Onshore

Region of Influence

The region of influence for land use includes the Main Base Complex and adjacent areas of the existing Restrictive Easement within the Mana Plain. Because KTF resides entirely within PMRF/Main Base, all discussion regarding land use and recreation stated for PMRF/Main Base would apply to KTF.

Affected Environment

On-base Land Use

PMRF's land use is managed via the 2006 Comprehensive Infrastructure Plan. The plan promotes efficient, effective use of resources through a consolidation of like land uses and the minimization, recognition, and deconfliction of existing constraints. The plan supports the protection of essential range operations from encroachment and the protection of human and natural environments (U.S. Department of the Navy, 2006b, U.S. Department of the Navy, 1998a).

According to the State Land Use Classification, PMRF is located within a conservation district (Figure 3.1.1.1.8-1). The 2000 Kauai General Plan and the Waimea-Kekaha Region Development Plan classify PMRF as a Military Land Use area. Kauai County has designated the dune area from Nohili Point to the north boundary of PMRF as a scenic ecological area.

The Nohili and Kinikini Ditches act as natural dividers, separating PMRF into three zones: North, Central, and South (Figure 3.1.1.1.8-1). The North Zone is used for rocket launches and its associated support activities, administration, and services. This includes ESQD Arcs and ground hazard areas. The Central Zone contains air operations, administration, supply, base services, range operations, ordnance maintenance, and fuel/supply. In addition, the runway has Clear Zones and Accident Potential Zones (I & II) as safety measures which are discussed further in Section 3.1.1.1.7. The South Zone contains housing, personnel support, recreational, communications and rocket launcher facilities (KTF). ESQDs and ground hazard areas exist for the rocket launcher pad as well. Additionally, KTF, as shown in Figure 3.1.1.1.8-1 is located in the northern portion of PMRF/Main Base.

On-base Recreation

Public access to the installation's approximately 200 feet wide by 2 mi long coastline is outlined in PMRFINST 5530.7 (March 2004). Individuals who can demonstrate Kauai residency can obtain a PMRF-approved beach access pass, which allows them access to the beach recreation area of Majors Bay at PMRF/Main Base. PMRF Range Operations maintains a 24-hour hotline, which is updated daily in order to provide information on recreational area access. Recreational activities include surfing, fishing, and boating. The physical areas accessible for fishing, surfing, recreation, and socializing run from Shenanigans (All-hands club) up to Kinikini Ditch (south end of runway). Under PMRFINST 5530.7, normal access is allowed 7 days a week from 0500 to 2200, except during heightened force protection conditions or range operational periods.

Off-base Land Use

Current land uses adjacent to PMRF are agricultural, recreational, and a landfill. No inhabited buildings are within these areas. The non-developed, open-type uses of these adjacent lands are compatible with range operations and safety requirements of PMRF. The State Land Use District Boundary Map classifies adjacent lands to the north of PMRF/Main Base (Polihale State Park) and adjacent lands to the South of PMRF/Main Base (Kekaha Landfill), as conservation (Figure 3.1.1.1.8-1). Adjacent lands to the east of PMRF/Main Base are classified as agricultural (formerly sugar cane fields). To the west of PMRF/Main Base is the Pacific Ocean (for Naval training and recreational activities). The state and county's designations are

EXPLANATION

- Road
- Elevation
- Proposed State Expansion Area for Polihale State Park
- Agriculture Preservation Initiative (API) Area
- Kamokala Magazines
- Existing Structure
- Kekaha Landfill
- Pacific Missile Range Facility - Main Base
- Special Management Area
- Agricultural
- Conservation
- Rural
- Urban

NORTH

0 0.5 1 2 Miles

State Land Use - Western Kauai, Hawaii

Kauai, Hawaii

Figure 3.1.1.1.8-1

compatible with base activities and limits development that would conflict with current use. PMRF activities which affect off-base land uses include those within the ESQD arcs, EMR areas, aircraft noise contours, and missile ground hazard areas. ESQD arcs that extend beyond the PMRF boundary include four areas in the northern area and one in the central portion of the base. The off-base land use within these state-owned lands has been designated by both the County and State as agricultural areas. Missile ground hazard areas which are only used during launch events, and extend off-base, occur in northern PMRF and encompass agricultural and recreational uses (See Figure 3.1.1.1.7-1 for a depiction of the existing Restrictive Easement). Specifically, adjacent areas to PMRF include Polihale State Park, the Agricultural Preservation Initiative (API) and the Kekaha Landfill (Figure 3.1.1.1.8-1).

Polihale State Park

Polihale State Park; a small area just east of PMRF North Gate; a parcel of land south of PMRF; and south makai (makai means "toward the sea"), from the Kekaha Landfill have been designated as special management areas (U.S. Department of the Navy, 1998a). Kauai County established guidelines for reviewing proposed developments in special management areas (Figure 3.1.1.1.8-1) as part of the Coastal Zone Management Act Program. Any development in these areas requires a special management use permit.

The Agricultural Preservation Initiative

In May of 2004, by amendments, the State Board of Land and Natural Resources approved the API (U.S. Department of the Navy, 2006a) which ensures lands adjacent to PMRF (5,586 acres), currently designated as agricultural by the State Land Use Commission, remain agricultural lands until December 31, 2030 ([U.S. Department of the Navy, 1998a).

The API includes 215 leased acres, which contain the pumping system for the Mana Plain. By placing the drainage pumps under a Navy lease, the Navy will be able to use Federal funds to maintain the pumps that help prevent flooding in the Mana Plain (U.S. Department of the Navy, 2006b).

Kekaha Landfill

Kekaha Landfill sits on 64 acres of land, of which 32 acres make up the footprint of the lined Subtitle-D landfill itself. Kekaha averages 230 tons of trash per day and 88,000 tons of trash per year. The Landfill was opened in 1953 and was expected to close in 2004, but was recently given permission to operate until approximately 2012 (Kauai Island Utility Cooperative, 2006). Kekaha Landfill is the only landfill on island suitable for landfill gas capture. A plan for gas recapture that could generate about 1.6 megawatts (MW) using reciprocating engine technologies is currently under development by PMRF and the County.

Off-base Recreation

Off-base recreation within the region of influence is limited to the 140 acres of Polihale State Park (Figure 3.1.1.1.8-1). The park provides overnight camping and day use recreational activities (swimming, shore fishing, subsistence fishing, picnicking). It is operated by the Department of Land and Natural Resources (DLNR), Division of State Parks, which estimates that half a million people visit during the day, each year. Approximately 70 acres of the southern extent of the park is within the restrictive easement boundary (Figure 3.1.1.1.7-1). Use of the restrictive easement may be exercised up to 30 times per year during launches conducted by the U.S. Government. In order to launch missiles from PMRF and KTF, the U.S. Government must, in accordance with DoD policy, be able to exclude nonparticipants from a ground hazard area (U.S. Army Space and Strategic Defense Command, 1993a). None of the developed campsites or picnic areas are within the restrictive easement or the ground hazard area (southern extent). The northern area, where picnicking and camping facilities are located, is accessible via a 5-mi dirt road from Highway 50 and is within a ground hazard area.

The Division of State Parks plans to expand Polihale State Park, subject to the availability of funds. The expansion would include a portion of a sugar cane field and cliffs adjacent to the park's boundary (Figure 3.1.1.1.8-1). The purpose is to encompass sensitive cultural resources and biological resources within the park boundary. No park development, other than interpretive trail signs, is expected within the expansion area (U.S. Department of the Navy, 1998a).

Coastal Zone Management

All Federal development projects in a coastal zone and all Federal activities which directly affect a coastal zone must be consistent to the maximum extent practicable with the Coastal Zone Management Program as authorized by the Coastal Zone Management Act of 1972. Federally owned, leased, or controlled facilities and areas are excluded from the State's Coastal Zone Management Plan, and are thus outside of the Coastal Zone.

In December 2007 the Kauai County Council passed a science-based shoreline setback ordinance. The law mandates a 40-foot minimum setback plus 70 times the annual coastal erosion rate as recommended in the Hawaii Coastal Hazard Mitigation Guidebook. The law preserves beaches and protects property owner's coastal assets. (The Garden Island, 2007, Hawaii Revised Statutes, 2007) Federally owned, leased, or controlled facilities are not subject to such requirements, but the Navy will remain consistent to the maximum extent possible or practicable.

3.1.1.1.9 Noise—PMRF/Main Base—Onshore

Region of Influence

The region of influence for noise analysis is the area within and surrounding PMRF/Main Base in which humans and wildlife may suffer annoyance or disturbance from noise levels at PMRF/Main Base. Receptors would be in all areas on the Mana Plain (PMRF, Polihale State Park, and former sugar cane fields), KTF, and the city of Kekaha.

Affected Environment

Primary sources of noise on PMRF/Main Base include airfield and range operations and missile, rocket, and drone launches. Airfield operations include take-offs and landings of high-performance and cargo/passenger aircraft, as well as helicopter operations. Range operations include training and RDT&E activities support. Ambient noise levels from natural sources include wind, surf, and wildlife.

Aircraft operations noise is quantified in the *Final Noise and Accident Potential Zone Study for the Pacific Missile Range Facility Barking Sands.* The noise contours for 2009 prospective flight operations (shown in Day/Night Sound Levels [DNL]) show that no more than 1 acre of land outside of PMRF boundaries falls within the 75-decibel (dB) noise contour area and no housing units or populations are impacted. In general, residential land uses are not compatible with a DNL above 65 dB but not to exceed 75 dB. Facilities at PMRF within these contours have been constructed to reduce interior noise levels. (U.S. Department of the Navy, Engineering Field Activity Chesapeake, 2006 and U.S. Department of Housing and Urban Development, 2004)

The activity with the most noticeable sound events is the launch of missiles, rockets, and drones. These launches result in high-intensity, short-duration sound events. Typical launches at PMRF/Main Base (including KTF launch sites) include Strategic Target System, THAAD, and Strypi missile launches, which have to date resulted in no public noise complaints. Table 3.1.1.1.9-1 lists the estimated noise levels for Strategic Target System launches at PMRF/Main Base.

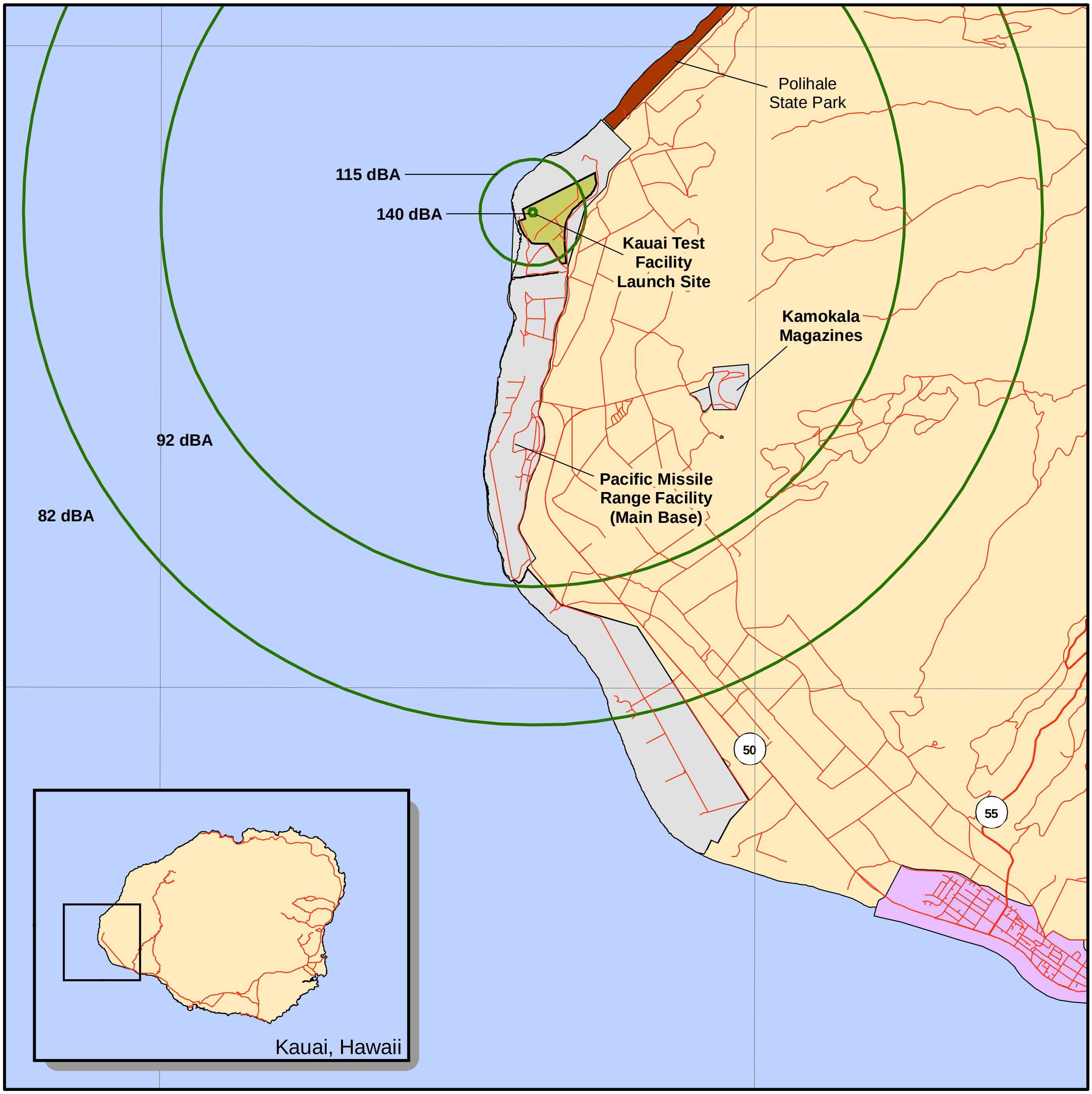
Table 3.1.1.1.9-1. Estimated Noise Levels for Strategic Target System Launches

Distance from Launch Pad (Miles)	dBA
0.05	107.89
1.0	100.21
2.0	91.47
4.0	81.28
8.0	69.17

Source: U.S. Army Strategic Defense Command, 1992
dBA= A-weighted Decibel

Figure 3.1.1.1.9-1 shows typical noise levels from launches at KTF launch facilities. Limits have been set by DoD and Occupational Safety and Health Administration (OSHA) to prevent damage to human hearing. Generally, noise levels above 140 A-weighted decibels (dBA) should not be exceeded at any time. A time-weighted limit for 15 minutes (or less) exposure is 115 dBA. In areas where these noise levels would be exceeded, personnel are required to wear hearing protection.

In addition to the noise from the rocket engine, launch vehicles can also generate sonic booms during flight. A sonic boom is a sound that resembles rolling thunder, and is produced by a shock wave that forms at the nose and at the exhaust plume of a missile that is traveling faster than the speed of sound. Shock waves that form at the nose and at the exhaust plume of a missile travelling faster than the speed of sound produce an audible sonic boom when they reach the ground. The sonic boom occurs some distance downrange of the launch site. The uprange boundary of the sonic boom carpet forms a parabola pointing downrange. Most of the region subjected to any sonic boom from launches at PMRF is the surface of the ocean. Thus, land based population centers are not affected. Under suitable atmospheric conditions and depending on the trajectory of the missile, low level sonic booms may reach the northern portion of Niihau, as is the case for current operations from PMRF. (ACTA, 2009)



EXPLANATION

50	State Highway		City of Kekaha
	Road		Kauai Test Facility
	Calculated Noise Level		Installation Area
	Polihale State Park		State/Private Land

Note: Noise levels calculated from modeling data and not based on the terrain or climate of the facility or surrounding area.

dBA = A-weighted decibels

NORTH

0 0.5 1 2 Miles

Typical Noise Levels (dBA) for Kauai Test Facility Launch Area

Kauai, Hawaii

Figure 3.1.1.1.9-1

3.1.1.1.10 Socioeconomics—PMRF/Main Base—Onshore

Socioeconomics describes the social and economic character of a community through the review of several metrics including population size, employment characteristics, income generated, and the type and cost of housing. This section presents a socioeconomic overview of the Kauai region.

Region of Influence

The region of influence for socioeconomics is defined as the island of Kauai, which covers 552 square miles. The entire island is designated as Kauai County.

Affected Environment

Population

In 2008, the population of Kauai County was estimated to be 63,689, which represents an estimated change of 8.9 percent from the 2000 census (58,463). Of the estimated 63,689, 49.4 percent are female and 50.6 percent are male. (U.S. Census Bureau, 2009) Table 3.1.1.1.10-1 summarizes the demographics of the population of Kauai in 2008. Table 3.1.1.1.10-2 illustrates the age profile of those living in Kauai County in 2008. In 2008 the medium household income for Kauai County was $61,842 (Economic Development Intelligence System, 2009).

Table 3.1.1.1.10-1. Demographics of the Estimated Population of Kauai in 2008

Persons		**63,689**
Race	Asian	20,253
	White	23,374
	Native Hawaiian and Other Pacific Islanders	5,732
	Hispanic/Latino	6,687
	Black or African American	446
	American Indian and Alaska Native	318
	Other	6,879
Female		**31,463**
Male		**32,226**

Source: U.S. Census Bureau, 2009.

Table 3.1.1.1.10-2. Age Profile of Kauai County Residents in 2008

Age group (years)	Kauai County		State of Hawaii	
	Population 63,689	Percentage	Population 1,288,198	Percentage
Under 5 years old	3,949	6.2	87,597	6.8
Under 18 (5–17 years)	14,203	22.3	284,693	22.1
18 years–64 years	36,047	56.6	725,255	56.3
65 and over	9,490	14.9	190,653	14.8

Source: U.S. Census Bureau, 2009.

Income

The DoD is the second major source of revenue to the State of Hawaii; second only to tourism. The total spending by the armed services in Hawaii in 2007 was $8.2 billion, which resulted in a total of $12.2 billion to Hawaii's economy and accounted for more than 110,000 jobs and $7.6 billion in household earnings. (Chamber of Commerce of Hawaii, Military Affairs Council, 2009)

PMRF is a major contributor to the economy of Kauai County, particularly on the western side of the island. The installation employs 850 military, civilian, and contract personnel and adds $130 million annually to the local economy. The American Recovery and Reinvestment Act of 2009 has proposed to stimulate economic growth by creating jobs through investments in infrastructure improvements and expanding energy research that will lead the way toward energy independence of our country. Hawaii is slated to directly receive $1.4 billion. This amount does not include funds going directly to individuals, such as tax credits and bonus social security checks, nor does it include direct Federal agency spending in Hawaii that will take place over the next 2 years (Lingle, 2009). PMRF is estimated to receive $31,500 for runway repair (American Recovery and Reinvestment Act, 2009). Over $944 million has been invested in and around PMRF, and it is the largest industrial and technology employer on the Island (Inouye, 2009). In 2004, it was estimated that FY 2005 expenditures for PMRF and other defense initiatives on Kauai would total about $113 million (Inouye, 2004). Resources such as PMRF provide both an infrastructure and market for Hawaii's expanding technology sector (State of Hawaii Department of Business, Economic Development and Tourism, 2001).

Housing

In 1993, housing on Kauai was characterized as overcrowded, costly, and in short supply (U.S. Department of the Navy, 1998a). In December 2006, sales remained fairly steady for all homes on Kauai: half sold for more than $592,500 and half for less, as the median price dropped 2 percent (Star Bulletin, 2007). Condominium prices on Kauai increased by 17.7 percent up to $570,000 in December 2006 from $484,500 in December 2005 (Star Bulletin, 2007). According to statistics from the Multiple Listing Service, the number of sales of single-family homes—island wide—went from 23 in October 2008 to 32 in October 2009. This resulted in a 39.13 percent increase when comparing 2008 and 2009 results. Sales volume of single-family homes jumped 57.66 percent between October 2008 and October 2009. Median sales prices for single-family homes on Kauai went down, island wide, from $515,000 in October 2008 to $446,500 in October 2009. The median price of condominiums (island wide) decreased from $520,000 in October 2008 to $395.000 in October 2009. (Hawaii Information Services, 2009)

Employment

In 2009, government and tourism were the main employment generators. In FY 2006, PMRF employed a total of 821 employees, which included 128 DoD civilian personnel, 54 military personnel, 609 contractor personnel, and 30 HIANG employees.

Unemployment in Kauai has steadily increased from 3.0 percent in January 2008 to 8.9 in January 2009*.* The September 2009 unemployment rate *was* 9.6 (Economagic.com, 2009). The 1998 unemployment rate *was* 11.6 percent.

Tourism

The tourism industry has been the economic mainstay of the Hawaiian Islands since statehood in 1959. After 4 years of growth from 2004 to 2007, combined expenditures by visitors who came to Hawaii by air or by cruise ships fell 11 percent in 2008, to $11.4 billion. In 2008 there were a total of 9,156,032 visitors to Hawaii, and 12 percent (1,101,753) of that total came to the island of Kauai—a 19.7 percent decrease. Between January and September 2009 the number of tourists to the Island of Kauai ranged from 70,149 to 95,975 (State of Hawaii, Department of Business, Economic Development & Tourism, 2009).

The state-wide hotel occupancy rate for 2008 was 70.4 percent, down from 75 percent in 2007. All four of the larger islands experienced lower hotel occupancy rates compared to the previous year. The largest decline was on the Island of Hawaii; Kauai was at 70.4 percent (-5.4 percentage points). For Kauai, all types of accommodations experienced fewer visitors compared to 2007. The most significant declines were in cruise ships (-59.2 percent) and hotels (-19.9 percent). (State of Hawaii, Department of Business, Economic Development & Tourism, 2008)

Education

Each year since FY 2000, the DoD has contributed $5 million to the Hawaiian public education system via the Joint Venture Education Forum. The Joint Venture Education Forum was started in 1998 as a cooperative effort between the Hawaii Department of Education and U.S. Pacific Command, and was formalized as an organization, via charter, in August of 2005. Additionally, in FY 2007-08, $5.5 million was provided to improve infrastructure for Hawaii's public schools with high enrollments of military children; more than $41 million has been given over the past 8 years (Chamber of Commerce of Hawaii, Military Affairs Council, 2008).

3.1.1.1.11 Transportation—PMRF/Main Base—Onshore

Region of Influence

The region of influence for transportation includes ground transportation and waterways in the vicinity of PMRF expected to be utilized for PMRF for training and other activities. There are no railways within the region of influence. See Section 3.1.1.1.2 for the discussion on PMRF/Main Base airways.

Affected Environment

Imiloa Road is a two-lane roadway that provides direct access to PMRF from the southwest through its intersection with State Highway 50 (Kaumualii Highway), a primary circulation route connecting the base with Kekaha and Lihue. Kaumualii Highway, in the vicinity of Imiloa Road, is a two-lane road with a posted speed limit of 50 mi per hour. On September 20 and 21, 2005, a Hawaii Department of Transportation traffic counter, located on Kaumualii Highway between Imiloa Road and Kao Road, measured 24-hour total volumes of 469 and 516 vehicles respectively. The average daily volume of 493 translates to Level of Service (LOS) B, which is a 50 to 75 percent volume-to-capacity of the roadway capacity. Another traffic counter between Imiloa Road and Kia Road on the same days counted 749 and 747 vehicles respectively in a 24-hr period, which again translates into LOS B (Hawaii Department of Transportation, 2005; Transportation Research Board, 2000; 2006). North Nohili Road, which branches off Imiloa Road, provides access to KTF.

Waterways around PMRF are used for the delivery of PMRF materials. Barges carrying PMRF required materials (e.g., explosives) are met at Nawiliwili Harbor by trained personnel for transit and delivery by truck to PMRF.

3.1.1.1.12 Utilities—PMRF/Main Base—Onshore

Region of Influence

The utility systems that could potentially be affected include potable water distribution, wastewater collection, solid waste collection and disposal, and electrical lines within or servicing the project sites.

Affected Environment

Water

Potable water at PMRF is a blend of on-base and municipal sources, including both the State DLNR and the Waimea-Kekaha Service Area of the Kauai Department of Water. The water department of Kauai County supplies water to PMRF that originates from the Kekaha's Waipao Valley Well, Paua Valley Well, and Shaft 12, as well as Waimea wells A and B (County of Kauai, Department of Water, 2006 and Naval Facilities Engineering Command, Hawaii, 2007). PMRF's portion is stored in two 126,000-gallon tanks at Kokole Point. These sources serve the southern portions of the base. The DLNR supply water originates from the Mana well (located approximately 1,000 feet south of the Kamokala Ridge magazine), which is pumped to PMRF and stored near the Main Hanger in one 100,000-gallon tank and one 420,000-gallon tank. This source serves the central and northern portions of the base (U.S. Army Space and Missile Defense Command, 2002). In 2006, PMRF's water consumption from the Mana well system was 78,533,000 gallons and 10,817,909 gallons from the Kauai County Department of Water. The monthly consumption from the Mana well ranged from as low as 3,753,000 gallons in November 2006 to as high as 8,827,000 gallons in July 2006. The monthly consumption from the Kauai County Department of Water ranged from as low as 215,147 gallons in November 2006 to as high as 1,719,843 gallons in May 2006 (Maintenance Logs and Records-PMRF, 2006). The Navy chlorinates and fluoridates all purchased water before distribution, except that provided by the State of Hawaii (Commerce Business Daily, 2000). The maximum delivery capacity of water from the state is 320,000 gallons per day (GPD).

Wastewater

The PMRF wastewater system comprises two domestic sewage treatment facilities and a collection system. These facilities include a treatment plant located approximately one half-mile south of the Main Gate and an oxidation pond south of the family housing area (U.S. Army Space and Missile Defense Command, 2002). A package treatment plant located at PMRF/Main Base treats approximately 8,000 GPD, or 27.7 percent of its 30,000-GPD design capacity. On the southern end of the base, an oxidation pond receives 20,000 to 25,000 GPD of its 54,000-GPD capacity. Both sites discharge their effluent into leach fields. For the period of 6 June 1995 to 31 May 1996, the average flow into the leach field (situated between the runway and the coast) was 9,500 GPD, or 37 percent of its 26,000-GPD design capacity. PMRF also has approximately 22 septic tank/leachfield systems and cesspools serving individual buildings in the northern part of PMRF/Main Base (U.S. Army Space and Missile Defense Command, 2002; Commerce Business Daily, 2000).

Solid Waste

Kauai County's Kekaha Landfill sits on 64 acres of land, of which 32 acres make up the footprint of the lined Subtitle-D landfill itself. Kekaha averages 230 tons per day and 88,000 tons per year. The Landfill was opened in 1953 and was expected to close in 2004, but was recently given permission to operate until approximately 2012. The FY 2006 total for refuse deposited into the landfill from PMRF was 530.6 tons, and 252.32 tons were recycled by PMRF (Burger and Nizo, 2007). To minimize waste flow, PMRF maintains a recycling program for aluminum cans, glass, paper and cardboard, all of which are collected biweekly. Green waste is collected and chipped for composting and use on the base (U.S. Army Space and Missile Defense Command, 2002).

Electricity (Energy)

Until recently, PMRF's municipal power was provided by Kauai Electric; however, in 2002 Kauai Electric was purchased by KIUC (Pacific Business News, 2002). The total firm electrical generating capacity on the island is 110 MW, with an additional 4.1 MW provided by non-firm sources (Kauai County, 2005).

PMRF is located in Kauai County's West Side region. The West Side's main transmission line runs along Kaumualii Highway from Port Allen to Mana, and includes double circuits between Port Allen and Kekaha. There are switchyards in Kekaha and Port Allen, as well as substations in Mana and Kaumakani (Kauai County, 2005). Power to PMRF/Main Base and northern complex area is supplied via a 57-kilovolt (kV)/69-kV transmission line between the KIUC's Mana Substation and Kekaha Switchyard. This West Side transmission line's capacity is 7.6 MW at 95 percent power factor; the current peak load is 2.5 MW (U.S. Department of the Navy, Naval Sea Systems Command, 2005). A 12.47-kV feeder circuit system owned by KIUC supplies primary power to the base's southern area; this circuit has a capacity of 4.3 MW at 95 percent power factor (U.S. Department of the Navy, Naval Sea Systems Command, 2005). In the event of a power outage PMRF provides additional power, utilizing commercial power as a backup. The PMRF power plant contains two 600-kW and three 300-kW generator units (U.S. Army Space and Missile Defense Command, 2002).

PMRF has been recognized for these energy-saving efforts, as well as initiating innovative high-tech energy conservation projects, including using methane gas, by the County of Kauai's Kekaha landfill and using fuel cells to support range operations (U.S. House of Representatives, 2003). In 2003 PMRF energy consumption had been considerably reduced from its 1985 baseline, allowing the KIUC to redirect energy to other areas on the island (U.S. House of Representatives, 2003). Since 2005, photovoltaic panels have been used to augment base requirements without increasing consumption from the island's commercial electric utility grid (Naval Facilities Engineering Command, Hawaii Public Affairs, 2005).

3.1.1.1.13 Water Resources—PMRF/Main Base—Onshore

Region of Influence

The region of influence for PMRF/Main Base includes the area within and surrounding the PMRF property boundaries. The region of influence also includes KTF and the restrictive easement, including the Mana Plain and the ground hazard area.

Affected Environment

For analysis purposes, water resources are divided into surface water, groundwater, and flood hazard areas. Any descriptions of fresh water quality and well water supplies can be found in the Utilities section of this EA/OEA.

Surface Water

The surface waters within the PMRF boundary are limited to the pump discharges into canals that connect the Mana Plain with the Pacific Ocean: Kinikini Ditch and Nohili Ditch outfalls. These easements have been in place for decades, allowing the agricultural lands to the east of PMRF/Main Base to dewater to an elevation approximately 2 feet below mean sea level. Throughout the Plain, a series of inter-connected drainage ditches converge at two pumping stations that are within an area leased to the U.S. Navy. In addition, there are several irrigation ponds within the agricultural lands beyond the Navy-leased buffer zone. (Burger, 2010a)

The waters in the irrigation ponds generally do not meet drinking water standards for chloride salts, but have near neutral to slightly alkaline pH. A surface water quality study for chloride was conducted in the Mana Plain/KTF area. The chloride levels do not indicate residual hydrochloric acid effects of the past launches at KTF (U.S. Army Program Executive Office, 1995). The surface waters on the southern half of PMRF/Main Base are expected to have similar chemical characteristics. Because the drainage ditches are designed to move water away from the agricultural fields during irrigation and rainfall, and to leach salts from the soil, no residual effects of past launches are expected. (U.S. Army Program Executive Office, 1995)

Surface water in the area of the restrictive easement on the Mana Plain is restricted to drains and agricultural irrigation ponds. Within the restrictive easement boundary, the surface water and storm water runoff drain onto former sugar cane lands and agricultural ponds below the Mana cliffs. The Mana Plain is drained by canals that flow seaward. Typically, the water from the canals that drain from the agricultural fields is brackish. (U.S. Army Space and Strategic Defense Command, 1993a)

Water quality along the PMRF shoreline was within Department of Health standards, with the exception of two locations where sugar cane irrigation water, pumped from the sugar cane fields, was discharged to the ocean (Belt Collins Hawaii, 1994). In these areas, Department of Health water quality criteria were exceeded within 164 feet of the shoreline. Mixing processes are sufficient to dilute the drainage water to near background levels within 164 to 328 feet of the shoreline (Belt Collins Hawaii, 1994). These outfall locations are currently monitored under a National Pollutant Discharge Elimination System Permit that is held by the Agribusiness Development Co-Operative (Burger, 2010a).

Groundwater

Groundwater in the region is generally considered to be potable at the base of the cliffs, increasing in salinity closer to the coast (U.S. Army Space and Strategic Defense Command, 1993a). The groundwater beneath the restrictive easement increases in salinity from the base of the Mana cliffs to the Pacific Ocean. Bedrock, alluvium, and sand dunes make up hydraulically connected aquifers within the region of influence. The bedrock (basement volcanics, primarily basalt) is highly permeable, containing brackish water that floats on seawater. (U.S. Army Space and Strategic Defense Command, 1993a)

The overlying sediments act as a caprock because of their overall low permeability, although individual layers, such as buried fossil coral reefs, may be as permeable as the basalt. 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 has a moderate hydraulic conductivity and moderate porosity of about 20 percent. It consists of a lens of brackish groundwater that floats on seawater and is recharged by rainfall and by seepage from the underlying sediments. The only record of an attempt to exploit this groundwater is of a well drilled for the Navy in 1974, 4 to 5 mi south of KTF. In 1992, the water was too brackish for plants and animals to consume; consequently, the well is not used. (U.S. Army Program Executive Office, 1995)

Sampling for perchlorate was initiated at PMRF in 2006. USEPA adopted an oral reference dose for perchlorate in 2009, following a National Academy of Sciences recommendation that it not exceed 15 parts per billion in drinking water. Until USEPA promulgates standards for perchlorate, the DoD has established 15 parts per billion as the current level of concern for managing perchlorate (Office of the Under Secretary of Defense, 2009). This level has also been adopted in the Navy Perchlorate Sampling and Management Policy.

As part of the implementation of the Navy policy, perchlorate sampling has been conducted at two drinking water supply locations. One location is the “Mana well,” which is the former Kekaha Sugar/AMFAC well from which PMRF obtains drinking water, referenced as “BS 335,” and supplies the “north end” of PMRF. The other location is the water tank at the southern end of the base identified as reference code “BS 820.” Water in the tank comes from the County of Kauai.

Perchlorate concentrations at both sites were less than the initial screening level of 4.0 parts per billion. Based on guidance PMRF received from Navy Region Hawaii, since the two consecutive samples were less than 4 parts per billion, no further analysis was required.

Flood Hazard Areas

In accordance with Executive Order 11988 (Floodplain Management), each Federal agency shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities for (1) acquiring, managing, and disposing of Federal lands and facilities; (2) providing Federally undertaken, financed, or assisted construction and improvements; and (3) conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities.

On PMRF/Main Base the primary floodplain hazard is from overflow of the ditches that drain the Mana Plain. Extended periods of heavy rainfall have resulted in minor flooding of low-lying areas of PMRF/Main Base. The Nohili and Kinikini ditches act as a natural divider, separating PMRF in to three zones: North, Central, and South (Figure 3.1.1.1.8-1). As it relates to the location of Nohili ditch, the Exoatmospheric Discrimination Experiment, KTF Pad 1, and Aegis sites are located to the North of the ditch and the Calibration Lab East site is to the south of the ditch. The THAAD Admin Area is located further south of Nohili Ditch and HIANG PMRF and the Golf sites are located further south, outside of the Nohili and Kinikini Ditches potential flood zone area. In addition, some of PMRF/Main Base is within the tsunami evacuation area.

3.1.1.2 Kamokala Magazines—Onshore

Kamokala Magazines are located approximately 2 mi east of PMRF/Main Base. Kamokala Magazines is a secure explosive storage area consisting of 10 earthen tunnel-type magazines and two earth-covered magazines.

This section describes the environmental resources that would be affected by the No-action Alternative and Proposed Action for Kamokala Magazines. Of the 13 resources considered for analysis, air quality, airspace, biological, geology and soils, land use, noise, socioeconomics, transportation, utilities, and water resources are not addressed.

3.1.1.2.1 Cultural Resources—Kamokala Magazines—Onshore

Region of Influence

The region of influence at the Kamokala Magazines encompasses one or more magazines that may require minor HVAC upgrade. The ordnance area consists of 10 tunnel magazines and two newer magazines used for the storage of ordnance items. The ten cave/tunnel-type magazines have been determined eligible for inclusion in the NRHP within the context of World War II (International Archaeological Resources Institute, Inc., 2005); however, the magazines that will be utilized for the activities described within this EA/OEA are situated adjacent to the historic ordnance caves and were constructed in 2002.

Affected Environment

Archaeological Resources (Prehistoric and Historic)

The Kamokala Magazine area has been surveyed for archaeological resources and no significant sites were identified (International Archaeological Resources Institute, Inc., 2005).

Historic Buildings and Structures

The two magazines that will be utilized for this program are located adjacent to the historic caves. They were built in 2002 and are not historic properties.

Traditional Resources

There are no identified traditional Hawaiian sites in the area of the Kamokala Magazines (International Archaeological Resources Institute, Inc., 2005).

3.1.1.2.2 Hazardous Materials and Waste—Kamokala Magazines—Onshore

Region of Influence

The region of influence for hazardous materials and potential hazardous waste would be limited to areas of Kamokala Magazines where hazardous materials are stored, handled, and consumed. The only hazardous materials stored at the Kamokala Magazines are associated with the devices authorized for storage; specifically, hypergolic fuels, solid propellants, and other ordnance. These materials are contained in the devices that are required to be stored in the Kamokala Magazines with proper ventilation, marking, and placarding.

Affected Environment

The magazines are a secured area controlled by the PMRF Ordnance Office, Code 7331, and they are the storage sites for the ordnance and solid rocket motors used in training events at PMRF. When needed, they are transported to the launch or loading site. All explosive ordnance, including solid rocket motors, is handled in accordance with Naval Sea Systems Command Publication (NAVSEAOP) 5, Volume 1.

3.1.1.2.3 Health and Safety—Kamokala Magazines—Onshore

Region of Influence

The region of influence for health and safety consists of the immediate work areas and ordnance hazard areas. The region of influence for public safety includes Kamokala Magazines, Mana Plain, and the ESQD not within the surrounding cliffs.

Affected Environment

Kamokala Magazines are an explosive storage area consisting of 10 tunnel-type magazines and two newer magazines. The health and safety issues for Kamokala Magazines are associated with the transfer and storage of ordnance. No more than 30,000-pound net explosive weight can be stored at each magazine cave; this generates a safety area with a 2,350-foot radius in a 60-degree arc to the front of each 30,000-pound net explosive weight tunnel, diminishing in radius by 30-degree increments away from the front (see Figure 3.1.1.1.7-1). Ordnance is stored in accordance with DoD and Navy standards. In addition, PMRF has established instruction 8023.G, which details how the storage and handling of ordnance is conducted.

3.1.2 KAUAI—OFFSHORE

Kauai Offshore addresses State waters (0-3 nm offshore) and other offshore waters within 12 nm of Kauai and Niihau, including ranges and training areas where activities are performed by the Navy. Discussions may include PMRF Offshore Barking Sands Tactical Underwater Range (BARSTUR) and the Barking Sands Underwater Range Extension (BSURE]) and Niihau Offshore. These offshore areas are not within the Hawaiian Islands Humpback Whale National Marine Sanctuary.

3.1.2.1 PMRF Offshore

PMRF Offshore includes ranges and training areas 0 to 12 nm from PMRF/Main Base. Included in PMRF Offshore are BARSTUR and BSURE, which are within the 12-nm area from PMRF/Main Base. BARSTUR is a 104-square nm range used for anti-submarine training. BSURE provides the capability to support Anti-Submarine Warfare training and over 80 percent of PMRF's underwater tracking capability.

This section describes the environmental resources that would be affected by the No-action Alternative and Proposed Action for PMRF Offshore. Of the 13 environmental resources considered for analysis, air quality, airspace, geology and soils, hazardous materials and waste, health and safety, land use, noise, utilities, and water resources are not addressed.

3.1.2.1.1 Airspace Resources—PMRF—Offshore

Region of Influence

The region of influence for airspace includes the airspace over and within 12 nm of PMRF/Main Base.

Affected Environment

The affected airspace is described in PMRF/Main Base Onshore, Section 3.1.1.1.2 and Open Ocean, Section 3.4.1.

3.1.2.1.2 Biological Resources—PMRF—Offshore

Region of Influence

The region of influence for offshore biological resources is the ocean area from the shoreline out to 12 nm.

Affected Environment

Vegetation

The substrates of Hawaiian rocky intertidal habitats are mostly consolidated basalts with some consolidated limestones (cemented beach rock or raised coral reefs). Common plants found in rocky intertidal habitats include sea lettuce, Sargasso or kala, coralline red algae, red fleshy algae, brown algae, and fleshy green algae. (U.S. Department of the Navy, 2005c)

Algal species on the limestone bench fronting Nohili Point preferred by the green sea turtle include but are not limited to lipuupuu, kala-lau-nunui, pahalahala, and mane`one`o. The algal and macroinvertebrate survey in Majors Bay noted that four macroalgal and eight macroinvertebrate species were present. (Pacific Missile Range Facility, 2001; Commander, Navy Region Hawaii, 2007)

Threatened and Endangered Vegetation

No threatened or endangered vegetation is located in the offshore area.

Wildlife

A description of the coral reef area associated with the Hawaiian Islands and its management by both the State of Hawaii and the Federal government is provided in Section 3.4.2.1. North of Mana Point on Kauai, a narrow fringing reef follows the coastline up to Nohili Point and Barking Sands (Figure 3.1.2.1.2-1). Coral density is low and is dominated by lobe coral and small stands of arborescent (branched or tree shaped) corals. Broad uncolonized pavement (1,772 feet wide) and colonized pavement (2,297 feet wide) stretch along the coastline seaward of the fringing reef. North of Nohili Point, the uncolonized pavement ends and the colonized pavement continues along a northward heading; it turns gradually to the east to join the coastline north of Keawanui. (U.S. Department of the Navy, 2007) Uncolonized pavement is flat, low relief, solid carbonate rock often covered by a thin sand veneer. The surface of the pavement often has sparse coverage of macroalgae, hard coral, and other sessile invertebrates that does not obscure the underlying surface. Colonized pavement is flat, low-relief, solid carbonate rock with coverage of macroalgae, hard coral, and other sessile invertebrates that are dense enough to begin to obscure the underlying surface. (Center for Coastal Monitoring and Assessment, 2006)

Wave action is the main natural control on coral reef structure along the coastline of the Hawaiian Islands (Grigg, 1997a; Jokiel et al., 2001; 2004). Corals in wave-exposed areas die as fast as they can be replaced (Grigg, 1997a). The breaking, scouring, and abrading action caused by waves on corals yields high mortality. Hence, no coral accretion takes place in wave-exposed areas. Despite the fact that wave action limits the accretion of reef building corals, reefs are also found along the north coastline of Kauai. (Maragos, 2000)

The general marine topography of the nearshore region off of PMRF consists of four sectors separated by distinct physiographic and biotic structure. The first three of these sectors are (1) the Nohili Sector, which extends from the northern end of the property to approximately the location of Nohili Ditch; (2) the Mana Point Sector, which extends southward to the southern part of Mana Point; and (3) the Majors Bay Sector, which extends to the southern boundary of PMRF at Kokole Point extending from the shoreline to a depth of approximately 49 feet. The fourth sector is considered the Offshore Sector, and extends along most of the entire length of PMRF within the depth range of 49 to 66 feet. (Commander, Navy Region Hawaii, 2007)

Total coral cover in the Nohili Sector ranges from 32 to 39 percent of bottom cover. The most abundant coral species are lobe coral, rose or cauliflower coral, and ringed rice coral. Macroinvertebrates in this area include the rock oyster, cone shells, sea urchins, and sea cucumbers. Along the central portion of PMRF in the Mana Sector, living coral is sparsely distributed, approximately one half of that found in the Nohili area. The dominant species is

Offshore Hardbottom Habitats of Pacific Missile Range Facility

Kauai, Hawaii

Figure 3.1.2.1.2-1

lobe coral. Coral cover in the Major's Bay Sector is less than 2 percent. The algal and macroinvertebrate survey in Majors Bay noted that eight macroinvertebrate species were present. (Pacific Missile Range Facility, 2001; Commander, Navy Region Hawaii, 2007)

The predominant coral found in the Offshore Sector is antler coral, which occurs as single large branching colonies. Other corals found on the platform are primarily smaller species which have a collective coverage of about 5 percent of bottom cover: rose or cauliflower coral, lobe coral, corrugated coral, flat lobe coral, Verrill's ringed rice coral, rice coral, crust coral, and mushroom coral. (Commander, Navy Region Hawaii, 2007)

Black coral is found south of Kauai outside the region of influence, closer to shore and in shallower water than black coral of other Hawaiian Islands (Western Pacific Regional Fishery Management Council, 2006).

Essential Fish Habitat (EFH) occurs and is incorporated within Kauai's Exclusive Economic Zone (EEZ), the 200-mi limit around the island. Pursuant to the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), the National Marine Fisheries Service (NMFS), eight regional fishery management councils (Councils), and other Federal agencies are mandated to identify and protect important marine and anadromous fish habitat. The Councils (with assistance from NMFS) are required to delineate EFH for all managed species. Federal agencies which fund, permit, or carry out activities that may adversely affect EFH are required to consult with NMFS regarding potential effects on EFH.

The MSFCMA defines EFH as those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity (16 U.S.C. § 1802). These waters include aquatic areas and their associated physical, chemical, and biological properties used by fish, and may include areas historically used by fish. Substrate types include sediment, hard bottom, structures underlying the waters, and associated biological communities.

EFH can consist of both the water column and the underlying surface (e.g., seafloor) of a particular area. Areas designated as EFH contain habitat essential to the long-term survival and health of our nation's fisheries. Certain properties of the water column such as temperature, nutrients, or salinity are essential to various species. Some species may require certain bottom types such as sandy or rocky bottoms, vegetation such as sea grasses or kelp, or structurally complex coral or oyster reefs. EFH also includes those habitats that support the different life stages of each managed species, as a single species may use many different habitats throughout its life to support breeding, spawning, nursery, feeding, and protection functions. Specific information on EFH is further described in a separate document, *Essential Fish Habitat and Coral Reef Assessment for the Hawaii Range Complex EIS/OEIS* (U.S. Department of the Navy, 2007).

EFH for adult and juvenile bottomfish includes the water column and all bottom habitats extending from the shoreline to a depth of 219 fathoms, which encompasses important steep drop-offs and high relief habitats. Shallow-water (0 to 328 feet) bottomfish species include uku or grey snappers, thicklip trevallies, groupers, and amberjacks. Deep-water (328 to 1,312 feet) species include ehu or squirrelfish snapper, onaga or red snapper (opapaka or pink snapper, and hapu`upu`u or Hawaiian grouper. (Western Pacific Regional Fishery Management Council, 2005)

Pelagic habitat areas of particular concern that include the offshore area are designated as the water column down to 3,280 feet from the shoreline to the EEZ that lies above all seamounts and banks shallower than 1,100 fathoms. Marketable pelagic species include striped marlin, bluefin tuna, swordfish, albacore, skipjack, and various sharks. Banks with summits less than 16.3 fathoms have been designated as a habitat area of particular concern for crustaceans. Crustacean species include spiny lobsters, slipper lobsters, and Kona crabs. (Western Pacific Regional Fishery Management Council, 2005)

Common animals found in rocky intertidal habitats include limpets or `opihi (*Cellana exerata*), periwinkles, littorine snails, rock crabs or `a`ama), gastropods (, and rock urchins. Adjacent to rocky shoreline, offshore waters are possible feeding areas for the threatened green sea turtle. (U.S. Department of the Navy, 2005c)

Spinner dolphins are the most commonly recorded cetaceans observed within 12 nm of the PMRF coastline. The spinner dolphin inhabits bays and protected waters, often in waters less than 40 feet deep (Pacific Missile Range Facility, 2001). Monitoring for Rim of the Pacific (RIMPAC) Exercises in 2006 showed that spinner dolphins are seen daily in the offshore area of Kekaha Beach, Kauai (near PMRF/Main Base) despite being accompanied regularly by tour boats (U.S. Department of the Navy, 2006a). Spinner dolphins are expected to occur in shallow water resting areas (about 162 feet deep or less) throughout the middle of the day, moving into deep waters offshore during the night to feed.

A small-boat based survey for odontocetes was undertaken off the islands of Kauai and Niihau in October and November 2005 to photo-identify individuals and collect genetic samples for examining stock structure. Survey coverage was from shallow coastal waters out to over a 9,842-foot depth, though almost half was in waters less than 1,640 feet in depth. There were 56 sightings of five species of odontocetes: 30 spinner dolphins; 14 bottlenose dolphins; 6 short-finned pilot whales; 5 rough-toothed dolphins; and 1 pantropical spotted dolphin. (Baird et al., 2006)

Threatened and Endangered Wildlife Species

Table 3.1.2.1.2-1 lists threatened and endangered species that are known or expected to occur in the offshore areas off PMRF/Main Base. A petition to list 83 species of coral was submitted to the Secretary of Commerce in October 2009 (Center for Biological Diversity, 2009). A 90-day finding on this petition was published in the Federal Register on 10 February 2010 (National Oceanic and Atmospheric Administration, 2010). Two of these species, blue rice coral (*Montipora flabellata*) and ringed rice coral (*Montipora patula*), have been identified as occurring within the region of influence. The coral species likely to be found offshore of the Hawaiian Islands and the NWHI are provided in Table 3.1.2.1.2-1.

Green and hawksbill (*Eretmochelys imbricata*) sea turtles are the most common sea turtles in offshore waters around the Main Hawaiian Islands, as they prefer reef-type environments that are less than about 55 fathoms in depth (U.S. Department of the Navy, 2005c). Additional information on sea turtles is provided in Section 3.4.2.3. Green sea turtles have been observed offshore of Nohili Ditch, the only area where basking/haul-out activity on PMRF/Main Base is observed. The PMRF Natural Resources Manager monitors sea turtle activity at PMRF. Security patrol reports include a record of the presence and locations of sea turtles. Any records of green sea turtle sitings are maintained by the PMRF Environmental Office. (Pacific Missile Range Facility, 2001)

Table 3.1.2.1.2-1. Listed Species Known or Expected to Occur Offshore of PMRF/Main Base

Scientific Name	Common Name	Federal Status
Coral[1]		
Acropora paniculata	Fuzzy table coral	P
Agaricia lamarcki	Lamarck's sheet coral	P
Cyphastrea agassizi	Agassiz's coral	P
Cyphastrea ocellina	Ocellated coral	P
Leptoseris incrustans	Swelling coral	P
Montipora dilatata	Irregular rice coral	P
Montipora flabellata	Blue rice coral	P
Montipora patula	Ringed rice coral	P
Porites pukoensis[2]	Blue lobe coral	P
Psammocora stellata	Stellar coral	P
Reptiles		
Caretta caretta	Loggerhead sea turtle[3]	T
*Chelonia myda*s	Green sea turtle	T
Dermochelys coriacea	Leatherback sea turtle	E
Eretmochelys imbricata	Hawksbill sea turtle	E
Lepidochelys olivacea	Olive ridley sea turtle	T
Birds		
Oceanodroma castro	Band-rumped storm-petrel	C
Phoebastria albatrus	Short-tailed albatross[4]	E
Pterodroma phaeopygia sandwichensis	\`Ua\`u (Hawaiian dark-rumped petrel)	E
Puffinus auricularis newelli	\`A\`o (Newell's Townsend's shearwater)	T
Mammals		
Megaptera noveangliae	Humpback whale	E
Monachus schauinslandi	Hawaiian monk seal	E

Source: U.S. Fish and Wildlife Service, 2006b; 2005a;b; 2007a; U.S. Department of the Interior, Office of Environmental Policy and Compliance Pacific Southwest Region, 2007; U.S. Fish and Wildlife Service, 2007b; Center for Biological Diversity, 2009; National Oceanic and Atmospheric Administration, 2010

Notes: 1 Being considered for listing as threatened or endangered
2 Located off Molokai only
3 Considered for listing as endangered
4 Observed in May 2000

Key to Federal Status:
C = Candidate
P = Petition to list
T = Threatened
E = Endangered

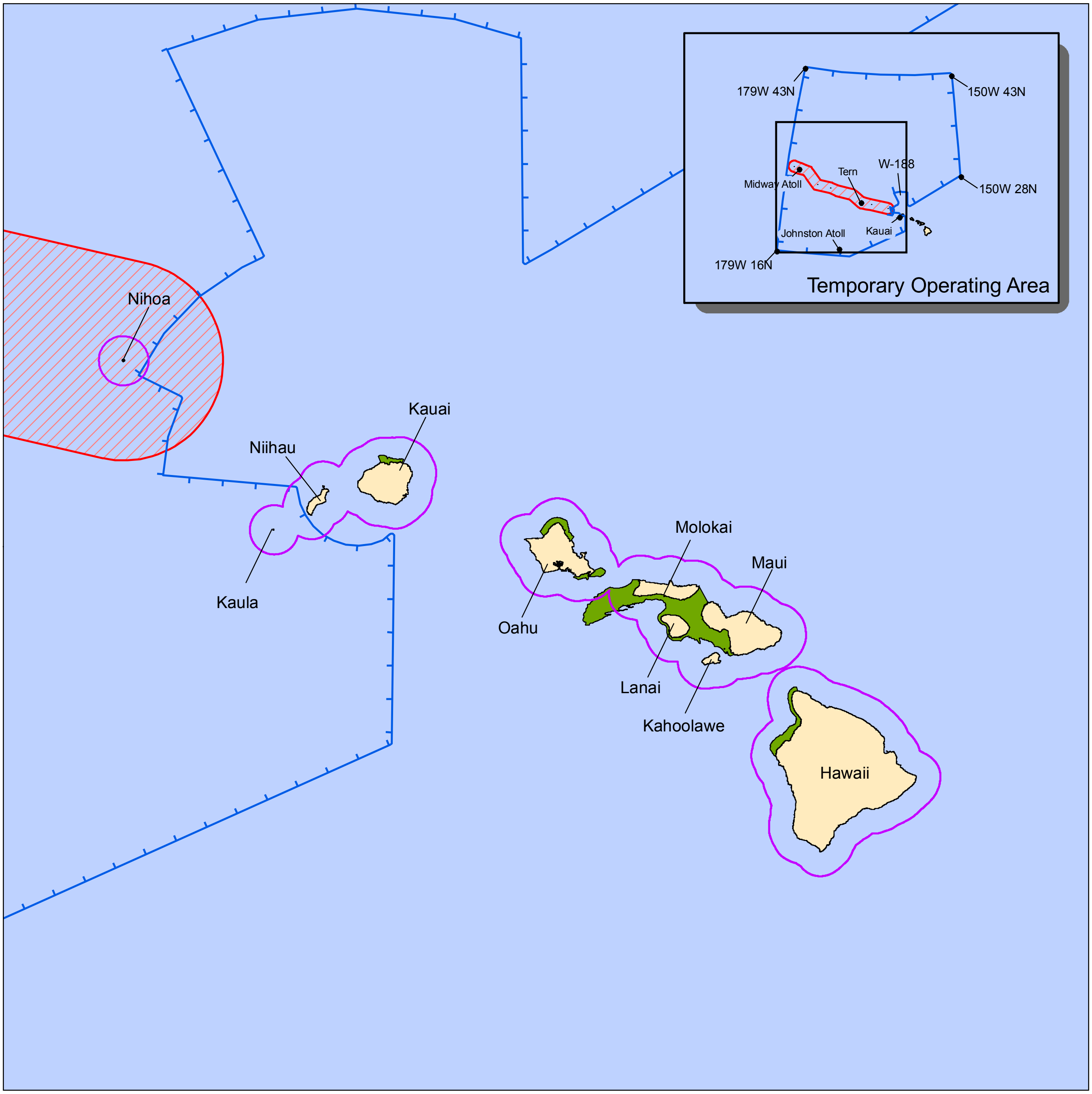
In March of 2000, a juvenile short-tailed albatross was observed at PMRF, resting in the grass on the mountain side of the PMRF runway (U.S. Fish and Wildlife Service, 2004). The Newell's shearwater or `A`o is a seabird that forages over deep open ocean and offshore waters near its breeding grounds from October to April when it returns to land to look for nest sites (State of Hawaii, Department of Land and Natural Resources, 2005). On Kauai, several grounded dark-rumped petrel fledglings have been collected in recent years as part of the Newell's shearwater recovery program. Most birds have been found near the mouth of Waimea Canyon, indicating that some birds still breed in the vicinity. Observations of the dark-rumped petrel at sea are scarce. (Virginia Tech Conservation Management Institute, 1996)

Of the marine mammals listed in Table 3.1.2.1.2-1, the Hawaiian monk seal, humpback whale, and spinner dolphin (discussed above) are the most likely species to be observed within 12 nm of the PMRF coastline. The endangered Hawaiian monk seal is an indigenous mammal that has been observed at and offshore of PMRF. The primary occurrence of Hawaiian monk seals is expected to be in a continuous band between Nihoa, Kaula, Niihau, and Kauai. This band extends from the shore to around 273 fathoms and is based on the large number of sightings and births recorded in this area (Westlake and Gilmartin, 1990; Ragen and Finn, 1996; Marine Mammal Commission, 2003; Baker and Johanos, 2004). Additional information on Hawaiian monk seals is provided in Section 3.4.2.4.

The humpback whale peak abundance around the Hawaiian Islands is from late February through early April (Mobley et al., 2001b; Carretta et al., 2005). During the fall-winter period, primary occurrence is expected from the coast to 50 nm offshore, including the areas off PMRF. Additional information on humpback whales, including description, habitat, abundance, and distribution, is provided in Section 3.4.2.4.

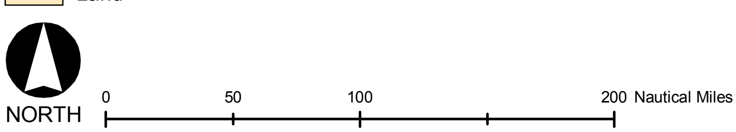
Hawaiian Islands Humpback Whale National Marine Sanctuary

The Hawaiian Islands Humpback Whale National Marine Sanctuary (Figure 3.1.2.1.2-2) was created by Congress in 1992. The Sanctuary includes a portion of the ocean north of Kauai, but not within the PMRF vicinity or in the BSURE coverage area (Pacific Missile Range Facility 2001). Further discussion of the sanctuary is provided in Section 3.7. Humpback whales are endangered marine mammals and are therefore 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 whale population is growing by an average of 7 percent annually. The best available estimate of abundance for the Central West Pacific stock of humpback whales in 2004 was 4,491 individuals (Mobley, 2004). According to 2008 Structure of Populations, Levels of Abundance and Status of Humpbacks (SPLASH) data, a total of 7,971 unique humpback whale individuals were catalogued following field efforts conducted on all known North Pacific winter breeding regions and all known summer feeding areas (U.S. Department of Commerce, 2008). The whales travel more than 3,500 mi from Alaska to Hawaii's warm waters to mate, give birth, and care for their calves. The whales span more than a 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. (National Oceanic and Atmospheric Administration, 2007; Mobley, 2002)



EXPLANATION

- 12-Nautical Mile Line
- Temporary Operating Area (TOA)
- Papahānaumokuākea Marine National Monument
- Hawaiian Islands Humpback Whale National Marine Sanctuary
- Land



Hawaiian Islands Humpback Whale National Marine Sanctuary

Hawaiian Islands

Figure 3.1.2.1.2-2

3.1.2.1.3 Cultural Resources—PMRF—Offshore

Region of Influence

The region of influence for offshore cultural resources is the ocean area from the shoreline out to 12 nm.

Affected Environment

Within the offshore waters surrounding each Hawaiian island, there are a variety of submerged resources. The most common of these are shipwrecks and fishponds; however, junked motor vehicles, harbor features, and old shoreline structures are also present.

Historically, Native Hawaiians constructed four different types of fishponds—freshwater taro ponds, other freshwater ponds, brackish water ponds, and seawater ponds (Aquaculture in Hawaii, 2006). Aquaculture was employed to supplement their other fishing activities, and permanent fishponds guaranteed a stable food supply for populations in lean times. Tended ponds provided fish without requiring fishing expertise, and harvesting the pond, unlike fishing at sea, was not weather dependent. Village-owned fishponds also increased the wealth of the managing Hawaiian Chief. At the time of European contact, there were hundreds of fishponds along the coast of the Hawaiian Islands. Many of the fishponds remain, but few are actively used (Aquaculture in Hawaii, 2006). Saltwater fishponds constructed on shallow water coral reef platforms are unique to the Hawaiian Islands and are very important national and international historical assets. Evidence suggests that Hawaiian fishponds were constructed as early as A.D. 1000, if not earlier, and continued to be built until the 1820s. The operation of fishponds declined throughout the islands by the early 1900s; there are approximately 488 fishponds in varying states of repair scattered throughout the six main islands. A database of identified Hawaiian saltwater fishponds is managed by the University of Hawaii at Manoa to publicize research and restoration projects, and to raise awareness of their cultural value. (State of Hawaii Office of Planning, 2005)

The underwater environment surrounding Kauai also encompasses a large number of shipwrecks. Among the wrecks is *Pele*, a freighter that sank on March 22, 1892. *Pele* rammed into an underwater pinnacle (tearing the hull) and sank a half-mile later in 14 fathoms of water. Very little of the wreck remains—the boiler, some hull plates, and a couple of anchors.

In 1824 the King of Hawaii (Kamehameha II) used a vessel named *Ha`aheo o Hawaii (Pride of Hawaii)* as a private yacht, a cargo and passenger transport, and a diplomatic vehicle. The ship was also once used as a pirate ship. While the king was en route to England on a diplomatic mission, a Native Hawaiian crew sailed her to the northern shore of the island of Kauai and wrecked her in the southwestern corner of Hanalei Bay. The ship struck a 5-foot-deep reef just a hundred yards offshore and sank after an unsuccessful salvage attempt by the local population. (Johnston, 2005)

3.1.2.1.4 Socioeconomics—PMRF—Offshore

Region of Influence

The region of influence for offshore Socioeconomics is the ocean area from the shoreline out to 12 nm from PMRF/Main Base.

Affected Environment

There are activities that occur in the offshore area of PMRF/Main Base that contribute to the economy of Kauai. They can be categorized as shipping, recreation, subsistence fishing, and tourism related.

Shipping

There is no commercial shipping to PMRF/Main Base, although boat tours are conducted within the region of influence. A primary commercial shipping route exists approximately 50 mi north of Kauai (EDAW, Inc., 2005).

Hawaii's remote location in the mid-Pacific makes it economically dependent upon the local waterways and its inter-modal maritime transportation system. Hawaii's harbors and local waterways use vessel traffic separation schemes that are closely monitored and supervised by the U.S. Coast Guard to promote safe navigation and provide a secure system for shipping. Barges and ships navigate these waterways daily to transport goods and personnel, not just within the Hawaiian Islands and to and from the mainland of North America, but across the Pacific Ocean to all the major ports of Asia, Oceania, Central and South America, and the South Pacific.

The National Oceanic and Atmospheric Administration (NOAA) provides frequently updated electronic and paper navigation charts for all mariners depicting the current vessel traffic separation schemes for all of Hawaii's major harbors and inland waterways. While traffic separation schemes are demarcated on NOAA charts to maintain safe traffic flow, inter-modal shipping lanes are not. Outside of the traffic schemes and regulated waterways of the Hawaiian Islands, mariners are free to plot their own course; however, it is common practice for many shipping companies to use great circle routes with track adjustments made for navigational risks such as restricted waters, obstructions, depth of water, currents, weather, traffic, and environmental factors. Great circle routes are commonly used because they are the shortest distance between two points on the globe; therefore, it is more economical for companies to follow these routes.

Recreation

Recreational activities include surfing, fishing, and boating. The physical areas accessible for fishing/surfing/recreation and socializing run from Shenanigans (all-hands club) up to Kinikini Ditch (south end of runway). Under PMRF Instruction 5530.7, normal access is allowed 7 days a week from 0500 to 2200, except during heightened force protection conditions or PMRF range operational periods.

Offshore of PMRF/Main Base, fishing is also allowed up to 1,000 feet in the Special Use Fishing Area (Kawaiele Ditch northward to the windsock adjacent to the runway) on weekends and

Federal holidays, except during heightened force protection conditions and PMRF range operational periods. Use of this area is limited to 25 fishermen at one time. Discussions with fisherman familiar with the resources fronting PMRF indicate that these waters are well known for the commercial catches of akule or bigeye scad which is done using nets, papios (members of the Jack family), threadfin, mackerel scad, grey snapper, goatfishes and surgeonfishes, all of which are caught by a variety of methods by both commercial and recreational fishers. Surfing is also permitted in front of the PMRF housing area. (Commander, Navy Region Hawaii, 2007)

Subsistence Fishing

Hawaii Revised Statutes (HRS) Section 188-22.6 defines subsistence fishing as the customary and traditional Native-Hawaiian uses of renewable ocean resources for direct personal or family consumption or sharing. HRS defines Native-Hawaiian as any descendant of the races inhabiting the Hawaiian Islands prior to 1778.

Fishing is still an extremely popular pastime for people in Hawaii (Western Pacific Regional Fishery Management Council, 1999). Recent data indicate that a quarter of Hawaii's population participates in some form of fishing at least once a year. Hawaii's annual fish consumption is about 90 lb per capita, over twice the national average (Western Pacific Regional Fishery Management Council, National Oceanic and Atmospheric Administration, 2003).

The overall level of subsistence fishing activity is difficult to assess, due to a lack of detailed catch data. Under-reporting by commercial fishermen and the existence of a large number of recreational and subsistence fishermen without licensing or reporting requirements have resulted in uncertainty in actual fisheries catch statistics for the state. Consequently, in the past no formal attempt to assess the subsistence fishing contribution to island economies has been made, but the value of fishing for subsistence by contemporary Native Hawaiians is known to be an important component of some communities, particularly rural communities (Pooley, 1993). However, it is believed that offshore recreational and subsistence catch is likely equal to or greater than the offshore commercial fisheries catch, with more species taken using a wider range of fishing gear (Friedlander, et al., 2004).

The Pacific Islands Region has a special mandate under the MSFCMA to promote the sustained participation of indigenous communities. In March of 2004, the "Strategic Plan for the Conservation and Management of Marine Resources in the Pacific Islands Region" was developed by three Federal agencies: the NMFS Pacific Islands Fisheries Science Center, the Pacific Islands Regional Office, and the Western Pacific Regional Fishery Management Council (WPRFMC). The plan discusses critical issues facing the region and provides plans for addressing the issues.

Hawaii's coastal fisheries, as in other parts of the world, are facing unprecedented overexploitation and severe depletion. In heavily populated areas of the Main Hawaiian Islands, fishing demands for offshore resources appear to exceed the capacity for resource renewal (Friedlander, et al., 2004).

The WPRFMC and NOAA worked together to prepare a *Supplemental EIS to the Final Environmental Impact Statement on the Fishery Management Plan for Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region* in May of 2005 to implement measures which would end overfishing in the bottomfish complex in the Hawaiian Archipelago. The draft of this document was published in March 2006 and concluded that the most effective means of ending overfishing would be implementation of alternative three (seasonal closures). For seasonal closures to be effective, state and Federal regulations would need to be promulgated (Western Pacific Regional Fishery Management Council, National Oceanic and Atmospheric Administration, 2003).

Due to the shape of Kauai and the lack of any protective barrier reef structure, the shoreline region is nearly continually scoured by the force of breaking waves. The essentially "round" shape of Kauai results in exposure from swells emanating from both the north and the south Pacific, hence the nearly continual wave action. The entire region offshore of PMRF is directly exposed to long-period swells generated by storms in both the North (winter) and South (summer) Pacific. As a result of these physical processes, the offshore areas are subjected to extreme stress from wave impact and scouring of sediment from wave action. Consequently, there is minimal coral reef development in the offshore areas off the coast of PMRF (Commander, Navy Region Hawaii, 2007). Since the implementation of the Force Protection Restriction after September 11, 2001, there has been a decline in fishing activities in the waters fronting PMRF, and this has corresponded to increases in the abundance, mean size, and biodiversity of fish in the area (Commander, Navy Region Hawaii, 2007).

Tourism

The tourism industry has been the economic mainstay of the Hawaiian Islands since statehood in 1959. Many island visitors enjoy participating in activities in the ocean areas such as scuba diving, kayaking, sailing, and dinner cruises. There are many businesses that rent equipment, offer guided tours, operate charter boats, and supply other services to the tourists within the region of influence. The commercial/recreational boat traffic that has the potential to cross within the vicinity of PMRF corridor can be up to 80 passes/40 round trips (Clements, 2010).

3.1.2.1.5 Transportation—PMRF—Offshore

Region of Influence

The region of influence for offshore transportation is the ocean area from the shoreline out to 12 nm. This area includes the Shallow Water Test Range, which is within 3 nm and extends into the 12 nm range of PMRF/Main Base; and BARSTUR and BSURE, which are within 12 nm of PMRF/Main Base.

Affected Environment

The affected environment is the area from the shoreline of PMRF/Main Base out to 12 nm.

Waterways

There is no commercial shipping to PMRF, although boat tours are conducted within the region of influence. A primary commercial shipping route exists approximately 50 mi north of Kauai (EDAW, Inc., 2005).

3.2 NIIHAU

3.2.1 NIIHAU—ONSHORE

Niihau is a privately owned island located about 17 nm southwest of Kauai. It is about 8 mi wide by 18 mi long and comprises approximately 72 mi^2. PMRF leases 1,167 acres of land in the northeastern corner of the island and operates radar units, optics, and Electronic Warfare sites. The north end of Niihau currently has remotely-operated surveillance radar, an Electronic Warfare site, called the Perch Site, and multiple Electronic Warfare portable simulator sites.

This section describes the environmental resources for Niihau that would be affected by the Proposed Action.

3.2.1.1 Airspace—Niihau—Onshore

Region of Influence

The region of influence for airspace includes the airspace above the island of Niihau.

Affected Environment

Niihau has no airport or airstrip, but the landowner maintains a helicopter for delivery of supplies and people to the island. See Section 3.1.1.1.2 for an additional description of the affected environment for Niihau airspace.

3.2.1.2 Biological Resources—Niihau—Onshore

Region of Influence

The region of influence for onshore biological resources is the island of Niihau.

Affected Environment

Vegetation

The vegetation of the island is dominated by non-native plant species and plant communities. The dominant types of vegetation on Niihau are kiawe forest, grassland, and koa haole. On the northern lowland areas, the kiawe forest is more open and has a kiawe overstory with an extensive shrub understory of `ilima. A coastal dry herbland/grassland community is present along the northeastern coast of Niihau. A dry coastal community, koa haole shrubland, often dominated by pure stands of koa haole, occurs at scattered locations at higher elevations on the island. This vegetation community is often associated with abandoned pastures. In some locations the koa haole canopy is so thick and grazing pressure of feral sheep and pigs so intense that there is little, if any, herbaceous understory. Small mixed stands of eucalyptus and common ironwood occur in a few sheltered areas at higher elevations. Ironwood also occurs in coastal areas near the ocean. Scattered individuals of the endemic naio occur at higher elevations in a mixed kiawe/koa haole shrub association. (Pacific Missile Range Facility, 2001; 2007; U.S. Department of the Navy, 1998a)

Threatened and Endangered Plant Species

Table 3.2.1.2-1 lists threatened and endangered species known or expected to occur on Niihau. Alula (*Brighamia insignis*), Federally listed as endangered, was historically known on Niihau. A population occurred on the Kaali Cliff, but has not been observed since 1947. Other endangered plants that have been found in the area include pu`uka`a (*Cyperus trachysanthos)* and *Lobelia niihauensis* (no common name) (Hawaii Department of Land and Natural Resources, no date [c]). Threats to the species include loss of native pollinators, browsing by goats, and invertebrate pests. (Hawaii Department of Land and Natural Resources, 2006)

Table 3.2.1.2-1. Listed Species Known or Expected to Occur on Niihau

Scientific Name	Common Name	Federal Status
Plants		
Brighamia insignis	Alula	E
Cyperus trachysanthos	Pu`uka`a (Sticky flatsedge)	E
Lobelia niihauensis	No common name	E
Panicum niihauense	Lau`ehu	E
Pritchardia aylmer-robinsonii	Lo`ulu	E
Sesbania tomentosa	`Ohai	E
Reptiles		
Chelonia mydas	Green sea turtle	T
Birds		
Anas wyvilliana	Koloa maoli (Hawaiian duck)	E
Fulica alai	`Alae ke`oke`o (Hawaiian coot)	E
Gallinula chloropus sandvicensis	`Alae ula (Hawaiian common moorhen)	E
Hemignathus munroi	`Akiapola`au (Honeycreeper)	E
Himantopus mexicanus knudseni	Ae`o (Hawaiian black-necked stilt)	E
Mammals		
Lasiurus cinereus spp. *semotus*	Hawaiian hoary bat	E
Monachus schauinslandi	Hawaiian monk seal	E

Source: U.S. Fish and Wildlife Service, 2005a; b; U.S. Department of the Interior, Office of Environmental Policy and Compliance Pacific Southwest Region, 2007

Key to Federal Status: T = Threatened; E = Endangered

Wildlife

The wildlife on Niihau is dominated by non-native species. The terrestrial vertebrate animal community is dominated by feral pigs, sheep, cattle, horses, donkeys, turkeys, quail, pheasants, and peacocks. Large numbers of pigs and sheep freely roam the island. The common bird species are introduced species such as the spotted dove, cardinal, and mynah. The migratory Laysan albatross nests on Niihau, but its success is limited by predation by feral pigs. (Pacific Missile Range Facility, 2001; 2007)

Threatened and Endangered Wildlife Species

Table 3.2.1.2-1 lists threatened and endangered species known or expected to occur on Niihau. The Hawaiian duck, common moorhen, Hawaiian stilt, and the Hawaiian coot are found in and around the lakes (playas) on the southern part of Niihau.

The endangered Hawaiian monk seal uses most of the coastline on Niihau to haul out, bask, and occasionally pup. From 10 to 12 pups are born on Niihau annually (Hawaii Institute of Marine Biology, 2006). The threatened green sea turtle has been observed ashore on selected beaches and it occasionally nests at some of these locations.

Environmentally Sensitive Habitat

An area of 357 acres in the northern portion of Niihau has been designated as critical habitat for the alula. This area is considered essential to the conservation of the taxon by the USFWS. (U.S. Fish and Wildlife Service, 2003b)

3.2.1.3 Cultural—Niihau—Onshore

Region of Influence

The region of influence for cultural resources at Niihau encompasses the entire island, where there is the potential for missile intercept debris to occur.

Affected Environment

Archaeological Resources (Prehistoric and Historic)
Niihau is a privately-owned, largely undeveloped island with restricted public access that has allowed much of the island to remain in its natural state. Some archaeological sites have been identified and coastal or sandy dune and upland areas may be sensitive for additional cultural resources, particularly burials.

Historic Buildings and Structures
There are no identified historic buildings and structures on Niihau.

Traditional Resources
There are no identified traditional Native Hawaiian sites on Niihau; however, as with archaeological sites, Native Hawaiian materials could be unexpectedly encountered anywhere on the island.

3.2.1.4 Health and Safety—Niihau—Onshore

Region of Influence

The region of influence for health and safety is Niihau.

Affected Environment

Niihau is a privately owned island, that through agreements with the owners, PMRF uses to support range operations. The primary health and safety concern for the residents of Niihau is the potential for a fire on the island. Due in part to the dry climate and kiawe vegetation that dominates the island, there is the potential for very large fires to occur. Currently, the island does not have any firefighting equipment. Emergency medical evacuation service can be provided by the helicopter owned by the Robinson family.

PMRF operates a radar at Paniau that is remotely operated from PMRF/Main Base. The radar unit, which is located on top of a facility, presents no Hazard of Electromagnetic Radiation to Personnel (HERP) hazards at ground level where any island resident could be affected. PMRF/Main Base also operates the Niihau Perch site Electronic Warfare system, which has a HERP EMR hazard of 12 feet in front of where the system is pointing. A warning light and warning signs are placed in the area when the system is operating. Presently, helicopters are airborne with buckets during near-land/over-land range operations occurring on or near Niihau to deal with potential fire hazards.

3.2.2 NIIHAU—OFFSHORE

Niihau Offshore includes proposed ranges and training areas in State waters (0-3 nm offshore) and other offshore waters within 12 nm from Niihau (Figure 2.1-1). This section describes the environmental resources for Niihau Offshore that would be affected by the Proposed Action.

3.2.2.1 Airspace—Niihau—Offshore

Region of Influence

The region of influence for airspace includes the island of Niihau.

Affected Environment

The landowner maintains a helicopter for delivery of supplies and people to the island. See Section 3.1.1.1.2 for an additional description of the affected environment for Niihau offshore airspace.

3.2.2.2 Biological Resources—Niihau—Offshore

Region of Influence

The region of influence for offshore biological resources is the ocean area from the shoreline of Niihau out to 12 nm.

Affected Environment

Vegetation

Common plants found in Niihau's rocky intertidal habitats include sea lettuce, Sargasso or *kala*, coralline red algae, red fleshy algae, brown algae, and fleshy green algae (U.S. Department of the Navy, 2005b). Common plants that inhabit the sandy beach intertidal habitat on Niihau include the pohinahina, pohuehue, milo, and hau (Maragos, 1998).

<u>Threatened and Endangered Vegetation</u>

No threatened or endangered vegetation is located in the offshore area.

Wildlife

Common animals using and inhabiting the sandy beach intertidal habitat on Niihau include ghost crabs, mitre and auger shells, clams, and seabirds. (Maragos, 1998)

Reefs offshore of Niihau are poorly developed due to extreme wave energy from all directions. There are no substantial bays that could shelter coral development. Colonized and uncolonized hardbottom areas are located off the western coastline. High-wave energy coral communities appear to be most common and are dominated by cauliflower coral and lobe coral. Black coral occurs as shallow as 90 feet off the northern end of the island. (Hawaii Institute of Marine Biology, 2006)

Pelagic fish such as tuna swim close to steep vertical walls around the northwest portion of Niihau. Large white saddle goatfish, squirrelfish, and parrotfish are abundant. Sharks are also present off of Niihau, including the grey reef shark, sandbar shark, Galapagos shark, and tiger shark. (Papastamatiou, et al., 2006; Hawaii Institute of Marine Biology, 2006)

EFH and habitat areas of particular concern are described in Section 3.4 (Open Ocean), and a detailed description, including status, distribution, and habitat preference of managed fisheries is provided in the Navy's *Final Essential Fish Habitat and Coral Reef Assessment for the Hawaii Range Complex EIS/OEIS* (U.S. Department of the Navy, 2007).

Threatened and Endangered Wildlife

The endangered Hawaiian monk seal and the threatened green sea turtle have been observed offshore of Niihau.

3.3 NORTHWESTERN HAWAIIAN ISLANDS

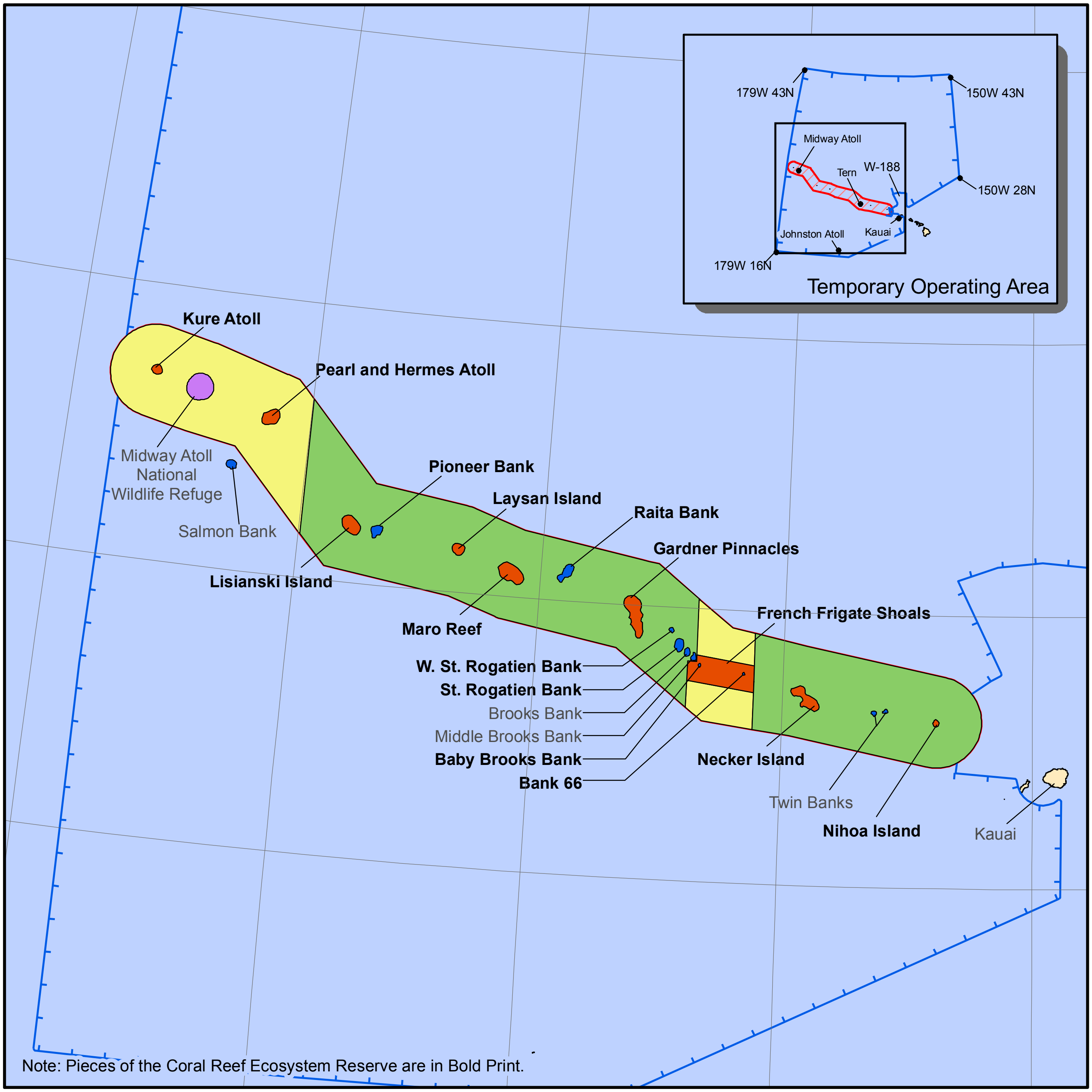
The NWHI are a chain of small islands, atolls, submerged banks, and reefs stretching for more than 1,000 mi northwest of the Main Hawaiian Islands. Depending on their trajectories, missiles launched from the PMRF have the potential to overfly portions of the NWHI. Of particular concern is the potential for missile debris on or offshore of the islands. The Temporary Operating Area (TOA) encompasses the entire Monument. This section describes the environmental resources that would be affected by the No-action and Proposed Action for the NWHI. Of the 13 environmental resources considered for analysis, air quality, airspace, geology and soils, hazardous materials and waste, land use, noise, socioeconomics, transportation, utilities, and water resources are not addressed.

Papahānaumokuākea (Northwestern Hawaiian Islands) Marine National Monument

On June 15, 2006, Presidential Proclamation 8031 established the Northwestern Hawaiian Islands Marine National Monument (Figure 3.3-1) under the authority of the Antiquities Act of 1906 (16 United States Code [U.S.C.] 431). The Monument was given the name Papahānaumokuākea Marine National Monument (Monument) in 2007. A Memorandum of Agreement provided that management of the Monument is the responsibility of three parties acting as Co-Trustees: the State of Hawaii, Department of Land and Natural Resources; the U.S. Department of the Interior, USFWS; and the U.S. Department of Commerce, NOAA. The Monument is a vast, remote, and largely uninhabited marine region that encompasses an area of approximately 139,793 mi^2 of the Pacific Ocean in the northwestern portion of the Hawaiian Archipelago. The 100-mi wide Monument is dotted with small islands, islets, and atolls as well as a complex array of marine and terrestrial ecosystems. The Monument includes a number of existing federal conservation areas: the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve, managed by the U.S. Department of Commerce through the NOAA; Midway Atoll National Wildlife Refuge; Hawaiian Islands National Wildlife Refuge; and Battle of Midway National Memorial, managed by the U.S. Department of the Interior through the USFWS. These areas remain in place within the Monument, subject to their applicable laws and regulations in addition to the provisions of the Proclamation.

The NWHI also include State of Hawaii lands and waters, managed by the State through the Department of Land and Natural Resources as the NWHI Marine Refuge and the State Seabird Sanctuary at Kure Atoll. These areas also remain in place and are subject to their applicable laws and regulations.

Presidential Proclamation 8031 establishing the Monument includes the following language regarding military activities in the area: 1) “The prohibitions required by this proclamation shall not apply to activities and exercises of the Armed Forces (including those carried out by the United States Coast Guard) that are consistent with applicable laws; 2) Nothing in this proclamation shall limit agency actions to respond to emergencies posing an unacceptable threat to human health or safety or to the marine environment and admitting of no other feasible solution; 3) All activities and exercises of the Armed Forces shall be carried out in a manner that avoids, to the extent practicable and consistent with operational requirements, adverse impacts on monument resources and qualities; 4) In the event of threatened or actual destruction of, loss of, or injury to a monument resource or quality resulting from an incident, including but not



EXPLANATION

- Bank
- Commercial Fishing Phase-Out Area
- Ecological Reserve
- Hawaiian Islands National Wildlife Refuge
- Midway Atoll National Wildlife Refuge
- Temporary Operating Area (TOA)
- Papahānaumokuākea Marine National Monument
- Land

NORTH

0 50 100 200 Nautical Miles

Papahānaumokuākea (Northwestern Hawaiian Islands) Marine National Monument

Hawaiian Islands

Figure 3.3-1

limited to spills and groundings, caused by a component of the Department of Defense or the USCG [U.S. Coast Guard], the cognizant component shall promptly coordinate with the Secretaries for the purpose of taking appropriate actions to respond to and mitigate the harm and, if possible, restore or replace the monument resource or quality." (U.S. Government, The White House, 2006)

The *Papahānaumokuākea Marine National Monument Management Plan* and Environmental Assessment address current military activities, with the understanding that "activities of the Armed Forces that could occur within the Monument are beyond the scope of [Monument Management Board] management activities," wording in keeping with the Presidential Proclamation's statement that required prohibitions are not applicable to activities and exercises of the Armed Forces. (Papahānaumokuākea Marine National Monument, 2008)

The Monument's large geographic area is vitally important to strategic interests and international commerce. The Navy expects that the final Monument Plan will continue to recognize the need to preserve the operational flexibility of the military services and combatant commanders in this strategically important region.

The Monument has been nominated for World Heritage status as a "mixed" site, for both its natural and cultural significance to the world. Very few sites are submitted as "mixed," and the rationale for this type of nomination is due to its unique geological, ecological, biological, and Native Hawaiian cultural heritage.

According to Friedlander et al. (2004), the coral reef fauna from the NWHI is rich, with over 1,000 identified species. Fifty-seven stony coral species have been identified in the shallow, subtropical waters of the NWHI (Friedlander et al., 2004). Only 12 species of alien marine algae, invertebrates, and fish have been recorded in the NWHI. *Hypnea musciformis*, an invasive algal species, is not yet established in the NWHI. It is located in drift only at Maro Reef. (National Oceanic and Atmospheric Administration, 2006a)

Nihoa lies 130 mi northwest of Niihau and is the closest of the NWHI to the Main Hawaiian Islands. It is the largest volcanic island in the northwestern chain, with approximately 170 acres of land. The submerged coral reef habitat associated with Nihoa is approximately 142,000 acres. Occasionally, short term field camps are established on Nihoa for wildlife monitoring and invasive species management (Papahānaumokuākea Marine National Monument, 2008).

The next closest island is Necker. This is a dry, volcanic island shaped like a fish hook that includes about 45 acres of land. Necker (Mokumanamana) is visited occasionally on day trips for wildlife monitoring, Native Hawaiian practices, and cultural research (Papahānaumokuākea Marine National Monument, 2008). More than 380,000 acres of coral reef habitat are associated with Necker (Hawaii Department of Land and Natural Resources, no date[b]).

French Frigate Shoals is an 18-mi wide, crescent-shaped atoll. Its lagoon contains two exposed volcanic rocks and 11 low, sandy islets. The French Frigate Shoals average about 12 charter flights per year on the existing runway. USFWS maintains a field station on Tern Island, French Frigate Shoals that is staffed by approximately 16 permanent year-round employees and volunteers at a time (Papahānaumokuākea Marine National Monument, 2008). Ninety to 95 percent of green sea turtle nesting and breeding occurs at French Frigate Shoals. The sand islets and volcanic rocks of French Frigate Shoals provide nesting habitat for 18 species of seabirds. Approximately 67 acres of land and 230,000 acres of coral reef habitat are associated with French Frigate Shoals.

Gardner Pinnacles consists of two peaks of volcanic rock that total 5 acres. Gardner Pinnacles is an important roosting site and breeding habitat for 12 species of tropical seabirds and is surrounded by approximately 600,000 acres of coral reef habitat (Hawaii Department of Land and Natural Resources, no date[b]).

Maro Reef is a largely submerged atoll, with only approximately 1 acre of emergent land but about 475,000 acres of submerged coral reef habitat.

Laysan is the largest island in the chain, with about 1,000 acres of land. It is well vegetated and contains a hypersaline lake that is one of only five natural lakes in the State of Hawaii. A year-round field camp of three to seven people supporting ecological restoration work has been maintained at Laysan Island since 1992 (Papahānaumokuākea Marine National Monument, 2008). Approximately 145,000 acres of coral reef habitat are associated with this island (Hawaii Department of Land and Natural Resources, no date[b]). Approximately 2 million birds nest on the island (National Oceanic and Atmospheric Administration, 2006a).

Lisianski Island is a low sand and coral island, with approximately 400 acres of land. It lies at the northern end of a large reef bank that spans about 65 mi^2, and totals about 310,000 acres. Resource managers occupy a seasonal field camp on the island (Papahānaumokuākea Marine National Monument, 2008).

Pearl and Hermes Reef is a large atoll with several small islets forming about 80 acres of land with approximately 200,000 acres of coral reef habitat. Resource managers occupy a seasonal field camp at the atoll (Papahānaumokuākea Marine National Monument, 2008). The islets are periodically washed over during winter storms (Hawaii Department of Land and Natural Resources, no date[b]).

Midway Atoll measures 5 mi across and includes three small islands located at the southeastern end of the lagoon totaling 1,550 acres. The protective reef around the lagoon is submerged in some places and 4 to 5 feet above sea level in others. Approximately 55,000 acres of reef habitat are associated with Midway Atoll (Hawaii Department of Land and Natural Resources, no date[b]). The airstrip on Midway Atoll is still active and averages about 45 flights per year. The U.S. Coast Guard (USCG) also uses Midway as a refueling stop. Today approximately 100 people reside on Midway year round. The maximum capacity for all overnight people is 150 with no more than 50 visitors at any one time. The Midway Atoll Visitor Services Plan also allows 3 large group (50-800 people) day-use visits per year, with no more than 400 people on the island at a time unless refuge management has approved a higher number (e.g., for very limited and special circumstances). (Papahānaumokuākea Marine National Monument, 2008)

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 NWHI in their natural character.

The NWHI 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 NWHI, extending approximately 1,200 nm long and 100 nm 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 overlies the Hawaiian Islands National Wildlife Refuge to the extent that it extends beyond the seaward boundaries of the State of Hawaii (Presidential Document, 2000).

Midway Atoll National Wildlife Refuge

The Midway Atoll National Wildlife Refuge was created by Executive Order 13022 in 1996. It is administered by the Secretary of the Interior through the USFWS in part to maintain and restore natural biological diversity and to provide for the conservation and management of fish and wildlife and their habitat. Fifteen species of seabirds nest on islands within the refuge, including the world's largest colony of Laysan albatross and the largest colonies of red-tailed tropicbirds, black noddies, and white terns in the Hawaiian archipelago. (U.S. Fish and Wildlife Service, 2006b)

Over 250 species of fish and a large diversity of marine invertebrates inhabit the lagoon and surrounding waters. Approximately 50 to 65 Hawaiian monk seals are located within the area offshore of the refuge. Midway's beaches provide critically important habitat where monk seals raise their pups. Threatened green sea turtles are most common offshore of Sand Island's beaches, but they are seen throughout the lagoon and surrounding offshore waters. A population of about 300 spinner dolphins also inhabit Midway's lagoon during daylight hours. (U.S. Fish and Wildlife Service, 2006b)

As part of the base closure process for Naval Air Facility Midway Island, the Navy was obligated to consider the effects of the closure process on historic sites and structures. The Navy determined that 78 structures, buildings, or objects were eligible for inclusion in the National Register of Historic Places, including the structures associated with the Battle of Midway National Historic Landmark, designated in 1986. (U.S. Fish and Wildlife Service, 2006b)

To guide the historic preservation process during the transition, the Navy entered into a Programmatic Agreement with the USFWS, the Hawaii SHPO, and the Advisory Council on Historic Preservation. The Programmatic Agreement recommended specific types of treatment for the 78 historic sites or structures. (U.S. Fish and Wildlife Service, 2006a)

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 800 mi northwest 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 (*Sterna fuscata*) and albatross, live within the refuge, which also provides a rich habitat for marine life (U.S. Fish and Wildlife Service, Pacific Islands, 2002).

Kure Atoll State Wildlife Sanctuary

Kure is the northernmost coral atoll in the world. The island has a 6-mi diameter that encloses approximately 200 acres of emergent land. The outer reef almost completely encircles the lagoon except for passages to the southwest. The only permanent land in the atoll is Green Island, located near the fringing reef in the southeastern part of the lagoon. Almost 80,000 acres of coral reef habitat are associated with Kure Atoll. (Hawaii Department of Land and Natural Resources, no date[b]) Kure Atoll is a State wildlife refuge/sanctuary under the jurisdiction of the Hawaii Division of Forestry and Wildlife, DLNR. Jurisdiction of the USFWS and NMFS applies to the enforcement of the Marine Mammal Protection Act (MMPA) and ESA, although Kure Atoll is not part of the Midway Atoll National Wildlife Refuge or the Hawaiian Islands National Wildlife Refuge. (Papahānaumokuākea Marine National Monument, 2008)

The associated marine habitats support 155 species of reef fishes. Fish species endemic to the Hawaiian Archipelago compose 56 percent of all fish recorded here. There are 27 species of coral found at the atoll. Of the two enclosed islets, the only permanent land is found on crescent-shaped Green Island, which rises to 20 feet above sea level and is located near the fringing reef in the southeastern quadrant of the lagoon. The atoll is an important breeding site for black-footed and Laysan albatrosses, Christmas shearwaters, and 14 other breeding seabirds. A resident population of spinner dolphins inhabits the lagoon during the day. There are 11 arthropods on Kure that are endemic to the Hawaiian Archipelago, one of which is a mite (*Hemicheyletia granula*) that is apparently endemic to Kure. (Papahānaumokuākea Marine National Monument, 2008)

3.3.1 NORTHWESTERN HAWAIIAN ISLANDS—ONSHORE

3.3.1.1 Biological Resources—Northwestern Hawaiian Islands—Onshore

Region of Influence

The region of influence for biological resources of includes all of the NWHI.

Affected Environment

Vegetation

The land plants of the NWHI are typically salt-tolerant and drought-resistant species of the beach strand and coastal scrub. The number of native species found at each site is positively correlated with island size but is negatively influenced by the number of alien species occurring at the site. The three sites with airstrips and a longer history of year-round human habitation have much larger populations of alien species of land plants. At least three species of NWHI endemic plants (*Achyranthes atollensis*, *Phyllostegia variabilis*, and *Pritchardia* species of Laysan) are believed to have gone extinct since European contact. Some other native species have found refuge in areas of the NWHI where rats were never introduced, and now occur at much greater densities than they do in the main Hawaiian Islands. (Papahānaumokuākea Marine National Monument, 2008)

Threatened and Endangered Plant Species

At least six species of terrestrial plants found only in the region are listed under the ESA and HRS 195D, some so rare that because of the limited surveys on these remote islands, they may have already vanished from the planet. The World Conservation Network lists *Cenchrus agrimonioides* var. *laysanensis* as extinct, though biologists still hold hope that it may exist. *Amaranthus brownii*, endemic to Nihoa, is deemed critically endangered by the World Conservation Network, while the Nihoa fan palm or loulu *(Pritchardia remota)* is considered endangered. (Papahānaumokuākea Marine National Monument, 2008)

The NWHI are the home of six endangered plants (Table 3.3.1.1-1) (Papahānaumokuākea Marine National Monument, 2008; U.S. Fish and Wildlife Service and Hawaii Department of Land and Natural Resources, Division of Aquatic Resources, 2002).

Table 3.3.1.1-1. Listed Species Known or Expected to Occur within the Northwestern Hawaiian Islands and Adjacent Ocean Area

Scientific Name	Common Name	Federal Status
Plants		
Amaranthus brownii[1]	No common name	E
Cenchrus agrimoniodes var laysanensis	Kamanomano	E
Mariscus pennatiformis ssp bryanii	No common name	E
Pritchardia remota[1]	Loulu (Nihoa fan palm)	E
Schiedea verticillata[1]	No common name	E
Sesbania tomentosa[1]	`Ohai	E
Birds		
Acrocephalus familiaris kingi	Nihoa millerbird	E
Anas laysanensis	Laysan duck	E
Phoebastria albatrus	Short-tailed albatross	E
Telespyza cantans	Laysan finch	E
Telespyza ultima	Nihoa finch	E
Reptiles		
Caretta caretta	Loggerhead sea turtle*	T
*Chelonia myda*s	Green sea turtle	T
Dermochelys coriacea	Leatherback sea turtle	E
Eretmochelys imbricata	Hawksbill sea turtle	E
Lepidochelys olivacea	Olive ridley sea turtle	T
Mammals		
Monachus schauinslandi	Hawaiian monk seal	E
Balaenoptera borealis	Sei whale	E
Balaenoptera musculus	Blue whale	E
Balaenoptera physalus	Fin whale	E
Eubalaena japonica	North Pacific right whale	E
Megaptera noveangliae	Humpback whale	E

Source: Papahānaumokuākea Marine National Monument, 2008; U.S. Fish and Wildlife Service, 2003b; National Oceanic and Atmospheric Administration, 2006c

1 Note: The entire island of Nihoa other than manmade features has been designated as critical habitat for these plants.

Key to Federal Status:
E = Endangered

The loulu relies on the isolation and protection from invasive species and disturbance that the Hawaiian Islands provide (U.S. Fish and Wildlife Service and Hawaii Department of Land and Natural Resources, Division of Aquatic Resources, 2002). The entire island of Nihoa other than manmade features has been designated as critical habitat for the plants as shown in Table 3.3.1.1-1 (U.S. Fish and Wildlife Service, 2003b).

Wildlife

For many years the only regular inhabitants of the NWHI have been vast numbers of birds, including black-footed albatross, Tristram's storm-petrel, Bulwer's petrel, wedge-tailed shearwaters, blue-gray noddies, red-tailed tropic birds, great frigate birds or \`iwa , three kinds of boobies, terns such as the gray-backed tern or pakalakala, white (fairy) tern or manu-o-ku, and sooty tern or \`ewa\`ewa. Birds nest in a variety of places, from the ground to the crowns of the palms present on the islands. (State of Hawaii, 2005a)

Although Midway's native vegetation and wildlife have been greatly altered by more than a century of human occupation, the island boasts the largest nesting colonies of Laysan and blackfooted albatrosses in the world, forming the largest colony of albatrosses in the world. The Navy, USFWS, and U.S. Department of Agriculture–Wildlife Services successfully eradicated rats from Midway, a small forest of mature ironwood trees (an alien invasive species) has been removed from Eastern Island, and new ironwood seedlings from the remaining seedbank are removed as they are detected.

Several species of migratory birds covered by the MBTA are present during some portion of the year including, but not limited to boobies, wedge-tailed shearwaters, and albatross.

The only other wildlife besides seabirds are land snails, spiders, and several endemic insects.

<u>Threatened and Endangered Wildlife Species</u>

Threatened and endangered wildlife species are listed in Table 3.3.1.1-1. Four endangered land bird species in the NWHI are protected under the ESA and HRS 195D. Three species are passerines (perching birds): the Laysan finch (*Telespyza cantans)*, currently found on Laysan Island and Pearl and Hermes Atoll and the Nihoa finch (*Telespyza ultima*) and Nihoa millerbird (*Acrocephalus familiaris kingi*), which are endemic to Nihoa. The fourth species is the Laysan duck (*Anas laysanensis*), which once was found on many Hawaiian Islands but is now restricted to Laysan Island and Midway Atoll. The Nihoa millerbird population is very small, and total population estimates fluctuate widely between years. The most recent population estimate (2007) is 814 birds, but results have ranged between 23 and 814 birds in these sporadic and irregularly timed surveys (with broad confidence intervals), and these results are insufficient to adequately monitor trends in the population. Based on monitoring surveys, the Nihoa finch population has fluctuated widely since 1968 from a low of 5,200 individuals to a high of 20,802, but the population and its habitat are considered to be relatively stable. However, the Pearl and Hermes Atoll population is likely declining as a result of habitat alteration by the invasive alien plant *Verbesina encelioides*. (Papahānaumokuākea Marine National Monument, 2008)

The current estimate of 300 to 700 Nihoa millerbirds and 2,000 to 4,000 Nihoa finches rely on the isolation and protection from invasive species and disturbance that the Hawaiian Islands provide (State of Hawaii, 2005b; U.S. Fish and Wildlife Service and Hawaii Department of Land

and Natural Resources, Division of Aquatic Resources, 2002). While 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 ESA still applies.

The total estimated Laysan duck population on Laysan Island has fluctuated from seven to more than 600 adult birds in the last century. The most recent (2005) population estimate of adult birds is 600 birds. Midway Atoll supports the first successful reintroduced population of endangered Laysan ducks, translocated from Laysan Island in 2004 and 2005. Laysan ducks use both the largely introduced vegetation of Midway Atoll and the restored patches of native vegetation. This reintroduction is significant because island ducks are globally threatened taxa, and because the Laysan duck is the most endangered waterfowl in the Northern Hemisphere and the United States. (Papahānaumokuākea Marine National Monument, 2008)

The population at Midway was founded with a total of 42 wild birds translocated from Laysan in 2004 and 2005. Of this original total, 25 or 26 birds are believed to have bred. After successful breeding seasons in 2005 through 2007, the number of ducks at Midway had increased to nearly 200. Another successful breeding season at Midway in 2008 added significantly to the population, but an outbreak of avian botulism in August 2008 caused the death of more than 130 ducks and a temporary setback to this new population. (Papahānaumokuākea Marine National Monument, 2008)

Green sea turtles and Hawaiian monk seals (Table 3.3.1.1-1) occasionally bask along the islands' coasts (National Oceanic and Atmospheric Administration, 2006a). Hawaiian green turtles nest from French Frigate Shoals through Midway Atoll. More than 95 percent of the breeding population of Hawaiian green turtles nests in the NWHI. Hawaiian monk seals breed on the islands and atolls of the Northwestern Hawaiian Islands from French Frigate Shoals through Kure Atoll. More than 90 percent of the breeding populations of this species occur in the NWHI. Both species also use the small beaches of Nihoa and Necker islands for basking. (Naval Facilities Engineering Command Pacific, 2010)

3.3.1.2 Cultural Resources—Northwestern Hawaiian Islands—Onshore

Region of Influence

The region of influence for cultural resources encompasses all of the Northwest Hawaiian Islands and the Papahānaumokuākea Marine National Monument.

Affected Environment

Archaeological Resources (Prehistoric and Historic)

The NWHI were explored, colonized, and in some cases, semi-permanently settled by Native Hawaiians in pre-contact times. Nihoa and Necker (Mokumanamana), the islands that are closest to the Main Hawaiian Islands (approximately 150 mi apart), are listed in the National and Hawaii State Registers of Historic Places and are protected by the USFWS.

Several archaeological surveys of Nihoa and Necker have been conducted beginning with a survey by the Bishop Museum (the Tanager Expedition in 1923) (Emory, 1928). Between the two islands more than 140 archaeological sites have been documented. Though barren and seemingly inhospitable to humans, the number of cultural sites they support is testimony to their occupation and use prior to European discovery, and demonstrates how human colonization and settlement can occur even in seemingly marginal environments (U.S. Department of Commerce, The Under Secretary of Commerce for Oceans and Atmosphere, 2007).

All of the documented prehistoric archaeological sites within the Monument are on either Nihoa or Necker (Mokumanamana). The other islands within the Monument have been less investigated for these types of sites, but may contain cultural sites that have either not yet been discovered or properly interpreted. Archaeologists suspect that Hawaiians did not leave artifacts that they wished to preserve on such low-lying islets because they knew that the elements would soon reclaim them. Several underwater ko`a have been found in the main Hawaiian Islands, however, and burials are not unknown; therefore, it is possible that additional cultural sites may be discovered in the NWHI (U.S. Department of Commerce, The Under Secretary of Commerce for Oceans and Atmosphere, 2007).

In addition to the prehistoric features within the Monument, there are World War II-era sites of national significance. These include the Battle of Midway National Memorial and nine defensive positions on Midway Atoll; each designated a National Historic Landmark under the theme of World War II Pacific battlefields (U.S. Department of Commerce, The Under Secretary of Commerce for Oceans and Atmosphere, 2007).

Nihoa

On Nihoa, 89 cultural sites have been recorded. The sites date from before the 13th century and include 25 to 35 house terraces, 15 ceremonial structures, burial caves, bluff shelters, and agricultural terraces. Numerous artifacts found on Nihoa establish a close relationship with Native Hawaiian culture in the Main Hawaiian Islands, and to the first settlers of Hawaii who sailed through the Pacific on large voyaging canoes. Because the island had sufficient soil and water for limited agriculture, Nihoa was a good place for voyagers to stop and resupply their canoes. This is evidenced by the remains of stone terraces that suggest an investment in agricultural food production (U.S. Department of Commerce, The Under Secretary of Commerce for Oceans and Atmosphere, 2007).

In 1789, Captain Douglas of the *Iphegenia* was the first Westerner to visit Nihoa. Queen Kaahumanu visited and annexed the island for the Kingdom of Hawaii in 1822 and, in 1885, Queen Liliuokalani and her 200-person entourage landed on Nihoa. As many as 175 people are estimated to have lived on the island at one time, but a shortage of fresh water likely was a limiting factor (Emory, 1928).

Necker (Mokumanamana)

At least 52 cultural sites exist on Necker (Mokumanamana), including 33 ceremonial features, which is the highest concentration of religious sites found anywhere in the Hawaiian Archipelago. Like Nihoa, Necker (Mokumanamana) shows clear evidence of prehistoric Hawaiian occupation, although given the numerous religious sites, the island appears to have been used primarily for worship by visitors from other Hawaiian Islands, rather than having supported permanent inhabitants for any length of time. Many of the temple sites closely resemble those of Tahiti, possibly establishing a link between this site and early Polynesian culture. Carved basalt human figurines found there are of a style not seen elsewhere in Hawaii, showing instead similarities to those found in the Marquesas. Emory (1928) considered the sites of Necker (Mokumanamana) to be a "…pure sample of the culture prevailing in Hawaii before the thirteenth century" (U.S. Department of Commerce, The Under Secretary of Commerce for Oceans and Atmosphere, 2007).

The first European to document Necker (Mokumanamana) was Compte de La Perouse in 1786. Captain John Paty claimed the island for the Kingdom of Hawaii in 1857, though his claim was later contested until the island was formally annexed by Hawaii's Provisional Government in 1894 (U.S. Department of Commerce, The Under Secretary of Commerce for Oceans and Atmosphere, 2007).

There are no longer permanent inhabitants of Nihoa or Necker (Mokumanamana); however, research scientists and other educational expeditions occasionally visit the various islands of the island chain and camp for 1 to 12 weeks (Northwestern Hawaiian Islands Multi-Agency Education Project, 2006).

Historic Buildings and Structures

There are no modern historic buildings or structures on Nihoa or Necker (Mokumanamana); however, there are a number of pre-contact stone structures representing habitation, agricultural, and ceremonial features (Emory, 1928). Historic structures on Midway include the Battle of Midway National Memorial and nine defensive positions.

Traditional Resources (Including Burials)

Among the recorded sites on Nihoa and Necker (Mokumanamana) are religious and ceremonial features (cairns, terraces, stone platforms, upright stones, and burial sites) (Emory, 1928; TenBruggencate, 2005; U.S. Department of Commerce, The Under Secretary of Commerce for Oceans and Atmosphere, 2007). Although there have been no systematic surveys for them, these types of resources may also exist at other locations within the NWHI.

3.3.1.3 Health and Safety—Northwestern Hawaiian Islands—Onshore

Region of Influence

The region of influence for health and safety is the onshore areas of the Papahānaumokuākea Marine National Monument.

Affected Environment

All U.S. vessels passing through the Monument without interruption will be required to provide notification at least 72 hours before entering and within 12 hours of leaving the Monument and must include intended and actual routes through the Monument and general categories of any hazardous cargo on board.

USFWS facilities at Midway Atoll serve as an emergency stop for marine vessels in distress in the mid-Pacific Ocean. The deep draft harbor at Sand Island can handle large vessels, and Henderson Airfield at Midway has the only runway that can handle large aircraft within a large swath of the mid-Pacific Ocean. Henderson Airfield is an FAA Part 139-certified airport and is an important emergency landing site for aircraft en route from the west coast of North America to East Asia. Extended twin engine aircraft operations (ETOPS) over the mid-Pacific Ocean use routes that keep them close enough to an FAA Part 139-certified airport to meet FAA requirements for alternate landing sites.

According to the FAA Advisory Circular 120-42A on ETOPS, "These suitable en route alternates serve a different purpose than the destination alternate airport and would normally be used only in the event of an engine failure or loss of primary airplane systems." Though the focus of en route alternate airports is primarily for twin-engine aircraft, these airports are important for the safety of all long-range operations regardless of the number of engines. Alternate airports support unscheduled landings from emergencies such as cargo fire, decompression, fuel leak, passenger illness, or severe turbulence. On several occasions, aircraft on non-ETOPS routes have diverted to various islands in the Pacific, namely Adak, Midway, Shemya, and Wake because of passenger or crew medical emergency, an unanticipated headwind requiring additional fuel, and an engine fire warning. As recently as January 2004, a commercial passenger jet used Henderson Field for an emergency landing after suffering an oil pressure drop in one engine.

Marine vessels periodically bring fishermen and researchers with medical emergencies to Midway. USFWS maintains emergency medical supplies, and an on-island medic can treat patients with emergency problems before the USCG transports them to Honolulu for treatment.

3.3.2 NORTHWESTERN HAWAIIAN ISLANDS—OFFSHORE

Northwestern Hawaiian Islands Offshore addresses State waters (0-3 nm offshore) and other offshore waters within 12 nm of the NWHI.

3.3.2.1 Biological Resources—Northwestern Hawaiian Islands—Offshore

The 12- to 50-nm portion of the Monument is discussed in the Open Ocean section.

Region of Influence

The region of influence for biological resources offshore of the NWHI is the ocean surrounding the islands from the shoreline out to 12 nm.

Affected Environment

A description of the coral reef area associated with the Hawaiian Islands and its management by both the State of Hawaii and the Federal government is provided in Section 3.1 and 3.4.2.1. Table 3.1.2.1.2-1 provides a list of coral species being considered for listing as threatened or endangered. Pink coralline, red, brown, and green algae are present offshore. The amount of shallow reef habitat immediately surrounding Nihoa is small due to the lack of suitable habitats, and fewer fish and other species have colonized there and been able to survive (Coral Reef Information System, 2007). Only submerged reefs are located around Nihoa. Most of the coral present only survives at depths greater than 40 feet, and coral cover is not greater than 25 percent. Seventeen species of stony coral have been identified offshore of Nihoa. Small lobe coral and rose coral colonies are the most common. The soft corals *Palythoa* sp. and *Sinularia abrupta* and the wire coral are also present (National Oceanic and Atmospheric Administration, 2001). The most common invertebrates are small encrusting species such as sponges, bryozoans, and tunicates. (Coral Reef Information System, 2007; U.S. Fish and Wildlife Service and Hawaii Department of Land and Natural Resources, Division of Aquatic Resources, 2002; National Oceanic and Atmospheric Administration, 2006a)

No age data are available for coral communities; however, marine surveys indicate that the rocky bottoms around islands such as Nihoa are scoured by powerful surf and have limited coral growth, suggesting that coral communities are composed of relatively young colonies. High-wave energy coral communities appear to be most common and are dominated by cauliflower coral and lobe coral.

Reef sharks and jacks are common to the waters offshore of the islands. The spotted knifejaw, which is uncommon in the Main Hawaiian Islands, is often seen. (Coral Reef Information System, 2007)

Most coral is found in habitats that are somewhat protected from wave scour, such as caves, overhangs, and trenches. The most commonly observed stony corals are small lobe coral and rose coral. Corals found at Necker that are not reported from Nihoa are finger coral, cauliflower coral, and corrugated coral. (Coral Reef Information System, 2007)

The marine and littoral areas of the Monument provide essential habitat for Hawaiian monk seals, one of the world's most endangered marine mammals. Their range generally consists of the islands, banks, and corridors within the Monument, although individual animals may be found beyond this extensive area on occasion, sometimes farther than 50 nm from shore. Necker supports a small population of endangered Hawaiian monk seals (Table 3.3.1.1-1) with limited reproduction that is possibly maintained by immigration from other breeding colonies (Coral Reef Information System, 2007). (Papahānaumokuākea Marine National Monument, 2008)

According to the NMFS 5-Year Review: Summary and Evaluation, the Hawaiian monk seal has a recovery Priority Number of One, based on criteria in the Recovery Priority Guidelines that describe a high magnitude of threats, high recovery potential, and the potential for economic conflicts while implementing recovery actions. The magnitude of threats is considered to be high based on the rapid population decline that has persisted for over 20 years. Although the most serious threat of food limitation is improving, the recovery potential is also high because the mitigation of other critical threats are known and in place. One such example is that the species' current core habitat in the NWHI is well-protected, and if foraging conditions improve, then recovery can be expected. However, the monk seal haul-out and pupping beaches are being lost to erosion in the NWHI, and monk seal prey resources in the NWHI may have been reduced as a result of climate cycles and other factors. The recovery potential can still be considered high because the Main Hawaiian Islands represent a large amount of under-occupied habitat, which could support a larger population of seals if appropriate management actions were in place. (National Marine Fisheries Service Pacific Islands Regional Office, 2007)

The waters of the Monument are also home to more than 20 cetacean species, six of them federally recognized as endangered under the ESA and HRS 195D, and "depleted" under the MMPA (see Table 3.3.1.1-1), but comparatively little is known about the distributions and ecologies of these whales and dolphins.

3.3.2.2 Cultural Resources—Northwestern Hawaiian Islands—Offshore

Region of Influence

The region of influence for cultural resources within offshore areas surrounding the NWHI includes any locations where missile launch intercepts and associated debris might affect submerged sites, features, wrecks, or ruins.

Affected Environment

Within the waters surrounding the NWHI, there are thousands of submerged cultural resources. Among the typical deep water resources are the wrecks of 19th century cargo ships, old whaling and merchant ships, fishing boats, World War II ships, 20th century U.S. Warships, recreational vessels, submarines, and aircraft. There is no definitive count of the number of submerged wrecks surrounding the NWHI, as the strong Pacific Ocean currents often destroy them and they are at depths that make them difficult to locate and record. Humpback whales and other marine mammals of cultural value to some Native Hawaiians and other people (National Oceanic and Atmospheric Administration, 2003) are also known to transit these areas.

The State of Hawaii's Geographic Information System and the *Marine Resources Assessment* for the Hawaiian Islands Operating Area, Final Report (U.S. Department of the Navy, 2005b) were reviewed to determine the potential for submerged wrecks to exist within the waters surrounding the NWHI.

3.3.2.3 Health and Safety—Northwestern Hawaiian Islands—Offshore

Health and safety offshore of the NWHI is the same as that described in Section 3.3.1.3.

3.4 OPEN OCEAN AREA

The Open Ocean Area is the area that is greater than 12 nm offshore of the Hawaiian Islands. The Open Ocean Area also includes the PMRF Warning Areas, Oahu Warning Areas, and the TOA (Figure 2.1-1). The TOA was established to support missile defense testing and extends primarily north and west of Kauai. The range and speed of the weapon and missile systems tested at PMRF require the large TOA to contain harmful debris and expended materials from test missions. To ensure safe operations, PMRF requests use of the airspace within the TOA from the FAA during missile defense testing. The FAA issues a NOTAM to avoid specific areas of airspace until testing is complete as described in Section 3.1.1.1.2. The Open Ocean Area, as part of the high seas (outside 12 nm from land), is subject to Executive Order 12114. Both sea and air operations are covered in this section. Of the 13 environmental resources considered for analysis, air quality, geology and soils, land use, noise, socioeconomics, transportation, and utilities are not addressed.

3.4.1 AIRSPACE—OPEN OCEAN AREA

Region of Influence

For this EA/OEA, the region of influence for the Open Ocean Area airspace is defined as those areas beyond the territorial limit which is otherwise known as international airspace.

Affected Environment

The affected airspace environment in the Open Ocean Area region of influence is described below in terms of its principal attributes: controlled and uncontrolled airspace, special use airspace, en route airways and jet routes, airports and airfields, and air traffic control. There are no military training routes in the region of influence.

Controlled and Uncontrolled Airspace

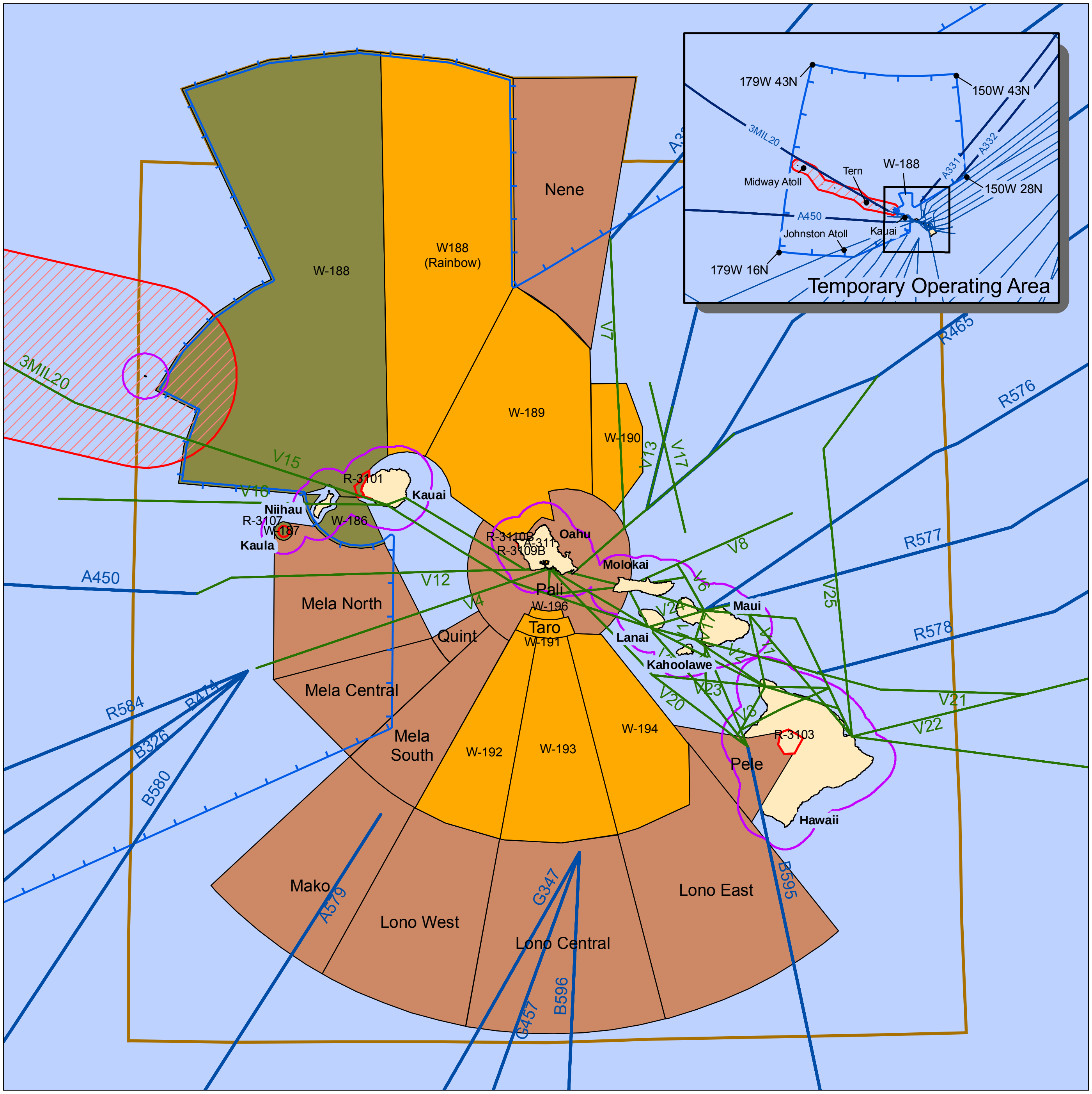
Most of the airspace within the region of influence is in international airspace, and air traffic is managed by the Honolulu Control Facility. The Honolulu Control Facility includes the ARTCC, the Honolulu Control Tower, and the Combined Radar Approach Control collocated in a single facility. Airspace outside that managed by the Honolulu Control Facility is managed by the Oakland ARTCC.

Special Use Airspace

The special use airspace in the region of influence (Figure 3.4.1-1) consists of Warning Area W-188 north of Kauai, and Warning Area W-186 southwest of Kauai, controlled by PMRF.

Warning Areas W-188 Rainbow, W-189 and W-190 north of Oahu, W-187 surrounding Kaula, and W-191, W-192, W-193, W-194, and W-196 south of Oahu are scheduled through the Navy FACSFACPH, which then coordinates with the Honolulu Control Facility. There are also 12 ATCAA areas within the region of influence. These ATCAA areas provide additional controlled airspace adjacent to and between the Warning Areas.

There are no prohibited or alert special use airspace areas in the Open Ocean Area airspace use region of influence.



EXPLANATION

- Air Traffic Services (ATS) Route
- Oceanic Route
- 12-Nautical Mile Line
- Temporary Operating Area (TOA)
- Hawaii Operating Area (OPAREA)
- Papahānaumokuākea Marine National Monument
- Restricted Airspace
- Oahu Warning Area
- Pacific Missile Range Facility (PMRF) Warning Area
- Air Traffic Control Assigned Airspace (ATCAA)
- Land

NORTH

0 50 100 200 Nautical Miles

Airways and Special Use Airspace

Hawaiian Islands

Figure 3.4.1-1

En Route Airways and Jet Routes

The Open Ocean Area airspace use region of influence has several en route high-altitude jet routes, as shown on Figure 3.1.1.1.2-1. Most of the oceanic routes enter the region of influence from the northeast and southwest and are generally outside the special use airspace warning areas described above. The Air Traffic Services routes are concentrated along the Hawaiian Islands chain. Most of the Open Ocean Area region of influence is well-removed from the jet routes that crisscross the North Pacific Ocean.

As an alternative to aircraft flying above 29,000 feet following published, preferred IFR routes (shown in Figure 3.1.1.1.2-1), 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.

The Central Pacific Oceanic Program is one of the Free Flight programs underway. In the airspace over the Central Pacific Ocean, advanced satellite voice and data communications are being used to provide faster and more reliable transmission to enable reductions in vertical, lateral, and longitudinal separation, more direct flights and tracks, and faster altitude clearances. With the full implementation of this program, the amount of airspace in the region of influence that is likely to be clear of traffic may decrease as pilots, whenever practical, choose their own route and file a flight plan that follows the most efficient and economical route.

As described in Section 3.1.1.1.2, other types of airspace and special airspace use procedures used by the military to meet its particular needs include air traffic control assigned airspace and ALTRV procedures. After launch, typically missiles are above 60,000 feet within seconds of launch. As such, all other local flight activities occur at sufficient distance and altitude that the missiles would be little noticed. However, activation of stationary ALTRV procedures, where the FAA provides separation between non-participating aircraft and the missile flight test activities, can 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 most of the intercept debris areas 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 are generally minimal.

All en route airways and jet routes that are predicted to pass through the missile intercept debris areas are identified before a test to allow sufficient coordination with the FAA to determine if the aircraft on those routes could be affected, and if so, if they would need to be re-routed or rescheduled. Routing around the debris areas is handled in a manner similar to severe weather. The additional time for commercial aircraft to avoid the area is generally less than 10 minutes at cruising altitudes and speeds.

The numerous airways and jet routes that crisscross the open ocean airspace use region of influence have the potential to be affected by missile testing. However, missile launches and missile intercepts are 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" (DoD Directive 4540.1, E5, 1981). Before conducting a missile launch and/or intercept test, NOTAMs are sent in accordance with the conditions of the directive specified in the primary responsible test range requirements.

In addition, to satisfy airspace safety requirements, the responsible test range obtains approval from the Administrator, FAA, through the appropriate DoD airspace representative. Provision is made for surveillance of the affected airspace either by radar or patrol aircraft. In addition, safety regulations dictate that hazardous operations be suspended when it is known that any non-participating aircraft have entered any part of the danger zone until the nonparticipating entrant has left the area or a thorough check of the suspected area has been performed.

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 IFR 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 by using ALTRV procedures, non-participating traffic are advised or separated accordingly, thus avoiding substantial adverse impacts to the low altitude airways and high altitude jet routes in the region of influence.

Airports and Airfields

There are no airports or airfields in the Open Ocean Area airspace use region of influence. However, a small portion of the Honolulu Class B airspace extends beyond the territorial limit into the region of influence.

Air Traffic Control

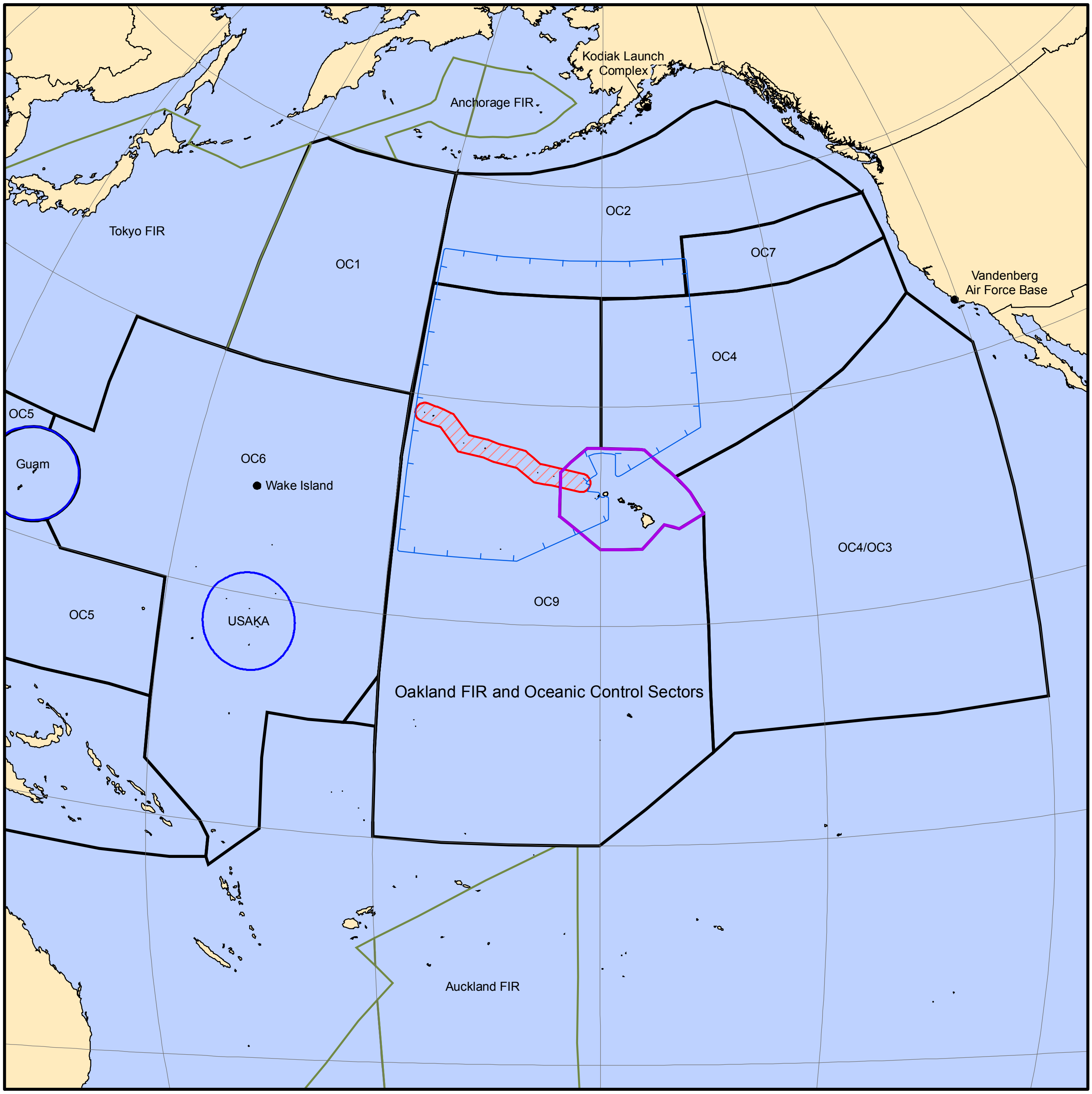
Air traffic in the region of influence is managed by the Honolulu Control Facility and Oakland ARTCC (see Figure 3.4.1-2).

3.4.2 BIOLOGICAL RESOURCES—OPEN OCEAN AREA

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 No-action Alternative and Proposed Action.

Region of Influence

The region of influence for open ocean species includes the areas of the Pacific Ocean within beyond 12 nm from the shore.



EXPLANATION

- Temporary Operating Area (TOA)
- Radar Control Area
- Oakland FIR and Oceanic Control (OC) Sector
- Flight Information Region (FIR)
- Honolulu Control Facility
- Papahānaumokuākea Marine National Monument
- Land

Note:
USAKA = U.S. Army Kwajalein Atoll
ARTCC = Air Route Traffic Control Center

NORTH

0 500 1,000 2,000 Nautical Miles

Airspace Managed by Oakland Air Route Traffic Control Center and Honolulu Control Facility

Pacific Ocean

Figure 3.4.1-2

Affected Environment

The affected biological resources environment in the Open Ocean Area region of influence is described below.

3.4.2.1 Coral

The Hawaiian Islands have 6,764.5 mi^2 of coral reef area, representing 84 percent of the coral reef area in the United States (Maragos, 1977). Due to the motion of the Pacific Plate, the Hawaiian Islands have been transported in a north to northwest direction away from their original location of formation over the hot spot at a rate of about 4 inches per year (Grigg, 1988; 1997b).

Precious coral are corals of the genus Corallium and the pink, gold, bamboo and black corals which in Hawaii and the Western Pacific are managed by the State of Hawaii and the U.S. Federal government per regulation. The state has jurisdiction over coral resources out to 3 nm but also claims authority over inter-island waters the Makapuu Coral Bed, 6 mi off Makapuu in the channel between Oahu and Molokai. Federal jurisdiction extends from 3 nm beyond the coast of Hawaii to 200 nm and from the shoreline of all U.S. possessions in the Western Pacific to 200 nm. This area is defined as the U.S. EEZ. (Grigg, 1993; United Nations Convention On The Law Of The Sea, 1982)

To the degree authorized by law, black corals in Hawaiian waters are managed by the State of Hawaii. Fishermen are required to have commercial fishing licenses and report their catch monthly to the Hawaii Division of Aquatic Resources. A State regulation sets a minimum size of 48 inches in colony height or a minimum stem diameter of 1 inch for the harvest of live black coral (U.S. Fish and Wildlife Service, 2007b). Currently, black coral divers in Hawaii comply voluntarily with this draft regulation (Grigg, 1993).

Precious coral resources within the U.S. EEZ are managed under a Fishery Management Plan (FMP) for precious coral. The FMP allows for domestic and foreign fishing by regular or experimental permits and requires logbooks. Specific weight quotas and size limits have been determined based on estimates of maximum sustainable yields and optimum yields (Grigg, 1993).

Deep-sea coral communities are prevalent throughout the Hawaiian archipelago. They often form offshore reefs that surround all of the Main Hawaiian Islands at depths between 27 and 109 fathoms (Maragos, 1998). Although light penetrates to these depths, it is normally insufficient for photosynthesis. The term “deep-sea corals” may be misleading because substrate (surface for growth), currents, temperature, salinity, and nutrient supply are more important factors in determining the distribution of growth rather than depth (Chave and Malahoff, 1998).

Deep-sea coral communities provide habitat, feeding grounds, recruitment, and nursery grounds for a range of deep-water organisms including epibenthic invertebrates (e.g., echinoderms, sponges, polychaetes, crustaceans, and mollusks), fishes, solitary precious corals (e.g., black corals), and marine mammals (e.g., monk seals) (Maragos, 1998; Midson, 1999; Coral Reef

Information System, 2003; Roberts and Hirshfield, 2003; Freiwald et al., 2004). Deep-sea corals live in complete darkness, in temperatures as low as 39 °F, and in waters as deep as 19,685 feet (Coral Reef Information System, 2003).

3.4.2.2 Fish

Distribution and abundance of fisheries, as well as the individual species, depend greatly on the physical and biological factors associated with an ecosystem. Physical parameters include habitat quality variables such as salinity, temperature, dissolved oxygen, and large-scale environmental disturbances (e.g., El Niño Southern Oscillation). Biological factors affecting distribution are complex and include variables such as population dynamics, predator/prey oscillations, seasonal movements, reproductive/life cycles, and recruitment success (Helfman et al., 1997). A single factor is rarely responsible for the distribution of fishery species; more often, a combination of factors is accountable.

Environmental variations, such as El Niño events, change the normal characteristics of water temperature, thereby changing the patterns of water flow. In the northern hemisphere, El Niño events typically result in tropical, warm-water species moving north (extending species range), and cold-water species moving north or into deeper water (restricting their range). Surface-oriented, schooling fish often disperse and move into deeper waters. El Niño events alter normal current patterns, alter productivity, and have dramatic effects on distribution, habitat range, and movement of pelagic species (National Marine Fisheries Service, 2002b). Fishes that remain in an affected region experience reduced growth, reproduction, and survival (National Marine Fisheries Service, 2002b).

Hawaii's unique fish fauna can be explained by its geographical and hydrographical isolation (Randall, 1998). Pelagic fishes such as the larger tunas, the billfishes, and some sharks are able to traverse the great distance that separates the Hawaiian Islands from other islands or continents in the Pacific Ocean; however, shore fishes are dependent on passive transport as larvae in ocean currents for distribution. As would be expected, the fish families that have a high percentage of species in the Hawaiian Islands compared to elsewhere tend to be those with a long larval life stage, such as the moray eels and surgeonfishes. Families that contain mainly species with short larval life stages, such as the gobies, blennies, and cardinal fishes, are not as well represented in Hawaii as in the rest of the Indo-Pacific region (Randall, 1995).

3.4.2.2.1 Essential Fish Habitat

EFH is described in Section 3.1.2.1.2, PMRF Offshore. The WPRFMC manages major fisheries within the EEZ around Hawaii and the territories and possessions of the United States in the Pacific Ocean (Western Pacific Regional Fishery Management Council, 1998, 2001). The WPRFMC, in conjunction with the State of Hawaii, Division of Aquatic Resources, manages the fishery resources in the study area and focuses on the major fisheries in the study area that require regional management. EFH species, as designated by the WPRFMC (2004), have been divided into management units according to their ecological relationships and preferred habitats.

Currently, no data are available to determine if the pelagic species are approaching an overfished situation (National Marine Fisheries Service, 2004b), except for the bigeye tuna. The National Marine Fisheries Service (2004c) determined that overfishing was occurring Pacific-wide for this species. In addition, shark species are afforded protection under the *Shark Finning Prohibition Act* (National Marine Fisheries Service, 2002c).

The broadbill swordfish, albacore tuna, common thresher shark, and salmon shark have been listed as data deficient on the International Union for Conservation of Nature and Natural Resources (IUCN) Red List due to inadequate information to make a direct, or indirect assessment of its risk of extinction based on its distribution and/or population status (Safina, 1996; Uozumi, 1996a; Goldman and Human, 2000; Goldman et al., 2001). The shortfin mako shark, oceanic whitetip shark, crocodile shark, blacktip shark, and blue shark have been listed as near threatened (Compagno and Musick, 2000; Shark Specialist Group, 2000; Smale, 2000; Stevens, 2000a; 2000b). The bigeye tuna and the great white shark are listed as vulnerable on the IUCN Red List (Uozumi, 1996b; Fergusson et al., 2000).

Offshore Ocean or Pelagic Species

Pelagic species occur in tropical and temperate waters of the western Pacific Ocean (National Marine Fisheries Service-Pacific Islands Region, 2001). Shark species can be found in the inshore ocean zone water from 109.3 to 546.7 fathoms. Factors such as gradients in temperature, oxygen, or salinity can affect the suitability of a habitat for pelagic fishes. Skipjack tuna, yellowfin tuna, and Indo-Pacific blue marlin prefer warm surface layers where the water is well-mixed and relatively uniform in temperature (Western Pacific Regional Fishery Management Council, 1998). Species such as albacore tuna, bigeye tuna, striped marlin, and broadbill swordfish prefer temperate waters associated with higher latitudes and greater depths (Western Pacific Regional Fishery Management Council, 1998). Certain species, such as broadbill swordfish and bigeye tuna, are known to aggregate near the surface at night. During the day broadbill swordfish can be found at depths of about 437 fathoms and bigeye tuna around 150 to 301 fathoms (Western Pacific Regional Fishery Management Council, 1998). Juvenile albacore tuna generally concentrate above 49 fathoms, with adults found in deeper waters (about 49 to 150 fathoms) (Western Pacific Regional Fishery Management Council, 1998).

3.4.2.3 Sea Turtles

Sea turtles are long lived reptiles that can be found throughout the world’s tropical, subtropical, and temperate seas (Caribbean Conservation Corporation and Sea Turtle Survival League, 2003). There are seven living species of sea turtles from two distinct families, the Cheloniidae (hard-shelled sea turtles; six species) and the Dermochelyidae (leatherback sea turtle; one species). These two families can be distinguished from one another on the basis of their carapace (upper shell) and other morphological features. Sea turtles are an important marine resource in that they provide economic, arid existence (non-use) value to humans (Witherington and Frazer, 2003). Over the last few centuries, sea turtle populations have declined dramatically due to human-related activities such as coastal development, oil exploration, commercial fishing, marine-based recreation, pollution, and over-harvesting (National Research Council, 1990; Eckert, 1995). As a result, all six species of sea turtles found in U.S. waters are currently listed as either threatened or endangered under the ESA. Five of the seven living species of sea turtles are known to occur in waters off the Hawaiian Islands: the green, hawksbill, loggerhead (*Caretta caretta*), olive ridley (*Lepidochelys olivacea*), and leatherback sea turtles.

Sea turtles are highly adapted for life in the marine environment and possess powerful flippers that enable them to swim continuously for extended periods of time (Wyneken, 1997). They also have compact and streamlined bodies that help to reduce drag. Additionally, sea turtles are among the longest and deepest diving of the air-breathing vertebrates, spending as little as 3 to 6 percent of their time at the water's surface (Lutcavage and Lutz, 1997). Sea turtles often travel thousands of miles between their nesting beaches and feeding grounds, which makes the aforementioned suite of adaptations very important (Ernst et al., 1994; Meylan, 1995). Sea turtle traits and behaviors also help protect them from predation. Sea turtles have a tough outer shell and grow to a large size as adults; mature leatherback sea turtles can weigh up to 2,091 lb (Eckert and Luginbuhl, 1988). Sea turtles cannot withdraw their head or limbs into their shell, so growing to a large size as adults is important.

Aside from a brief terrestrial period, which lasts approximately 2 months as eggs and an additional few minutes to a few hours as hatchlings scrambling to the surf, most sea turtles are rarely encountered out of the water. Sexually mature females return to land in order to nest, while certain species in the Hawaiian Islands, Australia, and the Galapagos Islands haul out on land in order to bask (Carr, 1995; Spotila et al., 1997). Sea turtles bask to thermoregulate, elude predators, avoid harmful mating encounters, and possibly to accelerate the development of their eggs, accelerate their metabolism, and destroy aquatic algae growth on their carapaces (Whittow and Balazs, 1982; Spotila et al., 1997).

Female sea turtles nest in tropical, subtropical, and warm-temperate latitudes, often in the same region or on the same beach where they hatched (Miller, 1997). Upon selecting a suitable nesting beach, most sea turtles tend to re-nest in close proximity during subsequent nesting attempts. The leatherback sea turtle is a notable divergence from this pattern. This species nests primarily on beaches with little reef or rock offshore. On these types of beaches erosion reduces the probability of nest survival. To compensate, leatherbacks scatter their nests over larger geographic areas and lay on average two times as many clutches as other species (Eckert, 1987).

Non-nesting emergences, known as false crawls, can occur if sea turtles are obstructed from laying their eggs (by debris, rocks, roots, or other obstacles), are distracted by surrounding conditions (by noise, lighting, or human presence), or are uncomfortable with the consistency or moisture of the sand on the nesting beach. Turtles successful at nesting usually lay several clutches of eggs during a nesting season with each clutch containing between 50 and 200 eggs, depending on the species (Witzell, 1983; Dodd, 1988; Hirth, 1997). Most sea turtles, with the possible exception of Kemp's ridley sea turtles (*Lepidochelys kempii*), do not nest in consecutive years; instead, they will often skip 2 or 3 years before returning to the nesting grounds (Márquez-M., 1990; Ehrhart, 1995). Nesting success is vital to the long-term existence of sea turtles since it is estimated that only 1 out of every 1,000 hatchlings survives long enough to reproduce (Frazer, 1986).

Hatchlings most often emerge from their nest at night (Miller, 1997). After emerging from the nest, sea turtle hatchlings use visual cues (e.g., light intensity or wavelengths) to orient themselves toward the sea (Lohmann et al., 1997).

Hatchlings that make it into the water will spend the first few years of their lives in offshore waters, drifting in convergence zones or amidst floating vegetation, where they find food (mostly pelagic invertebrates) and refuge in flotsam that accumulates in surface circulation features (Carr, 1987). Sea turtles will spend several years growing in the early juvenile "nursery habitat," which is usually pelagic and oceanic, before migrating to distant feeding grounds that comprise the later juvenile "developmental habitat," which is usually in shallow water (Musick and Limpus, 1997; Frazier, 2001). Hard-shelled sea turtles most often use shallow offshore and inshore waters as later juvenile developmental habitats; whereas leatherback sea turtles, depending on the season, can utilize either coastal feeding areas in temperate waters or offshore feeding areas in tropical waters (Frazier, 2001).

Green and hawksbill sea turtles are most common in offshore waters around the Main Hawaiian Islands and Nihoa, as they prefer to reside in reef-type environments that are less than about 55 fathoms in depth (U.S. Department of the Navy, 2005b). The green sea turtle is by far the most common species occurring in the offshore waters around the Hawaiian Islands; this is highly evidenced by the available stranding data for the Main Hawaiian Islands. More than 90 percent of all green sea turtle breeding and nesting activity in Hawaiian waters occurs at French Frigate Shoals in the NWHI, yet a substantial foraging population resides in and returns to the shallow, coastal waters surrounding the Main Hawaiian Islands (especially around Maui and Kauai). The Hawaiian population of green sea turtles appears to have increased gradually over the past 30 years and currently has population sizes sufficient to warrant a status review (Balazs, 1995; Balazs and Chaloupka, 2004). This is presumably due to effective protection at primary nesting areas in the NWHI and better enforcement of regulations prohibiting take of the species. Sporadic nesting events in the Main Hawaiian Islands have occurred along the north shore of Molokai, the northwest shore of Lanai, and the south, northeast, and southwest shores of Kauai (Pacific Missile Range Facility, 2001; U.S. Department of the Navy, 2002; National Ocean Service, 2001).

A herpes virus is involved in a sea turtle fibropapilloma that affects the skin with large tumors (Herbst, 1994; Herbst et al., 1995; Quackenbush et al., 1998). Fibropapilloma may be caused by exposure to marine areas impacted by pollution such as runoff from agricultural, industrial, or urban sources (Aguirre and Lutz, 2004). Growth rates of green sea turtles were significantly lower in those with fibropapilloma tumors (Chaloupka and Balazs, 2005). Despite the occurrence of fibropapillomatosis, and spirochidiasis, both of which are major causes of stranding of this species, nester abundance has continued to increase (Balazs and Chaloupka 2004). The size of the green sea turtle population in the Pacific Ocean was estimated at about 21,000 adults in 2001 (National Marine Fisheries Service, 2005; Seminoff, 2004).

Hawksbill sea turtles are the second most common species in the offshore waters of the Hawaiian Islands, as also reflected by the stranding records, yet they are far less abundant than green sea turtles. Hawksbills occur around and nest on several of the Main Hawaiian Islands. Hawksbill nesting occurs primarily on the southeastern end of Hawaii and on the eastern end of Molokai (Aki et al., 1994). A lack of regular quantitative surveys for hawksbill sea turtles in the Pacific Ocean and the discrete nature of this species' nesting have made it extremely difficult for scientists to assess the distribution and population status of hawksbills in the region (National Marine Fisheries Service and U.S. Fish and Wildlife Service, 1998a; Seminoff et al., 2003). Around the Hawaiian Islands, hawksbills are only known to occur in the coastal waters of the eight main and inhabited islands of the archipelago. Hawksbills forage throughout the Main Hawaiian Islands, although in much fewer numbers than green sea turtles. No reliable reports are known from Niihau (Pacific Missile Range Facility, 2001). Hawksbills are much more abundant in the shallow, offshore waters of the Hawaiian Islands than they are in deeper, offshore waters of the central Pacific Ocean.

There are few quantitative data available concerning the seasonality, abundance, or distribution of leatherbacks in the central North Pacific Ocean. The leatherback is not typically associated with insular habitats, such as those characterized by coral reefs, yet individuals are occasionally encountered in deep ocean waters near prominent archipelagos such as the Hawaiian Islands (Eckert, 1993). Leatherbacks were not sighted during any of the NMFS shipboard surveys, although their deep diving capabilities and long submergence times lessen the probability that observers would be able to spot them during marine surveys.

Further offshore (in waters beyond the 55-fathom isobath), juvenile loggerheads forage in or migrate through waters off the Hawaiian Islands as they move between North American developmental habitats and Japan. The highest densities of loggerheads can be found just north of the Hawaiian Islands within the North Pacific transition zone (Polovina et al., 2000). On 16 July 2007, NMFS received a petition from the Center for Biological Diversity and the Turtle Island Restoration Network requesting that loggerhead sea turtles in the North Pacific Ocean be reclassified as a Distinct Population Segment with endangered status and that critical habitat be designated. In a 2007 Federal Register Notice (National Marine Fisheries Service, 2007b), NMFS initiated a review of the status of the species to determine whether the petitioned action is warranted and to determine whether any additional changes to the current listing of the loggerhead sea turtle are warranted. National Marine Fisheries Service and U.S. Fish and Wildlife Service (1998b) listed four records of this species for the Hawaiian Islands: two from the southeastern end of the archipelago, one from Kure Atoll (recovered from the stomach of a tiger shark [*Galeocerdo cuvier*]), and a fourth from the coast of Oahu (seen just offshore of the Sheraton Waikiki hotel). All four individuals were identified as juvenile loggerheads and most likely drifted or traveled to the region from either Mexico or Japan. A single male loggerhead sea turtle has also been reported to visit Lehua Channel and Keamano Bay (located off the north coast of Niihau) every June through July (Pacific Missile Range Facility, 2001; National Ocean Service, 2001).

Until the advent of commercial exploitation, the olive ridley was highly abundant in the eastern tropical Pacific Ocean, probably outnumbering all other sea turtle species combined in the area (National Marine Fisheries Service and U.S. Fish and Wildlife Service, 1998d). Clifton et al. (1995) estimated that a minimum of 10 million olive ridleys were present in ocean waters off the Pacific coast of Mexico prior to 1950. Even though there are no current estimates of worldwide abundance, the olive ridley is still considered the most abundant of the world's sea turtles. However, the number of olive ridley sea turtles occurring in U.S. territorial waters is believed to be small (National Marine Fisheries Service and U.S. Fish and Wildlife Service, 1998c). The highest densities of olive ridleys are likely found just south of the region.

Due to the offshore habitat preferences of the green and hawksbill sea turtles and the oceanic habitat preferences of the loggerhead, olive ridley, and leatherback sea turtles, the entire Hawaiian Islands area is recognized as an area of primary occurrence for sea turtles. Since the Hawaiian Islands are situated in tropical waters that are warm year-round, the area of primary occurrence is the same in fall and winter as it is in spring and summer. Sea turtles are also known to come ashore at several locations throughout the Main Hawaiian Islands, for terrestrial basking (green sea turtles only) or nesting (primarily green and hawksbill sea turtles). Nesting/basking sites for sea turtles occur on all eight of the Main Hawaiian Islands. Of note are green sea turtle nesting/basking beaches located at PMRF Barking Sands on Kauai and a green sea turtle basking beach located along Kiholo Bay off the northwestern shore of Hawaii (National Ocean Service, 2001; U.S. Department of the Navy, 2004).

3.4.2.4 Marine Mammals

Marine mammals addressed within this EA/OEA include members of two orders: Cetacea, which includes whales, dolphins, and porpoises; and Carnivora, which includes true seals (family Phocidae) and sea lions (family Otariidae). Cetaceans spend their lives entirely at sea. Pinnipeds (seals and sea lions) hunt and feed exclusively in the ocean, and one of the species occurring in the areas addressed in this EA/OEA comes ashore to rest, mate, and bear young. There are 27 species of marine mammals that occur in the Hawaiian Islands area (Table 3.4.2.4-1). Most of the marine mammal species found in the Hawaiian Islands area are cetaceans, including 7 mysticetes (baleen whales) and 18 odonocetes (tooth whales and dolphins) with 2 pinniped species, both phocids (true seals). No otariids (sea lions and fur seals) or sirenians (dugongs and manatees) are found in the Hawaiian Islands area. Of the 27 marine mammal species, 7 species are considered endangered under the ESA and are considered a depleted and strategic stock under the 1972 MMPA.

Table 3.4.2.4-1. Summary of Hawaiian Islands Stock or Population of Marine Mammals

Order Cetacea	Scientific Name	Status	Occurs[1]	Group Size[2]	Detection Probability[3]		Hawaii Abundance
					Group 1-20	Group >20	
MYSTICETES (baleen whales)							
Family Balaenidae (right whales)							
North Pacific right whale	*Eubalaena japonica*	E	Rare				UNK
Family Balaenopteridae (rorquals)							
Humpback whale	*Megaptera novaeangliae*	E	Regular	1.7			4,491[4]
Sei whale	*Balaenoptera borealis*	E	Rare	3.4	0.90	0.90	236 [5]
Fin whale	*Balaenoptera physalus*	E	Rare	2.6	0.90	0.90	236 [5]
Blue whale	*Balaenoptera musculus*	E	Rare				UNK
ODONTOCETES (toothed whales)							
Family Physeteridae (sperm whale)							
Sperm whale	*Physeter macrocephalus*	E	Regular	7.3	0.87	0.87	6,919
PINNIPEDS (seals, sea lions, walruses)							
Family Phocidae (true seals)							
Hawaiian monk seal	*Monachus schauinslandi*	E	Regular				1,252

Source: U.S. Department of the Navy, 2005a; Barlow, 2003; Mobley, 2004; Barlow, 2006; Carretta et al., 2006
Notes: Taxonomy follows Rice (1998) for pinnipeds and sirenians and the International Whaling Commission (2007) for cetaceans.
[1] Occurrence: **Regular** = A species that occurs as a regular or normal part of the fauna of the area, regardless of how abundant or common it is; **Rare** = A species that only occurs in the area sporadically; *includes more than one species, but nomenclature is still unsettled.
[2] Mean group sizes are the geometric mean of best estimates from multiple observers and have not been corrected for bias.
[3] Barlow, 2006
[4] Central North Pacific Stock
[5] For analysis purposes, density was assumed to be the same as for the false killer whale
E = Endangered UNK = Unknown

Marine mammals inhabit most marine environments from deep ocean canyons to shallow estuarine waters. They are not randomly distributed. Marine mammal distribution is affected by demographic, evolutionary, ecological, habitat-related, and anthropogenic factors (Bowen et al., 2002; Bjørge, 2002; Forcada, 2002; Stevick et al., 2002). Marine mammal movements are often related to feeding or breeding activity (Stevick et al., 2002). A migration is the periodic movement of all, or significant components of, an animal population from one habitat to one or more other habitats and back again. Some baleen whale species, such as humpback whales, make extensive annual migrations to low-latitude mating and calving grounds in the winter and to high-latitude feeding grounds in the summer (Corkeron and Connor, 1999).

Marine Mammal Occurrence

Information on the abundance, behavior, distribution, and diving behavior of marine mammal species in the Hawaiian waters is based on peer reviewed literature including the most recent publications, the Navy Marine Resource Assessment, NMFS Stock Assessment Reports, marine mammals surveys using acoustics or visual observations from aircraft or ships, and previous environmental documents such as the RIMPAC EA and supplements and the Undersea Warfare Exercise EA/OEA and Incidental Harassment Authorization applications.

The North Pacific right whale is perhaps the world's most endangered large whale species (Perry et al., 1999; International Whaling Commission, 2001). North Pacific right whales are classified as endangered both under the ESA and on the IUCN Red List (Reeves et al., 2003). No reliable population estimate presently exists for this species; the population in the eastern North Pacific is considered to be very small, perhaps only in the tens of animals (National Marine Fisheries Service, 2002a; Clapham et al., 2004), while in the western North Pacific, the population may number at least in the low hundreds (Brownell et al., 2001; Clapham et al., 2004).

The best available estimate of abundance for the Central West Pacific stock of the humpback whales in 2004 was 4,491 individuals (Mobley, 2004). Humpback whales use Hawaiian waters as a major breeding ground during winter and spring (November through April). According to 2008 SPLASH data, a total of 7,971 unique humpback whale individuals were catalogued following field efforts conducted on all known North Pacific winter breeding regions and all known summer feeding areas (U.S. Department of Commerce, 2008). Evidence suggests that some humpback whales may move between the waters of Japan in the Western North Pacific (Darling and Cerchio, 1993; Salden, et al., 1999; Calambokidis et al., 2001; Witteveen et al., 2004). Calambokidis et al. (1997) estimated that up to half of the North Pacific populations of humpback whales migrate to the Hawaiian Islands during the winter. Peak abundance around the Hawaiian Islands is from late February through early April (Mobley et al., 2001a; Carretta et al., 2005). An estimated average of 18,302 represents the best estimate of the overall abundance of humpback whales in the North Pacific, excluding calves (U.S. Department of Commerce, 2008). During the fall–winter period, primary occurrence is expected from the coast to 50 nm offshore, which takes into consideration both the available sighting data and the preferred breeding habitat (shallow waters) (Herman and Antinoja, 1977; Mobley et al., 1999, 2000, 2001a). The greatest densities of humpback whales (including calves) are in the four-island region consisting of Maui, Molokai, Kahoolawe, and Lanai, as well as Penguin Bank (Mobley et al., 1999; 2001a; Maldini, 2003) and around Kauai (Mobley, 2005). Most of the central North Pacific stock of humpback whales migrate south to Hawaii in winter for breeding and calving from December through April (Clapham and Mead, 1999; Mobley et al., 2001a).

The sei whale *(Balaenoptera borealis)* is listed as endangered under the ESA and as a depleted and strategic stock under the MMPA (Carretta et al., 2005). Barlow (2006) did not give a density estimate for sei whales in Hawaii because the survey (originally analyzed in Barlow, 2003) was not conducted during the peak period of abundance. Therefore, for the analysis undertaken in support of this EA/OEA, it was assumed that the number and density of sei whales did not exceed that of the small population of false killer whales (236 false killer whales in Hawaii). There is no information on the population trend of sei whales. The sei whale is considered to be rare in Hawaiian waters based on reported sighting data and the species' preference for cool, temperate waters.

The fin whale *(Balaenoptera physalus)* is listed as endangered under the ESA and as a depleted and strategic stock under the MMPA. Barlow (2006) did not give a density estimate for fin whales in Hawaii because the survey (originally analyzed in Barlow 2003) was not conducted during the peak period of abundance. Therefore, for the analysis undertaken in support of this EA/OEA, it was assumed that the number and density of fin whales did not exceed that of the small population of false killer whales (236 false killer whales in Hawaii). There is no information on the population trend of fin whales. Fin whales are not common in the Hawaiian Islands. Sightings were reported north of Oahu in May 1976, the Kauai Channel in February 1979, and north of Kauai in February 1994 (Shallenberger, 1981; Mobley et al., 1996).

The blue whale *(Balaenoptera musculus)* is listed as endangered under the ESA and as a depleted and strategic stock under the MMPA. The NMFS considers blue whales found in Hawaii as part of the Western North Pacific stock (Carretta et al., 2005) due to differences in call types with the Eastern North Pacific stock (Stafford et al., 2001; Stafford, 2003). The blue whale was severely depleted by commercial whaling in the twentieth century (National Marine Fisheries Service, 1998). There is no information on the population trend of blue whales.

The sperm whale *(Physeter macrocephalus)* is listed as endangered under the ESA and as a depleted and strategic stock under the MMPA (Carretta et al., 2005). Although many sperm whale populations have been depleted to varying degrees by past whaling activities, sperm whales remain one of the more globally common great whale species. In fact, in some areas, they are actually quite abundant. For example, there are estimated to be about 21,200 to 22,700 sperm whales in the eastern tropical Pacific Ocean (Wade and Gerrodette, 1993). Sperm whales are widely distributed throughout the Hawaiian Islands year-round (Rice, 1960; Shallenberger, 1981; Lee, 1993; and Mobley et al., 2000). Sperm whale clicks recorded from hydrophones off Oahu confirm the presence of sperm whales near the Hawaiian Islands throughout the year (Thompson and Friedl, 1982).

The Hawaiian monk seal is listed as endangered under the ESA and as a depleted and strategic stock under the MMPA (Ragen and Lavigne, 1999; Carretta et al., 2005). Hawaiian monk seals are managed as a single stock, although there are six main reproductive subpopulations at French Frigate Shoals, Laysan Island, Lisianski Island, Pearl and Hermes Reef, Midway Atoll, and Kure Atoll (Ragen and Lavigne, 1999; Carretta et al., 2005). Genetic comparisons between the Northwestern and Main Hawaiian Islands seals have not yet been conducted, but observed interchange of individuals among the regions is extremely rare.

The Hawaiian monk seal occurs only in the central North Pacific. Until recently, this species occurred almost exclusively at remote atolls in the NWHI. In the last decade, however, sightings of Hawaiian monk seals in the Main Hawaiian Islands have increased considerably (Baker and Johanos, 2004; Carretta et al., 2005). Most monk seal haulout events in the Main Hawaiian Islands have been on the western islands of Niihau and Kauai (Baker and Johanos, 2004; Carretta et al., 2005). The best estimate of the total population size is 1,252 individuals in the Hawaiian Islands Archipelago (Carretta et al., 2006). There are an estimated 77 seals in the Main Hawaiian Islands (National Marine Fisheries Services, 2007c). The vast majority of the population is present in the NWHI.

3.4.3 CULTURAL RESOURCES—OPEN OCEAN AREA

Region of Influence

The region of influence for cultural resources within the Open Ocean Area encompasses locations where missile intercept debris might affect submerged sites, features, wrecks, or ruins.

Affected Environment

Open Ocean Area Archaeological Resources

In the waters surrounding the Hawaiian Islands, there are thousands of submerged cultural resources. The types of wrecks most likely to occur are 19th century cargo ships, submarines, old whaling and merchant ships, fishing boats, or 20th century U.S. Warships, aircraft, recreational craft, and land vehicles. There is no definitive count of the number of wrecks surrounding the Hawaiian Islands, as they are located at depths that make them difficult to locate and record. Pacific Ocean currents and storms are also quick to destroy these types of submerged resources. The State of Hawaii's Geographic Information System and the *Marine Resources Assessment for the Hawaiian Islands Operating Area, Final Report* (U.S. Department of the Navy, 2005b) were reviewed to determine the potential for shipwrecks to exist within the open ocean waters surrounding the Hawaiian Islands, as well as the specific proposed regions of influence.

Humpback whales and other marine mammals of cultural value to some Native Hawaiians and other people (National Oceanic and Atmospheric Administration, 2003) are also known to transit open ocean areas.

3.4.4 HAZARDOUS MATERIALS AND WASTE—OPEN OCEAN AREA

Open ocean areas are typically considered to be relatively pristine with regard to hazardous materials and hazardous wastes. Hazardous materials are present on the ocean, however, as cargoes and as fuel, lubricants, and cleaning and maintenance materials for marine vessels and aircraft. Infrequently, large hazardous materials leaks and spills—especially of petroleum products—have fouled the marine environment and adversely affected marine life. No quantitative information is available on the overall types and quantities of hazardous materials present on the sea ranges at a given time, nor on their distribution among the various categories of vessels.

Region of Influence

The hazardous materials and wastes region of influence for the Open Ocean Area includes the Navy's sea ranges and immediately adjacent waters.

Affected Environment

Hazardous Materials and Hazardous Constituents

The CHRIMP provides information on management of hazardous materials for both afloat and ashore. Hazardous materials associated with missile testing are described below.

Missiles

The single largest hazardous constituent of missiles is solid propellant, but numerous hazardous constituents are used in igniters, explosive bolts, batteries, and warheads. Most of the missiles fired carry inert warheads that contain no hazardous constituents. Exterior surfaces may be coated, however, with anti-corrosion compounds containing chromium or cadmium.

Aerial Targets

Aerial targets are used for testing and training purposes. Most aerial targets contain jet fuels, oils, hydraulic fluid, batteries, and explosive cartridges as part of their operating systems. Fuel is shut off by an electronic signal, the engine stops, and the target begins to descend. A parachute is activated and the target descends to the ocean surface where range personnel retrieve it. Some targets are actually hit by missiles, however, and those targets fall into the Range unrecovered.

Hazardous Wastes

Navy vessels conducting training do not intentionally release hazardous constituents into the open ocean area. USEPA and the DoD, however, have identified numerous waste streams from Navy vessels that do or may contain hazardous constituents. Waste streams from Navy vessels that may contain hazardous constituents include hull coating leachate, bilgewater/oil water separator discharges, gray water, cooling water, weather deck runoff, and photographic laboratory drains: In addition, small boat engines discharge petroleum products in their wet exhaust (U.S. Environmental Protection Agency, 2004).

Environmental compliance policies and procedures applicable to shipboard operations afloat are defined in Office of the Chief of Naval Operations Instruction 5090.1C (2007). This document has a compliance orientation to ensure safe and efficient control, use, transport, and disposal of hazardous waste. Munitions containing or comprising hazardous materials expended during training exercises that are irretrievable from the ocean are not considered a hazardous waste in accordance with the Military Munitions Rule. Navy ships may not discharge overboard untreated used or excess hazardous materials generated onboard the ship within 200 nm of shore. Hazardous wastes generated afloat are stored in approved containers. The waste is offloaded for proper disposal within 5 working days of arrival at a Navy port.

3.4.5 HEALTH AND SAFETY—OPEN OCEAN AREA

Region of Influence

The region of influence for public health and safety includes the sea ranges themselves, and ocean areas adjacent to the sea ranges.

Affected Environment

The ocean in the vicinity of the main Hawaiian Islands is used for a variety of recreational, commercial, scientific, transportation, cultural, and institutional purposes. The intensity of use generally declines with increasing distance from the shoreline, although specific resources in the Open Ocean Area may result in a concentration of use (e.g., sea mounts are preferred fishing locations). Areas that are shielded by land masses from the full force of wind and waves, such as the channels between Maui and adjacent islands, are preferred recreational areas. The State of Hawaii, Division of Aquatic Resources is conducting a Hawaii Marine Recreational Fishing Survey Project to determine the quantity of recreational fishing in Hawaii.

Activities in the Open Ocean Area have no influence on public health. These areas are widely used for recreation, commerce, and scientific, educational, and cultural activities, however, surface vessel transits, aircraft operations, and weapons firing have the potential to affect public safety. The Navy has developed extensive protocols and procedures for the safe operation of its vessels and the safe execution of its training events.

3.4.6 NOISE—OPEN OCEAN AREA

Wildlife receptors and their acoustic characteristic and sensitivities are described in Biological Resources.

Region of Influence

Noise sources in the region are transitory and widely dispersed. The region of influence for noise includes all areas where air operations or live weapons firings take place.

Affected Environment

Airborne noise sources include civilian and military aircraft (both types of which fly at altitudes ranging from hundreds of feet to tens of thousands of feet above the surface), bombs, naval gunfire, missiles, rockets, and small arms. Noise levels may be significant in the vicinity of these activities, but the noise intensity decreases rapidly with increasing distance from the source, especially for impulsive noise from the discrete noise events characteristic of military training. Additionally, these activities take place miles at sea, where few or no human receptors are exposed to the noise. Open Ocean Area noise events are widely dispersed, temporally and geographically, with little or no overlap or additive effects.

3.4.7 WATER RESOURCES—OPEN OCEAN AREA

Region of Influence

The region of influence for water resources includes open ocean waters associated with PMRF testing and training.

Affected Environment

The Open Ocean Area off the Hawaiian Islands is a dynamic, tropical marine environment. Average water temperatures vary from 71° F in March to 81°F in September. Wave height varies from occasional flat seas to over 40 feet during high winter winds. Average swells commonly range from 3.3 to 9.8 feet in height. Water quality in the Open Ocean Area is excellent, with high clarity, low concentrations of suspended particles, high levels of dissolved oxygen, and low levels of contamination from trace metals or hydrocarbons (components of petroleum-based fuels) (U.S. Department of the Navy, 2000).

4.0 Environmental Consequences

4.0 ENVIRONMENTAL CONSEQUENCES

This chapter describes the potential environmental consequences of the No-action and Proposed Action Alternatives by comparing these activities with the potentially affected environmental components described in Chapter 3.0. The amount of detail presented in each section is proportional to the potential for impacts.

To assess the potential for and significance of environmental impacts, 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 these activities. Thirteen broad areas of environmental consideration were assessed to provide a context for understanding the potential effects of the No-action Alternative and the Proposed Action. These areas included air quality, airspace, biological resources, cultural resources, geology and soils, hazardous materials and waste, health and safety, land use, noise, socioeconomics, transportation, utilities, and water resources. All 13 environmental resources are addressed and analyzed as applicable for the proposed location or activity, and according to location: Kauai is discussed first, followed by Niihau, Northwestern Hawaiian Islands, and Open Ocean Area.

4.1 NO-ACTION ALTERNATIVE

If this alternative is selected, the Pacific Missile Range Facility (PMRF) would continue existing range testing and training, operation activities, base operations, and maintenance activities as described in Sections 2.1.1 and 2.1.2. PMRF conducts fleet training and test and evaluation. Range instrumentation including radars, telemetry, and optical systems is used for tracking data collection. The number of exercises and operations, including intercept tests, conducted at PMRF, and the number of hours the range is scheduled for each event, vary daily, monthly, and annually. The environmental impacts of the activities that make up the No-action Alternative were analyzed in the 2008 Final Hawaii Range Complex Environmental Impact Statement/Overseas Environmental Impact Statement (HRC EIS/OEIS) and in subsequent National Environmental Policy Act (NEPA) documents listed in Section 1.6. These activities and the related environmental analysis have been reviewed to ensure they are still valid and are summarized below.

4.1.1 KAUAI ONSHORE—NO-ACTION

4.1.1.1 PMRF/Main Base—Onshore—No-action

4.1.1.1.1 Air Quality—PMRF/Main Base—Onshore—No-action

Under the No-action Alternative, air quality conditions will not differ from existing conditions described in Chapter 3.0. Analysis of Navy aircraft and launch-related impacts is covered in the 2008 HRC Final EIS/OEIS. Compliance with Standard Operating Procedures (SOPs) and air permits will continue to minimize impacts. Propellant and other combustion product emissions generated by current base activities disperse rapidly during flight, and hazardous levels will not accumulate. These conditions and the low frequency of tests contribute to ensure no significant impact to regional air quality. The tempo of launch events will continue to be managed by range activities in order to stay within the limits of current agreements; no more than 30 closures of the Restrictive Easement would occur annually.

4.1.1.1.2 Airspace—PMRF/Main Base—Onshore—No-action

No significant airspace impacts have been identified in the analysis presented in the documents listed in Section 1.6. Any potential impacts to airspace from continued activities and activities to controlled and uncontrolled airspace, special use airspace, en route airways and jet routes, or airports and airfields are minimized through SOPs, compliance with Department of Defense (DoD) Directive 4540.1, Office of the Chief of Naval Operations Instruction (OPNAVINST) 3770.4A, OPNAVINST 3721.20, and continued close coordination with the Federal Aviation Administration (FAA). No modifications or need for additional airspace are required.

4.1.1.1.3 Biological Resources—PMRF/Main Base—Onshore—No-action

Under the No-action Alternative, previously analyzed activities will continue to take place in existing operating areas without significant impacts to biological resources. Compliance with relevant Navy policies and procedures and biological opinions expressed by U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) addressing these activities will continue to minimize any adverse effects on listed vegetation and wildlife as described in Section 3.1.1.1.3, as well as limit the potential for introduction of invasive species.

4.1.1.1.4 Cultural Resources—PMRF/Main Base—Onshore—No-action

Under the No-action Alternative, activities would continue to occur within the same designated areas previously analyzed in the environmental documents listed in Section 1.6 and determined to have no significant adverse effects on cultural resources. The protection of cultural resources at PMRF and all of its sub-installations is guided by the PMRF Integrated Cultural Resources Management Plan (ICRMP), which incorporates the content of the Commander Navy Region Programmatic Agreement developed among the Commander Navy Region, Hawaii; the Hawaii State Historic Preservation Officer (SHPO); and the Advisory Council on Historic Preservation (Council) in 2003; a Memorandum of Agreement developed among PMRF, the Hawaii SHPO, and the Council in 1999; and the statutes and regulations described in Appendix C of this Environmental Assessment/Overseas Environmental Assessment (EA/OEA). If unanticipated cultural resources are encountered (particularly human remains) during any activity, all activities will cease in the immediate vicinity of the find and the PMRF Environmental Engineer will be notified. Subsequent actions and notifications would follow the guidance provided in the PMRF ICRMP (International Archaeological Research Institute, Inc., 2005).

4.1.1.1.5 Geology and Soils—PMRF/Main Base—Onshore—No-action

Ongoing training activities and exercises will utilize existing facilities. Therefore, there will be minimal direct impact on the beach and inland areas, and soils are not being permanently affected.

4.1.1.1.6 Hazardous Materials and Waste—PMRF/Main Base—Onshore—No-action

As described in Section 3.1.1.1.6, PMRF/Main Base has appropriate plans and SOPs in place to manage hazardous materials and waste, thus minimizing impacts. The No-action Alternative would have no significant impacts on the use of hazardous materials or disposal of hazardous wastes at PMRF.

4.1.1.1.7 Health and Safety—PMRF/Main Base—Onshore—No-action

Under the No-action Alternative, risk to public health and safety will continue to be minimized through compliance with Range commander’s Council (RCC) standards 321, Navy and U.S. Department of Energy (DOE) SOPs, policies, and plans described in Section 3.1.1.1.7. Thus, no significant impacts are expected.

4.1.1.1.8 Land Use—PMRF/Main Base—Onshore—No-action

Land uses and the Agricultural Preservation Initiative are compatible with PMRF activities. The continuation of activities will be consistent to the maximum extent practicable with the Hawaii Coastal Zone Management Program. Closure of public recreational areas on PMRF/Main Base (beaches and coastal areas) during hazardous activities will continue. Thus, no significant impacts are expected.

4.1.1.1.9 Noise—PMRF/Main Base—Onshore—No-action

The No-action Alternative would have no significant impact on the noise levels at or near PMRF. The current noise levels as described in Chapter 3.0 will remain the same because there would be no changes in military aircraft operations, or launch of missiles, rockets, and drones. Personnel working in noise hazard areas use appropriate hearing protection to bring noise levels within established safety levels. Beach access to the areas of each of the exercises is restricted for the duration of the launch exercises.

4.1.1.1.10 Socioeconomics—PMRF/Main Base—Onshore—No-action

Under the No-action Alternative, beneficial impacts to the economy and community on Kauai, such as continued employment and increased tourism and hotel use, will continue.

4.1.1.1.11 Transportation—PMRF/Main Base—Onshore—No-action

No significant impacts have been identified for the transportation system; temporary roadblocks or traffic surges as a result of PMRF launch events are discrete and intermittent. Transportation of ordnance and liquid propellants is conducted in accordance with U.S. Department of Transportation (DOT), DoD, and Navy established procedures.

4.1.1.1.12 Utilities—PMRF/Main Base—Onshore—No-action

Electricity demand, potable water consumption, wastewater generated, and solid waste disposal would be handled by existing facilities. Current utility capacity meets demands. Thus, no significant impacts are expected.

4.1.1.1.13 Water Resources—PMRF/Main Base—Onshore—No-action

Compliance with SOPs and policies will continue to minimize the potential for impacts to water resources. Debris from testing activities has a minimal impact to beach and inland areas, and surface drainage is not permanently affected. Emissions from launches and exercises do not significantly affect water resources.

4.1.1.2 Makaha Ridge—No-action

4.1.1.2.1 Air Quality—Makaha Ridge—No-action

Infrequent emissions associated with intermittent use of diesel generators would continue. There would be no change in existing regional air quality.

4.1.1.2.2 Biological Resources—Makaha Ridge—No-action

Previously analyzed activities will continue to take place in current operating areas, with no new activities or areal expansion proposed. Compliance with relevant Navy policies and procedures during these activities will continue to minimize the effects on listed vegetation and wildlife, as well as limit the potential for introduction of invasive species. Currently there are no significant impacts from electromagnetic radiation (EMR) generation to wildlife.

4.1.1.2.3 Cultural Resources—Makaha Ridge—No-action

Makaha Ridge has been surveyed for archaeological, historical, and Native Hawaiian resources, and none have been identified; however, there is always the potential for subsurface cultural resources to be unexpectedly discovered. If unanticipated cultural resources are encountered (particularly human remains) during any activity, all activities will cease in the immediate vicinity of the find and the PMRF Environmental Engineer will be notified. Subsequent actions and notifications would follow the guidance provided in the PMRF ICRMP (International Archaeological Research Institute, Inc., 2005). As a result, No-action Alternative activities are not expected to significantly affect any cultural resources.

4.1.1.2.4 Hazardous Materials and Waste—Makaha Ridge—No-action

Makaha Ridge currently has appropriate plans in place to manage hazardous materials and waste. Activities performed as part of the No-action Alternative would continue to be managed in accordance with these plans.

4.1.1.2.5 Health and Safety—Makaha Ridge—No-action

Compliance with SOPs will continue to minimize impacts. All location(s) used are away from the public, which results in no adverse public health and safety issues.

4.1.1.3 Kokee—No-action

4.1.1.3.1 Air Quality—Kokee—No-action

Infrequent emissions associated with intermittent use of diesel generators would continue. There would be no change in existing regional air quality.

4.1.1.3.2 Biological Resources—Kokee—No-action

Previously analyzed activities will continue to take place in current operating areas, with no new activities or areal expansion proposed. Compliance with relevant Navy policies and procedures during these activities will continue to minimize the effects on listed vegetation and wildlife, as well as limit the potential for introduction of invasive species. Currently there are no impacts from EMR generation to wildlife.

4.1.1.3.3 Cultural Resources—Kokee—No-action

Under the No-action Alternative, activities with the potential to affect cultural resources are not expected to increase or change in intensity or area. These activities have been analyzed within the environmental documents listed in Section 1.6 and determined to have no significant adverse effects.

4.1.1.3.4 Hazardous Materials and Waste—Kokee—No-action

Kokee currently has appropriate plans in place to manage hazardous materials and waste. Activities performed as part of the No-action Alternative would continue to be managed in accordance with these plans.

4.1.1.3.5 Health and Safety—Kokee—No-action

Compliance with SOPs will continue to minimize impacts to public health and safety.

4.1.1.4 Hawaii Air National Guard Kokee—No-action

4.1.1.4.1 Biological Resources—Hawaii Air National Guard Kokee—No-action

Current previously analyzed activities will continue to take place in existing operating areas, with no new activities or areal expansion proposed. Compliance with relevant Navy policies and procedures will continue to minimize the effects on listed wildlife. Currently there are no impacts from EMR generation to wildlife.

4.1.1.5 Kamokala Magazines—No-action

4.1.1.5.1 Cultural Resources—Kamokala Magazines—No-action

The Kamokala Magazines have been surveyed for archaeological and Native Hawaiian resources and historic buildings. There are no identified archaeological or Native Hawaiian resources of significance at this location; however, there are 10 tunnel-type magazines (earthen caves) that have been determined eligible for inclusion in the National Register of Historic Places (NRHP). Under the No-action Alternative, there are no activities with the potential to affect the historical characteristics of the magazines, and they are managed in accordance with the PMRF ICRMP (International Archaeological Resources Institute, Inc., 2005). As a result, no adverse effects are expected under the No-action alternative.

Any alteration of the tunnel-type magazines requires coordination with the PMRF Environmental Engineer prior to construction and any mitigation measures would be in accordance with the PMRF ICRMP (International Archaeological Resources Institute, Inc., 2005) and in consultation with the Hawaii SHPO.

Any alteration to or use of the two newer ordnance magazines (Magazines 12 and 13) located adjacent to the historic Kamokala caves can proceed as required. These two magazines were constructed in 2002 and are not historic properties.

4.1.1.5.2 Hazardous Materials and Waste—Kamokala Magazines—No-action

PMRF currently has procedures in place to manage hazardous materials and waste. Storage of and transportation of ordnance to Kamokala Magazines is conducted in accordance with established DOT, DoD, and Navy safety procedures described in Section 3.1.1.2.2.

4.1.1.5.3 Health and Safety—Kamokala Magazines—No-action

Compliance with existing health and safety plans and procedures will continue to minimize impacts. There would be no change in the type of ordnance stored and no increase in safety risks. Storage and transportation of ordnance are conducted in accordance with established DOT, DoD, and Navy safety procedures described in Section 3.1.1.2.3.

4.1.2 KAUAI—OFFSHORE—NO-ACTION

There are no reports of emissions from Navy training and research, development, test, and evaluation (RDT&E) activities affecting the air quality offshore of PMRF/Main Base. Use of the area offshore of PMRF could require control of the airspace; however, any issues associated with this airspace are included within the PMRF/Main Base Onshore discussion. Because no ground disturbance or building modifications would occur offshore, there is no impact on geology and soils. Training and RDT&E activities in the area offshore of PMRF require small amounts of hazardous materials for maintenance and generate small amounts of hazardous waste. All hazardous materials used and hazardous waste generated would continue to be managed in accordance with PMRF's hazardous materials management plans. No noise-sensitive land receptors are affected by existing offshore noise levels. All training and RDT&E activities offshore of PMRF/Main Base are conducted in accordance with existing health and safety guidance. There is no public health and safety issue. There is no impact on land use because the training population is transient and does not conflict with recreational activities occurring in or adjacent to PMRF. There are no utility issues associated with offshore training and RDT&E activities for PMRF/Main Base since no land-based utilities are required. The potential for impacts to offshore water resources is provided in the Open Ocean Area discussion.

4.1.2.1 PMRF/Main Base—Offshore—No-action

4.1.2.1.1 Airspace—PMRF/Main Base—Offshore—No-action

Use of the area offshore of PMRF can require control of the airspace; issues associated with this offshore airspace are similar to those discussed in the PMRF/Main Base Onshore section.

The Temporary Operating Area (TOA) was established to support missile defense testing and extends primarily north and west of Kauai. For safety purposes, PMRF requests use of the airspace within the TOA from FAA during missile defense testing. During current testing, PMRF controls the airspace, and the FAA issues Notices to Airmen (NOTAMs) to prevent aircraft from flying into a specific area of airspace within the TOA until testing is complete. Due to the range and speed of weapons and missiles, the larger area is required to contain debris and expended materials from test missions.

4.1.2.1.2 Biological Resources—PMRF/Main Base—Offshore—No-action

Potential impacts of RDT&E activities, including missile launches on marine biological resources within the PMRF region of influence, have been addressed in detail in prior documents such as the PMRF Enhanced Capability EIS, the Terminal High Altitude Area Defense (THAAD) Pacific Flight Tests Environmental EA, and the HRC EIS/OEIS (U.S. Department of the Navy, 1998a; U.S. Army Space and Missile Defense Command, 2002; U.S. Department of the Navy, 2008). Based on these prior analyses, the potential for short-term impacts of activities related to continuing RDT&E on offshore biological resources discussed in Section 3.1.2.1.2 are expected to remain minimal.

No threatened or endangered vegetation is located in the offshore area. Procedures and policies are in place, based in part on recommendations provided by USFWS and NMFS, which minimize impacts to biological resources including adverse effects on listed sea birds, sea turtles, and marine mammals. Minor and localized impacts to fish from debris would continue. Effects from noise, shock, or expended materials would continue to be localized and temporary. However, no impacts to Essential Fish Habitat (EFH) have been identified.

4.1.2.1.3 Cultural Resources—PMRF/Main Base—Offshore—No-action

Potential impacts from No-action Alternative activities (specifically missile launches and associated debris) have been addressed in detail in the various applicable environmental documents noted in Section 1.6. Debris analyses of the types, quantities, and sizes associated with PMRF missile activities indicate that the potential to significantly impact offshore resources is extremely remote. Based on the prior analyses and the known lack of significant effects from current and past missile launch activities, significant adverse effects from activities on offshore cultural resources are not expected.

4.1.2.1.4 Socioeconomics—PMRF/Main Base—Offshore—No-action

Offshore PMRF training and RDT&E activities have the potential to temporarily disrupt commercial fishing, commercial shipping to Kauai, and tourism offshore of PMRF (there is no commercial shipping to PMRF). Due to the Navy’s procedures for issuing Notices to Mariners (NOTMARs), such disruptions are limited since Navy use of the waterway offshore of PMRF/Main Base is occasional and temporary and adjacent areas to remain available. Under the No-action Alternative, the local economy of Kauai will continue to benefit from continued employment at PMRF/Main Base and the resulting increased tourism and hotel use.

4.1.2.1.5 Transportation—PMRF/Main Base—Offshore—No-action

The No-action Alternative stands as no change from current levels of training, and the Navy will continue its current activities. Offshore PMRF is used by tourist boats and range boats supporting test and training activities.

The Navy has developed extensive protocols and procedures for the safe operation of its vessels and the safe execution of its testing and training. Any disruption of tour boats due to Navy use of the waterway offshore of PMRF/Main Base is occasional and temporary. The Navy would continue to issue NOTMARs for scheduled activity times and locations, and precautions would be taken to ensure that no interactions between military activities and civilian vessels occur.

4.1.3 NIIHAU—ONSHORE—NO-ACTION

4.1.3.1 Airspace—Niihau—Onshore—No-action

Under the No-action Alternative, use of airspace over Niihau is limited to occasional flights by the island's helicopter.

4.1.3.2 Biological Resources—Niihau—Onshore—No-action

Previously analyzed training activities and major exercises take place in current operating areas, with no significant impacts to biological resources. Compliance with relevant Navy policies and procedures during these activities minimize the effects on listed vegetation and wildlife, as well as limit the potential for introduction of invasive species. No new activities or areal expansion are proposed.

4.1.3.3 Cultural Resources—Niihau—Onshore—No-Action

Activities under the No-action alternative have been previously analyzed for the potential to affect cultural resources within the various applicable documents noted in Section 1.6, and no significant adverse effects were identified. As a privately owned island, resources on Niihau are protected by the landowners and proponents and stipulations are included in contracts for various projects to ensure that sensitive cultural resources areas are either avoided or disturbance minimized.

4.1.3.4 Hazardous Materials and Waste—Niihau—Onshore—No-action

PMRF currently has appropriate plans in place to manage hazardous materials and waste on Niihau.

4.1.3.5 Health and Safety—Niihau—Onshore—No-action

Under the No-action Alternative, existing activities at Niihau would continue and there would be no adverse impacts to health and safety. PMRF takes every reasonable precaution during planning and execution of operations, training exercises, and test and development activities to prevent injury to human life or property at Niihau. Compliance with RCC 321, existing health and safety plans, and procedures will continue to minimize impacts. Radar and electronic warfare sites are located away from the public.

4.1.4 NIIHAU—OFFSHORE—NO-ACTION

4.1.4.1 Airspace—Niihau—Offshore—No-action

Analysis indicated that the proposed alternatives would not result in either short- or long-term impacts for this resource. Under the No-action Alternative, use of airspace over Niihau is limited to occasional flights by the island's helicopter.

4.1.4.2 Biological Resources—Niihau—Offshore—No-action

Procedures and policies are in place to minimize impacts to biological resources from previously analyzed activities. The potential for minor and localized adverse impacts to fish would continue. However, no impacts to EFH have been identified. Short-term effects from noise, shock, or expended materials to listed species would continue to be localized and temporary.

4.1.5 NORTHWESTERN HAWAIIAN ISLANDS—ONSHORE—NO-ACTION

4.1.5.1 Biological Resources—Northwestern Hawaiian Islands—Onshore—No-action

Some current flight trajectories can result in target and/or interceptor missiles such as THAAD flying over portions of the Northwestern Hawaiian Islands (NWHI) that are part of the Monument. Preliminary results of debris analysis in 2002 indicated that debris is not expected to adversely affect listed, migratory, or other endemic species. The probability for debris to hit birds, seals, or other wildlife would continue to be extremely low. Quantities of falling debris will also continue to be very low and widely scattered so as not to present a toxicity issue. Falling debris also cools down sufficiently and thus does not present a fire hazard for vegetation and habitat. If feasible, consideration is given to alterations in the missile flight trajectory to further minimize the potential for debris impacts.

4.1.5.2 Cultural Resources—Northwestern Hawaiian Islands—Onshore—No-action

Missile defense activities, including THAAD, have the potential to generate debris that falls within areas of the NWHI and the Monument. Debris analyses of the types, quantities, and sizes associated with PMRF missile activities indicate that the potential to impact land resources of any type is extremely remote. In addition, trajectories can be altered under certain circumstances to further minimize the potential for impacts. Future missions will include consideration of missile flight trajectory alterations, if feasible, to minimize the potential for debris within these areas. As a result, under the No-action Alternative, significant adverse effects on cultural resources within the NWHI are not expected.

4.1.6 NORTHWESTERN HAWAIIAN ISLANDS—OFFSHORE—NO-ACTION

4.1.6.1 Biological Resources—Northwestern Hawaiian Islands—Offshore—No-action

Some current flight trajectories can result in target and/or interceptor missiles flying over portions of the Monument. Preliminary results of debris analysis in 2002 indicated that debris is not expected to adversely affect offshore listed, migratory, or other endemic species. The probability for debris to hit birds, sea turtles, seals, or other marine wildlife is extremely low. Quantities of falling debris will be very low and widely scattered so as not to present a toxicity issue. If feasible, consideration is given to alterations in the missile flight trajectory, to further minimize the potential for debris impacts.

4.1.6.2 Cultural Resources—Northwestern Hawaiian Islands—Offshore—No-action

Missile defense activities have the potential to generate debris that falls within the NWHI and the Monument. Debris analyses of the types, quantities, and sizes associated with PMRF missile activities indicate that the potential to adversely affect cultural resources offshore of the islands is extremely remote. In addition, these submerged resources are situated at considerable depth below the surface. Trajectories can be altered under certain circumstances to further minimize the potential for effects and future missions will include consideration of missile flight trajectory alterations, if feasible, to minimize the potential for debris within these areas. As a result, significant adverse effects on cultural resources within the NWHI are not expected.

4.1.7 OPEN OCEAN AREA—NO-ACTION

4.1.7.1 Airspace—Open Ocean Area—No-action

No significant airspace impacts have been identified for past and current activities. Any potential impacts to controlled and uncontrolled airspace, special use airspace, en route airways and jet routes, or airports and airfields from continued activities are minimized through SOPs, compliance with DoD Directive 4540.1, OPNAVINST 3770.4A, OPNAVINST 3721.20, and continued close coordination with the FAA. No modifications or need for additional airspace are required.

4.1.7.2 Biological Resources—Open Ocean Area—No-action

The potential for impacts on the limited deep water corals from Navy training and RDT&E activities would continue to be very remote. Sources such as underwater communications and electronic warfare systems that may be deployed in the ocean are at frequency ranges or intensity levels that have no impact on fish. A direct hit from a piece of debris may kill or injure individual fish, but no impacts to an entire population of fish have been identified. Other RDT&E activities identified have minimal effects on fish.

Given the SOPs and the relatively low number of listed sea turtles and marine mammals, and Navy vessels in the open ocean, collisions with sea turtles or marine mammals would continue to be unlikely. Individual pieces of debris from ballistic missile intercept tests are dispersed over a large area. While a direct hit from a piece of debris would affect a sea turtle or marine mammal at the surface, it is extremely unlikely that this would ever occur.

Missile launches by their very nature involve some degree of risk, and it is for this reason that DoD and PMRF have specific launch and range safety policies and procedures, such as determining that the intercept area is clear of visible species prior to launch, to ensure that any potential risks to marine mammals are minimized. As a result, no significant impacts are expected.

4.1.7.3 Cultural Resources—Open Ocean Area—No-action

Missile intercept activities under the No-action alternative have been previously analyzed for the potential to affect cultural resources within the various applicable documents noted in Section 1.6, and no significant adverse effects were identified. Cultural resources within these areas (typically shipwrecks) are submerged at considerable depth, and the potential for them to be disturbed is extremely remote. As a result, significant adverse effects from activities associated with the No-action Alternative are not expected.

4.1.7.4 Hazardous Materials and Waste—Open Ocean Area—No-action

Implementation of the No-action Alternative would not result in significant impacts associated with the use of hazardous materials. The Navy has appropriate plans in place to manage hazardous materials used and generated. Hazardous materials will continue to be controlled in compliance with OPNAVINST 5090.1B. Fragments of expended training materials, e.g., missiles, chaff, and flares, could be deposited on the ocean floor and are not recovered. The widely dispersed, intermittent and generally small size of the material and the diluting effect of seawater on residual propellant minimizes the impact.

4.1.7.5 Health and Safety—Open Ocean Area—No-action

Implementation of the No-action Alternative will have minimal affect on public health and safety. Any potential risk to public health and safety is minimized through SOPs and compliance with RCC 321, DoD Directive 4540.1, OPNAVINST 3770.4 and Commander, Naval Surface Force, U.S. Pacific Fleet Instruction 3120.8F. The Navy notifies the public of hazardous activities through the use of NOTAMs and NOTMARs.

4.1.7.6 Noise—Open Ocean Area—No-action

The environmental impacts of the activities that make up the No-action Alternative were analyzed in the 2008 Final HRC EIS/OEIS. Potential airborne sound as a result of Navy training was examined to determine what effect the training and RDT&E activities would have in the overall ambient sound levels within the region that resulted in an effect on the traditionally analyzed sensitive human sound receptors (i.e., schools, hospitals, etc.). Impacts on biological resources are discussed above.

While testing and training does generate airborne sound, sound-generating events in the Open Ocean Area do not result in perceptible changes to the overall sound environment. In addition, training does not have an effect on sensitive sound receptors because these events are typically conducted away from populated areas and most sensitive sound receptors. For training events that involve the expenditure of munitions either from aircraft or surface vessels, the Navy uses advance notice and scheduling, and strict on-scene procedures to ensure the area is clear of civilian vessels or other non-participants. The public is notified of the location, date, and time of the hazardous activities via NOTMARs, thereby precluding any acoustical impacts on sensitive receptors. No-action increases in sound events would contribute a negligible level of increased sound, however, because they would continue to occur within the open ocean where typically no sensitive sound receptors are present.

Supersonic activity in the region is generally restricted to altitudes greater than 30,000 feet above sea level or in areas at least 30 nm from shore. These restrictions prevent most sonic booms from reaching the ground. There would be no perceptible increase in long-term sound levels as a result of sonic booms, and populated areas are not likely to be affected since such flights would typically be conducted in areas greater than 30 nm offshore and above 30,000 feet. (U.S. Department of the Navy, 2008)

4.1.7.7 Water Resources—Open Ocean Area—No-action

Potential water quality impacts, such as change in a small area's pH or temperature, associated with the implementation of the No-action Alternative are transitory in nature and do not reach a level of significance. No long-term significant impacts on water quality are anticipated due to the small quantities of materials relative to the extent of the sea range and large volumes of water in which they will be dispersed.

4.2 PROPOSED ACTION

This section addresses the potential environmental impacts that could occur as a result of implementing the Proposed Action.

4.2.1 KAUAI—ONSHORE—PROPOSED ACTION

4.2.1.1 PMRF/Main Base—Onshore—Proposed Action

Thirteen broad areas of environmental consideration were analyzed for PMRF/Main Base Onshore. These areas are air quality, airspace, biological resources, cultural resources, geology and soils, hazardous materials and waste, health and safety, land use, noise, socioeconomics, transportation, utilities, and water resources.

4.2.1.1.1 Air Quality—PMRF/Main Base—Onshore—Proposed Action

Potential issues related to the air quality 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 launches. Potential impacts were determined based on whether operations within attainment areas could cause a detrimental change in attainment status of the area, or increases in ambient air pollutant concentration could cause exceedances of the applicable ambient air quality standards.

In addition to criteria pollutants, green house gases may soon be regulated under the Clean Air Act (see Appendix C). The Hawaii Department of Health will adopt rules by January 2012 to implement the Global Warming Solution Act 234 of 2007, which establishes as state policy the reduction of greenhouse gas emissions to 1990 levels by 2020. Navy energy efficiency policy also requires ambitious energy targets by 2020. The Navy recognizes that greenhouse gas emissions reduction is linked to using less fossil fuels for generators, missiles, and vehicles. To meet this challenge, the Navy may use state-of-the-art generators and biomass fuels as these energy technologies mature on Kauai.

Site Preparation Activities

The Proposed Action would require construction of: the Interceptor Launch Area; the Aegis Ashore Test Center (AATC) (Launch Control Center, Mission Support Component, Ancillary sensors/Support Component, and AN/SPY-1 Radar); and the transportable Ballistic Missile Defense (BMD) System Communications Support Complex (BCSC). The proposed Interceptor Launch Area would disturb approximately 3 acres, and require construction of a 1,000-square foot support building, 10,000- square foot asphalt traffic area, and 1,156- square foot concrete launch area. The AATC would disturb 1 acre and would be an approximately 31,500- square foot, multi-story building with parking for approximately 100 permanent personnel. The BCSC would disturb 1 acre and would be located on a hardstand made of concrete or crushed coral that is 125 feet by 175 feet at a minimum distance of 656 feet from the radar. The hardstand area will be bordered by compact gravel or crushed coral and enclosed by a 200-foot by 250-foot security fence and gates.

A temporary increase in air emissions would be associated with new construction related to the Proposed Action. These emissions are estimated using an air emissions screening computer program developed by the Air Force to calculate air emissions for realignment of aircraft, personnel, and for facility construction (U.S. Air Force, 2010). Appendix C includes details of the screening and supporting analysis. Hawaii is currently attainment status for all criteria pollutants. However, the screening shows if an action could cause a detrimental change in attainment status of the area.

The estimated annual emission levels from two years of construction are minor as shown on Table 4.2.1.1.1-1. Carbon monoxide (CO), nitrogen dioxides (NO_x), and volatile organic compounds (VOCs) are related to architectural coatings, stationary equipment operation, and the transportation of workers to the site. Air emissions would include minor amounts (not included in table) of particulate matter with an aerodynamic diameter less than or equal to 10 microns (PM-10/) or less than or equal to 2.5 microns (PM-2.5) generated during grading. Fugitive dust would be mitigated through the use of watering during construction activities.

Table 4.2.1.1.1-1. Estimated Annual Emissions from New Construction Activity, Proposed Action Alternative

Pollutant Name	2011 Emissions, Tons/Year	2012 Emissions, Tons/Year	De Minimis Level (Tons/year)
CO	0.14	0.09	100
NO_X	0.01	0.01	100
VOC	0.20	0.19	100

Source: Calculated using the Air Conformity Applicability Model (ACAM), 2010 (see Appendix C)

Flight Activities

The increase in operational air emissions, such as space heating/cooling, employee commuting, Government vehicle use would be negligible, as shown on Table 4.2.1.1.1-2. Only the AATC would be occupied year round with 100 personnel. During test periods, up to 500 personnel would be assigned temporarily to PMRF. Test operations support would be 24 hours per day, 7 days per week, for as long as the test period runs, up to 8 weeks per year.

During test periods, most aspects of the Proposed Action, but primarily the radar facilities, would produce indirect impacts to the air quality from the use of commercial power or direct impacts from onsite generators and diesel fuel storage. Up to 4 megawatts (MW) of power for missile testing would be required. The Proposed Action would use power supplied by Kauai Island Utility Cooperative (KIUC) or by dedicated on-site generators during radar and mission operations. Table 4.2.1.1.1-2 shows estimated air emissions from flight support activities in 2013, when the test site would be fully operational. Estimated air emissions are based on four test flights per year. Generator(s) configuration (size and number) can vary; therefore, for the purpose of analysis, estimated hours of usage are based on a 500-kilowatt (kW) generator, two 2.5-MW (2500-kW) generators, and two 438-kW generators for four annual Aegis Ashore missile tests. Table 4.2.1.1.1-3 illustrates estimated generator size and hours of operation for four Aegis Ashore missile tests.

Table 4.2.1.1.1-2. Estimated Emissions from Flight Support for 2013 (Tons/Year)

Source	Pollutant (Tons/Year)					
	CO	NO_X	SO_2	VOC	PM-10	PM-2.5
Base Employee Commute VMT	0.18	0.01	0.00	0.01	0.00	0.00
On-Road GOV VMT	1.08	0.14	0.00	0.07	0.00	0.00
Generators (1)	12.08	54.20	2.12	2.86	2.60	2.60
Facility Space Cooling	0.10	0.22	0.00	0.01	0.01	0.00
Total	13.44	54.56	2.12	2.95	2.61	2.60
De minimis Level (see Appendix C)	100.00	100.00	100.00	100.00	100.00	100.00

Source: Calculated using ACAM, 2010
[1] For analysis purpose, the annual emissions are based on the combined estimated usageshown in Table 4.2.1.1.1-3.
VMT= Vehicle Miles Traveled
PM-10 = particulate matter equal to or less than 10 microns in size
PM-2.5 = particulate matter equal to or less than 2.5 microns in size
VOC = Volatile organic compound
Emissions displayed as fixed decimal numbers. Total calculated using full numbers

Table 4.2.1.1.1-3. Estimated Generator Size and Hours of Operation for Four Aegis Ashore Missile Tests

Equipment	Size	Annual Estimated Hours of Operation	Annual kWh
Generator - Interceptor Launch Area	500-kW	336 hours (2 weeks/year/24/7)	168,000
Generator - Aegis Ashore Test Center	Two 2,500-kW	672 hours(2 weeks/year/24/7)	1,680,000
Generator - BCSC	Two 438-kW	2,688 hours(8 weeks/year/24/7)	1,177,344
Annual Totals		3,696 hours	3,025,344 kWh

As shown in Table 4.2.1.1.1-2, the NO_x emissions are primarily from the direct use of generators during the missile tests; however emissions remain within acceptable de minimis levels (See Appendix C for details on the screening method used to determine air emissions). Therefore, no significant air quality impacts to the region are anticipated. The large generators may require the current Title V permit for PMRF/Main Base or Kauai Test Facility (KTF) to be modified. The Interagency Agreement between the Navy and DOE for operation of the KTF may also need to be modified.

The use of large generators will also affect greenhouse gas (GHG) emissions. Using the estimated generator size and hours of operation for four Aegis Ashore Missile Defense tests shown in Table 4.2.1.1.1-3, the generators are estimated to produce 2,395 tons/year of carbon dioxide equivalent GHG emissions (See Appendix C for calculations). This does not represent "meaningful" GHG emissions. The Council on Environmental Quality draft NEPA guidance for addressing GHG emissions states emissions greater than 27,557 tons annually of carbon dioxide-equivalent GHG emissions meets the test of "meaningful." Emissions above this level warrant at least some qualitative or quantitative discussion. Regardless, to limit GHG emissions, the Navy will use some amount of renewable energy (biofuel) when feasible for operating the generators.

Air pollutants emitted as a direct result of the missile testing include rocket exhaust products, products from the detonation of the Standard Missile (SM) ordnance section, and vehicles involved in support activities. The targets used for the Proposed Action are used currently at PMRF and are analyzed as part of the No-action Alternative.

Table 4.2.1.1.1-4 lists the emission constituents for each SM-1 launch as analyzed in the *Environmental Assessment for Standard Missile* (Naval Ordnance Missile Test Station, 1992). The hydroxyl-terminated polybutadiene/ammonium perchlorate (HTPB/AP)-based composite solid propellants for the booster contains a mixture of primarily ammonium perchlorate, aluminum, and cyclotetramethylenetetranitramine (HMX). The solid fuel propellant of the sustainer portion of the dual-thrust rocket motor and the sustainer rocket motor consists of ammonium perchlorate and aluminum.

Table 4.2.1.1.1-4. Estimated Emissions from Standard Missile-1 Propellants: Ammonium Perchlorate, Aluminum, and HMX

Reaction Product	Name	Tons per Launch
H_2O	Water	0.039
N_2	Molecular Nitrogen	0.042
CO	Carbon Monoxide	0.105
CO_2	Carbon Dioxide	0.0116
NO	Nitric Oxide	0.000006
NH_3	Ammonia	2.2×10^{-7}
H	Hydrogen	0.00011
HCl	Hydrogen Chloride	0.105
$AlCl_3$	Aluminum Chloride	0.00019
Al_2O_3	Aluminum Oxide	0.187 (liquid)
Fe_2O_3	Ferric Oxide	0.0076 (solid)
$FeCl_3$	Ferric Chloride	No emission factor listed

Source: Calculations based on Naval Ordnance Missile Test Station, 1992, Appendix A "Theoretical Specific Impulse and Exhaust Constituents."

The 1992 EA also found that the polyisoprene rubber used to insulate the SM-1 MK104 Dual Thrust Rocket Motor case contains approximately 46 percent chrysotile asbestos, the most commonly used form of asbestos. Any asbestos released during the launch process would be transformed into a non-asbestos condensate. If this did not occur due to a launch failure, exhausted concentrations of asbestos would be above ambient concentrations, which are likely to be near zero (Naval Ordnance Missile Test Station, 1992). SOPs concerning the handling of asbestos would be followed.

The analysis of the SM-1 in 1992 determined that the launch of the SM-1 would not significantly impact the ambient air quality. The exhaust volume from the SM-3 would be the larger than the SM-1. The propulsion system of the SM-1 was assumed to have 1,033 pounds of propellant in the booster and sustainer. The propulsion systems of the missiles for the Proposed Action have more propellant, e.g., the SM-3 has approximately 3,300 pounds of propellant. However, the volume of exhaust shown in Table 4.2.1.1.1-4, even if tripled, would remain within acceptable air emissions limits of the National Ambient Air Quality Standards (NAAQS; see Appendix C).

Future variants of the SM-3 missile may include additional components such as a hypergolic third stage and a Divert and Attitude Control System (DACS), which could impact the composition of the air emissions. The addition of a small amount of hypergolic chemical (liquid fuel) located in the DACS was analyzed for the THAAD Pacific Test Flights EA (U.S. Army Space and Missile Defense Command, 2002). This analysis found that air emissions from this component could pose a health threat during a launch mishap. A launch mishap could result in the unlikely, but possible, limited emission of nitric acid through release of the hypergolic bi-propellants in the DACS. The low levels of emission would be below applicable health-based standards at the edge of the ground hazard area. Also, personnel remaining outdoors within the Launch Hazard Area would wear appropriate safety equipment such as respirator masks.

No significant air quality impacts to the region are anticipated.

Post Flight Activities

Post flight activities would include removal of all the mobile equipment/assets brought to the site. This would cause localized and temporary amounts of air emissions such as vehicle exhaust and fugitive dust.

4.2.1.1.2 Airspace—PMRF/Main Base—Onshore—Proposed Action

Assessment of potential impacts to airspace is based on the following: if proposed activities have the potential to result in an obstruction to air navigation; modification to or new requirements for special use airspace; changes to existing air routes; or additional restricted access to regional airfields and airports.

Site Preparation Activities

Site preparation activities (airlift delivery of target and interceptor stages and related hardware), 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 region of influence. Access to the PMRF airfield would not be affected. All arriving and departing aircraft and all participating military aircraft are under the control of the PMRF Air Operations; thus, there would be no airport conflicts in the region of influence under the Proposed Action, and no impact.

Prior to missile launches requiring the Navy to exercise closure of the hazard area, Range Safety officials must determine that the areas are clear of aircraft. NOTAMs are issued by the FAA which identify areas to remain clear of and the times that avoidance of the area is advised.

Flight Activities

Special Use Airspace

Missile intercepts would continue to be conducted within either the existing special use airspace in Warning Area W-188 and W-186 controlled by PMRF or within the TOA shown in the inset on Figure 3.1.1.1.2-1. The missile launches represent precisely the kinds of activities for which special use airspace was created: namely, to accommodate national security and necessary military activities, and to confine or segregate activities considered to be hazardous to non-participating aircraft.

Due to the coordination and planning procedures that are in place, the proposed missile testing activities would represent only a minimum impact on special use airspace and minimal conflict with any airspace use plans, policies, and controls.

Under the Proposed Action, missiles (target or intercept) used in more complex threat scenarios would be launched from fixed or mobile launchers. Trajectories and distance would vary greatly depending on the test scenario. During some of these flight tests, small, lightweight fragments resulting from missile intercept could potentially drift beyond current PMRF-controlled areas and affect airspace over Kauai. PMRF, however, would continue to ensure the protection of the public from any intercept or other missile debris through the application of standard range safety procedures and risk standards, including RCC Standard 321.

The small, lightweight fragments have the potential to damage jet engines and high-speed aircraft. Since the fragments could take up to approximately 1 hour to settle due to their light weight, they have the potential to affect arriving and departing flights at area airports (e.g., Port Allen, Lihue, or Princeville) and air traffic (helicopter tours) in the area during this time. PMRF, in coordination with the FAA, would identify airspace where such fragments would occur and take the necessary precautions to temporarily exclude aircraft from the area immediately after an intercept test for approximately an hour. The fragments could result in effects to all or parts of the airspace over Kauai, Niihau, over the open ocean between the islands, or part of the channel between Kauai and Oahu depending on the actual test parameters. The program office of the agency conducting the activity would notify the FAA through PMRF that a test is being planned that could temporarily affect aircraft. The FAA would review the request and advise PMRF regarding windows of opportunity for the testing in order to minimize effects. These windows would determine whether the test could be performed, since a minimum of 2 hours of available time would be required for a test. PMRF would then request altitude reservations (ALTRVs) from the FAA, which would issue NOTAMs covering this additional temporary airspace if approved.

Intercept tests would be scheduled at times that would avoid periods of high numbers of air traffic based on FAA approval. Intercept tests could be performed at night to further avoid aircraft such as helicopter tours, which are conducted from sunrise through sunset, as long as mission requirements can still be met. If Medevac or other emergency flights are requested prior to target or interceptor launch, the mission would hold until the medical emergency requiring the flight is over. PMRF Flight Safety would conduct an analysis of the risk associated with each proposed intercept test activity prior to conducting tests and would configure test activities to ensure risk and debris dispersion criteria are met. Range Control would communicate with the operations conductors and all participants entering and leaving the range areas. The Range Control Officer would also communicate with other agencies such as the FAA Honolulu Control Facility in Honolulu, the PMRF/Main Base airfield control tower, the 169th Aircraft Control and Warning Squadron within the 154th Wing at Kokee, and the Fleet and Area Control and Surveillance Facility Pearl Harbor as required. The acceptable level of risk to aircraft and the persons on board would continue to follow the RCC 321 standard; only the location of the requested airspace would change.

PMRF would continue to coordinate with the Honolulu Control Facility or Oakland Air Route Traffic Control Center (ARTCC) military operations specialist assigned to handle such matters using ALTRV request procedures. After receiving the proper information on each test flight, a hazard pattern would be constructed and sent to the military operations specialist at the Honolulu Control Facility or Oakland ARTCC requesting airspace. When approval of the request of the airspace is received, PMRF would submit an ALTRV request to Central Altitude Reservation Function, which publishes the ALTRV 72 hours prior to the flight test. With these procedures in place, the RDT&E activities do not conflict with any airspace use plans, policies, and controls.

Controlled and Uncontrolled Airspace

No new airspace proposal or any modification to the existing controlled airspace has been identified to accommodate proposed testing; however, the area of coverage for NOTAMs may be extended for certain tests. Typically target and interceptor missiles would be above flight level (FL) 600 (60,000 feet) within seconds of the rocket motor firing. As such, all other local flight activities would occur at sufficient distance and altitude 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 for use of the airspace identified in Figure 3.1.1.1.2-1, 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. The airspace in the area is not heavily used by commercial aircraft, and is far removed from the en route airways and jet routes crossing the North Pacific Ocean. The relatively sparse use of the area by commercial aircraft and the advance coordination with the FAA regarding ALTRV requirements should result in minimal impacts on controlled and uncontrolled airspace from missile testing activities.

En Route Airway Jet Routes

Two Instrument Flight Rules (IFR) en route low altitude airways are used by commercial aircraft that pass through the PMRF Warning Areas. The two low altitude airways are V15 (through W-188), and V16 (through W-186). Use of these low altitude airways comes under the control of the Honolulu Control Facility. In addition, during a training event, provision is made for surveillance of the affected airspace either by radar or patrol aircraft. Safety regulations dictate that hazardous activities will be suspended when it is known that any non-participating aircraft has entered any part of the training danger zone until the non-participating entrant has left the area or a thorough check of the suspected area has been performed. Therefore, potential impacts on civilian aircraft are avoided.

Target and defensive missile launches and missile intercepts would be conducted in compliance with DoD Directive 4540.1, as enclosed by OPNAVINST 3770.4A. DoD Directive 4540.1 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" (DoD Directive 4540.1, § E5).

Before conducting a missile launch and/or intercept test, NOTAMs would be sent in accordance with the conditions of the directive specified in OPNAVINST 3721.20. In addition, to satisfy airspace safety requirements, the responsible commander would obtain approval from the Administrator, FAA, through the appropriate Navy airspace representative. Provision is made for surveillance of the affected airspace either by radar or patrol aircraft. In addition, safety regulations dictate that hazardous activities would 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 procedures cited above, there is a scheduling agency identified for each piece of special use airspace that would be used. The procedures for scheduling each piece of airspace are performed in accordance with letters of agreement with the controlling FAA facility, and the Honolulu Control Facility and Oakland ARTCC. Schedules are provided to the FAA facility as agreed among the agencies involved. 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 Honolulu Control Facility and Oakland ARTCC are responsible for air traffic flow control or management to transition air traffic. The Honolulu Control Facility and Oakland ARTCC provide separation services to aircraft operating on IFR flight plans and principally during the en route phases of the flight. They also provide traffic and weather advisories to airborne aircraft. Hazardous military activities are contained within the over-water Warning Areas or by using ALTRV procedures in the TOA to ensure non-participating traffic is advised or separated accordingly.

Airports and Airfields

Some Proposed Action missions may restrict access to, or affect arriving and departing flights at existing area airfields and airports in the region of influence. Access to the PMRF airfield, Lihue Airport, Princeville Airport, and Port Allen Airport could be temporarily affected. Commercial and private aircraft would be notified in advance of launch activities through NOTAMs by the FAA. If Medevac or other emergency flights are requested prior to target or interceptor launch, the mission would hold until the medical emergency requiring the flight is over.

Post Flight Activities

Flights required as part of the post flight activities (once the fragments from an intercept have settled) would not restrict access to, nor affect the use of, existing airfields in the region of influence. Operations at the airfield would not be obstructed. 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 PMRF Air Operations; thus, there would be no airfield conflicts in the region of influence, and no impact.

4.2.1.1.3 Biological Resources—PMRF/Main Base—Onshore—Proposed Action

The analytical approach for biological resources involved evaluating the degree to which the proposed activities could adversely 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. Adverse effects 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 native vegetation, or reduction in capacity of a habitat to support native wildlife.

The Proposed Action would be performed in accordance with any PMRF procedures established during current ongoing base-wide consultation with applicable agencies as long as impacts from the Proposed Action do not occur prior to the completion of the consultation.

Site Preparation Activities

Vegetation

Ground clearance for construction of the proposed launch site, radar, related structures, and access roads could result in vegetation removal and loss of wildlife habitat. However, most of the proposed construction sites are within previously disturbed grassy and kiawe areas. Minimal disturbance of unique habitat or indigenous or native vegetation would occur since the native strand vegetation along the shoreline would be avoided to the maximum extent practicable.

Compliance with relevant Navy policies and procedures limits the potential for introduction of invasive weed plant species. Inbound flights carrying cargo from the mainland and landing at PMRF are advised to inspect and secure their cargo prior to shipment to ensure it is free of invasives. Equipment flown in to the PMRF airfield is either via Honolulu, and inspected there, or direct from the mainland. Equipment (specifically missile defense test components) flown directly to PMRF from the Mainland is primarily packaged or containerized by the manufacturer in virtually sterile conditions with regard to the potential for invasive plants or animals. On the very rare occasion that equipment is introduced from the mainland directly to PMRF's airfield via U.S. Air Force transport (C-5A or C-17), it is required to be cleaned of any soil/debris and inspected prior to loading, and it is also on the PMRF airfield when the cargo arrives.

Construction equipment used on PMRF is predominantly Kauai-based. Otherwise, it is brought in from Oahu. There are currently no known off-island equipment cleaning techniques or any requirement by any State or County to inspect/clean equipment and materials shipped inter-island via Young Brothers, or containerized on the mainland and shipped by Matson directly to Kauai.

The Navy will prepare a Hazard Analysis and Critical Control Point Plan or a similar invasive species risk assessment plan that will address viable concerns that are or may be applicable to this project. In summary, the assembly and shipping practices for the equipment and devices associated with the actual program (as opposed to the construction of supporting structures, buildings, and utilities) are not a viable source for introduction of invasive species. This is due to the high standards of “clean” required in the workplaces where these devices are manufactured, assembled, crated, and shipped. In addition, the majority of construction equipment and supplies for structures that would support the program, building construction supplies/materials and related required construction equipment, are obtained locally or from Oahu suppliers. The area where there is a credible potential for the introduction of alien species is the relocation of construction equipment and vehicles that have been used off-island in locations where invasive species not already on Kauai could be introduced. Therefore, all contractor construction equipment that must be introduced to Kauai from off-island would be required to be inspected/cleaned/re-inspected as detailed in the Plan. The responsibility for implementing these requirements will be placed on the contractor, with oversight by a U.S. Navy representative.

The selected sites would be monitored during and after the construction phase to prevent the local establishment of unwanted weeds. A vegetation management technician (either in-house or through contract) would conduct weed control and dune-habitat restoration as part of PMRF’s Integrated Natural Resources Management Plan requirements. This individual would also be responsible, with the technical assistance of the Kauai Invasive Species Committee, for early detection and would respond rapidly to new weeds at the construction sites.

Threatened and Endangered Vegetation

Although ohai and lau`ehu have been observed north of PMRF/Main Base, there are no known listed plant species on PMRF, and thus no adverse effects are anticipated.

Wildlife

Site preparation activities would not result in impacts to EFH since no water bodies on base would be affected.

Construction noise and the presence of personnel could impact wildlife within the area. Construction ground disturbance and equipment noise-related impacts could include loss of habitat, displacement of wildlife, and short-term disruption of daily/seasonal behavior. At 50 feet from construction equipment, noise levels typically range from 70 to 98 A-weighted decibels (dBA). The combination of increased noise levels and human activity would likely displace some birds (e.g., common field and urban birds) that forage, feed, or nest within and adjacent to the construction site. Foraging water birds would be subjected to increased energy demands if flushed by the construction noise, but this should be a short-term, minimal impact. Construction would not impact the wetlands that these native water birds use for resting, nesting, and foraging. Bird migration patterns would not be altered.

Where possible, existing towers would be used for the placement of new equipment to enhance the PMRF testing and training capability. The construction of any new towers on Kauai would occur at locations selected by personnel familiar with local environmental constraints, including the presence of threatened or endangered species. Additional environmental documentation may be required once specific sites are identified. Any new towers would not be sited in or near wetlands, other known bird concentration areas (e.g., state or Federal refuges, staging areas, rookeries), in known migratory or daily movement flyways, or in habitat of threatened or endangered species. Any required lighting for new towers would be shielded in accordance with existing PMRF policy and would be in compliance with any PMRF procedures established during ongoing base-wide consultation with applicable agencies.

Threatened and Endangered Wildlife Species

Full cutoff, shielded exterior lighting would be installed following USFWS guidelines to minimize reflection and effects on light-sensitive wildlife to protect the Newell's shearwater and other night-flying migratory birds. PMRF works directly with Save our Shearwaters to minimize effects on the birds from its activities. If avoidance of activities during bird fallout season is not practicable, monitoring for downed birds near the new towers would be conducted as appropriate. The Proposed Action would be performed in accordance with any PMRF procedures established during ongoing base-wide consultation with applicable agencies.

PMRF will continue to manage the PMRF wedge-tailed shearwater colony through the clearing of invasive vegetation and monitoring by qualified, professional field biologists to produce detailed reports that document shearwater nesting success and health and growth of the colony. PMRF will continue its permitted relocation of albatross and albatross eggs from the KTF area to inhibit nesting there as part of its Bird Aircraft Strike Hazard program. To the extent practicable, construction activities would be scheduled so that as much of it as possible will occur outside of the nesting season.

Potential effects on listed Hawaiian water birds (Hawaiian duck, Hawaiian moorhen, Hawaiian coot, and Hawaiian stilt) that could be in or transiting the construction area would be limited to startle or flying away reactions. Because construction-related noise would be localized, intermittent, and occur over a relatively short-term, the potential for adverse effects on threatened or endangered wildlife would be minimal; except during Hawaiian stilt nesting periods.

PMRF would have U.S. Geological Survey personnel survey the footprint of the proposed construction sites prior to tree clearing in order to detect presence/absence of Hawaiian hoary bats. Few if any bats are anticipated to be observed at Barking Sands. However, if evidence of the presence of bats is found, surveys would be tailored to document residence time around particular facilities.

Construction activities of new facilities would be completely contained within the low-land habitat above the dune line. No direct or indirect adverse effects to sea turtles or their habitats would be anticipated. No construction activities would occur on the beach area or at the mouth of the Nohili Ditch where green sea turtles bask.

Environmentally Sensitive Habitat

New construction would follow standard methods to control erosion during construction. Standard erosion control measures would minimize the potential for indirect impacts to wetlands. The construction proposed as part of the Aegis Ashore Missile Defense complex would thus not likely directly or indirectly impact any wetlands on base including those associated with the Nohili Ditch and the Kawaiele Ditch. The areas proposed for use that are closest to these wetlands are the Aegis launch area and Calibration Lab site.

Flight Activities

Vegetation

Any vegetation near the selected launch pad could undergo temporary distress from heat generated at launch, resulting in wilting of new growth. However, vegetation is normally cleared from areas adjacent to the launch site, and the duration of high temperatures is extremely short (a few seconds), consequently no long-term adverse impacts on vegetation are anticipated. 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 can 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 impact 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. Similarly, it is expected that no impacts to vegetation would occur at other launch sites on PMRF. Vegetation would be mowed/maintained around the site selected for the Aegis Ashore launch pad to minimize the potential for both impacts from heat generated during the launch and fire.

Deluge water collected in the Vertical Launch System (VLS) plenum would be tested for toxic materials. Any water testing positive for these hazardous materials would be placed in drums and disposed of in accordance with PMRF policy; thus, no impacts to vegetation are anticipated. If applicable, missile launches would not be performed during a rain event and an external water deluge system for cooling and noise suppression would not be used.

Threatened and Endangered Vegetation

Although ohai and lau`ehu have been observed north of PMRF/Main Base, there are no known listed plant species on PMRF, and thus no adverse effects are anticipated from flight activities.

Wildlife

Deluge water collected in the VLS plenum would be tested for toxic materials. Any water testing positive for these hazardous materials would be placed in drums and disposed of in accordance with PMRF policy; thus, no impacts to wildlife are anticipated.

Noise

The impacts of noise on wildlife vary from serious to no impact 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) Noise from launches may startle nearby wildlife and cause flushing behavior in birds, but this startle reaction would be of short duration. The increased presence of personnel, vehicles, helicopters, and landing craft immediately before a launch would tend 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. However, testing is usually short in duration and occurs within regularly used range areas.

Air Emissions

Results of monitoring conducted following a Strategic Target System launch from KTF indicated little effect on wildlife due to the low-level, short-term hydrogen chloride air (exhaust) emissions. The program included surveys of representative birds and mammals for both pre-launch and post-launch conditions. Birds flying through an exhaust plume may be exposed to concentrations of hydrogen chloride that could irritate eye and respiratory membranes (Federal Aviation Administration, 1996). However, birds are unlikely to come in contact with the exhaust plume, because of their flight away from the initial launch noise. Deposition of aluminum oxide from missile exhaust onto skin, fur, or feathers of animals will not cause injury because it is inert and not absorbed into the skin. The U.S. Environmental Protection Agency has determined that non-fibrous aluminum oxide found in solid rocket motor exhaust is nontoxic (U.S. Air Force, Air Combat Command, 1997). Because aluminum oxide and hydrogen chloride do not bioaccumulate, no indirect impacts on the food chain are anticipated from these exhaust emissions. (U.S. Department of the Navy, 1998a; U.S. Army Space and Missile Defense Command, 2004)

Debris and Airborne Fragments

The probability for a launch mishap is very low. However, an early flight termination or mishap would cause missile debris to impact along the flight corridors. In most cases, the errant missile would be moving at such a high velocity that resulting missile debris would strike the water further downrange.

The low-energy, small fragments expected as a result of successful high altitude intercepts are not anticipated to impact wildlife in the area since the fragments would be widely scattered and of small size and quantities. The fine pieces would not present a toxicity issue.

In the unlikely event of an on-pad fire or early flight failure over land of a solid propellant missile, most or all of the fuel would likely burn up before being extinguished. Any remaining fuel would be collected and disposed of as hazardous waste. Soil contamination which could result from such an incident is expected to be localized, along with any impacts on vegetation or wildlife.

Electromagnetic Radiation

Specific siting and orientation of the radar results in a cone shaped EMR zone being projected skyward, yet within site boundaries. In terms of the potential for EMR impacts on wildlife, the main beam of ground-based radar systems during missile flight tests would not be directed toward the ground, which would preclude EMR impacts on terrestrial species. The potential for main-beam (airborne) exposure thermal impacts on birds exists. The potential for impacts on birds and other wildlife was addressed in the Ground-Based Radar Family of Radars EA (U.S. Army Space and Strategic Defense Command, 1993c) and more recently in the 2007 BMD System Programmatic EIS (Missile Defense Agency, 2007). 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 negligible. (U.S. Department of the Navy, 1998a)

Earlier analysis of ground-based radar's potential impacts on birds indicated that power densities of 243 to 390 milliwatts per square inch (mW/in^2) would be necessary to impact birds weighing up to 7.7 pounds. The power density of existing radars such as THAAD is not expected to exceed 32 mW/in^2. (U.S. Army Space and Strategic Defense Command, 1993c)

Based on a review of types of radars potentially used as part of BMD Systems in 2007, the EMR power densities of 243 to 390 mW/in^2 that were previously estimated to be thresholds for thermal loading effects in birds were more conservative than necessary for shorter duration exposures. Representative radars included the S-band Aegis radar. Birds also have a greater ability to eliminate body heat through respiration than mammals do and migratory birds regularly incur and must dissipate excess metabolic heat during long-distance migratory flights. Thus it was determined that 64.5 mW/in^2 averaged over 6 minutes would be a conservative reference value to protect against possible behavioral effects during migration due to thermal heating. The sweeping motion of the radar beam while in surveillance mode may result in all birds flying in the surveillance area of the radar encountering the beam, but the exposure duration would be so short that the estimated risk of harm is negligible for all radars operating in this mode. (Missile Defense Agency, 2007)

Few field experiments have been performed to determine the potential effects of high-frequency EMR on wild animals. Aberdeen University researchers have over time observed that bat activity is reduced in the vicinity of the Civil Air Traffic Control radar station despite the proximity of habitat where bat activity would be expected. This observation raised the possibility that the radiofrequency (RF) radiation from the station might cause an aversive behavioral response in foraging bats. (Nicholls and Racey, 2007)

Nicholls and Racey (2007) predicted that if high-frequency EMR exerts an aversive response in foraging bats, the bat activity would be reduced at radar installations. The results of their study indicate that total bat activity was higher in control sites (0 volts/meter) when compared to sites with a high level (>2 volts/meter) of EMR. Nicholls and Racey (2007) proposed that thermal induction leading to an increased risk of overheating/hyperthermia and echolocation were the two likely mechanisms through which electromagnetic fields could induce an aversive response. (Nicholls and Racey, 2007)

Threatened and Endangered Species

Potential adverse effects on listed Hawaiian water birds (e.g., Hawaiian duck, Hawaiian moorhen, Hawaiian coot, and Hawaiian stilt) that could be in or transiting the launch area at the time of launch would be limited to startle or flying away reactions. Because launch-related noise would be localized, intermittent, and occur over a relatively short-term, the potential for effects on threatened or endangered wildlife would be minimal. Other effects to threatened or endangered birds would be the same as those addressed above for wildlife in general.

Civil Air Traffic Control radar discussed above in the Nicholls and Racey study is continuous. The radar proposed for use at PMRF would be used infrequently (two to four times per year) and the radar beam is operated in a sweeping motion, making it virtually impossible that a bat would remain in the beam for an extended period of time, thus limiting the potential exposure duration. Hawaiian hoary bats are also rarely seen on PMRF. It is unlikely that the small number of bats observed on or near PMRF would be affected by the proposed activities.

Activities on PMRF incorporate procedures to avoid listed wildlife that are foraging, resting, or hauled out, such as threatened green sea turtles or endangered Hawaiian monk seals. Personnel would be instructed to avoid all contact with monk seals and sea turtles or sea turtle nests that might occur within the area. A launch would be delayed if a monk seal is observed on the beach within the Ground Hazard Area or Launch Hazard Area.

Environmentally Sensitive Habitat

Testing and training activities currently avoid the coastal dune systems. Measures were suggested in the PMRF Enhanced Capability EIS (U.S. Department of the Navy, 1998a) to further reduce possible environmental impacts to sensitive habitat. If applicable these measures would be implemented for the Proposed Action. The installation of a portable blast deflector on the launch pad would protect the vegetation on any adjacent sand dunes. The potential for starting a fire would be further reduced by clearing dry vegetation from around the launch pad. Spraying the vegetation adjacent to the launch pad with water just before launch would also reduce the risk of ignition. Emergency fire crews would be available during launches to quickly extinguish any fire and minimize its effects. An open (spray) nozzle will be used, when possible, rather than a directed stream when extinguishing fires, to avoid erosion damage to the sand dunes (if the Exoatmospheric Discrimination Experiment [EDX] site is selected).

Testing activities at PMRF would not occur in established critical habitat areas for ohai or lau`ehu that are located on or off base (Figure 3.1.1.1.3-1). Unexpected flight terminations or other launch mishaps have the potential to adversely affect an area that has been designated as unoccupied critical habitat by fire, debris, and the resultant cleanup. However, the likelihood of a mishap occurring is small, and appropriate measures will be in place to minimize adverse effects.

Post Flight Activities

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 testing would remain and become part of the range's infrastructure and would be maintained per their operating procedures. Fencing erected for Proposed Action activities would be retained or removed according to the needs of the installation. Transportation for removal of interceptor 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.

Vegetation

No additional impacts to indigenous or native vegetation are expected due to the removal of mobile equipment and assets brought to PMRF.

<u>Threatened and Endangered Plant Species</u>

No threatened or endangered vegetation has been identified on PMRF/Main Base.

Wildlife

The potential for impacts to wildlife would be similar to those described for site preparation activities.

<u>Threatened and Endangered Wildlife Species</u>

The activities would incorporate procedures to avoid threatened or endangered wildlife that are foraging, resting, or hauled out, such as threatened green sea turtles or endangered Hawaiian monk seals.

Environmentally Sensitive Habitat

Post flight activities would not affect areas of critical habitat for ohai or lau`ehu.

4.2.1.1.4 Cultural Resources—PMRF/Main Base—Onshore—Proposed Action

Impacts on significant cultural resources (known as historic properties) occur when an activity alters characteristics that make the property eligible for inclusion in the NRHP. Adverse effects on historic properties include but are not limited to physical destruction, damage, or alteration of all or part of the property; isolation of the property from its setting; or introduction of visual, audible, or atmospheric elements that are out of character with the property.

Site Preparation, Flight, and Post Flight Activities

Archaeological and Native Hawaiian Resources

Under the Proposed Action, new facilities and infrastructure features would be constructed. As sited, the new facilities would be located in areas where there are no known archaeological or Native Hawaiian sites; however, given its proximity to coastal dunes, the entirety of PMRF is sensitive for subsurface cultural resources, and there is always the potential for subsurface remains to be unexpectedly encountered during construction. This is particularly the case in the EDX area, where, based on previous survey and testing, there is medium to high sensitivity for subsurface archaeological and Native Hawaiian sites and burials. Construction of any new facilities would require close coordination with the PMRF Environmental Engineer and would follow the guidance provided in the PMRF ICRMP and its supporting documents (see Section 4.1.1.1.4) (International Archaeological Resources Institute, Inc., 2005). Mitigation measures could include, but not be limited to, archaeological monitoring during construction; prohibition of construction equipment in areas other than established roadways, lay down or other paved areas; and briefings to construction workers regarding the sensitive nature of PMRF coast-dune areas. Mitigation measures for post flight anomalies (e.g., fire) are also outlined in the PMRF ICRMP. Because in-place mitigation measures, guidance, and coordination is in place and strictly enforced, significant adverse effects on cultural resources are not expected.

If any unexpected resources are encountered during proposed activities, the activities would cease in the immediate area and the PMRF Environmental Engineer would be notified. Subsequent actions and notifications would follow the guidance provided In the PMRF ICRMP (International Archaeological Resources Institute, Inc. 2005).

The Nohili Dune, which is adjacent to the EDX site, is known to be sensitive for archaeological and traditional Native Hawaiian remains, particularly burials. The area is periodically used by Native Hawaiians for educational purposes and cultural exchange and, for safety reasons, access is granted as missions and launches allow. As currently proposed, activities in this EA/OEA will not pose additional restrictions on Native Hawaiian access to this area; therefore, significant impacts are not expected.

In addition, there is some potential for the island of Kauai and PMRF to be affected by small, lightweight fragments resulting from successful high altitude intercepts. Given the small size, low energy, and dilute concentration of the fragments falling from the intercepts, no adverse effects on PMRF cultural resources are expected.

Historic Buildings

There are no historic buildings proposed for modification under the Proposed Action; therefore, no adverse effects are expected.

4.2.1.1.5 Geology and Soils—PMRF/Main Base—Onshore—Proposed Action

This section addresses potential impacts to geology and soils that could result from proposed activities. Geology and soils impacts were evaluated on the following criteria: potential for ground disturbance; substantial erosion or siltation from water and wind during potential construction and operation; and contamination from launches.

Site Preparation Activities

New construction would follow standard methods to control erosion during construction. Soil disturbance would be limited to the immediate vicinity of the construction area and would be of short duration. If applicable, soil additives would be used to bond exposed surface soils or excavated material at launch sites frequently watered. Base personnel and contractors would exercise best management practices to reduce soil erosion. The geology of the area is not expected to be influenced by the Proposed Action.

Flight and Post Flight Activities

The Proposed Action could result in potential contamination of soils from exhaust products and debris from missile launches; however, the small, lightweight fragments resulting from successful high altitude intercepts would be widely dispersed and non-toxic. Additionally 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 flight termination. See Section 4.2.1.1.6.

4.2.1.1.6 Hazardous Materials and Waste—PMRF/Main Base—Onshore—Proposed Action

This section describes the potential impacts from hazardous materials and hazardous wastes that could occur from the Proposed Action.

Site Preparation Activities

The additional electrical generators needed for the Proposed Action would require additional petroleum, oil, and lubricants. Other hazardous materials storage facilities are planned. The types of hazardous materials that would be used for the HTPB/AP-based composite solid propellants are ammonium perchlorate, aluminum, and HMX.

Construction activities would use small quantities of hazardous materials, which would result in the generation of some hazardous and nonhazardous wastes. The hazardous materials that are expected to be used are commonly used during construction activities and may include diesel fuel, antifreeze, hydraulic fluid, lubricating oils, welding gases, and small amounts of paints, thinners, and adhesives. Nonhazardous and hazardous waste generated during construction activities include construction debris, empty containers, spent solvents, waste oil and antifreeze, and spill cleanup materials (if necessary). The existing hazardous materials/waste programs for PMRF or KTF would handle the needs of the Proposed Action including hazardous materials use and storage and the hazardous waste generated from construction activities such as paints, sealants, epoxies, and solvents. No changes to the current system are needed to accommodate future tests.

Flight Activities

During flight activities soil contamination could potentially occur from rocket emissions forming hazardous residues in concentrations, or in the event of an early flight termination, burning fuel may reach the ground. This local contamination could require soil sampling and analysis to determine if any clean-up is required. During nominal launches of a solid propellant missile, the primary emission products include hydrogen chloride, aluminum oxide, carbon dioxide, carbon monoxide, nitrogen, and water.

No adverse changes to soil chemistry are predicted to occur as a result of hydrogen chloride or aluminum oxide deposition from solid fueled target and interceptor launches. No solid propellant missile launches would occur during rainy conditions. As detailed in Section 3.1.1.1.6, potential deposition of aluminum oxide per launch is expected to be small relative to the background levels of aluminum present in the soil. Previous studies performed by the Department of Energy to evaluate the impact of launching Strategic Target Systems from KTF measured high background levels of aluminum in the soils of the Mana Plain. 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 would be deposited at PMRF.

In the unlikely event of an on-pad fire or early flight failure over land of a solid propellant missile, most or all of the fuel will likely burn up before being extinguished. Any remaining fuel will be collected and disposed of as hazardous waste. Potential soil contamination which could result from such an incident is expected to be localized. Such contamination could require soil sampling and analysis to determine if any clean-up is required.

Potentially hazardous materials (external to those preloaded into the launch vehicles) to be used would be fuel required for electrical power generators, coating, sealants, and solvents needed for launch and launch preparation. The types of hazardous materials used and hazardous waste generated would be managed in accordance with existing PMRF procedures, which conform to Federal and State of Hawaii requirements.

Post Flight Activities

The PMRF Fire Department and Spill Response Team are trained in the appropriate procedures to handle the materials associated with launches if a mishap occurs. All personnel involved in this training would wear protective clothing and receive specialized training in spill containment and cleanup. During launches there is the potential for a mishap to occur resulting in potentially hazardous missile debris and propellants falling within the ground hazard area.

Hazardous materials that result from a flight termination would be cleaned up and any contaminated areas remediated. All hazardous waste generated from such a mishap would be disposed of in accordance with appropriate State and Federal requirements. Specific restoration actions, if necessary, would be determined on a case-by-case basis in coordination with the procedures of the Facility Services Division of Hazardous Materials.

4.2.1.1.7 Health and Safety—PMRF/Main Base—Onshore—Proposed Action

An impact would be considered if it involved materials or operations that posed a potential public or occupational health hazard. 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.

Site Preparation Activities

New facilities are routinely constructed for both military and civilian activities and present only potential occupational-related effects on safety and health for workers involved in the performance of the construction activity. Construction would be performed in compliance with all applicable regulations and construction standards (Occupational Safety and Health Administration [OSHA], U.S. Army Corp of Engineers, etc.). The siting of new facilities would be in accordance with DoD standards.

Missile launches by nature involve some degree of risk, and it is for this reason that DoD and PMRF have specific launch and range safety policies and procedures to ensure that any potential risk to the public and government assets (launch support facilities) is minimized. Potential issues related to health and safety include mishaps during the transportation of missile components, toxic and explosive risks during missile integration and assembly, mishaps during payload/warhead mating, mishaps during handling, and launch associated debris and emissions.

Missiles and support equipment are routinely transported directly to PMRF by aircraft. Missiles support equipment may also be transported by ship to Nawiliwili Harbor, then by DoD/DOT-approved over-the-road carrier truck to PMRF. Applicable State and Federal regulations and range safety plans and procedures are followed in transporting and handling potentially explosive ordnance and hazardous materials. Missile components, including any propellant, are transported in DOT and military designed and approved shipping containers. Explosive Safety Quantity Distances (ESQDs) that move with the transport vehicle are established along transportation corridors as applicable.

The protection afforded by shipping containers is sufficient to protect solid rocket motors from the shock required to cause an explosion. In the event of a transportation accident, there is an extremely high probability that solid propellants would not be ignited, and if so, the probability of an explosion is extremely remote. The solid propellants would release combustion products, specifically hydrogen chloride, which would irritate the eyes and skin of persons nearby. Such an accident would not likely occur given the in-place safety procedures used by PMRF during transportation and handling of missile components.

On arrival at PMRF, support equipment is placed in secure storage until assembly and launch preparation. All elements of the launch vehicle would be transported, handled, and stored at PMRF in accordance with applicable Federal and State regulations, and standard range operation procedures would be used to limit any adverse impact. ESQDs are established around ordnance storage and Missile Assembly Buildings. Access to storage and support facilities is limited to trained and authorized PMRF/mission critical personnel.

A pre-launch accident would be characterized by either an explosion and/or detonation of the missile propellants, or a situation in which the missile propellants burn without detonation or explosion. An ESQD surrounding the launcher is calculated based on the equivalent explosive force of all propellant and pyrotechnic materials contained on the flight vehicle. All potentially hazardous debris resulting from an accident on the launcher will be contained entirely within the ESQD, which will already have been cleared of unprotected personnel. Figure 3.1.1.1.7-1 shows the ESQD arcs for the launch pads at PMRF/Main Base. Teams are available for fire suppression, hazardous materials emergency response, and emergency medical response during launch activities.

Flight Activities

During some of the proposed high altitude flight tests, small, lightweight fragments resulting from missile intercept could potentially drift beyond current PMRF-controlled areas and affect airspace over Kauai. The fragments would not be harmful to individuals on the ground. PMRF, however, would continue to ensure the protection of the public from any intercept or other missile debris through the application of standard range safety procedures and risk standards, including RCC Standard 321.

Procedures are in place to mitigate the potential hazards of an accident occurring during missile flight. The PMRF Flight Safety Office prepares a Range Safety Operation Plan (RSOP) for each mission that involves missiles, supersonic targets, or rockets. The development of the RSOP also considers the hazards from debris of hit-to-kill intercept tests where an interceptor missile impacts a target missile. The Commanding Officer of PMRF approves each RSOP, which includes specific requirements and mission rules. The Flight Safety Office has extensive experience in analyzing the risks posed by such activities. Appendix D further describes the general approach to protect the public and involved personnel from launch accident hazards. A brief overview of missile flight procedures is presented here, with specific examples for some of the proposed programs. The procedures in place are designed such that there is a very low probability of any adverse health or safety consequences of missile or rocket activities.

Prior to each mission, the PMRF Flight Safety Office performs a comprehensive analysis of the proposed mission, including flight plans, planned impact areas, vehicle response to malfunctions, and effects of flight termination action. A probabilistic analysis is performed with sufficient conservative assumptions incorporated to ensure that the risks from the mission are acceptable. PMRF follows the guidance of the RCC-321 for acceptable risk. These acceptable risk criteria are designed to ensure that the risk to the public from range operations is lower than the average background risk for other third-party activities.

To protect people from injury from either nominal launches or accidents, two primary mitigation measures are in place: flight termination and clearance of specified regions. Clearance areas include the ground hazard area for land areas, Ship Exclusion Zones for ocean areas, and Restricted Airspace and ALTRVs for airspace. In addition, launch times and trajectories are cleared with the U.S. Strategic Command to prevent impacts on satellites (both manned and unmanned); this process is called Collision Avoidance.

Flight termination is performed by the Missile Flight Safety Officer if a missile malfunctions and leaves a predefined region or violates other predefined mission rules. The acceptable flight region is bounded by Destruct Limits, which are defined to make impact of potentially hazardous debris on populated areas highly unlikely. The Missile Flight Safety Officer terminates flight if the Instantaneous Impact Point of a vehicle crosses a Destruct Limit. The range safety system includes highly-reliable in-flight tracking and command destruction systems. The Missile Flight Safety Officer monitors in real-time missile performance and evaluates flight termination criteria. The flight termination system provides a mechanism to protect the public with very high reliability, even in the unlikely case of a missile malfunction.

The sizes and locations of clearance regions, as well as the duration of closure, are determined for each particular launch through analysis and simulation. The ground hazard area includes the area that may be at risk from a vehicle failure very early in flight. It is a region in the vicinity of the launch location, typically extending 1,000 to 10,000 feet from the launch point, depending on the vehicle and mission. Clearance of this region ensures that the public is protected from individual risk levels above the individual risk criteria from an errant missile during the short interval between launch and the time the Missile Flight Safety Officer could respond to the malfunction). All non-mission essential personnel are excluded from the established ground hazard area and launch hazard areas during launch operations. For launches from the northern portion of PMRF Main Base, PMRF may activate the easement on State of Hawaii lands, and temporarily close roads on the Mana Plain.

The Ship and Aircraft Exclusion Areas ensure that vehicles are not in areas of unacceptable risk. These areas include the places where planned debris may impact (such as dropped stages of multi-stage vehicles or debris from hit-to-kill intercept engagements) and also the regions at risk if there is a failure (such as under the planned flight path). Aircraft regions are designed in a similar fashion. The specific definition of each of these regions is determined by a probabilistic risk analysis that incorporates modeling of the vehicle response to malfunctions, mission rules (such as Destruct Limits), and the vulnerability of vehicles to debris. NOTMARs and NOTAMs are issued for the entire region that may be at risk, encompassing both exclusion areas and warning areas (areas with very remote probability of hazard). Surveillance by aircraft and satellite is used to ensure that there are no ships or aircraft in cleared areas, and also that the collective risk meets acceptable risk criteria for the mission. If vessels (ships or fishing boats) are seen in an impact area, their cooperation is requested to leave the area. Launches are put on hold until the impact area is clear of traffic or it is determined that the encroaching parties are not exposed to risks beyond what is acceptable based on the application of existing standard range safety procedures and risk standards, including RCC Standard 321, Common Risk Criteria for National Test Ranges, Subtitle: Inert Debris. If aircraft are seen in an impact area, safety regulations dictate that hazardous activities will be suspended when it is known that any non-participating aircraft has entered any part of the training danger zone until the non-participating entrant has left the area or a thorough check of the suspected area has been performed.

Sensor instrumentation activities will also occur during launches from PMRF/Main Base. EMR health and safety issues described below address the hazard of EMR to personnel (HERP), hazard of EMR to fuel (HERF), and hazard of EMR to ordnance (HERO). Prior to installing any new radar or modifications to existing radar, PMRF conducts an EMR hazard review that considers hazards of EMR on personnel, fuel, and ordnance. The review provides recommendations for sector blanking (areas off-limits to EMR) and safety systems. HERP hazards are the result of tissue heating by RF energy. Hazard levels are a result of RF energy averaged over any 6-minute period. HERF is the ignition of fuel vapors by arcing or ignition of fuel in contact with the RF heated metal in intense RF fields. HERO is the potential to cause the ordnance to explode in intense RF fields.

Regular radiation hazard surveys occur of radar proposed for use and other EMR generating equipment used on PMRF. None of the EMR generated affects the public using the beaches on PMRF or the areas adjacent to the facility. EMR hazards to personnel on PMRF are minimized by conducting hazard surveys of existing and new systems to ensure appropriate safety precautions are implemented. In addition, each radar unit contains warning lights that operate to inform personnel when the system is emitting EMR. Overall, with the implementation of the existing safety procedures, EMR represents a minimal health and safety risk to personnel working on PMRF or the public.

Post Flight Activities

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 testing would remain and become part of the range's infrastructure and would be maintained per their operating procedures. Fencing erected for Proposed Action activities would be retained or removed according to the needs of the installation. Removal of interceptor equipment would require the same procedures as when it was brought into the installation. These activities would result in impacts similar to, but less than, those caused by site preparation.

4.2.1.1.8 Land Use—PMRF/Main Base—Onshore—Proposed Action

Impacts to land use were evaluated based on the following: whether conflicts with adjacent land use, zoning, or other planning regulations, or incompatibility with existing land use, would result from any potential construction, upgrades, and operation of the Interceptor Test Support Program at PMRF/Main Base.

Site Preparation and Pre-flight Activities

On-Base and Off-Base Land Use

Under the Proposed Action improvements would occur in support of current and future target and intercept testing support at PMRF/Main Base. Improvements for site preparation include the construction of new facilities or the upgrade to current facilities which would not alter the land use patterns for on-base, off-base, or adjacent properties during site preparation activities. Table 2.2.1.4-1 summarizes proposed construction on PMRF/Main Base.

During pre-flight activities all range safety and range control established safety measures (ESQD Arcs, ground hazard areas, and Accident Potential Zones) and all transportation activities would continue to follow all applicable regulations and appropriate safety measures. Pre-flight activities associated with the Proposed Action would not alter the land use patterns for on-base, off-base, or adjacent properties.

Flight Activities and Post Flight Activities

On-base Land Use

Testing of targets and interceptors is entirely consistent with the mission of PMRF/Main Base and these activities do not conflict with any land use plans, policies, or controls of PMRF/Main Base. PMRF/Main Base would continue to conduct target and intercept testing. All range safety and range control established safety measures would continue to be followed (ESQD Arcs, ground hazard areas, and Accident Potential Zones). PMRF Safety would continue to establish criteria for the execution of the test operations.

Since changes to operation, implementation, intensity, and frequency of testing/training of interceptors at PMRF are anticipated, a separate Coastal Zone Management review was performed. The continuation of testing/training at PMRF/Main Base will remain consistent to the maximum extent practicable with the Hawaii Coastal Zone Management Program.

On-base Recreation

Recreational services available to military and civilian personnel at PMRF/Main Base would remain at current status during non-hazardous training. Testing activities that restrict the use of any on-base recreation areas would continue to adhere to established safety measures (Section 3.1.1.1.7, Health and Safety).

Off-Base Land Use

PMRF operates adjacent to County and State designated agricultural areas (Figure 3.1.1.1.8-1). There are no inhabited buildings within these areas. Activities associated with the Proposed Action are not conducted within these areas. Activities performed within the missile ground hazard areas that extend off-base into these agricultural areas, which are only used during launch events, would continue to adhere to established safety measures (Section 3.1.1.1.7, Health and Safety—PMRF/Main Base).

To protect all persons, private property, and vehicles during testing/training events at PMRF/Main Base, a 2,110-acre restrictive easement has been established (Figure 3.1.1.1.7-1) (Appendix E). Approximately 70 acres of the southern extent of Polihale State Park contain missile ground hazard areas which are within the restrictive easement boundary for PMRF/Main Base. Ongoing testing/training events for launches are not conducted in the Park, and the missile ground hazard areas are only used during launch events. The safety restrictions are further ensured by restricting access to the land within a designated ground hazard area, prior to, during, and shortly after a launch. (U.S. Department of the Navy, 2008) Overall, under the Proposed Action**,** Flight Activities, and Post Flight Activities would not alter on-base, off-base, or adjacent properties land use patterns.

4.2.1.1.9 Noise—PMRF/Main Base—Onshore—Proposed Action

DoD or OSHA guidelines provide the following limits. Generally, impulse noise levels should not exceed 140 dBA at any time. A time-weighted limit for 15 minutes (or less) exposure from constant noise is 115 dBA. In areas where these noise levels would be exceeded, personnel are required to wear hearing protection. The Proposed Action could result in noise impacts from construction activities and rocket flight testing. The analysis in this section is concerned with human receptors at the launch facility and adjacent communities within approximately 8 mi centered on the launch pad; noise effects on wildlife are discussed under biological resources.

Site Preparation Activities

Noise generated during proposed construction activities would be temporary in nature and similar to any commercial construction site. Noise generated during modification of the launch pad should have minimal impact on worker or launch personnel and off-base areas.

Flight Activities

Noise would include transport vehicles, maintenance equipment, generators, and the launching and detonation of test missiles. KTF supports a variety of sounding rocket missions; therefore, occasional rocket, missile, or drone launches produce high-intensity, short-duration sound events. Noise monitoring was conducted in February 1993 during the Strategic Target System FTU-1 launch at KTF to confirm the determination made in the Strategic Target System EIS

(U.S. Army Strategic Defense Command, 1992) that noise produced from the largest launch would be below maximum acceptable levels. Data collected in the nearest town of Kekaha indicated that levels were no louder than noise generated from passing vehicles on a nearby highway (Sandia National Laboratories, 1993). A comparison of the smaller SM-3 to the larger already analyzed Strategic Target System launch vehicles is relevant. Mathematical modeling provided in the Strategic Target System EIS (U.S. Army Strategic Defense Command, 1992) as shown in Table 3.1.1.1.9-1 predicted a peak noise level of about 91 dBA at 2 miles (mi), which is slightly beyond the ground hazard area. When compared to some of the common noise levels provided in Appendix C, Table C-2, that is equivalent to the noise of a lawn mower at 3 feet.

The nearest on-base housing area is located approximately 5 mi south of the northern KTF and PMRF launch areas and 1 mi from the southern launch site. The nearest off-base residential area is Kekaha, which is approximately 8 mi south of the northern launch areas and 2 mi from the southern launch sites. Based on the modeling described above, the SM-3 missile launches would produce noise above this average expected in the vicinity; however, due to the low test frequency, and the short duration of each test, local populations would not be adversely affected.

Additional instantaneous sounds, such as the sonic boom of the supersonic target and the SM-3 missile, may accompany the SM launch from PMRF. As is the case for current operations, the sonic booms from launches will not occur over PMRF/Main Base or over any centers of population (ACTA, Inc., 2009).

Due to the design of the SM-3, the low test frequency, and the short duration of each test, as well as the distance from population centers, noise impacts from all the activities associated with the Proposed Action would not cause annoyance in populated areas. None of the noise levels outside the ground hazard areas, where non-essential personnel and public are excluded, will exceed either DoD or OSHA safety requirements. Personnel within the ground hazard areas, where noise levels could exceed DoD or OSHA safety requirements, would be required to wear hearing protection.

Post Flight Activities

Noise generated during the removal of mobile equipment and assets during post flight activities would have minimal impact to the noise environment on or off-base.

4.2.1.1.10 Socioeconomics—PMRF/Main Base—Onshore—Proposed Action

Socioeconomic characteristics are evaluated by analyzing the Proposed Action presented in Chapter 2.0 of this EA/OEA.

Site Preparation, Flight, and Post Flight Activities

Population, Income, Employment and Housing

The construction phase (upgrade or new construction—Table 2.2.1.4-1) of the Proposed Action could have a temporary positive effect on the local economy on Kauai through the employment of some sectors of the local construction community. There is no anticipated change in the number of permanent personnel needed for the Proposed Action; therefore, there is no expected change in the employment level and housing needs on Kauai based on the Proposed Action.

Tourism

An average of 300 to 500 additional individuals visit and work at PMRF for up to 4 weeks in support of specific missions (e.g., THAAD, Aegis), and this average number is not expected to increase with the implementation of the Proposed Action. These individuals would continue to have a positive impact on the local economy by the use of lodging facilities (hotels, condos, and vacation rentals), restaurants, and tourist attractions (e.g., beaches, fishing, surfing, hiking, cultural events, cruises) offered on Kauai.

4.2.1.1.11 Transportation—PMRF/Main Base—Onshore—Proposed Action

Transportation impacts are evaluated by analyzing testing activities associated with the Proposed Action presented in Chapter 2.0.

Site Preparation Activities

Construction

The amount of traffic on Highway 50, other local roadways, and on-base roadways may be affected by the temporary increase in construction traffic due to the construction of new facilities or modification to current facilities.

Flight and Post Flight Activities

PMRF has the capability to transport items via air (PMRF Airfield), water (Port Allen or Kikiaola Small Boat Harbor), and land (public roadways regulated by the United Stated DOT and private access roads). Within the Ground Hazard Area, road entrance and exit control points are established 3 hours prior to a launch, and the area is cleared just before a launch using vehicles, boats, and helicopters (if necessary). The Proposed Action would continue the need for delivery of equipment and personnel requirements to PMRF in support of testing/training activities (land and ship based). Additionally, PMRF plans to support upgraded and new defensive missiles launched from Navy ships or land locations (for example, but not limited to, Navy land-based BMD System, based on guidance, propulsion, and warhead upgrades to the SM-3, new land launch systems).

All program (current and future) requirements (ordnance, liquid propellant, solid propellants) would continue to be transported in accordance with DOT regulations and specific safety procedures developed for the location. PMRF has established PMRFINST 8023.G, and follows other guidelines (Naval Sea Systems Command Publication 5 Volume 1 Seventh Revision Table 7-5 and DoD 6055.9-STD Table C9.T16) that cover the handling and transportation of ammunition, explosives, and hazardous materials on the facility. Transport requirements do not affect transportation routes on the island of Kauai and there are no road closures during transport.

There is no missile debris or missile component recovery stage required after successful testing/training activities at PMRF/Main Base. All transportation safety procedures discussed above in Preflight Activities apply to Flight and Post Flight Activities.

The average 300 to 500 additional individuals that visit and work at PMRF for up to 4 weeks in support of specific missions (e.g., THAAD, Aegis) are not expected to increase with the implementation of the Proposed Action. Under the No-Action Alternative, no significant negative impacts have been identified that affect transportation systems on PMRF/Main Base or adjacent properties, and none are anticipated for the Proposed Action.

4.2.1.1.12 Utilities—PMRF/Main Base—Onshore—Proposed Action

Impacts on utilities were evaluated by analyzing testing activities associated with the Proposed Action presented in Chapter 2.0 of this EA/OEA. See the Air Quality section for evaluation of energy and alternative energy use for the Proposed Action.

Site Preparation, Flight, and Post Flight Activities

Under the Proposed Action an Interceptor Launch Area, a Test Center (Mission Support Facility, a radar, and Launch Control Center) and a BMD System Communication Support Complex Site could be constructed at PMRF/Main Base. The Federal Government is required to incorporate Leadership in Energy and Environmental Design, Executive Order 13514, requirements into the technical specifications of new construction. The proposed action would comply to the maximum extent practicable with Executive Order 13514 requirements and Executive Order 13423, including installation of high efficiency chillers and solar photovoltaic design and installation at the Aegis Ashore Test Complex.

Electricity (Energy)

The Interceptor Launch Area (Launch Pad, Launcher Equipment Building, and the MK41 VLS) would require 0.056 MW of power, which would be powered commercially by KIUC and an onsite generator (e.g., a 500-kW generator, with a 10,000-gallon fuel tank with a secondary containment system).

The AATC (Radar and Launch (Fire) Control Center) could be constructed on PMRF/Main Base adjacent to/beside the PMRF HIANG or adjacent to/beside the east side of the Calibration Laboratory site (Figures 2.2-5, 2.2-6). The total demand factor for electrical service (required power) for the proposed Aegis Ashore Test Center would be 3 MW. The radar would require 2.5 MW of power and the Launch Control Center would require 0.5 MW of power, which would be provided by KIUC or by generators and fuel tanks (e.g., two 2.5-MW generators).

The BCSC site would be powered by site-provided diesel fuel storage and distribution system. The power system would consist of generators only (e.g., two 438-kW generators with a fuel consumption for the generators at approximately 4,000 gallons per week at peak loads).

The total potential power required exclusively from KIUC for the Proposed Action would be approximately 3.056 MW (2.5 MW for the radar, 0.5 MW for Launch Control Center and 0.056 MW for the Interceptor Launch Area). See Table 2.2.1.4-2 for the total power requirements for Aegis Ashore facilities.

Currently, power to PMRF is provided by the KIUC Mana Substation and Kekaha Switchyard. The west side transmission line has a capacity of 7.6-MW, and the southern circuit has a 4.3-MW capacity. Additionally, there could be an upgrade to the existing power sources located on and associated with PMRF/Main Base. The average of 300 to 500 additional individuals that visit and work at PMRF for up to 4 weeks in support of specific missions (e.g., THAAD, Aegis) is not expected to increase with the implementation of the Proposed Action. Overall, any increase in electrical power requirements would be addressed (KIUC and generators) and no significant impact is anticipated.

Potable Water and Wastewater

The water required for the internal deluge system would be provided by connecting into the PMRF water system or from a potable water tank. The Test Center would be connected to the current potable water supply, sanitary wastewater collection and disposal. Overall, no significant impact to potable water and wastewater is expected.

4.2.1.1.13 Water Resources—PMRF/Main Base—Onshore—Proposed Action

This section addresses the potential impacts to water resources (surface, groundwater, and flood hazard areas) due to the Proposed Action.

Site Preparation Activities

Under the Proposed Action an Interceptor Launch Area, a Test Center, and Communications Hardstand could be constructed at PMRF/Main Base. If construction results in a total area disturbed greater than 1 acre, a Stormwater Pollution Prevention Plan would be prepared and submitted prior to construction, and a storm water permit would be required. The plan would specify all the measures to be used during construction to minimize and avoid adverse water quality impacts. The dry climate, level topography, and high permeability of the soils result in limited runoff and erosion during construction projects, reducing the potential for impacts on water resources from construction activities.

Construction activities would follow Spill Prevention, Control and Countermeasures Plans and transportation safety measures; therefore, potential effects on surface and groundwater resulting from accidental spills of hazardous materials would be minimized. Additionally, construction would be designed to promote positive drainage away from project area and to be in accordance with the standards and criteria of the provisions of Executive Order 11988, Floodplain Management for the EDX, KTF Pad 1, Aegis and Calibration Lab East sites. Lighting and instrumentation tower pad elevations would be 1 foot above the 100-year flood elevation.

Flight Activities and Post Flight

Although a potential impact to water resources could occur in the event of an accidental fuel spill or premature flight termination that results in fuel coming in contact with water resources, in the unlikely event of an accidental release emergency response personnel would comply with all PMRF safety regulation which include a list of project materials, items, or test conditions that could present hazards to personnel or material through toxicity, combustion, blast, acoustics, fragmentation, EMR, ionization, or other means.

4.2.2 KAUAI—OFFSHORE—PROPOSED ACTION

4.2.2.1 PMRF/Main Base—Offshore—Proposed Action

Thirteen broad areas of environmental resources were considered for analysis for PMRF/Main Base Offshore. These areas included air quality, airspace, biological resources, cultural resources, geology and soils, hazardous materials and waste, health and safety, land use, noise, socioeconomics, transportation, utilities, and water resources. This consideration of analysis indicated that the proposed action would not result in either short-or long-term impacts to air quality, airspace, geology and soils, hazardous materials and waste, health and safety, land use, noise, utilities, and water resources. Small, lightweight fragments from certain high altitude intercepts could in some test scenarios fall in State waters within 3 nm offshore. The very small nature and quantity of these fragments (up to 0.03 ounce in size) that could fall in State waters is not currently, and would not in the future be, able to be measured or otherwise discovered or noticed by the public, such as to involve either the State Litter Law (Hawaii Revised Statutes [HRS] Chapter 339: Litter Control) or the Clean Water Laws (Hawaii Administrative Rules [HAR] Chapter 11-54: Water Pollution Control) discussed in Appendix C.

There is no indication of emissions from the Proposed Action affecting the air quality offshore of PMRF/Main Base. Use of the area offshore of PMRF/Main Base could require control of the airspace; however, any issues associated with this airspace are included within the PMRF/Main Base discussion (Section 4.2.1.1.2). Because no ground disturbance or building modification would occur offshore, there would be no impact on geology and soils. Any activity associated with the Proposed Action in the area offshore of PMRF that would generate hazardous materials or waste would continue to be managed in accordance with PMRF's hazardous materials management plans as described in Appendix C. Any health and safety issue associated with the Proposed Action is included within the PMRF/Main Base discussion (Section 4.2.1.1.2). No noise-sensitive land receptors are affected by existing noise levels offshore. Any land use utilities, or water issue associated with the Proposed Action is included within the PMRF/Main Base discussion (Section 4.2.1.1.8, 4.2.1.1.12, and 4.2.1.1.13).

4.2.2.1.1 Biological Resources—PMRF—Offshore—Proposed Action

Site Preparation Activities

Vegetation

No threatened or endangered vegetation is located in the offshore area.

Wildlife

Site preparation activities would have no effect on offshore listed wildlife species.

Flight Activities

Vegetation

No threatened or endangered vegetation is located in the offshore area.

Wildlife

Noise

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) Noise from launches may startle nearby marine wildlife and cause flushing behavior in birds, but this startle reaction would be of short duration. The increased presence of personnel, vehicles, helicopters, and landing craft immediately before a launch would tend 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. Testing/training is usually short in duration and occurs within regularly used range areas.

Air Emissions

Within offshore waters, the potential ingestion of contaminants by fish and other marine species would be remote because of atmospheric dispersion of the emission cloud, the diluting effects of the ocean water, and the relatively small area of the EFH that would be affected. Further discussions on the effects of missile launches on fish and EFH are presented in the Navy's *Essential Fish Habitat and Coral Reef Assessment for the Hawaii Range Complex EIS/OEIS* (U.S. Department of the Navy, 2007).

In the unlikely event of a launch mishap involving a liquid-propellant missile, if the fuel and/or oxidizer do not explode or burn, they will likely be deposited on the ground or water surface. Materials will be rapidly diluted in the seawater and, except for the immediate vicinity of the debris, will not be found at concentrations identified as producing adverse effects (U.S. Department of the Navy, 1998a).

Since future variants of the Aegis SM may be equipped with a DACS, as an example, THAAD missiles can release a maximum of 0.5 gallon of hypergolic bi-propellants from the DACS. Bi-propellants are two liquid missile propellants, such as THAAD's monomethyl hydrazine and nitrogen tetroxide, stored in separate tanks and fed into the missile system separately as fuel and oxidizer. The nitric acid produced from the bi-propellant release would initially cause spattering, a localized increase in water temperature, and local lowering of the hydrogen ion concentration (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. The potential ingestion of toxins by fish species, which may be used for food sources, would be remote due to this buffering capacity, although some fish may be injured or killed if present at the bi-propellants' initial point of contact. (U.S. Army Space and Missile Defense Command, 2002)

Debris and Airborne Fragments

According to analysis contained in the 2008 HRC EIS/OEIS, debris from shore-based missile launch programs is not expected to produce any measurable impacts on offshore benthic (sea floor) resources.

The probability for a launch mishap is very low. However, an early flight termination or mishap would cause missile debris to impact along the flight corridor, potentially in offshore waters. Debris would be removed from shallow water if possible. In most cases, the errant missile would be moving at such a high velocity that resulting missile debris would strike the water further downrange. If humpback whales, monk seals, or sea turtles were observed in the offshore launch safety zone, the launch will be delayed (U.S. Department of the Navy, 1998a).

The potential impact on EFH from nominal launch activities would mainly be from spent boosters and missile debris to waters off the coast within the TOA. By the time the spent rocket motors impact in the ocean, generally all of the propellants in them will have been consumed. Any residual aluminum oxide, burnt hydrocarbons, or propellant materials are not expected to present toxicity concerns. In a successful intercept, both missiles will be destroyed by the impact over the ocean. Momentum will carry the debris along the respective paths of the two missiles until the debris falls to earth. The debris will consist of a few large pieces (10 to 100 pounds), many medium pieces (10 pounds or less), but mostly small lightweight fragments. Such missile components will immediately sink to the ocean bottom out of reach of most marine life. Some fish near the surface could be injured or killed by larger pieces of debris. It is unlikely that the smaller pieces of sinking debris will have sufficient velocity to harm individual marine mammals or fish.

According to the analysis in the Point Mugu Sea Range EIS, fewer than 0.0149 marine mammals in its affected area would be exposed to missile debris per year, and the probability of this debris affecting marine mammals or other marine biological resources is less than 1 in 1 million. This probability calculation was based on the size of the Pacific Ocean area studied and the marine mammal population density within that area. The Point Mugu range area (27,183 nm^2) is 1 percent of the PMRF TOA (2.1 million nm^2), and the density of marine mammals is larger. It is reasonable to conclude that the probability of marine mammals being struck by debris from missile testing at PMRF would be even more remote than at Point Mugu. (U.S. Department of the Navy, 1998b)

In the unlikely event of a launch mishap, scattered pieces of burning propellant could enter coastal water and potentially affect EFH closer to shore. 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 small and widely scattered, which would reduce the possibility of ingestion.

Electromagnetic Radiation (EMR)

The potential for main-beam (airborne) exposure thermal effects on birds exists. The potential for impacts on birds and other wildlife was addressed in the Ground-Based Radar Family of Radars EA (U.S. Army Space and Strategic Defense Command, 1993b). 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. The use of existing sensors is part of routine activities on PMRF as analyzed in the PMRF Enhanced Capability EIS. (U.S. Department of the Navy, 1998a)

Earlier analysis of ground-based radar's potential impacts on birds indicated that power densities of 243 to 390 mW/in^2 would be necessary to affect birds weighing up to 7.7 pounds. The power density of radars such as THAAD is not expected to exceed 32 mW/in^2. (U.S. Army Space and Strategic Defense Command, 1993c)

As discussed in Section 4.2.1.1.3, 64.5 mW/in^2 averaged over 6 minutes would be a conservative reference value to protect against possible behavioral effects during migration due to thermal heating. The sweeping motion of the radar beam while in surveillance mode may result in all seabirds flying in the surveillance area of the radar encountering the beam, but the exposure duration would be so short that the estimated risk of harm is negligible for all radars operating in this mode. (Missile Defense Agency, 2007)

Threatened and Endangered Species

Adverse impacts to listed species of sea birds, sea turtles, and marine mammals described in Section 3.1.2.1.2 threatened and endangered species would be similar to those discussed above for wildlife in general. In terms of the potential for EMR effects on listed wildlife, the main beam of the THAAD radar or other ground-based radar systems during missile flight tests would not be directed toward the ground, which would preclude EMR effects on green sea turtles or monk seals on the beach. To avoid wildlife that are foraging, resting, or hauled out, such as threatened green sea turtles or endangered Hawaiian monk seals, launch activities incorporate procedures such as instructions to personnel and delay of testing if listed species are present within the ground and launch hazard areas.

It is highly unlikely that an individual listed whale or sea turtle would be on or substantially above the surface of the water for a significant amount of time within the side lobe areas during the particular time that the radar would be operating (U.S. Department of the Navy, 2002).

Environmentally Sensitive Habitat

The Hawaiian Islands Humpback Whale National Marine Sanctuary EIS and Management Plan (National Oceanic and Atmospheric Administration, 1997) recognized that PMRF plays an important role in national defense training. The EIS included missile launches as one of the DoD activities that currently occur within the sanctuary boundaries. The proposed launches would have impacts to biological resources within the parameters of ongoing missile programs.

Post Flight Activities

No recovery activities are planned after testing; thus, no impacts to biological resources are anticipated.

4.2.2.1.2 Cultural Resources—PMRF—Offshore—Proposed Action

Site Preparation, Flight, and Post Flight Activities

Proposed activities with the potential to affect cultural resources within the PMRF offshore areas include missile intercepts and the associated debris. Cultural resources within this area include a sparse distribution of shipwrecks and fishponds. The resources are submerged, none are known to be eligible for inclusion in the NRHP and, given the small size, low energy, and dilute concentration of the fragments falling from the intercepts, the likelihood of the fragments adversely affecting these resources is extremely remote. As a result, no adverse effects on PMRF offshore cultural resources are expected.

4.2.2.1.3 Socioeconomics—PMRF—Offshore—Proposed Action

Socioeconomic characteristics are evaluated by analyzing the Proposed Action presented in Chapter 2.0 of this EA/OEA.

Site Preparation, Flight, and Post Flight Activities

Under the Proposed Action, an Interceptor Launch Area, a Mission Support Facility and a Radar and Launch Control Center could be constructed on PMRF/Main Base. No disruption of commercial fishing or tourism offshore of PMRF (there is no commercial shipping to PMRF) is anticipated. Due to the Navy's procedures for issuing NOTMARs, such disruptions are limited. Under the Proposed Action the Navy would continue to issue NOTMARs for scheduled testing/training activity times and locations, and precautions would be taken to ensure that no interactions between military activities and civilian vessels occurred during testing/training activities. NOTMARs provide notice to commercial ship operators, commercial fishermen, recreational boaters, and other area users that the military will be operating in a specific area. These temporary clearance procedures for safety purposes have been employed regularly over time without significant socioeconomic impacts on commercial shipping, commercial fishing, or tourist-related activities. Under the Proposed Action, the local economy of Kauai would continue to benefit from employment at PMRF/Main Base and increased tourism and hotel use.

4.2.2.1.4 Transportation—PMRF—Offshore—Proposed Action

Transportation impacts are evaluated by analyzing testing activities associated with the Proposed Action presented in Chapter 2.0.

Site Preparation, Flight, and Post Flight Activities

Implementation of the Proposed Action would not impact transportation procedures at PMRF/Main Base. Barges carrying explosives are met at Nawiliwili Bay by trained ordnance personnel and special vehicles for transit to and delivery at PMRF. All ordnance, including liquid propellants is transported in accordance with U.S. DOT regulations. PMRF has established guidelines (PMRF Instruction [PMRFINST] 8023.G) and follows other guidelines (Naval Sea Systems Command Publication 5 Volume 1 Seventh Revision Table 7-5 and DoD 6055.9-STD Table C9.T16) that cover the handling and transportation of ammunition, explosives, and hazardous materials on the facility.

The Navy has developed extensive protocols and procedures for the safe operation of its vessels and the safe execution of its training (e.g. NOTMARs). Any disruption of tour boats due to the Navy use of the waterway offshore of PMRF/Main Base is occasional and temporary. Under the Proposed Action the Navy would continue to issue NOTMARs for scheduled testing/training activity times and locations, and precautions would be taken to ensure that no interactions between military activities and civilian vessels occurred during testing/training activities.

4.2.3 NIIHAU—ONSHORE—PROPOSED ACTION

Thirteen broad areas of environmental resources were considered for analysis for Niihau Onshore. These areas included air quality, airspace, biological resources, cultural resources, geology and soils, hazardous materials and waste, health and safety, land use, noise, socioeconomics, transportation, utilities, and water resources. This consideration of analysis indicated that the Proposed Action would not result in either short-or long-term impacts to air quality, geology and soils, hazardous materials and waste, land use, noise, socioeconomics, transportation, utilities, and water resources.

There is no indication of emissions from the proposed action affecting the air quality onshore of Niihau. Because no ground disturbance or building modification would occur onshore, there would be no impact on geology and soils. Any activity associated with the Proposed Action in the area onshore of Niihau that would generate hazardous materials or waste would continue to be managed in accordance with PMRF’s hazardous materials management plans as described in Appendix C. No noise-sensitive land receptors are affected by existing noise levels on Niihau. There is no change to land use, socioeconomic, transportation, utilities, or water on Niihau associated with the Proposed Action.

4.2.3.1 Airspace—Niihau—Onshore—Proposed Action

Flight Activities

Under the Proposed Action, small, lightweight missile debris from some potential intercept tests could leave PMRF-controlled areas and fall over the island of Niihau. PMRF, however, would continue to ensure the protection of the public from any intercept or other missile debris through the application of standard range safety procedures and risk standards, including RCC Standard 321.

The small, lightweight fragments from the high altitude intercepts have the potential to damage jet engines and high-speed aircraft. Since the fragments could take up to approximately 1 hour to settle due to their light weight, they have the potential to affect arriving and departing helicopter flights to and from Niihau. PMRF, in coordination with the FAA, would need to use additional temporary airspace where such fragments would occur. The fragments could result in effects to all or parts of the airspace over Niihau depending on the actual test parameters. The program office would notify the FAA through PMRF that a test is being planned that could temporarily affect aircraft. The FAA would review the request and advise PMRF regarding windows of opportunity for the testing in order to minimize effects. These windows would determine whether the test could be performed, since a minimum of 2 hours of available time would be required for a test. PMRF would then request ALTRVs from the FAA, which would issue NOTAMs covering this additional temporary airspace if approved. Any additional impacts on airspace associated with Niihau are included within the PMRF/Main Base discussion.

4.2.3.2 Biological Resources—Niihau—Onshore—Proposed Action

Flight Activities

Vegetation

Vegetation on Niihau is dominated by non-native plant species and plant communities. Helicopter landings are in areas designated as suitable and absent of listed biological resources. For select intercept missions the potential exists for limited small, lightweight fragments to fall over Niihau. All proposed training and RDT&E activities would be performed in a manner that avoids, to the extent practicable and consistent with training requirements, adverse impacts on Niihau resources and qualities. All activities with the potential to impact Niihau biological resources would be performed in accordance with ongoing practices, such as equipment inspections, to minimize the potential for contributing to the spread of invasive species.

<u>Threatened and Endangered Vegetation</u>

The small, lightweight fragments resulting from some high altitude intercepts would have low impact kinetic energy and are not expected to adversely affect listed vegetation occurring on the island. Personnel would avoid areas that contain threatened or endangered plants. Fire suppression equipment would be provided as required.

Wildlife

Impacts to wildlife are expected to be low because of the non-native character of the dominant mammals on the island. Fine fragments with low impact kinetic energy are not expected to impact wildlife on the island. Helicopter landings are in areas designated as suitable and absent of listed biological resources.

<u>Threatened and Endangered Wildlife</u>

Fine fragments with low impact kinetic energy are not expected to affect listed wildlife species occurring on the island. Any personnel required on the island would be instructed to avoid any sea turtles or Hawaiian monk seals on the beach.

Environmentally Sensitive Habit

No effects are anticipated to the area designated as critical habitat for the alula in the northern portion of Niihau.

4.2.3.3 Cultural Resources—Niihau—Onshore—Proposed Action

Flight Activities

Some missile intercept activities under the Proposed Action have the potential to generate fine, small fragments that could potentially fall in the vicinity of Niihau. Given the small size, low energy, and dilute concentration of the fragments falling from the intercepts, the potential to adversely affect resources of any type is extremely remote. In addition, trajectories can be altered under certain circumstances to further minimize the potential for impacts. As feasible, mission flight trajectories would be altered to minimize the potential for small fragments within these areas. As a result, significant effects on cultural resources at Niihau are not expected.

4.2.3.4 Health and Safety—Niihau—Onshore—Proposed Action

Flight Activities

Under the Proposed Action, small, lightweight fragments from some potential high altitude intercept tests could drift beyond PMRF-controlled areas and possibly fall over the island of Niihau. The fragments would not be harmful to individuals on the ground and PMRF would continue to ensure the protection of the public from any intercept or other missile debris through the application of standard range safety procedures and risk standards, including RCC Standard 321, Common Risk Criteria Standards for National Test Ranges, Subtitle: Inert Debris. The potential for risk to aircraft is discussed in the airspace section.

4.2.4 NIIHAU—OFFSHORE—PROPOSED ACTION

Thirteen broad areas of environmental resources were considered for analysis for Niihau Offshore. These areas included air quality, airspace, biological resources, cultural resources, geology and soils, hazardous materials and waste, health and safety, land use, noise, socioeconomics, transportation, utilities, and water resources. This consideration of analysis indicated that the proposed action would not result in either short-or long-term impacts to air quality, cultural, geology and soils, hazardous materials and waste, health and safety, land use, noise, socioeconomics, transportation, utilities, and water resources. Small, lightweight fragments from certain high altitude intercepts could in some test scenarios fall in State waters within 3 nm offshore. The very small nature and quantity of these fragments (up to 0.03 ounce in size) that could fall in State waters is not currently, and would not in the future be, able to be measured or otherwise discovered or noticed by the public, such as to involve either the State Litter Law (HRS Chapter 339: Litter Control) or the Clean Water Laws (HAR Chapter 11-54: Water Pollution Control) discussed in Appendix C.

There is no indication of emissions from the Proposed Action affecting the air quality offshore of Niihau. Use of the area offshore of Niihau could require control of the airspace; however, any issues associated with this airspace are included within the Niihau Onshore discussion (Section 4.2.3.1). Any cultural resource issue associated with the Proposed Action is included within the Niihau Onshore discussion (Section 4.2.3.3). Because no ground disturbance or building modification would occur offshore, there would be no impact on geology and soils. Any activity associated with the Proposed Action in the area offshore of Niihau that would generate hazardous materials or waste would continue to be managed in accordance with PMRF's hazardous materials management plans as described in Appendix C. Any health and safety issue associated with the Proposed Action is included within the Niihau Onshore discussion (Section 4.2.3.4). No noise-sensitive land receptors are affected by existing noise levels offshore Niihau. There is no change to land use, socioeconomic, transportation, utilities, or water on Niihau associated with the Proposed Action.

4.2.4.1 Airspace—Niihau—Offshore—Proposed Action

Any impacts on offshore airspace associated with Niihau would be the same as those discussed in the Niihau Onshore airspace section and included within the PMRF/Main Base Offshore discussion.

4.2.4.2 Biological Resources—Niihau—Offshore—Proposed Action

Flight Activities

For select intercept missions the potential exists for limited small, lightweight fragments to fall into the waters offshore of Niihau. All training and RDT&E activities conducted would be performed in a manner that avoids, to the extent practicable and consistent with training requirements, adverse effects on Niihau resources and qualities, including listed species. All activities with the potential to affect Niihau would be performed in accordance with ongoing practices, such as equipment inspections, to minimize the potential for contributing to the spread of invasive species. Potential effects to offshore listed biological resources would be the same or similar to those discussed above in Section 4.2.2.1.1, PMRF Offshore.

The potential impacts of unspent solid and liquid fuels on marine resources, including subsistence fisheries, following an early flight termination event are expected to be negligible. Unburned solid fuel is hard and rubber-like. The ammonium perchlorate dissolves slowly out of the rubber-like binder. The ammonium perchlorate produces ammonia and chlorine, which are dispersed into the ocean. The aluminum oxide in the solid fuel is insoluble. As the solid fuel dissolves slowly, the outer layers become spongy, which further retards the dissolution rate. No toxic levels of ammonia, chlorine, or aluminum release from the solid fuels are expected (U.S. Army Strategic Defense Command, 1992).

4.2.5 NORTHWESTERN HAWAIIAN ISLANDS—ONSHORE—PROPOSED ACTION

A review of the 14 resources against program RDT&E activities under the No-action Alternative and proposed RDT&E activities was performed for the NWHI onshore.

Airspace issues associated with the NWHI are addressed under Section 4.2.1.1.1 (Airspace—PMRF/Main Base). There are no proposed activities that will affect air quality, land use, noise; or the geology or associated soils development of the islands. Socioeconomic characteristics (population size, employment, income generated, and housing cost) do not apply since all the islands are usually uninhabited. No transportation (roadways, railways, etc) and utility systems (water, wastewater, electricity, and natural gas) exist onshore. Proposed testing activities within the NWHI would not generate any hazardous waste streams that could impact local water quality.

Missiles coming into the TOA from various locations can overfly the Monument. At this point in their flight, the boosters follow a ballistic trajectory and would not impact the Monument.

4.2.5.1 Biological Resources—Northwestern Hawaiian Islands—Onshore—Proposed Action

Of particular concern is the potential for debris landing on islands in the NWHI. At this point in their flight, the boosters normally follow a ballistic trajectory and would not impact the monument resources. For select high altitude intercept missions the potential exists for small, lightweight fragments to fall on land or into the waters offshore of the NWHI in the Monument. In accordance with Presidential Proclamation 8031, all proposed activities conducted in the NWHI would be performed in a manner that avoids, to the extent practicable and consistent with training requirements, adverse impacts on Monument resources and qualities. Thus, as discussed in the beginning of Section 3.2, these military readiness activities are exempt from consultation requirements or monument regulations. All activities with the potential to affect the NWHI would be performed in accordance with ongoing practices, such as equipment inspections, to minimize the potential for contributing to the spread of invasive species.

Flight Activities

Vegetation

Any falling debris from missile tests with trajectories that have the potential to affect terrestrial habitat should cool down sufficiently prior to impact so as not to present a fire hazard for vegetation such as the endangered loulu, `ohai, *Amaranthus brownii*, and *Schiedea verticillata*. PMRF conducted a thermal degradation analysis of the potential debris. The analysis performed as part of the THAAD Pacific Flight Test EA showed the maximum temperature of the potential debris would be 302 degrees Fahrenheit (°F) at impact. Based on PMRF's literature review and conversations with a fire specialist with the U.S. Forest Service regarding the temperature required for a non-spark ignition of dry vegetation PMRF found ignition temperatures ranging between 392°F and 716°F. The debris would have to be in excess of 392°F and remain in contact with dry vegetation for a substantial amount of time in order to ignite the vegetation. Therefore, any debris potentially landing on Nihoa or other islands within the NWHI will not be a fire hazard. (Missile Defense Agency, 2006)

According to correspondence from the USFWS Pacific Islands Fish and Wildlife Office during the HRC EIS/OEIS process, the Service's previous concurrence of no significant impact from THAAD activities remained valid (U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, 2007). If feasible, consideration will be given to alterations in the missile flight trajectory, to further minimize the potential for debris impacts on vegetation on the land.

Wildlife

A debris analysis to identify weight and toxicity of the debris that could potentially impact Nihoa was performed by the THAAD (one of the missiles with a trajectory that could potentially result in debris on the NWHI) Project Office. Preliminary results indicated that debris greater than 0.5 foot-pound is not expected to impact on the NWHI (U.S. Army Space and Missile Defense Command, 2002). Debris with low impact kinetic energy (under 0.5 foot-pound) is not likely to affect threatened, endangered, migratory, or other endemic species occurring on the island. The probability for the widely scattered, small fragments from high altitude intercepts to hit birds, seals, or other wildlife will be low. Quantities of falling pieces of debris (e.g., drifting lightweight fragments, small amount of solid rocket propellant remaining) will be low and widely scattered so as not to present a toxicity issue.

Appendix C includes a description of the Migratory Bird Treaty Act (MBTA). Section 704(a) of the MBTA prescribes regulations to exempt the Armed Forces for the requirement to obtain an incidental take permit for migratory birds during military readiness activities authorized by the Secretary of Defense or the Secretary of the military department concerned. Congress determined that allowing incidental take of migratory birds as a result of military readiness activities is consistent with the MBTA and the treaties. The Armed Forces must give appropriate consideration to the protection of migratory birds when planning and executing military readiness activities, but not at the expense of diminishing the effectiveness of such activities. The low probability of debris capable of significantly impacting a population of a particular bird species should not require the development of conservation measures for the species. (U.S. Fish and Wildlife Service, 2007a; U.S. Department of the Navy, 2007)

Regular marine trash removal has been conducted within the NWHI since 1997 through a multi-agency effort led by the NMFS, in collaboration with, among others, the Navy, Coast Guard, USFWS, National Ocean Service, and State of Hawaii. This effort has resulted in the removal of more than 540 tons of fishing gear and other marine trash over the last 7 years. (National Oceanic and Atmospheric Administration, 2006c)

4.2.5.2 Cultural Resources—Northwestern Hawaiian Islands—Onshore—Proposed Action

Flight Activities

Missile intercept activities under the Proposed Action have the potential to generate small, lightweight fragments that could fall within areas of the NWHI. Given the small size, low energy, and dilute concentration of the fragments falling from the intercepts, the potential to adversely affect land resources of any type is extremely remote. In addition, mission flight trajectories can be altered under certain circumstances to further minimize the potential for effects. As a result, significant adverse effects on cultural resources within the NWHI are not expected.

4.2.5.3 Health and Safety—Northwestern Hawaiian Islands—Onshore—Proposed Action

Flight Activities

Under the Proposed Action, small, lightweight fragments from some potential high altitude intercept tests could drift beyond PMRF-controlled areas and possibly fall over the NWHI. The fragments would not be harmful to individuals on the ground and PMRF would continue to ensure the protection of the public from any intercept or other missile debris through the application of standard range safety procedures and risk standards, including RCC Standard 321, Common Risk Criteria Standards for National Test Ranges, Subtitle: Inert Debris.

4.2.6 NORTHWESTERN HAWAIIAN ISLANDS—OFFSHORE—PROPOSED ACTION

Small, lightweight fragments from certain high altitude intercepts could in some test scenarios fall in State waters within 3 nm offshore. The very small nature and quantity of these fragments (up to 0.03 ounce in size) that could fall in State waters is not currently, and would not in the future be, able to be measured or otherwise discovered or noticed by the public, such as to involve either the State Litter Law (HRS Chapter 339: Litter Control) or the Clean Water Laws (HAR Chapter 11-54: Water Pollution Control) discussed in Appendix C.

4.2.6.1 Biological Resources—Northwestern Hawaiian Islands—Offshore—Proposed Action

All proposed activities conducted in the NWHI would be performed in a manner that avoids, to the extent practicable and consistent with training requirements, adverse impacts on Monument resources and qualities in accordance with Presidential Proclamation 8031.

Flight Activities

Vegetation

No threatened or endangered marine vegetation has been identified offshore of the NWHI.

Wildlife

In a successful intercept, both missiles would be destroyed by the impact. Momentum would carry debris along the respective paths of the two missiles until the debris falls to earth. The debris would consist of a few large pieces (approximately 110 pounds) of each missile, many medium pieces (approximately 11 pounds), and mostly tiny particles. This debris is subject to winds on its descent to the surface and would generally fall into two elliptically-shaped areas. Most debris would fall into the Open Ocean within 3 to 40 minutes after intercept, but some of the lightweight fragments may drift airborne, for up to an hour before landing. (U.S. Department of the Navy, 1998a)

The potential exists for debris greater than 0.5 foot-pound to impact the offshore waters of the NWHI. No estimate of the actual area impacted was calculated since the likelihood of impacts on submerged coral reef habitat at Nihoa is anticipated to be low. A debris analysis to identify weight and toxicity of the debris that could potentially impact Nihoa was performed by the THAAD Project Office (U.S. Army Space and Missile Defense Command, 2002). Quantities of falling debris (e.g., lightweight fragments, solid rocket propellant) would be low and widely scattered so as not to present a toxicity issue. Since most of the coral present only survive at depths greater than 40 feet, coral cover is not greater than 25 percent, the debris will be widely scattered, and the velocity will be slowed following impact at the water's surface, the likelihood of impacts on submerged coral reef habitat associated with the NWHI will be low.

According to the analysis in the Point Mugu Sea Range EIS, fewer than 0.0149 marine mammals would be exposed to missile debris per year, and the probability of this debris affecting marine mammals or other marine biological resources is less than 1 in 1 million. This probability calculation was based on the size of the Pacific Ocean area studied and the marine mammal population density within that area. The Point Mugu range area (27,183 nm^2) is one percent of the PMRF TOA (2.1 million nm^2), and the density of marine mammals is larger. It is thus reasonable to conclude that the probability of marine mammals being struck by debris from similar missile testing at PMRF will be even more remote than at Point Mugu. (U.S. Department of the Navy, 1998b)

The various trajectories, launch sites, and intercept areas are selected with both consideration to the mission requirements and to minimize the effects on any particular location. During training, dedicated Navy lookouts who have received extensive training would be posted to scan the ocean for anything detectible in the water. For both training and RDT&E activities, spotters in aircraft would also relay information on marine species observed in the projected intercept areas. Training is halted, or a launch delayed, if marine mammals or sea turtles are detected in a target area. For a marine mammal or sea turtle to be injured, it would have to enter the target area undetected and then surface at the exact point where a projectile, spent missile, or spent target landed.

The potential ingestion of toxins, such as the small amount of propellant or simulant remaining in the spent boosters or on pieces of missile debris, by sea turtles, marine mammals, or fish species would be remote because of (1) atmospheric dispersion, (2) the diluting and neutralizing effects of seawater, and (3) the relatively small area that could potentially be affected.

4.2.6.2 Cultural Resources—Northwestern Hawaiian Islands—Offshore—Proposed Action

Flight Activities

Activities under the Proposed Action with the potential to affect submerged cultural resources include missile intercepts and the associated debris. Cultural resources within these areas typically include shipwrecks that are submerged at considerable depth. Given the small size, low energy, and dilute concentration of the small lightweight fragments falling from the intercepts, the potential to adversely affect submerged resources of any type is extremely remote. In addition, trajectories can be altered under certain circumstances to further minimize the potential for impacts within these areas. As a result, significant adverse effects on cultural resources within the NWHI offshore areas are not expected.

4.2.6.3 Health and Safety—Northwestern Hawaiian Islands—Offshore—Proposed Action

Flight Activities

Under the Proposed Action, small, lightweight fragments from some potential high altitude intercept tests could drift beyond PMRF-controlled areas and possibly fall offshore of the NWHI. The fragments would not be harmful to individuals in offshore areas and PMRF would continue to ensure the protection of the public from any intercept or other missile debris through the application of standard range safety procedures and risk standards, including RCC Standard 321, Common Risk Criteria Standards for National Test Ranges, Subtitle: Inert Debris.

4.2.7 OPEN OCEAN AREA—PROPOSED ACTION

Thirteen broad areas of environmental resources were considered for analysis for the Open Ocean Area. These areas included air quality, airspace, biological resources, cultural resources, geology and soils, hazardous materials and waste, health and safety, land use, noise, socioeconomics, transportation, utilities, and water resources. This consideration of analysis indicated that the proposed action would not result in either short-or long-term impacts to air quality, geology and soils, land use, noise socioeconomics, transportations, and utilities, resources.

There is no indication of emissions from the proposed action affecting the air quality in the Open Ocean area. Because no ground disturbance or building modification would occur in the Open Ocean, there would be no impact on geology and soils. No noise-sensitive Open Ocean receptors are affected by the Proposed Action. There is no association of land use, socioeconomic, transportation, or utilities resources for the Open Ocean area and the Proposed Action.

4.2.7.1 Airspace—Open Ocean Area—Proposed Action

Flight and Post Flight Activities

The potential impacts on controlled and uncontrolled airspace, special use airspace, en route airways and jet routes, and airports and airfields would be similar to that described in Section 4.2.1.1.2, PMRF/Main Base Onshore.

4.2.7.2 Biological Resources—Open Ocean Area—Proposed Action

Criteria for assessing potential impacts on marine biological resources are based on the potential for loss of habitat (destruction, degradation); excessive take (accidental or intentional death, injury); harassment; increases in exposure or susceptibility to disease and predation; and decrease in breeding success. Collision with missile debris, or vessels; release of contaminants from missile constituents; sound; or human contact could potentially cause impacts. Impacts are considered substantial if they have the potential to result in the reduction of population size of Federally listed threatened or endangered species, degradation of biologically important unique habitat, or reduction in capacity of a habitat to support species.

Flight Activities

Coral

Deep sea coral within the Open Ocean Area is located in deep water and is limited in area. The potential for impacts on these deep water corals from RDT&E activities would be very limited. The Navy activities would not result in any direct impacts on the coral or degradation of water/sediment quality in the vicinity of the corals. The probability of intercept debris affecting any coral is extremely small. In addition, the debris and expended materials would be spread out over a wide area so that even in the unlikely event the debris or expended materials lands on the coral, the pieces would be diffused and negligible.

Fish

The data obtained to date on effects of sound on fish are very limited both in terms of number of well-controlled studies and in number of species tested. Moreover, there are significant limits in the range of data available for any particular type of sound source. And finally, most of the data currently available has little to do with actual behavior of fish in response to sound in their normal environment. There is also almost nothing known about stress effects of any kind(s) of sound on fish. Most missile tests pose little risk to fish unless the fish were near the surface at the point of impact. Permanent, adverse impacts on EFH components are not anticipated since operations are conducted to avoid potential impacts; however, there are temporary, minimal unavoidable impacts associated with several operations that may result in temporary and localized impacts caused by debris.

Sea Turtles

Individual pieces of debris from ballistic missile intercept tests are dispersed over a large area. While a direct hit from a piece of debris would affect a sea turtle at the surface, it is extremely unlikely that this would ever occur. The testing event would be immediately halted if Navy spotters observe sea turtles within the drop zone areas and delayed until the animal voluntarily clears the area.

Marine Mammals

The primary source of potential marine mammal habitat impact during RDT&E activities within the open ocean would be underwater sound resulting from missile testing. However, the sound does not constitute a long-term physical alteration of the water column or bottom topography, as the occurrences are of limited duration and are intermittent in time given that surface vessels associated with testing move continuously and relatively rapidly through any given area.

Airborne sound from low-flying helicopters or airplanes or sonic booms may be heard by marine mammals and turtles while at the surface or underwater. Responses by mammals and turtles could include hasty dives or turns, or decreased foraging (Soto et al., 2006). Whales may also slap the water with flukes or flippers, or swim away from low flying aircraft. Due to the transient nature of sounds from aircraft involved in at-sea training and their generally high altitude, such sounds would not likely cause physical effects.

Navy vessels have incorporated significant underwater ship quieting technology to reduce their acoustic signature (as compared to a similarly-sized vessel) in order to reduce their vulnerability to detection by enemy passive acoustics (Southall, 2005). Therefore, the potential for noise-related impacts from Navy vessel and aircraft movement is extremely low given that the test events would be transitory in time and would occur over a large area of the ocean. Any masking of environmental sounds is expected to be temporary, as intercept noise would dissipate quickly. If behavioral disruptions result, they are expected to be temporary. Animals are expected to resume their migration, feeding, or other behaviors without any threat to their survival or reproduction.

Missile launches and intercept occur in a very controlled environment where safety is paramount. No firing is permitted until after it is determined that the range is clear. Many surface ships have electrically-enhanced optics (essentially sophisticated television cameras) that permit search and identification beyond normal visual ranges. Embarked helicopters are also frequently used to further examine the range to determine that no other surface craft or marine mammals are present. Each surface ship has a safety observer who determines that the range is clear before and during the exercise and who can halt the exercise if whales are observed.

The range safety precautions at PMRF are even more rigorous because of the extra sensors available. Exercises involving missiles are all conducted at PMRF. PMRF strictly controls weapons firings and does not permit an exercise to proceed until the range is determined clear after consideration of inputs from ships' sensors, visual surveillance of the range from aircraft and range safety boats, radar data, acoustic information from a comprehensive system of sensors and surveillance from shore. The test event can be modified as necessary to obtain a clear range or is canceled.

Post Flight Activities

Transit operations between harbors and operating areas pose a very low risk of potentially harmful effects on marine mammals, direct, indirect or cumulative. Despite having conducted countless ship transits from harbor to operations areas for many years, there have been no indications that such operations have had any effect on marine mammals in Hawaiian waters.

4.2.7.3 Cultural Resources—Open Ocean Area—Proposed Action

Flight and Post Flight Activities

Activities under the Proposed Action with the potential to affect submerged cultural resources within open ocean areas include missile intercepts and the associated debris. Cultural resources within these areas typically include shipwrecks that are submerged at considerable depth. Given the low energy of the debris falling within the Open Ocean from the intercepts, the potential to adversely affect submerged resources of any type is extremely remote. In addition, trajectories can be altered under certain circumstances to further minimize the potential for impacts. As feasible, mission flight trajectories will be altered to minimize the potential for debris within these areas. As a result, no significant adverse effects on cultural resources within open ocean areas are expected.

4.2.7.4 Hazardous Materials and Waste—Open Ocean Area—Proposed Action

Flight Activities

Missile debris would be expended into the waters off the coast within the TOA and not recovered. The effects on the open ocean from hazardous materials and waste under the Proposed Action would be insignificant. 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. Army Space and Missile Defense Command, 2002b)

Post Flight Activities

As stated in the HRC EIS/OEIS, the SM-1 and SM-2 propulsion system has 1,550 lb of aluminum and ammonia propellant in the booster and 386 lb of propellant in the sustainer. The warhead is 75–80 pounds, depending on the version. Missile batteries are another source of contaminants. SM-1 and -2 have a potassium hydroxide battery weighing 1.9 ounces. The SM-3 series is similar in its composition. The SM-2 uses 99–100 percent of the propellant during the exercise. The remaining solid propellant fragments sink to the ocean floor and undergo physical and chemical changes in the presence of seawater. Tests show that water penetrates only 0.06 inch into the propellant during the first 24 hours of immersion, and that fragments slowly release ammonium and perchlorate ions. These ions rapidly disperse into the surrounding seawater such that local concentrations are extremely low. (U.S. Department of the Navy, 2008)

4.2.7.5 Health and Safety—Open Ocean Area—Proposed Action

Flight Activities

All PMRF-controlled flight activities that occur over the open water would continue to be conducted in Warning Areas W-186 and W-188. Range Safety officials at PMRF ensure the operational safety of missiles, air operations, and other hazardous activity into PMRF-controlled areas. The range safety procedures at PMRF avoid risks to the public and operations personnel by providing some of the most rigorous safety procedures because of the extra sensors available. Before any operation is allowed to proceed, the overwater range is determined cleared using inputs from ship sensors, visual surveillance of the range from aircraft and range safety boats, radar data, and acoustic information from a comprehensive system of sensors and surveillance from shore. In addition, prior to conducting any missile testing on PMRF, the operation must obtain PMRF safety approval before proceeding, covering the type of weapon, type of target, speed, altitude, debris corridor, and surface water hazard area.

Once the area is determined cleared, operations are conducted within the boundaries of the safety areas. In addition, the Warning Areas are continually monitored during range operations to ensure that no unauthorized ships or aircraft enter the area. These safety procedures minimize potential risks to the public from fleet training exercises. As the range is determined clear prior to any operations being conducted, the only public health and safety issue is if a hazardous operation exceeds the safety area boundaries. This risk is reduced by providing termination systems on some of the missiles or by determining that the area based on the distance the system can travel for those missiles without flight termination (typical air-to-air missile) is clear. In the cases where a system does not have a flight termination, the range is determined clear based on the flight distance the vehicle can travel, plus a 5-mi area beyond the system performance parameters.

The Navy takes every reasonable precaution during the planning and execution of the operations, training exercises, and test and development activities to prevent injury to human life or property. Specific safety plans are developed to ensure that each hazardous operation is in compliance with applicable regulations and ensure the general public, range personnel, and range assets are provided an acceptable level of safety. As part of the safety analysis, range users are required to provide specific information about their program(s) so that an appropriate safety analysis can be completed prior to initiation of activities. This includes preparation of the Range Safety Approval and Range Safety Operational Plans required of all programs at PMRF.

Range Safety officials ensure operational safety for missiles and other hazardous operations into PMRF operational areas. The operational areas consist of two Warning Areas (W-186 and W-188) 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. For special operations, multi-participant, or hazardous weekend firings, PMRF publishes dedicated warning NOTMARs and NOTAMs.

In addition, all activities must be in compliance with DoD Directive 4540.1 (as enclosed by OPNAVINST 3770.4A) which specifies procedures for conducting aircraft operations and for missile/projectile firing, namely 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.”

Post Flight Activities

No recovery activities are planned, thus no adverse impacts to marine species are anticipated as a result of post flight activities.

4.2.7.6 Noise—Open Ocean Area—Proposed Action

Flight and Post Flight Activities

The proposed activities include interceptor targets launched from Wake Island, Kwajalein Atoll, or Vandenberg Air Force Base into the TOA; SM-3 launches from land-based platforms; and interceptor missile testing at higher altitude intercepts than previously analyzed. These activities could result in an increase in sound events. These increases would contribute a negligible level of increased sound; however, they would occur in the open ocean where typically no sensitive sound receptors are present.

Additional instantaneous sounds over the Open Ocean Area, such as low level sonic booms, may accompany the proposed missile launch from PMRF, as is the case for current operations. While the supersonic flight of missiles generates sonic booms, the size, design, and trajectory of interceptors limits the magnitude of the sonic boom generated. In the case of the Proposed Action, the magnitude of the sonic boom is not expected to be loud, and is not expected to impact populated areas.

4.2.7.7 Water Resources—Open Ocean Area—Proposed Action

This section addresses the potential impacts to water resources (e.g., physical and chemical properties, salinity, density, temperature, pH, dissolved gases marine pollutants) due to the Proposed Action.

Flight and Post Flight Activities

Implementation of the Proposed Action would not impact the Open Ocean Area. The activities associated with the Proposed Action would not introduce any new types of expended materials or debris in the Open Ocean Area.

4.3 FEDERAL ACTIONS TO ADDRESS ENVIRONMENTAL JUSTICE IN MINORITY POPULATIONS AND LOW-INCOME POPULATIONS (EXECUTIVE ORDER 12898)

An Environmental Justice analysis is included in this document to comply with the intent of Executive Order 12898*,* Navy, and DoD guidance. The Executive Order states that "each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations." In addition, the Executive Order requires that minority and low-income populations be given access to information and opportunities to provide input to decision-making on Federal actions. This EA/OEA and draft Finding of No Significant Impact were made available for public review and comment.

Proposed activities would be conducted in a manner that would not substantially affect human health and the environment. As discussed in the land use sections, access to some of the beaches adjacent to PMRF for fishing is allowed and some of these areas would be restricted during hazardous activities. Other areas along the coast currently open to the public would be available for use. Advance notification is provided of closure times (through a 24-hour hotline at PMRF), so minimal impacts on subsistence fishing are expected. This EA/OEA 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.

4.4 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.

5.0 Cumulative Impacts

5.0 CUMULATIVE IMPACTS

5.1 REQUIREMENT FOR CUMULATIVE IMPACT ANALYSIS

Cumulative impacts are impacts on the environment that result from "the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 Code of Federal Regulations [CFR] 1508.7). The Proposed Action, to be implemented over approximately the next 5 years, includes all of the projects associated with additional interceptor support at the Pacific Missile Range Facility (PMRF). While a single project may have individually minor impacts, when it is considered together with other projects on a regional scale, the effect may be collectively significant. A cumulative impact is the additive effect of all projects in the geographic area. Other projects in Hawaii that are likely to result in cumulative impacts over the next 0 to 3 years are provided in Table 5.1-1.

Table 5.1-1. Cumulative Projects List

Project	Related Project Location	Project Sponsor	Project Description	Projected Completion Date	Relevance to PMRF Intercept Test Support EA/OEA
Advanced Radar Detection Laboratory	Pacific Missile Range Facility	U.S. Navy	Construction of Advanced Radar Facility	2016	Additive
Rim of the Pacific (RIMPAC) Exercise	Hawaii Range Complex	U.S. Navy	RIMPAC is a biennial, sea controlled projection fleet exercise that has been conducted since 1968.	2010 and biennial thereafter	Additive
Undersea Warfare Exercise (USWEX)	Hawaii Range Complex	U.S. Navy	USWEX is an advanced Anti-Submarine Warfare Exercise proposed to be conducted by the U.S. Navy's Carrier Strike Groups and Expeditionary Strike Groups while in transit from the west coast of the United States to the western Pacific Ocean.	Ongoing	Additive
Long-range missile tests	Hawaii Range Complex Temporary Operating Area, Department of Defense Test Ranges	Missile Defense Agency	Between 2003-2007, 68 different Department of Defense target and interceptor missiles were launched from either Kodiak Launch Complex, Alaska; Vandenberg Air Force Base, California; Pacific Missile Range Facility (PMRF), Hawaii; Ronald Reagan Ballistic Missile Test Site, Marshall Islands, Wake Island, or mobile platforms in or near the Hawaii Temporary Operating Area. Approximately 628 missile launches occurred during this time period, and the majority of this missile activity was associated with the PMRF fleet training ranges. Current tempo of approximately of 125 launches per year is expected to continue into the future.	Ongoing	Additive

Source: U.S. Department of the Navy, 2008
Notes:
Additive: The project listed would or is likely to contribute substantially to cumulative effects on resources impacted by the Proposed Action.

5.2 CUMULATIVE IMPACT ANALYSIS

This section addresses the additive effects of the Proposed Action in combination with the projects identified in Table 5.1-1. Since environmental analyses for some of the projects listed are not complete or do not include quantitative data, cumulative impacts are addressed qualitatively and are described below.

5.2.1 AIR QUALITY

Activities affecting air quality in the region include, but are not limited to, mobile sources such as automobiles and aircraft, and stationary sources such as power generating stations, manufacturing operations and other industries, and volcanic eruptions. Implementation of the Proposed Action in conjunction with the cumulative actions listed in Table 5.1-1 would result in increases in air emissions within the region of influence. However, the State of Hawaii is generally in compliance with the Federal National Ambient Air Quality Standards (and the State ambient air quality standards. Federal ozone standards have not been exceeded in Hawaii during the past decade, despite the cumulative emissions from highway traffic, commercial and military aircraft operations, commercial and industrial facility operations, agriculture operations, and construction projects in both urban and rural areas. Launch events that occur in the Open Ocean Area have limited effect on air quality due to their distance offshore and regional meteorological conditions. Air permits cover all significant stationary emissions sources on PMRF/Kauai Test Facility. Missile exhaust is considered a mobile source and, thus, is exempt from permitting requirements.

Minor increases in air emissions may occur as a result of implementation of the Proposed Action. For example, operation of the proposed onsite generators using diesel fuel would cause nitrogen oxide emissions to increase by 27 tons per year. None of the emissions generated by the proposed construction and ongoing operations would exceed the *de minimis* or “conformity threshold” standards found in the Clean Air Act.

The greenhouse gas (GHG) emission from the Proposed Action does not represent “meaningful” GHG emissions. Regardless, there is a need to mitigate GHG impacts and the Proposed Action should use some amount of renewable energy (biofuel) when feasible for power generated onsite. In addition, conservation of power provided by the local utility for day-to-day operations will result in GHG emissions reductions.

The nature of the Proposed Action—small construction projects with no significant ongoing air emissions—does not warrant a lengthy discussion of climate change. However, because the project is located in a coastal zone, it could be considered vulnerable to specific effects of climate change, such as increasing sea level. There are design parameters for construction of buildings at PMRF that have been implemented for the Proposed Action because of the potential for floods due to ocean influences. Such design parameters should also be deemed appropriate for addressing potential increases in the rate of sea level rise.

5.2.2 AIRSPACE

The development of military lands prior to and after World War II had the biggest impact on airspace in the Hawaiian Islands. The expansion of military airfields continued as larger and more military aircraft were stationed in Hawaii. Following World War II, the increase in tourism resulted in an expansion of civilian airfields and airports. As with the military, the civilian aircraft increased in numbers and size requiring expansion of the existing airports. This historic development resulted in close monitoring of airspace as the land area is small in Hawaii with limited airspace (U.S. Department of the Army, 2004).

Implementation of the Proposed Action in conjunction with the cumulative actions listed in Table 5.1-1 would not incrementally affect airspace within the region of influence because no new special use airspace proposal, or any modification to the existing Special Use Airspace, is contemplated to accommodate the Proposed Action. No impacts to the surrounding low-altitude airways and/or high-altitude jet routes are identified. No impacts to the region of influence airways and jet routes are identified because of the required coordination with the Federal Aviation Administration (FAA).

Under the Proposed Action, a limited number of small, lightweight fragments resulting from some missile intercepts could potentially drift beyond current PMRF-controlled areas. Intercepts at higher altitudes would not necessarily generate more debris fragments, but the greater altitude would cause the small, lightweight fragments to be widely dispersed over a larger area, including land areas. The pattern of the fragments could result in effects to all or parts of the airspace over Kauai, Niihau, Northwestern Hawaiian Islands, over the open ocean between individual islands, or over part of the channel between Kauai and Oahu depending on the actual test parameters.

PMRF would notify the FAA that a test is being planned that could temporarily affect airspace. The FAA would review the request and advise regarding windows of opportunity for the testing in order to minimize or avoid effects. These windows would determine whether the test could be performed, since a minimum of 2 hours (includes launch, intercept, and fragment settlement) of time would be required for a test. PMRF would then request altitude reservations from the FAA, which, if approved, would issue Notices to Airmen covering this additional temporary airspace. Each individual test is coordinated with FAA prior to altitude reservation request. If Medevac or other emergency flights are requested prior to a missile launch, the launch would be delayed until the medical emergency flight is over.

The proposed intercepts would be conducted clear of established oceanic air routes or areas of known surface or air activity and in compliance with Department of Defense Directive 4540.1, Army Regulation 95-10, Army Regulation 385-62 (U.S. Department of the Army, 1988). Aircraft would still be notified by the issuance of Notices to Airmen to advise avoidance of the tracking radar area during program activities. The required range safety approval and range safety operational plans would obviate the potential for additive, incremental, cumulative impacts. Consultation with the FAA on all matters affecting airspace would eliminate the possibility of indirect adverse impacts; therefore, no cumulative impacts are expected from the implementation of the Proposed Action.

5.2.3 BIOLOGICAL RESOURCES

There should be no significant cumulative impacts to biological resources including marine mammals, sea turtles, or fish as a result of the Proposed Action in conjunction with the actions listed in Table 5.1-1. Any construction project or testing event would be required to be in compliance with the established Integrated Natural Resources Management Plan and applicable U.S. Fish and Wildlife Service Biological Opinions. In addition, any project proposed within the region affecting threatened or endangered species would have included Endangered Species Act Section 7 consultation addressing direct, indirect, and cumulative impacts. 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 on light-sensitive wildlife, such as the Newell's shearwater and other nocturnal birds in compliance with current base-wide consultation.

5.2.4 CULTURAL RESOURCES

Implementation of the Proposed Action in conjunction with other past, present, and reasonably foreseeable future actions will not result in significant cumulative impacts on cultural resources. There are no archaeological or Native Hawaiian sites identified within the specific region of influence for any of the optional program locations, and there are no historic buildings or structures that would be affected by the proposed activities.

Potential effects associated with the actions proposed in this EA/OEA are associated with unanticipated discovery and/or disturbance of subsurface materials (including burials), and restriction of access to the launch areas during program activities. Given the cultural resources sensitivity within the region of influence, unanticipated discoveries could occur at any of the optional construction locations.

Based on survey and testing, the highest potential for the inadvertent discovery of subsurface remains is in the Exoatmospheric Discrimination Experiment (EDX) area, where cultural resources maps indicate high to medium sensitivity in areas adjacent to the location selected for construction of a concrete launch pad and associated infrastructure. In accordance with Section 106 of the National Historic Preservation Act (36 CFR 800), as implemented through the PMRF Integrated Cultural Resources Management Plan and as described in the various sections of Chapter 4.0, mitigation measures to offset any potential adverse effects would be undertaken at all of the optional construction locations. The mitigation measures would include archaeological monitoring during construction and/or implementation of any other specific requirements already outlined in various agency planning documents. Construction would be undertaken in close coordination with the PMRF Environmental Engineer and additional mitigation measures developed as circumstances dictate.

As proposed, the number of total launches conducted in any given year would not increase and may actually decrease as other programs wind down. As a result, a decrease in Native Hawaiian access for cultural exchange and educational purposes, particularly the EDX area, is not anticipated.

Given the rigorous review process required under Section 106 prior to PMRF activities taking place and the measures already in place within agency planning documents to mitigate potential effects, implementation of the Proposed Action would not result in significant cumulative effects.

5.2.5 GEOLOGY AND SOILS

Implementation of the Proposed Action in conjunction with the cumulative actions listed in Table 5.1-1 would not result in significant impacts on geology and soils within the region of influence. The impacts on geology are very minor and mostly consist of localized soil disturbance in previously disturbed areas on the islands. Erosion is a naturally recurring issue, but it is not heavily exacerbated by military activities. While construction type projects in the region may have localized erosion, overall cumulative effects would be negligible since Best Management Practices for soil disturbing activities are typically implemented during any construction activity.

5.2.6 HAZARDOUS MATERIALS AND WASTE

Implementation of the Proposed Action in conjunction with the cumulative actions listed in Table 5.1-1 would not result in cumulative impacts associated with the use of hazardous materials within the region of influence. There are a large number of hazardous materials inherent in activities within the Proposed Action. There are no hazardous waste disposal sites located on any of the Hawaiian Islands. Hazardous waste is barged to disposal facilities. There are no capacity issues in regard to hazardous waste because it is only sent to a facility that will accept the waste.

The primary impact of cumulative hazardous materials use in the region would be to increase the amounts of hazardous constituents that are potentially released to the environment. The Department of Defense has dictated that all its facilities develop and implement Hazardous Waste Management Plans and Spill Prevention, Control and Countermeasure Plans to protect habitats and people from harmful releases. The use of hazardous materials by the Navy when added to that of other projects, would not significantly impact resources in the region.

The primary impact of the uncontrolled release of hazardous materials would be to contribute contaminants to surface soils and to surface runoff into the ocean. Such releases have historically been prevented through the implementation of Best Management Practices and the Spill Prevention Control and Countermeasures plans and programs. Construction projects and maintenance activities beyond those included as part of the Proposed Action could also contribute minor amounts of hazardous contaminants to surface soils. The contributions of these other projects would be very minor, however, in comparison to the effects of the testing activities. Thus, the cumulative impacts would be substantially the same as the impacts described under each location in Chapter 4.0.

5.2.7 HEALTH AND SAFETY

Implementation of the Proposed Action in conjunction with the cumulative actions listed in Table 5.1-1 would not affect public health and safety within the region of influence. The major factors influencing this analysis are: (1) the distance of hazardous operations from the islands; (2) the dispersed context of the hazardous operations, such that the intensity of the effects is not additive; (3) comprehensive Navy safety procedures in place to ensure that members of the general public are not placed in physical jeopardy due to testing; and (4) specific range clearance procedures and practices implemented daily prior to commencement of hazardous operations. The small, lightweight fragments resulting from some missile intercepts are not harmful to people on the ground. Based on these factors, no significant cumulative impacts would occur relative to public health and safety.

5.2.8 LAND USE

Implementation of the Proposed Action in conjunction with the cumulative actions listed in Table 5.1-1 would not affect land use within the region of influence because no adverse land use impacts were identified in Chapter 4.0, and most testing activities would occur on existing military installations and ranges with no change in use or land use designation. Testing activities that restrict the use of land areas would adhere to established safety measures. These safety measures would ensured by restricting access to the land within a designated ground hazard area, prior to, during, and shortly after a launch.

All proposed land uses would be compatible with State of Hawaii planning efforts. PMRF would continue to maintain a strip of coastline for public recreational purposes (except when closed for hazardous operations). Overall, recreational resources would continue to be protected and shoreline access would continue to be unimpeded.

5.2.9 NOISE

Implementation of the Proposed Action in conjunction with the cumulative actions listed in Table 5.1-1 would not incrementally affect noise within the region of influence. Noise levels are inherently localized because sound levels decrease relatively quickly with increasing distance from the source. Cumulative impacts would occur when multiple projects affect the same geographic areas simultaneously or when sequential projects extend the duration of noise impacts on a given area over a longer period of time. The noise environment in the Hawaiian Islands has changed over the years with the increase in human activity. The increased level of testing proposed would increase noise levels; however, noise levels from testing would be intermittent and similar to other noise levels already experienced in the region of influence. In addition, spatial separation among the cumulative projects listed in Table 5.1-1 would minimize or preclude cumulative noise impacts within the region of influence.

5.2.10 SOCIOECONOMICS

Implementation of the Proposed Action in conjunction with the cumulative actions listed in Table 5.1-1 would not produce any significant regional employment, income, housing, or infrastructure impacts. Effects on commercial and recreational fishermen, commercial tour boats, divers, and boaters would be short term in nature and produce some temporary access limitations. Most offshore events are of short duration and have a small operational footprint. Effects on fishermen and commercial tour boat operators are mitigated by public notification of scheduled activities. In selected instances where safety requires exclusive use of a specific area, commercial fishing vessels, commercial vessels, or private vessels may be asked to relocate to a safer nearby area for the duration of the exercise. These measures should not significantly impact any individual fisherman, overall commercial revenue, or public recreational opportunity in the Open Ocean Area. Implementation of the Proposed Action would not affect minority or low-income populations disproportionately, nor would children be exposed to increased noise levels or safety risks because events mainly occur at sea.

5.2.11 TRANSPORTATION

Implementation of the Proposed Action in conjunction with the cumulative actions listed in Table 5.1-1 would not represent a significant increase in average daily traffic on existing island roadways or vessel traffic in the Open Ocean Area.

5.2.12 UTILITIES

Implementation of the Proposed Action in conjunction with the identified cumulative actions listed in Table 5.1-1 would represent minor increases in demand for energy that cannot be met with renewable energy sources at this time.

5.2.13 WATER RESOURCES

Implementation of the Proposed Action in conjunction with the identified cumulative actions listed in Table 5.1-1 would not result in significant impacts on water quality within the region of influence. Water quality impacts associated with implementation of the Proposed Action would not reach a level of significance even in conjunction with other actions considered in an installation context.

THIS PAGE INTENTIONALLY LEFT BLANK

6.0 References

6.0 REFERENCES

ACTA, Inc., 2009. Comments received from ACTA, Inc. on the Preliminary Draft Pacific Missile Range Facility Intercept Test Support Environmental Assessment/Overseas Environmental Assessment regarding health and safety resources, November.

Aguirre, A.A., and P.L. Lutz, 2004. "Marine turtles as sentinels of ecosystem health: Is fibropapillomatosis an indicator?" *EcoHealth,* 1:275–283.

Air Force Center for Environmental Excellence Environmental Services Office, 2003. *U.S. Air Force 15th Airlift Wing Installation Restoration Program Final Decision to Support No Further Response Action Planned for AOC EA02 (Radar Shaft) Kokee Air Force Station Kauai, Hawaii,* 13 July.

Aki, K., R. Brock, J. Miller, J.R. Mobley, P.J. Rappa, D. Tarnas, M. Yuen, and K. Des Rochers, 1994. A site characterization study for the Hawaiian Islands Humpback Whale National Marine Sanctuary, HAWAU-T-94-001, University of Hawaii Sea Grant Program, 119 pp.

American Recovery and Reinvestment Act, 2009 [Online]. Available http://www.defenselink.mil/recovery/plans_reports/2009/march/ARRA_DoD_Expenditure_Plans.pdf Amoser, S. and F. Ladich, 2005. "Are hearing sensitivities of freshwater fish adapted to the ambient noise in their habitats?" Journal of Experimental Biology, 208: 3533-3542.

Aquaculture in Hawaii, 2006. "Aquaculture in Hawai`i," [Online]. Available: http://www.oceanicinstitute.org/_oldsite/aboutus/aquahawaiian.html.

Audubon, 2006. "The 2002 Audubon WatchList" [Online]. Available: http://audubon2.org/webapp/watchlist/viewWatchlist.jsp [15 June].

Aviation Supplies and Academics, Inc., 1996. *Federal Aviation Regulations and Aeronautical Information Manual*, Newcastle, WA.

Baird, R.W., G.S. Schorr, D.L. Webster, S.D. Mahaffy, A.B. Douglas, A.M. Gorgone, and D.J. McSweeney, 2006. "A Survey for Odontocete Cetaceans off Kaua`i and Ni`ihau, Hawai'i, During October and November 2005: Evidence for Population Structure and Site Fidelity," Report to Pacific Islands Fisheries Science Center, NOAA Fisheries [Online]. Available: http://www.cascadiaresearch.org/robin/Bairdetal2006odontocetesurvey.pdf.

Baker, J.D., and T.C. Johanos, 2004. "Abundance of the Hawaiian monk seal in the main Hawaiian Islands," *Biological Conservation,* 116:103-110.

Balazs, G.H., 1995. "Status of sea turtles in the central Pacific Ocean," pp. 243-252. In: K.A. Bjorndal, ed. *Biology and Conservation of Sea Turtles*. Rev. ed. Washington, D.C.: Smithsonian Institution Press.

Balazs, G.H., and M. Chaloupka, 2004. "Thirty-year recovery trend in the once depleted Hawaiian green sea turtle stock," *Biological Conservation,* 117:491–498.

Barlow, J., 2003. "Cetacean abundance in Hawaiian waters during summer/fall of 2002," *Southwest Fisheries Science Center Administrative Report LJ-03-13*, La Jolla, California: National Marine Fisheries Service.

Barlow J., 2006. "Cetacean abundance in Hawaiian waters estimated from a summer/fall survey of 2002," *Marine Mammal Science, 22:446-464*.

Belt Collins Hawaii, 1994. *Assessment of Lead (Pb) and Water Quality in the Nearshore Marine Environments Off the Pacific Missile Range Facility Kauai, Hawaii*, 23 July.

Bjørge, A., 2002. "How persistent are marine mammal habitats in an ocean of variability?" pp. 63-91 in P.G.H. Evans and J.A. Raga, eds. *Marine mammals: Biology and conservation,* New York: Kluwer Academic/Plenum Publishers.

Bjorndal, K., 1997. "Foraging ecology and nutrition of sea turtles," pp. 199-231 in P.L. Lutz and J.A. Musick, eds. *The biology of sea turtles,* Boca Raton, Florida: CRC Press.

Bjorndal, K.A., A.B. Bolten, and H.R. Martins, 2000. "Somatic growth model of juvenile loggerhead sea turtles *Caretta caretta*: Duration of pelagic stage," *Marine Ecology Progress Series,* 202:265-272.

Brownell, Jr., R.L., P.J. Clapham, T. Miyashita, and T. Kasuya, 2001. "Conservation status of North Pacific right whales," *Journal of Cetacean Research and Management, Special Issue*, 2:269-286.

Bowen, W.D., C.A. Beck, and D.A. Austin, 2002. "Pinniped ecology," pp. 911-921 in W.F. Perrin, B. Würsig, and J.G.M. Thewissen, eds. *Encyclopedia of marine mammals*, San Diego: Academic Press.

Bran, 2009. Personal communication (email) between Nando Bran, Pacific Missile Range Facility and Edd Joy, KAYA Associates, regarding shipment of explosives to the Pacific Missile Range Facility, 2 December.

Burger, J., 2006. Comments received from John Burger, Pacific Missile Range Facility, regarding hazardous materials and waste at Pacific Missile Range Facility.

Burger, J., 2007a. Comments received from John Burger, Pacific Missile Range Facility, regarding albatross egg relocation practices at Pacific Missile Range Facility, January.

Burger, J., 2007b. Information received from John Burger, Pacific Missile Range Facility, regarding green sea turtles on Pacific Missile Range Facility, 24 January.

Burger, J., 2007c. Personal communication via email: Information received from John Burger, Pacific Missile Range Facility, regarding invasive species protocols, 30 January.

Burger, J., 2007d. Information received from John Burger, Pacific Missile Range Facility, regarding the number of Laysan albatross eggs placed with surrogate parents during the 2007 season, 19 December.

Burger, J., 2009a. Comments received from John Burger, PMRF GDIT/RCSS, regarding affected environment on Pacific Missile Range Facility, 9 October.

Burger, J., 2009b. Personal communication (email) between John Burger, PMRF GDIT/RCSS and Rebecca Hommon, CNRH, regarding Native Hawaiian consultation with Debra Ruiz and Kunane Aipoalani, Kauai Burial Council, for activities associated with the PMRF Intercept Test Support EA/OEA, 1 December.

Burger, J., 2010a. Personal communication (email) between John Burger, PMRF GDIT/RCSS and Karen Barnes, KAYA Associates, regarding Water Resources on PMRF in order to update the overall Affected Environment for this resource at PMRF, 11 January.

Burger, J., 2010b. Comments received from John Burger, GDIT/RCSS, on the Coordinating Draft Pacific Missile Range Facility Intercept Test Support Environmental Assessment regarding information on biological species including barn owls and wedge-tailed shearwaters, 12 February.

Burger, J. and T. Nizo, 2007. Personal communication via email between John Burger, CIV PMRF, and Thomas Nizo, CIV NAVFAC HI, 30 January.

Cairns, S.D., 1994. "Scleractinia of the temperate North Pacific," *Smithsonian Contributions to Zoology,* 557:1-150.

Calambokidis, J., G.H. Steiger, J.M. Straley, T.J. Quinn II, L.M. Herman, S. Cerchio, D.R. Salden, M. Yamaguchi, F. Sato, J. Urban R., J.K. Jacobsen, O. Von Ziegesar, K.C. Balcomb, C.M. Gabrielle, M.E. Dahlheim, N. Higahsi, S. Uchida, J.K.B. Ford, Y. Miyamura, P.L. de Guevara P., S.A. Mizroch, L. Schlender, and K. Rasmussen, 1997. "Final Report - Abundance and population structure of humpback whales in the North Pacific basin," Unpublished contract report to the National Marine Fisheries Service, La Jolla, California.

Calambokidis, J., G.H. Steiger, J.M. Straley, L.M. Herman, S. Cerchio, D.R. Salden,., R.J. Urbán, J.K. Jacobson, O, vonZiegesar, K.C. Balcomb, C.M. Gabrielle, M.E. Dahlheim, S. Uchida, G. Ellis, Y. Miyamura, P., Ladrón de Guevara, M. Yamaguchi, F. Sato, S.A. Mizroch, L. Schlender, K. Rasmussen, J. Barlow, J. and T.J. Quinn II, 2001. "Movements and population structure of humpback whales in the North Pacific," *Marine Mammal Science,* 17 (4):769-794.

Caribbean Conservation Corporation and Sea Turtle Survival League, 2003. "Flatback Sea Turtle Information & Map," [On-line]. Available: http://www.cccturtle.org/flatback.htm

Carr, A., 1987. "New perspectives on the pelagic stage of sea turtle development," *Conservation Biology,* 1:103-121.

Carr, A., 1995. “Notes on the behavioral ecology of sea turtles,” pp. 19-26 in K.A. Bjorndal, ed. *Biology and conservation of sea turtles*, Rev. ed. Washington, D.C.: Smithsonian Institution Press.

Carretta, J.V., K.A. Forney, M.M. Muto, J. Barlow, J. Baker, B. Hanson, and M. Lowry, 2005. “U.S. Pacific marine mammal stock assessments: 2004,” NOAA Technical Memorandum NMFS-SWFSC-375:1-31 6.

Carretta, J.V., K.A. Forney, M.M. Muto, J. Barlow, J. Baker, B. Hanson, and M.S. Lowry, 2006. U.S. Pacific Marine Mammal Stock Assessments: 2005. U.S. Department of Commerce, NOAA-TM-NMFS-SWFSC–388.

Casper, B.M., P.S. Lobel, and H.Y. Yan, 2003. The hearing sensitivity of the little skate, *Raja erinacea*: A comparison of two methods. Environmental Biology of Fishes 68: 371-379.

Center for Biological Diversity, 2010. Before the Secretary of Commerce Petition to List 83 Coral Species under the Endangered Species Act [Online]. Available: http://www.biologicaldiversity.org/species/invertebrates/staghorn_coral/pdfs/Coral%20petition_10-20-09.pdf.

Center for Coastal Monitoring and Assessment, 2006. Benthic Habitats of the Main Hawaiian Islands – 2003, last updated on August 29, 2006, [Online]. Available: http://ccma.nos.noaa.gov/products/biogeography/benthic/htm/uchan.htm.

Center for Plant Conservation, 2006. “Center for Plant Conservation – National Collection of Endangered Plants,” [Online]. Available: http://www.centerforplantconservation.org/ASP/CPC_ViewProfile.asp?CPCNum=4421 [2 August 2006].

Chaloupka, M.Y., and J.A. Musick, 1997. “Age, growth, and population dynamics,” pp. 233-276 in P.L. Lutz and J.A. Musick, eds. *The biology of sea turtles,* Boca Raton, Florida: CRC Press.

Chaloupka, M., T.M. Work, G.H. Balazs, S.K.K. Murakawa, and R. Morris, 2008. Cause-specific temporal and spatial trends in green sea turtle strandings in the Hawaiian Archipelago (1982-2003). *Marine Biology* 154(5): 887-898, [Online]. Available: http://64.130.1.197/resources/documents/MSR_289Seaturtles.pdf.

Chamber of Commerce of Hawaii, Military Affairs Council, 2006 “Hawaii-Based Armed Forces Benefit All of US,” (Brochure) January 2006 [Online]. Available: http://www.hawaii.gov/dbedt/info/economic/data_reports/federal/

Chamber of Commerce of Hawaii, Military Affairs Council, 2007. “Profile of Hawaii-Based Armed Forces,” (Brochure) January 2007, [Online]. Available: http://www.hawaii.gov/dbedt/info/economic/data_reports/federal/DBEDT_Armed_Forces_2007-01.pdf.

Chamber of Commerce of Hawaii, Military Affairs Council, 2008. Advantages to Hawaii – Hawaii-Based Armed Forces Benefit All of Us, January.

Chamber of Commerce of Hawaii, Military Affairs Council, 2009. "Hawaii-Based Armed Forces Benefit All of Us", (Brochure) January 2009, [Online]. Available: http://cochawaii.com/_library/documents/new-pdfs/milbrochure2009final.pdf.

Chave, E.H., and A. Malahoff, 1998. "In deeper waters: Photographic studies of Hawaiian deepsea habitats and life-forms," Honolulu: University of Hawai`i Press.

Clapham, P.J. and J.G. Mead, 1999. "*Megaptera novaeangliae," Mammalian Species,* 604:1-9.

Clapham, P.J., C. Good, S.E. Quinn, R.R. Reeves, J.E. Scarff, and R.L. Brownell, 2004. "Distribution of North Pacific right whales (*Eubalaena japonica*) as shown by 19th and 20th century whaling catch and sighting records," *Journal of Cetacean Research and Management, 6:1-6.*

Clements, T., 2010. Information received on boat traffic via email from Tom Clements, Public Affairs, Pacific Missile Range Facility, 17 March.

Clifton, K., D.O. Cornejo, and R.S. Felger, 1995. "Sea turtles of the Pacific coast of Mexico," pp. 199-209. In: K.A. Bjorndal, ed. *Biology and conservation of sea turtles, revised edition.* Washington, D.C.: Smithsonian Institution Press.

Coles, W.C, and J.A. Musick, 2000. "Satellite sea surface temperature analysis and correlation with sea turtle distribution off North Carolina," *Copeia,* 2:551-554.

Commander, Navy Region Hawaii, 2007. *Survey of Marine and Fishery Resources for An Integrated Natural Resources Management Plan (INRMP) for the Pacific Missile Range Facility (PMRF) Barking Sands (BS),* Kauai, Hawaii – Phase II-2006, October: Revised June 2007.

Commerce Business Daily, 2000. *"Utility Systems: conveyance Authority"* [Online], Available: http://frwebgate1.access.gpo.gov/cgi-bin/waisgate.cgi?WAISdocID=357466283058+12+0+0&WAISaction=retrieve [15 September 2006].

Compagno, L.J.V. and J.A. Musick, 2000. *Pseudocharcharias kamoharai*. In 2004 IUCN red list of threatened species, [Online]. Available: http://www.redlist.org.

Coral Reef Information System, 2003. "Deep water corals," [Online]. Available: http://www.coris.noaa.gov/about/deep/deep.html [21 January 2004].

Coral Reef Information System, 2007. Northwestern Hawaiian Islands – Cultural History of the NWHI, Early Settlers; Geography and History; and Archaeology [Online]. Available: http://www.coris.noaa.gov/about/eco_essays/nwhi/history.html. [23 January]

Corkeron, P.J. and R.C. Connor, 1999. "Why do baleen whales migrate?" *Marine Mammal Science,* 15:1228-1245.

County of Kaua`i, Department of Water, 2006. "*Water Quality Report – Covering the period of January 1, 2006 to December 31, 2006*, Kauai Department of Water, Kekaha-Waimea Water System, 2007.

Cowan, J., 1994. *Handbook of Environmental Acoustics*. Van Nostrand Reinhold: New York.

Currents, 2007. "Navy Offers Sanctuary to Migratory Birds," [Online]. Available: http://www.p2pays.org/ref/41/40529.pdf.

Darling, J. D., and S. Cerchio, 1993. "Movement of a humpback whale (*Megaptera novaeangliae*) between Japan and Hawaii," *Marine Mammal Science,* 1:84-89.

Davenport, J., 1997. "Temperature and the life-history strategies of sea turtles," *Journal of Thermal Biology,* 22:479-488.

Day, R.H., B. Cooper, and T.C. Telfer, 2003. Decline of Townsend's (Newell's Shearwaters) (*Puffinus auricularis newelli*) on Kauai, Hawaii. Auk 120: 669-679.

Department of Energy, 1991. *Kauai Test Facility (KTF) Environmental Assessment*, Sandia National Laboratories, March.

Department of Business, Economic Development and Tourism, 2001. "Federal Activity and Hawaii's New Economy", July 200, [Online]. Available: http://hawaii.gov/dbedt/info/economic/data_reports/e-reports/fr07-01r.pdf.

Division of Economics, U.S. Fish and Wildlife Service, 2002. "*Draft Economic Analysis Of Proposed Critical Habitat Designations For Threatened And Endangered Plants On Kaua`i And Ni`ihau Hawai`i Revised Determination,"* Draft, April.

Dodd, C.K., 1988. "Synopsis of the biological data on the loggerhead sea turtle *Caretta caretta* (Linnaeus 1758)," *U.S. Fish and Wildlife Service Biological Report,* 88:1-110.

Drolet, R., A.K. Yoklavich, and J. Landrum, 1996. *Cultural Resources Management Overview Survey Pacific Missile Range Facility, Hawaiian Area Kaua`i, Hawai`i in Conjunction with Department of Defense Legacy Resource Management Program Project No. 70.* Prepared for the Department of the Navy, Naval Facilities Engineering Command. Ogden Environmental and Energy Services Co., Inc., Honolulu.

Eckert, K.L., 1987. "Environmental unpredictability and leatherback sea turtle (*Demochelys coriacea*) nest loss," *Herpetologica,* 43:315-323.

Eckert, K.L., 1993. "The biology and population status of marine turtles in the North Pacific Ocean," NOAA Technical Memorandum NMFS-SWFSC-186:1-156.

Eckert, K.L., 1995. "Anthropogenic threats to sea turtles," pp. 611-612 in K.A. Bjorndal, ed. *Biology and conservation of sea turtles*, Washington, D.C.: Smithsonian Institution Press.

Eckert, K.L., and C. Luginbuhl, 1988. "Death of a giant," *Marine Turtle Newsletter,* 43:2-3.

Economagic.com, 2009. "Series Title: Unemployment Rate: Kauai County, HI, Hawaii; Percent; NSA", [Online]. Available: http://www.economagic.com/em-cgi/data.exe/blsla/laucn15007003

Economic Development Intelligence System, 2009. "Kauai County (HI) - August 2009", [Online]: Available: https://edis.commerce.state.nc.us/docs/countyProfile/HI/15007.pdf.

EDAW, 2005. Electromagnetic Railgun Environmental Assessment Meeting Minutes, PMRF Alternative, May.

Ehrhart, L.M., 1995. "A review of sea turtle reproduction," pp. 29-38 in K.A. Bjorndal, ed. *Biology and conservation of sea turtles, Rev. ed*. Washington, D.C.: Smithsonian Institution Press.

Emory, K.P., 1928. *Archaeology of Nihoa and Necker Islands.* Bernice Pl Bishop Museum, Bulletin 53. Tanager Expedition, Publication Number 5. Honolulu, Hawai`i.

Epperly, S.P., J. Braun, A.J. Chester, F.A. Cross, J.V. Merriner, and P.A. Tester, 1995. "Winter distribution of sea turtles in the vicinity of Cape Hatteras and their interactions with the summer flounder trawl fishery," *Bulletin of Marine Science,* 56:547-568.

Ernst, C.H., R.W. Barbour, and J.E. Lovich, 1994*. Turtles of the United States and Canada,* Washington, D.C.: Smithsonian Institution Press.

Fay, R.R., 1988. *Hearing in vertebrates: a psychophysics data book*. Hill-Fay Associates, Winnetka, Illinois.

Fay, R.R., 2005. "Sound source localization by fishes," pp 36-66. In: *Sound Source Localization*, eds. A.N. Popper and R.R. Fay. New York: Springer Science + Business Media, LLC.

Fay, R.R., Megela-Simmons A. 1999. "The sense of hearing in fishes and amphibians," pp. 269-318. In: *Comparative Hearing: Fish and Amphibians*, eds. R.R. Fay and A.N. Popper. New York: Springer-Verlag.

Federal Aviation Administration, no date. Appendix A, National Airspace System Overview [Online]. Available: http://www.faa.gov/air_traffic/nas_redesign/regional_guidance/eastern_reg/nynjphl_redesign/documentation/feis/appendix/media/Appendix_A-National_Airspace_System_Overview.pdf.

Federal Aviation Administration, 1996. "Environmental Assessment of the Kodiak Launch Complex, Kodiak Island, Alaska," June.

Federal Aviation Administration, 2006. *Hawaiian Islands Sectional Aeronautical Chart*, Scale 1:500,000.

Fergusson, I., L.A. Compagno, and M. Marks, 2000. *Carcharodon carcharias*. In 2004 IUCN red list of threatened species [Online]. Available: http://www.redlist.org.

Flores, K.E., and A.G. Kaohi, 1993. *Hawaiian cultural and historical survey of Nohili and Mānā areas, Kona District, Island of Kaua`i, State of Hawai`i.* Unpublished MS on file with USASDC, Environmental Office, Huntsville, Alabama and Hawai`i State Historic Preservation Officer, Honolulu, Hawai`i.

Forcada, J., 2002. "Distribution," pp. 327-333 in W.F. Perrin, B. Würsig, and J.G.M. Thewissen, eds. *Encyclopedia of marine mammals*. San Diego: Academic Press.

Fornander, A., 1917. *The Hawaiian Account of the Formation of their Islands and Origin of their Race with the Traditions of their Migrations, etc., as gathered from original sources.* Fornander Collection of Hawaiian Antiquities and Folklore, Memoirs of the Bernice Pl Bishop Museum, Volume 4, Part 2, Bishop Museum Press, Honolulu.

Frazer, N.B., 1986. "Survival from egg to adulthood in a declining population of loggerhead turtles, *Caretta caretta," Herpetologica,* 42:47-55.

Frazier, J.G., 2001. "General natural history of marine turtles," in K.L. Eckert and F.A. Abreu-Grobois, eds. Proceedings of the regional meeting: *Marine turtle conservation in the wider Caribbean region: a dialogue for effective regional management,* Santo Domingo, Dominican Republic: WIDECAST, IUCN-MTSG, WWF, and UNEP-CEP, pp. 3-17.

Freiwald, A., J.H. Fossa, A. Grehan, T. Koslow, and J.M. Roberts, 2004. *Cold-water coral reefs,* Cambridge, U.K.: UNEP-WCMC, 84 pp.

Friedlander, A., R. Aeby, R. Brainard, E. Brown, A. Clark, S. Coles, E. Demartini, S. Dollar, S. Goodwin, C. Hunter, P. Jokiel, J. Kenyon, R. Kosaki, J. Maragos, P. Vroom, B. Walsh, I. Williams, and W. Wiltse, 2004. "Status of the coral reefs in the Hawaiian Archipelago, In C. Wilkinson, ed. *Status of coral reefs of the world. Volume 2,* Townsville, Queensland: Australian Institute of Marine Science, pp. 411-430.

Gass, S.E., 2003. *Conservation of deep-sea corals in Atlantic Canada,* World Wildlife Fund-Canada (WWF-Canada).

Gilmartin, M., and N. Revelante, 1974. "The 'island mass' effect on the phytoplankton and primary production of the Hawaiian Islands," *Journal of Experimental Marine Biology and Ecology,* 16:181-204.

Globalsecurity.org, 2008a. Aegis Ballistic Missile Defense (Aegis BMD) [Online]. Available: http://www.globalsecurity.org/military/systems/ship/systems/aegis-bmd.htm.

Globalsecurity.org, 2008b. AN/SPY-1 Radar [Online]. Available: http://www.globalsecurity.org/military/systems/ship/systems/an-spy-1.htm

Golden, J., R.P. Ouellette, S. Saari, P. Cheremisinoff, 1980. *Environmental Impact Data Book*, Ann Arbor Science Publishers, Inc., Ann Arbor, MI.

Goldman, K.J. and B. Human, 2000. "*Lamna ditropis,"* In 2004 *IUCN red list of threatened species* [Online]. Available: http://www.redlist.org

Goldman, K.J. and members of the Shark Specialist Group (as cited on the IUCN website), 2001. "*Alopias vulpinus"*. In 2004 *IUCN red list of threatened species* [Online]. Available: http://www.redlist.org

Gonzalez, Tirzo and Paige Peyton, 1999. *Final Cultural Resources Survey Report in Support of the Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement*. Proposed Facility Siting Areas, Island of Ni'ihau and Kamokala Caves Ordnance Magazine Area. Prepared for EDAW, Inc. Huntsville, Alabama. Earth Tech, Inc.

Grigg, R.W., 1988. "Paleoceanography of coral reefs in the Hawaiian-Emperor chain," *Science, 240:1737*-1743.

Grigg, Richard W., 1993. "Precious Coral Fisheries of Hawaii and the U.S. Pacific Islands. (Fisheries of Hawaii and U.S.-Associated Pacific Islands)," *Marine Fisheries Review* Date: 3/22/1993 [Online]. Available: http://www.encyclopedia.com/doc/1G1-15462284.html.

Grigg, R.W., 1997a. "Hawaii's coral reefs: Status and health in 1997, The International Year of the Reef," pp. 61-72 in R.W. Grigg and C. Birkeland, eds. *Status of coral reefs in the Pacific*. Sea Grant College Program, School of Ocean and Earth Science and Technology, University of Hawaii.

Grigg, R.W., 1997b. "Paleoceanography of coral reefs in the Hawaiian-Emperor chain – Revisited," pp. 117-121 in Proceedings of the Eighth Helfman, G.S., B.B. Collette, and D.E. Facey. 1999. *The diversity of fishes. 4th ed*. Malden, Massachusetts: Blackwell Science.

Han, T., S. Collins, S. Clark, and A. Garland, 1986. *Moe Kau A Ho`Oilo: Hawaiian Mortuary Practices at Keopu, Kona, Hawai`i.* Department of Anthropology, Department Report Series: Report 86-1, Bishop Museum Press, Honolulu.

Hawaii Coral Reef Assessment and Monitoring Program, 2006. "Coral Reef Assessment and Monitoring Program Long Term Monitoring Study Sites: Kauai," [Online]. Available: http://cramp.hawaii.edu/LT_Monitoring_files/lt_study_sites_Kauai.htm [28 August].

Hawaii Department of Aquaculture, 2004. "Hawaii Aquaculture Continues Upward Climb", released 12 October 2004, [Online}. Available: http://www.kauaihawaii-realestate.com/

Hawaii Department of Business, Economic Development & Tourism, 2008. Hawaii Greenhouse Gas Inventory: 1990 and 2007, December Available: http://hawaii.gov/dbedt/info/energy/greenhouse/HI%20GHG%20Inventory%20Revised,%201990%20and%202007,%2012-31-08.pdf.

Hawaii Department of Health, 2003. Covered Source Permit Review CSP No. 0110-01-C (USN PMR-Barking Sands) Application for Renewal No. 0110-03, June.

Hawaii Department of Health, 2008. Noncovered Source Permit No. 0523-01-N, US Army, THAAD, April.

Hawaii Department of Land and Natural Resources, 2005. "Seabirds 'Akē'akē or Band-rumped Storm-Petrel *Oceanodroma castro*" [Online]. Available: http://www.state.hi.us/dlnr/dofaw/cwcs/files/NAAT%20final%20CWCS/Chapters/Terrestrial%20Fact%20Sheets/Seabirds/band-rumped%20storm%20petrel%20NAAT%20final%20!.pdf [accessed November 2009].

Hawaii Department of Land and Natural Resources, 2006. "Alulu, Olulu *Brighamia insignis,"* [Online]. Available: http://www.state.hi.us/dlnr/dofaw/cwcs/files/Flora%20fact%20sheets/ Bri_ins%20plant%20NTBG_OK.pdf.

Hawaii Department of Land and Natural Resources, no date [a]. *Forest Bird and Related Projects*, "Newell's Shearwater Project," [Online]. Available: http://www.dofaw.net/fbrp/projects.php?id=00064 [29 August].

Hawaii Department of Land and Natural Resources, no date [b]. "The Northwestern Hawaiian Islands," [Online]. Available: http://www.hawaii.gov/dlnr/exhibits/nwhi/NWHI_1.htm

Hawaii Department of Land and Natural Resources, no date [c]. "Lo`ulu *Pritchardia aylmer-robinsonii*" [Online]. Available: http://www.state.hi.us/dlnr/dofaw/cwcs/files /Flora%20fact%20sheets/Pri_ayl%20plant%20NTBG_W.pdf.

Hawaii Department of Transportation, 2005. "Highway Division – Station Description: Waialo Rd. ID NO: 130054100101 – 10/19/2005-Kauai-DIR 2-To Kaumualli Hwy," The Traffic Group, Inc.

Hawaii Information Services, 2009. "Kauai Real Estate: When Paradise is Calling You", [Online]. Available: http://www.kauaihawaii-realestate.com/

Hawaii Institute of Marine Biology, 2006. "Coral Reef Assessment and Monitoring Program Hawaii, "[Online]. Available: http://cramp.wcc.hawaii.edu/LT_Montoring_files/lt_study_site_Niihau.htm [28 August].

Hawaii Revised Statutes, 2007. Hawaii Revised Statutes- HRS § 205A-43 – Establishment of shoreline and duties and powers of the department.

Hawaii, State of, 2005a. *"Kauai County,"* Hawaii Workforce Informer (HIWI), [Online]. Available: http://www.hiwi.org, 2005.

Hawaii State Department of Health, Clean Air Branch, 2008. Hawaii Greenhouse Gas Inventory: 1990 and 2007, December.

Hawaii, State of, 2005b. *The State of Hawaii Data Book 2005*.

Hawaii Visitors Bureau, 1993. "Average Daily Visitor Statistics Kaua`i and State of Hawai`i."

Herbst, L.H. 1994. "Fibropapillomatosis of marine turtles," *Annual Review of Fish Diseases*. 4:389–425.

Herbst, L.H., E.R. Jacobson, R. Moretti, T. Brown, J.P. Sundberg, and P.A. Klein, 1995. "Experimental transmission of green turtle fibropapillomatosis using cell-free tumor extracts," *Diseases of Aquatic Organisms*, 22:1–12.

Helfman, O.S., B.S. Collette, and D.E. Facey, 1997. *The diversity of fishes.* MaIden Massachusetts: Blackwell Science.

Herman, L.M., and R.C. Antinoja, 1977. "Humpback whales in Hawaiian waters: Population and pod characteristics," *Scientific Report of the Whales Research Institute,* 29:59-85.

Hirth, H.F., 1997. "Synopsis of the biological data on the green turtle *Chelonia mydas* (Linnaeus 1758)," *U.S. Fish and Wildlife Service Biological Report,* 97:1-120.

Honolulu Advertiser 2006. Economic Impact of the Military in Hawaii, 2006. "*Economic Impact of the Military in Hawaii"* [Online]. Available: http://military.honoluluadvertiser.com/mil/2006/4, [26 October].

Inouye, D., 2004 (U.S. Senator from Hawaii). Dan Inouye. U.S. Senator from Hawaii. July 16, 2004 [Online]. Available: http://www.senate.gov/~inouye/04pr/20040716.htnml [2 January 2007].

Inouye, D. 2009 (U.S. Senator from Hawaii). Dan Inouye. U.S. Senator from Hawaii. "Security and Preparedness", [Online]. Available: http://inouye.senate.gov/Working4Hawaii/Security.cfm.

International Archaeological Resources Institute, 2005. Integrated *Cultural Resources Management Plan for the Pacific Missile Range Facility (PMRF), Island of Kauai, State* Prepared by M J Tomonari-Tuggle and Ann Yoklavich, Mason Architects, Inc. Prepared for Commander Navy Region Hawaii. April.

International Civil Aviation Organization, 1996. *Procedures for Air Navigation Services Rules of the Air and Air Traffic Services* 13th Edition, November.

International Civil Aviation Organization, 1997. *Amendment to the Procedures for Air Navigation Services Rules of the Air and Air Traffic Services* 13th Edition, November.

International Whaling Commission, 2001. "Report on the Workshop on the Comprehensive Assessment of Right Whales: A worldwide comparison," *Journal of Cetacean Research and Management, Special Issue,* 2:1-60.

International Whaling Commission, 2007. Classification of the Order Cetacea (whales, dolphins and porpoises). *Journal of Cetacean Research and Management*, 9(1): v-xii.

Itano, D.G., and K.N. Holland, 2000. “Movement and vulnerability of bigeye (*Thunnus obesus*) and yellowfin tuna (*T. albacares*) in relation to FADs and natural aggregation points,” *Aquatic Living Resources*, 13:213-223.

Johnston, Paul F., 2005. Beneath The Seven Seas, Adventures with the Institute of Nautical Archaeology. Revised Edition. Thames & Hudson Ltd., London.

Jokiel, P.L., E.K. Brown, A. Friedlander, S.K. Rodgers, and W.R. Smith, 2001. “Hawaii coral reef initiative, coral reef assessment and monitoring program (CRAMP) Final Report 1999-2000,” Silver Spring, Maryland: National Oceanic and Atmospheric Administration, National Ocean Service, 66 pp.

Jokiel, P.L., E.K. Brown, A. Friedlander, S.K. Rodgers, and W.R. Smith, 2004. “Hawai`i coral reef assessment and monitoring program: Spatial patterns and temporal dynamics in reef coral communities,” *Pacific Science*, 58:159-174.

Kalmijn A.J., 1988. “Hydrodynamic and acoustic field detection,” pp. 83-130. In: *Sensory Biology of Aquatic Animals*, eds. A. Atema, R.R. Fay, A.N. Popper, and W.N. Tavolga, New York: Springer-Verlag.

Kalmijn A.J., 1989. “Functional evolution of lateral line and inner ear sensory systems,” pp. 187-215. In: The mechanosensory lateral line - Neurobiology and evolution, eds. S. Coombs, P. Görner, and M. Münz. Berlin: Springer Verlag.

Kauai, County of 2005. *Kauai General Plan*, Planning Department, “Preserving Kauai’s Rural Character.” [Online]. Available: http://www.kauai.gov/Portals/0/planning/Ch5.PDF

Kauai Island Utility Cooperative, 2006 *KIUC Current*, “Kakaha Potential”. October 2006, p. 5, [Online]. Available: http://www.kiuc.coop/pdf/currents/CurrentsOct06.pdf.

Kauai Island Utility Cooperative, 2008a. Strategic Plan 2008 – 2023, October [Online].Available: http://www.kiuc.coop/pdf/SP2023%202008%20Update%20Approved-2008-10.pdf.

Kauai Island Utility Cooperative, 2008b. Strategic Plan 2008 – 2023: November 2007 Updated October 2008.

Kaua`i Monk Seal Watch Program, 2003. “Fall 2003 Newsletter,” October, [Online]. Available: http://www.kauaimonkseal.com/News/OCT03NL.htm

Kennett, J.P., 1982. *Marine geology*. Englewood Cliffs, New Jersey: Prentice-Hall, Inc.

Kikuchi, W.K., 1987. *Archaeological Surface Survey of Proposed Helicopter Landing site: Lehua Landing and Keanahaki, Island of Ni`ihau*, February.

Ladich, F., and A.N. Popper, 2004. “Parallel evolution in fish hearing organs,” pp. 95-127. In: Manley, G.A., A.N. Popper, and R.R. Fay (eds), *Evolution of the Vertebrate Auditory System.* Springer Handbook of Auditory Research. Springer-Verlag, New York.

Land Study Bureau, 1997. *Detailed Land Classification - Island of Kauai, L.S.B. Bulletin No. 9*, University of Hawaii, Honolulu, December.

Larkin, R., 1996. "Effects of military noise on wildlife": A Literature Review, Center for Wildlife Ecology, Illinois Natural History Survey January.

Lee, T., 1993. "Summary of cetacean survey data collected between the years of 1974 and 1985," NOAA Technical Memorandum NMFS-SWFSC-181:I -1 85.

Lenhardt, M.L., 1994. "Seismic and Very Low frequency sound induced behaviors in captive loggerhead marine turtles (*Caretta caretta*)," Proceedings, Fourteenth Annual Symposium on Sea Turtle Biology and Conservation, *National Oceanic and Atmospheric Administration Technical Memorandum NMFS-SEFSC-351,* Marine Fisheries Service, Southeast Fisheries Science Center, Miami, Florida, pp. 238-241, 32.

Lingle, L. (Governor of Hawaii), 2009. "Federal Government's Role in Stimulating Hawaii's Economy", released 24 August 2009 – Hawaii Reporter, [Online]. Available: http://www.hawaiireporter.com/story.aspx?13ebf451-420d-416c-89c3-eb015bdf6a4b

Lockheed Martin, 2009. Aegis Ballistic Missile Defense (Aegis BMD) [Online]. Available: http://www.lockheedmartin.com/products/AegisBallisticMissileDefense/index.html

Lohmann, K.J., B.E. Witherington, C.M.F. Lohmann, and M. Salmon, 1997. "Orientation, navigation, and natal beach homing in sea turtles," pp. 107-136. In: P.L. Lutz and J.A. Musick, eds. The biology of sea turtles, Boca Raton, Florida: CRC Press.

Lutcavage, M.E., and P.L. Lutz, 1997. "Diving physiology," pp. 277-296 in P.L. Lutz and J.A. Musick, eds. *The biology of sea turtles,* Boca Raton, Florida: CRC Press.

Maintenance Logs and Records, 2007. Personal communication via email between Greg Hayashi, S CIV NAVFAC HI OPBP6, and Randall Young, CIV NAVFAC PAC, 18 January.

Maldini, D., 2003. "Abundance and distribution patterns of Hawaiian odontocetes: Focus on Oahu," Ph.D dissertation, University of Hawaii, Manoa.

Maly, K. and W. Wulzen, 1997. "Historical Documentary Research," in Wulzen et al., *Archaeological Reconnaissance Survey Pacific Missile Range Facility Barking Sands and Makaha Ridge. Land of Waimea, Waimea District, Island of Kauai*, pp. 6-23. Prepared for Department of the Navy, Pacific Division, Naval Facilities Engineering Command, Pearl Harbor, Paul H. Rosendahl, Ph.D., Inc., Hilo.

Maragos, J.E., 1977. "Order scleractinia—Stony corals," pp. 158-241 in D.M. Devaney and L.G. Eldredge, eds. *Reef and shore fauna of Hawaii. Section 1: Protozoa through Ctenophora,* Bishop Museum Special Publication 64(1), Honolulu, Hawaii: Bishop Museum Press.

Maragos, J.E., 1998. "Marine ecosystems," pp. 111-120 in S.P. Juvik and J.O. Juvik, eds. *Atlas of Hawai`i, 3d ed*. Honolulu, Hawaii: University of Hawaii Press.

Maragos, J.E., 2000. “Hawaiian Islands (U.S.A.),” pp. 791-812 in C.R.C. Sheppard, ed. *Seas at the millennium: An environmental evaluation. Volume 2: Regional chapters: The Indian Ocean to the Pacific,* Amsterdam, Netherlands: Pergamon Press.

Marine Mammal Commission, 2003. Workshop on the management of Hawaiian monk seals on beaches in the Main Hawaiian Islands. Final report of a workshop held 29-31 October in Koloa, Kauai, Hawaii. Bethesda, Maryland: Marine Mammal Commission.

Márquez-M., R., 1990. *Sea turtles of the world. An annotated and illustrated catalogue of sea turtle species known to date*, Rome: Food and Agriculture Organization of the United Nations.

McGerty, L., and R.L. Spear, 1997a. *An Inventory Survey with Oral Histories of a Parcel of Land on the Plain of Mana, West of Kekaha in the Ahupua`a of Waimea, District of Kona, Island of Kaua`i*. Prepared for Controlled Environment Aquaculture Technology, Inc. Scientific Consultant Services, Inc., Honolulu.

Megyesi, J. and C.R. Griffin, 1996. “Breeding Biology of the Brown Noddy on Tern Island, Hawaii,” *Wilson Bull., 108(2)*, 1996, pp. 317-334 [Online]. Available: http://elibrary.unm.edu/sora/Wilson/v108n02/p0317-p0334.pdf.

Meylan, A., 1995. “Sea turtle migration - evidence from tag returns,” pp. 91-100 in K.A. Bjorndal, ed. *Biology and conservation of sea turtles*, Rev. ed. Washington, D.C.: Smithsonian Institution Press.

Midson, B., 1999. “NURP research helps manage precious coral harvesting so as to preserve foraging sites used by endangered Hawaiian monk seals, ”[Online]. Available: http://www.soest.hawaii.edu/ HURL/precious_corals.html [13 June 2005].

Miller, J.D., 1997. “Reproduction in sea turtles,” pp. 51-81 in P.L. Lutz and J.A. Musick, eds. *The biology of sea turtles,* Boca Raton, Florida: CRC Press.

Missile Defense Agency, 2004. *Mobile Launch Platform Environmental Assessment,* June.

Missile Defense Agency, 2006. Letter to Mr. Patrick Leonard, Field Supervisor, Pacific Islands Office, U.S. Fish and Wildlife Service from Brian Huizenga, Team Lead Missile Defense Agency, regarding the potential for debris striking the Island of Nihoa to cause fires, December 7.

Missile Defense Agency, 2007. *Ballistic Missile Defense System Programmatic Environmental Impact Statement*, January.

Mobley, J.R., 2002. “Information on humpback whale population, Isle Humpbacks could be jockeying for flipper room” *Star Bulletin*, 17 March 2002, [Online]. Available: http://starbulletin.com/2002/03/17/news/story14.html, [29 April 2002].

Mobley, J.R., 2004. Results of marine mammal surveys on U.S. Navy underwater ranges in Hawaii and Bahamas. Final Report to Office of Naval Research, 27 pp.

Mobley, J.R., 2005. "Assessing responses of humpback whales to North Pacific Acoustic Laboratory (NPAL) transmissions: Results of 2001–2003 aerial surveys north of Kauai," *Journal of the Acoustical Society of America,* 117:1666-1673.

Mobley, Jr., J.R., M. Smultea, T. Norris, and D. Weller, 1996. "Fin whale sighting north of Kauai, Hawaii," *Pacific Science,* 50:230-233.

Mobley, J.R., G.B. Bauer, and L.M. Herman, 1999. "Changes over a ten-year interval in the distribution and relative abundance of humpback whales (*Megaptera novaeangliae*) wintering in Hawaiian waters," *Aquatic Mammals,* 25:63-72.

Mobley, J.R., S.S. Spitz, K.A. Forney, R. Grotefendt, and P.H. Forestell, 2000. "Distribution and abundance of odontocete species in Hawaiian waters: Preliminary results of 1993-98 aerial surveys," *Southwest Fisheries Science Center Administrative Report LJ-00-14C*, La Jolla, California: National Marine Fisheries Service.

Mobley, J.R., S.S. Spitz, and R. Grotefendt, 2001a. *Abundance of humpback whales in Hawaiian waters: Results of 1993-2000 aerial surveys,* Report prepared for the Hawaii Department of Land and Natural Resources and the Hawaiian Islands Humpback Whale National Marine Sanctuary, NOAA, U.S. Department of Commerce [Online]. Available http://www.iwcoffice.org/_documents/sci_com/workshops/MSYR/Mobley-Hawaii-humpbacks-2001.pdf.

Mobley, J.R., L.L. Mazzuca, A.S. Craig, M.W. Newcomer, and S.S. Spitz, 2001b. "Killer whales (*Orcinus orca*) sighted west of Niihau, Hawaii," *Pacific Science,* 55:301-303.

Mossman, V., 2007. Communication between Vida Mossman (CTR PMRF) and Karen Barnes on 9 February 2007. Regarding Population figures/numbers for PMRF.

Musick, J.A., and C.J. Limpus, 1997. "Habitat utilization and migration of juvenile sea turtles," pp. 137-163 in P.L. Lutz and J.A. Musick, eds. *The biology of sea turtles*, CRC Press, Boca Raton, Florida.

National Aeronautical Charting Office, 2007. Hawaiian Islands Sectional Aeronautical Chart, Hawaiian Islands Sectional Aeronautical Chart.

National Marine Fisheries Service, 1998. *Recovery plan for the blue whale (Balaenoptera musculus),* Prepared by R.R. Reeves, P.J. Clapham, R.L. Brownell, and G.K. Silber, Silver Spring, Maryland: National Marine Fisheries Service.

National Marine Fisheries Service, 2002a. "Endangered and threatened species: Determination on a petition to revise critical habitat for northern right whales in the Pacific," *Federal Register, Vol* 67, No. 34, pp. 7660-7665, Wednesday, [20 February].

National Marine Fisheries Service, 2002b. "Fisheries off west coast states and in the western Pacific; Atlantic highly migratory species; Fisheries of the northeastern United States; Implementation of the shark finning prohibition act—Final rule," *Federal Register,* 67(28):6194-6202.

National Marine Fisheries Service, 2002c. "Fisheries off west coast states and in the western Pacific; Atlantic highly migratory species; Fisheries of the northeastern United States; Implementation of the shark finning prohibition act—Final rule," *Federal Register,* Vol 67, No. 28, pp. 6194-6202.

National Marine Fisheries Service, 2004a. "International Sea Turtle Activities, Research and Training for Mitigation of Sea Turtle Interactions with Fisheries." 3pp. Pacific Island Regional Office, NOAA National Marine Fisheries Service. [Online]. Available: http://www.fpir.noaa.gov/IFD/ifd_sea_turtles_indonesia.html 2/.

National Marine Fisheries Service, 2004b. *Cause of stranding database for marine turtle strandings in the Hawaiian Islands, 1982–2003,* Honolulu, Hawaii: National Marine Fisheries Service-Pacific Islands Fisheries Science Center.

National Marine Fisheries Service, 2004c. "Fisheries off west coast and in the western Pacific; Western Pacific fisheries; Highly migratory species fisheries; Overfishing determination for bigeye tuna," *Federal Register, Vol 69, No. 250*, pp. 78397078398.

National Marine Fisheries Service, 2005. "Biological opinion on the continued authorization of the Hawaii-based pelagic, deep-set, tuna longline fishery based on the Fishery Management Plan for Pelagic Fisheries in the Western Pacific Ocean," U.S. Department of Commerce, National Oceanic and Atmospheric Administration.

National Marine Fisheries Service, 2007a. "Recovery Plan for the Hawaiian Monk Seal (*Monachus schauinslandi*) Revision," National Marine Fisheries Service, Silver Spring, MD., 165 pp. [Online]. Available: http://www.nmfs.noaa.gov/pr/pdfs/recovery/hawaiianmonkseal.pdf.

National Marine Fisheries Service, 2007b. Listing Endangered and Threatened Wildlife and Designating Critical Habitat; 90-day Finding for a Petition to Reclassify the Loggerhead Turtle in the North Pacific Ocean as a Distinct Population Segment with Endangered Status and to Designate Critical Habitat. Federal Register, Vol 72, No 221, pp. 64585-645874. 16 November 2007.

National Marine Fisheries Service, 2007c. "Recovery Plan for the Hawaiian Monk Seal (*Monachus schauinslandi*) Revision," National Marine Fisheries Service, Silver Spring, MD., 165 pp. [Online]. Available: http://www.nmfs.noaa.gov/pr/pdfs/recovery/hawaiianmonkseal.pdf.

National Marine Fisheries Service and U.S. Fish and Wildlife Service, 1998a. *Recovery plan for U.S. Pacific populations of the green turtle (Chelonia mydas),* Silver Spring, Maryland: National Marine Fisheries Service.

National Marine Fisheries Service and U.S. Fish and Wildlife Service, 1998b. *Recovery plan for U.S. Pacific populations of the hawksbill turtle (Eretmochelys imbricata)*, Silver Spring, Maryland: National Marine Fisheries Service.

National Marine Fisheries Service and U.S. Fish and Wildlife Service, 1998c. *Recovery plan for U.S. Pacific populations of the leatherback turtle (Dermochelys coriacea)*, Silver Spring, Maryland: National Marine Fisheries Service.

National Marine Fisheries Service and U.S. Fish and Wildlife Service, 1998d. *Recovery plan for U.S. Pacific populations of the olive ridley turtle (Lepidochelys olivacea)*, Silver Spring, Maryland: National Marine Fisheries Service.

National Marine Fisheries Service, Pacific Islands Regional Office, 2007. Hawaiian Monk Seal *(Monachus schauinslandi)* 5-Year Review: Summary and Evaluation, August.

National Marine Fisheries Service, Pacific Islands Region (NMFS-PIR), 2001. *Final Environmental Impact Statement: Fishery management plan, pelagic fisheries of the western Pacific region. Volumes I and II*, Prepared for National Marine Fisheries Service-Pacific Islands Region by URS Corporation, Honolulu, HI under contract to Research Corporation of the University of Hawaii, 1,163 pp.

National Ocean Service, 2001. *Environmental sensitivity index (ESI) atlas: Hawaii. Volumes 1 and 2*, Seattle, Washington: NOAA.

National Oceanic and Atmospheric Administration, 1997. *Hawaiian Islands Humpback Whale National Marine Sanctuary Final Environmental Impact Statement Management Plan, February.*

National Oceanic and Atmospheric Administration, 2001. "Final Rule for the Shock Trial of the WINSTON S. CHURCHILL (DDG-81), Taking and Importing Marine Mammals; Taking Marine Mammals Incidental to Naval Activities" *Federal Register*, Department of Commerce; NMFS, FR 66, No. 87, 22450-67.

National Oceanic and Atmospheric Administration, 2003. "The Cultural Significance of Whales in Hawai`i," Third Printing [Online]. Available: http://hawaiihumpbackwhale.noaa.gov/special_offerings/sp_off/publication_pdfs/Cultural_brochure.pdf.

National Oceanic and Atmospheric Administration, 2006a. *Northwestern Hawaiian Islands Proposed National Marine Sanctuary Draft Environmental Impact Statement and Management Plan*, Vol. II of II, Honolulu, Hawaii, April, [Online]. Available: http://www.hawaiireef.noaa.gov/management/mp.html.

National Oceanic and Atmospheric Administration, 2006b. "Northwestern Hawaiian Islands Marine National Monument," Federal Register Vol. 71, No. 167/Tuesday, August 29 2000/Rules and Regulations, pp. 51134-51142. [Online]. Available: http://hawaiireef.noaa.gov/pdfs/nwhinmn_finalregs.pdf.

National Oceanic and Atmospheric Administration, 2006c. *Northwestern Hawaiian Islands Proposed National Marine Sanctuary Draft Environmental Impact Statement and Management Plan*, Vol. II of II, Honolulu, Hawaii, April, [Online]. Available: http://www.hawaiireef.noaa.gov/management/mp.html.

National Oceanic and Atmospheric Administration, 2006d. *Public Draft Environmental Assessment National Oceanic and Atmospheric Administration Pacific Region Center*, March.

National Oceanic and Atmospheric Administration, 2006f. "Screening Quick Reference Tables. Screen concentration for inorganic and organic contaminates in various environmental media." November Online: [Available]: http://response.restoration.noaa.gov/book_shelf/122_squirt_cards.pdf.

National Oceanic and Atmospheric Administration, 2007. "It's Whale Season in Hawai`i," *Announcements,"* 4 April [Online]. Available: http://hawaiihumpbackwhale.noaa.gov/.

National Oceanic and Atmospheric Administration, 2010. Endangered and Threatened Wildlife; Notice of 90-Day Finding on a Petition to List 83 Species of Coral as Threatened or Endangered Under the Endangered Species Act (ESA) [Online], *Federal Register/Vol. 75 No. 27/Wednesday, February 10, 2010/Proposed Rules.* Available: http://www.nmfs.noaa.gov/pr/pdfs/fr/fr75-6616.pdf.

National Wetlands Inventory, 2007. Providing Wetland Information to the American People [Online]. Available: http://www.fws.gov/nwi/ [17 October].

National Research Council, 1990. *Decline of the sea turtles: Causes and prevention*, National Academy Press, Washington D.C.

Nature Conservancy and Natural Resources Defense Council, 1992. *The Alien Pest Species Invasion in Hawai`i: Background Study and Recommendations for Interagency Planning*, Review draft 3, Honolulu. [Online]. Available: http://www.hear.org/articles/pdfs/nrdctnch1992.pdf.

Naval Facilities Engineering Command, Hawaii, 2007. "2007 Annual Water Quality Report-Pacific Missile Range Facility Water System, Mana Well Source." [Online]. Available: http://www.hawaii.navy.mil/Environmental/Water_Quality_Reports/Water%20Qual%20PMRF%202007_4May07.pdf.

Naval Facilities Engineering Command, Hawaii Public Affairs, 2005. *Green Power on the Garden Isle*. [Online]. Available: https://portal.navfac.navy.mil/portal/page?_pageid=181,3991235_dad=portal&_schema=PORTAL.

Naval Facilities Engineering Command Pacific, 2009. "PMRF Nene Translocation Project Description – and Status of the Biological Opinion," 24 December.

Naval Facilities Engineering Command Pacific, 2010. Comments received from Naval Facilities Engineering Command Pacific re the Coordinating Draft of the Pacific Missile Range Facility Intercept Test Support, Environmental Assessment/Overseas Environmental Assessment, regarding biological species, 12 February.

Naval Ordnance Missile Test Station, 1992. *Environmental Assessment for Standard Missile*.

Nedwell, J.R., B. Edwards, A.W.H. Turnpenny, and J. Gordon, 2004. "Fish and marine mammal audiograms: A summary of available information," Subacoustech Ltd., Report, Ref. 534R0214.

Nicholls B and Racey P.A., 2007. "Bats Avoid Radar Installations: Could Electromagnetic Fields Deter Bats from Colliding with Wind Turbines?" open access freely available online in *PLoS ONE* 2(3): e297. [Online]. Available: www.plosone.org.

Northwestern Hawaiian Islands Multi-Agency Education Project, 2006. "Expeditions," [Online]. Available: http://www.hawaiianatolls.org/research/index.php.

Office of Naval Research, 1995. *Final Environmental Assessment for the Advanced Concept and Technology Demonstration of the Wide Area Defense Program at Pacific Missile Range Facility, Kauai, Hawaii*, April.

Office of the Under Secretary of Defense, 2009. Memorandum for Deputy Assistant Secretary of the Army (Environment, Safety & Occupational Health) Deputy Assistant Secretary of the Navy (Environment) Deputy Assistant Secretary of the Air Force (Energy, Environment, Safety & Occupational Health) Director, DLA Enterprise Support Subject: Perchlorate Release Management Policy, 22 April.

Onboard Informatics, 2009. "Kauai County, Hawaii (HI)", [Online]. Available: http://www.city-data.com/county/Kauai_County-HI.html.

Pacific Business News, 2002. "Co-op closes Kauai Electric purchase", [Online], Available: http://pacific.bizjournals.com/pacific/stories/2002/10/28/daily84.html [15 September 2006].

Pacific Missile Range Facility, Commander, 1997. Pacific Missile Range Enhanced Capability: Coordinating Draft Siting Report, 3 March.

Petteys, E., 1997. Interview with Petteys, Hawaii Forestry and Wildlife Division by EDAW Inc., regarding use of Pine Forest picnic area, 25 August.

Pacific Missile Range Facility, 1999. "Wildlife Flourishing at PMRF," Release #24-99, [Online]. Available: http://www.pmrf.navy.mil/pr_seals.html, [26 April 2002].

Pacific Missile Range Facility, 2001. *Integrated Natural Resources Management Plan, Pacific Missile Range Facility, Hawaii, Final*, October.

Pacific Missile Range Facility, 2006a. "Barking Sands Botanical Survey Report," May.

Pacific Missile Range Facility, 2006b. "Pacific Missile Range Bird Surveys, "Results conducted on 13-17 February and 14-20 April.

Pacific Missile Range Facility, 2006c. "Herpetological and Mammal Surveys at Pacific Missile Range Facility," February and April.

Pacific Missile Range Facility, 2006d. "The Status of *Wilkesia hobdyi* (Asteraceae) U.S. Navy Pacific Missile Range Facility Makaha Ridge, Kokee, Kauai, Hawaii, Prepared for Helber Haster & Fee, Planners, by K.R. Wood/Research Biologist, 17-21 April.

Pacific Missile Range Facility, 2006e. "Kokee Botanical Survey Report," May.

Pacific Missile Range Facility, 2007. *An Integrated Natural Resources Management Plan (INRMP) for the Pacific Missile Range Facility (PMRF) Barking Sands (BS), Kauai, Hawaii, Phase II 2006, Marine and Fisheries Resources Final Report*, June.

Pacific Missile Range Facility, Barking Sands, Hawaii, 1991. *Fleet Mission Planning Guide, FMPG-91,* 1 April.

Papahānaumokuākea Marine National Monument, 2008. *Papahānaumokuākea Marine National Monument Management Plan*, December [Online]. Available: http://papahanaumokuakea.gov/management/mp/vol1_mmp08.pdf.

Papastamatiou, Y.P, B.M. Wetherbee, C.G. Lowe, and G.L. Crow, 2006. "Distribution and diet of four species of carcharhinid shark in the Hawaiian Islands; evidence for resource partitioning and competitive exclusion," *Marine Ecology Progress Series, Vol. 320; 239,251,* published 29 August [Online]. Available: http://www.hawaii.edu/HIMB/sharklab/Papastamatiou_MEPS06.pdf.

Perry, S.L., D.P. DeMaster, and G.K. Silber, 1999. "The great whales: History and status of six species listed as endangered under the U.S. Endangered Species Act of 1973," *Marine Fisheries Review,* 61:1-74.

Petteys, E., 1997. Interview with Petteys, Hawaii Forestry and Wildlife Division by EDAW Inc., regarding use of Pine Forest picnic area, 25 August.

Polovina, J.J., D.R. Kobayashi, D.M. Parker, M.P. Seki, and G.H. Balazs, 2000. "Turtles on the edge: Movement of loggerhead turtles (*Caretta caretta*) along oceanic fronts, spanning longline fishing grounds in the central North Pacific, 1997-1998," *Fisheries Oceanography,* 9:71-82.

Pooley, S.G., 1993. "Hawaii Marine Fisheries: Some history, long-term trends, and recent development," *Marine Fisheries Review 55(2):7-19* [Online]. Available: http://www.encyclopedia.com/doc/1G1-15462276.html.

Poot, H., B.J. Ens, H. de Vries, M.A.H. Donners, M.R. Wernand, and J.M. Marquenie, 2008. Green light for nocturnally migrating birds. Ecology and Society 13: 47 [online]. Available: www.ecologyandsociety.org/vol13/iss2/art47/ES-2008-2720.pdf.

Popper A.N., R.R. Fay, C. Platt, and O. Sand, 2003. "Sound detection mechanisms and capabilities of teleost fishes," pp.3-38. In Sensory Processing in Aquatic Environments, eds. S.P. Collin and N.J. Marshall, New York: Springer-Verlag.

Presidential Document, 2000. "Executive Order 13178—Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve," *Federal Register*, 65(236):76901- 76910. [Online]. Available: http://www.denix.osd.mil/denix/Public/Legislation/EO/note77.html [1 January 2007].

Presidential Document, 2006. "Proclamation 8031 of June 15, 2006. Establishment of the Northwestern Hawaiian Islands Marine National Monument," *Federal Register*, 71(122):36441-36475.

Quackenbush, S.L., T.M. Work, G.H. Balazs, R.N. Casey, J. Rovnak, A. Chaves, L. du Toit, J. D. Baines, C.R. Parrish, P.R. Bowser, and J.W. Casey, 1998. "Three closely related herpes viruses are associated with fibropapillomatosis in marine turtles," *Virology,* 246:392–399.

Raytheon, 2007. "The Standard Missile Family," [Online]. Available: http://www.raytheon.com/products/standard_missile/.

Ragen, T.J., and M.A. Finn, 1996. The Hawaiian monk seal on Nihoa and Necker Islands, 1993," pp. 90-94 in T.C. Johanos and T.J. Ragen, eds. *The Hawaiian monk seal in the Northwestern Hawaiian Islands, 1993,* NOAA Technical Memorandum NMFS-SWFSC 227.

Ragen, T.J. and D.M. Lavigne, 1999. "The Hawaiian monk seal: Biology of an endangered species," pp. 224-245. In J.R. Twiss, Jr. and R.R. Reeves, eds. *Conservation and Management of Marine Mammals*, Washington D.C.: Smithsonian Institution Press.

Randall, J.E., 1995. "Zoogeographic analysis of the inshore Hawaiian fish fauna," pp. 193-203. In: J.E. Maragos, M.N.S. Peterson, L.G. Eldredge, J.E. Bardach and HF. Takeuchi, eds. *Marine and coastal biodiversity in the tropical island Pacific region, Volume 1. Species systematics and information management priorities*, Honolulu. Hawaii: East-West Center.

Randall, J.E., 1998. "Zoogeography of shore fishes of the Indo-Pacific region," *Zoological Studies,* 37:227-268.

Range Commanders Council, Range Safety Group, 2007. "Standard 321-07," *Common Risk Criteria for National Test Ranges, Subtitle: Inert Debris,* June.

Rechtman, R., A. Yoklavich, and M. Binder, 1998. *Cultural Resources Management Plan, Pacific Missile Range Facility, Barking Sands, Kauai,* Prepared for the Department of the Navy, Naval Facilities Engineering Command, Paul H. Rosendahl, Ph.D., Inc., Hilo.

Resture, J., 2002. "Welcome, Nihoa Island" [Online]. Available: http://www.janeresture.com/nihoa/ [23 April 2002].

Resture, J., 2004. "Welcome, Necker Island" [Online]. Available: http://www.janeresture.com/necker/index.htm.

Reeves, R.R., B.D. Smith, E.A. Crespo, and G. Notarbartolo di Sciara, 2003. *2002-2010 conservation plan for the world's cetaceans: Dolphins, whales, and porpoises*, Gland, Switzerland: IUCN - The World Conservation Union, 147 pp.

Rice, D.W., 1960. "Distribution of the bottle-nosed dolphin in the Leeward Hawaiian Islands," *Journal of Mammalogy,* 41:407-408

Rice, D.W., 1998. "Marine mammals of the world: Systematics and distribution," *Society for Marine Mammalogy Special Publication,* 4:1-231.

Roberts, S., and M. Hirshfield, 2003. "Deep sea corals: Out of sight, but no longer out of mind," *Oceana*, Washington, D.C.: 18 pp.

Rogers, A.D., 1994. "The biology of seamounts," pp. 306-350 in J.H. Blaxter, and A.J. Southward, eds. *Advances in marine biology* 30: 305-354, San Diego: Academic Press.

Rogers P.H. and M. Cox, 1988. "Underwater sound as a biological stimulus," pp. 131-149. In: Sensory Biology of Aquatic Animals, eds. A. Atema, R.R. Fay, A.N. Popper, and W.N. Tavolga, New York: Springer-Verlag.

Safina, C., 1996. *Xiphias gladius*. In 2004 IUCN red list of threatened species [Online]. Available: http://www.redlist.org.

Salden, D.R., L.M. Herman, M. Yamaguchi, and F. Sato, 1999. "Multiple visits of individual humpback whales (*Megaptera novaeangliae*) between the Hawaiian and Japanese winter grounds," *Canadian Journal of Zoology,* 77:504-508.

Sandia National Laboratories, 1993. SNL Acoustic Monitoring Plan of the STARS Flight Test Unit 1. Memo to Linda Ninh from B.E. Swanson. Sandia National Laboratories, Albuquerque, NM.

Sandia National Laboratories, 2006. Calendar Year 2005, *Annual Site Environmental Report for Tonopah Test Range, Nevada and Kauai Test Facility, Hawaii,* Sandia National Laboratories, September.

Sandia National Laboratories, 2009. Calendar Year 2008, *Annual Site Environmental Report for Tonopah Test Range, Nevada and Kauai Test Facility, Hawaii,* Sandia National Laboratories, September.

Seminoff, J.A., 2004. "Marine Turtle Specialist Group Review: 2004 Global Status Assessment, Green Turtle (*Chelonia mydas*)," The World Conservation Union (IUCN), Species Survival Commission Red List Programme, Marine Turtle Specialist Group, [Online]. Available: http://www.iucnmtsg.org/red_list/cm/MTSG_Chelonia_mydas_assessment_expanded-format.pdf [June 26, 2005].

Seminoff, J.A., W.J. Nichols, A. Resendiz, and L. Brooks, 2003. "Occurrence of hawksbill turtles, *Eretmochelys imbricata* (Reptilia: Cheloniidae), near the Baja California Peninsula, Mexico," Pacific Science, 57:9-16.

Shallenberger, E.W., 1981. *The status of Hawaiian cetaceans,* Report prepared under Contract #MM7AC028 for the Marine Mammal Commission, Washington, D.C.

Shark Specialist Group, 2000. *Carcharhinus limbatus*. In 2004 IUCN red list of threatened species [Online]. Available: http://www.redlist.org.

Simpson, J.H., P.B. Tett, M.L. Argote-Espinoza, A. Edwards, K.J. Jones, and G. Savidge, 1982. "Mixing and phytoplankton growth around an island in a stratified sea," *Continental Shelf Research,* 1:15-31.

Smale, M.J., 2000. *Carcharhinus longimanus*. In 2004 IUCN red list of threatened species [Online]. Available: http://www.redlist.org.

Soto, N.A., M. Johnson, P.T. Madsen, P.L. Tyack, A. Bocconcelli, J.F. Borsani, 2006. "Does intense ship noise disrupt foraging in deep-diving Cuvier's beaked whales (*Ziphius cavirostris*)," Marine Mammal Science, 22(3): 690-699.

Southall, B.L., 2005. *Final Report of the National Oceanic and Atmospheric Administration (NOAA) International Symposium: Shipping Noise and Marine Mammals: A Forum for Science, Management, and Technology, 18-19 May 2004*. Released 27 April 2005.

Spotila, J.R., M.P. O'Connor, and F.V. Paladino, 1997. "Thermal biology," pp. 297-314 in P.L. Lutz and J.A. Musick, eds. *The biology of sea turtles,* Boca Raton, Florida: CRC Press.

Stafford, K.M., 2003. "Two types of blue whale calls recorded in the Gulf of Alaska," *Marine Mammal Science*," 19:682-693.

Stafford, K.M., S.L. Nieukirk, and C.G. Fox, 2001. "Geographic and seasonal variation of blue whale calls in the North Pacific," *Journal of Cetacean Research Management,* 3(1):65–76.

Star Bulletin, 2007. "Sales, prices drop for neighbor isle properties," Volume 12, Issue 6 – Saturday, January 6, 2007 [Online]. Available: http://starbulletin.com/2007/01/06/business/story01.html.

State of Hawaii, 1993. *Botanical Database and Reconnaissance Survey of the Polihale Area, Kaua`i,* Division of State Parks, Department of Land and Natural Resources, Honolulu.

State of Hawaii, 2005a. *Index of /dlnr/dofaw/cwcs/files/NAAT final CWCS/Chapters/Terrestrial Fact Sheets* [Online]. Available: http://www.state.hi.us/dlnr/dofaw/cwcs/files/NAAT%20final%20CWCS/Chapters/Terrestrial%20Fact%20Sheets/.

State of Hawaii, 2005b. *Northwestern Hawaiian Islands Passerines* "Nihoa Millerbird *Acrocephalus familiaris*," p. 3-16[Online]. Available: http://www.state.hi.us/dlnr/dofaw/cwcs/files/NAAT%20final%20CWCS/Chapters/Terrestrial%20Fact%20Sheets/NWHI/Nihoa_Millerbird%20NAAT%20final%20!.pdf.

State of Hawaii, 2008a. "2008 Annual Visitor Research Report", [Online]. Available: http://hawaii.gov/dbedt/info/visitor-stats/visitor-research/2008-annual-visitor.pdf.

State of Hawaii, 2008b. "Number of Farms, Farm Acreage, and Farm Employment, by County: 1990 TO 2007-The State of Hawaii Data Book, 2008", [Online]. Available: http://hawaii.gov/dbedt/info/economic/databook/2008-individual/19/190508.pdf.

State of Hawaii Department of Business, Economic Development and Tourism, 2001. Federal Activity and Hawaii's New Economy. [Online]. Available: http://hawaii.gov/dbedt/info/economic/data_reports/e-reports/fr07-01r.pdf.

State of Hawaii Department of Business, Economic Development and Tourism, 2006. *"2005 Annual Visitor Research Report,"* State of Hawaii, 2005.

State of Hawaii, Department of Business, Economic Development & Tourism, 2008. County Social, Business and Economic Trends in Hawaii: 1990-2007. [Online]. Available: http://hawaii.gov/dbedt/info/economic/data_reports/county_report/County_Trend_2007-Final.pdf.

State of Hawaii, Department of Business, Economic Development & Tourism, 2009. 2008 Annual Visitors Research Report. [Online]. Available: http://hawaii.gov/dbedt/info/visitor-stats/visitor-research/2008-annual-visitor.pdf.

State of Hawaii, Department of Land and Natural Resources, 2005. "Draft Newell's Shearwater Five-year Work Plan," Drafted by the NESH Working Group--October 2005 [Online]. Available: http://www.state.hi.us/dlnr/dofaw/fbrp/docs/NESH_5yrPlan_Sept2005.pdf.

State of Hawaii Office of Planning, 2005. "Hawaii Statewide GIS Program," [Online]. Available: http://www.hawaii.gov/dbed/gis [October 2005].

Statistics of Hawaii Agriculture, 2007. "National Agricultural Statistics Service – Statistic of Hawaii Agriculture 2007", [Online]. Available: http://www.nass.usda.gov/hi/stats/t_of_c.htm.

Stevens, J. 2000a. *Lamna nasus* (Northeast Atlantic subpopulation). In: *2003 IUCN Red List of Threatened Species*. [Online]. Available: www.redlist.org.

Stevens, J.D., 2000b. "The effects of fishing on sharks, rays, and chimaeras (chondrichthyans), and the implications for marine ecosystems. International Council for the Exploration of the Sea," *Journal of Marine Science*, Vol. 57, Issue 3, pp. 476-494.

Stevick, P.T., B.J. McConnell, and P.S. Hammond, 2002. "Patterns of movement," pp. 185-216 in A.R. Hoelzel, ed. *Marine mammal biology: An evolutionary approach,* Oxford: Blackwell Science.

Strategyworld.com, 2008. Aegis Comes Ashore [Online]. Available: http://www.strategypage.com/htmw/htada/20080718.aspx.

TenBruggencate, J., 2005. “Coral tests could unravel Nihoa’s mysterious past” in the *Honolulu Advertiser.* August 29.

The Garden Island, 2007. “Kauai Leads State in Coastal Protection.” Wednesday, December 26, 2007. [Online]. Available: http://www.kauaiworld.com/articles/2007/12/20/news/news01.txt.

Thompson, P.O., and W.A. Friedl, 1982. “A long term study of low frequency sounds from several species of whales off Oahu, Hawaii,” Cetology, 45(l): - 1 9.

Thurman, H.V., 1997. *Introductory oceanography*, Upper Saddle River, New Jersey: Prentice Hall.

Transportation Research Board, 2000. Highway Capacity Manual [Online]. Available: http://onlinepubs.trb.org/onlinepubs/circulars/ec018/ec018toc.pdf.

Transportation Research Board, 2006. Highway Capacity Manual [Online]. Available: http://onlinepubs.trb.org/onlinepubs/circulars/ec018/ec018toc.pdf.

United Nations Convention on the Law of the Sea, 1982. Agreement Relating to the Implementation of Part XI of the Convention, 10 December.

University of Hawaii, 1983, Department of Geography, Atlas of Hawaii, Second Edition, Honolulu: University of Hawaii Press.

U.S. Air Force, Air Combat Command, 1997. *Environmental Effects of Self-Protection Chaff and Flares.* Prepared for Headquarters Air Combat Command, Langley Air Force Base, Virginia.

U.S. Air Force, 2010. Air Force Center for Environmental Excellence. Air Conformity Applicability Model, Version 4.5. [Online]. Available: http://www.afcee.brooks.af.mil/products/air/acam/acam.asp.

U.S. Army Program Executive Office, 1995. *Final Environmental Assessment Army Mountain Top Experiment*, May.

U.S. Army Space and Missile Defense Command, 2001. *North Pacific Targets Program Environmental Assessment*, April.

U.S. Army Space and Missile Defense Command, 2002. *“Theater High Altitude Area Defense (THAAD) – Pacific Test Flights-Environmental Assessment,”* Missile Defense Agency, 20 December 2002.

U.S. Army Space and Missile Defense Command, 2002b. *Liquid Propellant Missile (LPM) Site Preparation and Launch Environmental Assessment*, Missile Defense Agency, July.

U.S. Army Space and Missile Defense Command, 2003. *Ground-Based Midcourse Defense (GMD) Extended Test Range (ETR) Final Environmental Impact Statement*, July.

U.S. Army Space and Missile Defense Command, 2004. *Use of Tributyl Phosphate (TBP) in the Intercept Debris Measurement Program (IDMP) at White Sands Missile Range (WSMR) Environmental Assessment*, April.

U.S. Army Strategic Defense Command, 1990. Exoatmospheric Discrimination Experiment *(EDX) Environmental Assessment*, September.

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

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

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

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

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

U.S. Census Bureau, 2009. “State & County QuickFacts - Kauai County, Hawaii”, [Online]. Available: http://quickfacts.census.gov/qfd/states/15/15007.html

U.S. Department of Commerce, The Under Secretary of Commerce for Oceans and Atmosphere, 2007. *Papahanaumokuakea Marine National Monument: Application for Inclusion of a Property in the U.S. World Heritage Tentative List.* Friday March 30.

U.S. Department of Commerce, 2008. Structure of Populations, Levels of Abundance and Status of Humpbacks (SPLASH) in Hawai`i, Hawaiian Islands Humpback Whale National Marine Sanctuary, 13 August [Online]. Available: http://hawaiihumpbackwhale.noaa.gov/science/splashhawaii.html.

U.S. Department of Defense, 2006. *Joint Hawaii Range Complex Management Plan – Final Draft,* April 2006*.*

U.S. Department of Housing and Urban Development, 2004. 24 CFR Part 51—Environmental Criteria and Standards, April. Available: http://www.wbdg.org/pdfs/24cfr51.pdf.

U.S. Department of the Interior, Office of Environmental Policy and Compliance Pacific Southwest Region, 2007. Comments received from U.S. Department of the Interior on the *Hawaii Range Complex Draft Environmental Impact Statement/Overseas Environmental Impact Statement* regarding biological resources.

U.S. Department of the Navy, 1990. *Master Plan PACMISRANFAC HAWAREA, Barking Sands, Kauai, Hawaii,* Pacific Division, Naval Facilities Engineering Command, Facilities Planning Department, Pearl Harbor, Hawaii, October.

U.S. Department of the Navy, 1993. Commander, Surface Forces Pacific (COMSURFPAC) Instruction 3120.8D, *Procedures for Disposal of Explosives at Sea/Firing of Depth Charges and Other Underwater Ordnance.*

U.S. Department of the Navy, 1995. *Report on Military Activities in Hawaiian Waters*, April.

U.S. Department of the Navy, 1998a. *Pacific Missile Range Facility Enhanced Capability Final Environmental Impact Statement Volume 1 of 3,* December.

U.S. Department of the Navy, 1998b. *Point Mugu Sea Range marine mammal technical report. Point Mugu Sea Range Environmental Impact Statement / Overseas Environmental Impact Statement,* Prepared by LGL Limited, Ogden Environmental and Energy Services, Naval Air Warfare Center Weapons Division, and Southwest Division Naval Facilities Engineering Command, 281 pp.

U.S. Department of the Navy, 2000. *Rim of the Pacific (RIMPAC) Environmental Assessment*, Commander THIRD FLEET, Hawaii, May.

U.S. Department of the Navy, 2002. *Rim of the Pacific (RIMPAC) Programmatic Environmental Assessment,* June 2002. Commander, Third Fleet (COMTHIRDFLT) Hawaii.

U.S. Department of the Navy, 2004. "Green turtle and Hawaiian monk seal geodatabase for Pacific Missile Range Facility Barking Sands," NAVFAC Pacific.

U.S. Department of the Navy, 2005a. Draft Overseas Environmental Impact Statement/Environmental Impact Statement – East Coast Underwater Training 24 Range.

U.S. Department of the Navy, 2005b. *Marine Resources Assessment for the Hawaiian Islands Operating Area, Final Report*, Prepared for the Department of the Navy, Commander, U.S. Pacific Fleet, December.

U.S. Department of the Navy, 2005c. *Marine Resources Assessment for the Hawaiian Islands Operating Area, Final Report*, Prepared for the Department of the Navy, Commander, U.S. Pacific Fleet, December.

U.S. Department of the Navy, 2006a. Rim of the Pacific Exercise After Action Report: Analysis of Effectiveness of Mitigation and Monitoring Measures as Required Under the Marine Mammals Protection Act (MMPA) Incidental Harassment Authorization and the National Defense Exemption from the Requirements of the MMPA for Mid-Frequency Active Sonar Mitigation Measures.

U.S. Department of the Navy, 2006b. *Comprehensive Infrastructure Plan, Volume 1 of 2.* Pacific Missile Range Facility, Barking Sands, Kauai, Draft, June.

U.S. Department of the Navy, 2007. *Draft Essential Fish Habitat and Coral Reef Assessment for the Hawaii Range Complex Environmental Impact Statement/Overseas Environmental Impact Statement,* June.

U.S. Department of the Navy, 2008. *Hawaii Range Complex Environmental Impact Statement/Overseas Environmental Impact Statement,* May.

U.S. Department of the Navy, 2009a. United States Navy Fact File-Standard Missile. [Online] Available: (http://www.navy.mil/navydata/fact_display.asp?cid=2200&tid=1200&ct=2).

U.S. Department of the Navy, 2009b. *Environmental Assessment Advanced Radar Detection Laboratory (ARDEL)*, Pacific Missile Range Facility, Barking Sands, Kauai, Hawaii, August.

U.S. Department of the Navy, Engineering Field Activity Chesapeake, 2006. "Noise and Accident Potential Zone Study for the Pacific Missile Range Facility Barking Sands," November.

U.S. Department of the Navy, Naval Facilities Engineering Command, Pearl Harbor, 1996. *Environmental Baseline Study, Pacific Missile Range Facility, Second Working Copy*, January (for official use only).

U.S. Department of the Navy, Naval Sea Systems Command, 2005. "*Evaluation of Electric Power Supply Alternatives for the MDETC P-419 Electromagnetic Launcher (EML) Railgun Facility"* Final Submittal, 26 April 2005.

U.S. Environmental Protection Agency, 2004. Preliminary Remediation Goals. October.

U.S. Fish and Wildlife Service, 2000. "Endangered and Threatened Wildlife and Plants: Determination of Whether Designation of Critical Habitat is Prudent for 81 Plants and Proposed Designations for 76 Plants from the Islands of Kauai and Niihau, Hawaii, Proposed Rule," *Federal Register*, Volume 65, No. 216, pp. 66807-66884.

U.S. Fish and Wildlife Service, 2002. "Endangered and Threatened Wildlife and Plants; Revised Determination of Prudency and Proposed Designations of Critical Habitat for Plant Species From the Islands of Kauai and Niihau, Hawaii; *Federal Register*, Proposed Rule," Vol 68, No.18, pp. 3939-4098.

U.S. Fish and Wildlife Service, 2003a. "Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Five Plant Species From the Northwestern Hawaiian Islands, Hawaii, Final Rule," 22 May. Vol 68, No. 99, pp. 28054-28075. [Online]. Available: http://www.fws.gov/pacificislands/CHRules/nwhifinal.pdf.

U.S. Fish and Wildlife Service, 2003b. "Endangered and Threatened Wildlife and Plants; Final Designation or Nondesignation of Critical Habitat for 95 Plant Species from the Islands of Kauai and Niihau, HI; *Federal Register*, Final Rule," Volume 68, No. 39, pp. 9115-9479.

U.S. Fish and Wildlife Service, 2004. "U.S. Fish and Wildlife Service Biological Opinion under section 7 of the Endangered Species Act on the effects of the reopened shallow-set sector of the Hawaii-based longline fishery on the short-tailed albatross *(Phoebastria albatrus),*" formal consultation log number 1-2-199-F-02.2 (supplementing 1-2-1999-F-02R), October.

U.S. Fish and Wildlife Service, 2005a. *Draft Revised Recovery Plan for Hawaiian Waterbirds, Second Draft of Second Revision,* May.

U.S. Fish and Wildlife Service, 2005b. "Partners??Outside the Box? Efforts Save Kauai Albatross Chicks," in *Fish and Wildlife Journal*, 15 March [Online]. Available: http://www.fws.gov/arsnew/regmap.cfm?arskey=15065.

U.S. Fish and Wildlife Service, 2006a. "Welcome to Midway Atoll," [Online]. Available: http://www.fws.gov/midway/intro/default.

U.S. Fish and Wildlife Service, 2006b. "Listed species (based on published population data) – 328 listings," *USFWS Threatened and Endangered Species System (TESS) [Online]. Available: http://ecos.fws.gov/tess_public/StateListing.do?state=HI&status=listed.*

U.S. Fish and Wildlife Service, 2006c. "General Provisions; Revised List of Migratory, Birds, Federal Register, Vol 71, No 164, pp. 50194-50221, Thursday [24 August] [Online]. Available: http://www.epa.gov/fedrgstr/EPA-SPECIES/2006/August/Day-24/e7001.htm.

U.S. Fish and Wildlife Service, 2007a. Species List and Technical Assistance regarding Informal Section 7 Consultation for the Hawaii Range Complex. Letter dated 8 November 2007, Pacific Islands Fish & Wildlife Office, Honolulu, Hawaii.

U.S. Fish and Wildlife Service, 2007b. "Endangered and Threatened Wildlife and Plants; 90-Day Finding on a Petition to List the Black-Footed Albatross (*Phoebastria nigripes*) as Threatened or Endangered," Federal Register, Vol 72, No 194, pp. 57278-57283, Tuesday, [9 October]. [Online]. Available: http://www.fws.gov/policy/library/E7-19690.html.

U.S. Fish and Wildlife Service, 2007c. "Papahānaumokuākea Marine National Monument, Hawaii; Monument Management Plan." Federal Register / Vol. 72, No. 64 , Wednesday, April 4, 2007- p. 16328. [Online]. Available: http://frwebgate.access.gpo.gov/cgi-bin/getpage.cgi?dbname=2007_register&position=all&page=16328.

U.S. Fish and Wildlife Service, 2009. Formal Section 7 Consultation for Translocation of Nene (*Branta sandvicensis*) from Pacific Missile Range Facility Main Base, Kauai, Hawaii, 24 December.

U.S. Fish and Wildlife Service and Hawaii Department of Land and Natural Resources, Division of Aquatic Resources, 2002. *Coral Reef Ecosystems of the Northwestern Hawaiian Islands: Interim Results Emphasizing the 2000 Surveys,* [Online]. Available: http://www.hawaiianatolls.org/research/NOWRAMP_2000.pdf.

U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, 2007. Correspondence received from Kevin Foster, Marine Ecologist and Regional Diving Officer, U.S. Fish and Wildlife Service Pacific Islands Fish and Wildlife Office regarding concurrence with no significant impact from Terminal High Altitude Area Defense activities, 10 January.

U.S. Fish and Wildlife Service, Pacific Islands, 2002. "Pacific Islands—National Wildlife Refuges, Pacific/Remote Islands National Wildlife Refuge Complex," [Online]. Available: http://www.fws.gov/pacificislands/wnwr/pnorthwestnwr.html, [29 October].

U.S. Fish and Wildlife Service, Pacific Region, 2002. "Critical Habitat for 83 Plant Species from Kauai and Niihau," *News Releases, Pacific Region,* [Online]. Available: http://pacific.fws.gov/news/2002/piea04/faq.pdf, [30 April].

U.S. Forest Service, undated. "*Chenopodium oahuense* (Meyen) Aellen `aheahea" [Online]. Available: http://www.fs.fed.us/global/iitf/pdf/shrubs/ Chenopodium%20oahuenseFinalIEd2.pdf.

U.S. Government, The Whitehouse, 2006. *Establishment of the Northwestern Hawaiian Islands Marine National Monument, A Proclamation by the President of the United States of America*, [Online]. Available: http://www.whitehouse.gov/news/releases/2006/06/ 20060615-18.html.

U.S. House of Representatives, 2003. Congressman Ed Cse – News Release. [Online]. Available: http://wwwc.house.gov/case/press_releases/2003107.html.

U.S. Navy NAVFAC Pacific Environmental Planning, 2007. Pacific Missile Range Facility *Wedge-tailed Shearwater Population Survey Project Summary Report.*

University of Hawaii, 1983. *Atlas of Hawaii.* Department of Geography, Second Edition, Honolulu: University of Hawaii Press.

Uozumi, Y., 1996a. *Thunnus alalunga*. In 2004 IUCN red list of threatened species [Online]. Available: http://www.redlist.org.

Uozumi, Y., 1996b. *Thunnus obesus*. In: 2004 IUCN red list of threatened species [Online]. Available: http://www.redlist.org.

Virginia Tech Conservation Management Institute, 1996. "(DRAFT) – Taxonomy Species Petrel, Dark-Rumped, Hawaiian Species Id ESIS101028," [Online]. Available: http://fwie.fw.vt.edu/WWW/esis/lists/e101028.htm.

Von Holt, I., 1985. *Stories of Long Ago AHN Ni`ihau, Kauai, Oahu*.

Waller, G., 1996. *SeaLife: A Complete Guide to the Marine Environment*. Washington, DC: Smithsonian Institution Press.

Wade, P.R, and T. Gerrodette, 1993. "Estimates of cetacean abundance and distribution in the eastern tropical Pacific," *Reports of the International Whaling Commission 43:477-493*.

Waller, G., 1996. *SeaLife: A Complete Guide to the Marine Environment*. Washington, DC: Smithsonian Institution Press.

West, E. and K. Desilets, 2005. *Archaeological Survey and Testing in Support of a Launcher Relocation at Pacific Missile Range Facility (PMRF*), Mana Ahupua`a, Kona District, Kaua`i, Prepared for Commander, Navy Region Hawai`i, Department of the Navy, Naval Facilities Engineering Command, Pacific, October. [For Official Use Only].

Western Pacific Regional Fishery Management Council, 1998. *Magnuson-Stevens Act definitions and required revisions: Amendment 6 to the bottomfish and seamount groundfish fisheries management plan, Amendment 8 to the pelagic fisheries management plan, Amendment 10 to the crustacean fisheries management plan, and Amendment 4 to the precious corals fisheries management plan,* Honolulu, Hawaii: Western Pacific Regional Fishery Management Council, 449 pp.

Western Pacific Regional Fishery Management Council, 1999. "The value of the fisheries in the western pacific fishery management council area," July. [Online]. Available: http://www.wpcouncil.org/documents/value.pdf.

Western Pacific Regional Fishery Management Council, 2001. *Final Fishery management plan for coral reef ecosystems of the western Pacific region*. Volumes I-III including Amendment 7 bottomfish and seamount groundfish fisheries, Amendment 11 crustacean fisheries, Amendment 5 precious corals, fisheries, and Amendment 10 pelagic fisheries. Honolulu, Hawaii: NMFS Southwest Region, Pacific Islands Area Office, 1,221 pp.

Western Pacific Regional Fishery Management Council, 2004. EFH/HAPC designations for fishery management units covered under the bottomfish, crustacean, pelagic, precious corals, and coral reef ecosystem fishery management plans. Updated. Honolulu, Hawaii: WPRFMC. 7 pp.

Western Pacific Regional Fishery Management Council, 2005. *Draft Programmatic Environmental Impact Statement Towards an Ecosystem Approach for the Western Pacific Region: From Species-based Fishery Management Plans to Place-based Fishery Ecosystem Plans*, 27 October [Online]. Available: http://www.wpcouncil.org/documents/DPEIS.pdf.

Western Pacific Regional Fishery Management Council, 2006. 2006 Black Coral Science and Management Workshop Report, April 18-19, 2006 Honolulu, Hawaii [Online]. Available: http://www.wpcouncil.org/precious/Documents/2006%20Black%20Coral%20Science%20and%20Management%20Workshop%20Report-SCANNED%20VERSION.pdf.

Western Pacific Regional Fishery Management Council, National Oceanic and Atmospheric Administration, 2003. "Strategic Plan for the Conservation and Management of Marine Resources in the Pacific Islands Region," p.5. NOAA-NA04NM4-4410086

Westlake, R.L., and W.G. Gilmartin, 1990. "Hawaiian monk seal pupping locations in the Northwestern Hawaiian Islands," *Pacific Science,* 44:366-383.

Whittow, G.C. and G.H. Balazs, 1982. "Basking behavior of the Hawaiian green turtle (*Chelonia mydas*)," *Pacific Science,* 36:129-139.

Witherington, B.E., and N.B. Frazer, 2003. "Social and economic aspects of sea turtle conservation," pp. 355-384 in P.L. Lutz, J.A. Musick and J. Wyneken, eds. *The biology of sea turtles. Volume II*, Boca Raton, Florida: CRC Press.

Witteveen, B.H., J.M. Straley, O. Ziegesar, D. Steel, and C.S. Baker, 2004. "Abundance and mtDNA differentiation of humpback whales (*Megaptera novaeangliae*) in the Shumagin Islands, Alaska," *Canadian Journal of Zoology.*, 82:1352-1359.

Witzell, W.N., 1983. "Synopsis of biological data on the hawksbill turtle *Eretmochelys imbricata* (Linnaeus 1766) FIR/S137," *FAO Fisheries Synopsis,* 137:1-78.

Wolanski, E., R.H. Richmond, G. Davis, E. Deleersnijder, and R.R. Leben, 2003. "Eddies around Guam, an island in the Mariana Islands group," *Continental Shelf Research,* 23:991-1003.

Wyneken, J., 1997. "Sea turtle locomotion: Mechanics, behavior, and energetics," pp. 165-198 in P.L. Lutz and J.A. Musick, eds. *The biology of sea turtles*, Boca Raton, Florida: CRC Press.

Yasui, M., 1986. "Albacore, *Thunnus alalunga*, pole-and-line fishery around the Emperor Seamounts," from *Environment and Resources of Seamounts in the North Pacific*. R. Uchida, S. Hayashi, and G. Boehlert, eds. NOAA Technical Report NMFS 43, pp. 37-40.

7.0 List of Preparers

7.0 LIST OF PREPARERS

Government Preparers

David Hasley, Environmental Engineer
U.S. Army Space and Missile Defense Command
B.S., 1984, Mechanical Engineering, University of Texas, Arlington
Years of Experience: 25

Contractor Preparers

Michael Allen, Technical Writer, KAYA Associates, Inc.
M.F.A., 2008, Writing, Texas State University
B.A., 2003, English, University of Tennessee
Years of Experience: 2

Karen Charley-Barnes, Environmental Scientist, KAYA Associates, Inc.
Ed.D., 2009 Higher Education Administration – Policy Evaluation and Implementation, George Washington University, Washington, D.C.
M.S., 1998, Environmental Science-Policy and Management, Florida A&M University
B.S., 1989, Natural Science and Mathematics, University of Alabama, Birmingham
Years of Experience: 19

Greg Denish, Graphic Artist, KAYA Associates, Inc.
B.A., 2002, Studio Art, Design Emphasis, University of Tennessee
Years of Experience: 6

Jonathan Henson, Geographic Information Systems Specialist, KAYA Associates, Inc.
B.S., 2000, Environmental Science, Auburn University
Years of Experience: 9

Rachel Y. Jordan, Senior Environmental Scientist, KAYA Associates, Inc.
B.S., 1972, Biology, Christopher Newport College, Virginia
Years of Experience: 21

Edd V. Joy, Senior Environmental Planner, KAYA Associates, Inc.
B.A., 1974, Geography, California State University, Northridge
Years of Experience: 36

Amy McEniry, Technical Editor, KAYA Associates, Inc.
B.S., 1988, Biology, University of Alabama in Huntsville
Years of Experience: 20

Rickie D. Moon, Senior Systems Engineer, Teledyne Solutions, Inc.
M.S., 1997, Environmental Management, Samford University
B.S., 1977, Chemistry and Mathematics, Samford University
Years of Experience: 24

Paige Peyton, Senior Archaeologist, KAYA Associates, Inc.
Ph.D., (in progress), Research in Archaeology and Ancient History, University of Leicester, United Kingdom
M.A., 1990, Anthropology, California State University, San Bernardino
B.A., 1987, Anthropology, California State University, San Bernardino
Years of Experience: 26

Rebecca J. White, Environmental Specialist, KAYA Associates, Inc.
B.S., 2000, Civil/Environmental Engineering, University of Alabama in Huntsville
Years of Experience: 9

Barbara Young, Senior Environmental Scientist, KAYA Associates, Inc.
M.A., 1986, Geography, University of Maryland, College Park
B.A., 1978, Geography, Macalester College, St. Paul, MN
Years of Experience: 29

8.0 Agencies and Individuals Contacted

8.0 AGENCIES AND INDIVIDUALS CONTACTED

The National Environmental Policy Act regulations require that Federal, State, and local agencies with jurisdiction or special expertise regarding environmental impacts be consulted and involved in the National Environmental Policy Act process. Agencies involved include those with authority to issue permits, licenses, and other regulatory approvals. Other agencies include those responsible for protecting significant resources such as endangered species or wetlands. The agencies listed below were contacted during the preparation of this Environmental Assessment/Overseas Environmental Assessment.

Federal

Federal Aviation Administration
Honolulu Control Facility
Honolulu, HI

Federal Aviation Administration Western Service Area
Department of the Navy Representative
Renton, WA

U.S. Fish and Wildlife Service
Pacific Islands Office
Honolulu, Hawaii

National Marine Fisheries Service Pacific Islands Office
Honolulu, HI

Navy Region Hawaii
Joint Base Pearl Harbor-Hickam, HI

U.S. Navy, Pacific Fleet
Environmental Public Affairs Officer
Joint Base Pearl Harbor-Hickam, HI

U.S. Army Space Missile Defense Command
Deputy to SMDCEN, Environmental, Legal, Operations
Huntsville, AL

Missile Defense Agency-DPW
Aegis Ashore Missile Defense Program,
Legal, OCONUS Facilities Engineering Branch
Huntsville, AL

Navy Surface Warfare Center
Dahlgren, Missile Integration
Port Hueneme

State

State of Hawaii, DBED&T
Office of Planning
(Coastal Zone Management)
Honolulu, HI

Office of Hawaiian Affairs
Honolulu, HI

State Historic Preservation Officer
Department of Land and Natural Resources
Honolulu, HI

THIS PAGE INTENTIONALLY LEFT BLANK