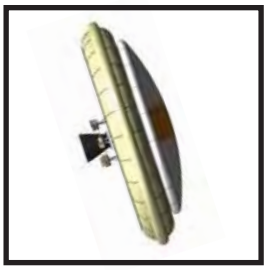
National Aeronautics and Space Administration
Low Density Supersonic Decelerator
Technology Demonstration Mission
Pacific Missile Range Facility



Environmental Assessment

Final

May 2013

Space Technology Mission Directorate
National Aeronautics and Space Administration
Washington, DC 20546

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National Aeronautics and Space Administration

Headquarters
Washington, DC 20546-0001

Reply to Attn of: Space Technology Mission Directorate

National Environmental Policy Act;
Low Density Supersonic Decelerator Technology Demonstration Mission

AGENCY: National Aeronautics and Space Administration (NASA), Space Technology Mission Directorate

ACTION: Finding of No Significant Impact

SUMMARY: Pursuant to the National Environmental Policy Act of 1969 (NEPA), as amended (42 U.S.C. 4321 et seq.), the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 CFR Parts 1500-1508), and NASA policy and regulations (14 CFR Part 1216 Subpart 1216.3), NASA has made a finding of no significant impact (FONSI) with respect to the proposed Low Density Supersonic Decelerator (LDSD) Technology Demonstration Mission (TDM). Accordingly, an Environmental Impact Statement is not required. This mission would involve the launch, operation, and recovery of up to four Test Vehicles from a designated location on the Pacific Missile Range Facility (PMRF). Each test would involve a Test Vehicle with a small solid rocket motor, launched on a high altitude balloon from PMRF. The baseline plan calls for one test in the summer of 2014, and up to three tests in the summer of 2015.

DATE: 29 May 2013

AVAILABILITY: The Environmental Assessment (EA) and FONSI prepared for the LDSD TMD mission are available at:

http://www.govsupport.us/nasaldsdea, or

http://netspublic.grc.nasa.gov/eadocuments.cfm, or

http://www.nasa.gov/mission_pages/tdm/ldsd/.

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SUPPLEMENTAL INFORMATION:

NASA has determined that the document entitled "National Aeronautics and Space Administration Low Density Supersonic Decelerator Technology Demonstration Mission Pacific Missile Range Facility Environmental Assessment" (hereinafter the "LDSD EA") adequately and accurately analyzes the potential environmental effects of the proposed action. The LDSD EA and its underlying documents are hereby incorporated by reference in this FONSI.

BACKGROUND: The National Aeronautics and Space Act of 1958, as amended (42 U.S.C. 2451(d)(1)(5)) establishes a mandate to conduct activities in space that contribute substantially to "[t]he expansion of human knowledge of the Earth and of phenomena in the atmosphere and space," and "[t]he preservation of the role of the United States as a leader in aeronautical and space science and technology and in the application thereof to the conduct of peaceful activities within and outside the atmosphere." In response to this mandate, NASA, in coordination with the National Academy of Sciences, has developed a prioritized set of science objectives to be met through a long-range program of spacecraft missions.

As part of a prioritized set of science programs, NASA is currently undertaking a long-term Mars Exploration Program (MEP). The MEP is fundamentally a science-driven program that focuses on understanding and characterizing Mars as a dynamic system and ultimately addressing whether life is, or was, a part of that system through a strategy referred to as "follow the water." The MEP would also ensure the development and demonstration of the technologies required to attain these goals.

The NASA Space Technology Mission Directorate (STMD) is responsible for direct management of NASA's Space Technology programs. NASA's Space Technology initiative develops and demonstrates advanced space systems concepts and technologies enabling new approaches to achieving NASA's current and future missions. The STMD and the Space Technology initiative complement the technology development activities within NASA's Mission Directorates, and deliver forward-reaching technology solutions for future NASA science and exploration missions and significant national needs.

The Jet Propulsion Laboratory (JPL) manages the LDSD TDM for NASA. The NASA Goddard Space Flight Center Wallops Flight Facility serves as the range operations and recovery agency for JPL on the Supersonic Flight Dynamics Test (SFDT) portion of the LDSD project. The United States Navy PMRF serves as the host range for the execution of the SFDT portion of the LDSD program. The NASA Columbia Scientific Balloon Facility is responsible for providing the balloon launch platform and launch services, and any required Federal Aviation Administration (FAA) transponders and strobes.

DESCRIPTION OF THE PROPOSED ACTION: The NASA JPL is proposing to conduct a series of SFDTs for NASA's LDSD Project from PMRF in Kauai, Hawaii. These proposed tests would consist of launch, operation, and recovery of up to four missions from a designated location on PMRF. The purpose of the tests is to demonstrate and evaluate development of new supersonic inflatable aerodynamic decelerator (SIAD) and Supersonic Ring-Sail (SSRS) parachute technologies. These tests would allow the SIAD and SSRS parachute to fly in the Earth's stratosphere at supersonic speed to simulate operation in the thin atmosphere of Mars. The Test Vehicle with its small solid rocket motor would be launched on a high altitude balloon from PMRF.

NO-ACTION ALTERNATIVE: Under the No-action Alternative, NASA would not conduct the Proposed Action. If in the future the agency decides to pursue the Proposed Action at a location other than PMRF, additional environmental analysis and documentation would be performed.

ENVIRONMENTAL EFFECTS: Fourteen areas of environmental consideration were initially evaluated for PMRF 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, visual aesthetics, and water resources. Ultimately, 7 of the 14 areas of environmental consideration were addressed for the Proposed Action at PMRF, 4 of the 14 areas of environmental consideration were addressed for Niihau, and 6 of the 14 areas of environmental consideration were addressed for Open Ocean. The Global Environment was also analyzed for the effect of the Proposed Action on greenhouse gases and global warming, and the stratospheric ozone layer.

Air Quality:

PMRF — Negligible temporary increases in air emissions would occur from the launch of the SFDT. Due to the limited size and scope of the Proposed Action, air quality impacts as a result of pre-launch, flight test, and post-flight test activities would be minor and transitory. The SFDT launches would be short-term, discrete events, thus allowing time between launches for emissions products to be dispersed. No other construction projects, which would occur in the same locations and timeframe, have been identified. The total direct and indirect emissions from the execution of the Proposed Action, therefore, are not likely to result in adverse cumulative impacts to the regional air quality.

Niihau — Resource not applicable and not analyzed for this location.

Open Ocean — Resource not applicable and not analyzed for this location.

Airspace:

PMRF — The LDSD program would consist of up to four missions, beginning in the summer of 2014 and ending in the summer of 2015. The LDSD launches would be short-term, discrete events managed by the PMRF Range Control Facility. The Proposed Action would not occur at the same time as other regional programs. No other projects in the region of influence have been identified that would have the potential for adverse cumulative impacts to airspace. The use of the required scheduling and coordination process for Notice to Airmen (NOTAMs) will lessen the potential for adverse impact. No incremental, additive adverse cumulative impacts to airspace use have been identified.

Niihau — Up to four overflights of Niihau from approximately June to July 2014 and June to August 2015 would not result in adverse impacts to the island's airspace. Approximately one flight would be conducted in 2014 and up to three in 2015.

Open Ocean — Launches are short-term, discrete events that are actively managed by PMRF range safety. The Proposed Action is not scheduled to occur at the same time as other regional programs. The use of the required scheduling and coordination process for area airspace, and adherence to applicable DoD directives and FAA regulations concerning issuance of NOTAMs and selection of the Test Vehicle firing areas and trajectories, lessens the potential for substantial incremental, additive, adverse cumulative impacts.

Biological Resources:

PMRF — Up to four LDSD vehicles would be launched from PMRF from approximately June to July 2014 and June to August 2015. The Proposed Action when combined with current and proposed launch activities would have little or no impact to biological resources. These combined activities would be performed at varying times and locations on PMRF and should have negligible cumulative impacts on biological resources. No substantial cumulative impacts to biological resources have been identified as a result of prior launches from PMRF. The Proposed Action would not affect the Papahanaumokuakea Marine National Monument.

Niihau — Up to four LDSD Test Vehicles would be launched from PMRF from approximately June to July 2014 and June to August 2015. These launches could potentially overfly Niihau, but are not anticipated to impact biological resources on the island. No substantial adverse cumulative impacts to biological resources are expected. The Proposed Action would not affect the Papahanaumokuakea Marine National Monument.

Open Ocean — The Proposed Action would not result in any direct impacts on the coral or degradation of water/sediment quality in the vicinity of the corals. PMRF strictly controls launches 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. Implementation of these controls minimizes the potential for cumulative impacts to marine species. No substantial adverse cumulative impacts are anticipated from the four planned LDSD launches. The Proposed Action would not affect the Papahanaumokuakea Marine National Monument.

Cultural Resources:

PMRF — Under the Proposed Action, identified historic properties are situated some distance from PMRF's Red Label Area launch point and would not be affected by LDSD activities.

Niihau — Under the Proposed Action, there are no known historic properties that would be affected at Niihau.

Open Ocean — Under the Proposed Action, there are no known historic properties that would be affected within the Open Ocean Area.

Hazardous Material and Waste:

PMRF —The pre-launch and launch activities represent routine types of activities at PMRF. Hazardous materials used and waste generated, as a result of the SFDT activities would not exceed the existing hazardous waste permit conditions on PMRF. Solid propellants used with the SFDT will be self-contained and not pose a risk of spill. The types of hazardous materials used and waste generated would be similar to those currently used and generated at PMRF and would follow existing PMRF Standard Operating Procedures. All hazardous waste would be disposed of in accordance with the PMRF Hazardous Waste Management Plan. Implementation of the Proposed Action would not introduce new types of hazardous materials and wastes. As a result, no substantial adverse impacts from the management of SFDT Project related hazardous materials and waste are anticipated.

Niihau — Resource not applicable and not analyzed for this location.

Open Ocean — The implementation of the Proposed Action would not introduce new types of hazardous materials and waste into the Open Ocean Area, and only small increases in quantities of previously introduced types of hazardous waste are expected. Therefore, no substantial adverse cumulative impacts from the management of hazardous waste and materials are expected in the Open Ocean Area.

Health and Safety:

PMRF — As a major established test range, PMRF routinely provides safety support and infrastructure for multiple test and training programs. All missions or projects are closely reviewed and analyzed to ensure that there are no unacceptable risks to the public, Government and military personnel, and contractors. The Proposed Action activities would not occur at the same time as other regional programs. PMRF range operations management would regulate the site preparation, operational, and post-flight activities to ensure that established safety procedures and protocols are followed. As such, no adverse cumulative impacts to health and safety are anticipated from the Proposed Action.

Niihau — Up to four LDSD vehicles would be launched from PMRF during approximately June to July 2014 and June to August 2015. These launches could potentially overfly Niihau, but are not anticipated to impact the health and safety of the residents on the island. No substantial adverse cumulative impacts are expected.

Open Ocean — Launches are short-term, discrete events that are actively managed by PMRF range safety. The Proposed Action is not scheduled to occur at the same time as other launch programs. The use of the required scheduling and coordination process for area airspace, and adherence to applicable DoD directives and FAA regulations concerning issuance of NOTAMs and selection of the Test Vehicle firing areas and trajectories, lessens the potential for substantial incremental, additive, health and safety adverse cumulative impacts. The Recovery operations would not adversely affect the health and safety of those involved with retrieving the Test Vehicle and the balloon.

Socioeconomics:

PMRF — The implementation of the Proposed Action would have a temporary positive impact on the local economy during each SFDT launch. There would be no adverse impact on the permanent population size, employment characteristics, schools, and type of housing available on island.

Niihau — Resource not applicable and not analyzed for this location.

Open Ocean — Resource not applicable and not analyzed for this location.

Water Resources:

PMRF — The amount of exhaust products from the SFDT that could potentially be deposited due to the Proposed Action would be small, and no cumulative impacts are expected. Test vehicle hardware, debris, and propellants that could fall into the ocean are expected to have only a localized, short-term effect on water quality. Because of the minimal risk from fuel or other hazardous material spill or leakage to occur during the Propose Action activities, no substantial adverse cumulative impacts to water resources are anticipated.

Niihau — Resource not applicable and not analyzed for this location.

Open Ocean — No cumulative effects to water resources are anticipated as a result of the Proposed Action. The effect of any rocket motor emission products deposited in the open ocean would be very transient due to the buffering capacity of seawater and dilution by ocean current mixing and would not be expected to result in any adverse cumulative effects.

For the Global Environment:

On a global basis, the Proposed Action would release a minute quantity of carbon dioxide compared to anthropogenic releases worldwide and the CEQ's draft threshold guidance. The limited amounts of emissions would not contribute significantly to cumulative global warming; however, any emissions of greenhouse gas represent an incremental increase that could have incremental effects on the global atmosphere. Because the LDSD launches would release little or no ozone depleting substance, there would be no adverse cumulative impacts on the stratospheric ozone layer.

CONCLUSION:

On the basis of the LDSD EA and underlying reference documents, the NASA has determined that the environmental impacts associated with this Proposed Action will not individually or cumulatively have a significant effect on the quality of the human environment. Accordingly, the requirements of NEPA and the CEQ Regulations, 40 CFR Parts 1500-1508 are fulfilled and an environmental impact statement is not required.

Michael J. Gazarik, Ph.D.
Associate Administrator
Space Technology Mission Directorate

May 10, 2013
Date

Executive Summary

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EXECUTIVE SUMMARY

Introduction

The National Aeronautics and Space Administration (NASA) has prepared this Environmental Assessment (EA) for the proposed launch, operation, and recovery of the Low Density Supersonic Decelerator (LDSD) Technology Demonstration Mission (TDM) at the U.S. Navy's Pacific Missile Range Facility (PMRF) on Kauai, Hawaii. The open ocean recovery location for the balloon is approximately 139 kilometers (75 nautical miles) due west of PMRF, and the recovery location for the Test Vehicle with parachute is approximately 56 kilometers (30 nautical miles) northeast of the balloon drop point. The Test Vehicle with parachute drop point is approximately 111 kilometers (60 nautical miles) off the northwest coast of PMRF. This EA is in compliance with the following statutes, regulations, and procedures:

- National Environmental Policy Act (NEPA) of 1969, as amended (42 United States Code [U.S.C.] 4321 et seq.)
- Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 Code of Federal Regulations [CFR] CFR Parts 1500-1508)
- NASA NEPA Implementing Regulation (14 CFR Part 1216.3)
- NASA Procedural Requirement 8580.1A, Implementing the National Environmental Policy Act and Executive Order 12114

Background

The National Aeronautics and Space Act of 1958, as amended (42 U.S.C. 2451(d)(1)(5)) establishes a mandate to conduct activities in space that contribute substantially to "[t]he expansion of human knowledge of the Earth and of phenomena in the atmosphere and space," and "[t]he preservation of the role of the United States as a leader in aeronautical and space science and technology and in the application thereof to the conduct of peaceful activities within and outside the atmosphere." In response to this mandate, NASA, in coordination with the National Academy of Sciences, has developed a prioritized set of science objectives to be met through a long-range program of spacecraft missions.

As part of a prioritized set of science programs, NASA is currently undertaking a long-term Mars Exploration Program (MEP). The MEP is fundamentally a science-driven program that focuses on understanding and characterizing Mars as a dynamic system and ultimately addressing whether life is, or was, a part of that system through a strategy referred to as "follow the water." The MEP is also responsible for the development and demonstration of the technologies required to attain these goals.

The NASA Space Technology Mission Directorate (STMD) is responsible for direct management of NASA's space technology programs. NASA's Space Technology Initiative, managed by the STMD, develops and demonstrates advanced space systems concepts and technologies enabling new approaches to achieving NASA's current and future missions. The STMD and the Space Technology Initiative complement the technology development activities within NASA's Mission Directorates, and deliver forward-reaching technology solutions for future NASA science and exploration missions and significant national needs.

The Proposed Action presented in this EA is a Supersonic Flight Dynamics Test (SFDT) campaign to be conducted at PMRF as a part of the NASA Jet Propulsion Laboratory (JPL) LDSD project. The NASA Goddard Space Flight Center Wallops Flight Facility serves as the mission integration and execution agency for JPL on the SFDT portion of the LDSD project. The PMRF would serve as the host range for the execution of the SFDT portion of the LDSD program. The NASA Columbia Scientific Balloon Facility is responsible for the 962,773 cubic meter (34 million cubic foot) scientific balloon serving as the mobile launch platform for JPL's Test Vehicles on the SFDT portion of the LDSD project.

Purpose and Need

NASA seeks to use atmospheric drag as a solution to the limitations of parachute-only deceleration systems in thin exoatmospheric (outside earth's atmosphere) environments, saving rocket engines and fuel for final maneuvers and landing procedures. The heavier planetary landers of tomorrow, however, would require much larger drag devices than those currently available to slow them down. Next-generation drag devices would also need to be deployed at higher supersonic speeds to safely land vehicle, crew, and cargo. NASA's LDSD TDM, led by JPL in Pasadena, California, would conduct full-scale, stratospheric tests of these breakthrough technologies in the Earth's stratosphere (which mimics Mars' thin atmosphere), to prove their value for future missions to Mars and potentially other solar system bodies.

Proposed Action

The NASA JPL is proposing to conduct SFDTs for NASA's LDSD Project with preparation and launches from PMRF. This proposed SFDT campaign would consist of launch, and operation of up to four missions and recovery of components that land in the ocean. The purpose of the SFDT campaign is to demonstrate and evaluate development of the new supersonic inflatable aerodynamic decelerator (SIAD) and supersonic ring-sail (SSRS) parachute technologies. These tests would allow the SIAD and SSRS parachute to fly in the Earth's stratosphere at supersonic speed to simulate operation in the thin atmosphere of Mars. The Test Vehicle would be launched on a high altitude balloon from PMRF.

No-action Alternative

Under the No-action Alternative, NASA would not conduct the Proposed Action. If in the future the agency decides to pursue the Proposed Action at a location other than PMRF, additional environmental analysis and documentation would be performed.

Alternatives Considered but Not Carried Forward

Based on the results of the NASA LDSD Range Selection Process and the summary presented in Chapter 2.0, two alternative test sites/ranges were considered but not carried forward:

- San Nicolas Island, CA was considered but not carried forward because the test site/range had fewer number of good launch days compared to PMRF and Woomera Test Range (WTR), Evetts Field that are conducive to the launch of the scientific balloon.

- WTR (Evetts Field) was considered but not carried forward; however, the test site/range is considered as a back-up location and if redefined of necessity as the baseline test site/range the requirements of Executive Order 12114, Environmental Effects Abroad of Major Federal Actions, would be followed.

Impact Assessment Methodology

Fourteen areas of environmental consideration were initially evaluated for PMRF 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, visual aesthetics, and water resources. Ultimately, 7 of the 14 areas of environmental consideration were addressed for the Proposed Action at PMRF. The remaining resources areas were not analyzed at PMRF for the reasons listed below. Additionally, 4 of the 14 areas of environmental consideration were addressed for Niihau, and 6 of the 14 areas of environmental consideration were addressed for the Open Ocean. The Global Environment was also analyzed for the effect of the Proposed Action on greenhouse gases and global warming, and the stratospheric ozone layer.

- **Cultural Resources:** No historic properties would be affected as a result of LDSD activities. At the PMRF Red Label Area, recorded archaeological and historical properties within 305 meters (1,000 feet) of the launch area include one World War II revetment, a World War II gun emplacement and a Japanese Cemetery. These properties are situated away from the launch point. Trenching has been proposed for a communication cable route from the proposed communication box to the viewing and memorial area. Naval Facilities Engineering Command (NAVFAC) determined that the undertaking does not have the potential to cause effects to listed, contributing, or eligible historic properties (specifically archaeological sites/objects/traditional cultural places), and has approved the action (see EA Appendix C).

None of the buildings and structures that would be used by the test campaign at either PMRF or Makaha Ridge are historic. The Kamokala Magazines have been previously determined to be historic; however, the storage of explosives and chemicals is in keeping with their historic function, and there are no modifications proposed for them under the LDSD test campaign.

Coastal dune areas, which are known to be sensitive for archaeological and traditional Native Hawaiian remains, particularly burials, are adjacent to the launch area; however, the closest known burial is approximately 610 meters (2,000 feet) northwest of the launch site.

The entirety of PMRF is sensitive for subsurface cultural resources, and there is always the potential for subsurface remains to be unexpectedly encountered during intentional or unanticipated ground disturbing activities. If any unexpected cultural resources are encountered during the proposed activities, the activities would cease in the immediate area and the PMRF Environmental Engineer would be notified. Subsequent actions and notifications would follow appropriate elements of guidance provided in the PMRF Integrated Cultural Resources Management Plan and its supporting documents. Such mitigating guidance could include, but not be limited to, archaeological monitoring; prohibition of construction equipment in areas other than established roadways, lay down, or other paved areas; and cultural briefings to project personnel regarding the sensitive nature of PMRF coast-dune and back bay areas. In addition, there are no known historic properties within the Area of Potential Effects for either Niihau or the Open Ocean Area.

- **Geology and Soils:** The Proposed Action does not require construction or other activities that might cause soil disturbance; therefore, there will be no impacts to geology and soils.

- **Land Use:** There are no planned changes to existing land use patterns. Airfield, storage, and maintenance activities associated with the Proposed Action are normal operations within the Red Label Area. The Proposed Action will be consistent to the maximum extent practicable with the Coastal Zone Management Program as authorized by the Coastal Zone Management Act of 1972. However, 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.

- **Noise:** Any change in noise levels is expected to be short-term and temporary and would not adversely affect people or animals.

- **Transportation:** Increased vehicular traffic related to the temporary increase in personnel associated with the LDSD SFDT campaign is not expected to negatively impact the level of service on roadways leading to and from PMRF. Waterways and air routes are routinely used to transport mission-required

personnel and equipment to PMRF and would experience little or no effect as a result of the Proposed Action activities.

- **Utilities:** The capacity of utilities in the Red Label Area is adequate to support LDSD SFDT campaign activities; therefore, there will be little or no adverse effects on water, wastewater, electrical, or other utility usage as a result of the Proposed Action.

- **Visual Aesthetics:** While the balloon and parachute may be visible for a brief time, no known potential impacts to "scenic views" in the region of influence are anticipated. The Proposed Action would not permanently alter the current scenic quality of the area in view of the balloon launch area.

Results

Table ES-1 summarizes the conclusions of the analyses made for each of the areas (PMRF, Niihau, and Open Ocean) of environmental consideration. Some results are labeled N/A (not applicable) because the resource is not affected by the Proposed Action and does not warrant analysis.

Table ES-1. Summary of Environmental Impacts

Resource Category	Pacific Missile Range Facility (PMRF)	Niihau	Open Ocean	Global Environment
Air Quality	No-Action: Under the No-action Alternative, NASA would not conduct the Proposed Action at PMRF. Proposed Action: Negligible temporary increases in air emissions would occur from the launch of the Supersonic Flight Dynamics Test (SFDT). Due to the limited size and scope of the Proposed Action, air quality impacts as a result of pre-launch, flight test, and post-flight test activities would be minor and transitory. The SFDT launches would be short-term discrete events, thus allowing time between launches for emissions products to be dispersed. No other construction projects, which would occur in the same locations and timeframe, have been identified. The total direct and indirect emissions from the execution of the Proposed Action, therefore, are not likely to result in adverse cumulative impacts to the regional air quality.	No-Action: Not applicable (N/A)* Proposed Action: N/A	No-Action: N/A Proposed Action: N/A	No-Action: Under the No-action Alternative, NASA would not conduct the Proposed Action at PMRF. Proposed Action: On a global basis, the Proposed Action would release a minute quality of carbon dioxide compared to anthropogenic releases worldwide and the Council on Environmental Quality (CEQ's) draft threshold guidance. The limited amounts of emissions would contribute negligibly to cumulative global warming; however, any emissions of greenhouse gas represent an incremental increase that could have incremental effects on the global atmosphere. Because the Low Density Supersonic Decelerator (LDSD) launches would release little or no ozone depleting substance, there would be no discernible adverse cumulative impacts on the stratospheric ozone layer.

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

Resource Category	Pacific Missile Range Facility (PMRF)	Niihau	Open Ocean	Global Environment
Airspace	No-Action: Under the No-action Alternative, NASA would not conduct the Proposed Action at PMRF. Proposed Action: The LDSD program would consist of up to four missions, beginning approximately in the summer of 2014 and ending in the summer of 2015. Approximately one flight would be conducted in 2014 and up to three in 2015. The LDSD launches would be short-term, discrete events managed by the PMRF Range Control Facility. The Proposed Action would not occur at the same time as other regional programs. No other projects in the region of influence have been identified that would have the potential for adverse cumulative impacts to airspace. The use of the required scheduling and coordination process for Notices to Airmen will lessen the potential for adverse impact. No incremental, additive adverse cumulative impacts to airspace use have been identified.	No-Action: Under the No-action Alternative, NASA would not conduct the Proposed Action at PMRF. Proposed Action: Up to four overflights of Niihau from approximately June to July 2014 and June to August 2015 would not result in adverse impacts to the island's airspace. Approximately one flight would be conducted in 2014 and up to three in 2015.	No-Action: Under the No-action Alternative, NASA would not conduct the Proposed Action at PMRF. Proposed Action: Launches are short-term, discrete events that are actively managed by PMRF range safety. The Proposed Action is not scheduled to occur at the same time as other regional programs. The use of the required scheduling and coordination process for area airspace, and adherence to applicable Department of Defense directives and FAA regulations concerning issuance of Notices to Airmen (NOTAMs) and selection of the Test Vehicle firing areas and trajectories, materially lessens the potential for substantial incremental, additive, adverse cumulative impacts.	No-Action: N/A Proposed Action: N/A

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

Resource Category	Pacific Missile Range Facility (PMRF)	Niihau	Open Ocean	Global Environment
Biological Resources	No-Action: Under the No-action Alternative, NASA would not conduct the Proposed Action at PMRF. Proposed Action: Up to four LDSD vehicles would be launched from PMRF from approximately June to July 2014 and June to August 2015. The Proposed Action when combined with current and proposed launch activities would have little or no impact to biological resources. These combined activities would be performed at varying times and locations on PMRF and should have negligible cumulative impacts on biological resources. No substantial cumulative impacts to biological resources have been identified as a result of prior launches from PMRF. The Proposed Action would not affect the Papahanaumokuakea Marine National Monument.	No-Action: Under the No-action Alternative, NASA would not conduct the Proposed Action at PMRF. Proposed Action: Up to four LDSD Test Vehicles would be launched from PMRF from approximately June to July 2014 and June to August 2015. These launches could potentially overfly Niihau, but are not anticipated to impact biological resources on the island. No substantial adverse cumulative impacts to biological resources are expected. The Proposed Action would not affect the Papahanaumokuakea Marine National Monument.	No-Action: Under the No-action Alternative, NASA would not conduct the Proposed Action at PMRF. Proposed Action: The Proposed Action would not result in any direct impacts on the coral or degradation of water/sediment quality in the vicinity of the corals. PMRF strictly controls launches 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. Implementation of these controls minimizes the potential for cumulative impacts to marine species. No substantial adverse cumulative impacts are anticipated from the four planned LDSD launches. The Proposed Action would not affect the Papahanaumokuakea Marine National Monument.	No-Action: N/A Proposed Action: N/A

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

Resource Category	Pacific Missile Range Facility (PMRF)	Niihau	Open Ocean	Global Environment
Cultural Resources	No-Action: N/A Proposed Action: N/A (Under the Proposed Action, identified historic properties are situated some distance from PMRF's Red Label Area launch point and would not be affected by LDSD activities.)	No-Action: Under the No-action Alternative, NASA would not conduct the Proposed Action at PMRF. Proposed Action: Under the Proposed Action, there are no known historic properties that would be affected at Niihau.	No-Action: Under the No-action Alternative, NASA would not conduct the Proposed Action at PMRF. Proposed Action: Under the Proposed Action, there are no known historic properties that would be affected within the Open Ocean Area.	No-Action: N/A Proposed Action: N/A
Hazardous Materials and Waste	No-Action: Under the No-action Alternative, NASA would not conduct the Proposed Action at PMRF. Proposed Action: The pre-launch and launch activities represent routine types of activities at PMRF. Hazardous materials used and waste generated as a result of the SFDT activities would not exceed the existing hazardous waste permit conditions on PMRF. Solid propellants used with the SFDT will be self-contained and not pose a risk of spill. The types of hazardous materials used and waste generated would be similar to those currently used and generated at PMRF and would follow existing PMRF Standard Operating Procedures. All hazardous waste would be disposed of in accordance with the PMRF Hazardous Waste Management Plan. Implementation of the Proposed Action would not introduce new types of hazardous materials and wastes. As a result, no substantial adverse impacts from the management of SFDT Project related hazardous materials and waste are anticipated.	No-Action: N/A Proposed Action: N/A	No-Action: Under the No-action Alternative, NASA would not conduct the Proposed Action at PMRF. Proposed Action: The implementation of the Proposed Action would not introduce new types of hazardous materials and waste into the Open Ocean Area, and only small increases in quantities of previously introduced types of hazardous waste are expected. Therefore, no substantial adverse cumulative impacts from the management of hazardous waste and materials are expected in the Open Ocean Area.	No-Action: N/A Proposed Action: N/A

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

Resource Category	Pacific Missile Range Facility (PMRF)	Niihau	Open Ocean	Global Environment
Health and Safety	No-Action: Under the No-action Alternative, NASA would not conduct the Proposed Action at PMRF. Proposed Action: As a major established test range, PMRF routinely provides safety support and infrastructure for multiple test and training programs. All missions or projects are closely reviewed and analyzed to ensure that there are no unacceptable risks to the public, Government and military personnel, and contractors. The Proposed Action activities would not occur at the same time as other regional programs. PMRF range operations management would regulate the site preparation, operational, and post-flight activities to ensure that established safety procedures and protocols are followed. As such, no adverse cumulative impacts to health and safety are anticipated from the Proposed Action.	No-Action: Under the No-action Alternative, NASA would not conduct the Proposed Action at PMRF. Proposed Action: Up to four LDSD vehicles would be launched from PMRF during approximately June to July 2014 and June to August 2015. These launches could potentially overfly Niihau, but are not anticipated to impact the health and safety of the residents on the island. No substantial adverse cumulative impacts are expected.	No-Action: Under the No-action Alternative, NASA would not conduct the Proposed Action at PMRF. Proposed Action: Launches are short-term, discrete events that are actively managed by PMRF range safety. The Proposed Action is not scheduled to occur at the same time as other launch programs. The use of the required scheduling and coordination process for area airspace, and adherence to applicable Department of Defense directives and Federal Aviation Administration regulations concerning issuance of NOTAMs and selection of the Test Vehicle firing areas and trajectories, lessens the potential for substantial incremental, additive, health and safety adverse cumulative impacts.	No-Action: N/A Proposed Action: N/A
Socio-economics	No-Action: Under the No-action Alternative, NASA would not conduct the Proposed Action at PMRF. Proposed Action: The implementation of the Proposed Action would have a small temporary positive impact on the local economy during each SFDT launch. There would be no adverse impact on the permanent population size, employment characteristics, schools, and type of housing available on island.	No-Action: N/A Proposed Action: N/A	No-Action: N/A Proposed Action: N/A	No-Action: N/A Proposed Action: N/A

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

Resource Category	Pacific Missile Range Facility (PMRF)	Niihau	Open Ocean	Global Environment
Water	No-Action: Under the No-action Alternative, NASA would not conduct the Proposed Action at PMRF. Proposed Action: The amount of exhaust products from the SFDT that could potentially be deposited due to the Proposed Action would be small, and no cumulative impacts are expected. Test Vehicle hardware, debris, and propellants that could fall into the ocean are expected to have only a localized, short-term effect on water quality. Because of the minimal risk from fuel or other hazardous material spill or leakage to occur during the Proposed Action activities, no substantial adverse cumulative impacts to water resources are anticipated.	No-Action: N/A Proposed Action: N/A	No-Action: Under the No-action Alternative, NASA would not conduct the Proposed Action at PMRF. Proposed Action: No cumulative effects to water resources are anticipated as a result of the Proposed Action. The effect of any rocket motor emission products deposited in the open ocean would be very transient due to the buffering capacity of sea water and dilution by ocean current mixing and would not be expected to result in any adverse cumulative effects.	No-Action: N/A Proposed Action: N/A

*N/A - Resource not applicable and not analyzed for this location.

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Acronyms and Abbreviations

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ACRONYMS AND ABBREVIATIONS

AAQS	Ambient Air Quality Standards
APE	Area of Potential Effect
Ar	Argon
ARTCC	Air Route Traffic Control Center
AST	Aboveground Storage Tank
ATC	Air Traffic Control
ATCRBS	Air Traffic Control Radar Beacon System
ATK	Alliant Techsystems Incorporated
ºC	Degrees Celsius
CEQ	Council on Environmental Quality
CFC	Chlorofluorocarbon
CFR	Code of Federal Regulations
CHRIMP	Consolidated Hazardous Material Reutilization and Inventory Management Program
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CONUS	Continental United States
COSIP	Coherent Signal Processor
CSBF	Columbia Scientific Balloon Facility
DGPS	Differential Global Positioning System
DoD	Department of Defense
DOE	Department of Energy
DON	Department of the Navy
DOT	Department of Transportation
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EGSE	Electronic Ground Support Equipment
EMR	Electromagnetic Radiation
EO	Executive Order
EOD	Explosive Ordnance Disposal
ESA	Endangered Species Act

ESQD	Explosive Safety Quantity-Distance
ºF	Degrees Fahrenheit
FAA	Federal Aviation Administration
FACSFACPH	Fleet Area Control and Surveillance Facility Pearl Harbor
FIR	Flight Image Recorder
FL	Flight Level
FM	Frequency Modulation
FONSI	Finding of No Significant Impact
FTS	Flight Termination System
FY	Fiscal Year
GG	Gas Generator
GHA	Ground Hazard Area
GHE	Ground Handling Equipment
GHG	Greenhouse Gas(es)
GLNMAC	Gimbal-mounted LN-200 with Sandia Miniature Airborne Computer
GPS	Global Positioning System
GSE	Ground Support Equipment
GSFC	Goddard Space Flight Center
H_2	Hydrogen
H_2O	Water
He	Helium
HERP	Hazards of Electromagnetic Radiation to Ordnance
HTPB	Hydroxyl-Terminated Polybutadiene
ICAO	International Civil Aviation Organization
ICRMP	Integrated Cultural Resources Management Plan
IFR	Instrument Flight Rules
ISR	Installation Restoration Program
ICBM	Intercontinental Ballistic Missile
ITAR	International Traffic in Arms Regulation
JPL	Jet Propulsion Laboratory
KIUC	Kauai Island Utility Cooperative
KTF	Kauai Test Facility
kW	Kilowatts
LDSD	Low Density Supersonic Decelerator

LEB	Launch Equipment Building
LOS	Line of Sight
MAB	Missile Assembly Building
MBTA	Migratory Bird Treaty Act
µg/m3	Micrograms Per Cubic Meter
MEP	Mars Exploration Program
MET	Meteorological
MHz	Megahertz
MIP	Micro Instrumentation Package
MMPA	Marine Mammal Protection Act
msl	Mean Sea Level
N_2	Nitrogen
NAAQS	National Ambient Air Quality Standards
NAS	National Academy of Sciences
NASA	National Aeronautics and Space Administration
NAVFAC	Naval Facilities Engineering Command
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
N_2O	Nitrous Oxide
nm	Nautical Mile
NO_2	Nitrogen Dioxide
NOx	Nitrogen Oxides
NOTAM	Notice to Airmen
NOTMAR	Notice to Mariners
NTSC	National Television System Committee
O_2	Oxygen
OEQC	Office of Environmental Quality Control
OML	Outer Mold Line
OTH	Over the Horizon
PDD	Parachute Deployment Device
PL	Public Law
PM-2.5	Particulate Matter with Aerodynamic Diameter Less than 2.5 Microns
PM-10	Particulate Matter with Aerodynamic Diameter Less than 10 Microns
PPM	Parts per Million

PMRF	Pacific Missile Range Facility
PMRFINST	Pacific Missile Range Facility Instruction
RCC	Range Commanders Council
RF	Radiofrequency
RIB	Rigid Inflatable Boat
ROCC	Range Operations Control Center
RTB	Return to Base
RUB	Range User Building
SFDT	Supersonic Flight Dynamics Test
SIAD	Supersonic Inflatable Aerodynamic Decelerator
SO_2	Sulfur Dioxide
SRM	Solid Rocket Motor
SSRS	Supersonic Ring-Sail
STMD	Space Technology Mission Directorate
TDM	Technology Demonstration Mission
THAAD	Terminal High Altitude Area Defense
TM	Telemetry
TP-H	Ammonium Perchlorate, Aluminum and Hydroxyl-terminated Polybutadiene
UDS	Universal Data System
UHF	Ultra-High Frequency
U.S.C.	United States Code
USCG	United States Coast Guard
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UST	Underground Storage Tank
VOC	Volatile Organic Compound
WFF	Wallops Flight Facility
WPRFMC	Western Pacific Regional Fishery Management Council
WTR	Woomera Test Range
ZPP	Zirconium Potassium Perchlorate

UNIT CONVERSION TABLE

Metric Unit		Conversion Factor		Imperial (English) Unit
centimeter	Multiply by:	0.393701	To convert to:	inch
meter		3.28084		foot
kilometer		0.539957		nautical mile*
kilometer		0.621371		mile
square meter		10.7639		square foot
hectare		2.47105		acre
cubic meter		1.307951		cubic yard
cubic meter		35.3147		cubic feet
microgram		3.5274×10^{-8}		ounce
milligram		3.5274×10^{-5}		ounce
gram		0.035274		ounce
kilogram		2.20462		pound
metric ton		0.984207		ton (long)

*Note: To convert miles into nautical miles multiply by 0.86897.

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1.0 Purpose and Need for Proposed Action

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1.0 PURPOSE AND NEED FOR PROPOSED ACTION

The National Aeronautics and Space Administration (NASA) has prepared this Environmental Assessment (EA) for the proposed launch, operation, and recovery of the Low Density Supersonic Decelerator (LDSD) Technology Demonstration Mission (TDM) at the U.S. Navy's Pacific Missile Range Facility (PMRF) on Kauai, Hawaii (Figure 1-1). The open ocean recovery location for the balloon is approximately 139 kilometers (75 nautical miles [nm]) due west of PMRF, and the recovery location for the Test Vehicle with parachute is approximately 56 kilometers (30 nm) northeast of the balloon drop point. The Test Vehicle with parachute drop point is approximately 111 kilometers (60 nm) off the northwest coast of PMRF. This EA is in compliance with the following statutes, regulations, and procedures:

- National Environmental Policy Act (NEPA) of 1969, as amended (42 United States Code [U.S.C.] 4321 et seq.)
- Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 Code of Federal Regulations [CFR] Parts 1500-1508)
- NASA NEPA Implementing Regulation (14 CFR Part 1216.3)
- NASA Procedural Requirement 8580.1A, Implementing the National Environmental Policy Act and Executive Order 12114

The LDSD mission would conduct full-scale, stratospheric tests of breakthrough technologies high above Earth to prove their value for potential future exoplanetary missions. This EA has been prepared to evaluate and discuss the potential environmental consequences of conducting these tests at PMRF.

1.1 BACKGROUND

The National Aeronautics and Space Act of 1958, as amended (42 U.S.C. 2451(d)(1)(5)) establishes a mandate to conduct activities in space that contribute substantially to "[t]he expansion of human knowledge of the Earth and of phenomena in the atmosphere and space," and "[t]he preservation of the role of the United States as a leader in aeronautical and space science and technology and in the application thereof to the conduct of peaceful activities within and outside the atmosphere." In response to this mandate, NASA, in coordination with the National Academy of Sciences (NAS), has developed a prioritized set of science objectives to be met through a long-range program of spacecraft missions. As part of the U.S. Space and Earth exploration effort, these missions are designed to be conducted in a specific sequence based on technological readiness, launch opportunities, timely data return, and a balanced representation of scientific disciplines. The purpose of these spacecraft missions is to

EXPLANATION

Proposed Launch Area
(not to scale)

Red Label Area
(not to scale)

NORTH

Overview of PMRF and the Western Shore Kauai

Hawaii

Figure 1-1

gather scientific information and to demonstrate advanced, low-cost technologies for exploring and utilizing space that meet NASA's objectives for Earth and Space Science.

As part of a prioritized set of science programs, NASA is currently undertaking a long-term Mars Exploration Program (MEP). The MEP is fundamentally a science-driven program that focuses on understanding and characterizing Mars as a dynamic system and ultimately addressing whether life is, or was, a part of that system through a strategy referred to as "follow the water."

The MEP is also responsible for the development and demonstration of the technologies required to attain these goals. Some of the technology developments and improvements over the course of the program would enable a progressive increase in the payload mass delivered to Mars orbit and surface by program spacecraft, enhance the capability to safely and precisely place payloads at any desired location on the surface, and enable full access to the subsurface, surface, and atmospheric regions (National Aeronautics and Space Administration, 2005). The NASA Space Technology Mission Directorate (STMD) is responsible for direct management of NASA's space technology programs. The STMD also serves as the NASA technology point of entry and contact with other Government agencies, academia, and the commercial aerospace community. The STMD is responsible for developing and executing innovative technology partnerships, technology transfer, commercial activities, and the development of collaboration models for NASA.

NASA's Space Technology Initiative, managed by the STMD, develops and demonstrates advanced space systems concepts and technologies enabling new approaches to achieving NASA's current and future missions (National Aeronautics and Space Administration, 2012a). The STMD and the Space Technology Initiative perform "push" technology development[1] and demonstration. Such push technologies are either crosscutting, in that they serve multiple NASA Mission Directorates, industry, and other Government agencies, and/or game-changing by enabling currently unrealizable approaches to space systems and missions. This approach is in contrast to the mission-focused technology development activities within the NASA Mission Directorates, which "pull" technology development based on established mission needs. The STMD and the Space Technology initiative complement the technology development activities within NASA's Mission Directorates, and deliver forward-reaching technology solutions for future NASA science and exploration missions and significant national needs.

The Proposed Action presented in this EA is a Supersonic Flight Dynamics Test (SFDT) campaign to be conducted at PMRF as part of the NASA Jet Propulsion Laboratory (JPL) LDSD project. The JPL manages the LDSD TDM for NASA. The NASA Goddard Space Flight Center (GSFC) Wallops Flight Facility (WFF) serves as the mission integration and execution agency for JPL on the SFDT portion of the LDSD project.

1 "Push technology" is defined as a situation where an emerging technology or a new combination of existing technologies provides the driving force for an innovative product and problem solution.

PMRF would serve as the host range for the execution of the SFDT portion of the LDSD program. The NASA Columbia Scientific Balloon Facility (CSBF) is responsible for the 962,773 cubic meter (34 million cubic foot) scientific balloon serving as the mobile launch platform for JPL's Test Vehicles on the SFDT portion of the LDSD project.

1.2 SCOPE OF ENVIRONMENTAL ASSESSMENT

This EA is prepared in compliance with the statutes and regulations previously listed that direct NASA officials to consider potential environmental consequences when authorizing or approving Federal actions. This EA evaluates the potential environmental effects of the proposed flight demonstrations of the LDSD technology. The EA identifies and addresses potential environmental impacts at PMRF and describes the selection process of PMRF from a list of reasonable alternative ranges. The EA also considers the No-action Alternative. If the No-action Alternative is chosen, the LDSD activities described in this EA would not take place at PMRF.

This EA addresses all of the reasonably foreseeable activities in the particular geographical areas potentially affected by the Proposed Action and the No-action Alternative and focuses on those activities ready for Federal and resource agency decisions. The majority of activities would use existing facilities and/or be on previously disturbed land.

Consistent with the CEQ regulations, the scope of the analysis presented in this EA was defined by the range of potential environmental impacts that would result from implementation of the Proposed Action or the No-action Alternative. Resources that may be impacted were considered in the EA analysis to provide the decision makers with sufficient evidence and analysis for evaluation of the potential effects of the action. For this EA, the environment is discussed in terms of seven resource areas. Each resource area is discussed at each location (PMRF, Niihau, and Open Ocean) and addressed in this EA proportionate to its potential for environmental impacts.

1.3 PURPOSE AND NEED OF THE PROPOSED ACTION

1.3.1 PURPOSE

NASA’s TDMs are used to bridge the gap between need and means, between scientific and engineering challenges and the technological innovations needed to overcome them, and between laboratory development and demonstration in space.

Once a technology is proven in the laboratory environment, the program becomes a bridge from ground to flight testing. System-level technology solutions are given the opportunity to operate in the actual space environment—where they gain operational heritage, reduce risks to future missions by eliminating the need to fly unproven hardware, and continue NASA’s long history as a technological innovator. These cutting-edge technologies allow future NASA missions to pursue bolder and more

sophisticated science, enable safe and rewarding human missions beyond low-Earth orbit, and enable entirely new approaches to United States space operations.

NASA seeks to use atmospheric drag as a solution to the limitations of parachute-only deceleration systems in thin exoatmospheric environments, saving rocket engines and fuel for final maneuvers and landing procedures. The heavier planetary landers of tomorrow, however, would require much larger drag devices than those currently employed to slow them down. The next-generation drag devices would also need to be deployed at higher supersonic speeds to safely land vehicle, crew, and cargo. NASA's LDSD TDM, led by JPL in Pasadena, California, would conduct full-scale, stratospheric tests of these breakthrough technologies in the Earth's stratosphere (which mimics Mars' thin atmosphere), to prove their value for future missions to Mars and potentially other solar system bodies.

The goal of NASA's LDSD TDM is to address the lack of technology development in the area of descent. The specific LDSD project top level objectives are as follows:

- Develop new supersonic inflatable decelerator and supersonic parachute technologies
  - 6 and 8-meter (19.7 and 26.2-foot) diameter Mach 3.5 (ratio of the speed of a body to the speed of sound) inflatable decelerators
  - 33.5-meter (109.9-foot) diameter Mach 2+ supersonic ringsail (SSRS) parachute with non-mortar deployment
- Enable sending future larger payloads to higher elevations on Mars, with greater precision
  - 2 to 2.7 metric tons (2.2 to 3.0 tons) for science and human precursor and cargo missions
  - Kilometers to meters (miles to feet) precision, and +1 kilometer (0.6 mile) Mars Orbiter Laser Altimeter altitude
- Pave the way for technology development for human missions
- Fly in the Earth's stratosphere at supersonic speeds to simulate operation in the thin atmosphere of Mars

A high-altitude balloon lofts the 3,175-kilogram (7,000-pound) Test Vehicle, with a solid rocket motor, to 36,576 meters (120,000 feet), and the rocket fires to send it to 54,864 meters (180,000 feet) at Mach 4 (4,900.2 kilometers per hour or 3,044.8 miles per hour).

The LDSD technology objectives would align with NASA's goals of technology testing for enabling future space exploration and validating technologies that could be used to safely land vehicles, crew, and cargo on other planetary bodies. Conducting full-scale tests of these technologies in the Earth's stratosphere could prove the value of these

technologies for potential Mars missions. The LDSD TDM would provide breakthrough technology research for Mars exploration that would allow the capability to expand payload mass, increase the accuracy of landings, and increase the range of safe landing sites at higher altitudes, to enhance future science expeditions.

The technology testing would begin approximately June to July 2014 and be completed by approximately June to August 2015.

1.3.2 NEED

NASA plans for ambitious new robotic missions to Mars and is laying the groundwork for even more complex human science expeditions in the future. The spacecraft needed to land safely on Mars' surface would necessarily require increasingly larger payloads to accommodate extended stays on the Martian surface. NASA has continuously used a parachute-based deceleration system since the Viking Program, which put two landers on Mars in 1977. The Mars Science Laboratory "Curiosity" rover, the most massive Mars payload yet, landed successfully using this same system in August 2012. New technology beyond the current parachute-based deceleration systems is needed to slow even larger, heavier landers from the supersonic speeds of atmospheric entry to subsonic surface-approach speeds for Mars.

As expressed by the Space Studies Board's Committee on the Planetary Science Decadal Survey in *Vision and Voyages for Planetary Science in the Decade 2013-2022,* a technology development program is considered one of the highest priority activities for the upcoming decade in support of the MEP. The report emphasized the need for a focused technology program that includes the development of new and improved capabilities for entry, descent, and landing in a variety of surfaces and atmospheres including Venus and Mars. The Space Studies Board further elaborates that the continued success of NASA planetary exploration is dependent on a "robust, stable technology development program" emphasizing key investment technologies that do not currently exist. (Space Studies Board, 2011)

1.4 COORDINATING AGENCY

NASA, as the lead agency for preparation of this EA, has requested the cooperation of the U.S. Navy. A cooperating agency, as defined in 40 CFR §1508.5, is "any Federal agency other than a lead agency which has jurisdiction by law or special expertise with respect to any environmental impact involved in a proposal (or a reasonable alternative) for legislation or other major Federal action significantly affecting the quality of the human environment." The U.S. Navy is a coordinating agency in the preparation of this EA since the PMRF facilities and range have been selected as the baselined location for the LDSD SFDT campaigns.

The LDSD is being developed under the NASA Headquarters STMD and is neither associated with any Department of Defense (DoD) program nor using any repurposed weapons technology. The LDSD project is not regulated by any of the following

treaties: Strategic Arms Reduction Treaty, Intermediate-Range Nuclear Forces Treaty, Open Skies Treaty, Anti-ballistic Missile Treaty, or Chemical Weapons Convention.

1.5 PUBLIC NOTIFICATION AND REVIEW

In accordance with the CEQ, NASA, and DoD regulations for implementing the NEPA, NASA is soliciting comments on this Draft EA from interested and affected parties. A Notice of Availability for the Draft EA was published in the newspapers identified in Table 1-1:

Table 1-1. Local Newspapers

Country or State	City/Town	Newspaper
Hawaii	Kauai	*The Garden Island*
	Honolulu	*Star Advertiser*
	Honolulu	*Environmental Notice, Office of Environmental Quality Control*

Copies of the Draft EA have been placed in local libraries and are available over the Internet at https://govsupport.us/nasaldsdea. Appendix A lists agencies, organizations, and libraries that have been sent a copy of the Draft EA.

1.6 DECISION(S) TO BE MADE

The decision(s) to be made are based in part on the analysis presented in the Draft EA. Following the public review period (as specified in the newspaper notices), NASA will consider public and agency comments received to decide whether to (1) issue a Finding of No Significant Impact, which would allow the Proposed Action to proceed; or (2) conduct additional environmental analysis (if needed); or (3) select the No-action Alternative; or (4) prepare a Notice of Intent to prepare an Environmental Impact Statement.

1.7 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 to ensure NEPA and Executive Order (EO) 12114, Environmental Effects Abroad of Major Federal Actions, compliance include the following:

- Pacific Missile Range Facility Integrated Natural Resources Management Plan, November 2010
- Final Programmatic Environmental Assessment NASA Scientific Balloon Program, September 2010

- Hawaii Range Complex Environmental Impact Statement/Overseas Environmental Impact Statement, May 2008; and Record of Decision, June 2008
- Pacific Missile Range Facility Integrated Cultural Resources Management Plan, April 2005
- Mars Exploration Program Programmatic Environmental Impact Statement, June 2004
- Development and Demonstration of the Long Range Air Launch Target System Environmental Assessment, October 2002
- NASA Final Supplemental Environmental Impact Statement for Sounding Rocket Program, 1998; and Record of Decision, 30 June 2000
- Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement, December 1998

2.0 Description of Proposed Action and Alternatives

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2.0 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

This chapter describes the Proposed Action (Section 2.1), Test Description and Procedures (Section 2.2), Launch Trajectory (Section 2.3), Launch Operation (Section 2.4), the No-action Alternative (Section 2.5), and Site Selection Process and Alternatives Considered But Not Carried Forward (Section 2.6).

2.1 PROPOSED ACTION

The NASA JPL is proposing to conduct SFDTs for NASA's LDSD Project from the Department of Navy's PMRF. This proposed test campaign would consist of launch, operation, and recovery of up to four missions from a designated location on PMRF. The purpose of the SFDT campaign is to demonstrate and evaluate development of new supersonic inflatable aerodynamic decelerator (SIAD) and SSRS parachute technologies. These tests would allow the SIAD and SSRS parachute to fly in the Earth's stratosphere at supersonic speed to simulate operation in the thin atmosphere of Mars. The Test Vehicle with a small solid rocket motor would be launched on a high altitude balloon from PMRF. Figure 2-1 provides an illustration of the LDSD test operational sequence at PMRF.

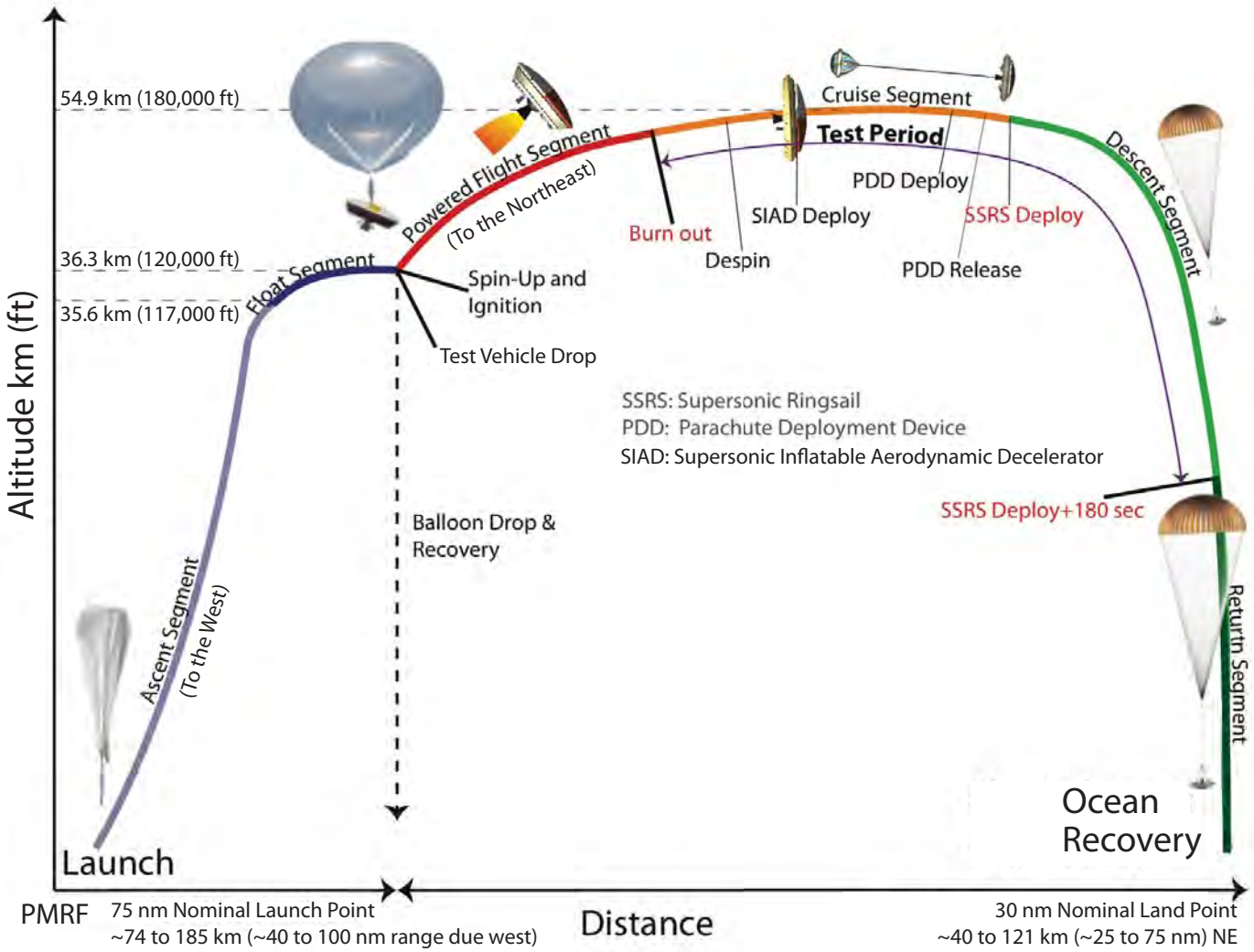
2.2 TEST DESCRIPTION AND PROCEDURES

2.2.1 TEST DESCRIPTION AND PROCEDURES OVERVIEW

2.2.1.1 Supersonic Flight Dynamic Test Overview

Each SFDT would be a full-scale drop of the Test Vehicle from a high-altitude balloon at approximately 36,576 meters (120,000 feet). After Test Vehicle drop, small solid-fuel spin motors would ignite and spin the Test Vehicle for stability ahead of the main motor ignition. The main motor for all SFDTs would be the Alliant Techsystems Incorporated (ATK) manufactured Star 48 solid-fueled rocket engine. The Star 48 would be ignited, propelling the Test Vehicle upward to a maximum altitude of 54,864 meters (180,000 feet) at a speed of approximately Mach 4. The Test Vehicle would then deploy its SIAD in order to slow descent to approximately Mach 2.5 where a ballute would be deployed. The ballute (a combination of a balloon and parachute) would then deploy the Test Vehicle's SSRS parachute between Mach 2 to 2.2, carrying the Test Vehicle safely for a controlled water impact/splashdown (Figure 2-1).

Operation of the balloon launch platform would terminate following deployment of the Test Vehicle via a "terminate command." The terminate command would cause the balloon to open up, releasing the lift gas, and allow the assembly to fall. The balloon launch platform, Test Vehicle, and Flight Image Recorder would be recovered. The SFDT campaign would consist of up to four flights from approximately June to July 2014



Supersonic Flight Dynamics Test Sequence

Figure 2-1

and June to August 2015. One flight would be conducted in 2014 and up to three in 2015. The baseline plan for the test campaign is described below:

- Risk Reduction Flight
  - Single Flight
  - Planned Date: Summer 2014
  - Would test the 6 meter (19.7 foot) diameter SIAD and SSRS parachute.
- Flights for Record
  - Up to three flights
  - Planned Date: Summer 2015
  - Would incorporate lessons learned from the risk reduction flight.
  - Would test the 6 meter and 8 meter (19.7 foot and 26.2 foot) diameter SIADs and SSRS parachute

2.2.1.2 Test Vehicle System Information Overview

The static balloon launch technique would not require a mobile launch vehicle/tower for suspension and launch of the balloon carrying the Test Vehicle. The Test Vehicle is suspended from a vertical tower structure approximately 24.4 meters (80 feet) in height that remains stationary during the launch process. The Test Vehicle would be suspended from an approximately 4.6-meter (15-foot) long horizontal jib boom mounted on the tower to provide adequate Test Vehicle /tower clearance. The current design calls for the jib to be movable so it can slide up and down the tower on a rail system. This would allow Test Vehicle suspension from the jib at the bottom tower position. The jib and Test Vehicle would be elevated to the top of the tower with a hoist and locked into position with a mechanical locking system. The tower would be mounted to a heavy mobile platform stabilized with ballast and hydraulic outriggers. The tower could be lowered to the horizontal position when not in use. The roughly 24.4-meter (80-foot) tower height and corresponding increased Test Vehicle ground clearance (approximately 15.2 meters [50 feet]) would eliminate the potential for the Test Vehicle to strike the ground at nominal (according to plan or design) release angles of the erect balloon system (approximately 15 degrees from vertical).

The static launch technique would use an approximately 61-meter (200-foot) long anchor line to connect the balloon base fitting to an anchor point on the rear of the launch tower. This line would carry the maximum balloon inflation load of 6,577 kilograms (14,500 pounds) of helium during inflation and would be severed by a guillotine cutter shortly after spool release of the balloon. The sole purpose of the anchor line would be to remove the balloon inflation load from the tower.

The static launch tower and associated support hardware would consist of the following:

- Launch Spool: Would restrain the balloon bubble during inflation and allow it to be erected to the appropriate launch mark as helium is put into the balloon.

- Launch Tower: Would suspend the Test Vehicle at a height so that the Test Vehicle would not strike the ground during launch as the balloon becomes vertical or nearly vertical after spool release. The approximate tower height is 80 feet, but the actual height would be determined by a yet to be defined set of wind speed and direction constraints in the first approximately 305 meters (1,000 feet) above the surface.
- Center Pivot Transport Table: Would support the balloon after layout and during inflation. It has drive wheels capable of rotating the entire balloon and flight train to align the system with the wind immediately prior to launch.

Figure 2-2 depicts a notional illustration of the launch tower and associated support hardware.

2.2.2 BALLOON LAUNCH PLATFORM

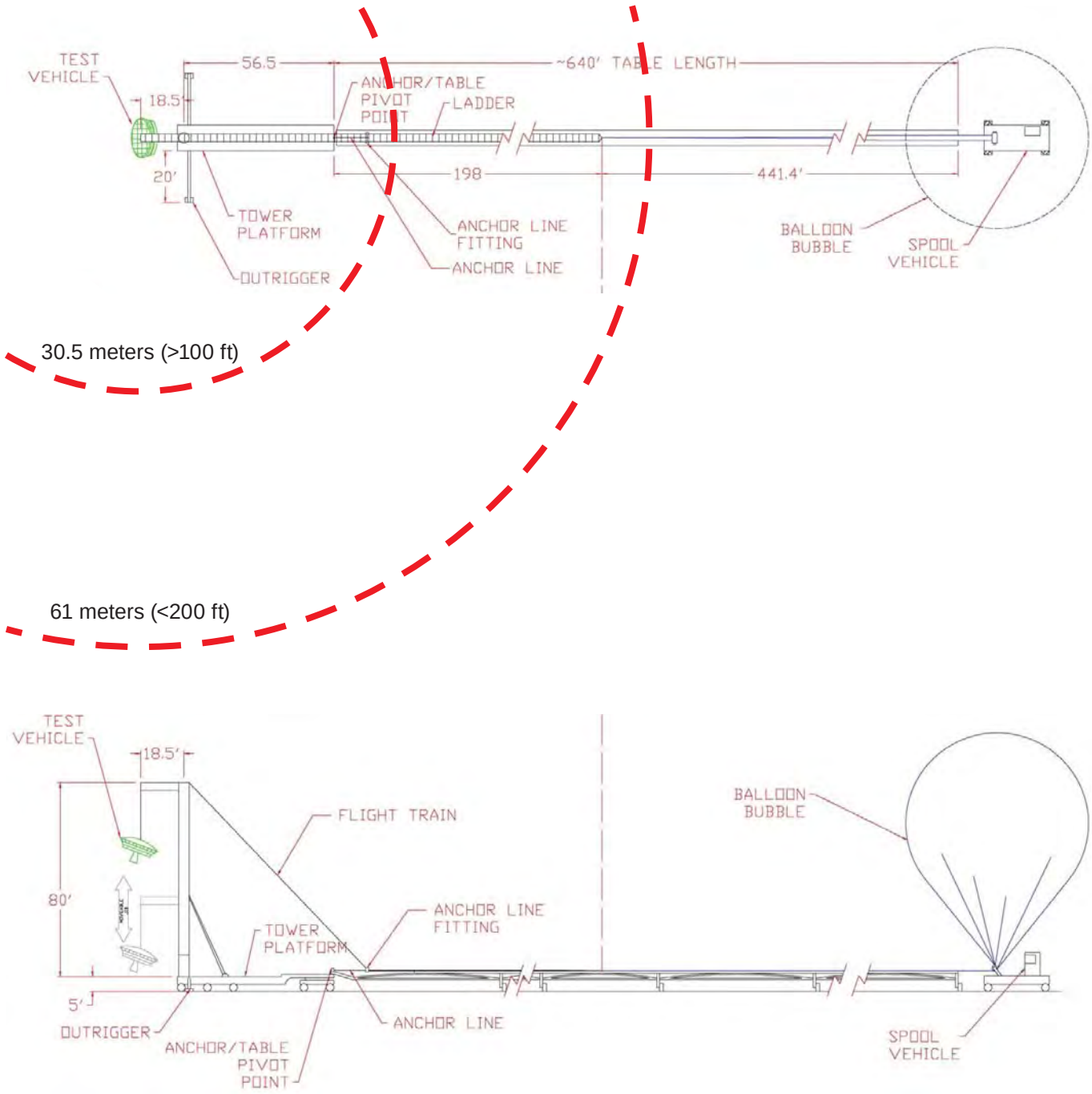
The balloon launch platform is capable of lifting the Test Vehicle to the desired altitude of 36,576 meters (120,000 feet) at which point the Star 48 rocket motor would propel the Test Vehicle to the final desired altitude and velocity. The LDSD balloon train design configuration differs from conventional and long duration balloon trains. The LDSD balloon train design configuration does not have a parachute for descent of the flight train after Test Vehicle release. The total mass allocation for the balloon train is approximately 434 kilograms (957 pounds). The balloon lift capacity is 3,629 kilograms (8,000 pounds), allowing a 434-kilogram (957-pound) balloon train, a 2,995-kilogram (6,603-pound) Test Vehicle, and a 200-kilogram (441-pound) unallocated margin. CSBF would provide the necessary helium used to inflate the balloon. The gaseous helium would be contained in a number of tube trailers.

The balloon launch platform would be equipped with an Air Traffic Control Radar Beacon System should the Federal Aviation Administration (FAA) require it. This system would be used by local FAA Air Traffic Control to enhance surveillance radar monitoring and separation of air traffic.

The balloon launch platform would be equipped with a Micro Instrumentation Package (MIP). The MIP would provide uplink and downlink communications, housekeeping information (including global positioning system [GPS] position), ballasting, and balloon termination. For uplink and downlink telemetry (TM), the MIP would use a Line of Sight (LOS) Ultra-High Frequency (UHF) transceiver and an Iridium unit for Over the Horizon (OTH) commanding and TM.

2.2.3 SFDT TEST VEHICLE

The SFDT Test Vehicle is designed as a full-scale representation of the re-entry surface of a Mars planetary deployment capsule. Its dimensions are based on the Outer Mold Line (OML) of the Mars Sample Return design reference vehicle and the Orion Multi-Purpose Crew Vehicle. The Test Vehicle would be equipped with a C-band beacon for radar tracking.



Source: National Aeronautics and Space Administration, 2012b

EXPLANATION

Explosive Safety Quantity-Distance (ESQD)
30.5m to 61m (>100 ft to <200 ft)

Notional Launch Tower and Associated Support Hardware

20 feet 50 feet 100 feet 200 feet

Figure 2-2

The SFDT Test Vehicle would consist of two TM downlink systems. Both systems would operate at S-band in the frequency range of 2,200-2,300 megahertz (MHz). The first system would downlink all TM data and consist of a Frequency Modulation (FM) transmitter. This transmitter would be connected to two circularly polarized slot antennas mounted in a diametrically opposed configuration on the outer circumference of the Test Vehicle via an equal split power divider. The antenna configuration maximizes overall antenna coverage around the vehicle to ensure that links can be maintained with the PMRF ground stations at Makaha Ridge/Kokee Park.

The second S-band downlink system would be for downlink of National Television System Committee (NTSC) standard video. The transmitter and antenna configuration are identical to the TM system but would be independent. The S-Band video FM transmitter would receive an NTSC video signal from the video multiplexer for downlink to the ground stations at PMRF. The video system would be powered-on once the balloon has reached float altitude to minimize power consumption during the flight.

Each microcontroller, through its transceiver, can receive commands at any time from the balloon Electronic Ground Support Equipment (EGSE) except when the transceiver is transmitting a data packet. The MIP data packets typically are transmitted once every 30 seconds and last an average of 5 seconds.

The Test Vehicle tower will have an Explosive Safety Quantity–Distance (ESQD) of less than 61.0 meters (200 feet). The exact Ground Hazard Area (GHA) for the test would be determined prior to the launch and is not anticipated to extend beyond the current restricted easement.

2.2.4 OPERATION FACILITIES

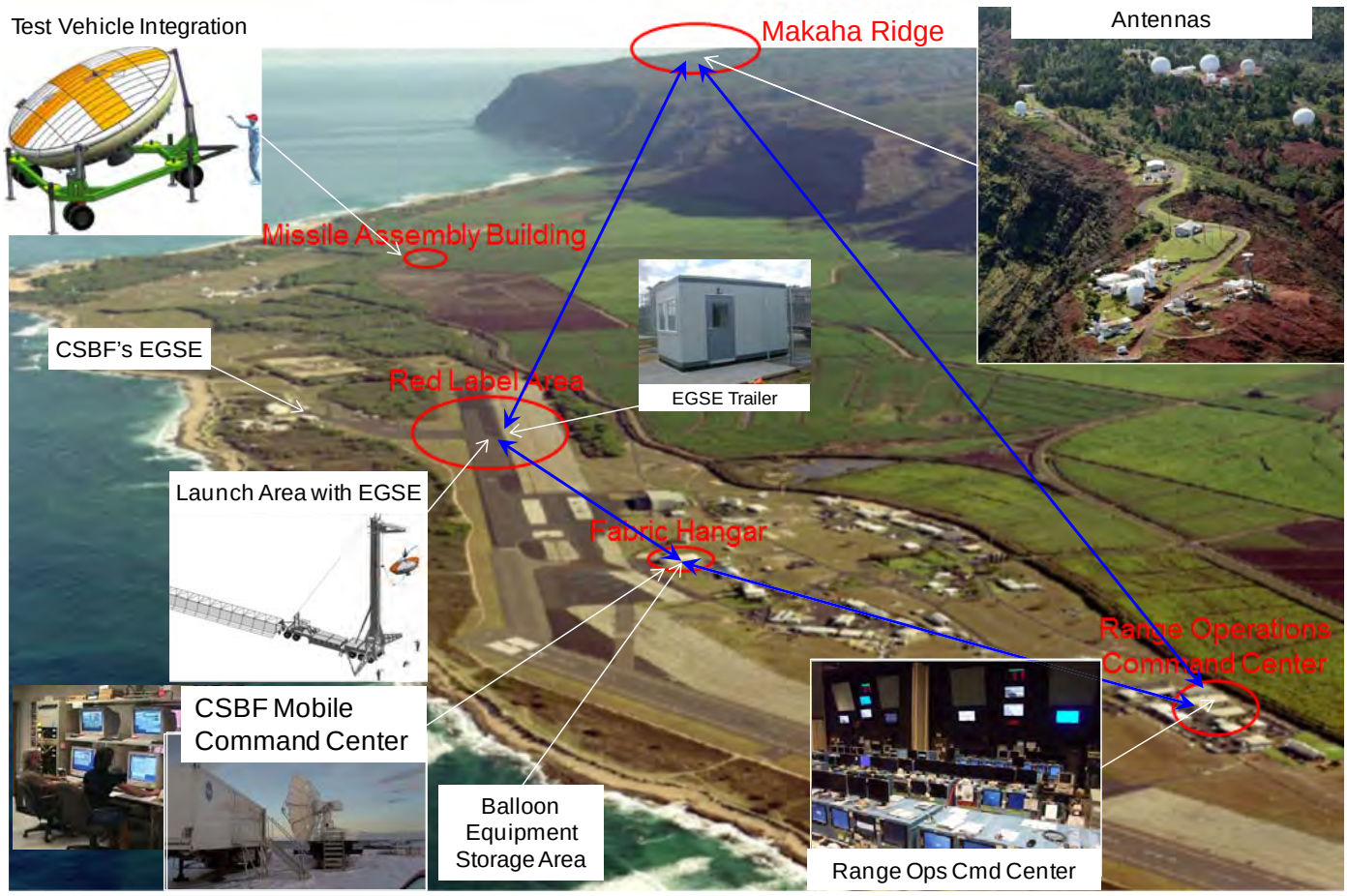
Any appropriate and available operation facility could be used for the proposed SFDT. Figure 2-3 provides an overview of the primary operation facilities, described below, for the proposed SFDT.

Balloon Launch Pad Area

The Balloon Launch Pad Area would be the airfield Red Label Area. The existing explosive siting accommodates the SFDT ordnance items. Figure 2-4 provides an on-the-ground view of the Balloon Launch Pad Area, and Figure 2-5 illustrates two sample balloon system layouts for the SFDT.

Balloon Processing Facility—Building 376

The Balloon Processing Facility (Building 376) would be used as the airfield fabric hangar and the balloon equipment storage area. The building would be equipped with air conditioning, phones/internet, power, and grounding.



Source: National Aeronautics and Space Administration, 2012b

Primary Operation Facilities for the Supersonic Flight Dynamics Test

Figure 2-3

Source: National Aeronautics and Space Administration, 2012b

EXPLANATION

Proposed Launch Area

Red Label Area

Balloon Launch Pad Area

Figure 2-4

Source: National Aeronautics and Space Administration, 2012b

EXPLANATION

◯ Red Label Area

Sample Balloon System Layouts

Figure 2-5

CSBF Mobile Command Center

The CSBF Mobile Command Center would be located in the same area as the Balloon Processing Facility.

Kamokala Magazines

The Kamokala Magazines are located approximately 3.2 kilometers (2 miles) east of PMRF Main Base and are a secure explosive storage area consisting of 10 magazines.

Launch Equipment Building (LEB)/Electronic Ground Support Equipment (EGSE) Trailer

This building would be a deployable building (either a conex/shipping and storage box or transportable guard stack). Power and communications would be run above ground on as needed basis to minimize impact to airfield operations. The LEB would be air conditioned with approximately 5.6 cubic meters (200 cubic feet) of interior space. This EGSE trailer would be located in the Red Label Area and connected by umbilical to the Test Vehicle.

Building 453

The building would be used to house the CSBF's EGSE.

Meteorological (MET) Sounding Rocket Processing and Launch Facilities—Building 573

The building would be equipped with air conditioning, phones/internet, power, grounding and a 25-ton crane. The building has a 90,718-kilogram (200,000 pound) net explosive weight hazard class 1.3 explosives rating.

Test Vehicle Processing Facility—PMRF Missile Assembly Building (MAB) Building 590

The building is equipped with air conditioning, phones/internet, power, grounding and a 3-ton crane. The building has a 13,608-kilogram (30,000 pound) net explosive weight hazard class 1.3 explosives rating. The Test Vehicle integration would be performed in this building. The JPL EGSE would be located in or around Building 590.

Range Operations Command Center (ROCC)—Building 105

This is a secure facility with restricted access. The facility provides for command, control, and communication among various mission elements during launch operations. Building 105 would provide VIP viewing areas outside of the control room with access to displays and monitoring of voice communications.

2.2.5 TEST VEHICLE SYSTEM ORDNANCE ITEMS AND STORAGE

2.2.5.1 Ordnance Items

Table 2-1 summarizes ordnance devices and their total estimated explosive weight and material.

Table 2-1. Ordnance Devices and Total Estimated Explosive Weight and Material

Location/ Function	Device	Quantity	Cartridge/Booster & Quantity (Per Device)	Category	Total Estimated Explosive Weight and Material
SFDT TEST VEHICLE					
Main Motor	STAR 48	1	(See Spin Motor Initiators)	A*	3,545 kilograms (7,185 pounds) (nominal), TP-H-3340 (nominal): TP-H-3340 is 71% ammonium perchlorate (NH_4ClO_4), 18% aluminum, and 11% HTPB, (hydroxyl-terminated polybutadiene— polymerized C_4H_6).
Main Motor Safe and Arm Device	Redundant electro-mechanical S&A	1	(2) Electro-Explosive Detonators (EEDs)	A*	EEDs initiate detonation waves in Explosive Transfer Lines leading to Thru-Bulkhead Initiators on main motor.
Spin Motors	Nammo Talley P/N 50579	8	See below	A*	<11 kilograms (< 24.3 pound-mass) TP-H-3498 (estimate)
Spin Motor Initiators		12 (max)	(2) NSI/Boosters w/ (1) NSI ea.	A*	TP-H-3498 (estimated) weight. included in above mass
Camera Lens Cover	0.64-centimeter (0.25-inch) Cutter	5	Integral Initiator	A*	100 milligrams (0.004 ounce) zirconium potassium perchlorate (ZPP)
FADS Pyro Valve		1			
Balloon Interface	4-centimeter (1.6-inch) Sep Nut	1	(2) NSI/Boosters w/ (1) NSI ea.	A*	228 milligrams (0.008 ounce) ZPP - 70 mg (0.002 ounce) HT
SIAD					
Inflation System Gas Generators (GG)	Autoliv APH-1a Hybrid Inflator	27 (CBE)	A7ZR 2.1 Hybrid Initiation System	A*/B**	44 grams (1.6 ounces) MNP-352 per GG (1.188 kilogram total for 27 GGs) 1 gram(0.035 ounce) $BKNO_3$ per GG (27 g total for 27 GGs) 260 milligrams (0.009 ounce) ZPP per GG (7.02 grams total for 27 GGs)
R/R Cutters	Line Cutter H5	2	(1) igniter charge Zirconium/Iron Oxide/ Magnesium Oxide		Total Net Explosive Wt: 120 milligrams (0.004 ounce) per device, Delay – zirconium nickel alloys/potassium perchlorate/barium chromate

Table 2-1. Ordnance Devices and Total Estimated Explosive Weight and Material (Continued)

Location/ Function	Device	Quantity	Cartridge/Booster & Quantity (Per Device)	Category	Total Estimated Explosive Weight and Material
PARACHUTE					
Ballute Gas Generator (GG)	Gas Generator	1	(2) NSIs, 1 booster charge 1-gram (0.035-ounce) Double Base Propellant	A*	20 grams (0.7 ounce) Double Base Propellant
Counter Balance GG	Gas Generator	1	(2) NSIs, 1 booster charge 1-gram (0.035-ounce) Double Base Propellant	A*	20 grams (0.7 ounce) Double Base Propellant
Parachute Deployment Device Bridle Line Pin Puller	6.8-centimeter (2.7-inch) pin puller	3	(2) NSIs each	B**	684 milligrams (0.024 ounce) ZPP
Confluence Fitting Cutter	0.64-centimeter (0.25-inch) Cutter	1	Integral Initiator	B**	20 milligrams (0.0007 ounce) ZPP
SSRS Pack Tie Down Cutter	0.64-centimeter (0.25-inch) Cutter	1	Integral Initiator	B**	20 milligrams (0.0007 ounce) ZPP

*A= This category of material presents a fire hazard. It includes propelling charges, bag charges, rocket motors, pyrotechnics, and small arms ammunition. Category A material should be separated from materials in the other categories (B through E) by at least 107 meters (350 feet).
**B=. This category of material presents fire and fragment or fragment and explosion hazards. It includes fixed ammunition, separate loading projectiles, complete rockets (assembled or unassembled), grenades, and mortars. Category B material should be separated from materials in the other categories by at least 107 meters (300 feet).
NOTE:
1. Mass properties qualities in chart are to be considered as estimates only.
2. Category of Ordnance may change once installed in the Test Vehicle. All devices considered Cat 'A' when being handled prior to installation.

NASA would provide 16 Super Loki Rockets to be used during launch operations at PMRF to collect MET data above 30,480 meters (100,000 feet). The use of the Super Loki Rockets has been analyzed under other/previous PMRF NEPA documentation. The rockets are expected to sink to the ocean floor and therefore would not be recovered. The Super Loki rocket motor consists of an aluminum case with an internal burning cast-in-the-case solid propellant. The propellant fuel is a polysulfide polymer, and the oxidizer is ammonium perchlorate. The igniter would consist of two parallel 1-watt/1-ampere no-fire squibs and an appropriate ignition charge. The igniter would be separable from the motor and would be installed at the launch site. NASA would ship all 16 rockets at once via government transport equating to a total explosive weight of approximately 295 kilograms (650 pounds) of hazard classification 1.3 ordnance.

2.2.5.2 Ordnance and Propellant Storage

Solid propellant and other chemical constituents would be used during the SFDT process. Storage of the various mission related ordnance items, during operations at PMRF and potentially between mission campaigns, would be at the Kamokala magazines area (Figure 2-6).

2.2.6 TEST VEHICLE INSTRUMENTATION SYSTEM

Two independent telecom systems would be associated with each SFDT: the balloon launch platform downlink/uplink and the Test Vehicle downlink/uplink. CSBF would deploy its own EGSE to be used for open-loop communications with the balloon launch platform. The EGSE would be located in Building 453 (Figure 2-6). The balloon EGSE would not interface with PMRF's instrumentation or communications infrastructure and would act as a standalone system.

2.2.7 TEST VEHICLE GLOBAL POSITIONING SYSTEM

Both the balloon launch platform and Test Vehicle are equipped with GPS receivers to provide three-dimensional location and velocity information. Data from the GPS receivers would be passed to the appropriate EGSE (balloon or Test Vehicle) via a combination of S-band and L-band telemetry.

2.2.8 TEST VEHICLE COMMAND SYSTEM DESCRIPTION

2.2.8.1 Balloon

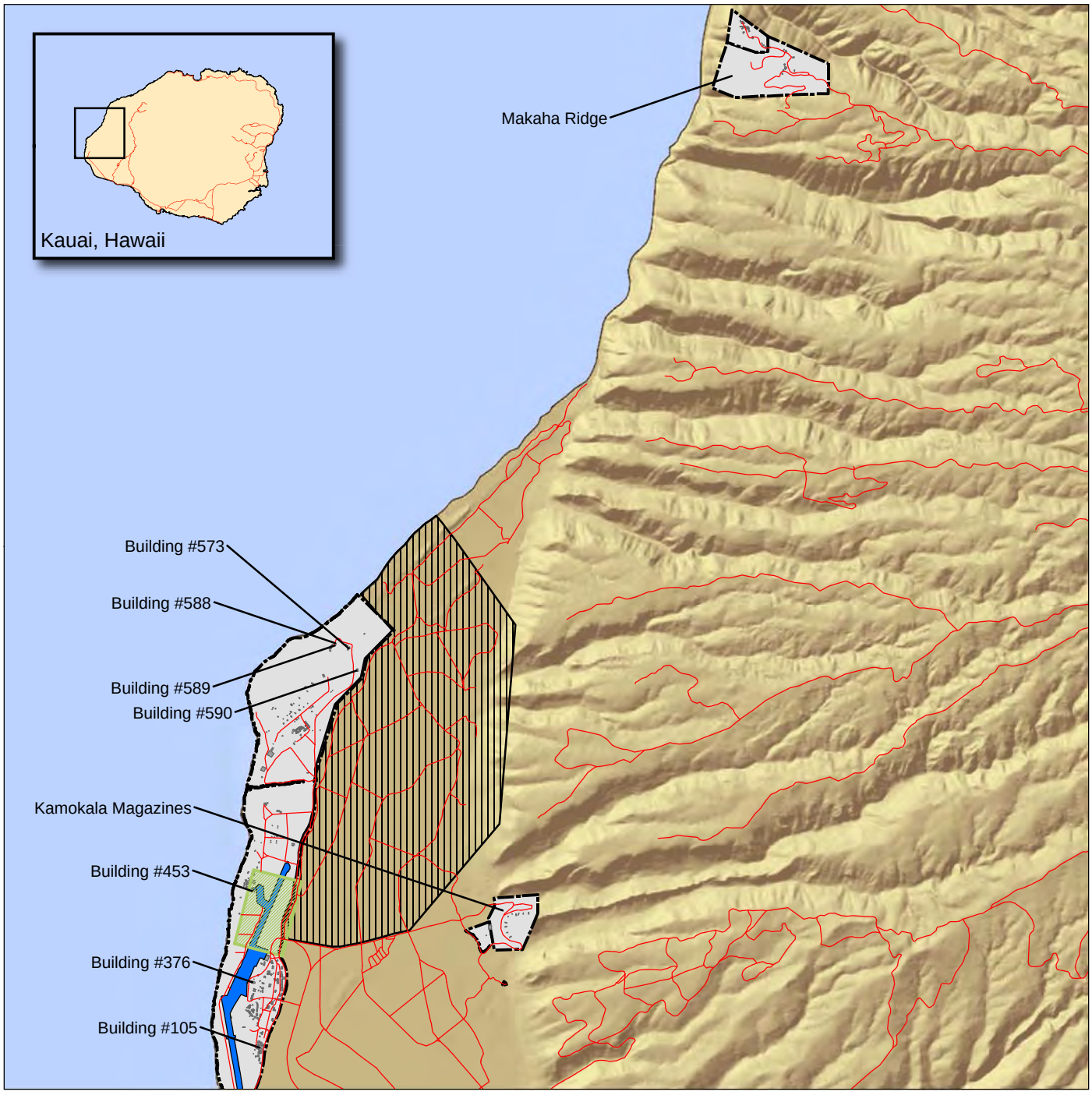
The NASA Solar Pointing System or Rotator is typically used to point or control azimuth orientation of the balloon gondola. Along with nominal azimuth sun-tracking and differential GPS modes, the system would have the ability to offset-point relative to the sun and rotate at a controlled velocity. The Rotator would be mounted to the bottom of the balloon flight train just below the launch pin/holding plate.

2.2.8.2 Drop Circuit

The purpose of the drop circuit would be to allow the range to separate the Test Vehicle from the balloon at any time after the balloon launch platform launches via a ground command. During a nominal mission, once the Test Vehicle is armed the range would drop the vehicle prior to motor ignition. In the event of an out of bounds balloon float or other issue, the range would be able to drop the Test Vehicle using the same system.

2.2.8.3 Test Vehicle Commanding During Ascent

The Test Vehicle would be using the MIP for the purpose of sending power switching and payload ordnance safe and arm commands. Any payload ordnance commands received would be routed from the Ethernet power switching unit to the ordnance electronics.



EXPLANATION

- Road
- Launch Area (Inside Red Label Area)
- Restrictive Easement
- Airfield Area
- Existing Structure
- Installation Area

NORTH

0 0.5 1 2 Miles

Buildings and Facility Locations

Kauai, Hawaii

Figure 2-6

26_pmrf_buildings, 2/21/2013

2.2.8.4 Test Vehicle Ordnance Firing After Release

All Test Vehicle ordnance firing circuits (excluding the Test Vehicle release mechanism) would be triggered from an on-board instrument called the Gimbal-mounted LN-200 with Sandia Miniature Airborne Computer. Most of the Test Vehicle ordnance would be initiated in this manner at pre-programmed times. A few events, such as the main parachute release, would be triggered by achieving a pre-programmed velocity gate within a specific time period during the Test Vehicle flight. In the event that a velocity gate is not achieved within the allotted time period, the Miniature Airborne Computer would issue a pre-programmed timed trigger as a backup.

2.2.9 TEST VEHICLE FLIGHT TERMINATION SYSTEM

Launch flight safety at PMRF requires the protection of life and property from the hazards associated with the SFDT. The SFDT flight system would be equipped with an abort system via a Flight Termination System (FTS). Figure 2-7 provides an example of how an unplanned SFDT would be terminated if required.

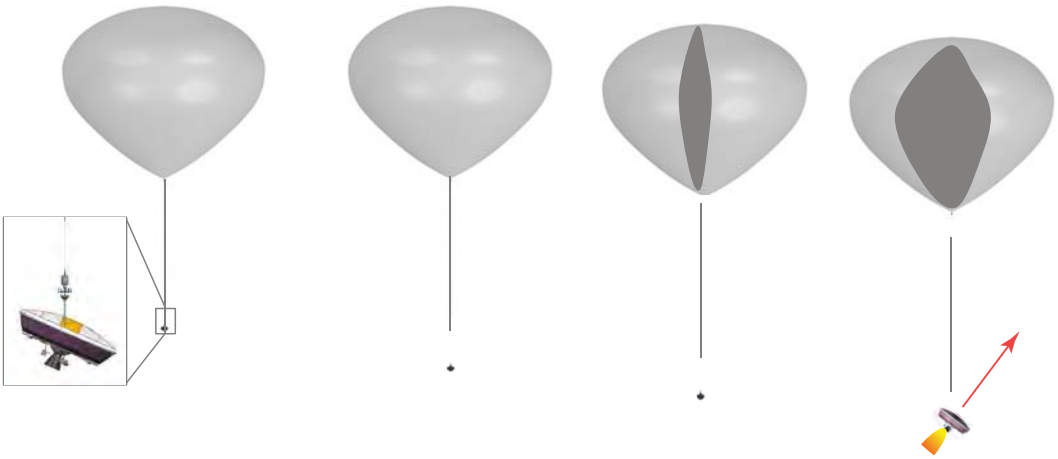
2.3 LAUNCH TRAJECTORY

2.3.1 BALLOON LAUNCH PLATFORM NOTIONAL TRAJECTORY

In evaluating notional balloon behaviors, CSBF used MET data from NASA Global Forecast System models to predict the balloon's climb-out trajectory. The Earth Global Reference Atmospheric Model, Range Reference Atmosphere for PMRF was used to establish confidence internals for the various MET parameters. The notional predicted trajectories from PMRF, including possible over-flight of Niihau Island, were used to define a notional SFDT launch basket (i.e., drop/recovery area) for the Test Vehicle release. This basket was expanded by 185 kilometers (100 nm) to the west to account for a 1-hour balloon float at altitude. The trajectory for the SFDT would potentially follow one of the examples illustrated on Figure 2-8. These trajectory examples would occur within the northerly and southerly boundary tracks as indicated in Figure 2-9. The Proposed Action would not affect the Papahanaumokuakea Marine National Monument.

2.3.2 SFDT TEST VEHICLE NOMINAL TRAJECTORY INFORMATION

The assumed drop location for this notional trajectory for the balloon is approximately 139 kilometers (75 nm) off-shore due west from PMRF. The assumed drop location for the notional trajectory of the Test Vehicle with parachute is approximately 56 kilometers (30 nm) northeast of the balloon drop location, with the assumed launch azimuth of 30 degrees from north to ensure an on-range splashdown. The Test Vehicle with parachute would be located approximately 111 kilometers (60 nm) northwest off-shore of PMRF. Figure 2-10 represents a notional trajectory for a completed southerly boundary track for the SFDT that begins at test start and ends with a Test Vehicle landing and water recovery footprint.



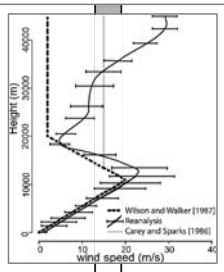
Test start altitude is roughly 36,576 meters (120,000 ft).

Test vehicle is released to initiate the test.

Flight Train is released 1 second after test vehicle. Flight train pulls a rip-cord in the balloon membrane to sever it open.

Balloon membrane is split open completely and allows the balloon system to fall back to Earth.

Landing Footprint is Determined by Wind Profile

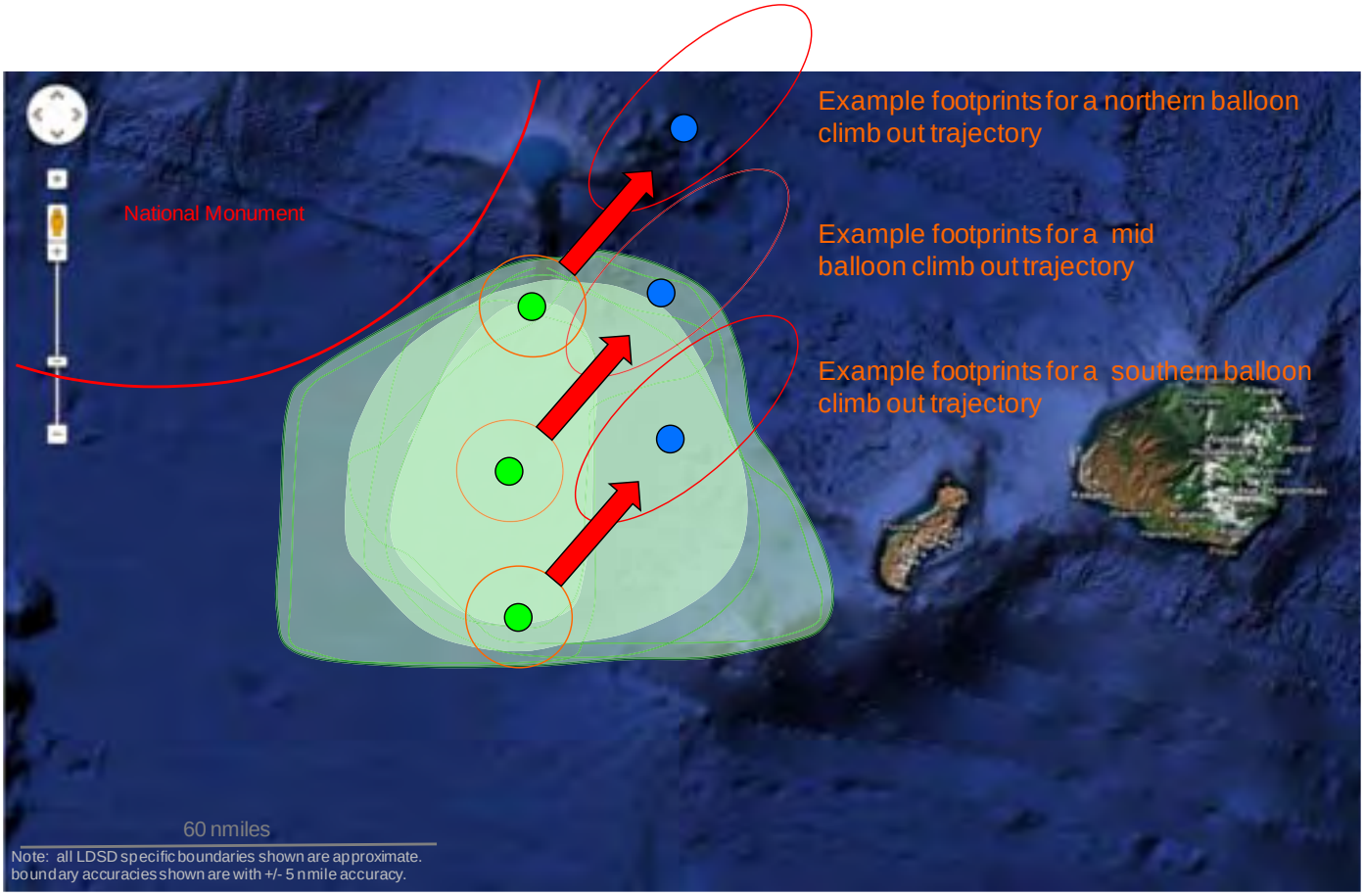


19.0 km (10 nm) landing footprint

Source: National Aeronautics and Space Administration, 2012b

Balloon Flight Termination Sequence

Figure 2-7



Source: National Aeronautics and Space Administration, 2012b

EXPLANATION

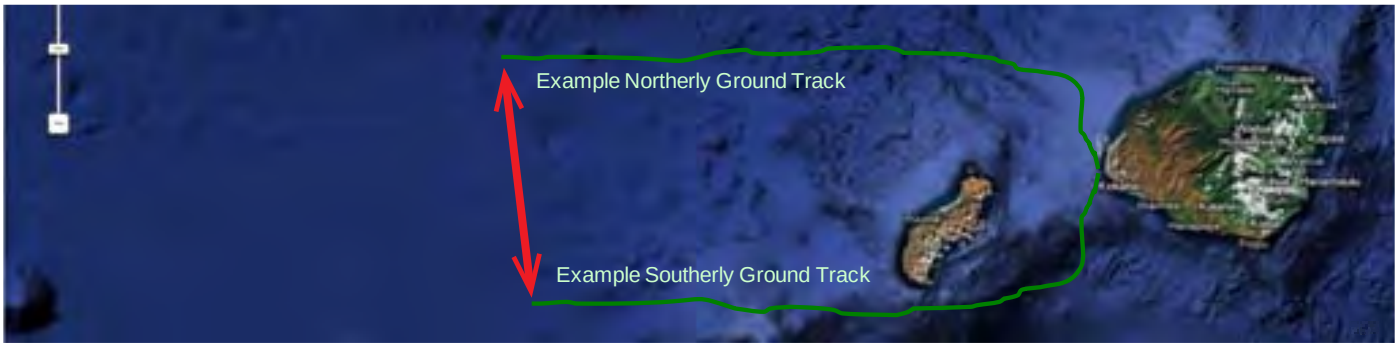
- Balloon Drop Point
- Test Vehicle with Parachute Drop Point
- Test Footprint Area

NORTH

Examples of Potential Test Footprints for a Balloon Supersonic Flight Dynamic Test Launch Trajectory

Kauai, Niihau, Hawaii

Figure 2-8



Source: National Aeronautics and Space Administration, 2012b

EXPLANATION

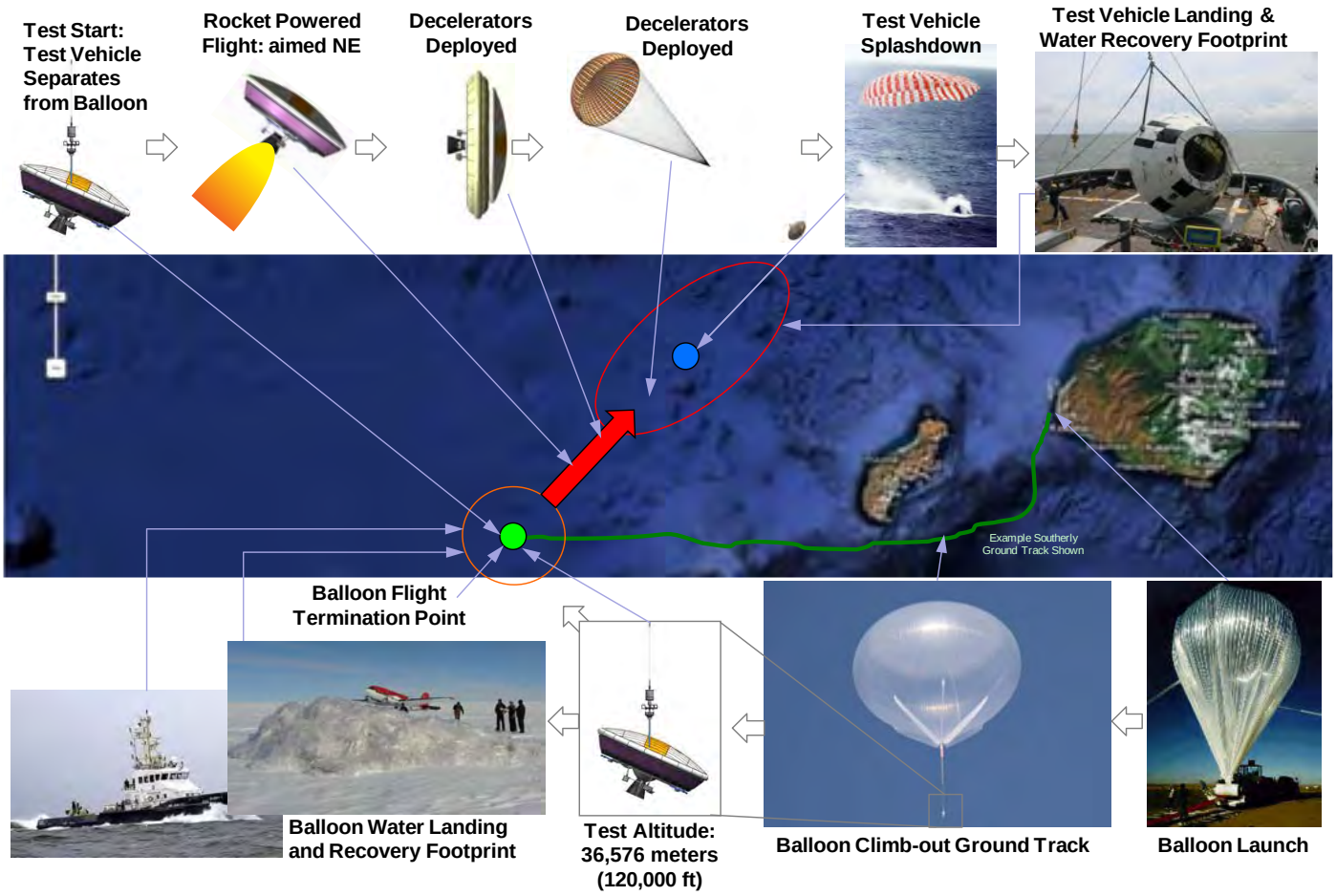
Potential Area for a Test Footprint for a Balloon SFDT Launch Trajectory

NORTH

Northerly and Southerly Boundary Tracks for Trajectory Examples

Kauai, Niihau, Hawaii

Figure 2-9



Source: National Aeronautics and Space Administration, 2012b

Notional Completed Supersonic Flight Dynamics Test

Kauai, Niihau, Hawaii

Figure 2-10

2.4 LAUNCH OPERATION

2.4.1 PRE-LAUNCH ACTIVITIES

2.4.1.1 Launch Preparation Activities

During the launch preparation process, hardware associated with the Proposed Action would begin arriving up to 6 weeks before the first day of the launch opportunity. Balloon equipment would arrive via barge and be driven to PMRF. The mechanical team would arrive about 5 weeks before day of launch and the electrical team would arrive about 3 weeks before the day of launch. Full Test Vehicle and balloon compatibility tests would occur roughly 1 week before the day of launch. Compatibility testing would take place at the MAB-Building 590 (Figure 2-6).

The Launch Spool Vehicle, Portable Launch Tower, Center Pivot Balloon Transport System, Tube Trailers, Transportation Cart at the MAB, and other Ground Handling Equipment (GHE) would be pre-positioned before the day of launch as well as the layout of the flight train and balloon. The balloon system would be ready to go 1 week prior to launch. A final Test Vehicle Electrical System Checkout and a final Connectivity Test between EGSE located in the MAB (Building 590) and the Launch Pad would be conducted before the day of launch.

Preflight activities also include the confirmation status for the following elements:

- Day of launch weather forecast
- Day of launch balloon climb-out prediction
- Balloon Launch Platform and Launch Pad status
- Test Vehicle and associated EGSE status
- MET sounding rocket status
- Recovery assets status
- The program assumes the range would also report their status.

Trenching has been proposed for a communication cable route from the proposed communication box to the viewing and memorial area. Naval Facilities Engineering Command (NAVFAC) determined that the undertaking does not have the potential to affect listed, contributing, or eligible historic properties (specifically archaeological sites/objects/traditional cultural places), and has approved the action (Appendix C).

2.4.1.2 Transportation and Storage

CSBF would ship their equipment to the Island of Kauai, Hawaii via barge. Upon arrival, the CSBF equipment would be unloaded and configured for over-the-road transportation and then transferred from the arrival port to PMRF over public roads.

CSBF would store their equipment onsite at PMRF between the summer of 2014 and summer of 2015 test. Following completion of the 2015 test, CSBF would remove or retrograde their equipment via public roadway to a convenient port for ship transport.

CSBF would require assistance from PMRF logistics to develop a transportation plan, ensure all the necessary permits are in place ahead of transportation, and facilitate coordination with the appropriate state and local agencies.

JPL and Wallops Flight Facility (WFF) would transport their equipment directly to PMRF via government aircraft. Upon arrival, the JPL and WFF equipment would be unloaded and deposited to the various onsite support facilities at PMRF.

JPL and WFF would store their equipment onsite at PMRF between the summer 2014 and summer 2015 mission campaigns. Some of the equipment would be returned or retrograded to the Continental United States (CONUS) for use in the buildup of the flight hardware for the 2015 mission campaign.

2.4.1.3 Personnel, Utility, and Equipment Requirements

Personnel

A total of approximately 70 temporary personnel would be required for the SFDT campaign. CSBF personnel would deploy approximately 20 personnel during the 2014 and 2015 mission campaigns. CSBF would require personnel workspace in the CSBF administrative facility and balloon processing facility. JPL and WFF would deploy approximately 50 personnel during the 2014 and 2015 test. NASA personnel may utilize on-base housing to accommodate deployed personnel during the occupancy periods in 2014 and 2015.

Utility Requirements

NASA would require ordnance certified grounding at the MABs and launch pad area. There would be no requirement for PMRF to provide potable water at the various support facilities. NASA would require storage of mission related hardware between the 2014 and 2015 test campaigns.

Equipment Requirements

The Proposed Action would require the use of a portable crane at PMRF with at least a 6.7-meter (22-foot) hook height.

2.4.1.4 Safety Hazard Issues

NASA would require hazardous waste containment, disposal, and documentation services to support processing, testing, and launch as required by law. Handling and control to certified points of disposal for residual quantities of materials would be required. Typical materials could include residual oil, grease, solder, acetone, hydraulic fluid, ashless grease, and chromate putty.

The primary safety hazards associated with the Proposed Action include:

- Solid Rocket Motors (SRMs): Star 48 SRM and small solid propellant spin motors used to insert the Test Vehicle into supersonic mode and spin-up/spin-down SRMs for vehicle stability
- Pyrotechnic Devices (used for SIAD inflation and release of Test Vehicle from balloon)
- Gas Generators: SIAD Inflation System
- Parachute deployment mortar with gas generator
- Non-ionizing radiation
- High pressure system
- Mechanical operations involving lifting/movement of Test Vehicle and EGSE.

Table 2-2 lists the potential hazards. Any mitigation for these hazards is discussed in Chapter 4.0 (Environmental Consequences) of this EA.

Table 2-2. Potential Hazards Associated with the Proposed Action

Hazard	Potential Safety Issue
Structural failure of Test Vehicle, Supersonic Inflatable Aerodynamic Decelerator, or support ground support equipment handling	During handling or test-results in personnel injury/death or facility damage due to impact of structure.
Lithium battery cell overpressure	Stored electrical energy leakage, rupture, electrical shock, burn. Corrosive and toxic hazards associated with the battery electrolyte.
Inadvertent ordnance firing	During powered operations through commanded paths. Personnel injury/death; damage to payload/ facilities.
Radio frequency (RF), non-ionizing radiation	Inadvertent transmission open loop. Operation of RF transmitters may expose personnel to levels of RF energy in excess of permissible exposure levels. Personnel injury due to RF exposure (tissue damage).
Inadvertent pyro actuation prior to installation in Test Vehicle	Burn, explosion hazard: Low Density Supersonic Decelerator utilizes various types of pyrotechnic initiated devices and initiators including a parachute mortar (gas generator).
Mechanical damage, impact	During lifting or movement of Test Vehicle or Ground Support Equipment results in personnel injury or death.

2.4.2 LAUNCH ACTIVITIES

2.4.2.1 Day of Launch Timeline

Prior to day of launch, the following activities would occur:

1. CSBF would generate a favorable weather forecast and trajectory prediction using National Weather Service MET data made available locally at 5:00 a.m. This would occur the day before launch.
2. CSBF would set up the Launch Tower, Launch Spool Vehicle, and the Center Pivot Balloon Transport System.
3. CSBF would lay out the balloon launch platform and flight train.
4. PMRF would give authorization to pick up the launch countdown.

Table 2-3 summarizes the notional day of launch timeline. Table 2-4 summarizes the Test Vehicle nominal sequence of events.

Table 2-3. Summary of the Notional Day of Launch Timeline

Time (T-Minus)	Event Description
-8 hours	Columbia Scientific Balloon Facility (CSBF) meteorologist call to station • Update forecast and trajectory predictions • Prepare pre-countdown pick up weather brief • Set up acoustic sounder and begin capturing data
-7 hours	CSBF meteorologists begin pilot balloon evaluations
-6 hours	Program personnel call to Station (Jet Propulsion Laboratory [JPL], Wallops flight Facility [WFF], and CSBF) • CSBF conducts weather briefing • Decision made to pick up countdown
-5 hours	Countdown pickup • CSBF begins final launch tower setup • JPL and WFF begin transportation of Test Vehicle from Missile Assembly Building
-4 hours	JPL and WFF begin Test Vehicle operations at launch pad • Test Vehicle checkouts via hardline • Final arming of Test Vehicle
-3 hours	Test Vehicle and Balloon Launch Platform mating • Test Vehicle connected to flight train • Test Vehicle lifted into launch position
-2 hours	Test Vehicle checkouts via hardline and Open Loop • Decision made to inflate balloon
-1.5 hours	CSBF begins balloon inflation
-1.0 hours	CSBF Meteorological team update
	First Super Loki Sounding Rocket Launch
-0.5 hours	JPL and WFF perform final Test Vehicle checkouts • Concurrent operation with balloon inflation
0 hours	Balloon launch
	Second Super Loki Sounding Rocket Launch

Table 2-3. Summary of the Notional Day of Launch Timeline (Continued)

Time (T-Minus)	Event Description
+2.5 hours	Balloon spotter aircraft deployed
+3.0 hours	Balloon launch platform reaches desired altitude • Potential for 1 hour of float while awaiting optimal test environment for Supersonic Flight Dynamics Test (SFDT) • Test Vehicle released to begin SFDT • Balloon Launch Platform terminated once Test Vehicle is clear and balloon is in optimal position for recovery
	Third Super Loki Sounding Rocket Launch
+4.0 hours	SFDT complete • Concurrent recovery operations begin for the Balloon Launch Platform and Test Vehicle

Table 2-4. Summary of the Test Vehicle Nominal Sequence of Events for Test Vehicle Launch

Event	Timing (sec)	Altitude kilometers (miles)	Mach	Remarks
Release	0.00	37.00 (23)	0.00	
Begin Spin-Up	1.00	37.00 (23)	0.03	Release +1 sec
Ignite Star 48	3.00	37.00 (23)	0.09	Release +3 sec
Star 48 Burnout	71.47	48.9 (30.4)	4.13	Timing per Alliant Techsystems Incorporated supplied profile (sensed acceleration trigger in flight)
Begin Spin-Down	73.47	49.3 (30.6)	3.99	Burnout +2 sec
Deploy Supersonic Inflatable Aerodynamic Decelerator	77.47	49.9 (31)	3.75	Burnout +4 sec
Parachute Deployment Device (PDD) Triggered	108.48	49.00 (30.4)	2.35	Relative velocity (Global Positioning System velocity trigger in flight)
Parachute Extraction	115.08	47.9 (29.7)	2.15	PDD +6.6 sec (timed to hit Mach target and allow some ballute damping effect)
Mach ~0.5	135.93	44.5 (27.7)	~0.50	Trajectory dependent
Splashdown	2,540.24	0.00	0.00	Total Test Vehicle mission time is approximately 42 minutes

2.4.2.2 Launch Control

Launch processing of the Super Loki would be executed from Building 573. Building 590 would be the secondary launch operations site and the location of the Test Vehicle EGSE. Building 590 would need to provide approximately 28 square meters (300 square feet) of flat floor space with easy connectivity to PMRF's infrastructure if required. The blockhouse (LEB/EGSE Trailer) located on PMRF would be a temporary building that would provide approximately 14 square meters (150 square feet) of flat floor space in an environmentally controlled structure within 15.0 meters (50 feet) of the launch tower at the Launch Pad/Red Label Area. This temporary facility would be used to house part of the Test Vehicle's EGSE. The launch operation of the balloon would be executed from Building 105. Figure 2-6 depicts the building locations.

2.4.2.3 Metric, Telemetry, and Meteorology Data

Metric Data

NASA would require a single skin, track-capable radar to track the balloon launch platform from balloon launch through loss of contact or balloon splashdown. The purpose of this radar would be to provide additional information on the balloon's splashdown location, thereby aiding in recovery operations. NASA would require a single C-band beacon tracking radar (with a single backup) to meet mission success criteria. PMRF would determine the selection of the two radar support systems. NASA would require a single-wide band Coherent Signal Processor (COSIP) radar to track the Test Vehicle from release through end of mission. The purpose of this radar would be to provide additional detailed signature information necessary for timeline reconstruction. Radar tracking support will be provided by existing PMRF radars. No new radars are required.

2.4.2.4 Telemetry Data

The L-band TM links would originate from the balloon launch platform. The L-band TM link would provide video from the balloon. The TM link would provide an additional data pathway for the balloon's health and status information. The balloon's L-band TM link would be meant to provide the balloon's health and status information to PMRF for display in the ROCC and to allow PMRF to record this data for post-mission delivery. Additionally, NASA would require a single TM antenna (with a single backup) to meet mission success criteria. PMRF would determine the selection of two existing TM instrumentation support systems.

Meteorology Data

CSBF would deploy a certified meteorologist to PMRF to serve as the project's weather expert. The CSBF MET support would provide routine weather forecasts to identify potential impacts to processing activities, the information required to evaluate the weather-related launch commit criteria, and probable balloon climb-out trajectories. NASA would require that PMRF provide severe weather notifications during PMRF's normal operating hours to project management. NASA would also require launch of a limited number of MET balloons to collect MET data on the day of launch.

2.4.2.5 Other Support Activities

Other launch support activities could be required to execute the Proposed Action. Table 2-5 summarizes these other potential activities.

Table 2-5. Summary of Other Support Activities

Support Activity	Support Activities
Command System	• NASA would require Ultra-High Frequency (UHF) commanding for pre–launch recurring tests, and on launch day for UHF command of the Wallops Range Safety Manual (RSM-2002-B) drop circuit from T-30 minutes through Test Vehicle release from the balloon launch platform vehicle.
Timing Signals	• NASA would require access to a timing signal source formatted to IRIG-B as defined in RCC 200-04, IRIG Serial Time Code Formats. The locations of these interfaces are co-located with NASA's electronic ground support equipment (EGSE) in the Test Vehicle's processing facility and mission support location. The location of NASA's EGSE would be determined by Pacific Missile Range Facility (PMRF) and coordinated through the Universal Data System (UDS) process. • NASA would require Global Positioning System (GPS) relay systems for L1 and L2 installed in the Test Vehicle's processing facility.
Visual Countdown	NASA would require: • A local time of day clock visible from the launch pad to coordinate pad operations with other Low Density Supersonic Decelerator (LDSD) support sites during data flow checkouts, mission dress rehearsals, and launch operations; at the LDSD support site housing NASA's EGSE to coordinate launch pad operations during data flow checkouts, mission dress rehearsals, and launch operations; clock in the LDSD associated support rooms within the Range Operations Control Center (ROCC) to coordinate launch pad operations during data flow checkouts, mission dress rehearsals, and launch operations; at the Columbia Scientific Balloon Facility (CSBF) ground station site to coordinate launch pad operations during data flow checkouts, mission dress rehearsals, and launch operations. • A countdown clock visible from the launch pad to coordinate launch pad operations with other LDSD support sites during mission dress rehearsals and launch operations; at the LDSD support site housing NASA's EGSE to coordinate launch pad operations with other LDSD support sites during mission dress rehearsals and launch operations; at the CSBF ground station site to coordinate launch pad operations with other LDSD support sites during mission dress rehearsals and launch operations; in the LDSD associated support rooms within the ROCC to coordinate launch pad operations with other LDSD support sites during mission dress rehearsals and launch operations.
Communications (Air/Ground/ Video/ Network/ Telephone/ Frequencies	• NASA would require voice communications with recovery spotter aircraft and PMRF's surveillance aircraft that may be supporting recovery efforts. This communication is used to coordinate recovery activities and provide situation awareness; voice nets be established on PMRF's Operational Intercommunications Systems for use by the LDSD project during operations at PMRF; voice communications with seaborne recovery vessels and PMRF's surveillance ships that may be supporting recovery efforts. This communication is used to coordinate recovery activities and provide situation awareness; Hand held radio to communicate with PMRF's Air Traffic Control Tower during operations taking place on or near PMRF's airfield. • CSBF would utilize handheld radios to coordinate launch activities at the launch pad; JPL would utilize handheld radios to coordinate launch activities at the launch pad. • would require unclassified internet access in some PMRF facilities and video recording and feed, teleconference system, telephones, dedicated data pathway(s), on-board video, and high speed and high definition cameras.
Real Time Data Display/ Control	• NASA would require real time displays be available on the front wall of the ROCC Alpha, Bravo, Charlie, and Delta rooms and real time displays are available within view of the Test Vehicle's EGSE operator locations. • The Balloon Launch Platform and Test Vehicle situational videos would be telemetered from their respective on-board video systems (i.e., balloon video via L-band and Test Vehicle video via S-band). PMRF would be required to properly receive, process, route, and display the two TM links within view of the Test Vehicle's EGSE operator location and for display on the various wall displays in the ROCC.
Photographic	• NASA would deploy in-house documentary photographic support to capture key test events during ground processing. NASA would comply with all PMRF guidelines and requirements for camera use on the Main Base and would require assistance from PMRF Main Base to determine if existing optics instrumentation organic to PMRF would provide usable data products from land-based support locations.

2.4.3 POST-LAUNCH ACTIVITIES

2.4.3.1 Recovery and Recovery Support

Each SFDT would involve over-water flight and test execution. In both nominal and contingency flight scenarios, the intention would be to deposit the balloon within approximately 139 kilometers (75 nm), and the Test Vehicle within approximately 111 kilometers (60 nm) of the PMRF coastline. NASA would recover any floating debris such as the balloon (any floating elements of the balloon), Test Vehicle and Flight Image Recorder (FIR) following each SFDT. If separated from the Test Vehicle, to the extent possible the FIR would be recovered. Table 2-6 provides an overview of recovery aids.

Balloon and Test Vehicle ocean salvage/recovery would commence following launch and must be accomplished by appropriate ocean-worthy vessel(s) capable of 3 to 4 days underway time, or with an appropriate on-station time greater than its distance fuel allowance. The paradigm for recovery is to establish visual contact with the balloon and Test Vehicle following impact using either existing surveillance aircraft assets, or general aviation spotter aircraft. Both test articles would be outfitted with beacon tracking devices. The aircraft would remain on-station at each test article until positive beacon location can be assessed at the PMRF Range Control Center. In the event a beacon location on either article fails, the spotter aircraft would remain on-station, and be replaced by another aircraft as necessary due to fuel consumption until the recovery vessels arrive on-station. The test articles would be salvaged from the ocean surface and securely fastened to the vessel deck for Return to Base (RTB) to PMRF dock operation at Port Allen.

The balloon material would be disposed of following offload to the Port Allen public pier. The Test Vehicle would be inspected and flight data recorders removed, followed by disposition (storage) at a PMRF location. WFF is the responsible agency for developing a recovery plan, which would be approved by JPL and PMRF, for the balloon and the Test Vehicle.

The balloon recovery ship must be capable of lifting the balloon from the water incrementally, the total balloon and water weight being 2,722 to 4,082 kilograms (6,000 to 9,000 pounds). It is expected that the area the balloon would occupy when on deck would need to hold approximately 11.5 cubic meters (15 cubic yards) of polyethylene material. The balloon is considered salvage to be disposed of post-launch. A crane and/or capstan would be utilized to pull the balloon from the water.

Prior to balloon removal from the water, the operation would likely utilize a two-man dive team and Rigid Inflatable Boats (RIBs) to survey the balloon disposition and determine the circumference/area that the balloon occupies in the ocean and mark it appropriately with marker buoys. Following RTB to Port Allen, the balloon would be offloaded from the vessel and disposed.

Table 2-6. Overview of Recovery Aids

Flight Hardware	
Balloon Launch Platform	• Equipped with two water active dye markers developed by NASA ➢ One mounted on the top balloon interface plate ➢ One mounted on the bottom balloon interface plate • Recovery aids such as Global Positioning System (GPS) beacons or other similar transmitting systems were not used on the balloon for the reasons below: ➢ would most likely be entangled by the balloon carcass as it fell ➢ end up submerged and non-functional ➢ come to rest in a non-operational position (example: antenna downward) • The notional concept of operations (ConOps) for recovering the balloon is to have a spotter plane within visual range as the balloon falls and that reports its position once in the water.
Test Vehicle	• Equipped with two water active dye markers developed by NASA ➢ Located on opposite sides of the Test Vehicle • Equipped with two different types of GPS locators ➢ One GPS locator system relays data over the Argos satellite network ➢ One GPS locator system relays data over the Iridium satellite network ➢ The GPS locators are situated on the Test Vehicle such that one or the other can function despite the orientation of the Test Vehicle in the water.
Flight Image Recorder	• Equipped with a ruggedized GPS locator developed by the U.S. Army • Equipped with a water active dye marker developed by NASA • Equipped with a water activated audible pinger developed by Teledyne Benthos • The notional ConOps is that the Flight Image Recorder stays with the Test Vehicle and the water activated recovery aids do not engage. In the event of an anomaly, the Flight Image Recorder is designed to separate from the Test Vehicle. Depending on the circumstances of the anomaly, the water activated recovery aids on the Flight Image Recorder may help locate the Test Vehicle. • The ruggedized GPS locator is designed to activate even in the notional ConOps to provide an additional recovery aid for the Test Vehicle. Given the location of the Flight Image Recorder, the orientation of the Test Vehicle in the water will affect the ruggedized GPS locator's functionality.

The Test Vehicle recovery ship must be capable of lifting the Test Vehicle from the water using a boom or appropriate crane in one lift operation, the Test Vehicle total weight ranging from 3,629 to 4,536 kilograms (8,000 to 10,000 pounds) depending on Test Vehicle impact angle and cavity saturation by sea-water. The Test Vehicle is approximately 4.6 meters (15 feet) in diameter and 2.1 meters (7 feet) in height. Prior to Test Vehicle removal from the water, the operation would require the U.S. Navy Mobile Diving Salvage Unit Explosive Ordnance Disposal (EOD) dive team and RIBs to survey the Test Vehicle disposition and determine if all on-board ordnance is expended. A safety official would be onboard to brief the dive team on ordnance systems and to assist with determining ordnance status. Following inspection, the Test Vehicle

parachute harness would be removed from the Test Vehicle and the parachute and the Test Vehicle would be removed from the ocean. The parachute can be marked appropriately with marker buoys to maintain the position of the parachute apex for ease in retrieval. The parachute is made of lightweight nylon. Laid flat, the parachute canopy would have a diameter of 33.5 meters (nearly 110 feet). Following RTB to Port Allen the Test Vehicle would be offloaded from the vessel, inspected by the LDSD engineering team, flight data recorders removed and disposed of on PMRF.

2.4.3.2 Test Vehicle Recovery Aids

2.4.3.2.1 Flotation Duration

All recovery aids would be required to remain active for a minimum of 4 days, with the exception of the dye markers which would only be intended to help the initial spotter aircraft on the scene to locate the Test Vehicle.

2.4.3.2.2 Electronic Aids

The balloon and the Test Vehicle would use two different types of electronic recovery aids. The first would be Trident's Iridium GPS beacon, which would be used by the balloon and the Test Vehicle. The second system of the balloon would be a Telonics marine Argos/GPS beacon. The balloon could also be equipped with two audible beacons; one each would be mounted in the same locations as the other recovery aids (top and bottom of the balloon). The recovery vessel would have an underwater hydrophone designed specifically to listen for these if they are activated.

The Test Vehicle would contain water-tight data enclosures which are intended to stay with the vehicle upon water impact. In the event that these enclosures separate from the vehicle upon impact, they would be equipped with audible beacons for water recovery. The Test Vehicle could also be equipped with three audible beacons mounted on the rear camera boxes in the event the camera boxes become dislodged from the vehicle during impact with the water. The Test Vehicle would utilize the Iridium system to account for either of two possible float orientations in the water.

2.4.3.2.3 Visual Aids

As currently planned the balloon visual aids would include two dye markers and two strobe lights to aid the spotter planes in the initial location. The units would be located in the same locations as the Iridium and Argos beacons and would be salt water activated.

The Test Vehicle visual aids would also include two dye markers and two strobe lights to aid the spotter planes. The units would be located in the shoulder region of the Test Vehicle and would be salt water activated.

2.5 NO-ACTION ALTERNATIVE

Under the No-action Alternative, NASA would not conduct the Proposed Action. If in the future the agency decides to pursue the Proposed Action at a location other than PMRF, additional environmental analysis and documentation would be performed.

2.6 PROPOSED LAUNCH SITE/RANGE SELECTION PROCESS AND ALTERNATIVES CONSIDERED BUT NOT CARRIED FORWARD

2.6.1 BACKGROUND

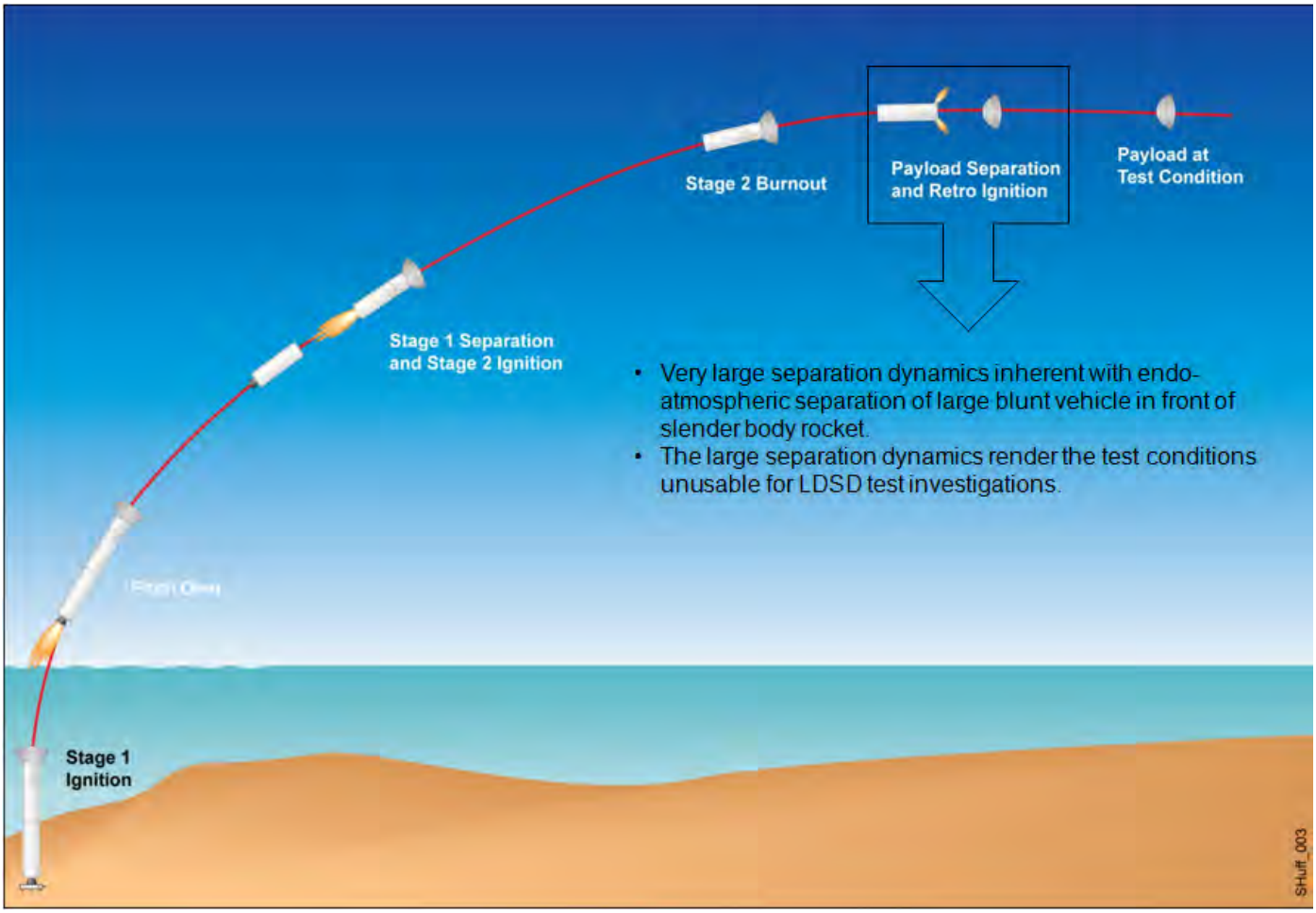
Early in the formulation of the LDSD Project, NASA funded two industry studies to develop detailed concepts and cost estimates for the use of either commercial Castor rocket stages or surplus Intercontinental Ballistic Missile (ICBM) rocket stages to accomplish the SIAD flight tests instead of the approach used by the Viking-era Balloon-Launched Decelerator Test Program in 1972. Figure 2-11 illustrates the methodology used for a rocket stage insertion; however, this methodology was determined to be unusable for the current proposed LDSD tests and not carried forward.

The rocket-only test methodology was eliminated from consideration for the LDSD flight testing campaign for two reasons:

1. The test methodology represented a significant risk regarding the Test Vehicle deployment. Since the decelerator technologies being developed have the defined purpose of slowing down the Test Vehicle, this introduced a high risk of the ELV 2nd stage re-contacting the Test Vehicle after deployment. After extended consideration, it was not clear that a deployment system could be developed given the mass and volume constraints of the SFDT Test Vehicle.

2. Even using surplus ICBM stages, the cost of this approach turned out to be prohibitive, and would have limited the LDSD project to a single SFDT. A stated goal of the LDSD project is to conduct at least two successful SFDT flights of the SIAD-R and one successful flight of the SIAD-E. A single SFDT would not satisfy the stated LDSD project goal.

Based on these considerations, NASA determined that the LDSD project would use the balloon/rocket approach successfully employed by the Viking Balloon Launch Decelerator Test Program to accomplish the LDSD SFDT flights.



Source: National Aeronautics and Space Administration, 2012b

Note: This alternative was considered but not carried forward for this proposed action

Low Density Supersonic Decelerator Rocket Only Test Methodology

Figure 2-11

22_climbout, 7/20/2012

2.6.2 PROPOSED LAUNCH TEST SITE/RANGE SELECTION PROCESS

2.6.2.1 NASA LDSD Range Selection Process

The Launch Range Considerations white paper written for the LDSD project was completed in 2011 (National Aeronautics and Space Administration, 2013). The basis for this 2011 study started with the information gathered for the 2006 High Altitude Supersonic Parachute project and was expanded by adding additional test sites for consideration. Twelve test sites were considered. Table 2-7 lists the 12 candidate test sites and their geographic locations. These sites were selected as a representative sampling of ocean front and land locked test sites. The end goal of this study (white paper) was to determine the most feasible options for an ocean front site and land locked site to feed into the project decision of whether the concept of operations would be to land the Test Vehicle in water or on land.

Table 2-7. List of Candidate Test Sites/Ranges

Range	Location
United States Federal Government	
1. Kodiak Launch Complex	Alaska
2. San Nicolas Island	California
3. Vandenberg Air Force Base	California
4. Eastern Range	Florida
5. Pacific Missile Range Facility	Hawaii (Kauai)
6. White Sands Missile Range	New Mexico
7. Utah Test and Training Range	Utah
8. Wallops Flight Facility, Main Base	Virginia
9. Wallops Flight Facility, Farm Land	Virginia
United States Federal Government Controlled	
10. Range Test Site	U.S. Army Kwajalein Atoll
Foreign Government	
11. Woomera Test Range, Evetts Field	South Australia
12. Woomera Test Range, Maralinga	South Australia

To select the best viable test site the CSBF identified personnel to participate in this final site selection evaluation. The first contribution made by CSBF was to down-select the potential test sites based on their expert experience and familiarity with launching balloons all over the world. The list of 12 candidate sites was reduced to 2 sites. In CSBF's expert opinion, the only viable test sites for the LDSD project were PMRF or Woomera Test Range (WTR), Evetts Field. CSBF performed a series of scientific balloon climb out analyses to determine which of the two candidate test sites provided the highest degree of safety for execution of the SFDT portion of the LDSD project. Additionally, San Nicolas Island was included in the analysis.

The analysis process included (1) weather data sources, (2) trade wind and prevailing westerlies winds, (3) trajectory determination, and (4) number of good launch days, annually.

Based on the analysis, the NASA WFF team recommends that PMRF represents the most viable candidate under consideration from a testing and operations perspective. In the event that PMRF cannot be used as the test site for the LDSD project, the NASA WFF team recommends that NASA JPL select WTR, Evetts Field as their backup test site. San Nicolas Island was not carried forward. Table 2-8 summarizes the results of the site evaluation based on the analysis for a 30-day period.

Table 2-8. Summary of Final Test Site Evaluation

	Month	Number of Good Launch Days	Acceptable Trajectories
Test Site:	**Pacific Missile Range Facility**		
	April	20 (66.7%*)	3 (10.0%)
	May	23 (74.2%)	0 (0%)
	June	29 (96.7%)	8 (26.7%)
	July	28 (90.3%)	9 (29.0%)
	August	25 (80.7%)	4 (12.9%)
	September	29 (96.7%)	8 (26.7%)
Test Site:	**Woomera Test Range, Evetts Field**		
	December	4 (12.9%)	1 (3.2%)
	January	5 (16.1%)	0 (0%)
	February	4 (14.3%)	1 (3.6%)
	March	4 12.9%)	1 (3.2%)
Test Site:	**San Nicolas Island**		
	April	4 (13.3%)	2 (6.67%)
	May	1 (3.23%)	1 (3.23%)
	June	1 (3.23%)	1 (3.23%)
	July	2 (6.45%)	2 (6.45%)
	August	2 (6.45%)	2 (6.45%)
	September	2 (6.67%)	2 (6.67%)

*- Percentage based on a 30-day calendar month

WTR (Evetts Field) was not selected as the baseline test site/range; however, the test site/range is considered as a back-up location, and if redefined of necessity as the baseline test site/range the requirements of EO 12114, Environmental Effects Abroad of Major Federal Actions, would be followed.

2.6.2.2 Launch Site Selection on PMRF

The NASA JPL siting process identified PMRF as the best site/range for the execution of the SFDT. Further analysis was performed at PMRF as part of the launch site/range baseline process. A 5-week Wind Study Project was performed at PMRF from 28 June through 4 August 2012. This study was used to ascertain a more defined wind pattern for the 2 hours before and after sunrise (over the study period) time period to precisely model and predict the path of large scientific balloons that may be deployed at PMRF in the future. This wind study quantified the early morning, surface to upper atmospheric wind speeds and direction by releasing and tracking a series of small pilot balloons. The results of this climb-out analysis indicated the months of June through September at PMRF would provide the best chance to meet the balloon launch criteria for the SFDT.

The SFDT launch of the LDSD would be performed from the existing taxiway area (inside the Red Label Area) on PMRF (Figure 2-12). This area would be 304.8 by 304.8 meters (1,000 by 1,000 feet). The orientation of the balloon would be determined on the launch day, from a range of orientations baselined from the wind study results. Figure 2-1 shows the SFDT sequence.

2.6.3 ALTERNATIVE CONSIDERED BUT NOT CARRIED FORWARD

Based on the results of the NASA LDSD Range Selection Process and the summary presented in Section 2.6.2 and Table 2-7, two alternative test site/ranges were considered but not carried forward:

- San Nicolas Island, CA was considered but not carried forward because the test site/range had fewer number of good launch days compared to PMRF and WTR, Evetts Field that are conducive to the launch of the scientific balloon.

- WTR (Evetts Field) was considered but not carried forward; however, the test site/range is considered as a back-up location and if redefined of necessity as the baseline test site/range the requirements of EO 12114, Environmental Effects Abroad of Major Federal Actions, would be followed.

EXPLANATION

Proposed Launch Area

Red Label Area

NORTH

Proposed Launch Area

Hawaii

Figure 2-12

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3.0 Affected Environment

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3.0 AFFECTED ENVIRONMENT

This chapter describes the environmental characteristics that may be affected by the Proposed Action. The information serves as a baseline from which to identify and evaluate environmental changes resulting from the LDSD program in the Pacific region of PMRF (Section 3.1), Niihau (Section 3.2), the Open Ocean Area (Section 3.3) and the Global Environment (3.4). To provide a baseline point of reference for understanding any potential impacts, the affected environment is briefly described; any components of greater concern are described in greater detail.

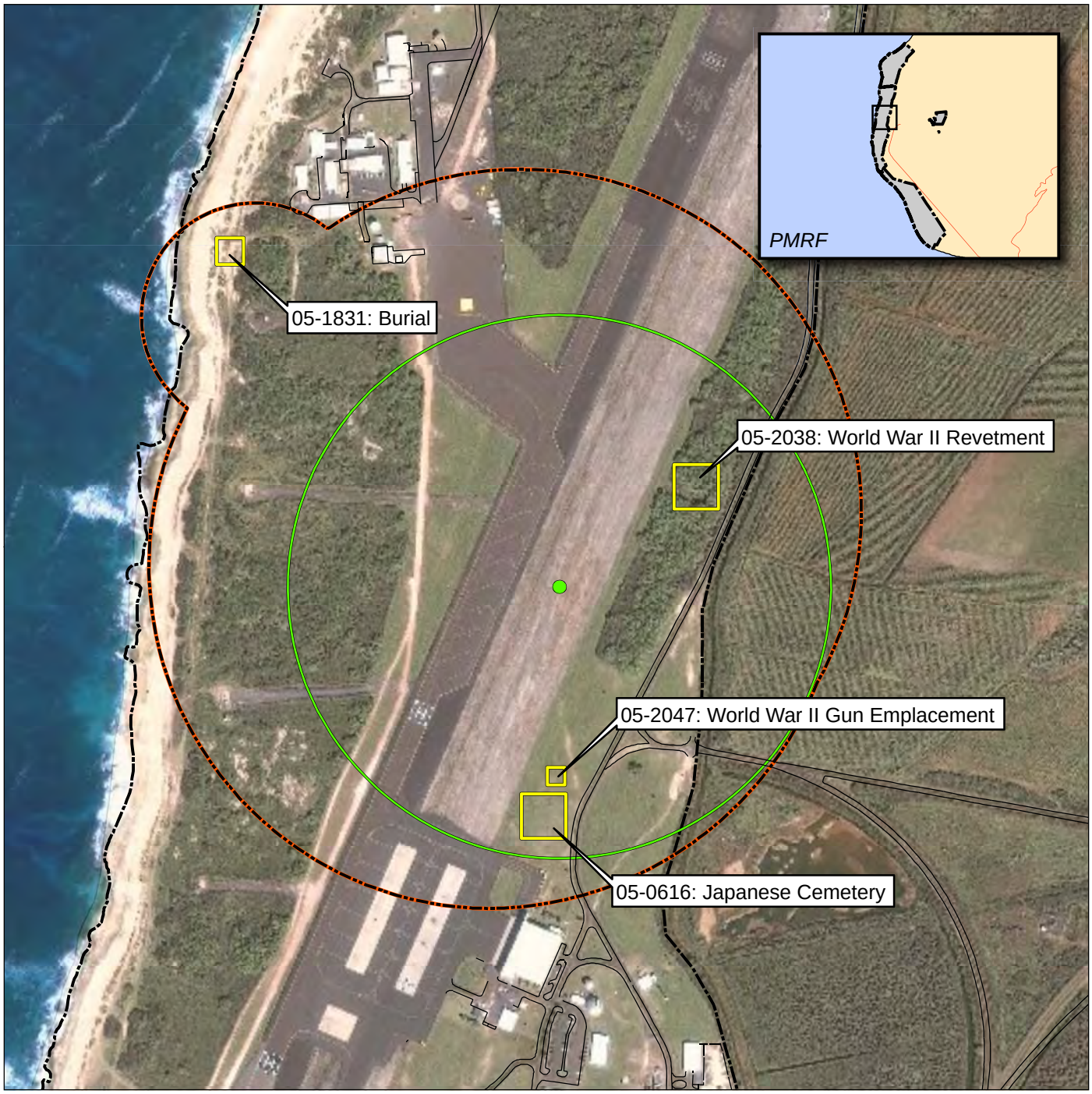
Available reference materials, including EAs, EISs, and base master plans, were reviewed. To fill data gaps (questions that could not be answered from the literature) and to verify and update available information, installation and facility personnel were contacted.

3.1 PACIFIC MISSILE RANGE FACILITY

The majority of PMRF's facilities and equipment are at the Main Base, which occupies a land area of 779 hectares (1,925 acres) and lies just south of Polihale State Park. PMRF/Main Base is generally flat and is approximately 0.8 kilometer (0.5 mile) wide and 10.5 kilometers (6.5 miles) long with a nominal elevation of 4.6 meters (15 feet) above mean sea level (msl). PMRF is a multi-environment range capable of supporting surface, subsurface, air, and space events and activities simultaneously. (U.S. Department of the Navy, 2008)

Fourteen areas of environmental consideration were initially evaluated for PMRF 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, visual aesthetics, and water resources. Ultimately 7 of the 14 areas of environmental consideration were addressed in detail at PMRF for the Proposed Action. The remaining resources areas were not analyzed in such a manner for the following reasons:

- **Cultural Resources:** No historic properties would be affected as a result of LDSD activities. The Area of Potential Effects (APE) for the LDSD program is shown on Figures 3-1 and 3-2. At the PMRF Red Label Area, recorded archaeological and historical properties within 304.8 meters (1,000 feet) of the launch area include one World War II revetment (Site No. 05-2038), a World War II gun emplacement (Site No. 05-2047), and a Japanese Cemetery (Site No. 05-0616) (International Archaeological Research Institute, Inc. 2005). These properties are situated away from the launch point. Trenching has been



EXPLANATION

- Approximate Low Density Supersonic Decelerator (LDSD) Launch Point
- Installation Boundary
- Road
- Red Label Area
- 1,000-foot Radius around Launch Point

NORTH

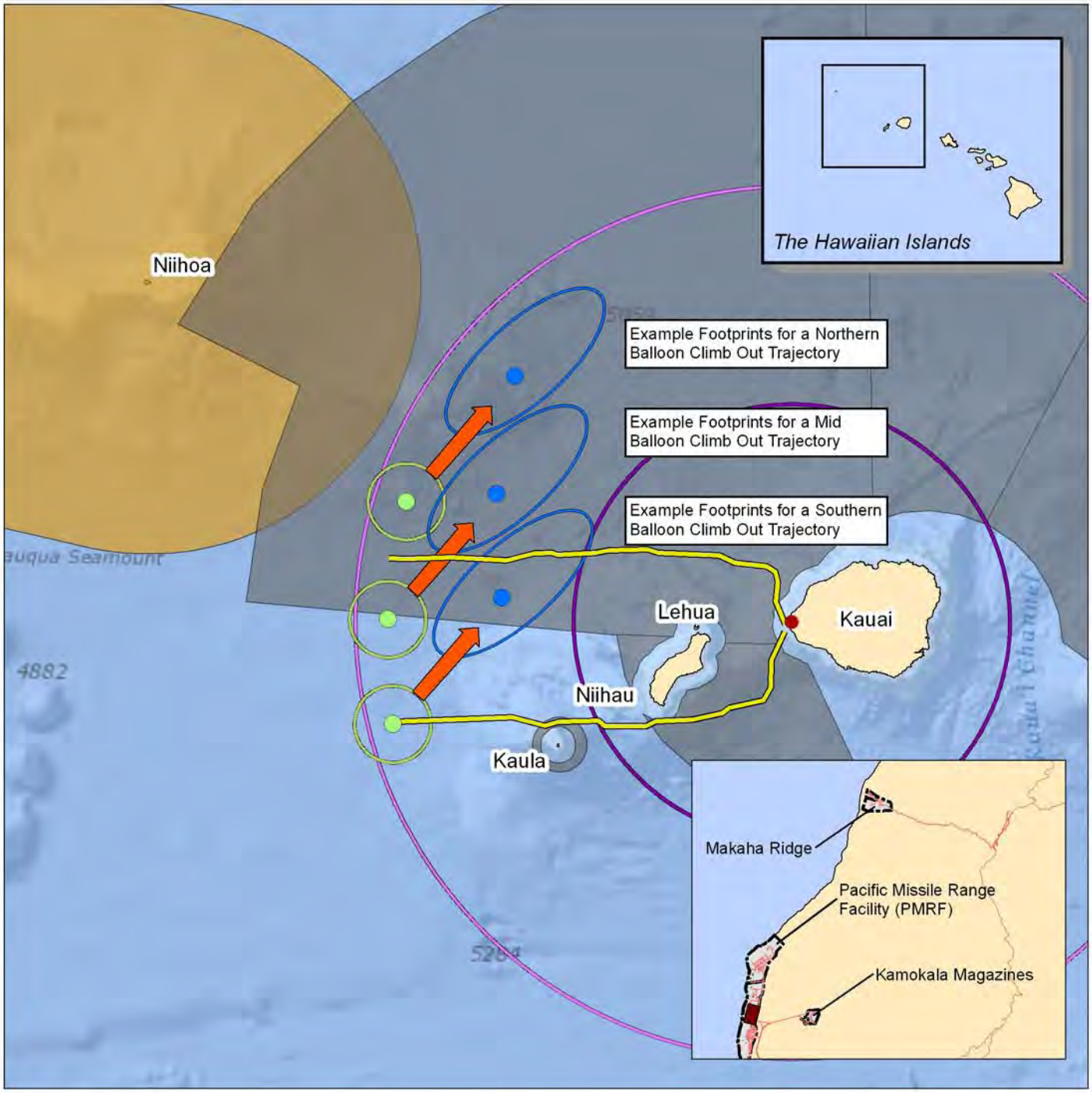
0 500 1,000 2,000 Feet

Low Density Supersonic Decelerator (LDSD) Cultural Resources Area of Potential Effects

Red Label Launch Area

Figure 3-1

SHPO_Figure2, 2/11/2013



EXPLANATION

- Balloon Drop Point
- Test Vehicle with Parachute Drop Point
- Red Label Area
- Balloon Flight Path
- Balloon Drop Point
- Test Vehicle with Parachute Drop Point
- LDSD Launch Point 40-nm Arc
- LDSD Launch Point 80-nm Arc
- Special Use Airspace
- Marine National Monument

NORTH

0 12.5 25 50 Nautical Miles

0 25 50 100 Miles

Low Density Supersonic Decelerator (LDSD) Cultural Resources Area of Potential Effects

PMRF, Niihau, and Open Ocean Recovery Area

Figure 3-2

SHPO_Figure1_Monument1, 11/16/2012

proposed for a communication cable route from the proposed communication box to the viewing and memorial area. NAVFAC determined that the undertaking does not have the potential to cause effects to listed, contributing, or eligible historic properties (specifically archaeological sites/objects/traditional cultural places), and has approved the action (Appendix C).

None of the buildings and structures that would be used by the program at either PMRF or Makaha Ridge are historic. The Kamokala Magazines have been previously determined to be historic (International Archaeological Research Institute, Inc. 2005); however, the storage of explosives and chemicals is in keeping with their historic function, and there are no modifications proposed for them under this program.

Coastal dune areas, which are known to be sensitive for archaeological and traditional Native Hawaiian remains, particularly burials, are adjacent to the launch area; however, the closest known burial (Site No. 05-1831) is approximately 609.6 meters (2,000 feet) northwest of the launch site.

The entirety of PMRF is sensitive for subsurface cultural resources, and there is always the potential for subsurface remains to be unexpectedly encountered during intentional or unanticipated ground disturbing activities. If any unexpected resources are encountered during the 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 Integrated Cultural Resources Management Plan (ICRMP) and its supporting documents (International Archaeological Research Institute, Inc., 2005). Such mitigating guidance could include, but not necessarily be limited to, archaeological monitoring; prohibition of construction equipment in areas other than established roadways, lay down, or other paved areas; and briefings to project personnel regarding the sensitive nature of PMRF coast-dune and back bay areas.

- **Geology and Soils:** The Proposed Action does not require construction or other activities that might cause soil disturbance; therefore, there will be no adverse impacts to geology and soils.

- **Land Use:** There are no planned changes to existing land use patterns. Airfield, storage, and maintenance activities associated with the Proposed Action are normal operations within the Red Label Area. The Proposed Action will be consistent to the maximum extent practicable with the Coastal Zone Management Program as authorized by the Coastal Zone Management Act of 1972. However, 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.

- **Noise:** Any change in noise levels is expected to be short-term and temporary and would not adversely affect people or animals.

- **Transportation:** Increased vehicular traffic related to the temporary increase in personnel associated with the LDSD Program is not expected to negatively impact the level of service on roadways leading to and from PMRF. Waterways and air routes are routinely used to transport mission-required personnel and equipment to PMRF and thus would not be substantially adversely affected as a result of the Proposed Action activities.

- **Utilities:** The capacity of utilities in the Red Label Area is adequate to support LDSD Program activities; therefore, there will be no substantial adverse effects on water, wastewater, electrical, or other utility usage as a result of the Proposed Action.

- **Visual Aesthetics:** While the balloon and parachute may be visible for a brief time, no known potential adverse impacts to "scenic views" in the region of influence are anticipated. The Proposed Action would not permanently alter the current scenic quality of the area in view of the balloon launch area.

3.1.1 AIR QUALITY (PMRF)

Air quality in Hawaii is defined with respect to compliance with primary and secondary National Ambient Air Quality Standards (NAAQS) (40 CFR §50) established by the U.S. Environmental Protection Agency (USEPA) and adopted by the State of Hawaii. The Clean Air Act (42 U.S.C. 7401-7671q), as amended, gives USEPA the responsibility to set safe concentration levels for six criteria pollutants: particulate matter measuring less than 10 and 2.5 microns in diameter (PM-10 and PM-2.5), sulfur dioxide, carbon monoxide, nitrogen oxides, 8-hour ozone, and lead. Ozone is measured by emissions of volatile organic compounds (VOCs) and nitrogen oxides.

3.1.1.1 Region of Influence

For inert pollutants (all pollutants other than ozone and its precursors), the region of influence is generally limited to an area extending several miles downwind from the source (Red Label Area). The region of influence for ozone may extend much farther downwind than the region of influence for inert pollutants. Consequently, for the air quality analysis, the region of influence for the project activities is the existing airshed (the geographic area responsible for emitting 75 percent of the air pollution reaching a body of water) surrounding the Red Label Area, which encompasses the Mana Plain, including PMRF/Main Base. The region of influence for greenhouse gas (GHG) emissions is global and is discussed in detail in the Air Quality Open Ocean Area (Section 3.3). Table 3-1 lists the monitored concentrations of carbon monoxide, PM-2.5, sulfur dioxide, and nitrogen dioxide for the past 2 years. No other criteria pollutants are monitored at the Niumalu monitoring station. The daily maximum concentrations have not exceeded the Federal standard, and therefore the region of influence maintains its attainment status.

Table 3-1. Air Quality Standards and Ambient Air Concentration for Kauai County, HI

Pollutant	July 2010	July 2011	July 2012	Hawaii Standards	Federal Primary Standards
	Kauai County	Kauai County	Kauai County		
PM-2.5 (µg/m^3) 24-hour average	*(no data)*	5.9	9.1	None	35 (24-hour average) 9 (8-hour average)
CO (parts per million [ppm]) 24-hour average	*(no data)*	0.5	0.4	9.0 (1-hour average)	35 (1-hour average) 9 (8-hour average)
SO_2 (ppm) 24-hour average	*(no data)*	0.0029	0.0029	0.14 (24-hour block average)	0.50 (3-hour average)
NO_2 (ppm) 24-hour average	*(no data)*	0.001	0.002	0.04 (annual average)	0.053

Source: Department of Health, Hawaii, Air Quality Station Report, 2012; Environmental Protection Agency Ambient Air Quality Standards
Notes: PM-2.5 = particulate matter with aerodynamic diameter less than 2.5 microns, µg/m^3 = micrograms per cubic meter, CO = carbon monoxide, SO_2 = sulfur dioxide, NO_2 = nitrogen dioxide

3.1.1.2 Affected Environment

Climate on PMRF

Weather is an important factor in the dispersion 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 25.5 to 29.4 degrees Celsius (°C) (78 to 85 degrees Fahrenheit [°F]) and lows from 18.3 to 23.3 °C (65 to 74 °F). The trade winds are from the northeast and are typically light—mean trade winds are between 30 to 33 kilometers per hour (16 to 18 knots). Precipitation in the area averages 104 centimeters (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. Currently, the State maintains 13 air monitoring stations on 4 islands. In 2010, a special purpose monitor was established on the island of Kauai to only monitor the impact of emissions from cruise ships downwind of Nawiliwili Harbor. Between 2004 and 2009, none of the monitored ambient air concentrations in the State exceeded the annual average ambient air quality standards (AAQS), with the exception of monitoring stations near the Kilauea volcano. These stations experienced higher levels of sulfur dioxide and PM-2.5 with occasional exceedences of the NAAQS. Because the USEPA considers emissions from the volcano an uncontrollable natural event, the State of Hawaii requested exclusion of these NAAQS exceedences from attainment/non-attainment determination. Therefore, an air conformity analysis is not required for the Proposed Action. (Hawaii State Department of Health, Clean Air Branch, 2010a, b)

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).

In 2009, the total usage reported from Kauai Test Facility (KTF) to the State of Hawaii was 59,208 liters (15,641 gallons) of diesel fuel and 1,701 hours of operation for the permitted generators. Sandia Corporation was in compliance with all air quality regulations in 2009. Climatic information representative of KTF is obtained from PMRF. (Sandia National Laboratories, 2010)

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, Makaha Ridge, Kokee, 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, 2010)

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. 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 to be achieved by 2020. The targets of significance to this EA 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.

3.1.2 AIRSPACE (PMRF)

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

3.1.2.1 Region of Influence

The region of influence for airspace includes the airspace over and surrounding PMRF to the west and southwest. Figure 3-3 shows a view of the airspace within the PMRF region of influence; it includes the PMRF Aircraft Operational Areas, the R-3101 Restricted Area, and surrounding airspace off the western coast of Kauai.

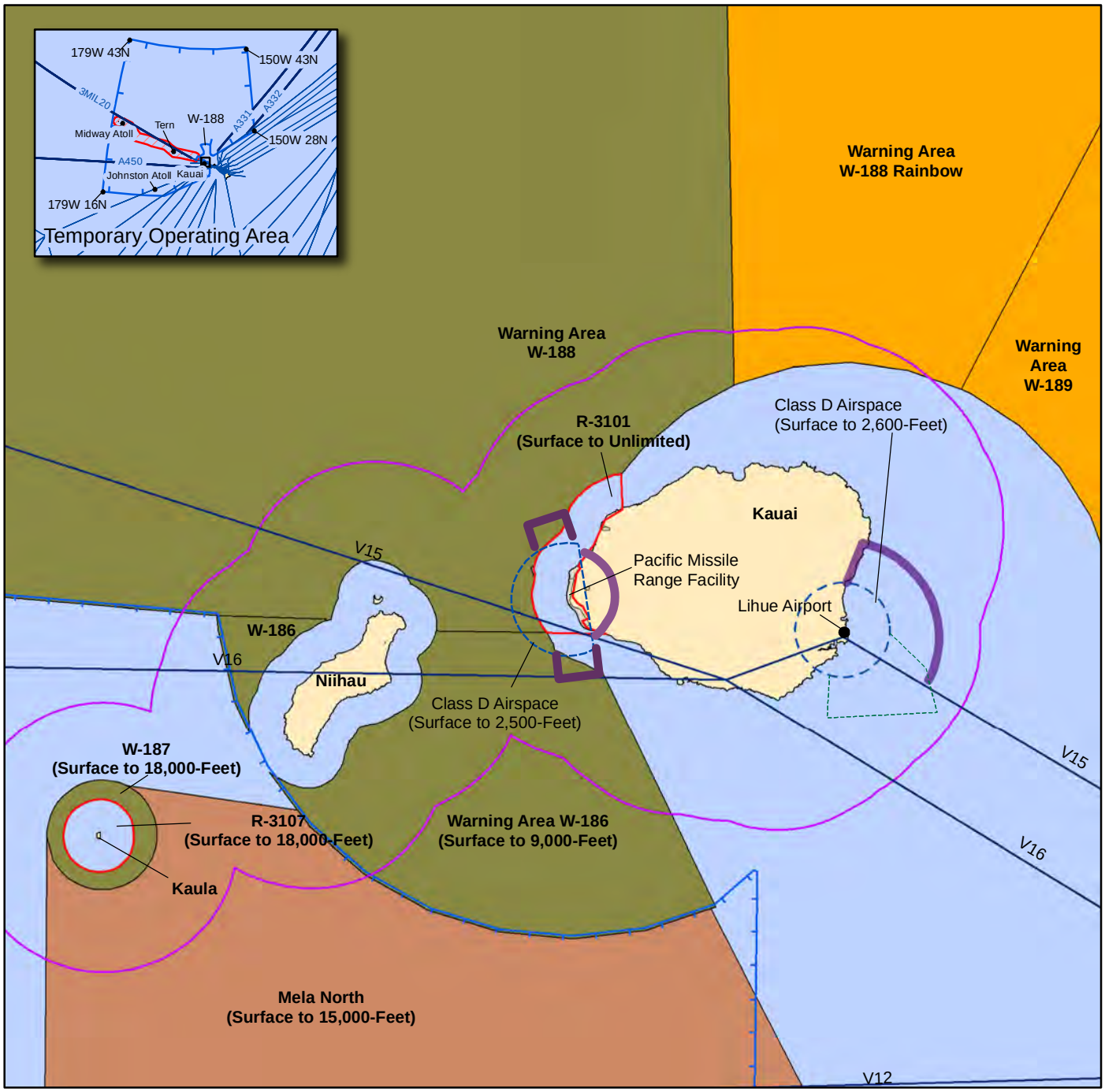
3.1.2.2 Affected Environment

The affected airspace use environment in the PMRF region of influence is described below in terms of its principal attributes: controlled and uncontrolled airspace, special use airspace, enroute 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 the 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 762 meters (2,500 feet). It is surrounded to the north, south, and east by Class D airspace with a floor 213.4 meters (700 feet) above the surface (see Figure 3-3). Lihue Airport, located approximately 37 kilometers (20 nm) east of PMRF, includes Class D, surface Class E, and additional Class E airspace with a floor 213.4 meters (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.



EXPLANATION

- Class D Airspace
- Class E Airspace with Floor at the Surface
- Class E Airspace with Floor 700-Feet Above Surface
- Airway
- Temporary Operating Area
- Oahu Warning Area
- Pacific Missile Range Facility (PMRF) Warning Area
- Air Traffic Control Assigned Airspace (ATCAA)
- Restricted Airspace
- Class D Airspace
- 12-Nautical Mile Line
- Installation Area
- Land

NORTH

0 1,000 2,000 4,000 Nautical Miles

Airspace Use Surrounding Pacific Missile Range Facility

Kauai, Niihau, and Kaula, Hawaii

Figure 3-3

31_airspace_pmrf, 8/30/2012

Special Use Airspace

A restricted area is airspace designated under 14 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 5.5 kilometers (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.

The special use airspace in the region of influence (see Figure 3-3) 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 35 kilometers (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 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. The PMRF airspace use region of influence has no Prohibited or Alert special use airspace areas.

Special Airspace Use Procedures

To ensure safe operations, PMRF requests use of specific areas of airspace from the FAA during missile defense testing and other rocket launches. 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 NOTAM 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, and (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. (Federal Aviation Administration, 2011)

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 3-3). An accounting of the number of flights using each airway is not maintained.

The airspace use region of influence, located to the west and south of Kauai, contains 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

With the exception of the airfield at PMRF/Main Base and the Kekaha airstrip approximately 4.8 kilometers (3 miles) to the southeast of PMRF and 3.2 kilometers (2 miles) northwest of Kekaha, there are no airfields or airports in the airspace use region of influence. 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 37 kilometers (23 miles) east of PMRF and is the primary airport on Kauai. It handles overseas and interisland flights. 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 ICAO Document 444, *Rules of the Air and Air Traffic Services*, are followed (International Civil Aviation Organization, 2008). ICAO Document 444 is the equivalent air traffic control manual to FAA Handbook 7110.65, *Air Traffic Control*. Air traffic in the region of influence is managed by the Honolulu Control Facility (Figure 3-4).

3.1.3 BIOLOGICAL RESOURCES (PMRF)

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.

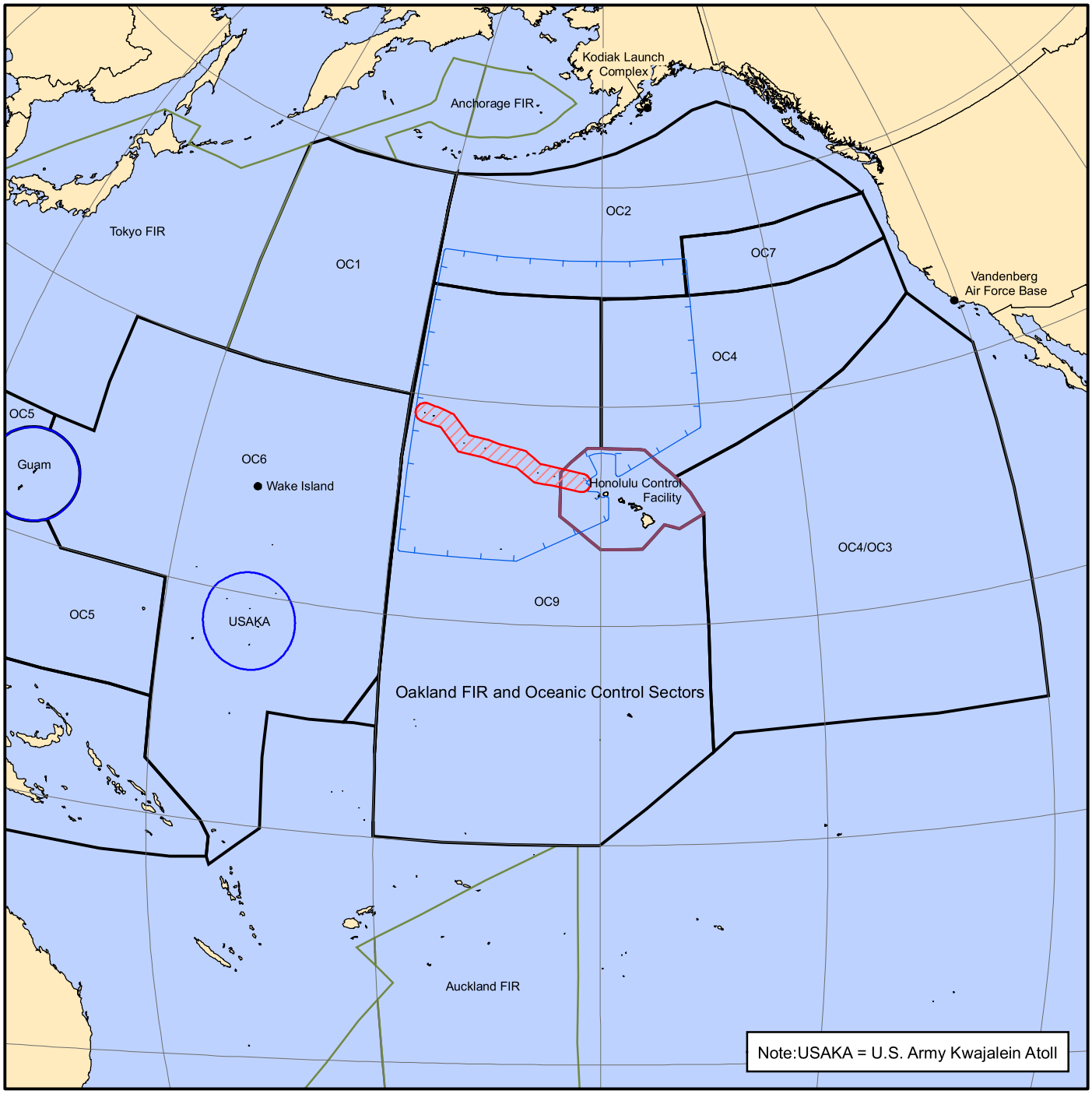
3.1.3.1 Region of Influence

The region of influence for biological resources includes the area within the PMRF property boundary that could be affected by proposed activities. Within the region of influence, human activities have altered most of the natural terrestrial environment.

3.1.3.2 Affected Environment

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



EXPLANATION

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

NORTH

0 500 1,000 2,000 Nautical Miles

Airspace Managed by Oakland Air Route Traffic Control Centers

Pacific Ocean

Figure 3-4

32_airspace, 8/30/2012

the shoreline. (Commander, Navy Region Hawaii, 2010) 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. The southern half of PMRF has stands of `a`ali`i, but the dominant woody vegetation through much of Barking Sands consist of kiawe (known as mesquite on the mainland) and koa haole scrub. As described in the PMRF Integrated Natural Resources Management Plan, a`ali`i-nama scrub is found on the southern half of PMRF, from about the housing area to the antenna fields. The best example of this vegetation type is found in the area around the oxidation ponds. (Commander, Navy Region Hawaii, 2010)

The Navy in cooperation with the Invasive Species Committee developed a new procedure for the destruction of the variety of algaroba referred to as "long thorn kiawe" in Hawaii (Commander, Navy Region Hawaii, 2010). Portions of Barking Sands that had been designated as Critical Habitat for the endangered dune grass lau`ehu (*Panicum niihauense*) including areas of long thorn kiawe and also perhaps containing buried cultural resources were considered in developing the protocol. Before initiating the new procedure in 2005, both the State Historic Preservation Office and USFWS were informed and approved the action. This involved a large excavator with a rotary mulcher brush cutting the 20-foot and taller long thorn kiawe down to a short stump, then cutting, cleaning, and treating with stump killer. No subsurface disturbance occurs and the Critical Habitat is improved. Kauai Invasive Species Committee staff returns on a schedule to treat seed bed regrowth. This procedure has been followed up until the present time, with over 90 percent of the long thorn kiawe on Barking Sands destroyed and native vegetation, especially a`ali`I shrubs, recruiting. (Burger, 2012)

Threatened and Endangered Plant Species

No plant species listed as threatened or endangered or candidates for listing are known to grow on PMRF. (Commander, Navy Region Hawaii, 2010)

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 in Polihale State Park. Lau`ehu (*Panicum niihauense*), an endangered species of rare grass, has been observed near Queens Pond also north of PMRF. (Commander, Navy Region Hawaii, 2010; U.S. Department of the Navy, 1998)

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; 2006a)

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 (Commander, Navy Region Hawaii, 2010), has also been observed on PMRF. Wedge-tailed shearwaters nest in the Nohili dunes area in the northern portion of the base. A nesting colony of wedge-tailed shearwaters is also located near the beach cottages in the central portion of the base. 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, 0.4-hectare (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 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; 2006a). 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 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 with new surrogate parents. All of the resulting chicks 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 is anticipated to continue as long as viable eggs are available at PMRF/Main Base. (Burger, 2007a; U.S. Fish and Wildlife Service, 2005b; U.S. Department of the Navy, 1998; 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, 1998; 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 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, 2006b; U.S. Department of the Navy, 1998; U.S. Army Space and Missile Defense Command, 2001)

Corals

Results of quantitative transects, conducted at selected areas within this region where at least some hard bottom was encountered, revealed coral cover of less than 2 percent of the total bottom cover. (Commander, Navy Region Hawaii, 2010)

Fish and Macroinvertebrates

Results of surveys of fish communities in Majors Bay reveal that in 2000, 22 species of fish were noted. In 2006, 30 species of fish were recorded. (Commander, Navy Region Hawaii, 2010)

Marine Mammals

During a 3-week survey performed in support of the 2012 Annual Marine Species Monitoring Report for the U.S. Navy's Hawaii Range Complex, 34 rough-toothed dolphins, 15 bottlenose dolphins, 10 spinner dolphins, 2 false killer whales, single sightings of pantropical spotted dolphins and pilot whales, and 4 sightings of unidentified dolphins were observed visually or acoustically. Spinner dolphins (*Stenella longirostris*) were visually observed in groups ranging from 20–30 individuals in shallow water outside the PMRF hydrophone field. Spinner dolphins are known to rest in bays and other protected waters around the Hawaiian Islands, and several schools occur around Kauai. Spinner dolphins have a well defined home range and can regularly be found in the same area. They spend considerable time close to shore in waters 14 meters (45 feet) or less in depth. The typical activity pattern of spinner dolphins is an early morning period of school movement and high activity, followed by a calmer period lasting the remainder of the day. In the late afternoon, high activity restarts during which time the smaller groups may join together and head seaward, presumably to feed during the night. (Dilley and McCarthy, 2012; Commander, Navy Region Hawaii, 2010)

Bottlenose dolphins (*Tursiops truncatus gilli*) are likely to be found in the coastal waters off of Kauai including Barking Sands (Commander, Navy Region Hawaii, 2010). During the 2012 survey, observers were able to acoustically differentiate among rough-toothed dolphins (*Steno bredanensis*), bottlenose dolphins, and pilot whales (*Globicephala macrorhynchus*) by examining click and whistle structures that were documented during previous PMRF tests (Dilley and McCarthy, 2012). In addition, spotted dolphins (*Stenella attenuata*), bottlenose dolphins, pilot whales, melon headed whales

(*Peponocephala electra*), and pygmy killer whales (*Feresa attenuata*) are likely to be found in the coastal waters off of Kauai (Commander, Navy Region Hawaii, 2010).

Threatened and Endangered Wildlife Species

The orange clownfish (*Amphiprion percula*), Hawaiian dascyllus (*Dascyllus albisella*), and Johnston Island damselfish *(Plectroglyphidodon johnstonianus*) are Pomacentrid (damselfish and anemonefish) reef fish that have recently been listed as Candidate Species that inhabit U.S. waters in Hawaii, and may be in waters offshore of PMRF and/or Niihau. The fish are threatened by ocean warming and ocean acidification that degrade and destroy their coral reef and anemone habitat. Table 3-2 provides a list of additional wildlife species known or expected to occur on and adjacent to PMRF that are listed as threatened, endangered, or candidate in accordance with the Endangered Species Act (ESA). Seven Federally listed bird species are potentially present or confirmed in the PMRF area.

Band-rumped Storm-Petrel. The band-rumped storm-petrel (*Oceanodroma castro*) has recently been listed as a candidate species. It is a small seabird about 20 centimeters (8 inches) long. It is an overall blackish-brown bird with a white rump. Sexes are alike in size and appearance. The species is long-lived (15–20 years) and probably does not breed until its third year. In Hawaii, band-rumped storm-petrels are currently known to nest only in remote cliff locations on Kauai and Lehua Islet, and in high-elevation lava fields on Hawaii. (U.S. Fish and Wildlife Service, 2011)

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 594.3 meters (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. Adults establish nesting sites in April or May (U.S. Fish and Wildlife Service, 2011). Like most seabirds this storm-petrel lays a single egg per season, between May and June, and nestlings fledge in October. When not at nesting sites, adults spend their time foraging on the open ocean. (Hawaii Department of Land and Natural Resources, 2005)

Introduced predators (rats, cats, dogs, mongoose, and barn-owls) are believed to be the most serious threats facing the band-rumped storm-petrel on land in Hawaii. The band-rumped storm-petrel lacks effective anti-predator behavior, and has a lengthy incubation and fledgling period; thus adults, eggs, and young are highly vulnerable to predation by introduced mammals. Another impact to the band-rumped storm petrel is the attraction to artificial lights on fledgling young and, to a lesser degree, adults. Artificial lighting of roads, resorts, ballparks, residences, and other development in lower elevation areas both attracts and confuses night-flying band-rumped storm-petrel fledglings, resulting in fall-out and collisions with buildings and other objects. (U.S. Fish and Wildlife Service, 2011)

Table 3-2. Listed Species Known or Expected to Occur in the Vicinity of PMRF/Main Base/KTF

Scientific Name	Common Name	Federal Status
Reptiles		
Caretta caretta	Loggerhead turtle*	E
Chelonia mydas	Green turtle	T
Dermochelys coriacea	Leatherback turtle	E
Eretmochelys imbricata	Hawksbill turtle	E
Lepidochelys olivacea	Olive ridley 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
Phoebastria nigripes	Black-footed albatross	P
Pterodroma phaeopygia sandwichensis	`Ua`u (Hawaiian petrel)	E
Puffinus auricularis newelli	`A`o (Newell's Townsend's shearwater)	T
Coral		
Montipora flabellata	Blue rice coral	P
Montipora patula	Ringed rice coral	P
Mammals		
Lasiurus cinereus spp. *semotus*	Hawaiian hoary bat	E
Megaptera noveangliae	Humpback whale	E
Monachus schauinslandi	Hawaiian monk seal	E
Pseudorca crassidens	False killer whale	C

Source: U.S. Fish and Wildlife Service, 2005a; b; 2007a; 2010; U.S. Department of the Interior, Office of Environmental Policy and Compliance Pacific Southwest Region, 2007; National Oceanic Atmospheric Administration, 2010; 2013; Commander, Navy Region Hawaii, 2010; International Union for the Conservation of Nature and Natural Resources, 2012

Notes: * Considered for listing as endangered

** Observed in May 2000

Key to Federal Status:
C = Candidate T = Threatened E = Endangered P=Proposed for listing as threatened or endangered

Nene. 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 Hawaii Air National Guard complex on 23 November 2009, less than 1.6 kilometers (1 mile) from the south end of the active runway. Approximately 20 additional adult nenes were also observed, many of them less than 0.5 kilometer (0.3 mile) 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 USFWS 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 20 hectares (50 acres) of fenced wetland area, and has 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. (Naval Facilities Engineering Command Pacific, 2009; U.S. Fish and Wildlife Service, 2009)

Newell's Shearwater. Kauai provides the majority of Hawaii's habitat for the threatened Newell's shearwater (*Puffinus auricularis newelli*). The Newell's shearwater uses the open tropical seas and offshore waters near its breeding grounds. The Newell's shearwater has a glossy black top, a white bottom, and a sharply hooked black bill. Its claws are well adapted for burrow excavation and climbing. (U.S. Fish and Wildlife Service, 2011)

The most recent population estimate from 1995 estimates the total population to be roughly 84,000 birds, with approximately 75 percent occurring on the island of Kauai. Recent ornithological radar surveys, combined with returns of downed birds to the Save Our Shearwater program have shown an estimated decline of 75 percent between 1993 and 2008. Depletion of available nesting habitat is one of the main threats to this species. The introductions of the mongoose, black rat, and Norway rat have played a primary role in the reduction of ground-nesting seabirds. Predation by feral cats and barn owls has also been observed. In addition, feral pigs are known to collapse burrows as well as consume or prey on shearwaters. (U.S. Fish and Wildlife Service, 2011)

Another major threat is the species' attraction to light. The Newell's shearwater nests from April to November in burrows under ferns on forested slopes in the interior mountains of Kauai. A single egg is laid in late May or early June, which both sexes incubate for approximately 45 days. Daily flights to and from the colonies occur only at night. 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. Since 1979 the Kauai District of Hawaii's Division of Forestry and Wildlife has supported a program called Save our Shearwaters to collect Newell's shearwaters and Hawaiian petrels that have either collided with structures or fallen out, or have been injured or killed due to exhaustion caused by light attraction. (U.S. Fish and Wildlife Service, 2011)

PMRF has had an ongoing program to reduce fallout of these nocturnal fledging migratory seabirds. This has included replacement of fixtures and lamps to be dark-sky compliant and energy conserving with full-cutoff LED fixtures mounted horizontally, horizontal alignment of all fully-recessed (full cutoff) fixtures, shielding with hoods, and replacement of high-intensity metal halide white lamps with green lamps to test published reports based on European experience with fallout reduction that identified the green spectrum as both human and bird-friendly compared to other wavelengths. (Burger 2012)

Short-tailed Albatross. On 31 July 2000, the USFWS published a final rule listing the short-tailed albatross (*Phoebastria albatrus*) as endangered throughout its range. Critical habitat has not been designated for this species. The short-tailed albatross is a large pelagic (open ocean) bird with long narrow wings adapted for soaring just above the water's surface. The bill, which is disproportionately large compared to the bills of other northern hemisphere albatross, is pink with a bluish hooked tip and a conspicuous thin black line around the base. The short-tailed albatross' beak has conspicuous external nostrils. (U.S. Fish and Wildlife Service, 2008)

The short-tailed albatross is the largest of the three species of North Pacific albatross (Laysan and black-footed) with a body length of 83.8 to 94 centimeters (33 to 37 inches). The wingspan of the short-tailed albatross is also the largest of the three species, at 213.4 to 228.6 centimeters (84 to 90 inches). (U.S. Fish and Wildlife Service, 2008)

Short-tailed albatross are also the only North Pacific albatross that develop an entirely white back at full maturity. The white heads of both sexes develop a yellow-gold crown and nape over several years. Fledged juveniles are dark brown-black, but soon develop the pale bills and legs that distinguish them from black-footed and Laysan albatross. (U.S. Fish and Wildlife Service, 2008)

The short-tailed albatross once ranged throughout most of the North Pacific Ocean and Bering Sea. A worldwide subadult population has been estimated as 1,292 individuals. This number, added to the adult population of 1,114, would indicate a 2007-2008 total population of about 2,406 short-tailed albatross worldwide. National Marine Fisheries Service (NMFS) biologists observed the short-tailed albatross at sea in 2000. Midway Atoll is the only area within U.S. jurisdiction where short-tailed albatross have attempted to breed. Approximately 2 million black-footed and Laysan albatross nest throughout the islands. Observations of individual short-tailed albatross have also been made during the breeding season on Laysan Island, Green Island at Kure Atoll, and French Frigate Shoals, but there is no indication that this species breeds in these locations. (U.S. Fish and Wildlife Service, 2008)

Black-footed Albatross. The black-footed albatross is a small, all dark albatross, with a dark bill and dark legs. The juvenile is even more uniform brown. (BirdLife International, 2012)

The black-footed albatross breeds on the Northwestern Hawaiian Islands, the U.S. Minor Outlying Islands, and three outlying islands of Japan, colonies having been lost from other Pacific islands. In total there are estimated to be 64,500 pairs breeding each year in at least 14 locations. The largest populations are about 24,000 and 21,000 pairs on Midway Atoll and Laysan Island respectively, which together account for 73 percent of the global population. (BirdLife International, 2012)

Its populations declined significantly due mainly to feather and egg collecting in the late 1800s and early 1900s. The population then recovered during the first half of the twentieth century, but has shown a declining trend in the last 15 years. Between 1978 and 1992, the population experienced elevated mortality from interactions with high seas drift-nets in the North Pacific. In 2003, mortality was estimated to be at least 2,000 birds per year in U.S.-based fisheries and a further 6,000 in Japanese/Taiwanese fleets. Recent estimates indicate a significant reduction in U.S. longline bycatch from previous years that is very likely attributable to the use of effective seabird avoidance measures, with an average of 130 birds killed per year in longline fisheries in Alaska and Hawaii between 2004 and 2006. (BirdLife International, 2012)

Hawaiian Petrel. The endangered Hawaiian petrel (*Pterodroma phaeopygia sandwichensis*) is a medium-sized seabird in the family *Procellariidae* (shearwaters, petrels, and fulmars). The Hawaiian petrel is a large petrel, approximately 41 centimeters (16 inches) long with a wing span of 0.9 meter (3 feet). The Hawaiian petrel has a dark gray head, wings, and tail, and a white forehead and belly. Hawaiian petrels have stout grayish-black bills that are hooked at the tip, and feet that are pink and black.

The total population including juveniles and subadults in 1995 was estimated at 20,000 with a breeding population of 4,500 to 5,000 pairs. Kauai populations are difficult to assess, but potentially a large portion of the population nests on the island. (U.S. Fish and Wildlife Service, 2011)

Hawaiian petrels are colonial and nest in burrows, crevices in lava, or under ferns. The Hawaiian petrels arrive in their colonies in late February and may traverse the area from their nesting grounds to the sea. After a period of burrow maintenance and social activity they return to sea until late April, when egg-laying begins. Non-breeding birds visit the colony from February until late July. Hawaiian petrels are nocturnal over land and are active from about 1 hour after sunset until about 1 hour before sunrise. Chicks begin hatching in late June and fledge between late September to late November, slightly earlier than that of the Newell's shearwater. On rare occasion, grounded Hawaiian 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. (Audubon, 2006; U.S. Fish and Wildlife Service, 2011; Virginia Tech Conservation Management Institute, 1996)

The Hawaiian petrel faces severe threats from non-native predators including rats, cats, mongoose, and introduced barn owls. Other significant anthropogenic sources of

Hawaiian petrel mortality are light attraction and collision with communications towers, power transmission lines and poles, fences, and other structures. (U.S. Fish and Wildlife Service, 2011)

Other Listed Birds. 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 northern PMRF/Main Base. The Hawaiian coot, black-necked stilt, and common moorhen (U.S. Fish and Wildlife Service, 2006) nest on Kauai year-round. (U.S. Department of the Navy, 1998)

Hawaiian Hoary Bat. The Hawaiian hoary bat (*Lasiurus cinereus* spp. *semotus*) is listed as a Federal and State endangered species. The subspecies is the only land mammal endemic to Hawaii. Hawaiian hoary bats generally occur in or near forest habitat, and apparently use native vegetation more frequently than non-native vegetation. Their diet consists of flying insects. Hawaiian hoary bats have been observed to forage over open fields, over the open ocean near the mouths of river or stream outlets, and over streams and ponds. The current population size of Hawaiian hoary bats is unknown, but the greatest threats to populations are thought to be habitat loss, use of pesticides, and predation. It has been recorded at PMRF; a group of four was observed foraging around the sewage treatment ponds, and another separate group of five bats was seen just offshore of northern PMRF (Commander, Navy Region Hawaii, 2010). No sightings have been recorded in the southern portion of the base within the region of influence. (Naval Facilities Engineering Command Pacific, 2010b; Commander, Navy Region Hawaii, 2010)

During the week of 30 June to 7 July 2010, U.S. Geological Survey (USGS) biologists deployed four Anabat detectors on the southern half of PMRF Main Base: one along the west side of the private shrimp farm located east of the base, one at the PMRF sewage treatment pond, one at the Hawaii Air National Guard site, and one along the Kini Kini Ditch just southeast of the PMRF runway. During this 1-week Anabat deployment, one bat was detected for approximately 30 seconds at the PMRF sewage treatment pond. No bats were detected at the Hawaii Air National Guard site, nor at the other two sites. During the week of 8 to 15 July 2010, Anabat detectors were deployed along Nohili Ditch (approximately 137.2 meters [150 yards] from the ocean) and the Aegis Ashore Interceptor Launch Area (detectors were also placed at two locations at Kamokala Magazines, a PMRF site east of the Main Base). During this 1-week deployment, no bats were detected at these sites. (Naval Facilities Engineering Command Pacific, 2010b)

Marine Species

Two species of coral (*Montipora flabellata* [blue rice coral] and *M. patula* [ringed rice coral]) present offshore of the central portion of PMRF are among the 59 species currently proposed for listing under the ESA (National Marine Fisheries Service, 2013)

Two marine wildlife species Federally and State listed as threatened or endangered commonly occur on PMRF/Main Base: the Hawaiian monk seal (*Monachus schauinslandi*) and the green sea turtle (*Chelonia mydas*). The hawksbill sea turtle (*Eretmochelys imbricata*) has been reported in the open waters offshore of Kauai; however, there are no known records of hawksbill sea turtles coming ashore or nesting within or adjacent to PMRF. The humpback whale (*Megaptera noveangliae*) is located in water offshore. In addition, the false killer whale (*Pseudorca crassidens*) has been sighted off of the west coast of Kauai near Barking Sands. (Commander, Navy Region Hawaii, 2010)

***Montipora flabellata*.** Blue rice coral is only found in Hawaii and is usually blue in color, but may photograph pink, brown, or purple. This coral is usually flat and sheetlike (Center for Biological Diversity, 2012).

Its colonies are encrusting, with irregular lobes. Corallites (skeletons of individual polyps) are small (4.3 centimeters [1.7 inches]). Papillae cover the colony surface and are sometimes fused into ridges. Its septa are poorly developed. Blue rice coral is found in shallow reef environments. Blue rice coral is vulnerable to bleaching, habitat degradation, and disease (Center for Biological Diversity, 2012).

***Montipora patula*.** *M. patula* colonies are composed of encrusting or tiered plates with free edges that can be over 2 meters (6.6 feet) in diameter. The "sandpaper"-like consistency of the colony surface results from tiny corallites of irregular height and their surrounding papillae. *M. patula* colonies appear tan in color and generally have purple polyps. This is a shallow reef species that has been found in depths of up to 10 meters (33 feet). (Center for Biological Diversity, 2009)

M. patula is abundant throughout and endemic to the Hawaiian Islands. Unlike *M. flabellata*, its range also includes Johnston Atoll. While *M. patula* is the most abundant of the three *Montipora* species that are endemic to Hawaii (International Union for the Conservation of Nature and Natural Resources, 2012), its very limited range (fewer than five locations) puts it at high risk from the threats to sibling species described above, including climate-related bleaching and disease as well as crown-of-thorns starfish predation. (Center for Biological Diversity, 2009)

Hawaiian Monk Seal. The endangered Hawaiian monk seal is an indigenous mammal that has been observed at PMRF. The primary occurrence of Hawaiian monk seals within the region of influence is expected to be in a continuous band between Nihoa, Kaula, Niihau, and Kauai. This band extends from the shore to around 273 fathoms (1,638 feet) 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).

Endangered Hawaiian monk seals regularly haul out on the PMRF/Main Base beach. Sitings of Hawaiian monk seal haul outs are documented by the PMRF Environmental

Office. 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, 2006; National Marine Fisheries Service, 2007). Three pups were born on Kauai in 2005, and four pups were born in 2006 (National Oceanic and Atmospheric Administration, 2006; National Marine Fisheries Service, 2007). Pups are born between February and August.

Green Sea Turtle. Threatened green sea turtles (*Chelonia mydas*) 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. Department of Land and Natural Resources staff on Kauai documented one case of nesting by a green sea turtle at Barking Sands approximately 2.1 kilometers (1.3 miles) north of Kokole Point in 1989. Green sea turtles had not nested anywhere along the beachfront in the last 10 years. In the past 3 years only one apparent "false nesting" had been observed. (Burger, 2007b) However, in 2010 two green sea turtles nested for the first time in more than a decade, and the turtles hatched successfully from both nests in August (MidWeek Kauai, 2010). Security patrols reports include a record of the presence and locations of turtles. Any records of green sea turtle sightings are maintained by the PMRF Environmental Office. (Commander, Navy Region Hawaii, 2010)

Humpback Whale. The humpback whale (*Megaptera noveangliae*) peak abundance around the Hawaiian Islands is from late February through early April (Mobley et al., 2001; Carretta et al., 2005). During the fall-winter period, primary occurrence is expected from the coast to approximately 93 kilometers (50 nm) offshore, including the areas off PMRF.

The humpback whale is listed as endangered under the ESA and as a depleted and strategic stock under the Marine Mammal Protection Act (MMPA) (Carretta et al., 2005). There is no designated critical habitat for this species in the North Pacific. Humpback whales and other marine mammals are of interest from a cultural perspective to some Native Hawaiians and other people (National Oceanic and Atmospheric Administration, 2003).

Humpback whales were once plentiful in oceans worldwide. The global population was depleted by the commercial whaling industry at the start of the 20th century. Currently, as many as 10,000 animals may migrate to Hawaii each year. The humpback is slowly making a comeback to its estimated pre-whaling population of 15,000 to 20,000 animals. (National Oceanic and Atmospheric Administration, 2012)

Humpback whales spend summer months feeding on zooplankton and small fish in the colder, nutrient-rich waters of temperate and sub-polar regions like Alaska. It is believed that humpbacks follow cues of temperature, ocean currents, and the earth's

magnetic field to navigate about 4,828 kilometers (3,000 miles) of open ocean during migration. Once in warmer waters, the whales engage in mating, calving, and nursing activities. (National Oceanic and Atmospheric Administration, 2012)

False Killer Whale. The false killer whale is a large member of the dolphin family. Females reach lengths of 4.6 meters (15 feet), while males are almost 6 meters (20 feet). In adulthood, false killer whales can weigh approximately 680 kilograms (1,500 pounds). In November 2010, NMFS proposed to list the Hawaiian insular false killer whale as endangered under the ESA. False killer whales have been sighted offshore of Kauai and Niihau, but the stock identity of these animals is unknown. They prefer tropical to temperate waters that are deeper than 1,006 meters (3,300 feet). (National Marine Fisheries Service, Office of Protected Resources, 2012)

The breeding season of the false killer whale lasts several months. Gestation periods range from 14 to 16 months, and lactation occurs for 1.5 to 2 years. False killer whales have low reproduction rates, with calving intervals of approximately 7 years. Maturity occurs at around 12 years of age, and the maximum longevity is 63 years. (National Marine Fisheries Service, Office of Protected Resources, 2012)

These whales are usually found in groups of 10 to 20 that belong to much larger groups of up to 40 individuals in Hawaii and 100 individuals elsewhere. They are known to strand in large groups as well. False killer whales are also found with other cetaceans, most notably bottlenose dolphins. To increase success of finding prey, these whales travel in a broad band that can be up to several miles wide. (National Marine Fisheries Service, Office of Protected Resources, 2012)

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, 2010).

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

The USFWS evaluated 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 3-5). The critical habitat in the southern portion of the base falls within the area designated as the original GHA in the 1992 KTF EA. The GHA is the area that would contain debris as a result of an unplanned, early flight termination of the missile. 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. (Commander, Navy Region Hawaii, 2010; U.S. Fish and Wildlife Service, 2003)

3.1.4 HAZARDOUS MATERIALS AND WASTE (PMRF)

In general, hazardous substances (materials) and wastes are defined as those substances that, because of their quantity, concentration, or physical, chemical, or infectious characteristics, would present substantial danger to public health and welfare or to the environment when released into the environment.

As defined by the DOT, a hazardous material is a substance or material that is capable of posing an unreasonable risk to health, safety, or property when transported in commerce and has been so designated. Hazardous waste is further defined as any solid waste not specifically excluded which meets specified concentrations of chemical constituents or has certain toxicity, ignitability, corrosivity, or reactivity characteristics.

3.1.4.1 Region of Influence

The region of influence for hazardous materials and hazardous waste would be limited to areas of the Red Label Area to be used for launch preparation, launch, and post-launch activities and in areas where hazardous materials are stored and handled.

3.1.4.2 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.

EXPLANATION

- Road
- Kauai Test Facility
- Critical Habitat
- Wetland Area
- Installation Area
- Land

NORTH 0 0.5 1 2 Miles

Critical Habitat - Western Kauai, Hawaii

Kauai, Hawaii

Figure 3-5

35_ch_wkauai_ldsd, 2/11/2013

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 189,271-liter (50,000-gallon) underground storage tanks (USTs) located at the Fuel Farm, one 113,562-liter (30,000-gallon) UST located at the Power Plant, two 18,927-liter (5,000-gallon) USTs at the Navy Exchange, three 18,927-liter (5,000-gallon) USTs at the gasoline station, and one 3,785-liter (1,000-gallon) UST at the Calibration Lab. There are two 22,712-liter (6,000-gallon) diesel aboveground storage tanks (ASTs) and one 3,785-liter (1,000-gallon) AST at Makaha Ridge, three 757-liter (200-gallon) ASTs near building 510, and one 3,785-liter (1,000-gallon) AST near building 450. (Burger, 2006)

KTF has one 9,463-liter (2,500-gallon) UST and one 37,854-liter (10,000-gallon) aboveground fuel tank. KTF complies with PMRF's management plans for oil and hazardous materials outlined in the PMRF Spill Prevention Control and Countermeasures Plan and the Installation Spill Contingency Plan. (Sandia National Laboratories, 2010)

Hazardous Waste Management

KTF is designated a small-quantity hazardous waste generator by the USEPA and generates some hazardous waste through normal operations at KTF. KTF has one hazardous waste accumulation point. (Sandia National Laboratories, 2010)

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 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 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.

Installation Restoration Program

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.

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 Laboratories, 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.

Asbestos, Lead-Based Paint and Polychlorinated Biphenyls

All facilities associated with PMRF follow its lead-based paint management plan. The exception is KTF, which follows DOE plans for the removal of lead-based paint wastes. KTF follows the DOE plans for the removal of any lead-based paint wastes. The transformers on the KTF site have been tested and are free of polychlorinated biphenyls, and there are no asbestos issues at the site. (Sandia National Laboratories, 2010)

3.1.5 HEALTH AND SAFETY (PMRF)

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

- **The well-being, safety, or health of workers**—Workers are considered to be persons directly involved with the operation producing the effect or who are physically present at the operational site.

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

3.1.5.1 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, areas where rocket/satellite components are stored and handled and where pre-launch, launch, and post-launch activities would occur. The worker population of concern for the Proposed Action would predominantly consist of the personnel directly involved with the SDFT. Of particular concern to human health and safety are the following rocket exhaust constituents: aluminum oxide, nitrogen dioxide, hydrochloride, carbon monoxide, and lead oxide.

The region of influence for potential impact related to public health and safety includes the areas on PMRF, Kauai County, and the island of Kauai affected by range operations, pre-launch, launch, and post-launch activities.

3.1.5.2 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. 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 GHAs 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 and rocket 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/rocket computer systems may be used to recognize malfunctions and terminate missile/rocket 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, 1998)

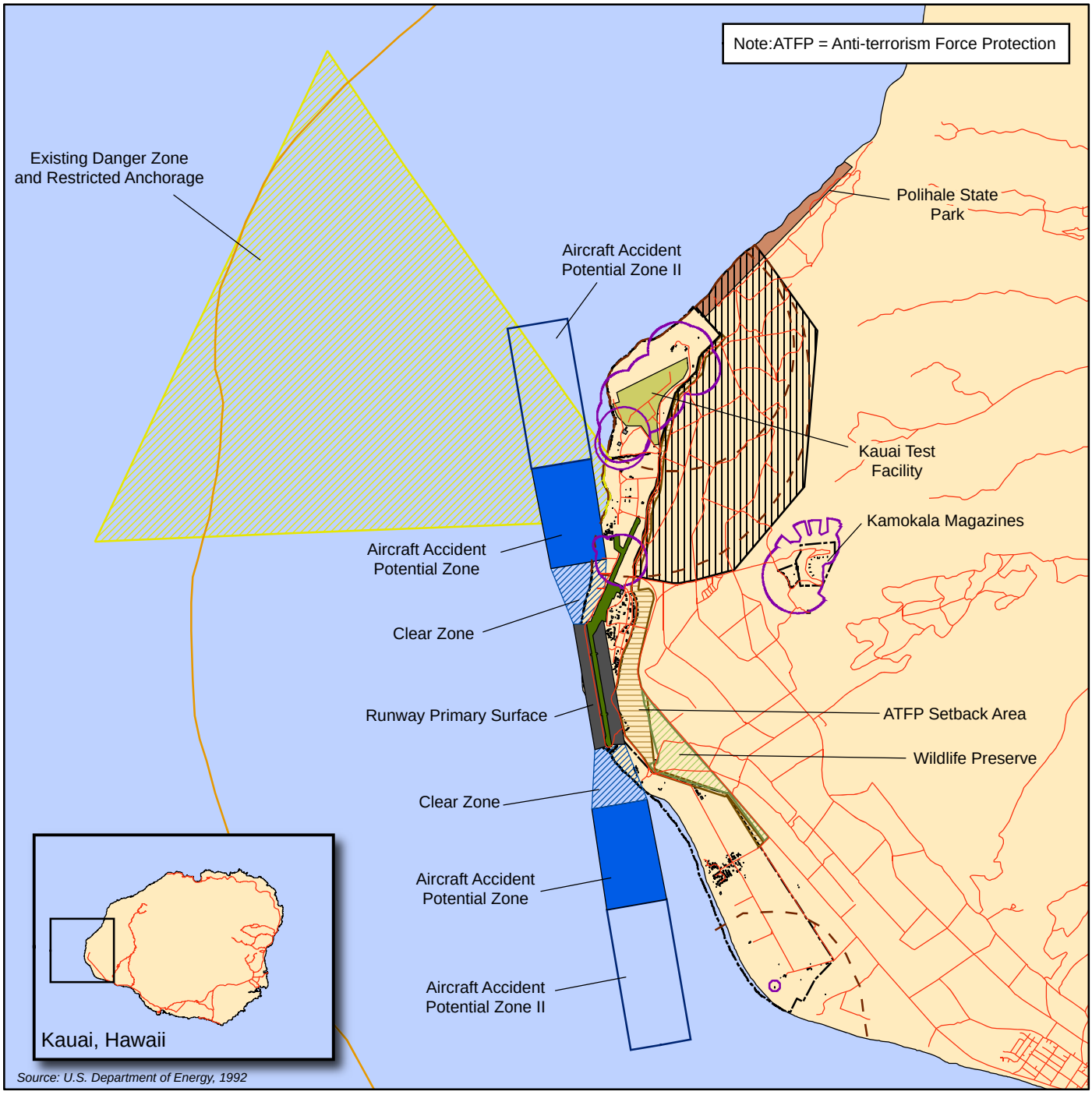
Missile/Rocket Flight Analysis

PMRF conducts flight safety, which includes analysis of missile/rockets performance capabilities and limitations, of hazards inherent in missile/rocket operations and destruct systems, and of the electronic characteristics of missiles/rockets and instrumentation. It also includes computation and review of missile/rockets trajectories, launch azimuths, 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 Officer 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 launch systems using PMRF (U.S. Department of the Navy, 1998). PMRF uses the most up to date Range Commanders Council (RCC) 321 (e.g., RCC 321-10); *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 the most up to date RCC 321 (e.g., RCC 321-10), 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 3-6 shows the PMRF health and safety areas including the GHAs associated with launch activities at PMRF.

To ensure the protection of all persons and property, standard operating procedures (SOPs) have been established and implemented. 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 GHAs. At 20 minutes before a launch, the GHA 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, 1998) No inhabited structures are located within the off-base sections of the GHA. The potential for launch-associated hazards is further minimized through the use of the PMRF Missile Accident Emergency Team. This team is assembled for all launches from PMRF facilities and on-



EXPLANATION

- Road
- 3-Nautical Mile Line
- Existing ESQD Arc
- 5200', 6000', and Modified 10,000' GHA
- Airfield Area
- Aircraft Accident Potential Zone II
- Aircraft Accident Potential Zone
- Clear Zone
- Runway Primary Surface
- Restrictive Easement
- Wildlife Preserve
- Kauai Test Facility
- ATFP Setback Area
- Restricted Anchorage
- Polihale State Park
- Installation Area
- Existing Structure

NORTH

0 0.5 1 2 Miles

Pacific Missile Range Facility Health and Safety Areas

Kauai, Hawaii

Figure 3-6

36_pmrf_safety_ldsd, 2/13/2013

call for all PMRF launches in accordance with Pacific Missile Range Facility Instruction (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 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 test 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.

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 also 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.

A 381-meter (1,250-foot) ESQD Red Label Area (area of proposed LDSD activities), to handle incoming and outgoing ordnance items, is centered on the airfield taxiway; 381 meters (1,250 feet) from Building 412 (see Figure 3-6). A soft pad in the Red Label recovery area is used by helicopters for setting down targets and weapons recovered from the range. The 243.8-meter (800-foot) ESQD surrounding the soft pad falls totally within the Red Label ESQD area.

Transportation Safety

PMRF transports ordnance including propellants by cargo aircraft when available or by truck from Nawiliwili Harbor to PMRF along Highway 50 (see Figure 3-7). A barge or ship carrying explosives is 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 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).

Source: State of Hawaii Office of Planning

EXPLANATION

- Highway 50
- Highway
- Installation Area
- Land

NORTH

0 100 200 400 Miles

Ordnance Transport from Nawiliwili Harbor to Pacific Missile Range Facility

Kauai, Hawaii

Figure 3-7

35_explosives_transportation, 8/30/2012

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 3.1.2.2.

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.

3.1.6 SOCIOECONOMICS (PMRF)

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.

3.1.6.1 Region of Influence

The region of influence for socioeconomics is defined as the island of Kauai, which covers 1,429.7 square kilometers (552 square miles). The entire island is designated as Kauai County.

3.1.6.2 Affected Environment

Population

In 2011, the population of Kauai County was estimated to be 67,701, which represents an estimated change of 0.9 percent from the 2010 census (67,091). Of the estimated 67,701, 49.8 percent are female and 50.2 percent are male. (U.S. Census Bureau, 2012) Table 3-3 summarizes the demographics of the population of Kauai in 2011. Table 3-4 illustrates the age profile of those living in Kauai County in 2011. In medium household income for Kauai County between 2006-2010 was $62,531 (U.S. Census Bureau, 2012).

Table 3-3. Demographics of the Estimated Population of Kauai in 2011

Persons		**67,701**
Race	Asian	21,529
	White	22,680
	Native Hawaiian and Other Pacific Islanders	6,228
	Hispanic/Latino	6,567
	Black or African American	406
	American Indian and Alaska Native	339
	Other	9,952
Female		**33,715**
Male		**33,986**

Source: U.S. Census Bureau, 2012.

Table 3-4. Age Profile of Kauai County Residents in 2011

Age group (years)	Kauai County		State of Hawaii	
	Population 67,701	Percentage	Population 1,374,810	Percentage
Under 5 years old	4,333	6.4	87,988	6.4
Under 18 (5–17 years)	15,165	22.4	307,957	22.2
18–64 years	37,709	55.7	765,769	56.7
65 years and over	10,494	15.5	213,096	14.7

Source: U.S. Census Bureau, 2012.

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 2009 was $6.5 billion, which resulted in a total of $12.2 billion to Hawaii's economy and accounted for more than 101,000 jobs and $3.5 billion in household earnings. (Chamber of Commerce of Hawaii, Military Affairs Council, 2012)

Housing

In May 2012 single-family home sale prices dropped by 19 percent to a median price of $487,740, but the condominium prices were up 22 percent to $264,500 when compared to the same period in 2011. (Pacific Business News, 2012) Table 3-5 illustrates Kauai sales activity for the first quarter of 2012 compared to the first 3 months of 2011.

Table 3-5. Kauai Housing Sales Activity for First Quarter 2012 and 2011

Single Family					
2012 YTD* # of Sales	**2011 YTD # of Sales**	**% Change**	**2012 Median Price**	**2011 YTD Median Price**	**% Change**
95	91	4.4	$449,000	$450,000	-0.22
Condos					
2012 YTD # of Sales	**2011 YTD # of Sales**	**% Change**	**2012 Median Price**	**2011 YTD Median Price**	**% Change**
59	68	-13.24	$290,000	$187,450	54.71
Vacant Land					
2012 YTD # of Sales	**2011 YTD # of Sales**	**% Change**	**2012 Median Price**	**2011 YTD Median Price**	**% Change**
24	32	-18.8	405,000	237,500	70.0%

Source: Century 21 Kauai Real Estate, 2012
*YTD – year to date

Employment

Between 2006 and 2010, 35,100 individuals were in the labor force. Of this number 34,190 were employed in the civilian labor force, 190 were in the armed forces, and 1,977 were unemployed. (U.S. Census Bureau, 2006-2010 American Community Survey, 2012)

PMRF is one of Kauai's largest employers with nearly 1,000 active duty Navy, Government, civil service and contract civilians, and Hawai`i Air National Guard members. PMRF's prime contractor is Manu Kai, with approximately 500 employees, providing base support as well as high-tech range safety and scheduling operations. Numerous other contractors, both on and off Kauai, are associated with PMRF. PMRF is also the largest business contributor to the Kauai Food Bank, and many of its employees serve as sports program coaches and mentors for Kauai's youth. Employment at PMRF remains stable, with a possible increase in opportunities arising from future programs such as THAAD. (Kauai Chamber of Commerce, 2012)

In June 2012 the unemployment rate for Kauai was 8.7% which is a decrease from 9.8% in June 2011, 10.3% in 2010, and 10.6% in June 2009. The unemployment rate was 8.7% in 1992. (U.S. Bureau of Labor Statistics, 2012)

Tourism

In 2011 there were over 1,015,264 visitors to the island of Kauai which was 11.2% of Hawaii's total 2011 visitors. Airline seats were filled to 90.6% capacity in 2011. (Hawaii Tourism Authority, 2011) For the first 7 months of 2012, arrivals to Kauai increased 7.1 percent to 637,677 visitors, while total visitor expenditures grew 20.7 percent to $840.9 million. (Hawaii Tourism Authority, 2012)

Overnight accommodations on Kauai include luxury hotels, budget hotels, small inns, bed and breakfast accommodations, youth hostels, campgrounds, and other types. (Hawaii for Visitors, 2012)

Education

PMRF is in the Waimea complex school area of the Kauai District. The Waimea complex is made up of four elementary schools (including Niihau Elementary), one middle school, two high schools (including Niihau High) and two charter schools. (Hawaii State Department of Education, 2012)

An active participant in the community, PMRF participates in the Mayor's Adopt a School program, and is actively engaged in math and science programs and facility upgrade projects.

3.1.7 WATER RESOURCES (PMRF)

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

Water resources include those aspects of the natural environment related to the availability and characteristics of water. For the purposes of this document, water resources can be divided into three main sections: surface water, groundwater, and flood hazard areas.

Surface water includes discussions of runoff, changes to surface drainage, and general surface water quality. Groundwater discussions focus on aquifer characteristics, general groundwater quality, and water supply. Flood hazard area discussions center on floodplains.

Where practicable, water resources are described quantitatively (volume, mineral concentrations, salinity, etc.); otherwise they are described qualitatively (good, poor, etc.) when necessary.

3.1.7.1 Region of Influence

The region of influence for PMRF/Main Base includes the area within and surrounding the Red Label Area.

3.1.7.2 Affected Environment

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 0.6 meter (2 feet) below mean sea level. Throughout the Plain, a series of interconnected 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)

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, 1993). 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 volcanic, primarily basalt) is highly permeable, containing brackish water that floats on seawater. (U.S. Army Space and Strategic Defense Command, 1993)

Sampling for perchlorate was initiated at PMRF in 2006. USEPA adopted an oral reference dose for perchlorate in 2009 and submitted a proposed rule in February 2011. The 2011 proposed rule action notifies interested parties of USEPA's determination to regulate perchlorate, but imposes no requirements on public water systems. However, this action also initiates the process to develop a national primary drinking water regulation for perchlorate. 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.

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.

PMRF has an established 100-year floodplain. 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.

3.2 NIIHAU

Fourteen areas of environmental consideration were initially evaluated for Niihau 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, visual aesthetics, and water resources. The only element of the LDSD Program with the potential to affect the island of Niihau is the possible overflight of the balloon and Test Vehicle and any effects of equipment or debris unexpectedly impacting the island. Although that potential is extremely low, 4 of the 14 areas of environmental consideration have been addressed in detail in this EA. The remaining resource areas were not analyzed for the following reasons:

- **Air Quality:** The LDSD Program is not expected to adversely impact the federal and state ambient air quality standards for Niihau nor increase the concentration of various pollutants in the atmosphere associated with Niihau.

- **Geology and Soils:** The LDSD Program proposes no ground activities on the island of Niihau that would affect geology and soils.

- **Hazardous Materials and Waste:** The production or use of hazardous substances, hazardous wastes, or marine pollutants on, or in the vicinity of, Niihau is not an element of the LDSD Program. In the remote chance that Test Vehicle equipment or debris unexpectedly impacts the island during overflight, the SOPs that govern PMRF's usage and control of hazardous waste and materials would apply to Niihau.

- **Land Use:** The LDSD Program does not anticipate the use of facilities or land on Niihau; therefore, land use will not be affected.

- **Noise:** Any change in noise levels is expected to be short-term and temporary and is not expected to substantially adversely affect people or animals on Niihau.

- **Socioeconomics:** Activities associated with the LDSD Proposed Action would not affect the social or economic character (population size, employment, income generated, type and cost of housing) of Niihau.

- **Transportation:** All of the transportation-related activities associated with the LDSD Program would take place on the island of Kauai; none are proposed for the island of Niihau.

- **Utilities:** The LDSD Program does not require the use of any of Niihau's utilities; therefore, the island's water supply, wastewater treatment, and electricity would not be impacted.

- **Visual Aesthetics:** Although the balloon launch and Test Vehicle splashdown may be visible from Niihau for a brief period, no long-term adverse effects on the visual aesthetics of the area are anticipated.

- **Water:** None of the LDSD Program activities are proposed for the island of Niihau; therefore, no effects are expected on surface or groundwater resources.

3.2.1 AIRSPACE (NIIHAU)

3.2.1.1 Region of Influence

The region of influence encompasses the airspace above the island of Niihau.

3.2.1.2 Affected Environment

Niihau has no airport or airstrip, but the landowner maintains a helicopter landing area for the transfer of supplies and people to and from the island. Given the proximity of the two islands, the description of airspace for Kauai is also applicable to Niihau (see Section 3.1.2).

3.2.2 BIOLOGICAL RESOURCES (NIIHAU)

3.2.2.1 Region of Influence

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

3.2.2.2 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. (Commander, Navy Region Hawaii, 2010; U.S. Department of the Navy, 1998*)*

Marine Species

Blue rice coral and ringed rice coral have recently been proposed as candidates for listing under the ESA by NMFS. These species are likely found on reefs at Niihau.

Threatened and Endangered Plant Species

Table 3-6 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 3-6. Listed Species Known or Expected to Occur in the Vicinity of 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
Corals		
Montipora flabellata	Blue rice coral	P
Montipora patula	Ringed rice coral	P
Mammals		
Lasiurus cinereus spp. *semotus*	Hawaiian hoary bat	E
Monachus schauinslandi	Hawaiian monk seal	E

Source: International Union for the Conservation of Nature and Natural Resources, 2012; 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. (Commander, Navy Region Hawaii, 2010)

Threatened and Endangered Wildlife Species

Table 3-6 lists threatened and endangered species known or expected to occur on Niihau. Blue rice coral is endemic to Hawaii and is found on all of the Hawaiian Islands except for Johnston Atoll. Ringed rice coral is found on all of the Hawaiian Islands including Johnston Island (International Union for the Conservation of Nature and Natural Resources, 2012). 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 144.5 hectares (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, 2003)

3.2.3 CULTURAL (NIIHAU)

3.2.3.1 Region of Influence

The region of influence for cultural resources at Niihau encompasses the entire island, most specifically any area where there is the potential for Test Vehicle equipment or debris to impact the island surface (see Figure 3-2).

3.2.3.2 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; however, there are no known historic properties. 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 currently no identified traditional Native Hawaiian sites on Niihau; however, as with archaeological sites, these types of sites could be unexpectedly encountered anywhere on the island.

3.2.4 HEALTH AND SAFETY (NIIHAU)

3.2.4.1 Region of Influence

The region of influence for health and safety is Niihau.

3.2.4.2 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 hazard of 3.7 meters (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. Helicopters would be airborne with buckets during near-land/over-land range operations occurring on or near Niihau to deal with potential fire hazards.

3.3 OPEN OCEAN AREA

The Open Ocean Area for PMRF is the area that is greater than 22.2 kilometers (12 nm) offshore of the Hawaiian Islands. The Open Ocean Area also includes the PMRF Warning Areas, Oahu Warning Areas, and the Temporary Operating Area (TOA) as illustrated in Figure 3-4. The Open Ocean Area, as part of the high seas (outside 22.2 kilometers [12 nm] from land), is subject to Executive Order 12114. Both sea and air operations are covered in this section. Given the nature of the open ocean environment, most of the typical environmental resources described in this EA are not applicable to this section; therefore, air quality, geology and soils, land use, noise, socioeconomics, utilities, transportation, and visual aesthetics are not addressed.

3.3.1 AIRSPACE (OPEN OCEAN AREA)

3.3.1.1 Region of Influence

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, that may be affected by the Proposed Action.

3.3.1.2 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

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

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 3-3. 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 8,839 meters (29,000 feet) following published, preferred Instrument Flight Rules routes, the FAA is gradually permitting aircraft to select their own routes. This “Free Flight” program is an innovative concept designed to enhance the safety and efficiency of the National Airspace System. The concept moves the National Airspace System from a centralized command-and-control system between pilots and air traffic controllers to a distributed system that allows pilots, whenever practical, to choose their own route and file a flight plan that follows the most efficient and economical route.

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.

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 Altitude Reservation (ALTRV) procedures. After launch, typically missiles are above 18,288 meters (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 splashdown 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 splashdown and 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 4540.01 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. An exception to this operating procedure may be made when it can be ascertained that aircraft are operating above the maximum ordinate of the trajectory” (DoD Directive 4540.01, 2007). (DoD Directive 4540.01, 2007). Before conducting a launch and/or rocket 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.

Air Traffic Control

Air traffic in the region of influence is managed by the Honolulu Control Facility and Oakland ARTCC (see Figure 3-4).

3.3.2 BIOLOGICAL RESOURCES (OPEN OCEAN AREA)

3.3.2.1 Region of Influence

The region of influence for open ocean species includes the areas of the Pacific Ocean beyond 22 kilometers (12 nm) from the shore.

3.3.2.2 Affected Environment

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

Coral

The Hawaiian Islands have 17,519 square kilometers (6,764.5 square miles) 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 10 centimeters (4 inches) per year (Grigg, 1988; 1997).

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 5.5 kilometers (3 nm) but also claims authority over inter-island waters. Therefore, it has declared jurisdiction over the Makapuu Coral Bed, 9.7 kilometers (6 miles) off Makapuu in the channel between Oahu and Molokai. Federal jurisdiction extends from 5.5 kilometers (3 nm) beyond the coast of Hawaii to 370 kilometers (200 nm) and from the shoreline of all U.S. possessions in the Western Pacific to 370 kilometers (200 nm). This area is defined as the U.S. Exclusive Economic Zone (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 122 centimeters (48 inches) in colony height or a minimum stem diameter of 2.5 centimeters (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 50 and 200 meters (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), fish, 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 3.9°C (39°F), and in waters as deep as 6,000 meters (19,685 feet) (Coral Reef Information System, 2003).

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.

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).

Essential Fish Habitat

An Essential Fish Habitat (EFH) is "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" [16 U.S.C. 1802 (10)]. Federal agencies funding, permitting, or undertaking activities that may adversely impact EFH are required to consult with the NMFS regarding the actions with a potential for effects to EFH and respond to NMFS recommendations. Close cooperation between NMFS and federal action agencies provides a regulatory environment in which agencies can carry out activities while simultaneously considering the health of fish habitat. As a mandate for the NMFS, the Magnuson Fishery Conservation and Management Act of 1976 established regional fishery management councils. The Western Pacific Regional Fishery Management Council (WPRFMC) is one of eight regional fishery management councils established by the Magnuson Fishery Conservation and Management Act of 1976 to identify and protect important marine and anadromous fish habitat. 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, 2004a), except for the bigeye tuna. The bigeye tuna and the great white shark are listed as vulnerable on the IUCN Red List (Uozumi, 1996b; Fergusson et al., 2000). NMFS determined that overfishing was occurring Pacific-wide for this species (National Marine Fisheries Service, 2004b). In addition, shark species are afforded protection under the *Shark Finning Prohibition Act* (National Marine Fisheries Service, 2002b).

The broadbill swordfish, albacore tuna, common thresher shark, and salmon shark have been listed as data deficient on the 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).

Offshore Ocean or Pelagic Species

NMFS biologists observed the short-tailed albatross at sea in 2000. 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 about 200 to 1,000 meters (109 to 547 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 800 meters (437 fathoms) and bigeye tuna around 275 to 550 meters (150 to 301 fathoms) (Western Pacific Regional Fishery Management Council, 1998). Juvenile albacore tuna generally concentrate above 90 meters (49 fathoms), with adults found in deeper waters (about 90 to 275 meters [49 to 150 fathoms]) (Western Pacific Regional Fishery Management Council, 1998).

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 and 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 (*Dermochelys coriacea*).

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 948.5 kilograms (2,091 pounds) (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 regulate their body temperature, 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).

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 amidst floating vegetation, where they find refuge in flotsam that accumulates in surface circulation features (Carr, 1987).

Sea turtles spend several years growing in the early juvenile “nursery habitat” 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, as they prefer to reside in reef-type environments that are less than about 100 meters (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. More than 90 percent of all green sea turtle breeding and nesting activity in Hawaiian waters occurs at French Frigate Shoals, 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 and better enforcement of regulations prohibiting take of the species. Sporadic nesting events in the Main Hawaiian Islands have occurred along the south,

northeast, and southwest shores of Kauai (Pacific Missile Range Facility, 2001; U.S. Department of the Navy, 2002; National Ocean Service, 2001).

Hawksbill sea turtles are the second most common species in the offshore waters of the Hawaiian Islands, yet they are far less abundant than green sea turtles. Hawksbills occur around several of the Main Hawaiian Islands. A lack of regular quantitative surveys for hawksbill sea turtles in the Pacific Ocean has 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, 1998; 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.

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 on Kauai (National Ocean Service, 2001; U.S. Department of the Navy, 2004).

Marine Mammals

Marine mammals addressed within this EA 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 comes ashore to rest, mate, and bear young. There are 27 species of marine mammals that occur in the Hawaiian Islands area (Table 3-7). 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 Marine Mammal Protection Act (MMPA).

Table 3-7. Summary of Hawaiian Islands Stock or Population of Marine Mammals

Order Cetacea	Scientific Name	Status
MYSTICETES (baleen whales)		
Family Balaenidae (right whales)		
North Pacific right whale	*Eubalaena japonica*	E
Family Balaenopteridae (rorquals)		
Humpback whale	*Megaptera novaeangliae*	E
Sei whale	*Balaenoptera borealis*	E
Fin whale	*Balaenoptera physalus*	E
Blue whale	*Balaenoptera musculus*	E
ODONTOCETES (toothed whales)		
Family Physeteridae (sperm whale)		
Sperm whale	*Physeter macrocephalus*	E
PINNIPEDS (seals, sea lions, walruses)		
Family Phocidae (true seals)		
Hawaiian monk seal	*Monachus schauinslandi*	E

Source: U.S. Department of the Navy, 2008; 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.
E = Endangered

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 Rim of the Pacific 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). 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., 2001; 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 92.6 kilometers (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, 2001). 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; 2001; Maldini, 2003) and around Kauai (Mobley, 2005). Most of the central North Pacific stock of humpback whales migrates south to Hawaii in winter for breeding and calving from December through April (Clapham and Mead, 1999; Mobley et al., 2001).

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, 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, 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 Northwestern Hawaiian Islands. 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, 2007). The vast majority of the population is present in the Northwestern Hawaiian Islands.

3.3.3 CULTURAL RESOURCES (OPEN OCEAN AREA)

3.3.3.1 Region of Influence

The LDSD region of influence for cultural resources within the Open Ocean Area encompasses locations where the Test Vehicle system equipment splashdown and debris might affect submerged sites, features, wrecks, or ruins (see Figure 3-2).

3.3.3.2 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, 2005a) were reviewed to determine the potential for submerged cultural resources within the Area of Potential Effects; none were noted.

3.3.4 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.

3.3.4.1 Region of Influence

The hazardous materials and wastes region of influence for the Open Ocean Area includes the area of the open ocean that could potentially be impacted by hazardous materials and waste.

3.3.4.2 Affected Environment

Hazardous Materials and Hazardous Constituents

The U.S. Navy's CHRIMP provides information on management of hazardous materials for both afloat and ashore. Hazardous materials associated with missile/rocket testing are described below.

Open ocean areas are typically considered to be relatively pristine with regards to hazardous materials and hazardous wastes. The single largest hazardous constituent of missiles/rockets launches is solid propellant, but numerous hazardous constituents are used in igniters, explosive bolts, batteries, and warheads. Exterior surfaces may be coated, however, with anti-corrosion compounds containing chromium or cadmium.

3.3.5 HEALTH AND SAFETY (OPEN OCEAN AREA)

3.3.5.1 Region of Influence

The region of influence for public health and safety includes the sea ranges and ocean areas adjacent to them that could potentially be affected by the Proposed Action.

3.3.5.2 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.

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 USCG and FAA publish dedicated warnings of 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.

3.3.6 WATER RESOURCES (OPEN OCEAN AREA)

3.3.6.1 Region of Influence

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

3.3.6.2 Affected Environment

The Open Ocean Area off the Hawaiian Islands is a dynamic, tropical marine environment. Average water temperatures vary from 21.7°C (71°F) in March to 27.2°C (81°F) in September. Wave height varies from occasional flat seas to over 12 meters (40 feet) during high winter winds. Average swells commonly range from 1 to 3 meters (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).

3.4 GLOBAL ENVIRONMENT

In addition to actions at PMRF, Niihau, and the Open Ocean, this EA considered the environmental effects on the global environment in accordance with the requirements of EO 12114. Specifically, potential impacts on the global atmosphere are discussed. This section describes the baseline conditions that may be affected by the Proposed Action.

3.4.1 GLOBAL ATMOSPHERE

During its flight path, the emissions from the SFDTs have the potential to affect air quality in the global upper atmosphere.

3.4.1.1 Affected Environment

Greenhouse Gases and Global Warming

GHG are components of the atmosphere that contribute to the greenhouse effect and global warming. Several forms of GHG occur naturally in the atmosphere, while others result from human activities, such as the burning of fossil fuels. Federal agencies, States, and local communities address global warming by preparing GHG inventories and adopting policies that will result in a decrease of GHG emissions.

According to the Kyoto Protocol and Hawaii's Global Warning Solution Act 234, there are six GHG:

- Carbon dioxide (CO_2)
- Nitrous oxide (N_2O)
- Methane (CH_4)
- Hydrofluorocarbons
- Perfluorocarbons
- Sulfur hexafluoride

(United Nations Framework Convention on Climate Change, 2008).

Although the direct GHG (CO_2, CH_4, and N_2O) occur naturally in the atmosphere, human activities have changed GHG atmospheric concentrations. The 2012 average annual concentration of CO_2 in the atmosphere (Mauna Loa Observatory) is 393.8 parts per million (ppm). The 2011 average is 391.6 ppm. For the past decade (2003–2012) the average annual increase is 2.1 ppm per year. The average for the prior decade (1993–2002) is 1.7 ppm per year. Since the 1958 start of precision CO_2 measurements in the atmosphere, the annual mean concentration of CO_2 has only increased from one year to the next. (CO_2Now, 2013) On a global scale, fossil fuel combustion added approximately 30×10^9 tons of CO_2 to the atmosphere in 2004, of which the United States accounted for about 22 percent (U.S. Air Force, 2010).

Since 1900, the earth's average surface air temperature has increased by about 1.2 to 1.4°F. December 2012 marks the 18th warmest December since global temperature records began in 1880. The coolest was December 1916. Annually, 2012 was the 10th warmest year since 1880. Only one year during the 21st century was warmer than 2012. (CO_2Now, 2013) With this in mind, the DoD is supporting climate-changing initiatives globally, while preserving military operations, sustainability, and readiness by working, where possible, to reduce GHG emissions (U.S. Air Force, 2010).

Stratospheric Ozone Layer

The stratosphere, which extends from 10 to 48 kilometers (6 to 30 miles) in altitude, contains the earth's ozone layer (National Oceanic and Atmospheric Administration, 2008). The ozone layer plays a vital role in absorbing harmful ultraviolet radiation from the sun. Over the last 20 years, anthropogenic (human-made) gases released into the atmosphere, primarily chlorine related substances, have threatened ozone concentrations in the stratosphere. Such materials include chlorofluorocarbons (CFCs), which have been widely used in electronics and refrigeration systems, and the lesser-used Halons, which are extremely effective fire extinguishing agents. Once released, the motions of the atmosphere mix the gases worldwide until they reach the stratosphere, where ultraviolet radiation releases their chlorine and bromine components.

Through global compliance with the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer and amendments, the worldwide production of CFCs and other ozone-depleting substances has been drastically reduced and banned in many countries. A continuation of these compliance efforts is expected to allow for a slow recovery of the ozone layer (World Meteorological Organization, 2006).

4.0 Environmental Consequences

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4.0 ENVIRONMENTAL CONSEQUENCES

This chapter addresses potential environmental impacts caused by the Proposed Action at PMRF. This chapter describes the potential environmental consequences of the proposed activities by comparing these activities with the potentially affected environmental components provided 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 magnitude of environmental impacts from, the proposed program activities, a list of activities was developed (Chapter 2.0) and the environmental setting was described, with emphasis on any special environmental sensitivities (Chapter 3.0). Project activities were then assessed with the potentially affected environmental components to determine the environmental impacts of the proposed activities.

4.1 PACIFIC MISSILE RANGE FACILITY

4.1.1 AIR QUALITY (PMRF)

Potential issues related to the air quality of the area around PMRF include compliance with national and State air quality standards for criteria pollutants released during proposed activities. Air quality at PMRF could be impacted by site preparation activities and launch emissions. Potential impacts were determined based on whether operations within attainment areas could cause or materially contribute to a detrimental change in attainment status of the area, or increases in ambient air pollutant concentration could cause exceedances of the applicable AAQS.

The General Conformity Rules (40 CFR 93.153) require Federal agencies to determine whether their actions would increase emissions of criteria pollutants above present threshold levels. These *de minimis* rates vary depending on the severity of the nonattainment and geographic location. The entire State of Hawaii, including PMRF, is in attainment for the NAAQS criteria pollutants. Consequently, Clean Air Act applicability analysis and conformity determination do not apply to Federal actions in Hawaii.

4.1.1.1 Site Preparation Activities

There are no anticipated site preparation activities for SFDT that would impact the air quality in the immediate vicinity of the Red Label Area or the launch area.

4.1.1.2 Pre-Launch Activities

The manufacturing of the proposed SIAD and SSRS would occur outside of Hawaii in existing facilities that normally perform this type of production, and emissions at these locations have not been included in the scope of this EA. The components would arrive complete, requiring only final onsite safety and quality checks before assembly.

To mitigate any adverse impact to air quality, any propellant spills that occur during the onsite fueling of the proposed SFDT would be contained and cleaned up in accordance with existing PMRF spill containment procedures. Adherence to approved SOPs at PMRF would minimize the potential hazards to personnel in the unlikely event of an unplanned fuel release. The low likelihood of such an event and the implementation of approved emergency response plans would limit such a release.

Pre-launch activities would also include the arrival of SFDT equipment as well as the transportation of flight test personnel. Vehicle engines would be turned off when not in use to minimize exhaust emissions. Emissions produced during these activities would be temporary and localized and are not anticipated to affect regional air quality.

Pre-launch activities would be powered by power generators for PMRF. Power generators for PMRF would be operated in compliance with the PMRF Title V Covered Source Permit. Therefore, no adverse impacts to air quality are anticipated for the continued use of these generators.

No exceedances of the NAAQS and Hawaii air standards are anticipated from pre-launch activities. No amendments to PMRF's existing Title V permit would be required for pre-launch activities.

4.1.1.3 Launch Activities

Any power generators used for PMRF would be operated in compliance with the PMRF Title V Covered Source Permit. These levels of emissions are considerably low and are not anticipated to impact the regional air quality or exceed the AAQS for Hawaii.

The STAR 48 Motor used for the SFDT would use the solid propellant TP-H (ammonium perchlorate, aluminum and hydroxyl-terminated polybutadiene [HTPB]) and ZPP (zirconium perchlorate potassium). The Star 48 is a type of solid rocket motor used by many space propulsion and launch vehicle stages. It is mostly used almost exclusively as an upper stage. Nominal (according to plan or design) launch activities during prime conditions (best launch time) could result in the deposition of very small amounts of criteria pollutants from the STAR 48 motor exhaust. Most of the constituents would be suspended in air and dispersed over extremely large areas. These emissions are not anticipated to impact regional air quality.

Automotive gas generators used in hybrid auto passenger airbags would be used for the SIAD inflation system and the parachute. These generators contained stored gas (Ar, N_2O, He) and pyro gas (O_2, CO_2, H_2O, N_2, CO, and H_2). Most of the constituents would be suspended in air and dispersed over extremely large areas. These emissions are not anticipated to impact regional air quality.

Helium, used to inflate the balloons, is non-toxic, non-flammable, and has no harmful effects on the Earth's environment. The gas exists in small quantities within the Earth's

atmosphere and is mined from underground pools where it occurs mixed with natural gas deposits. Helium will be released from the balloon during either stratospheric float or at the moment when the balloon flight is terminated.

Additionally, the Proposed Action would not introduce any new stationary sources of air emissions; thus, no new emission permits or modifications to the current Title V permit would be required.

4.1.1.4 Post-Launch Activities

Activities performed during post-launch would include the removal of equipment and assets brought to PMRF. The removal would result in small localized amounts of fugitive dust, which would have a negligible impact on air quality. Dust control measures would be implemented.

4.1.1.5 Cumulative Impacts

Based on the analysis presented above, negligible impacts would be expected during the execution of the Proposed Action. Negligible temporary increases in air emission would occur from the launch of the SFDT. Due to the limited size and scope of the Proposed Action, air quality impacts as a result of pre-launch, flight test, and post-flight test activities would be minor and transitory. The SFDT launches would be short-term, discrete events, thus allowing time between launches for emissions products to be dispersed. No other construction projects, which would occur in the same locations and timeframe, have been identified. The total direct and indirect emissions from the execution of the Proposed Action, therefore, are not likely to result in adverse cumulative impacts to the regional air quality.

4.1.2 AIRSPACE (PMRF)

Assessment of potential impacts to airspace use 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.

4.1.2.1 Site Preparation Activities

Site preparation activities such as airlift delivery of LDSD components 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 Radar Control Facility; thus, there would be no airport conflicts in the region of influence under the Proposed Action, and no impact.

4.1.2.2 Pre-Launch Activities

Pre-launch activities that could potentially affect airspace would include the Super Loki Sounding Rocket launches that would begin about 1 hour prior to the launch. Sounding rockets have been launched from PMRF and would not alter existing controlled and uncontrolled airspace in the PMRF region of influence. Approximately 1 hour before a launched balloon's ascent or descent/landing, the appropriate FAA ARTCC would be notified. The FAA ARTCC clears a 130-kilometer (70-nm) radius around the launch and predicted balloon and payload/parachute landing zones to ensure flight safety in the region. Pre-launch activities would not restrict access to, nor affect the use of, existing airfields and airports in the region of influence. Commercial and private aircraft would be notified in advance of launch activities by PMRF as part of their routine operations through NOTAMs by the FAA.

4.1.2.3 Launch Activities

Special Use Airspace

Proposed LDSD launches from PMRF would not alter existing controlled and uncontrolled airspace in the PMRF region of influence. The Test Vehicle would be well above Flight Level (FL) 600 (60,000 feet) and still be within the R-31-01 Restricted Area, which covers the surface to unlimited altitude, within 1 minute of the rocket motor firing. Aircraft are routinely excluded from the restricted area during launches. FAA requires balloons weighing over 2.7 kilograms (6 pounds) be equipped with a Mode C transponder (short for transmitter-responder), an electronic device attached to the balloon system that transmits a response to a secondary radar system to assist air traffic controllers in separating aircraft (National Aeronautics and Space Administration, 2010). All local flight activities occur at sufficient distance and altitude such that the LDSD SFDT launches would not require changes to or create a hazard to these flight activities. Commands sent during flight termination include balloon/payload separation; parachute activation, and payload/parachute separation. As shown in Figure 2-1, the test start altitude would be about 36,576 meters (120,000 feet). The Flight Train would be released 1 second after the Test Vehicle. The Flight train pulls a rip-cord in the balloon membrane to sever it open. The balloon membrane would be split open completely and fall back to earth.

En Route Airway Jet Routes

Local flight activities along the two en route altitude airways (V15 [through W-188] and V16 [through W-186]) would occur at sufficient distance and altitude such that the LDSD vehicle launches would have no substantial impact. Use of these low altitude airways comes under the control of the Honolulu Control Facility and Oakland ARTCC. There are no high altitude jet routes in the PMRF region of influence.

Airports and Airfields

The Proposed Action would not restrict access to, nor affect the use of, existing airfields and airports in the region of influence. Operations at the PMRF airfield would continue unhindered. Access to the PMRF airfield would not be curtailed. As part of their routine

operations, PMRF issues a launch notice through NOTAMs by the FAA. Thus, commercial and private craft would be able to reschedule or choose alternate routes before the flight experiments. All arriving and departing aircraft and all participating military aircraft are under the control of PMRF Range Control Facility; thus, there would be no airfield or airport conflicts in the region of influence and no impact.

4.1.2.4 Post-Launch Activities

Post-launch activities on PMRF would include removal of any temporary LDSD components and hardware once the test has been completed. While these activities could involve additional flights in and out of the PMRF airfield, the Proposed Action would not restrict access to, nor affect the use of, existing airfields and airports in the ROI. Access to the PMRF airfield would not be affected. All arriving and departing aircraft and all participating military aircraft are under the control of the PMRF Radar Control Facility; thus, there would be no airport conflicts in the region of influence under the Proposed Action, and thus no impact.

4.1.2.5 Cumulative Impacts

The LDSD program would consist of up to four missions conducted from approximately June to July 2014, and June to August 2015. Approximately one flight would be conducted in 2014 and up to three in 2015. The LDSD launches would be short-term discrete events managed by the PMRF Range Control Facility. The Proposed Action would not occur at the same time as other regional programs. No other projects in the region of influence have been identified that would have the potential for cumulative impacts to airspace. The use of the required scheduling and coordination process for NOTAMs will lessen the potential for adverse impact. No incremental, additive adverse cumulative impacts to airspace use have been identified.

4.1.3 BIOLOGICAL RESOURCES (PMRF)

The analytical approach for biological resources involved evaluating the degree to which the proposed activities could impact the vegetation, wildlife, threatened or endangered species, and sensitive habitat within the affected area. Criteria for assessing potential impacts to biological resources are based on the following: the number or amount of the resource that would be impacted relative to its occurrence at the project site, the sensitivity of the resource to proposed activities, and the duration of the impact. Impacts are considered substantial if they have the potential to result in reduction of the population size of federally listed threatened or endangered species, degradation of biologically important unique habitats, substantial long-term loss of vegetation, or reduction in capacity of a habitat to support wildlife.

Potential impacts of construction, building modification, and missile launches on terrestrial biological resources within the PMRF region of influence have been addressed in detail in the Strategic Target System EIS, the Restrictive Easement EIS, the PMRF Enhanced Capability EIS, and the THAAD Pacific Flight Tests EA, (U.S. Army Strategic Defense Command, 1992; U.S. Army Space and Strategic Defense

Command, 1993; U.S. Department of the Navy, 1998; U.S. Army Space and Missile Defense Command, 2002). Based on these prior analyses, and the effects of current and past missile launch activities, the potential impacts of the proposed activities related to continuing research, development, training, and evaluation on terrestrial biological resources are expected to be minimal.

4.1.3.1 Site Preparation Activities

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 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 inspected on the PMRF airfield when the cargo arrives. NASA shall comply with relevant Navy policies and procedures concerning limiting introduction of invasive species.

Vegetation

Any ground clearance required for the modification of the tower and launch site may result in some vegetation removal. However, the area is paved and any vegetation present is mowed regularly to minimize the presence of vegetation. No unique habitat would be lost. No impacts to indigenous or native vegetation are expected.

Threatened and Endangered Plant Species

No threatened or endangered vegetation has been identified on PMRF.

Wildlife

Site preparation noise and the increased presence of personnel could affect wildlife within the area. Equipment noise-related impacts would include temporary loss of habitat, displacement of wildlife, and short-term disruption of daily/seasonal behavior. Noise from equipment and personnel on-site may startle nearby wildlife and cause flushing behavior in birds, but this startle reaction would be of short duration. The combination of increased noise levels and human activity would likely displace some birds that forage, feed, or roost within a 15.2-meter (50-foot) radius that would contain the highest noise levels. While some wildlife may potentially leave the immediate area permanently, others may likely become accustomed to the increased noise and human presence.

Any outdoor lighting associated with construction/setup activities and permanent structures would be properly shielded, following USFWS guidelines to minimize reflection and impact to nocturnal birds.

Threatened and Endangered Wildlife 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 site preparation-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.

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 turtle nests that might occur on the installation. If turtle nests are discovered that could potentially be affected, then University of Hawaii personnel would contact PMRF Environmental, who would perform any required consultation with appropriate agencies. There are no known records of hawksbills coming ashore or nesting within or adjacent to PMRF. Threatened and endangered marine mammals would not be affected since no site preparation activities would take place offshore.

Environmentally Sensitive Habitat

Although lau`ehu does not grow on PMRF, the USFWS has determined that dune areas along the southern portion of the range contain primary constituents necessary for the recovery of lau`ehu because not enough areas exist outside of PMRF. Site preparation activities would not affect these areas of critical habitat.

4.1.3.2 Pre-Launch Activities

Vegetation

Pre-launch activities such as installing the components on the tower and launching sounding rockets to gather MET data would have no impact on vegetation.

Threatened and Endangered Plant Species

No threatened or endangered vegetation is located within the launch site boundary.

Wildlife

Other than the impacts associated with the presence of additional personnel (noise), pre-launch activities should result in minimal impacts to wildlife.

4.1.3.3 Launch Activities

Vegetation

No impacts to indigenous or native vegetation are expected from nominal launches.

Threatened and Endangered Plant Species

No threatened or endangered vegetation is located within the launch site boundary or in the offshore area.

Wildlife

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 wildlife and cause flushing behavior in birds, but this startle reaction would be of short duration. The increased presence of personnel, vehicles, aircraft, 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, launch activities are usually short in duration and occur within regularly used range areas.

The probability for a launch mishap is very low. However, an early flight termination or mishap would cause debris to impact along the flight corridor, potentially in offshore waters. Debris would be removed from shallow water if possible. An errant LDSD vehicle is anticipated to be sufficiently downrange so that debris is unlikely to reach back to the launch site.

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 essential fish habitat that would be affected. By the time the spent rocket motors impact in the ocean, generally virtually all of the propellants in them will have been consumed. Any residual aluminum oxide, burned hydrocarbons, or propellant materials are not expected to present toxicity concerns. Close cooperation would continue with NMFS to provide a regulatory environment in which agencies can carry out activities while simultaneously considering the health of fish habitat. No impacts to EFH are anticipated from the proposed activities.

Threatened and Endangered Wildlife Species

The activities would incorporate procedures to avoid threatened or endangered wildlife that are foraging, resting, or hauled out, such as threatened green turtles or endangered Hawaiian monk seals. If humpback whales, monk seals, or sea turtles are observed in the offshore launch safety zone, the launch will be delayed (U.S. Department of the Navy, 1998).

Noise from a Super Loki Sounding Rocket and balloon launch may startle or flush threatened or endangered birds that could be transiting through the area. However, this startle reaction would be of short duration, similar to other reactions to unexpected noise, and is unlikely to result in long-term effects to threatened and endangered birds

and birds covered under the MBTA. Other effects would be similar to those discussed above.

Environmentally Sensitive Habitat

Nominal operational activities would not affect areas of critical habitat for lau`ehu (*panicum niihauense)*—an endangered plant species.

4.1.3.4 Post-Launch Activities

Vegetation

No additional impacts to indigenous or native vegetation are expected due to the removal of mobile equipment and assets brought to PMRF.

Threatened and Endangered Plant Species

No threatened or endangered vegetation is located within the launch site boundary.

Wildlife

The potential for impacts to wildlife would be similar to those described for site preparation activities.

Threatened and Endangered Wildlife Species

The potential for impacts to wildlife would be similar to those described for site preparation activities. Post-launch activities would incorporate procedures to avoid threatened or endangered wildlife that are foraging, resting, or hauled out, such as threatened green turtles or endangered Hawaiian monk seals. (U.S. Department of the Navy, 1998)

Environmentally Sensitive Habitat

Post-flight activities would not affect areas of critical habitat for the endangered grass plant lau`ehu.

4.1.3.5 Cumulative Impacts

Up to four LDSD vehicles would be launched from PMRF during approximately June to July 2014 and June to August 2015. Approximately one flight would be conducted in 2014 and up to three in 2015. The Proposed Action when combined with current and proposed launch activities would not result in substantial adverse cumulative impacts to biological resources in the region of influence. These combined activities would be performed at varying times and locations on PMRF and should have negligible adverse cumulative impacts on biological resources. No substantial cumulative impacts to biological resources have been identified as a result of prior launches from PMRF.

4.1.4 HAZARDOUS MATERIALS AND WASTE (PMRF)

The U.S. DOT defines a hazardous material as a substance or material that the Secretary of Transportation has determined is capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and that has been designated as hazardous under Section 5103 of the Federal hazardous materials transportation law (49 U.S.C. 5103). The term includes hazardous substances, hazardous wastes, marine pollutants, elevated temperature materials, materials designated as hazardous in the Hazardous Material Table (see 49 CFR 172.101) and materials that met the defining criteria for hazard classes and divisions (49 CFR 173).

The following criteria were used to identify the potential for impacts to hazardous materials and waste: amount of hazardous materials brought onto the installation that could result in exposure to the environment or the public through release or disposal practices, hazardous waste generation that could increase regulatory requirements, and requirement for exotic or unusual materials.

4.1.4.1 Site Preparation Activities

There are no site preparation activities (e.g., construction or intrusive ground activities) anticipated for the Proposed Action.

4.1.4.2 Pre-Launch Activities

All components of the SFDT would be transported, handled, and stored at PMRF in accordance with applicable existing PMRF SOPs, as well as Federal, State, U.S. Army, U.S. Navy, and NASA safety regulations. SFDT components would be transported to PMRF for temporary storage, pre-flight assembly and checkout, and flight preparation. The components would be shipped to PMRF as finished products that require only final assembly onsite. The hazardous materials contained within the SFDT include solid rocket propellant. No separate fueling would occur onsite.

4.1.4.3 Launch Activities

Hazardous Material Management

The solid propellants associated with the Proposed Action would be similar to past missile/ rocket systems launched from PMRF and would follow the same hazardous materials and hazardous waste handling procedures developed under existing plans described in the affected environment. The types of hazardous materials used and hazardous waste generated would be similar to current materials and would not result in any existing procedural changes to the hazardous materials and hazardous waste management plans currently in place.

Hazardous Waste Management

During launches of the SFDT there is the potential for a mishap to occur, resulting in potentially hazardous debris and propellants falling on land or water. As addressed for

previous launch programs on PMRF, the hazardous materials that result from a flight termination or mishap would be cleaned up, and any contaminated areas would be remediated in accordance with existing PMRF emergency response plans and hazardous materials and hazardous waste plans. All hazardous waste generated in such a mishap would be disposed of in accordance with appropriate State and Federal regulations. Overall, no adverse impacts would result from hazardous materials used or hazardous waste generated under the Proposed Action.

4.1.4.4 Post-Launch Activities

Specific restoration actions and equipment recovery procedures will be performed following each SFDT and in coordination with PMRF. In the event of a mishap, the Test Vehicle would be sufficiently downrange that debris is unlikely to reach back to the launch site. At the conclusion of launch activities, PMRF and SFDT Project personnel would remove all mobile equipment/assets brought to the range. Any hazardous materials remaining would be used or disposed of in accordance with the U.S. Navy's CHRIMP.

4.1.4.5 Cumulative Impacts

The pre-launch and launch activities represent routine types of activities at PMRF. Hazardous materials used and waste generated as a result of the SFDT activities would not exceed the existing hazardous waste permit conditions on PMRF. Solid propellants used with the SFDT will be self-contained and not pose a risk of spill. The types of hazardous materials used and waste generated would be similar to those currently used and generated at PMRF and would follow existing PMRF SOPs. All hazardous waste would be disposed of in accordance with the PMRF Hazardous Waste Management Plan. Implementation of the Proposed Action would not introduce new types of hazardous materials and wastes. As a result, no substantial adverse impacts from the management of SFDT Project related hazardous materials and waste are anticipated.

4.1.5 HEALTH AND SAFETY (PMRF)

An impact would be considered substantial 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, transportation mishaps, leaks or spills of fuel, impacts to aircraft and boats/ships, and public and personnel safety from EMR and other launch-related activities.

4.1.5.1 Site Preparation Activities

Activities required for the LDSD SFDT launches would comply with the Navy Occupational Safety and Health Program Manual, Navy Operations Instruction 5100.23E. Site preparation activities are routinely accomplished on PMRF for both military and civilian operations and should not result in impacts related to health and safety to workers.

4.1.5.2 Pre-Launch Activities

Pre-mission planning uses NASA-approved safety criteria that take into account failure modes and constrain operations so as to mitigate risk. PMRF would be used as the storage location for all materials that would be used during the launches. The primary hazard related to transport and storage operations of rocket components is injury due to packaging and movement of components and the potential for explosion/fire. Applicable State and Federal regulations and range safety plans and procedures shall be followed in transporting and handling potentially explosive ordnance and hazardous materials. LDSD components, including any propellant, shall be transported in DOT and military designed and approved shipping containers.

The protection afforded by shipping containers is sufficient to protect SRMs from shock required to cause an explosion. In the unlikely event of a transportation accident, the solid propellants will likely burn rather than explode. 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 rocket components. ESQDs are established along transportation corridors to minimize the potential for adverse impacts. The ESQD would adjust with the location or movement of the transportation vehicle along the corridor.

On arrival at PMRF, support equipment is placed in secure storage until assembly and launch preparations. ESQDs are established around ordnance storage MABs. Access to storage and support facilities is limited to trained and authorized PMRF/mission critical personnel. The ground and launch hazard areas for the LDSD balloon and Test Vehicle launch are determined by the hazards presented by the Test Vehicle's STAR48 motor.

4.1.5.3 Launch Activities

Balloons are flown as "acceptable risk" which is a "Negligible Risk Criteria" of less than 30×10^{-6} (or 30 in a million). For any mission that would exceed this risk, approval would be required by the WFF Director of Suborbital and Special Orbital Projects or equivalent PMRF safety official. (National Aeronautics and Space Administration, 2010)

Helium, a non-toxic, non-flammable gas is used to inflate balloons. While helium does not pose a health risk, NASA has implemented a policy in which only LDSD personnel are permitted near the balloon prior to balloon inflation and launch. An area extending 3 meters (10 feet) on either side of the payload and balloon up to the spool truck with a 15-meter (50-foot) radius around the center of the spool truck is cleared. The area remains under clearance conditions until the balloon system is released. (National Aeronautics and Space Administration, 2010)

Safety procedures currently in place for balloon system launch, flight, and termination would continue to be followed to protect the public and personnel. Many procedures

are in place to mitigate the potential hazards of an accident during the flight of one of the launch vehicles (sounding rocket or balloon assembly). Operation of the LDSD SFDT campaign would comply with the PMRF Range Safety Operation Plan, which is generated by PMRF Range Safety personnel prior to range operations. Launches would not be permitted to occur without review and agreement by the Range Safety Officer. GHAs based on payload, rocket or launch vehicle, and launch azimuth would be established for each launch. The GHA would be verified cleared before the launch signal would be given. The Test Vehicle (rocket) would be sufficiently downrange that debris would be unlikely to reach back to the launch site.

Commercial and private aircraft and ocean vessels would be notified in advance of launch activities by PMRF as part of their routine operations through NOTAMs by the FAA and NOTMARs, respectively. Thus, they would be able to reschedule or choose alternate routes before the flight experiments. PMRF takes every reasonable precaution during the planning and execution of range operations and launch activities to prevent injury to human life and property.

4.1.5.4 Post-Launch Activities

During recovery activities, safety is of paramount concern, as with the other aspects of the balloon mission. Care is taken when disassembling the payload and scientific instrumentation to prevent damage to instrumentation and to ensure that no safety risks are incurred. Any substances or instruments that pose specific potential safety hazards are identified early in the balloon flight application process, and are indicated in the safety plan. On site recovery teams are made aware of any potential hazards and are equipped with any necessary gear to deal with the unlikely event of a leak or spill, or other unforeseen hazard arising from recovery activities.

At the conclusion of testing activities, LDSD personnel would remove all mobile equipment/assets brought to the range. No adverse health and safety impacts are expected from these activities.

4.1.5.5 Cumulative Impacts

As a major established test range, PMRF routinely provides safety support and infrastructure for multiple test and training programs. All missions or projects are closely reviewed and analyzed to ensure that there are no unacceptable risks to the public, Government and military personnel, and contractors. The Proposed Action activities would not occur at the same time as other regional programs. PMRF range operations management would regulate the site preparation, launch, and post-launch activities to ensure that established safety procedures and protocols are followed. As such, no adverse cumulative impacts to health and safety are anticipated from the Proposed Action.

4.1.6 SOCIOECONOMICS (PMRF)

4.1.6.1 Site Preparation Activities

There are no site preparation activities (construction phases) that could have an effect on the local economy on Kauai.

4.1.6.2 Pre-Launch Activities and Launch Activities

There will be at minimum 20 temporary workers located on Kauai during the pre-launch activities and 50 temporary workers during launch activities of the SFDT for 2012 and 2015. These individuals may be on island for months using local accommodation (lodging/hotels, restaurants, recreation, and tourism), and would be spending an estimated $400.00 per diem with an estimated total cost on the order of $1 million.

4.1.6.3 Post-Launch Activities

During the recovery operation for both the Test Vehicle and balloon carcasses, NASA anticipates using local resources beyond those provided by PMRF to carry out the recovery processes. The current rough estimated for the recovery process is $3.5 million.

4.1.6.4 Cumulative Impacts

The implementation of the Proposed Action would have a positive impact on the local economy during each SFDT launch. There would be no impact on the permanent population size, employment characteristics, schools, and type of housing available on island.

4.1.7 WATER RESOURCES (PMRF)

This section addresses the potential impacts to water resources due to proposed activities. The impacts to water resources were evaluated based on whether the proposed activities would cause the following: a violation of applicable State or Federal water quality standards, related storm water pollution prevention plans, or other applicable water quality related plans, policies, or permit conditions; major changes in existing drainage and runoff patterns that alter the course of existing waterways or exceed the capacity of existing storm water drainage systems; or substantial degradation of water quality.

4.1.7.1 Site Preparation Activities

There are no site preparation activities (e.g., construction or intrusive ground activities) anticipated for the Proposed Action.

4.1.7.2 Pre-Launch Activities and Launch Activities

Under nominal launch conditions, no water resource impacts are expected because nearly all rocket motor emissions would be rapidly dispersed to nontoxic levels away

from the launch site. A qualified accident response team would be stationed at the launch site to negate or reduce the environmental effect in the unlikely event of an early adverse flight failure. Toxic concentrations of emission products and Test Vehicle (rocket) debris would be rapidly buffered and diluted by the sea and limited to within a few feet of the source.

Although a potential impact to water resources could occur in the event of an accidental spill or premature flight termination that resulted in propellant coming in contact with water resources, in the unlikely event of an accidental release, emergency response personnel would comply with PMRF's Hazardous Materials Contingency Plan and the Hazardous Waste Management Plan.

The possibility of water pollution is associated primarily with toxic materials that may be released to and are soluble in the water environment. The primary emission products of concern from a water quality-standpoint are hydrogen chloride and aluminum oxide. These emissions are not expected to cause a substantial water quality impact. Solid rocket propellants are the dominant source of such materials, although consideration must be given also to soluble materials originating from hardware and miscellaneous materials and to certain toxic combustion products. Solid propellants are primarily composed of plastics or rubbers such as polyvinylchloride, polyurethane, polybutadiene, polysulfide, etc., mixed with ammonium perchlorate. The plastics and rubbers are generally considered nontoxic and, in the water, would be expected to decompose and disperse at a very slow rate. No substantial effects on seawater quality due to solid fuel emissions, solid fuel debris, or missile debris are expected. In the event that not all of the solid propellant is burned, the hard rubber-like solid fuel would dissolve slowly. The small amount of any potential toxic materials would be rapidly dispersed to nontoxic levels by ocean currents. No run-off to the ocean is expected.

4.1.7.3 Post-Launch Activities

No adverse impacts to water resources on PMRF are expected from post-flight activities.

4.1.7.4 Cumulative Impacts

The amount of exhaust products from the SFDT that could potentially be deposited due to the Proposed Action would be small, and no cumulative impacts are expected. The Test Vehicle hardware, debris, and propellants that could fall into the ocean are expected to have only a localized, short-term effect on water quality. Because of the minimal risk from fuel or other hazardous material spill or leakage to occur during the Proposed Action activities, no or minimal adverse cumulative impacts to water resources are anticipated.

4.2 NIIHAU

4.2.1 AIRSPACE (NIIHAU)

4.2.1.1 Site Preparation, Pre-launch, Launch, and Post-launch Activities

Analysis indicated that the Proposed Action would not result in either short- or long-term impacts for this resource. The LDSD Proposed Action may require overflight of Niihau, which would not result in adverse impacts to airspace over Niihau. Additional use of airspace over Niihau would be limited to occasional flights by the island's helicopter. See Section 4.1.2 and 4.3.2 for additional information on the potential for impacts to area airspace.

4.2.1.2 Cumulative Impacts

Up to four overflights of Niihau during approximately June to July 2014 and June to August 2015 would not result in adverse impacts to the island's airspace. Approximately one flight would be conducted in 2014 and up to three in 2015.

4.2.2 BIOLOGICAL RESOURCES (NIIHAU)

4.2.2.1 Site Preparation Activities

No site preparation activities would occur on Niihau.

4.2.2.2 Pre-Launch Activities

Pre-launch activities would include overflights of the island and surrounding Open Ocean as part of the range clearance activities; no adverse impacts to biological resources are anticipated.

4.2.2.3 Launch Activities

Launch would occur from PMRF. While the trajectory may include overflight of Niihau, no adverse impacts are anticipated from a nominal flight and recovery. PMRF would respond to any mishap on Niihau, and would comply with relevant Navy policy and procedures to mitigate and prevent any adverse impacts to biological resources. As stated in Section 4.1.3.3, while the probability for a launch mishap is very low, an early flight termination or mishap would cause debris to impact along the flight corridor potentially in Niihau offshore waters. Debris would be removed from shallow water if possible.

4.2.2.4 Post-Launch Activities

Post-launch activities would include the potential for additional overflights of Niihau by recovery aircraft, but no adverse impacts are anticipated from a nominal flight and recovery. PMRF would respond to any mishap on Niihau, and would comply with relevant Navy policy and procedures to mitigate and prevent any adverse impacts to biological resources.

4.2.2.5 Cumulative Impacts

Up to four LDSD vehicles would be launched from PMRF from approximately June to July 2014 and June to August 2015. Approximately one flight would be conducted in 2014 and up to three in 2015. The Proposed Action when combined with current and proposed launch activities would not result in substantial adverse cumulative impacts to biological resources on or off-shore of Niihau. These launches could potentially overfly Niihau, but are not anticipated to impact biological resources on the island. No substantial adverse cumulative impacts to biological resources are expected.

4.2.3 CULTURAL RESOURCES (NIIHAU)

4.2.3.1 Site Preparation

There are no site preparation activities proposed for Niihau; therefore, there will be no historic properties affected by LDSD activities.

4.2.3.2 Pre-launch and Launch Activities

Although archaeological sites have been identified on Niihau, they are few in number and scattered across the island; therefore, the potential for Test Vehicle equipment or debris to strike any of the sites is extremely remote. As a result, no historic properties will be affected by LDSD activities.

4.2.3.3 Post-Launch Activities

Any post launch recovery operations on Niihau would require permission of the landowners and undertaken at their direction to ensure that no cultural resources are inadvertently disturbed or damaged. As a result, there will be no historic properties affected.

4.2.3.4 Cumulative Impacts

Implementation of the LDSD Proposed Action in conjunction with other past, present, and reasonably foreseeable future actions will not result in cumulative effects on cultural resources on Niihau.

4.2.4 HEALTH AND SAFETY (NIIHAU)

4.2.4.1 Site Preparation Activities

No site preparation activities would occur on Niihau, and thus there would be no potential adverse impacts to the health and safety of its residents.

4.2.4.2 Pre-Launch Activities

All pre-launch activities would occur on PMRF, and therefore would not adversely affect Niihau.

4.2.4.3 Launch Activities

Launch would occur from PMRF. While the trajectory may include overflight of Niihau, no adverse impacts are anticipated to the island's residents from a nominal flight and recovery. PMRF would respond to any mishap on Niihau, and would comply with relevant Navy policy and procedures to mitigate and prevent any adverse impacts to biological resources.

4.2.4.4 Post-Launch Activities

Post-launch activities would include the potential for additional overflights of Niihau by recovery aircraft, but no adverse impacts to the island's residents from a nominal flight and recovery are anticipated.

4.2.4.5 Cumulative Impacts

Up to four LDSD vehicles would be launched from PMRF from approximately June to July 2014 and June to August 2015. Approximately one flight would be conducted in 2014 and up to three in 2015. All missions or projects are closely reviewed and analyzed to ensure that there are no unacceptable risks to the public, Government and military personnel, and contractors. The Proposed Action activities would not occur at the same time as other regional programs. While the launches could potentially overfly Niihau, they are not anticipated to adversely impact the health and safety of the residents on the island. No substantial adverse cumulative impacts are expected.

4.3 OPEN OCEAN AREA

4.3.1 AIRSPACE (OPEN OCEAN AREA)

4.3.1.1 Site Preparation Activities

No site preparation activities would occur in the open ocean.

4.3.1.2 Pre-Launch Activities

Before any operation is allowed to proceed, the overwater range is verified clear 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 missile/rocket, speed, altitude, debris corridor, and surface water hazard area.

4.3.1.3 Launch Activities

Before launching an LDSD launch vehicle from PMRF, NOTAMs would be sent to notify commercial and private aircraft in advance of launch activities by PMRF Range Safety through the FAA as part of their routine operations. NOTAMs would also advise avoidance of any tracking radar areas during the proposed project activities.

Safety regulations dictate that launch operations would be suspended when it is known or suspected that any unauthorized aircraft have entered any part of the surface danger zone (as noted by the FAA issued NOTAM) until the unauthorized entrant has been removed or a thorough check of the suspected area has been performed.

4.3.1.4 Post-Launch Activities

Flights required as part of the post-flight test activities such as scanning for wounded or dead marine mammals (i.e., whales, dolphins, porpoises, etc.) would not restrict access to, nor affect the use of, existing airfields in the region of influence. Operations at the airfields would continue unhindered. Existing airfield or airport arrival and departure traffic flows would also not be affected, and access to the airfield would not be curtailed.

4.3.1.5 Cumulative Impacts

Rocket launches are short-term, discrete events that are actively managed by PMRF range safety. The Proposed Action is not scheduled to occur at the same time as other regional programs. The use of the required scheduling and coordination process for area airspace, and adherence to applicable DoD directives and FAA regulations concerning issuance of NOTAMs and selection of missile firing areas and trajectories, minimizes the potential for substantial incremental, additive, adverse cumulative impacts.

4.3.2 BIOLOGICAL RESOURCES (OPEN OCEAN AREA)

4.3.2.1 Site Preparation Activities

No site preparation activities would occur in the open ocean.

4.3.2.2 Pre-Launch Activities

Pre-launch activities would include verification of the open ocean splashdown areas clearance which would entail additional flights or ocean vessel traffic. No adverse impacts to marine species are anticipated since pilots of ocean vessels would follow existing mitigation measures such as avoiding visible and reporting visible whales and sea turtles to launch control. Additionally, the pre-launch activities have no plans to affect the Papahanaumokuakea Marine National Monument.

4.3.2.3 Launch Activities

Coral

Deep sea coral within the Open Ocean Area is limited in area. The potential for impacts on these deep water corals from launch activities would be very small. The LDSD activities should not result in any direct impacts on the coral or degradation of water/sediment quality in the vicinity of the corals. The probability of splashdown or rocket 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 happen to be near the surface at the point of impact. Permanent, adverse impacts from LDSD components are not anticipated since operations are conducted to avoid potential impacts. Additionally, the launch activities would not affect the Papahanaumokuakea Marine National Monument.

Sea Turtles and Marine Mammals

Each LDSD Test Vehicle would splash down in separate areas within the Open Ocean Area. Although a direct hit from a booster or piece of debris would affect a sea turtle at the surface, it is extremely unlikely that this would ever occur. Spotters would report any sea turtle observations within the potential drop zone areas. Any injured or killed sea turtles would be reported to the NMFS and USFWS. Additionally, the launch activities would not affect the Papahanaumokuakea Marine National Monument.

The primary source of potential marine mammal habitat impact during launch activities within the open ocean would be underwater sound (sonic boom) resulting from rocket launches and ship traffic. 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 (whales, dolphins, porpoises, etc.) 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.

The potential for noise-related impacts from Navy or other vessel and aircraft movement is extremely low given that the test events would be limited and would occur over a large area of the ocean. Any masking of environmental sounds is expected to be temporary, as launch and booster splashdown 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.

Rocket launches 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. The range safety precautions at PMRF are even more rigorous because of the extra sensors available. The proposed launches would be conducted at PMRF, which strictly controls launches and does not permit an exercise to proceed until the range is determined clear of ships, aircraft, and large visible marine mammals (whales, dolphins, porpoises, etc.) 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.

4.3.2.4 Post-Launch Activities

Post-launch activities would involve over-water flight and test execution. The program intention would be to deposit the balloon launch platform within approximately 139 kilometers (75 nm) and the Test Vehicle within approximately 111 kilometers (60 nm) offshore of the Kauai coastline. The LDSD Project requires that the balloon and Test Vehicle both be recovered following a planned nominal test. The Super Loki rockets are expected to sink to the ocean floor and therefore would not be recovered. The likelihood that a marine mammal or sea turtle would be directly under the expected impact spots is small.

Each SFDT associated with the LDSD project would involve over-water flight and test execution. In both nominal and contingency flight scenarios, the intention would be to deposit the balloon within approximately 139 kilometers (75 nm), and the Test Vehicle within approximately 111 kilometers (60 nm) of the PMRF coastline. NASA would recover any floating debris such as the balloon (any floating elements of the balloon) and Test Vehicle following each SFDT. If separated from the Test Vehicle, to the extent possible the FIR would be recovered. WFF is the responsible agency for developing a recovery plan for the balloon and the Test Vehicle, which would be approved by JPL and PMRF.

Balloon and Test Vehicle ocean salvage/recovery would begin following launch and would be accomplished by appropriate ocean-worthy vessel(s) capable of 3-4 days underway time, or with an appropriate time on-station greater than its distance fuel allowance. All recovery aids would be required to remain active for a minimum of 4 days with the exception of the dye markers, which would only be intended to help the initial spotter aircraft on the scene to locate the Test Vehicle. The method for recovery is to first establish visual contact with the balloon and Test Vehicle following impact using either existing surveillance aircraft assets, or general aviation spotter aircraft. Both test articles would be outfitted with beacon tracking devices. In the event that a

beacon location on either article fails, the spotter aircraft would remain on-station, and be replaced for fuel coordination until the recovery vessels arrive on-station. Prior to balloon removal from the water, the operation would likely utilize a two-man dive team and RIBS to survey the balloon disposition.

The balloon recovery ship would lift the balloon from the water incrementally since the total balloon and water weight would be 2,722 to 4,082 kilograms (6,000 to 9,000 pounds). It is expected that the area the balloon would occupy when on deck would need to hold approximately 11.5 cubic meters (15 cubic yards) of polyethylene material. The balloon is considered salvage to be disposed of post-launch. A crane and/or capstan (winch) would be used to pull the balloon from the water. The test articles would be salvaged from the ocean surface and securely fastened to the vessel deck for RTB to PMRF dock operation at Port Allen. The balloon material would be disposed of following offload to the Port Allen public pier. The Test Vehicle would be inspected and flight data recorders removed, followed by disposition (storage) at a PMRF location.

4.3.2.5 Cumulative Impacts

The proposed activities would not result in any direct impacts on the coral or degradation of water/sediment quality in the vicinity of the corals. PMRF strictly controls launches 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. Implementation of these controls minimizes the potential for cumulative impacts to marine species. No substantial adverse cumulative impacts are anticipated from the four planned LDSD launches.

4.3.3 CULTURAL RESOURCES (OPEN OCEAN AREA)

4.3.3.1 Site Preparation

As proposed, LDSD site preparation activities would take place on land and would have no effect on open ocean cultural resources.

4.3.3.2 Launch Activities

LDSD activities with the potential to affect submerged cultural resources (e.g., aircraft wrecks, shipwrecks) within open ocean areas include impacts from falling LDSD equipment and debris. Given the low energy of the falling debris, the potential to affect submerged resources of any type is extremely remote. As a result there will be no submerged cultural resources affected within open ocean areas.

4.3.3.3 Post Flight Activities

Post flight recovery operations would not have the potential to affect any deeply submerged cultural resources within the Open Ocean Area.

4.3.3.4 Cumulative Impacts

Implementation of the Proposed Action in conjunction with other past, present, and reasonably foreseeable future actions will not result in cumulative effects on cultural resources within the Open Ocean Area. Any submerged features that might be within this area are at considerable depth, and the potential for disturbance is extremely remote.

4.3.4 HAZARDOUS MATERIALS AND WASTE (OPEN OCEAN AREA)

4.3.4.1 Hazardous Materials and Waste (Open Ocean Area)

The U.S. DOT defines a hazardous material as a substance or material that the Secretary of Transportation has determined is capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and that has been designated as hazardous under Section 5103 of the Federal hazardous materials transportation law (49 U.S.C. 5103). The term includes hazardous substances, hazardous wastes, marine pollutants, elevated temperature materials, materials designated as hazardous in the Hazardous Material Table (see 49 CFR 172.101), and materials meeting the defining criteria for hazard classes and divisions (49 CFR 173).

The following criteria were used to identify the potential for impacts to hazardous materials and waste: amount of hazardous materials brought onto the installation that could result in exposure to the environment or the public through release or disposal practices, hazardous waste generation that could increase regulatory requirements, and requirement for exotic or unusual materials.

4.3.4.2 Site Preparation Activities

No site preparation activities are proposed.

4.3.4.3 Pre-Launch, Launch, and Post-Launch Activities

Test equipment (balloon launch platform and Test Vehicle) expended into the waters off the coast of PMRF would be recovered. The effects on the Open Ocean Area from hazardous materials and waste under the Proposed Action would be negligible, if at all. Since the majority of propellant would be expended before equipment splashdown, only trace amounts of propellant would be left, which would minimize the potential for toxic effects.

Any remaining solid propellant fragments are expected to sink to the ocean floor and undergo physical and chemical changes in the presence of seawater. Tests show that water penetrates only 0.15 centimeter (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)

4.3.4.4 Cumulative Impacts

The implementation of the Proposed Action would not introduce new types of hazardous materials and waste into the Open Ocean Area, and only small increases in quantities of previously introduced types of hazardous wastes are expected. Therefore, no substantial adverse cumulative impacts from the management of hazardous waste and materials are expected in the Open Ocean Area.

4.3.5 HEALTH AND SAFETY (OPEN OCEAN AREA)

4.3.5.1 Site Preparation Activities

No site preparation activities are planned for the Open Ocean Area.

4.3.5.2 Pre-Launch Activities

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 missile/rocket, speed, altitude, debris corridor, and surface water hazard area.

4.3.5.3 Launch Activities

The test flights would originate from PMRF and proceed in a southerly direction. All PMRF-controlled flight activities that occur over the Open Ocean Area would continue to be conducted in Warning Area W-186. 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.

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. 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 or by verifying that the area based on the distance the system can travel without flight termination is clear, LDSD and PMRF personnel would take every reasonable precaution during the planning and execution of the operations to prevent injury to human life or property. NASA would develop specific safety plans 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.

The Warning Area is in international waters and is not restricted; however, the surface area of the Warning Area 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. All activities must be in compliance with DoD Directive 4540.01 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."

4.3.5.4 Post-Launch Activities

Flights required as part of the post-flight test activities would not affect public health and safety in the region of influence. Operations at area airfields would continue unhindered.

4.3.5.5 Cumulative Impacts

Rocket launches are short-term, discrete events that are actively managed by PMRF range safety. The Proposed Action is not scheduled to occur at the same time as other launch programs. The use of the required scheduling and coordination process for area airspace, and adherence to applicable DoD directives and FAA regulations concerning issuance of NOTAMs and selection of missile firing areas and trajectories, minimizes the potential for substantial incremental, additive, health and safety adverse cumulative impacts.

4.3.6 WATER RESOURCES (OPEN OCEAN AREA)

Open ocean water resources include the potential impacts to physical and chemical properties, salinity, density, temperature, pH, dissolved gases, and marine pollutants due to the Proposed Action.

4.3.6.1 Site Preparation Activities

There are no site preparation activities proposed.

4.3.6.2 Operational (Pre-Launch, and Launch 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.

4.3.6.3 Post-Launch Activities

The possibility of water pollution is associated primarily with toxic materials, which may be released to and are soluble in the water environment. Rocket propellants are the

dominant source of such materials, although consideration must be given also to soluble materials originating from hardware and miscellaneous materials and to certain toxic combustion products. Solid propellants are primarily composed of plastics or rubbers such as polyvinylchloride, polyurethane, polybutadiene, polysulfide, etc., mixed with ammonium perchlorate. The plastics and rubbers are generally considered nontoxic and, in the water, would be expected to decompose and disperse at a very slow rate. Negligible effects on seawater quality due to solid fuel emissions, solid fuel debris, or missile debris are expected. In the event that not all of the solid propellant is burned, the hard rubber-like solid fuel would dissolve slowly. The small amount of any potential toxic materials would be rapidly dispersed to nontoxic levels by ocean currents.

The activities associated with the Proposed Action would not introduce new types of expended materials or debris in the open ocean.

4.3.6.4 Cumulative Impacts

No cumulative effects to water resources are anticipated as a result of the Proposed Action. The effect of any rocket motor emission products deposited in the open ocean would be very transient due to the buffering capacity of sea water and dilution by current ocean mixing and would not be expected to result in any cumulative adverse effects.

4.4 GLOBAL ENVIRONMENT

4.4.1 GLOBAL ATMOSPHERE

On a global basis, the Proposed Action would release a minute quantity of carbon dioxide compared to anthropogenic releases worldwide and the CEQ's draft threshold guidance (Council on Environmental Quality, 2010). The limited amounts of emissions would not contribute measurably to cumulative global warming; however, any emissions of GHG represents an incremental increase that could have incremental effects on the global atmosphere. Because the LDSD launches would release little or no ozone depleting substance, there would be no adverse cumulative impacts on the stratospheric ozone layer.

4.5 NO-ACTION ALTERNATIVE

Under the No-action Alternative, NASA would not conduct the Proposed Action. No adverse or cumulative impacts would result from selection of the No-action Alternative. If in the future the agency decides to pursue the Proposed Action at a location other than PMRF, additional environmental analysis and documentation would be performed.

4.6 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 EO 12898*,* Navy, and DoD guidance. The EO 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 EO requires that minority and low-income populations be given access to information and opportunities to provide input to decision-making on Federal actions.

Proposed activities would be conducted in a manner that would not substantially affect human health and the environment. 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 has identified no human health or environmental effects that would result in disproportionately high or adverse effects 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.

4.7 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 EO 13045, as amended by EO 13229.

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5.0 REFERENCES

Audubon, 2006. "The 2002 Audubon WatchList" [Online]. Available: http://audubon2.org/webapp/watchlist/viewWatchlist.jsp [15 June].

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.

BirdLife International, 2012. Species factsheet: *Phoebastria nigripes* [Online]. Available: http://www.birdlife.org, 30 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.

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, N., 2009. Personal communication (e-mail) between Nando Bran, Pacific Missile Range Facility and Edd Joy, KAYA Associates, regarding shipment of explosives to the Pacific Missile Range Facility, 2 December.

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.

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., 2010a. Personal communication (e-mail) between John Burger, PMRF GDIT/RCSS and Karen Barnes, KAYA Associates, Inc., 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., 2012. Comments received from John Burger, Pacific Missile Range Facility, regarding practices at Pacific Missile Range Facility, November.

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.

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.

Center for Biological Diversity, 2009. Petition to List 83 Coral Species under the Endangered Species Act [Online]. Available: http://sero.nmfs.noaa.gov/pr/esa/pdf/091020_CBD_Coral_Petition.pdf, 20 October.

Center for Biological Diversity, 2012. Coral Conservation [Online]. Available: http://www.biologicaldiversity.org/campaigns/coral_conservation/index.html.

Century 21, 2012. Kauai Real Estate [Online]. Available: http://www.kauai-realestate.com/articles/2012/201204-kauai-real-estate-update.php.

Chamber of Commerce of Hawaii, 2012. "Military Affairs – Economic Impact of Armed Forces in Hawaii."

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.

CO_2Now, 2013. Annual Data: Atmospheric CO_2 [Online]. Available: http://co2now.org/Current-CO2/CO2-Now/annual-co2.html.

Commander, Navy Region Hawaii, 2010. Integrated Natural Resources Management Plan Pacific Missile Range Facility Islands of Kauai, Oahu, and Kaula, State of Hawaii, November.

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].

Corkeron, P.J. and R.C. Connor, 1999. "Why do baleen whales migrate?" Marine Mammal Science, 15:1228-1245.

Council on Environmental Quality, 2010. Draft Guidance for Greenhouse Gas Emissions and Climate Change Impacts [Online]. Available: http://www.whitehouse.gov/sites/default/files/microsites/ceq/20100218-nepa-consideration-effects-ghg-draft-guidance.pdf

Currents, 2007. "Navy Offers Sanctuary to Migratory Birds" [Online]. Available: http://www.p2pays.org/ref/41/40529.pdf.

Department of Health, Hawaii, Air Quality Station Report, 2012. State of Hawaii 2012 Air Monitoring Network Plan [Online]. Available: http://hawaii.gov/health/environmental/air/cab/cab_monitoring/monitoring_pdf/2012_Air_Monitoring_Network_Plan.pdf July.

Dilley, A. and E. McCarthy, 2012. Pacific Missile Range Facility (PMRF) Species Verification and Satellite Tagging Test June and July 2012 Post-Test Report, 21 September [Online]. Available: http://www.navymarinespeciesmonitoring.us/files/6713/4876/2414/Dilley_and_McCarthy-2012.pdf.

Eckert, K.L. and C. Luginbuhl, 1988. "Death of a giant," Marine Turtle Newsletter, 43:2-3.

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.

Environmental Protection Agency Ambient Air Quality Standards, 2012. National Ambient Air Quality Standards (NAAQS) [Online]. Available: http://www.epa.gov/air/criteria.html.

Ernst, C.H., R.W. Barbour, and J.E. Lovich, 1994. Turtles of the United States and Canada, Washington, D.C.: Smithsonian Institution Press.

Federal Aviation Administration, 2011. Subject: Notices to Airmen, Chapter 2. Aeronautical Information Services [Online]. Available: http://www.faa.gov/air_traffic/publications/atpubs/ntm/not0201.html, 20 October.

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.

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.

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.

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.

Grigg, R.W., 1988. "Paleoceanography of coral reefs in the Hawaiian-Emperor chain," *Science, 240:1737*-1743.

Grigg, R.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., 1997. "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.

Hawaii Department of Business, Economic Development & Tourism, 2008. Hawaii Greenhouse Gas Inventory: 1990 and 2007, December [Online]. Available: http://hawaii.gov/dbedt/info/energy/greenhouse/HI%20GHG%20Inventory%20Revised,%201990%20and%202007,%2012-31-08.pdf.

Hawaii Department of Land and Natural Resources, no date. 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, 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 for Visitors, 2012. "Kauai Travel Guide-Introduction to Kauai for Visitors" [Online]. Available: http://www.hawaiiforvisitors.com/kauai/.

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_sites_Niihau.htm [28 August].

Hawaii State Department of Education, 2012. "Find my School on Kauai" [Online]. Available: http://doe.k12.hi.us/myschool/map_kauai.htm

Hawaii State Department of Health, Clean Air Branch, 2010a. State of Hawaii Air Monitoring Network Plan, July.

Hawaii State Department of Health, Clean Air Branch, 2010b. State of Hawaii Annual Summary 2009 Air Quality Data.

Hawaii Tourism Authority, 2011. "2011 Hawaii Tourism Authority Visitor Statistics Infograph." [Online]. Available: http://www.hawaiilife.com/articles/2012/02/hawaii-visitor-statistics-infograph/.

Hawaii Tourism Authority, 2012. "HAWAI`I TOURISM ECONOMY ON PACE FOR RECORD YEAR-Kauai Visitor Arrivals and Total Expenditures Positive Year-to-Date 2012" [Online]. Available: http://www.hawaiitourismauthority.org/default/assets/File/HTA%20Statement%20on%20July%202012%20Visitor%20Stats_Kauai%20FINAL.pdf

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.

International Archaeological Research Institute, Inc., 2005. Integrated Cultural Resources Management Plan for the Pacific Missile Range Facility (PMRF), Island of Kauai, State Prepared by M.J. Tomonari-Tuggle and A. Yoklavich, Mason Architects, Inc. Prepared for Commander Navy Region Hawaii. April. FOR OFFICIAL USE ONLY.

International Civil Aviation Organization, 2008. Amendment No. 1 to the Procedures for Air Navigation Services Air Traffic Management (Doc 4444) [Online]. Available: http://www2.icao.int/en/FITS/FITSLibrary/PANS%20ATM%20Amendment.pdf, 25 June.

International Union for the Conservation of Nature and Natural Resources, 2012. IUCN Red List of Threatened Species. Version 2012.2 [Online]. Available: http://www.iucnredlist.org/details/133229/0, May.

International Whaling Commission, 2001. Classification of the Order Cetacea (whales, dolphins and porpoises). Journal of Cetacean Research and Management, 9(1):v-xii.

Kauai Chamber of Commerce, 2012. "Kauai Industries - Kauai Chamber of Commerce" [Online]. Available: http://www.kauaichamber.org/pages/KauaiIndustries1/.

Kauai Island Utility Cooperative, 2008. Strategic Plan 2008 – 2023, October [Online]. Available: http://www.kiuc.coop/pdf/SP2023%202008%20Update%20Approved-2008-10.pdf.

Kauai Monk Seal Watch Program, 2003. "Fall 2003 Newsletter," October [Online]. Available: http://www.kauaimonkseal.com/News/OCT03NL.htm.

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.

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.

Maldini, D., 2003. "Abundance and distribution patterns of Hawaiian odontocetes: Focus on Oahu," Ph.D dissertation, University of Hawaii, Manoa.

Maragos, J.E., 1998. "Marine ecosystems," pp. 111-120 in S.P. Juvik and J.O. Juvik, eds. Atlas of Hawai`i, 3rd ed. Honolulu, Hawaii: University of Hawaii 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.

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].

MidWeek Kauai, 2010. "The Navy's Nature Guy" an article by Anne E. O'Malley, 1 September 2010 [Online]. Available: http://www.midweekkauai.com/2010/09/ the-navys-nature-guy/.

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.

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, 2001. 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.

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.

National Aeronautics and Space Administration, 2005. Final Programmatic Environmental Impact Statement for the Mars Exploration Program Volume 1. Washington, DC: Science Mission Directorate, NASA Headquarters.

National Aeronautics and Space Administration, 2010. NASA Scientific Balloon Program Programmatic Environmental Assessment, September.

National Aeronautics and Space Administration, 2012a. NASA Office of the Chief Technologist Introduction [Online]. Available: http://www.nasa.gov/offices/oct/about_us/index.html, 28 March.

National Aeronautics and Space Administration, 2012b. Low Density Supersonic Decelerator Formulation Review, 26–28 September.

National Aeronautics and Space Administration, 2013. Low Density Supersonic Decelerators Range Selection Process Out Brief Original.

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 [Online]. Available: http://nmfs.noaa.gov/pr/pdfs/recovery/

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, Vol 67, No. 28, pp. 6194-6202.

National Marine Fisheries Service, 2004a. *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, 2004b. "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, 2007. "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, 2012. Corals That Are Candidates for Listing under the ESA, Status Review Report [Online]. Available: http://www.nmfs.noaa.gov/pr/species/invertebrates/corals.htm, 12 April.

National Marine Fisheries Service, Office of Protected Resources, 2012. False Killer Whale *(Pseudorca crassidens),* December.

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 Marine Fisheries Service and United States Fish and Wildlife Service, 1998. Recovery [Online]. Available: http://www.nmfs.noaa.gov/pr/pdfs/recovery/turtle_green_pacific.pdf.

National Ocean Service, 2001. Environmental sensitivity index (ESI) atlas: Hawaii. Volumes 1 and 2, Seattle, Washington: NOAA.

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, 2006. Public Draft Environmental Assessment National Oceanic and Atmospheric Administration Pacific Region Center, March.

National Oceanic and Atmospheric Administration, 2008. Stratospheric Ozone Monitoring and Research in NOAA [Online]. Available: http://www.ozonelayer.noaa.gov/, 20 March.

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 Oceanic and Atmospheric Administration, 2012. Hawaiian Islands Humpback Whale National Marine Sanctuary [Online]. Available: http://hawaiihumpbackwhale.noaa.gov/welcome.html, 4 July.

National Oceanic and Atmospheric Administration, 2013. Corals Proposed for Listing under the ESA, NOAA Fisheries Office of Protected Resources [Online]. Available: http://www.nmfs.noaa.gov/pr/species/invertebrates/corals.htm, 9 April.

National Research Council, 1990. Decline of the sea turtles: Causes and prevention, National Academy Press, Washington D.C.

National Wetlands Inventory, 2007. Providing Wetland Information to the American People [Online]. Available: http://www.fws.gov/nwi/ [17 October].

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. Response from the U.S. Department of the Navy to Dr. Loyal Mehrhoff, U.S. Fish and Wildlife Service, Pacific Islands Office on comments received re biological species including the Hawaiian hoary bat, 20 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.

Pacific Business News, 2012. “Kauai's housing market shows mixed results in May - Pacific Business News” [Online]. Available: http://www.bizjournals.com/pacific/news/2012/06/05/kauais-housing-market-shows-mixed.

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, Barking Sands, Hawaii, 1991. *Fleet Mission Planning Guide, FMPG-91,* 1 April.

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.

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.

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., 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.

Safina, C., 1996. *Xiphias gladius*. In 2004 IUCN red list of threatened species [Online]. Available: http://www.redlist.org.

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, 2010. Calendar Year 2009 Annual Site Environmental Report for Tonopah Test Range, Nevada and Kauai Test Facility, Hawaii, September.

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.

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.

Space Studies Board, 2011. Vision and Voyages for Planetary Science in the Decade 2013-2022. Washington, D.C.: The National Academies Press.

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.

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.

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.

United Nations Convention on the Law of the Sea, 1982. Agreement Relating to the Implementation of Part XI of the Convention [Online[. Available: http://www.un.org/Depts/los/convention_agreements/texts/unclos/closindx.htm, 10 December.

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 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 Strategic Defense Command, 1992. *Final Environmental Impact Statement for the Strategic Target System, May.*

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

U.S. Bureau of Labor Statistics, 2012. "Unemployment in the U.S. - Google Public Data Explorer" [Online]. Available: http://www.google.com/publicdata/explore?ds=z1ebjpgk2654c1_&met_y=unemployment_r.

U.S. Census Bureau, 2006-2010 American Community Survey, 2012. "Selected Economic Characteristics 2006-2010 American Community Survey 5-Year Estimates" [Online]. Available: http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk.

U.S. Census Bureau, 2012. "Kauai County QuickFacts from the US Census Bureau" [Online]. Available: http://quickfacts.census.gov/qfd/states/15/15007.html.

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 Energy, 1992. Kauai Test Facility (KTF) Environmental Assessment, July.

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 Hawaiian Range Complex Draft Environmental Impact Statement/Overseas Environmental Statement regarding biological resources.

U.S. Department of the Navy, 1998. Pacific Missile Range Facility Enhanced Capability Final Environmental Impact Statement Volume 1 of 3, December.

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, 2008. Final Environmental Impact Statement/Overseas Environmental Impact Statement – Hawaii Range Complex.

U.S. Fish and Wildlife Service, 2003. "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, 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, 2006. "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, 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, 2008. Short-tailed Albatross Recovery Plan [Online]. Available: http://ecos.fws.gov/docs/recovery_plan/090520.pdf, Anchorage, AK, 105 pp.

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, 2010. Hawaiian Islands Animals: Updated April 13, 2010, Listed Species, as Designated under the U.S. Endangered Species Act [Online]. Available: http://www.fws.gov/pacificislands/publications/listinganimals.pdf.

U.S. Fish and Wildlife Service, 2011. Biological and Conference Opinions for the Proposed Intercept Test Facility, Pacific Missile Range Facility, Kauai, 28 March.

U.S. Navy NAVFAC Pacific Environmental Planning, 2007. Pacific Missile Range Facility Wedge-tailed Shearwater Population Survey Project Summary Report.

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.

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.

Wallops Flight Facility, 2012. Draft LDSD Program Introduction (PI). Wallops, VA.

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, 2001. Final Fishery management plan for coral reef ecosystems of the western Pacific region. Volumes I-Ill 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.

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.

World Meteorological Organization, 2006. WMO Greenhouse Gas Bulletin, "The State of Greenhouse Gases in the Atmosphere Using Global Observations through 2006" [Online]. Available: ftp://ftp.wmo.int/Documents/PublicWeb/arep/gaw/ghg-bulletin-3.pdf.

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.

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7.0 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.

Federal

Federal Aviation Administration
Honolulu Control Facility

U.S. Fish and Wildlife Service
Pacific Islands Office

National Marine Fisheries Service
Pacific Islands Office

State

Hawaii Coastal Zone Management Program
Department of Business, Economic Development and Tourism, Office of Planning

The Office of Hawaiian Affairs
Honolulu Headquarters

State Historic Preservation Division
Department of Land and Natural Resources

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Appendix A
Distribution List

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APPENDIX A
DISTRIBUTION LIST

Federal

Federal Aviation Administration
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Waimea Public Library
9750 Kaumualii Highway
Waimea, Kauai, HI 96796

Hawaii State Library
Hawaii and Pacific Section Document Unit
478 South King Street
Honolulu, Oahu, HI 96813-2994

Lihue Public Library
4344 Hardy Street
Lihue, Kauai, HI 96766

Appendix B
Correspondence

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APPENDIX B
CORRESPONDENCE

National Aeronautics and
Space Administration
Mission Support Directorate

NASA Management Office

4800 Oak Grove Drive
Pasadena, CA 91109-8099

Reply to Attn of: LP040

December 13, 2012

Mr. Neil Okuna
Federal Aviation Administration
Honolulu Control Facility
760 Worchester Ave
Honolulu, HI 96818

SUBJECT: Low-Density Supersonic Decelerator Test Coordinating Draft Environmental Assessment

Dear Mr. Okuna:

The National Aeronautics and Space Administration (NASA) has completed the Coordinating Draft Environmental Assessment (CDEA) for proposed field tests involving launch, operation, and recovery of the Low Density Supersonic Decelerator (LDSD). These tests are part of a technology demonstration project that is baselined to launch from the U.S. Navy's Pacific Missile Range Facility (PMRF) on Kauai.

The NASA Jet Propulsion Laboratory is proposing to conduct supersonic flight dynamic tests (SFDT) for NASA's LDSD Project from the Department of the Navy's PMRF. These proposed tests would consist of launch, operation, and recovery of up to four missions from a designated location on PMRF. The purpose of the SFDT is to demonstrate and evaluate development of new supersonic inflatable aerodynamic decelerator (SIAD) and supersonic ringsail (SSRS) parachute technologies. These tests would allow the SIAD and SSRS parachute to be tested in the Earth's stratosphere at supersonic speed to simulate operation in the thin atmosphere of Mars. The Test Vehicle with its small solid rocket motor would be launched on a high altitude balloon from PMRF.

This CDEA has also been provided for comment to Mr. William Aila, Jr., chairperson of the State of Hawaii Department of Land and Natural Resources; Ms. Colette Machado, chairperson of the Office of Hawaiian Affairs; Dr. Steven Kolinski, National Marine Fisheries Service; and Dr. Loyal Mehrhoff, U.S. Fish and Wildlife Service.

If you wish to provide comments please reply by January 28, 2013. Comments can be provided to Mark Phillips, LDSD Project NEPA lead, at the Jet Propulsion Laboratory, Attention: Mark Phillips, 4800 Oak Grove Drive – M/S 301-370, Pasadena, CA 91109, or by calling 818-354-1181, or by e-mail at j.m.phillips@jpl.nasa.gov.

Sincerely,

Steve Slaten
Environmental and Facilities Manager
NASA Management Office

Enclosure: CDEA (Hard Copy and CD)

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Neil OKuna FAA

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Tracking no.: 794298399207

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Shipment Dates	Destination
Ship date Dec 13, 2012 Delivery date Dec 14, 2012 2:42 PM	HONOLULU, HI

Shipment Options

Hold at FedEx Location
Hold at FedEx Location service is not available for this shipment.

Shipment Facts

Service type	Priority Pak	Delivered to	Receptionist/Front Desk
Weight	2.0 lbs/.9 kg	Reference	0106.100423.04.003 ODC-Barnes

Shipment Travel History

Select time zone: Local Scan Time

All shipment travel activity is displayed in local time for the location

Date/Time	Activity	Location	Details
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Dec 14, 2012 10:09 AM	At local FedEx facility	HONOLULU, HI	
Dec 14, 2012 8:28 AM	At destination sort facility	HONOLULU, HI	
Dec 14, 2012 4:21 AM	In transit	MEMPHIS, TN	
Dec 14, 2012 4:12 AM	Departed FedEx location	MEMPHIS, TN	
Dec 14, 2012 12:51 AM	Arrived at FedEx location	MEMPHIS, TN	
Dec 13, 2012 9:00 PM	Left FedEx origin facility	MADISON, AL	
Dec 13, 2012 5:49 PM	Picked up	MADISON, AL	
Dec 13, 2012 2:44 PM	Shipment information sent to FedEx		

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National Aeronautics and
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Mission Support Directorate

NASA Management Office

4800 Oak Grove Drive
Pasadena, CA 91109-8099

Reply to Attn of: LP040

December 13, 2012

Dr. Steven Kolinski
National Marine Fisheries Service
Pacific Islands Region Office
1601 Kapiolani Blvd, Suite 1110
Honolulu, HI 96814-4700

SUBJECT: Low Density Supersonic Decelerator Test Coordinating Draft Environmental Assessment

Dear Dr. Kolinski:

The National Aeronautics and Space Administration (NASA) has completed the Coordinating Draft Environmental Assessment (CDEA) for proposed field tests involving launch, operation, and recovery of the Low Density Supersonic Decelerator (LDSD). These tests are part of a technology demonstration project that is baselined to launch from the U.S. Navy's Pacific Missile Range Facility (PMRF) on Kauai.

The NASA Jet Propulsion Laboratory is proposing to conduct supersonic flight dynamic tests (SFDT) for NASA's LDSD Project from the Department of the Navy's PMRF. These proposed tests would consist of launch, operation, and recovery of up to four missions from a designated location on PMRF. The purpose of the SFDT is to demonstrate and evaluate development of new supersonic inflatable aerodynamic decelerator (SIAD) and supersonic ringsail (SSRS) parachute technologies. These tests would allow the SIAD and SSRS parachute to be tested in the Earth's stratosphere at supersonic speed to simulate operation in the thin atmosphere of Mars. The Test Vehicle with its small solid rocket motor would be launched on a high altitude balloon from PMRF.

This CDEA has also been provided for comment to Dr. Loyal Mehrhoff, U.S. Fish and Wildlife Service; Mr. William Aila, Jr., Chairperson of the State of Hawaii Department of Land and Natural Resources; Ms. Colette Machado, Chairperson, The Office of Hawaiian Affairs; and Mr. Neil Okuna, Federal Aviation Administration.

To ensure that any concerns you might have about our efforts to identify issues and assess potential impacts are fully addressed, please provide any written comments on the enclosed CDEA by January 28, 2013. Comments can provided to Mark Phillips, LDSD Project NEPA lead, at the Jet Propulsion Laboratory, Attention: Mark Phillips, 4800 Oak Grove Drive – M/S 301-370, Pasadena, CA 91109, or by calling 818-354-1181, or by email at j.m.phillips@jpl.nasa.gov.

Sincerely,

Steve Slaten
Environmental and Facilities Manager
NASA Management Office

Enclosure: CDEA (Hard Copy and CD)

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Dr. Steven Kolinski - NMFS

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Ship date Dec 13, 2012 Delivery date Dec 14, 2012 1:59 PM	HONOLULU, HI

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Weight	2.0 lbs/.9 kg	Reference	0106.100423.04.003 ODC-Barnes

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Dec 14, 2012 1:59 PM	**Delivered**	HONOLULU, HI	
Dec 14, 2012 11:03 AM	On FedEx vehicle for delivery	HONOLULU, HI	
Dec 14, 2012 10:08 AM	At local FedEx facility	HONOLULU, HI	
Dec 14, 2012 8:28 AM	At destination sort facility	HONOLULU, HI	
Dec 14, 2012 4:21 AM	In transit	MEMPHIS, TN	
Dec 14, 2012 4:12 AM	Departed FedEx location	MEMPHIS, TN	
Dec 14, 2012 12:51 AM	Arrived at FedEx location	MEMPHIS, TN	
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Dec 13, 2012 5:49 PM	Picked up	MADISON, AL	
Dec 13, 2012 2:50 PM	Shipment information sent to FedEx		

National Aeronautics and
Space Administration
Mission Support Directorate

NASA Management Office

4800 Oak Grove Drive
Pasadena, CA 91109-8099

Reply to Attn of: LP040

December 13, 2012

Ms. Colette Machado, Chairperson
The Office of Hawaiian Affairs, Honolulu Headquarters
711 Kapiolani Blvd., Suite 500
Honolulu, HI 96813

SUBJECT: Low Density Supersonic Decelerator Test Coordinating Draft Environmental Assessment

Dear Ms. Machado:

The National Aeronautics and Space Administration (NASA) has completed the Coordinating Draft Environmental Assessment (CDEA) for proposed field tests involving launch, operation, and recovery of the Low Density Supersonic Decelerator (LDSD). These tests are part of a technology demonstration project that is baselined to launch from the U.S. Navy's Pacific Missile Range Facility (PMRF) on Kauai.

The NASA Jet Propulsion Laboratory is proposing to conduct supersonic flight dynamic tests (SFDT) for NASA's LDSD Project from the Department of the Navy's PMRF. These proposed tests would consist of launch, operation, and recovery of up to four missions from a designated location on PMRF. The purpose of the SFDT is to demonstrate and evaluate development of new supersonic inflatable aerodynamic decelerator (SIAD) and supersonic ringsail (SSRS) parachute technologies. These tests would allow the SIAD and SSRS parachute to be tested in the Earth's stratosphere at supersonic speed to simulate operation in the thin atmosphere of Mars. The Test Vehicle with its small solid rocket motor would be launched on a high altitude balloon from PMRF.

This CDEA has also been provided for comment to Mr. William Aila, Jr., chairperson of the State of Hawaii Department of Land and Natural Resources; Mr. Neil Okuna, Federal Aviation Administration; Dr. Steven Kolinski, National Marine Fisheries Service; and Dr. Loyal Mehrhoff, U.S. Fish and Wildlife Service.

If you wish to provide comments please reply by January 28, 2013. Comments can be provided to Mark Phillips, LDSD Project NEPA lead, at the Jet Propulsion Laboratory, Attention: Mark Phillips, 4800 Oak Grove Drive – M/S 301-370, Pasadena, CA 91109, or by calling 818-354-1181, or by e-mail at j.m.phillips@jpl.nasa.gov.

Sincerely,

Steve Slaten
Environmental and Facilities Manager
NASA Management Office

Enclosure: CDEA (Hard Copy and CD)

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Colette Machado - OHA

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Ship date Dec 13, 2012
Delivery date Dec 14, 2012 3:06 PM

Destination

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Shipment Facts

Service type	Priority Pak	Delivered to	Receptionist/Front Desk
Weight	2.0 lbs/.9 kg	Reference	0106.100423.04.003 ODC-Barnes

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Dec 14, 2012 10:09 AM	At local FedEx facility	HONOLULU, HI	
Dec 14, 2012 8:28 AM	At destination sort facility	HONOLULU, HI	
Dec 14, 2012 4:21 AM	In transit	MEMPHIS, TN	
Dec 14, 2012 4:12 AM	Departed FedEx location	MEMPHIS, TN	
Dec 14, 2012 12:51 AM	Arrived at FedEx location	MEMPHIS, TN	
Dec 13, 2012 9:00 PM	Left FedEx origin facility	MADISON, AL	
Dec 13, 2012 5:49 PM	Picked up	MADISON, AL	
Dec 13, 2012 2:52 PM	Shipment information sent to FedEx		

National Aeronautics and
Space Administration
Mission Support Directorate

NASA Management Office
180-801
4800 Oak Grove Drive
Pasadena, CA 91109-8099

Reply to Attn of: LP040

December 13, 2012

Mr. William J. Aila, Jr.
State Historic Preservation Division
Department of Land and Natural Resources
601 Kamokila Boulevard, Suite 555
Kapolei, HI 96707

SUBJECT: Low Density Supersonic Decelerator Test – Coordinating Draft Environmental Assessment

Dear Mr. Aila:

In accordance with Section 106 of the National Historic Preservation Act and its implementing regulations 36 CFR 800, the National Aeronautics and Space Administration (NASA) would like to initiate consultation regarding proposed field tests involving launch, operation, and recovery of the Low Density Supersonic Decelerator (LDSD). These tests are part of a technology demonstration project that is baselined to launch from the U.S. Navy's Pacific Missile Range Facility (PMRF) on Kauai. The proposed series of tests would consist of up to four missions from a designated location on PMRF. For each mission NASA would loft the LDSD Test Vehicle with its small solid rocket motor into the stratosphere using a large diameter balloon, and a rocket motor would propel the payload to supersonic speeds, simulating the speeds that current landers experience as they enter Mars' thinner atmosphere. A parachute would then slow the Test Vehicle to subsonic speeds and landing and recovery of the Test Vehicle and parachute would be from the Open Ocean Area. NASA has identified that the above actions are an undertaking under Section 106.

NASA has prepared the enclosed Coordinating Draft Environmental Assessment (CDEA) in compliance with the National Environmental Policy Act (NEPA) of 1969, as amended (42 United States Code [U.S.C.] 4321 *et seq.*). The CDEA outlines the proposed action and its potential environmental effects. The proposed undertaking is similar to other launches by the Navy and other entities at PMRF.

The purpose of the supersonic flight dynamic tests (SFDT) is to demonstrate and evaluate development of new supersonic inflatable aerodynamic decelerator (SIAD) and supersonic ringsail (SSRS) parachute technologies. These tests would allow the SIAD and SSRS parachute to be tested in the Earth's stratosphere at supersonic speed to simulate operation in the thin atmosphere of Mars.

The Area of Potential Effects (APE) encompasses the PMRF Main Base airfield's red label area, the Kamokala Magazines, Makaha Ridge, areas of Open Ocean, and possible balloon over-flight of Niihau (please see CDEA Sections 3.1, 3.2.3, 3.3.3, 4.2.3, and 4.3.3, and figures 3-1 and 3-2). Based on a review of cultural resources surveys, testing reports, and sensitivity maps within the APE, recorded archaeological and historical properties include one World War II revetment, a World War II gun emplacement, and a Japanese Cemetery, none of which are expected to be affected by launch activities. The closest known archaeological/traditional Native Hawaiian site (Site No. 05-1831 – a burial) is approximately 609.6 meters (2,000 feet) northwest of the launch site. The Kamokala Magazines have been previously determined to be historic; however, the storage of explosives and chemicals is in keeping with their historic function, and there are no modifications proposed for them under this program. There are no known historic properties at Makaha Ridge, within the open ocean recovery areas, or within the balloons flight path over Niihau. There are also no ground disturbing activities associated with this project at any of the proposed locations. Additionally, the Proposed Action would not affect the Papahanaumokuakea Marine National Monument.

NASA's proposed LDSD mission will support ambitious new robotic missions to Mars and other planetary bodies and will lay the groundwork for even more complex human and science explorations in the future. NASA has continuously used a parachute-based deceleration system since the Viking Program, which put two landers on Mars in 1977. New technology beyond the current parachute-based deceleration systems is needed to slow even larger, heavier landers from the supersonic speeds of atmospheric entry to subsonic surface-approach speeds for these other planetary bodies. The LDSD will test new parachute technology to further space exploration.

NASA's LDSD CDEA addresses all of the reasonably foreseeable activities in the particular geographical areas affected by the Proposed Action and the No-action Alternative and focuses on those activities ready for Federal and resource agency decisions. The majority of activities would use existing facilities and/or be on previously disturbed land. NASA anticipates no land disturbance activities that might affect cultural resources and intends to carry out its activities much the same way PMRF regularly conducts launch tests. The Department of the Navy (DON) and PMRF previously conducted the Hawaii Range Complex Environmental Impact Statement/Overseas Environmental Impact Statement (HRC EIS/OEIS) (May 2008) outlining the use of the Hawaii Range, which was concurred on by your office.

Based on the analysis in the CDEA and coordination with the DON/PMRF, NASA has determined that there will be no historic properties affected by the proposed undertaking and seeks your concurrence. If NASA does not receive any comment from your office on the proposed undertaking within 30 days, we will assume concurrence with our determination. In accordance with 36 CFR 800.4(d)(1) a copy of this letter has been provided to the Office of Hawaiian Affairs as documentation of our determination.

The CDEA is also available for your review. Please provide any written comments on the CDEA by January 28, 2012. Comments can be provided to Mark Phillips, LDSD Project NEPA lead, at the Jet Propulsion Laboratory, Attention: Mark Phillips, 4800 Oak Grove Drive – M/S 301-370, Pasadena, CA 91109, or by calling 818-354-1181, or by email at j.m.phillips@jpl.nasa.gov.

Sincerely,

Steve Slaten
Environmental and Facilities Manager
NASA Management Office

Enclosure: CDEA (Hard Copy and CD)

cc: Colette Machado

2

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Mr. William J. Aila, Jr. SHPD

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Signed for by: E PENHEARD

Shipment Dates	Destination
Ship date Dec 13, 2012 Delivery date Dec 14, 2012 12:42 PM	Kapolei, HI

Shipment Options

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Hold at FedEx Location service is not available for this shipment.

Shipment Facts

Service type	Priority Pak	Delivered to	Receptionist/Front Desk
Weight	2.0 lbs/.9 kg	Reference	0106.100423.04.003 ODC-Barnes

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Dec 13, 2012 2:54 PM	Shipment information sent to FedEx		

National Aeronautics and
Space Administration
Mission Support Directorate

NASA Management Office

4800 Oak Grove Drive
Pasadena, CA 91109-8099

Reply to Attn. of: LP040

December 13, 2012

Dr. Loyal Mehrhoff
U.S. Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office
300 Ala Moana Blvd. Room 3-122
Honolulu, HI 96850

SUBJECT: Low Density Supersonic Decelerator Test Coordinating Draft Environmental Assessment

Dear Dr. Mehrhoff:

The National Aeronautics and Space Administration (NASA) has completed the Coordinating Draft Environmental Assessment (CDEA) for proposed field tests involving launch, operation, and recovery of the Low Density Supersonic Decelerator (LDSD). These tests are part of a technology demonstration project that is baselined to launch from the U.S. Navy's Pacific Missile Range Facility (PMRF) on Kauai.

The NASA Jet Propulsion Laboratory is proposing to conduct supersonic flight dynamic tests (SFDTs) for NASA's LDSD Project from the Department of the Navy's PMRF. These proposed tests would consist of launch, operation, and recovery of up to four missions from a designated location on PMRF. The purpose of the SFDT is to demonstrate and evaluate development of new supersonic inflatable aerodynamic decelerator (SIAD) and supersonic ringsail (SSRS) parachute technologies. These tests would allow the SIAD and SSRS parachute to be tested in the Earth's stratosphere at supersonic speed to simulate operation in the thin atmosphere of Mars. The Test Vehicle with its small solid rocket motor would be launched on a high altitude balloon from PMRF.

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To ensure that any concerns you might have about our efforts to identify issues and assess potential impacts are fully addressed, please provide any written comments on the enclosed CDEA by January 28, 2013. Comments can be provided to Mark Phillips, LDSD Project NEPA lead, at the Jet Propulsion Laboratory, Attention: Mark Phillips, 4800 Oak Grove Drive – M/S 301-370, Pasadena, CA 91109, or by calling 818-354-1181, or by e-mail at j.m.phillips@jpl.nasa.gov.

Sincerely,

Steve Slaten
Environmental and Facilities Manager
NASA Management Office

Enclosure: CDEA (Hard Copy and CD) (2)

cc: Lisa Van Atta

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Dr. Loyal Mehrhoff
USFWS

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Signed for by: A.ONUZA

Shipment Dates	Destination
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Shipment Options

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Shipment Facts

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Shipment Travel History

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Delivery date Dec 17, 2012 11:57 AM	

Shipment Options

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Shipment Facts

Service type	Priority Envelope	Delivered to	Shipping/Receiving
Weight	2.0 lbs/.9 kg	Reference	LDSD CDEA

Shipment Travel History

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Date/Time	Activity	Location	Details
Dec 17, 2012 11:57 AM	**Delivered**	Kekaha, HI	
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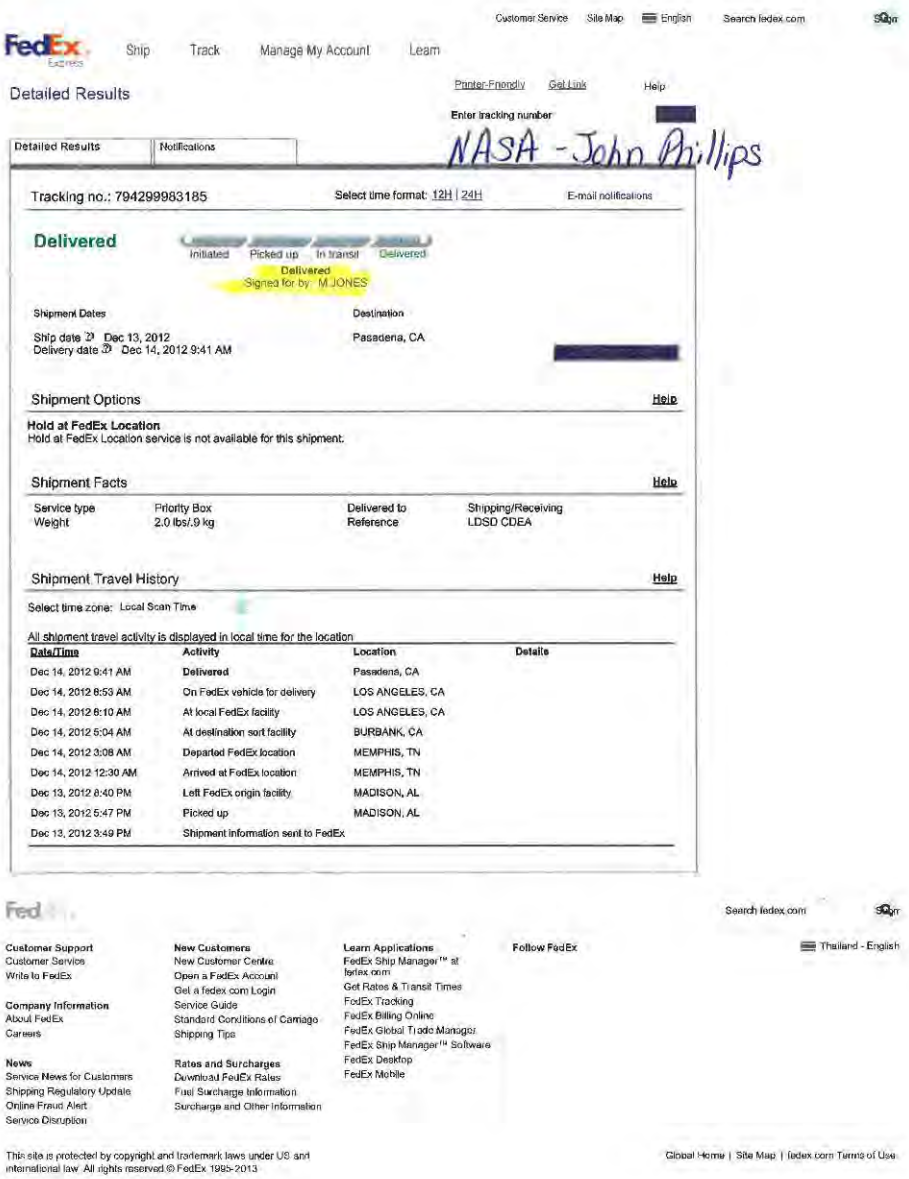

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NASA - John Phillips

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Delivery date Dec 14, 2012 9:41 AM	

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Date/Time	Activity	Location	Details
Dec 14, 2012 9:41 AM	Delivered	Pasadena, CA	
Dec 14, 2012 8:53 AM	On FedEx vehicle for delivery	LOS ANGELES, CA	
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Dec 14, 2012 3:08 AM	Departed FedEx location	MEMPHIS, TN	
Dec 14, 2012 12:30 AM	Arrived at FedEx location	MEMPHIS, TN	
Dec 13, 2012 8:40 PM	Left FedEx origin facility	MADISON, AL	
Dec 13, 2012 5:47 PM	Picked up	MADISON, AL	
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National Aeronautics and
Space Administration
Mission Support Directorate

NASA Management Office
180-801
4800 Oak Grove Drive
Pasadena, CA 91109-8099

Reply to Attn of: LP040

DATE March 7, 2013

SUBJECT: NASA Draft Environmental Assessment for the Low Density Supersonic Decelerator (LDSD) Project

The National Aeronautics and Space Administration (NASA) has completed the Draft Environmental Assessment (DEA) for the proposed launch, operation, and recovery of the Low Density Supersonic Decelerator (LDSD) Technology Demonstration Mission at the Pacific Missile Range Facility (PMRF) on Kauai, Niihau, and the Open Ocean Area. The DEA was prepared in accordance with the following statutes, regulations, and procedures:

- National Environmental Policy Act (NEPA) of 1969, as amended;
- Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA ;
- NASA NEPA implementing regulations; and
- NASA Procedural Requirement 8580.1A, Implementing the National Environmental Policy Act and Executive Order 12114.

The NASA Jet Propulsion Laboratory is proposing to conduct Supersonic Flight Dynamics Tests (SFDTs) for NASA's LDSD Project from the Department of the Navy's PMRF. This test campaign would consist of launch, operation, and recovery of up to four missions from a designated location on PMRF. The purpose of the SFDT campaign is to demonstrate and evaluate development of new supersonic inflatable aerodynamic decelerator (SIAD) and supersonic ringsail (SSRS) parachute technologies. These tests would allow the SIAD and SSRS parachute to fly in the Earth's stratosphere at supersonic speed to simulate operation in the thin atmosphere of Mars. The Test Vehicle with a small solid rocket motor would be launched on a high altitude balloon from PMRF. Enclosed is a copy of the DEA for the National Aeronautics and Space Administration Low Density Supersonic Decelerator Test – Pacific Missile Range Facility. This document and a blank comment form are also available online at http://www.govsupport.us/nasaldsdea.

Please provide your written comments on this DEA by **April 19, 2013,** using the enclosed comment form. Comments may be submitted to: Mark Phillips, LDSD Project NEPA lead, Jet Propulsion Laboratory, 4800 Oak Grove Drive – M/S 301-370, Pasadena, CA 91109, or by fax to 818-393-6020, or by email at j.m.phillips@jpl.nasa.gov.

If you or any other staff have questions, please contact Mark Phillips using the contact information listed above, or by calling 818-354-1181.

Steve Slaten
Environmental and Facilities Manager
NASA Management Office

Enclosures: One hardcopy and 1 cd of Draft EA, and comment form

National Aeronautics and
Space Administration
Mission Support Directorate

NASA Management Office
180-801
4800 Oak Grove Drive
Pasadena, CA 91109-8099

Reply to Attn of: LP040

DATE March 7, 2013

SUBJECT: NASA Environmental Assessment for the Low Density Supersonic Decelerator (LDSD) Project

To Whom It May Concern:

Please provide space in your library or offices for public access to the enclosed National Aeronautics and Space Administration Low Density Supersonic Decelerator Test – Pacific Missile Range Facility Draft Environmental Assessment (DEA). The DEA will be available for public access and review through **April 19, 2013**.

The document and a blank comment form are also available on the internet at https://www.govsupport.us/nasaldsdea

Anyone wishing to provide comments can do so in one of three ways:

1. E-mail comments to j.m.phillips@jpl.nasa.gov.

2. Mail comments to:
   Jet Propulsion Laboratory, Attention: Mark Phillips
   4800 Oak Grove Drive – M/S 301-370
   Pasadena, CA 91109

3. Fax comments to:
   Jet Propulsion Laboratory, Attention: Mark Phillips
   4800 Oak Grove Drive – M/S 301-370
   Pasadena, CA 91109
   818-393-6020

Comments should be received no later than **April 19, 2013**. Questions and comments regarding the Draft EA, or requests for additional copies, can be sent to j.m.phillips@jpl.nasa.gov.

Steve Slaten
Environmental and Facilities Manager
NASA Management Office

Enclosures: One hardcopy and 1 cd of Draft EA, and comment form

FedEx

SAPD

799262737900

Ship (P/U) date :
Tues 3/12/2013 7:24 pm
HUNTSVILLE, AL US

Delivered

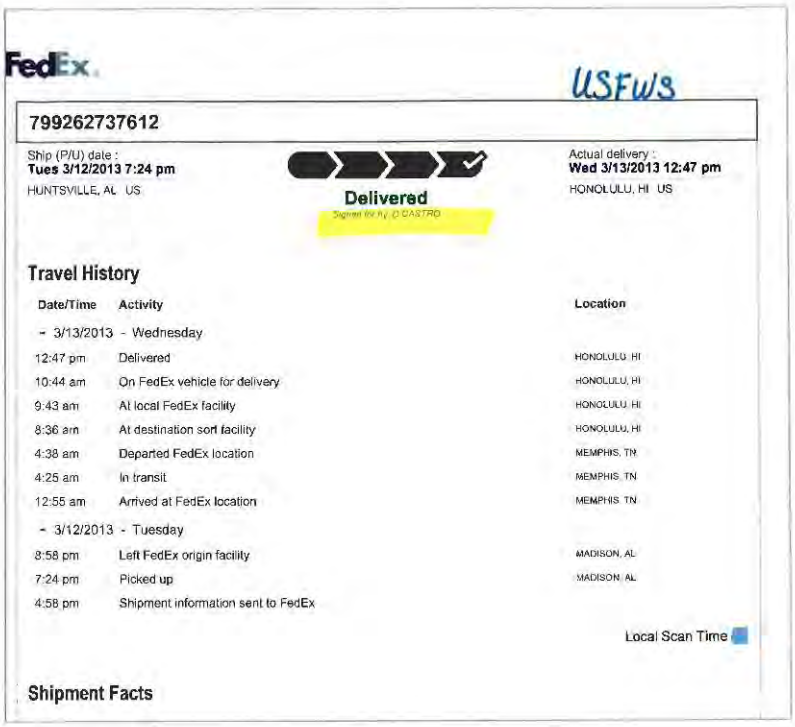
Actual delivery :
Wed 3/13/2013 12:44 pm
Kapolei, HI US

Travel History

Date/Time	Activity	Location
- 3/13/2013 - Wednesday		
12:44 pm	Delivered	Kapolei, HI
10:29 am	On FedEx vehicle for delivery	HONOLULU, HI
9:53 am	At local FedEx facility	HONOLULU, HI
8:36 am	At destination sort facility	HONOLULU, HI
4:38 am	Departed FedEx location	MEMPHIS, TN
4:25 am	In transit	MEMPHIS, TN
12:55 am	Arrived at FedEx location	MEMPHIS, TN
- 3/12/2013 - Tuesday		
8:58 pm	Left FedEx origin facility	MADISON, AL
7:24 pm	Picked up	MADISON, AL
4:58 pm	Shipment information sent to FedEx	

Local Scan Time

Shipment Facts



FedEx

USFWS

799262737612

Ship (P/U) date :
Tues 3/12/2013 7:24 pm
HUNTSVILLE, AL US

Delivered
Signed for by: D CASTRO

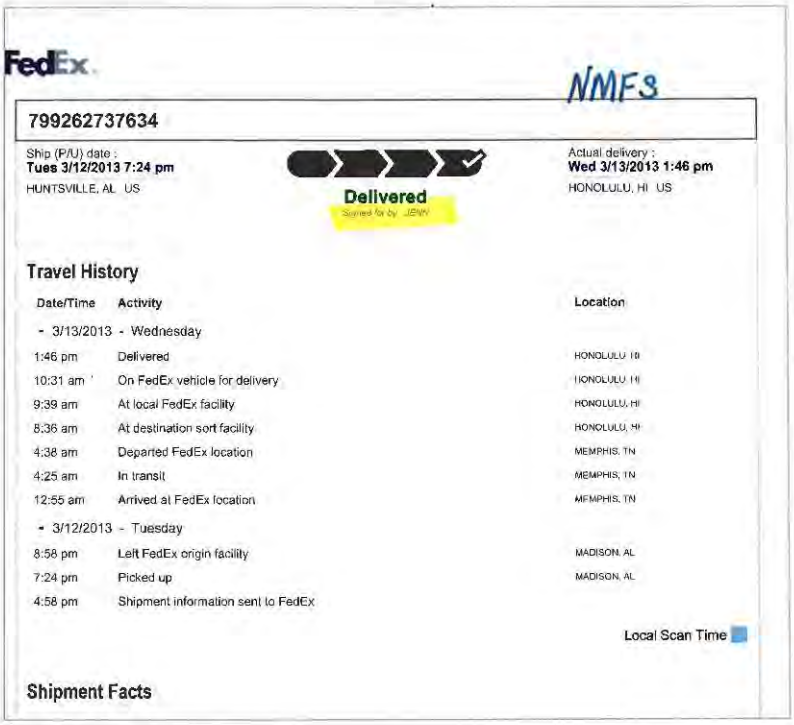
Actual delivery :
Wed 3/13/2013 12:47 pm
HONOLULU, HI US

Travel History

Date/Time	Activity	Location
- 3/13/2013 - Wednesday		
12:47 pm	Delivered	HONOLULU, HI
10:44 am	On FedEx vehicle for delivery	HONOLULU, HI
9:43 am	At local FedEx facility	HONOLULU, HI
8:36 am	At destination sort facility	HONOLULU, HI
4:38 am	Departed FedEx location	MEMPHIS, TN
4:25 am	In transit	MEMPHIS, TN
12:55 am	Arrived at FedEx location	MEMPHIS, TN
- 3/12/2013 - Tuesday		
8:58 pm	Left FedEx origin facility	MADISON, AL
7:24 pm	Picked up	MADISON, AL
4:58 pm	Shipment information sent to FedEx	

Local Scan Time

Shipment Facts



FedEx

NMFS

799262737634

Ship (P/U) date :
Tues 3/12/2013 7:24 pm
HUNTSVILLE, AL US

Delivered
Signed for by: JENN

Actual delivery :
Wed 3/13/2013 1:46 pm
HONOLULU, HI US

Travel History

Date/Time	Activity	Location
- 3/13/2013 - Wednesday		
1:46 pm	Delivered	HONOLULU, HI
10:31 am	On FedEx vehicle for delivery	HONOLULU, HI
9:39 am	At local FedEx facility	HONOLULU, HI
8:36 am	At destination sort facility	HONOLULU, HI
4:38 am	Departed FedEx location	MEMPHIS, TN
4:25 am	In transit	MEMPHIS, TN
12:55 am	Arrived at FedEx location	MEMPHIS, TN
- 3/12/2013 - Tuesday		
8:58 pm	Left FedEx origin facility	MADISON, AL
7:24 pm	Picked up	MADISON, AL
4:58 pm	Shipment information sent to FedEx	

Local Scan Time

Shipment Facts

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FedEx.

OHA

799262737369

Ship (P/U) date :
Tues 3/12/2013 7:24 pm
HUNTSVILLE, AL US

Delivered

Actual delivery :
Wed 3/13/2013 2:04 pm
HONOLULU, HI US

Travel History

Date/Time	Activity	Location
- 3/13/2013 - Wednesday		
2:04 pm	Delivered	HONOLULU, HI
10:21 am	On FedEx vehicle for delivery	HONOLULU, HI
9:44 am	At local FedEx facility	HONOLULU, HI
8:36 am	At destination sort facility	HONOLULU, HI
4:38 am	Departed FedEx location	MEMPHIS, TN
4:25 am	In transit	MEMPHIS, TN
12:55 am	Arrived at FedEx location	MEMPHIS, TN
- 3/12/2013 - Tuesday		
8:58 pm	Left FedEx origin facility	MADISON, AL
7:24 pm	Picked up	MADISON, AL
4:58 pm	Shipment information sent to FedEx	

Local Scan Time

Shipment Facts

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FedEx

FAA

799262738230

Ship (P/U) date :
Tues 3/12/2013 7:24 pm
HUNTSVILLE, AL US

Delivered

Actual delivery :
Wed 3/13/2013 3:25 pm
HONOLULU, HI US

Travel History

Date/Time	Activity	Location
- 3/13/2013 - Wednesday		
3:25 pm	Delivered	HONOLULU, HI
10:31 am	On FedEx vehicle for delivery	HONOLULU, HI
9:49 am	At local FedEx facility	HONOLULU, HI
8:36 am	At destination sort facility	HONOLULU, HI
4:38 am	Departed FedEx location	MEMPHIS, TN
4:25 am	In transit	MEMPHIS, TN
12:55 am	Arrived at FedEx location	MEMPHIS, TN
- 3/12/2013 - Tuesday		
8:58 pm	Left FedEx origin facility	MADISON, AL
7:24 pm	Picked up	MADISON, AL
4:58 pm	Shipment information sent to FedEx	

Local Scan Time

Shipment Facts

FedEx

PMAF

799262736796

Ship (P/U) date :
Tues 3/12/2013 7:24 pm
HUNTSVILLE, AL US

Delivered
Signed for by: C.SAL VAZQUEZ

Actual delivery :
Thur 3/14/2013 10:55 am
Kekaha, HI US

Travel History

Date/Time	Activity	Location
- 3/14/2013 - Thursday		
10:55 am	Delivered	Kekaha, HI
7:35 am	On FedEx vehicle for delivery	LIHUE, HI
- 3/13/2013 - Wednesday		
2:04 pm	At local FedEx facility	LIHUE, HI
2:03 pm	Delivery exception Package at station, arrived after courier dispatch	LIHUE, HI
1:12 pm	At local FedEx facility	LIHUE, HI
8:52 am	At local FedEx facility	HONOLULU, HI
8:36 am	At destination sort facility	HONOLULU, HI
4:38 am	Departed FedEx location	MEMPHIS, TN
4:25 am	In transit	MEMPHIS, TN
12:55 am	Arrived at FedEx location	MEMPHIS, TN
- 3/12/2013 - Tuesday		
8:58 pm	Left FedEx origin facility	MADISON, AL
7:24 pm	Picked up	MADISON, AL
4:59 pm	Shipment information sent to FedEx	

FedEx

NASA

799262736671

Ship (P/U) date :
Tues 3/12/2013 7:24 pm
HUNTSVILLE, AL US

Delivered

Actual delivery :
Wed 3/13/2013 9:39 am
Pasadena, CA US

Travel History

Date/Time	Activity	Location
- 3/13/2013 - Wednesday		
9:39 am	Delivered	Pasadena, CA
8:31 am	On FedEx vehicle for delivery	LOS ANGELES, CA
7:31 am	At local FedEx facility	LOS ANGELES, CA
4:51 am	At destination sort facility	BURBANK, CA
3:34 am	Departed FedEx location	MEMPHIS, TN
12:55 am	Arrived at FedEx location	MEMPHIS, TN
- 3/12/2013 - Tuesday		
8:58 pm	Left FedEx origin facility	MADISON, AL
7:24 pm	Picked up	MADISON, AL
4:58 pm	Shipment information sent to FedEx	

Local Scan Time

Shipment Facts

Tracking number	799262736671	**Service**	FedEx Priority Overnight
Weight	2 lbs	**Delivered To**	Shipping/Receiving

https://www.fedex.com/fedextrack/index.html?tracknumbers=799262737900,79926273761... 5/1/2013

FedEx

Hawaii State Library

799262737130

Ship (P/U) date:
Tues 3/12/2013 7:24 pm
HUNTSVILLE, AL US

Delivered

Actual delivery:
Wed 3/13/2013 11:29 am
HONOLULU, HI US

Travel History

Date/Time	Activity	Location
- 3/13/2013 - Wednesday		
11:29 am	Delivered	HONOLULU, HI
10:22 am	On FedEx vehicle for delivery	HONOLULU, HI
9:44 am	At local FedEx facility	HONOLULU, HI
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4:38 am	Departed FedEx location	MEMPHIS, TN
4:25 am	In transit	MEMPHIS, TN
12:55 am	Arrived at FedEx location	MEMPHIS, TN
- 3/12/2013 - Tuesday		
8:58 pm	Left FedEx origin facility	MADISON, AL
7:24 pm	Picked up	MADISON, AL
4:58 pm	Shipment information sent to FedEx	

Local Scan Time

Shipment Facts

FedEx

Lihue Public Library

799262736720

Ship (P/U) date :
Tues 3/12/2013 7:24 pm
HUNTSVILLE, AL US

Delivered
Signed for by: G KIRANOS

Actual delivery :
Wed 3/13/2013 3:04 pm
Lihue, HI US

Travel History

Date/Time	Activity	Location
- 3/13/2013 - Wednesday		
3:04 pm	Delivered	Lihue, HI
1:51 pm	On FedEx vehicle for delivery	LIHUE, HI
1:13 pm	At local FedEx facility	LIHUE, HI
8:52 am	At local FedEx facility	HONOLULU, HI
8:36 am	At destination sort facility	HONOLULU, HI
4:38 am	Departed FedEx location	MEMPHIS, TN
4:25 am	In transit	MEMPHIS, TN
12:55 am	Arrived at FedEx location	MEMPHIS, TN
- 3/12/2013 - Tuesday		
8:58 pm	Left FedEx origin facility	MADISON, AL
7:24 pm	Picked up	MADISON, AL
4:58 pm	Shipment information sent to FedEx	

Local Scan Time

Shipment Facts

FedEx

Waimea Public Library

799262737277

Ship (P/U) date :
Tues 3/12/2013 7:24 pm
HUNTSVILLE, AL US

Delivered
Signed for by: N JENSEN

Actual delivery :
Thur 3/14/2013 9:33
WAIMEA, HI US

Travel History

Date/Time	Activity	Location
- 3/14/2013 - Thursday		
9:33 am	Delivered	WAIMEA, HI
7:35 am	On FedEx vehicle for delivery	LIHUE, HI
- 3/13/2013 - Wednesday		
2:04 pm	At local FedEx facility	LIHUE, HI
2:03 pm	Delivery exception Package at station, arrived after courier dispatch	LIHUE, HI
1:12 pm	At local FedEx facility	LIHUE, HI
8:52 am	At local FedEx facility	HONOLULU, HI
8:36 am	At destination sort facility	HONOLULU, HI
4:38 am	Departed FedEx location	MEMPHIS, TN
4:25 am	In transit	MEMPHIS, TN
12:55 am	Arrived at FedEx location	MEMPHIS, TN
- 3/12/2013 - Tuesday		
8:58 pm	Left FedEx origin facility	MADISON, AL
7:24 pm	Picked up	MADISON, AL
4:58 pm	Shipment information sent to FedEx	

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Appendix C
Naval Facility Engineering Command Approval

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APPENDIX C
NAVAL FACILITY ENGINEERING COMMAND APPROVAL

PROGRAMMATIC AGREEMENT RECORD

DATE: January 14, 2013
PROJECT TITLE: Communications Cable Trenching
PROJECT LOCATION: PMRF, Barking Sands
REVIEWED BY: Dr. Eric West
ACTIVITY/CODE: NAVFAC PAC, EV23
TELEPHONE: 472-1415

PROJECT DESCRIPTION:

This project proposes to install communications cables between the helicopter landing area ("red label") and the Japanese Plantation Cemetary Memorial at Pacific Missile Range Facility, Barking Sands (see attached figures). Trenching is required for the installation. Excavation activities will occur within the low archaeological sensitivity zone north and east of Site 50-30-05-0616, the plantation era cemetary. The only other site nearby is Site 50-30-05-2047, two concrete structures representing a World War II-era gun emplacement located immediately north of the cemetary. Neither sites are within the APE of this project.

ARCHAEOLOGICAL MANAGEMENT AREAS:

Area: Low

	Yes	No	N/A
Any National Register [eligible] sites present?	☑	☐	
Will this Undertaking affect this site?	☐	☑	☐

DETERMINATION

Considering the information presented on this form, pursuant to the Standard Operating Procedures detailed in the 2005 PMRF ICRMP, and as stipulated in the 2003 PA among the Commander Navy Region Hawaii, The Advisory Council on Historic Preservation and the Hawaii State Historic Preservation Officer regarding Navy undertakings in Hawaii, the proposed undertaking does not require further Section 106 review under the National Historic Preservation Act. This memorandum is to be retained as administrative record of this finding.

[Check all that apply.]

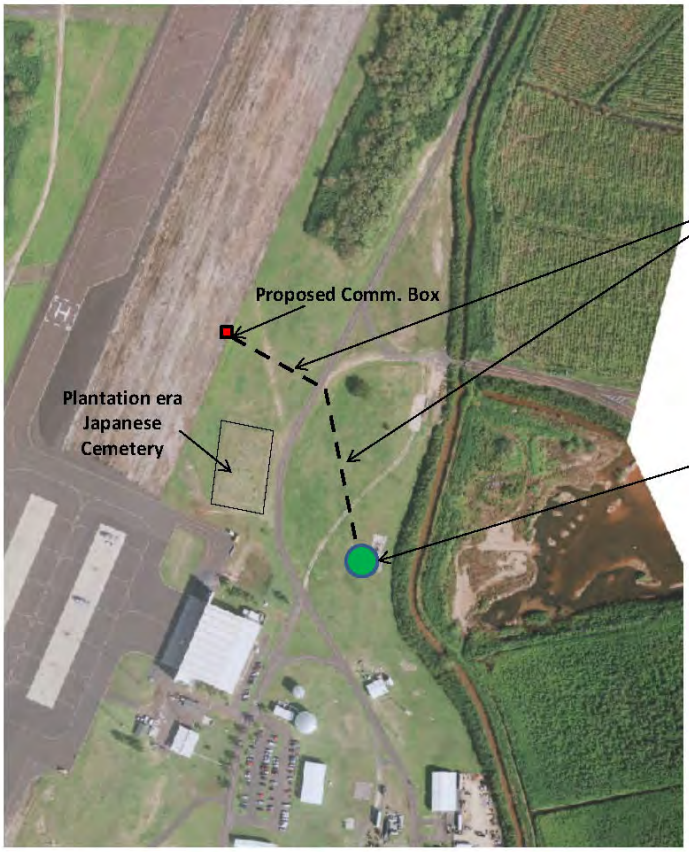
☑ Stipulation IX(A)(1)
The undertaking does not have the potential to cause effects to listed, contributing, or eligible historic properties (specifically archaeological sites/objects/traditional cultural places) as noted above.

☐ Stipulation IX(A)(2)
The undertaking is listed in Appexdix A.

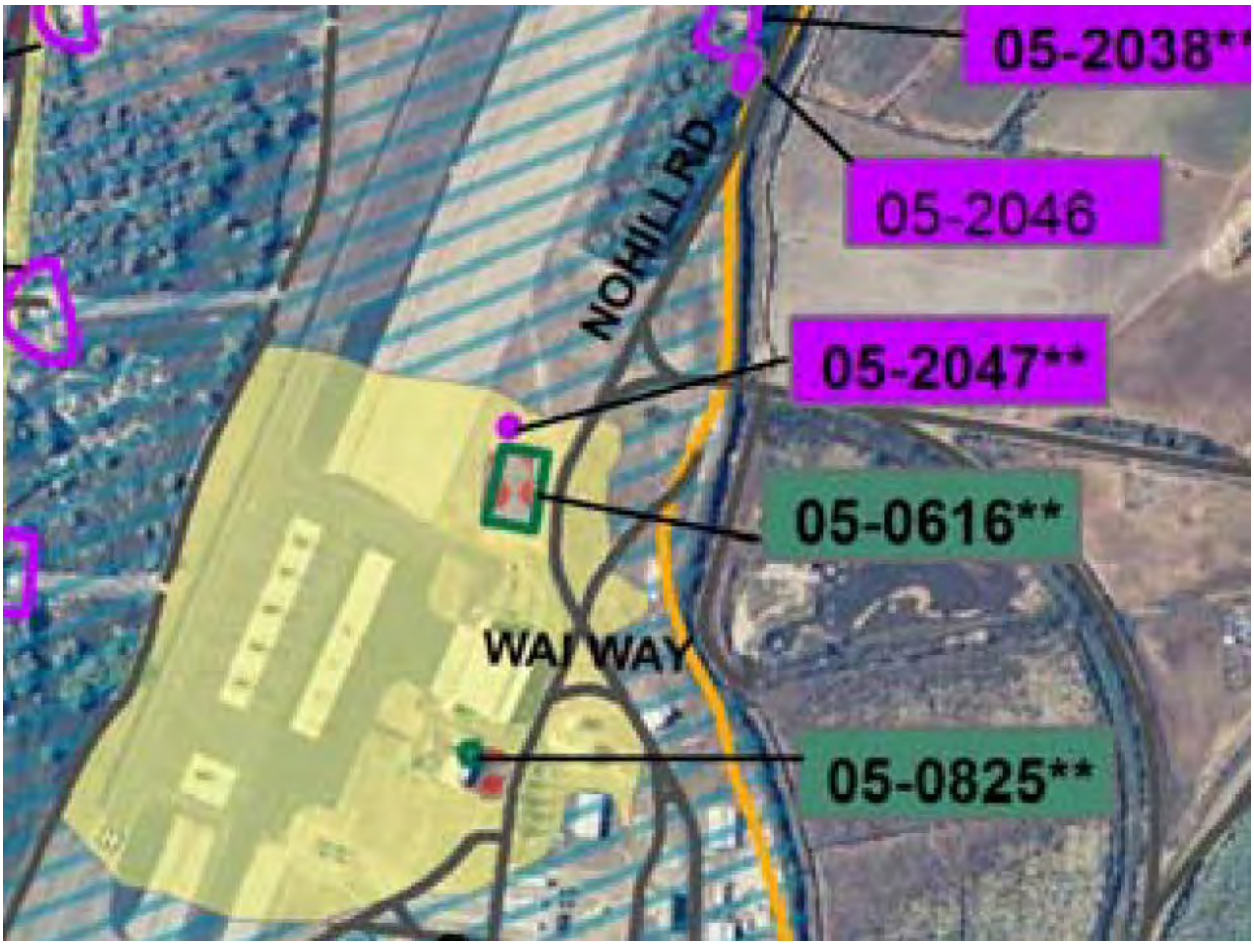
I.B.3:Ground disturbing activities that occur outside archaeologically sensitive areas indicated on ICRMP maps.

REVIEWER SIGNATURE:

ERIC W. WEST, Ph.D.
Supervisory Archaeologist, NAVFAC Pacific



NOTIONAL [NEW] CABLE ROUTE FOR LDSD COMMS.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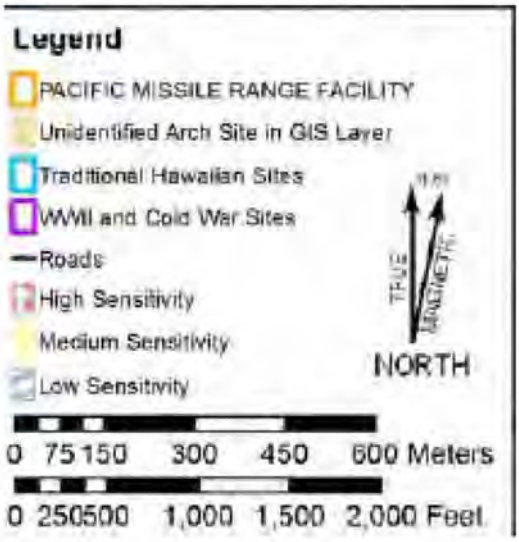
05-2046
NOHILL RD
05-2047**
05-0616**
WAIWAY
05-0825**


Legend
PACIFIC MISSILE RANGE FACILITY
Unidentified Arch Site in GIS Layer
Traditional Hawaiian Sites
WWII and Cold War Sites
Roads
High Sensitivity
Medium Sensitivity
Low Sensitivity
TRUE
NORTH
0 75 150 300 450 600 Meters
0 250 500 1,000 1,500 2,000 Feet

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