ENVIRONMENTAL ASSESSMENT
December 2007

AIRBORNE LASER DEBRIS MANAGEMENT
VANDENBERG AFB, CALIFORNIA

Approved for Public Release
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AIRBORNE LASER DEBRIS MANAGEMENT ENVIRONMENTAL ASSESSMENT VANDENBERG AIR FORCE BASE, CALIFORNIA

AGENCY: Missile Defense Agency

ACTION: Finding of No Significant Impact

BACKGROUND: The attached Environmental Assessment (EA) was prepared by the Missile Defense Agency (MDA) to evaluate the potential environmental impacts of implementing debris management activities associated with Airborne Laser (ABL) tests and is incorporated by reference. These tests include launching Liquid Fueled Target System (LFTS) target missiles from Vandenberg Air Force Base (AFB) and destroying the target missiles by the ABL over the Western Range. The EA was prepared pursuant to the National Environmental Policy Act (NEPA) of 1969, as amended (42 U.S. Code [U.S.C.] 4321 et seq.); Council on Environmental Quality regulations for implementing the procedural provisions of NEPA (40 Code of Federal Regulations [CFR] 1500-1508); and the Department of the Air Force Policy and Procedures (32 CFR Part 989) *Environmental Impact Analysis Process*.

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

The Proposed Action involves the observation, photography, and debris management associated with up to seven LFTS target missile intercepts (or shootdowns) by the ABL. An additional test, or "dress rehearsal," also would be conducted where all aspects of pre-launch, launch, and post-launch debris management activities would be conducted, but there would be no actual launch or intercept of a target missile. Target launches were previously evaluated in the Final Environmental Impact Statement (EIS) for the Program Definition and Risk Reduction Phase of the ABL Program and the Supplemental EIS for ABL Test Activities and were, therefore, not evaluated in this EA.

LFTS target missile launch and debris management activities would occur no sooner than fiscal year (FY) 2009 and be completed in FY 2014. The range clearance/biological monitoring aircraft that would support debris management activities is anticipated to operate for 8 hours for each LFTS target missile launch, for a total of 64 hours of operation. Likewise, debris boat operations would be approximately 24 hours in duration per LFTS target missile launch to support tracking buoy placement and debris assessment, recovery, and/or disposal for a total of 192 hours of debris boat operations.

Under the No-Action Alternative, the ABL test activities would be conducted; however, buoy placement and debris observation, photography, and debris destruction would not be conducted.

SUMMARY OF ENVIRONMENTAL CONSEQUENCES

Methodology

Initial analyses indicated that the Proposed Action and No-Action Alternative would not result in either short- or long-term impacts to the following resources: socioeconomics, transportation, utilities (potable water, wastewater, electricity, and natural gas), land use, aesthetics, hazardous materials management, soils and geology, noise, cultural resources, and environmental justice. The resources analyzed in more detail include: health and safety, hazardous waste management, water resources, air quality, and biological resources.

Environmental Effects

Under the Proposed Action, operation of the range clearance/biological monitoring aircraft and debris boat would be conducted in accordance with established standard operating procedures and would not be operated during adverse weather/ocean conditions. Floating debris and LFTS fuel/oxidizer released from either intact or destroyed target missiles could result in several potential hazards.

Health and Safety. Based on the debris migration modeling and debris disposal actions, LFTS target missile debris is not anticipated to reach the shore or the Channel Islands. However, shore evaluations would be conducted over 3 days after the intercept to ensure the public is safe from debris washing ashore. Personnel involved in assessment of debris would wear personal protective equipment (PPE) appropriate for both debris hazards (e.g., sharp edges, chemicals) and ocean hazards (e.g., cold water, drowning). Should an intact tank of oxidizer be identified, additional PPE (including appropriate respiratory protection) would be used. Appropriate measures would be in place to protect the personnel involved in debris assessment activities and to ensure that no harm to the public would occur; therefore, no significant impacts to health and safety are anticipated.

Hazardous Waste Management. If a release of fuel and/or oxidizer occurs, the reportable quantity for two constituents of LFTS fuel (nitric acid [454 kg or 1,000 pounds] and nitrogen dioxide [4.5 kg or 10 pounds]) could be exceeded. Because the estimated quantity of kerosene fuel (223 liters or 59 gallons) that could be released would likely result in a "visible sheen" on the surface of the water, Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) reporting for petroleum products releases would be triggered. MDA modeling shows that over a 24-hour period the debris could migrate approximately 27 km (17 miles) to the south or approximately 6 km (4 miles) towards the shore. Management of any hazardous wastes in accordance with applicable regulations would preclude any significant impacts.

Water Resources. MDA's modeling shows that the hydrogen ion concentration (pH) of the ocean would be lowered in the immediate vicinity of the release for approximately 5 hours. Over this 5-hour period, the oxidizer plume could migrate approximately 3 km (2 miles) to the south or 0.8 km (0.5 mile) towards shore before the pH of the water would return to nonhazardous levels. No significant long-term impacts to water resources are anticipated.

Air Quality. Debris management activities (i.e., debris boat and range clearance/biological monitoring aircraft operations) would result in short-term air quality impacts. Total emissions from debris management activities include 0.49 ton of volatile organic compounds (VOCs), and 4.52 tons of nitrogen oxides (NO_X), and 0.22 ton of particulate matter equal to or less than 10 microns in diameter (PM_{10}). Emissions associated with debris management activities would not adversely affect compliance with the California Ambient Air Quality Standards or National Ambient Air Quality Standards. No significant impacts to air quality are anticipated.

Biological Resources. Potential impacts to aquatic plants and animals in surface waters of the offshore ABL impact area likely would be of limited spatial extent and duration because chemicals would quickly dilute in the water column, evaporate into the atmosphere, and degrade based on anticipated half-lives of days to weeks in surface waters. Relatively low octanol-water partition coefficient (log K_{ow}) values suggest low bioaccumulation in aquatic organisms that could serve as forage items for higher trophic level consumers such as seabirds, marine mammals, and sea turtles. Solid debris (e.g., metal and plastic debris from missile parts) may be harmful to exposed organisms due to entanglement (leading to drowning or strangulation) or physical injury (e.g., cuts, bruises), but any floating debris, such as intact kerosene and/or oxidizer tanks, would be sunk to ensure that the environment and the public are safe from floating debris hazards. No significant long-term impacts to biological resources are anticipated.

The U.S. Fish and Wildlife Service (USFWS) and National Oceanic and Atmospheric Administration (NOAA) Marine Fisheries Service were consulted in accordance with Section 7 of the Federal Endangered Species Act. In response, the USFWS and NOAA Marine Fisheries Service have indicated that they concur with the determination that testing the ABL may affect, but is unlikely to adversely affect threatened and endangered species and their habitats.

Cumulative Impacts

No other reasonably foreseeable actions related to hazardous waste management, water resources, and biological resources have been identified that could pose a potential cumulative impact on the environment along with impacts associated with implementation of debris management activities. Health and safety and air quality are the only resource areas for which potential cumulative impacts could occur.

Vandenberg AFB has established procedures in place to ensure a safe environment to conduct ABL test activities (e.g., range closure, restricted airspace, Notice to Mariners, Notice to Airmen, evacuating or sheltering personnel on off-shore oil rigs, and road and beach closures). An average of 14 government-launched missiles occurs annually at Vandenberg AFB. Based on the limited number of launches, coupled with existing NEPA documentation, the impacts from the proposed four LFTS target missile launches, one "dress rehearsal," and associated debris management activities would not result in cumulative environmental impacts, even if combined with other activities within the Western Range. Other missile or rocket launches have been addressed and are carefully scheduled and coordinated to prevent cumulative impacts of launch operations.

Emission levels from proposed ABL flight-test activities, evaluated in the Supplemental EIS for the Airborne Laser Program, when combined with emission levels from proposed debris management activities, would not result in cumulative impacts to regional air quality.

Mitigation Measures

Appropriate procedures, as presented in the attached EA, would be in place to ensure the health and safety of personnel involved in debris management activities and to ensure that no harm to the general public would occur.

A visual survey of the debris field would be conducted to assess the size of the debris pieces and determine the best approach for disposal. If necessary, floating LFTS target missile debris would be sunk to ensure the environment and the public are safe from floating debris hazards.

Shoreline evaluations would be conducted to identify and remove any debris that washes ashore. Experienced biological monitors would participate in the shoreline evaluations to determine if any damage or impact to shoreline environments occurred, monitor debris removal actions (if necessary), and identify any potentially affected species that have come ashore after making contact with floating debris or fuel/oxidizer.

CONCLUSION

Based on the analysis of impacts in the EA and proposed measures to mitigate those impacts, MDA has determined that the Proposed Action is not a Federal action that would significantly affect the quality of the human environment within the meaning of NEPA, as amended. Therefore, the preparation of an Environmental Impact Statement (EIS) is not required and MDA is issuing a Finding of No Significant Impact (FONSI). The MDA made this determination in accordance with all applicable environmental laws.

AIRBORNE LASER DEBRIS MANAGEMENT
ENVIRONMENTAL ASSESSMENT
VANDENBERG AIR FORCE BASE, CALIFORNIA

AGENCY: Missile Defense Agency (MDA)

ACTION: Finding of No Significant Impact

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Deputy for Agency Operations

ENVIRONMENTAL ASSESSMENT
FOR
AIRBORNE LASER DEBRIS MANAGEMENT

VANDENBERG AIR FORCE BASE, CALIFORNIA

December 2007

COVER SHEET

ENVIRONMENTAL ASSESSMENT
AIRBORNE LASER DEBRIS MANAGEMENT
VANDENBERG AIR FORCE BASE, CALIFORNIA

a. Lead Agency: Missile Defense Agency (MDA)

b. Proposed Action: Implement debris management activities for Airborne Laser (ABL) testing at Vandenberg Air Force Base (AFB), California.

c. Written comments and inquiries regarding this document should be directed to: ABL Debris Management EA, c/o Department of Defense, Missile Defense Agency, 7100 Defense Pentagon, Washington, DC 20301-7100, Attn: DOI Environmental; or via e-mail EnvGrp@mda.mil.

d. Designation: Environmental Assessment (EA)

e. Abstract: Potential effects of conducting ABL test activities were evaluated in the Supplemental Environmental Impact Statement (EIS) for ABL Test Activities (2003). However, additional information has been developed regarding the likely occurrence of debris resulting from a target shoot-down (e.g., quantity of fuel potentially released, debris footprint, support aircraft and boat operations, etc.) and how this debris would be managed and monitored. This EA evaluates the potential environmental impacts of proposed debris management activities associated with ABL tests that involve launching Liquid Fueled Target System (LFTS) target missiles from Vandenberg AFB and destroying the target by the ABL over the Western Range. This EA addresses only those debris management activities that are intended to occur; anomalies (such as flight termination) that occur during test activities are not anticipated and as such are not evaluated.

This EA has been prepared in accordance with the National Environmental Policy Act to analyze the potential environmental consequences of the Proposed Action and No-Action Alternative. The Proposed Action involves the observation, photography, and destruction of LFTS target missile debris. Debris management activities would occur during pre-launch, launch, and post-launch phases of the ABL test activity. Under the No-Action Alternative, the ABL test activities would be conducted; however, no observation and no debris destruction would occur.

All environmental resources were analyzed in this EA; however, only the environmental resources potentially affected by the Proposed Action and No-Action Alternative were analyzed in-depth, including health and safety, hazardous waste management, water resources, air quality, and biological resources. Based on the analysis of the Proposed Action and No-Action Alternative, the MDA has determined that no significant impacts would occur.

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Privacy Advisory

Your comments on this environmental assessment (EA) are requested. Letters or other written or oral comments provided may be published in the final EA. As required by law, comments will be addressed in the final EA and made available to the public. Any personal information provided will be used only to identify your desire to make a statement during the public comment period or to fulfill requests for copies of the final EA or associated documents. Private addresses will be compiled to develop a mailing list for those requesting copies of the final EA. However, only the names of the individuals making comments and specific comments will be disclosed. Personal home addresses and telephone numbers will not be published in the final EA.

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LIST OF ACRONYMS/ABBREVIATIONS

ABL	Airborne Laser
AFB	Air Force Base
AFI	Air Force Instruction
AGE	aerospace ground equipment
ARS	active ranging system (laser)
BILL	Beacon Illuminator Laser
BMDS	Ballistic Missile Defense System
Bt	*Bacillus thuringiensis*
C	Celsius
CAA	Clean Air Act
CAAQS	California Ambient Air Quality Standards
CARB	California Air Resources Board
CCC	Criteria Continuous Concentration
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CINMS	Channel Islands National Marine Sanctuary
CO	carbon monoxide
COIL	chemical, oxygen, iodine laser
CO_2	carbon dioxide
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
°	degree
DDT	dichloro diphenyl trichloroethane
EA	environmental assessment
EFH	Essential Fish Habitat
EIS	environmental impact statement
EPA	Environmental Protection Agency
EWR	Eastern and Western Range
F	Fahrenheit
FAA	Federal Aviation Administration
FLIR	Forward Looking Infrared
HEL	high-energy laser
HELSTF	High-Energy Laser System Test Facility
H_3O^+	hydronium ion
HF	hydrofluoric acid
HNO_3	nitric acid
HNO_2	nitrous acid
hp	horsepower
IDMP	Intercept Debris Measurement Program
IRFNA	Inhibited Red Fuming Nitric Acid
IRP	Installation Restoration Program
IRST	infrared search and track
kg	kilogram
km	kilometer
K_{ow}	octanol-water partition coefficient
LF-6	Launch Facility 6

LFTS	Liquid Fueled Target System
LTO	landing and takeoff
MDA	Missile Defense Agency
MOA	Memorandum of Agreement
MOTR	Multiple Object Tracking Radar
MSDS	Material Safety Data Sheet
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
NAAQS	National Ambient Air Quality Standards
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic & Atmospheric Administration
NO_2	nitrogen dioxide
NO_2	nitrous ion
NO_3	nitrate ion
NO_x	nitrogen oxide
NRWQC	National Recommended Water Quality Criteria
PCB	polychlorinated biphenyl
pH	hydrogen ion concentration
P.L.	Public Law
$PM_{2.5}$	particulate matter equal to or less than 2.5 microns in diameter
PM_{10}	particulate matter equal to or less than 10 microns in diameter
PPE	personal protective equipment
PSD	Prevention of Significant Deterioration
RANS	Range Squadron
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
ROI	region of influence
RONA	Record of Non Applicability
ROPS	Range Operations Squadron
RQ	reportable quantity
SBCAPCD	Santa Barbara County Air Pollution Control District
SHEL	Surrogate High-Energy Laser
SO_2	sulfur dioxide
SW	Space Wing
SWRCB	State Water Resources Control Board
TBP	tributyl phosphate
TILL	Track Illuminator Laser
U.S.C.	U.S. Code
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service
VOC	volatile organic compound
WSMR	White Sands Missile Range

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1.0 PURPOSE OF AND NEED FOR ACTION

This Environmental Assessment (EA) evaluates the potential environmental impacts of proposed debris management activities associated with Airborne Laser (ABL) tests, which involve launching Liquid Fueled Target System (LFTS) target missiles from Vandenberg Air Force Base (AFB), California, and destroying the target with the ABL over the Western Range. This EA addresses only those debris management activities that are intended to occur; anomalies that occur during test activities (such as launch pad failures or missiles that must be destroyed shortly after launch) are not anticipated and as such are not evaluated.

This document has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, as amended (42 U.S. Code [U.S.C.] 4321, et seq.), the Council on Environmental Quality (CEQ) regulations for implementing the procedural provisions of NEPA (40 Code of Federal Regulations [CFR] Parts 1500-1508), and Air Force policy and procedures (32 CFR Part 989).

1.1 PURPOSE AND NEED

The United States (U.S.) and its allies have a limited capability to effectively defend against ballistic missile attacks. Improvements in missile range and accuracy, the rapid increase in the number of missile-capable nations, and the absence of arms limitation treaties increase the threat. In addition, missile launchers are difficult to detect because the launchers and support equipment are highly mobile.

The Secretary of Defense has directed the Missile Defense Agency (MDA) to develop a capability to defend the U.S., deployed forces, U.S. allies, friends, and areas of vital interest from ballistic missile attack. In response, MDA is developing the Ballistic Missile Defense System (BMDS). The ABL is an element of the BMDS and would destroy a target missile in its initial, or boost phase. During ABL test activities, a lethality demonstration (target shootdown) against boosting ballistic missile targets would occur. Potential environmental effects of conducting ABL test activities were evaluated in the Final Environmental Impact Statement (EIS) for the Program Definition and Risk Reduction Phase of the ABL Program (U.S. Air Force, 1997a) and the Supplemental EIS for ABL Test Activities (Missile Defense Agency, 2003). However, additional information has been developed regarding the debris resulting from a target shoot-down (e.g., quantity of fuel potentially released and debris impact area). This additional information caused MDA to prepare this EA to address how the debris would be managed, monitored, and rendered safe to the environment and the public.

The purpose of this EA is to 1) evaluate the new information regarding debris and its management that were not available during the preparation of the Supplemental EIS and 2) provide the MDA and Air Force decision makers and the public with the information needed to understand the potential environmental consequences of proposed debris management activities.

1.2 LOCATION OF THE PROPOSED ACTION

Vandenberg AFB comprises more than 98,000 acres within Santa Barbara County and is approximately 55 miles north of the city of Santa Barbara near Lompoc, California (Figure 1-1). The Western Range (in which debris management activities would occur) extends west over the Pacific Ocean (Figure 1-2). The host unit at Vandenberg AFB is the 30th Space Wing, which is responsible for launching satellites into orbit.

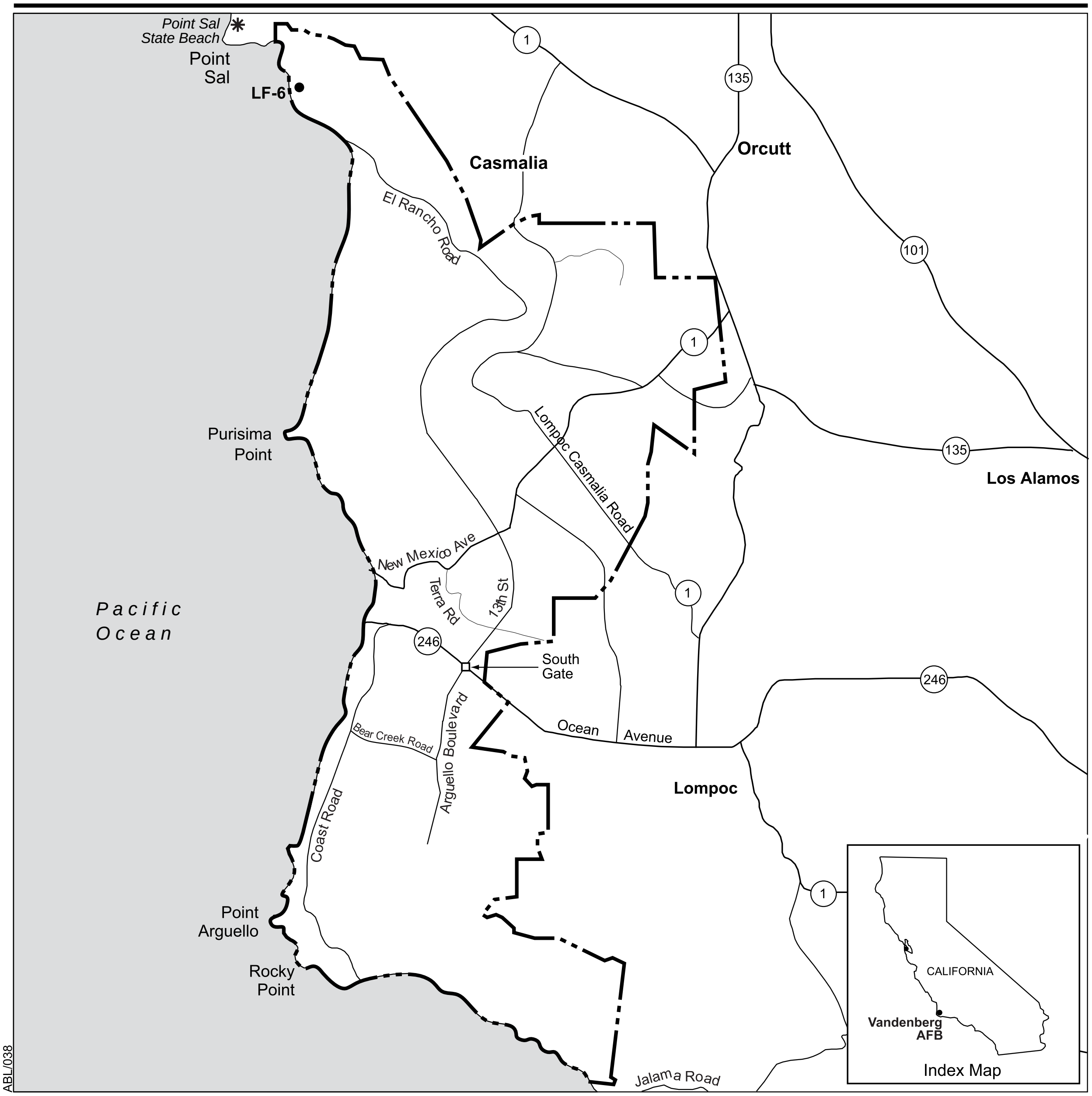
1.3 SCOPE OF ENVIRONMENTAL REVIEW

This EA focuses on those resources that may be affected by implementation of the Proposed Action or alternatives. Consistent with the CEQ regulations, the scope of analysis presented in this EA is defined by the potential range of environmental impacts that would result from implementation of the Proposed Action and alternatives. These resource areas include hazardous waste, potential effects to water quality, potential effects to air quality from operation of the debris boat and range clearance aircraft, and potential effects to biological resources. The affected environment and the potential environmental consequences relative to these resources are described in Chapters 3.0 and 4.0, respectively.

Initial analysis of potential environmental consequences of implementing debris management activities indicates that no significant short- or long-term impacts are anticipated for socioeconomics, transportation, utilities (water, wastewater, electricity, and natural gas), land use, aesthetics, Installation Restoration Program (IRP) sites, hazardous materials management, storage tanks, asbestos, lead-based paint, polychlorinated biphenyls (PCBs), pesticide usage, radon, medical or biohazardous waste, radioactive materials, soils and geology, noise, cultural resources, and environmental justice. The reasons for not addressing these resources further in this EA are briefly discussed below.

Socioeconomics. Potential socioeconomic impacts were evaluated in the Supplemental EIS for ABL Test Activities (Missile Defense Agency, 2003). There is the potential for impacts to local commercial and recreational fishing in the waters offshore of Vandenberg AFB; however, ocean vessels would be notified in advance of launch activity through a Notice to Mariners to warn vessels of test operations and the potential hazards. These notifications are done on a regular basis for missile launches from Vandenberg AFB and typically are of short duration. As a result, any impacts to commercial and recreation fishing vessels and fishing activities are not expected to be substantial.

Transportation. As discussed in the Supplemental EIS for ABL Test Activities, Vandenberg AFB has established procedures in place to ensure a safe environment to conduct ABL test activities. As part of these procedures, restricted airspace areas would be controlled according to Eastern and Western Range (EWR) 127-1 Range Safety Requirements, Safety Operating Instructions, 30 Space Wing (SW) regulations, and Federal Aviation Administration (FAA) directives and regulations. Notice to Mariners and Notice to Airmen would be disseminated. Because transportation and airspace/air traffic issues were



EXPLANATION

Base Boundary

● Existing Launch Facilities

(1) State Highway

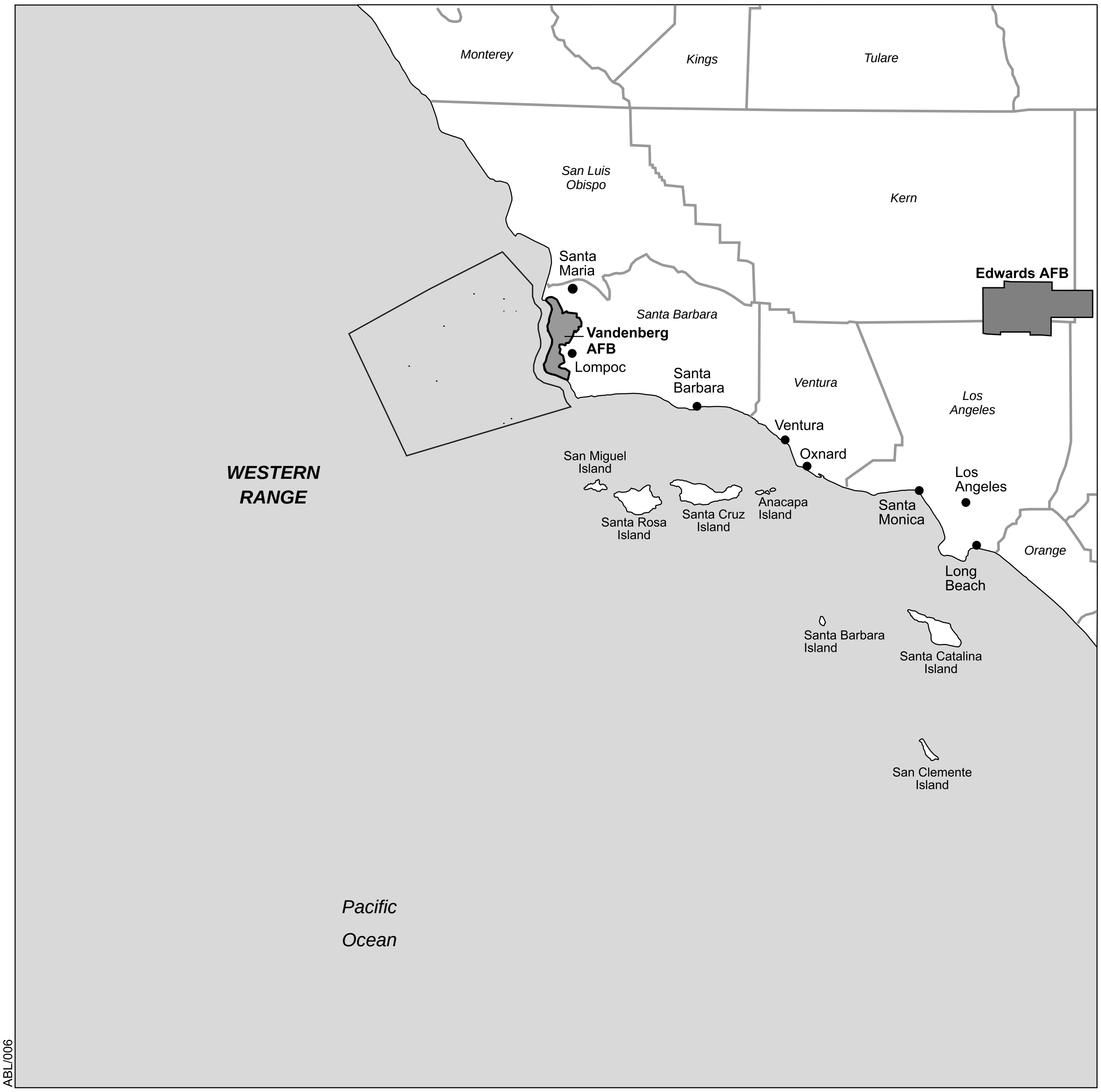
LF Launch Facility

0 1.25 2.5 5 Miles
0 2 4 8 km

Note: Actual launch site is approximately 600 feet southwest of LF-6.

Vandenberg AFB Vicinity Map

Figure 1-1



EXPLANATION

Area where debris management activities would potentially occur

Western Range, Vandenberg AFB

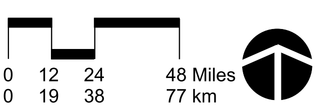


Figure 1-2

addressed in the Supplemental EIS for ABL Test Activities and no adverse impacts were identified, transportation is not analyzed further in this EA.

Utilities. No substantial utility requirements have been identified for debris management activities. Any additional fuel/utilities to support debris management activities would be insignificant. No adverse impacts to utilities (water, wastewater, electricity, and natural gas) would occur.

Land Use. Potential land use impacts were evaluated in the Supplemental EIS for ABL Test Activities (Missile Defense Agency, 2003). Because debris management activities would occur within the Western Range (more than 3 miles from shore), no land use changes are anticipated. If the debris tracking buoy indicates that debris could be drifting towards the shore, the coastline in that area may require closure. Vandenberg AFB, the County Parks Department, the County Sheriff, and the California Highway Patrol routinely close the beaches with civilian access, when necessary, to protect visitors (Missile Defense Agency, 2003). Impacts to land use from debris management activities are not expected and are not analyzed further in this EA.

Aesthetics. Because debris management activities would occur more than 3 miles from shore, no adverse impacts to the aesthetic quality of the area would occur.

Installation Restoration Program. There are no IRP sites situated in the vicinity of proposed debris management activities (i.e., more than 3 miles from shore); therefore, impacts to IRP sites would not occur.

Hazardous Materials Management. Debris management activities would focus on the debris and any associated oxidizer/fuel, which would be handled as hazardous waste until it is determined to be safe. The only hazardous materials associated with debris management activities would be fuel for the debris boat and range clearance aircraft. Tributyl phosphate (TBP) liquid could be used as a simulant to study potential effects from a biological agent. Less than 100 gallons of TBP could be used during each ABL test event. While a substantial portion of the TBP used in a test would volatilize during an intercept, TBP has been found in air, water, sediment, and biological tissue. Once in an aqueous environment, the majority of TBP finds its way to sediments. Biodegradation of TBP in water is substantial under aerobic conditions. The bioaccumulation potential for TBP in fish is low, and depuration (to cleanse or purify) is rapid (half-life of 1.25 hours) (www.inchem.org). MDA analyzed the dispersion of TBP in a 2004 EA and found no potentially significant effects (Missile Defense Agency, 2004). Impacts from hazardous materials are not expected, and are not further analyzed in this EA.

Storage Tanks. There are no storage tanks situated in the vicinity of proposed debris management activities (i.e., more than 3 miles from shore).

Asbestos. Because the LFTS target missile does not contain asbestos, no impacts from asbestos would occur.

Lead-Based Paint. Because the LFTS target missile does not contain lead-based paint, no impacts from lead-based paint would occur.

Polychlorinated Biphenyls. No PCB-containing equipment are associated with the LFTS target missile and none would be utilized during debris management activities. Therefore, impacts from PCBs would not occur.

Pesticide Usage. Debris management activities would not require the use of pesticides; however, *Bacillus thuringiensis* (Bt), a pesticide powder, could be used as a simulant to study dispersion of a biological agent. Less than 100 pounds of Bt would be used during each ABL test event. Bt has been found to be safe for use in the environment and has no known effect on wildlife such as mammals, birds, and fish. The U.S. Environmental Protection Agency (EPA) has not identified any human health hazards related to using Bt and has found it safe enough to exempt it from food residue tolerances, groundwater restrictions, endangered species labeling, and special review requirements (www.bt.ucsd.edu). MDA analyzed the lasing of a restrained thrusting solid rocket motor with Bt powder included as a payload in a dispersion of TBP in a 2005 EA and found no potentially significant effects (Missile Defense Agency, 2005b). Therefore, impacts from pesticide usage are not expected, and are not analyzed further in this EA.

Radon. Radon is a naturally occurring, colorless, and odorless radioactive gas that is produced by radioactive decay of naturally occurring uranium. Because debris management activities would occur more than 3 miles from shore, no adverse impacts from radon would occur.

Medical/Biohazardous Waste. No medical/biohazardous waste impacts would result from debris management activities. In the event that fish or other species are killed by the release of limited quantities of fuel or oxidizer, mortality from low hydrogen ion concentration (pH) liquids would not cause the animal to be hazardous and the constituents from the fuels are not bioaccumulative. Therefore, impacts from medical/biohazardous waste are not expected, and are not analyzed further in this EA.

Radioactive Materials. Debris management activities would not require the use of radioactive materials and no radioactive materials are associated with the LFTS target missile. Therefore, no adverse impacts from radioactive materials would occur.

Soils and Geology. No effect on soils and geology is anticipated from debris management activities. Depending on the magnitude/type of debris management activity, there may be some monitoring activities that occur on the beach. Impacts to soils and geology are not expected and are not analyzed further in this EA.

Noise. Because debris management activities would occur more than 3 miles from shore, adverse impacts from noise are expected to be minor. In support of ABL test activities and debris management actions, only a limited number of flight operations (8 hours per LFTS target missile launch) for the range clearance/biological monitoring aircraft and operations for the debris boat (24-hour operations per LFTS target missile launch) would occur. Impacts from noise are not analyzed further in this EA.

Cultural Resources. Debris management activities are not anticipated to involve any land disturbance and would occur more than 3 miles from shore; therefore, no adverse impacts to cultural resources would occur.

Environmental Justice. Debris management activities would occur more than 3 miles from shore within the Western Range, away from populated areas. Because debris management activities would be conducted and contained within the range boundaries, no disproportionately high and adverse impacts to low-income and minority populations would occur. Therefore, potential environmental justice impacts are not analyzed further in this EA.

1.4 FEDERAL, STATE, AND LOCAL PERMITS AND LICENSES

The ABL Program Office and the regulatory compliance organization at Vandenberg AFB would work together to apply for or seek to modify various permits or licenses (as necessary) in accordance with federal, state, or local regulatory requirements. MDA has requested informal consultations with both the U.S. Fish and Wildlife Service (USFWS) and the National Oceanic & Atmospheric Administration (NOAA) Fisheries Service regarding proposed debris management activities.

Federal activity in, or affecting a coastal zone requires preparation of a Coastal Zone Consistency Determination, in accordance with the federal Coastal Zone Management Act (CZMA) of 1972, as amended (P.L. 92-583) and implemented by NOAA. This act was passed to preserve, protect, develop and, where possible, restore or enhance the nation's natural coastal zone resources, which include wetlands, floodplains, estuaries, beaches, dunes, barrier islands, coral reefs, and fish and wildlife and their habitat. The California Coastal Zone Management Program was formed through the California Coastal Zone Conservation Act of 1972. The MDA is responsible for making the coastal zone consistency determination for its activities within the state, and the California Coastal Commission reviews federally authorized projects for consistency with the California Coastal Zone Management Program. In compliance with Section 307(c)(1) of the CZMA, the MDA has initiated consultation with the California Coastal Commission regarding proposed ABL debris management activities off the coast of Vandenberg AFB.

Consultation letters sent to the USFWS, NOAA Fisheries Service, and the California Coastal Commission and agency response correspondence are included in Appendix C.

1.5 RELATED ENVIRONMENTAL DOCUMENTS

The documents listed below have been prepared by MDA for the ABL program and other, related testing at Vandenberg AFB. These documents provided supporting information and environmental analysis for the balance of the program.

- The Final Environmental Impact Statement for the Program Definition and Risk Reduction Phase of the Airborne Laser Program (U.S. Air Force, 1997a) considered options for siting a Home Base, a Diagnostic Test Range, and an Expanded-Area Test Range in support of the ABL Program. The Record of Decision (ROD) for the 1997 EIS identified Edwards AFB as the Home Base for the ABL aircraft, White Sands Missile Range (WSMR) as the Diagnostic Test Range, and the Western Range as the Expanded-Area Test Range (for supporting proposed flight test activities of the ABL systems). This EIS analyzes the destruction of target missiles over the Western Range, but does not specifically address a fuel tank from a target missile that falls into the ocean and floats, posing a hazard to human health and the environment.

- The Final Supplemental Environmental Impact Statement for the Airborne Laser Program (Missile Defense Agency, 2003) was prepared to address refinement of proposed test activities, and to address various aspects of the proposed ABL tests that had changed since the completion of the 1997 EIS (U.S. Air Force, 1997a). The analysis included launching up to 25 target missiles at the Western Range during ABL test activities. Other actions that were analyzed in the Supplemental EIS included assessment of two ABL aircraft; assessment of proposed ground testing; assessment of potential effects due to off-range lasing during test activities; assessment of effects of lowering the minimum testing altitude of the ABL aircraft from 12.2 km (40,000 feet) to 10.7 km (35,000 feet); assessment of testing the Active Ranging System (ARS) laser, the Beacon Illuminator Laser (BILL), the Track Illuminator Laser (TILL), and the Surrogate High-Energy Laser (SHEL) systems; and refinement of proposed ABL test activities (i.e., location of tests, types of tests, and number of tests). This EIS does not consider the possibility of an intact fuel tank floating on the water as part of the debris analysis.

- The Final Theater Ballistic Missile Targets Programmatic Environmental Assessment (U.S. Air Force, 1997b) evaluated the proposed expansion of the capabilities of the Western Range to provide launches of small, mobile theater, and larger rail-launched targets from Vandenberg AFB to be intercepted over the open ocean of the Western Range off the California coast. This EA analyzed the potential environmental impacts of launching up to 30 target missiles (solid or liquid-fueled) per year, at multiple launch sites, from Vandenberg AFB using mobile launchers and one fixed-rail launcher. The EA does not analyze potential impacts of floating debris or associated debris management activities.

- The Use of Tributyl Phosphate in the Intercept Debris Measurement Program (IDMP) at White Sands Missile Range Environmental Assessment analyzes the dispersion of the simulant TBP from intercepted target missiles at WSMR (Missile Defense Agency, 2004). Testing was intended to provide a better understanding of a weapon system’s effectiveness against a nerve agent, which TBP simulates. Impacts from up to two tests per year over 10 years were evaluated in this EA. The EA focuses on the impacts relating to TBP, including launch preparation, aerial dispersion, bulk ground impact, and post-launch activities.

- The MUDPACK II Tests Environmental Assessment (Missile Defense Agency, 2005b) assessed the environmental impacts of firing a laser beam at a horizontally restrained thrusting rocket motor and the subsequent effects on the payload, which contained Bt powder, a commonly used organic insecticide, to simulate a lethal biological agent. The impacts of up to four tests using CASTOR IVA solid rocket motors are analyzed, with all of the testing occurring at the High-Energy Laser System Test Facility (HELSTF) at WSMR.

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2.0 DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

2.1 INTRODUCTION

This section describes the Proposed Action, No-Action Alternative, and alternatives considered but eliminated from further study.

2.1.1 Background

The ABL aircraft is a modified Boeing 747 aircraft that accommodates a laser-weapon system. The aircraft incorporates four different lasers that are designed to acquire, engage, and destroy a target missile shortly after it is launched (Figure 2-1). An onboard Battle Management Command Center provides computerized control of aspects of the laser-weapon system, communications, and intelligence systems.

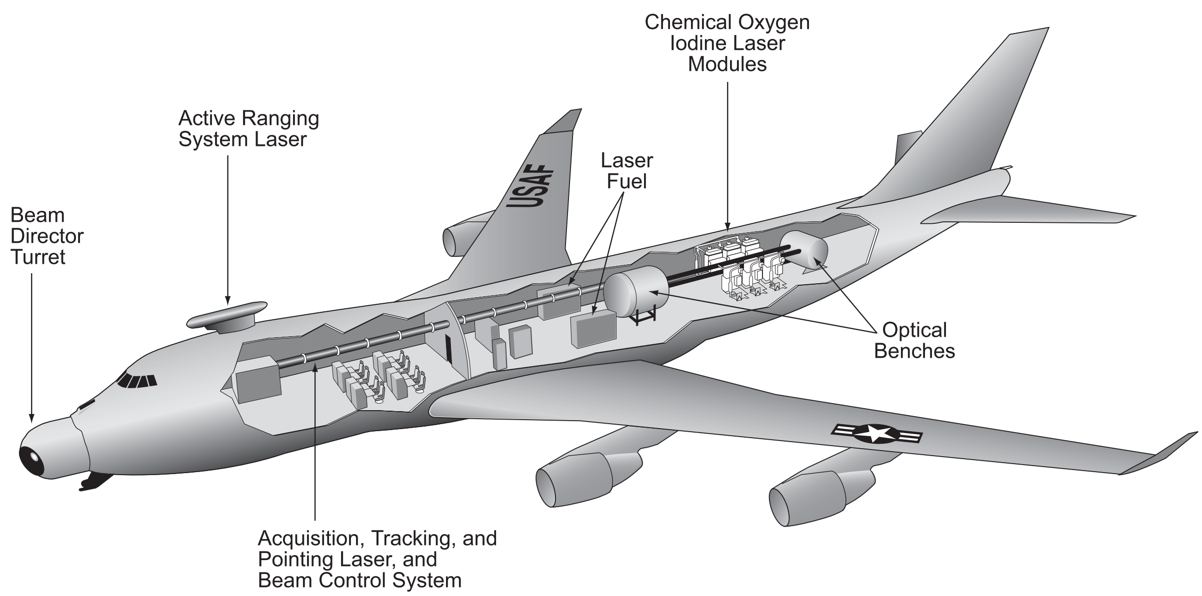
During ABL flight test activities, MDA would use the on-board sensors to acquire the infrared signature of the target missile and begin tracking the target when it is at an altitude of approximately 10.7 km (35,000 feet). The high-energy laser (HEL) would then be directed in an upward direction, toward the missile. The energy from the HEL would heat the missile body canister causing a stress fracture, which would allow the pressure inside the tanks to destroy the missile. The geometry of the tests would preclude operation of the HEL, except at an upward angle. Figure 2-2 illustrates the engagement scenario.

2.1.2 Overview of Airborne Laser Test Activities

The ABL aircraft would be based at Edwards AFB, California. MDA would begin and end ABL test flights at Edwards AFB and conduct LFTS test activities over the Western Range (see Figure 1-2). During ABL flight test activities, MDA would launch LFTS target missiles from Vandenberg AFB and attempt to shoot them down with the ABL.

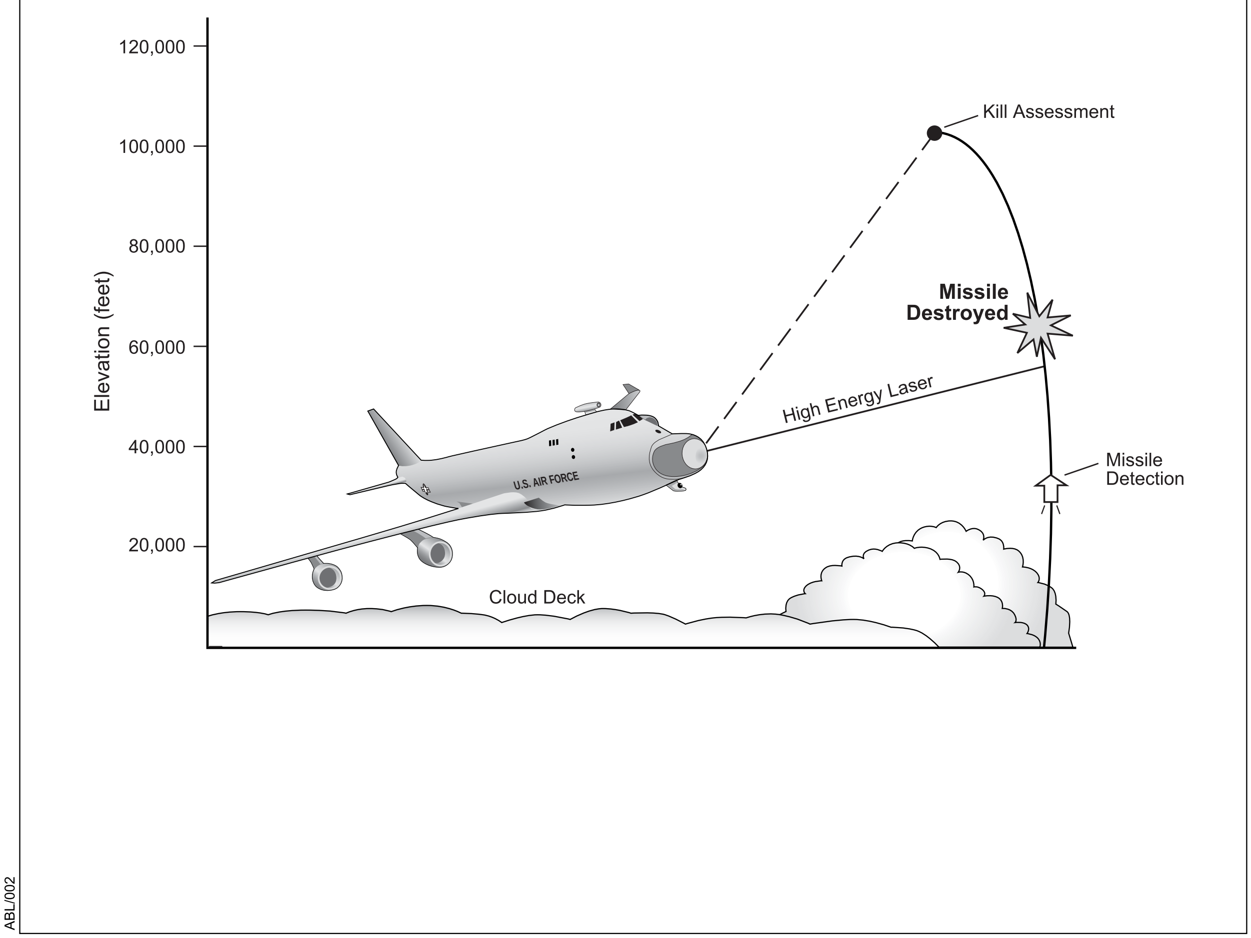
The LFTS target missile (Figure 2-3) is a single-stage ballistic missile with an inertial guidance system and a non-separating payload. The missile is composed of a payload section, guidance and control section, and propulsion section. The propulsion section consists of the propellant tanks (fuel and oxidizer), rocket engine, and associated valves, plumbing, and interface structure. This target would not carry a live warhead; the payload section would house telemetry and flight termination instrumentation

The flight termination system for the LFTS target missile is a fuel shutoff valve. When fully fueled, the missile contains approximately 1,117 liters (295 gallons) of kerosene fuel, 57 liters (15 gallons) of initiator fuel, and 1,855 liters (490 gallons) of Inhibited Red Fuming Nitric Acid (IRFNA) oxidizer. The fuel is composed of approximately 60 percent coal tar distillate consisting of benzene, toluene, mixed xylenes, and cymene (methyl isopropyl benzene), with the balance being



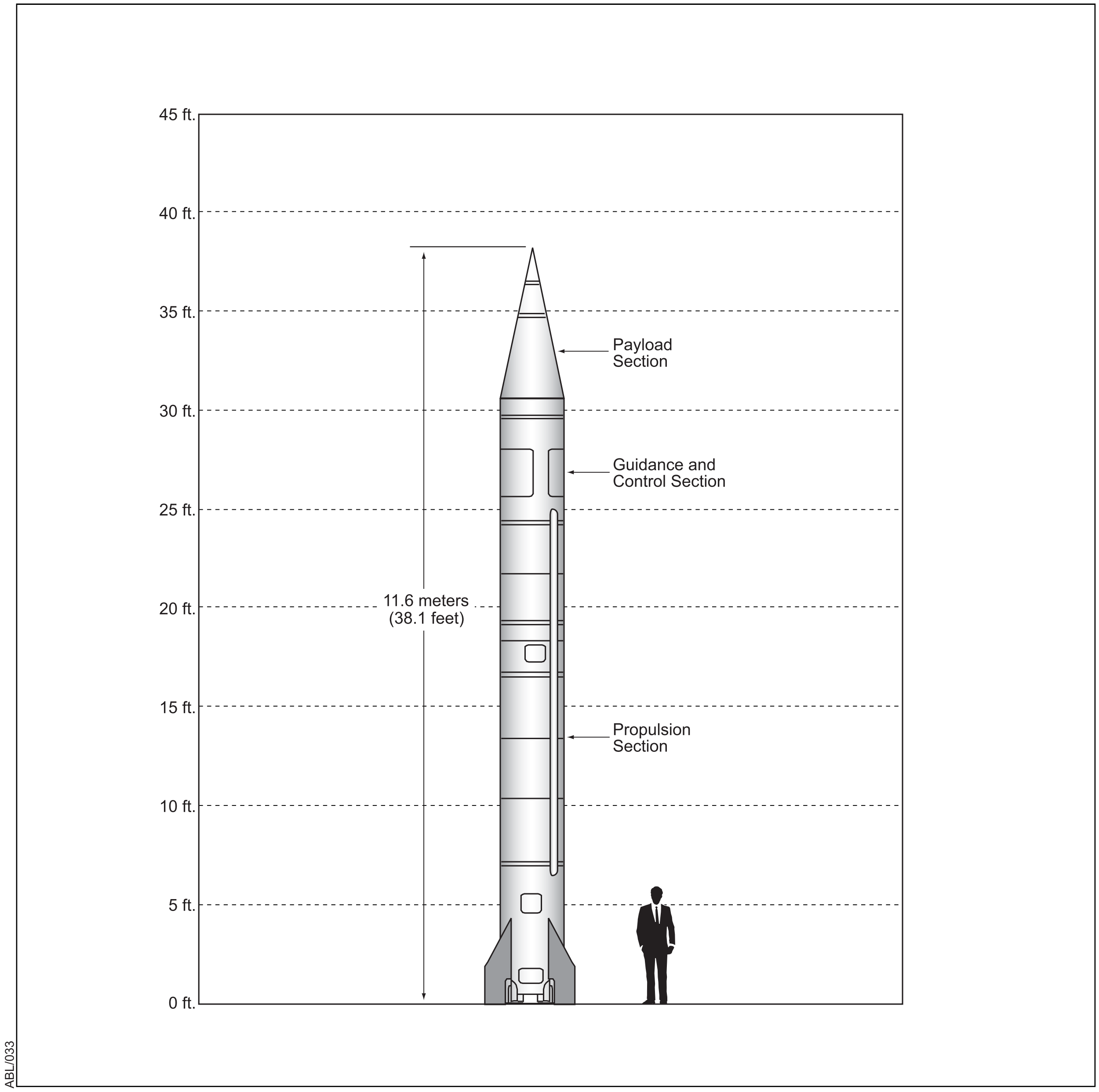
Conceptual Rendition of ABL Installed on Boeing 747 Aircraft

Figure 2-1



Conceptual ABL Engagement Scenario

Figure 2-2



Liquid Fueled Target System (LFTS) Missile

Figure 2-3

kerosene. The initiator fuel is a 50/50 mixture of triethylamine/dimethylanilines. The IRFNA oxidizer is composed of approximately 86 percent nitric acid, 13 percent nitrogen dioxide, and 0.6 to 0.7 percent hydrofluoric acid.

Launches would occur primarily at night (approximately between the hours of midnight and 4:00 AM) because of optimal atmospheric conditions and reduced air traffic. The ABL aircraft would fly at an altitude above 10.7 km (35,000 feet) where it would destroy the target at an altitude of approximately 12.2 km (40,000 feet) or higher. The trajectory of the missile target would be such that any debris from the destruction of the LFTS target missile during test activities would fall a minimum of 10 km (6 miles) from the coastline. Depending on the time required for the ABL to engage and destroy the target missile, destruction could occur up to 25 km (15.5 miles) from the coastline.

Several different scenarios could occur during ABL test activities. For purposes of the analysis in this EA, these representative scenarios are based on conservative assumptions that would result in the maximum quantity of propellants released to the environment.

1. The laser beam impacts the target and destroys it in midair. In this case, the propellants would either be consumed on impact or the fuel tanks would rupture and the propellants would then dissipate in the air. The amount of propellant remaining at the time of destruction would be approximately 223 liters (59 gallons) of kerosene fuel, 19 liters (5 gallons) of initiator fuel, and 636 liters (168 gallons) of IRFNA oxidizer. Debris from the target would fall to the ocean following target destruction.

2. The laser beam impacts the target causing a tear in the missile without immediately destroying it. In this case, the target would tumble to the ocean with the possibility of a propellant tank remaining intact. The propellants would then have the potential to be released into ocean waters as a result of damage to the fuselage. The amount of propellant remaining in the fuel tanks at the time of destruction, and which has the potential to spill into the ocean would be approximately 223 liters (59 gallons) of kerosene fuel, 19 liters (5 gallons) of initiator fuel, and 636 liters (168 gallons) of IRFNA oxidizer.

3. The laser beam impacts the target causing a hole in the fuel tank. This would cause the fuel tank to depressurize as fuel leaks out and the motor to stop burning fuel (flight termination-like result). In this case, the target would continue in a shortened trajectory with the fuel and oxidizer tanks intact. The IRFNA would continue to spew out of the motor in flight until pressure was gone. It is estimated that approximately 223 liters (59 gallons) of kerosene fuel, 19 liters (5 gallons) of initiator fuel, and 189 liters (50 gallons) of IRFNA oxidizer would remain in the tanks and have the potential to spill into the ocean.

4. The laser beam impacts the target destroying the fuel tank and causing a separation of the missile into two remaining pieces, the payload section and the oxidizer tank/motor section. In this case, the two pieces of the target would fall to the ocean with the oxidizer tank intact. Because the fuel tank would be destroyed, the kerosene fuel is expected to be consumed during the destruction and none would be released to the ocean. However, the IRFNA oxidizer would remain intact and have the potential to spill into the ocean. The amount of oxidizer remaining in the tank at the time of destruction would be approximately 636 liters (168 gallons).

5. The laser beam misses the target. In this case, the target would continue in a ballistic arc (approximately 290 km [180 miles] to 355 km [220 miles] down-range) to the ocean as an intact missile. Any remaining propellants would then have the potential to spill into the ocean upon impact. The amount of propellant remaining in the fuel tanks at the time of impact would be approximately 37.9 liters (10 gallons) of kerosene fuel, 0 liters (0 gallons) of initiator fuel, and 189 liters (50 gallons) of IRFNA oxidizer (approximately 10 percent of the original volume of IRFNA). The actual volume of IRFNA remaining the tank is likely to be less than this “worst case” amount.

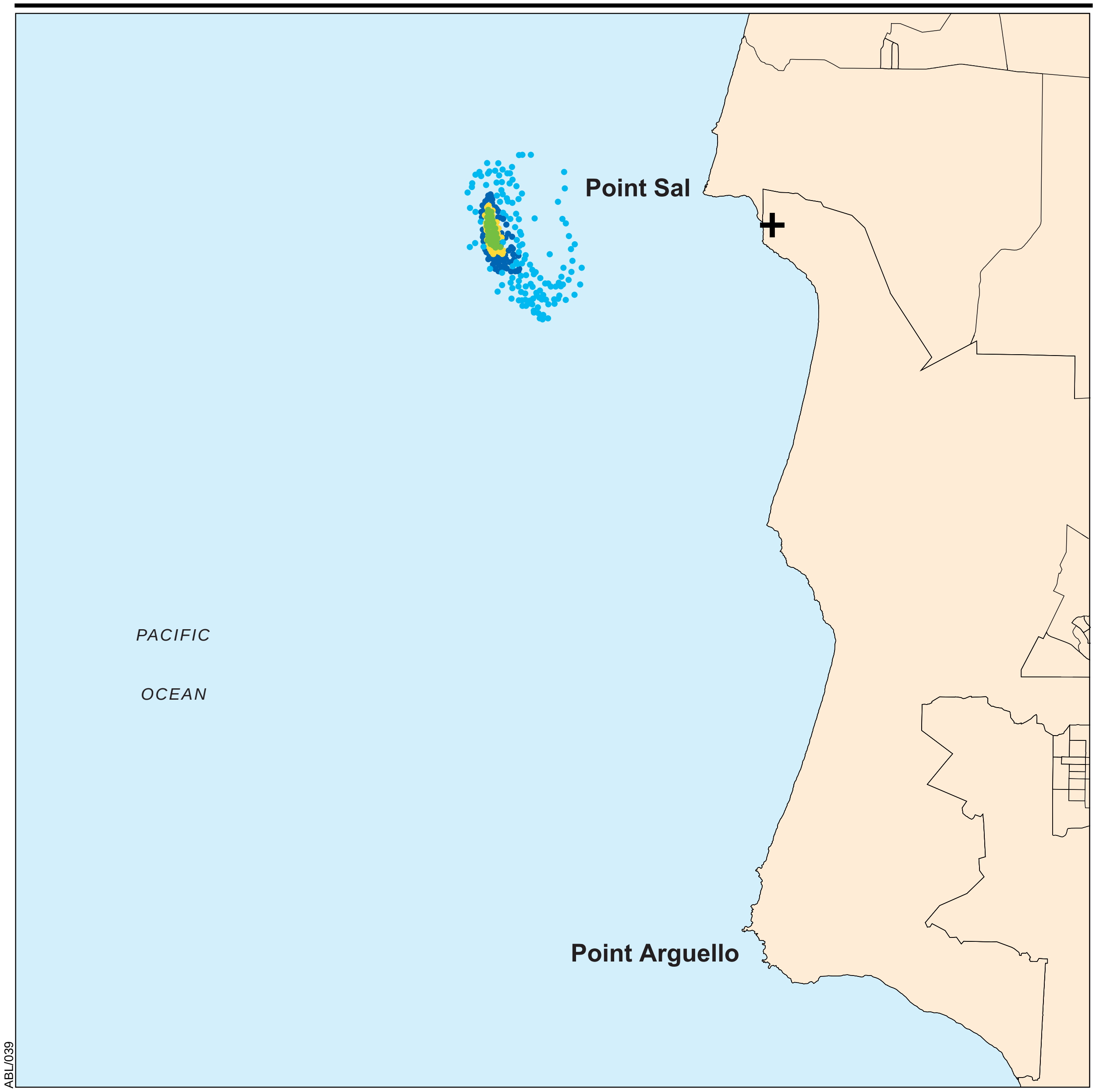
The distribution of the fallout debris and remaining propellants, subsequent to the destruction of the target, would depend on breakup pattern and whether the target is destroyed at the time of impact or is stopped in its intended flight trajectory and falls into the ocean. The trajectory of the target missiles would be such that the missile and any debris from the destruction of the missile during test activities would occur at least 10 km (6 miles) from the coastline (Figures 2-4 to 2-7).

Although offshore oil rigs and the Channel Islands are not within the anticipated debris fallout area, oil rig operators, the National Park Service, and the Channel Islands National Marine Sanctuary (CINMS) would be notified of the possible debris flow (both solid and fuel/oxidizer) from the impact site based on modeling of regional ocean currents.

2.2 DESCRIPTION OF THE PROPOSED ACTION

The Proposed Action involves the observation, photography, and destruction of LFTS target missile debris. For purposes of this EA, it is assumed that seven LFTS target missile launches would occur between fiscal year (FY) 2009 and 2014, as well as an additional “dress rehearsal” in which no LFTS target missile would be launched, but all other aspects of pre-launch, launch, and post launch debris management activities would occur.

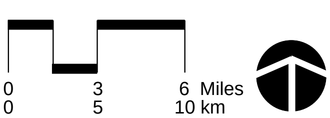
As discussed in greater detail below, the range clearance/biological monitoring aircraft that would support debris management activities is anticipated to operate for 8 hours for each LFTS target missile launch, for a total of 64 hours of operation for all test activities. Likewise, debris boat operations would be approximately 24 hours in duration per LFTS target missile launch to support



EXPLANATION

Tumble Rate

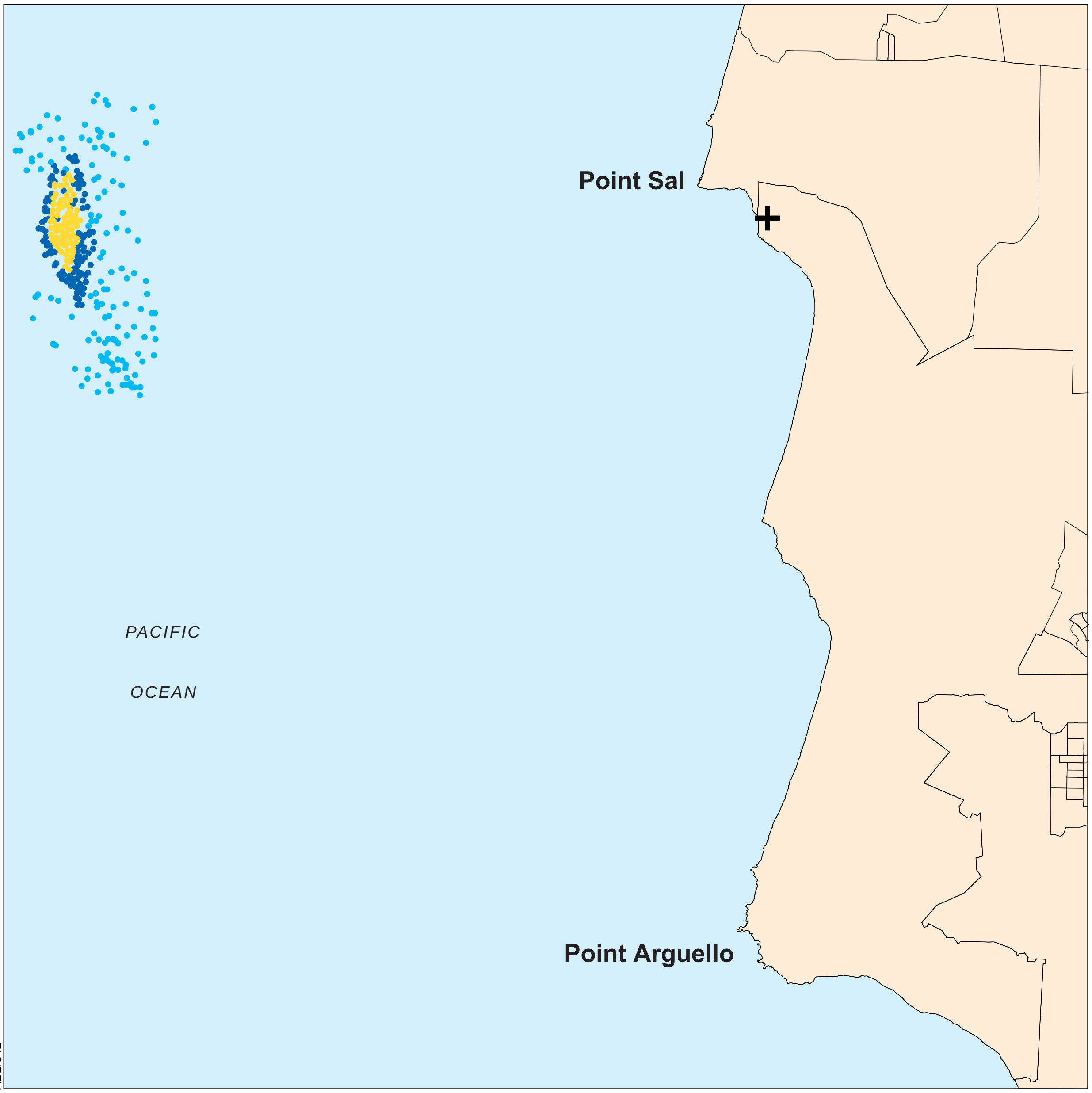
- 0.028 Hz
- 0.083 Hz
- 0.167 Hz
- 0.250 Hz
- ✚ Launch Site



Source: Science Applications International Corporation, 2002.

LFTS Debris Estimate 12.2 km (7.6 miles) Breakup Altitude (Intact Tank)

Figure 2-4



EXPLANATION

Tumble Rate

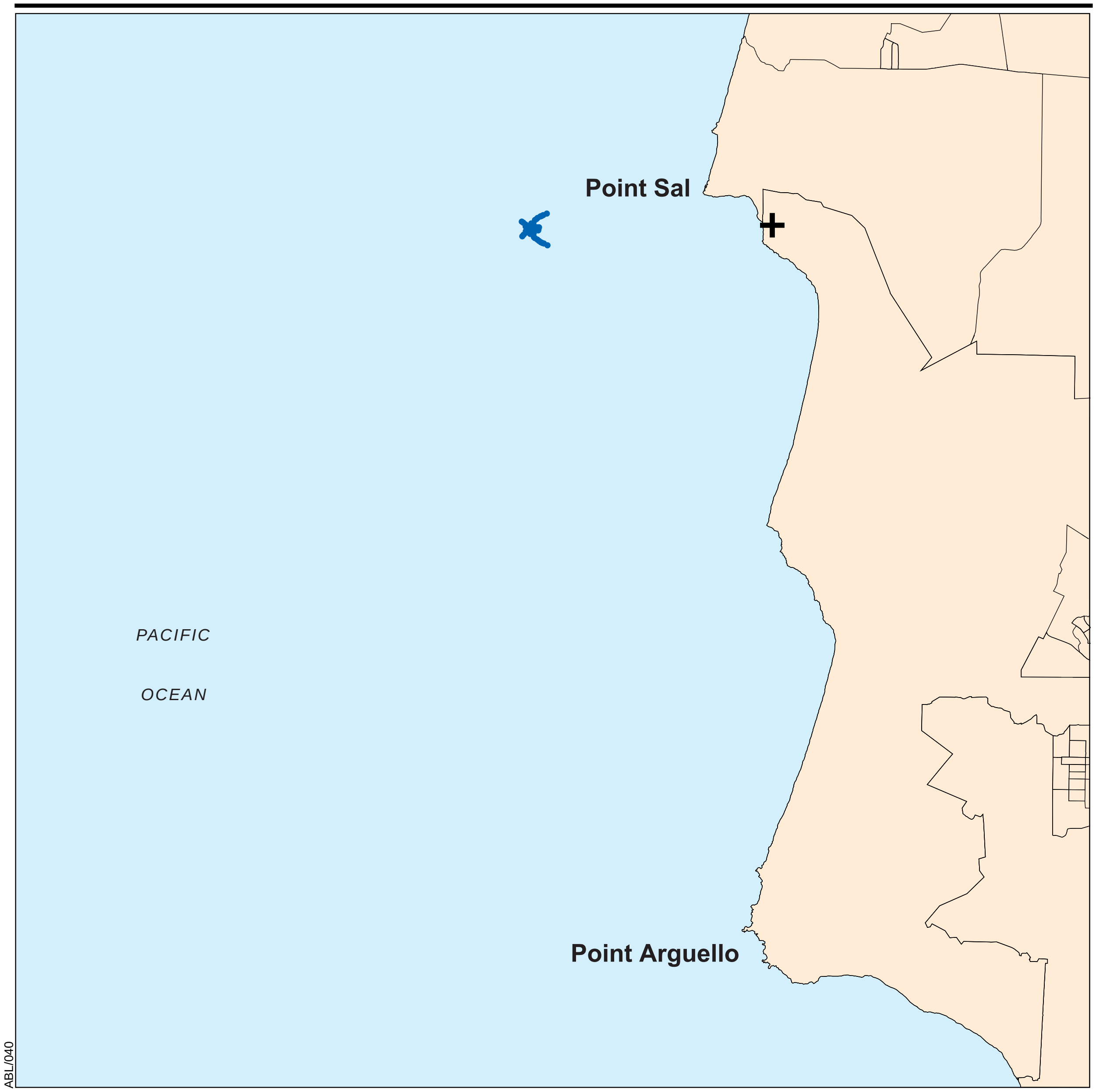
- 0.028 Hz
- 0.083 Hz
- 0.167 Hz
- 0.250 Hz
- Launch Site

0 3 6 Miles
0 5 10 km

Source: Science Applications International Corporation, 2002.

LFTS Debris Estimate 18.3 km (11.4 miles) Breakup Altitude (Intact Tank)

Figure 2-5



EXPLANATION

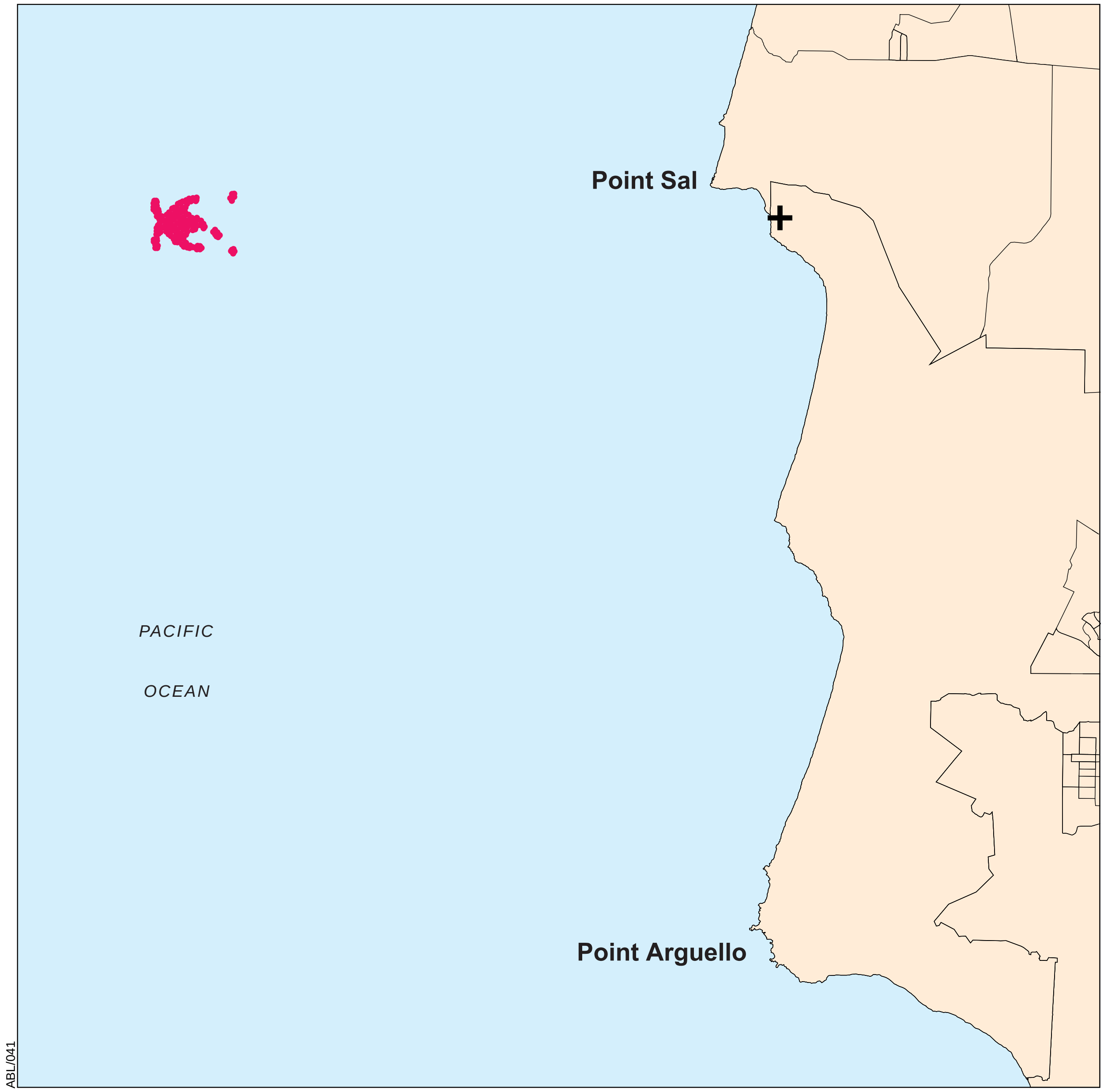
✚ Launch Site

LFTS Debris Estimate 12.2 km (7.6 miles) Breakup Altitude (Ruptured Tank)

0 3 6 Miles
0 5 10 km

Source: Science Applications International Corporation, 2002.

Figure 2-6



EXPLANATION

✚ Launch Site

0 3 6 Miles
0 5 10 km

Source: Science Applications International Corporation, 2002.

LFTS Debris Estimate 18.3 km (11.4 miles) Breakup Altitude (Ruptured Tank)

Figure 2-7

tracking buoy placement and debris assessment, for a total of 192 hours of debris boat operations for all test activities.

The description of the Proposed Action debris management activities is organized to address each phase of action (i.e., pre-launch, launch, and post-launch phases). This EA addresses only those actions that are intended to occur; anomalies that occur during test activities (e.g., launch pad mishaps or launch failures) are not anticipated and as such are not evaluated.

2.2.1 Pre-Launch Operations

This section addresses ABL debris management activities prior to launching the LFTS target missile and conducting ABL test activities. Activities that would occur during the pre-launch phase of the test activity include range clearance, target/debris tracking, ground support, and biological monitoring.

Most pre-launch activities were addressed in the Airborne Laser Supplemental EIS (Missile Defense Agency, 2003); however, several new/refined actions have been identified that will be addressed further in this EA. Refined pre-launch activities involve the use of an aircraft to conduct clearance surveys and biological monitoring and a debris vessel to place a tracking buoy in the anticipated debris fallout area to aid in the tracking of LFTS target missile debris. Pre-launch range clearance activities are discussed briefly in the following pages.

2.2.1.1 Range Clearance.

Based on the ABL test description (e.g., target trajectory, anticipated debris impact area), the range safety officer would establish the hazard area to meet security requirements, and reduce the hazard to persons and property during a launch-related activity. Impact limit areas and boat exclusion zones would be established through the designation of debris impact areas for each specific launch. The 30 SW has established procedures in place to ensure the area is clear before launch actions commence. Additional detail about range clearance activities is provided in the ABL Supplement EIS, June 2003.

An aircraft (equipped with Forward Looking Infrared [FLIR] radar) would takeoff from Vandenberg AFB prior to launching the LFTS target missile to aid in surface clearance of the anticipated debris impact area. This aircraft would continue surface clearance until required to vacate the hazard area, at which time the aircraft would either return to the Vandenberg AFB airfield (if time allows) or move to a position outside the hazard area established by the range safety officer. The debris boat would be stationed outside the boat exclusion zone established by the range safety officer. The debris boat would be a vessel originating from Port Hueneme or Morro Bay, California, and would not port at Vandenberg AFB.

Point Sal State Beach would be closed on the day of a missile launch if ABL test activities are conducted during daytime hours. Although direct overflight of the beach is not anticipated, there is the possibility of debris from a launch anomaly impacting the beach. In order to protect beach visitors, Vandenberg AFB, the Santa Barbara County Parks Department, the Santa Barbara County Sheriff, and the California Highway Patrol would coordinate closure of the beach during daytime launches. Point Sal State Beach is closed during nighttime hours and overnight camping is not permitted.

As an added safety precaution, target-missile flight tests may require temporary closure of areas in the vicinity of Vandenberg AFB. Laser hazard control regulations and range safety regulations are in place that adequately address outdoor lasing activities to ensure the safety of surrounding receptors. Range officials would coordinate with appropriate local authorities to temporarily close beaches, highways, sea-lanes, and air traffic routes, as required, during laser-testing activities and missile launches.

2.2.1.2 Target/Debris Tracking.

Debris models would be run to calculate the likely location of the debris field. The area affected by debris would depend on the altitude of destruction, severity of destruction, and winds. The debris boat would place a buoy in the anticipated debris fallout area to aid in the tracking of LFTS target missile debris. The buoy would be placed as close to launch time as possible while allowing the debris boat time to get to a safe position prior to launch. This buoy would drift with the ocean current providing information on the drift of any LFTS target missile debris.

Placement of the tracking buoy would be canceled if ocean or weather conditions prevent the debris boat from proceeding to the anticipated impact area. Adverse ocean conditions (e.g., large swells, large waves) and weather conditions (e.g., fog, rain, lightning, high winds) would prevent the use of the debris boat. Adverse weather conditions would likely suspend the use of the range clearance aircraft and launch of the LFTS target missile.

2.2.1.3 Biological Monitoring.

Two NOAA Fisheries Service-approved biological monitors would be used to survey the portions of the sea range that would be used during ABL test activities (i.e., areas potentially impacted by falling LFTS target missile debris) for the presence of marine mammals. Marine mammals to be monitored include whales, porpoises, dolphins, seals, sea otters, sea turtles, and sea lions. Appendix B provides a brief discussion of biological species potentially in the affected area. This survey would include those areas 4.8 to 8.0 km (3 to 5 miles) around the impact area to determine if any biological species may migrate into the area by the time test activities occur. Observations would be made from an altitude of at least 305 meters (1,000 feet) to avoid harassing marine mammals.

If ABL test activities occur during nighttime hours, the biological monitors would use the FLIR radar, to the extent possible, to look for marine mammals in the water. However, the presence of a heavy marine layer (i.e., fog) would reduce the effectiveness of the FLIR. As a result, marine mammals would not be visible if they are too far below the water surface, and identification of the types of marine mammals would not be possible. This aircraft would continue biological monitoring until 15 minutes prior to launching the LFTS target missile, at which time the aircraft would either return to the Vandenberg AFB airfield (if time allows) or move to a position outside the hazard area established by the range safety officer.

If ABL test activities occur during daytime hours, the biological monitors would fly along with the range clearance aircraft, one on each side, and would conduct biological monitoring using binoculars. If marine mammals are observed in or near the predicted impact area, the observers, through the pilot, would contact the Operations Conductor for the test who would then contact the Environmental Project Office for additional guidance. The decision to delay or move the launch would depend on the best professional judgment of the biological monitors who would determine if there is a possibility that marine mammals would be in the anticipated debris impact area during the time of the ABL test activity.

2.2.2 Launch Operations

This section addresses ABL debris management activities from the time the LFTS target missile is destroyed to splash-down of the LFTS target missile debris. Activities that would occur during the launch phase of the test activity include range clearance and target/debris tracking. Flight termination is considered an anomaly and is not an intended action during ABL test activities. This EA addresses only those actions that are intended to occur; therefore, anomalies such as flight termination will not be evaluated further.

Activities occurring during the launch phase were addressed in the Airborne Laser Supplemental EIS (Missile Defense Agency, 2003). Launch phase activities are discussed briefly below.

2.2.2.1 Range Clearance.

The portions of the sea range determined to be used during ABL test activities (i.e., areas potentially impacted by falling LFTS target missile debris) would be confirmed cleared (see Section 2.2.1, Pre-Launch Operations). Air traffic would also be confirmed cleared for areas to be utilized during ABL test activities. Sensors onboard the ABL aircraft and laser clearinghouse ephemeris data would be used to confirm that aircraft or satellites are not within the potential path of the beam.

Vandenberg AFB and local law enforcement agencies would maintain beach closures (as necessary) through the duration of ABL test activities. Overnight camping at Point Sal State Beach is not permitted; therefore, closure during nighttime hours would not be required.

The range clearance aircraft would either return to the Vandenberg AFB airfield (if time allows) or move to a position outside the hazard area established by the range safety officer during ABL test activities.

2.2.2.2 Target/Debris Tracking.

A Multiple Object Tracking Radar (MOTR) would be used to track the LFTS target missile and LFTS target missile debris after destruction. This radar is capable of tracking multiple objects and would focus on the larger pieces of debris (e.g., payload section, fuel and oxidizer tanks, rocket motor).

Debris would be tracked to within 100 to 200 meters (328 to 656 feet) of the impact point. If debris cannot be tracked to the surface, a computer program would be used to calculate the likely impact area based on the last known location and trajectory of the debris. A transponder installed in the payload section (nose) of the LFTS target missile would be monitored to aid in tracking its trajectory after target missile destruction.

2.2.3 Post-Launch Operations

This section addresses ABL debris management activities from the time the LFTS target missile debris impacts the ocean to final assessment and monitoring of the debris and any potential biological resources in the impact area.

Activities that would occur during the post-launch phase of the test activity include range clearance, target/debris tracking, debris assessment and sinking (if necessary), and biological monitoring.

2.2.3.1 Range Clearance.

Once the ABL test activity has been completed (i.e., LFTS target missile launch, lasing test, and debris fallout) the range safety officer would clear the area for entry. The range safety officer would use standard Vandenberg AFB procedures to determine when it is safe to enter the debris zone. Vandenberg AFB and local law enforcement agencies would reopen any closed beaches.

The range safety officer would determine the appropriate time to cancel the restrictions for aircraft and surface vessels established for the ABL test activity. This would be based on inputs from the range radar/sensor data and be conducted in accordance with standard Vandenberg AFB procedures.

2.2.3.2 Target/Debris Tracking.

Once the range safety officer has cleared the area for entry, the debris boat would approach the debris field based on the results of MOTR tracking of the debris and drop a buoy to track the drift of the debris.

At first light, the debris boat would begin a search for the debris field (focusing on large debris [e.g., tanks]) starting at the position of the tracking buoy. Once the debris field has been identified, the debris boat would recover the tracking buoy.

An aerial search of the anticipated debris area would also be conducted at first light to aid in identifying the debris field. The debris search aircraft would fly at an altitude of at least 305 meters (1,000 feet) to minimize harassment of marine mammals. This aircraft also would support post-launch biological monitoring of the area.

If no debris is identified in the vicinity of the tracking buoy, the debris boat would proceed to the radar- tracked location of the debris impact, searching the area that the tracking buoy had traveled. Personnel on the debris boat would use binoculars to aid in identifying debris. The debris boat also would be in contact with the aerial search aircraft to aid in locating and identifying debris.

Search for LFTS target missile debris would be canceled if ocean or weather conditions prevent the debris boat and/or search aircraft from looking for debris. Adverse ocean conditions (e.g., large swells, large waves) and weather conditions (e.g., fog, rain, lightning, high winds) would prevent the use of the debris boat and search aircraft.

2.2.3.3 Debris Assessment and Disposal.

Floating LFTS target missile debris (e.g., kerosene tanks and oxidizer tanks) would be photographed and sunk to ensure that the environment and public are safe from floating debris hazards. Qualified personnel would be onboard the debris boat to shoot floating debris with appropriate caliber guns. The debris boat would maintain a safe distance from the floating debris to allow accurate targeting of the debris to be sunk. No attempt would be made to recover sunken debris.

A visual survey of the debris field would be conducted to assess the size of the debris pieces and determine the best approach for disposal. Because the pH of the water could potentially be lowered in the immediate vicinity of the debris, safety is a primary limiting factor to conducting debris assessment. Due to the oxidizer reactivity with water, human contact with the debris will be kept to a minimum (e.g., divers would not be placed into the water).

Personnel involved in assessment of debris would wear personal protective equipment (PPE) appropriate for both debris hazards (e.g., sharp edges, chemicals) and ocean hazards (e.g., cold water, drowning). No inhalation hazard is anticipated from the debris. However, should an intact tank of oxidizer be identified, additional PPE (including appropriate respiratory protection) would be used.

2.2.3.4 Biological Monitoring.

A post-launch aerial survey would be conducted at first light (weather permitting) to determine if any species were affected by the debris. The biological monitor would go with the debris search aircraft and would conduct biological monitoring using binoculars. Observations would be made from an altitude of at least 305 meters (1,000 feet) to avoid harassing marine mammals.

The post-launch biological survey would be canceled if weather conditions prevent the debris search aircraft from taking off. The biological survey would resume once weather conditions allow for safe aircraft flight. The survey would begin at the area of initial impact of the debris (based on MOTR tracking data).

The post-launch biological survey would include a surface assessment of Vandenberg AFB beach areas to determine if any debris has washed up on shore and evaluate if birds, otters, or other wildlife coming to shore may have been affected by the debris. Beach area surveys would be conducted for 3 days following ABL test activities. Any fish, mammalian, or avian species that appears to have died as a result of the LFTS target missile debris would be disposed appropriately. The Vandenberg AFB landfill can accept deceased animals if they are not contaminated with persistent hazardous chemicals.

A biological monitor would also accompany the debris boat to assess if any effects to biological resources occurred in the debris impact area. A report detailing observed effects to biological resources from ABL test activities would be submitted to NMFS prior to the next planned test.

2.3 ALTERNATIVES TO THE PROPOSED ACTION

2.3.1 No-Action Alternative

Under the No-Action Alternative, the ABL test activities would be conducted; however, no debris observation or management activities would occur.

All of the activities discussed under the Proposed Action would still occur under the No-Action Alternative, except for target/debris tracking, debris assessment, and disposal activities. Debris management activities associated with operation of the debris boat (i.e., buoy placement, debris observation, photography, and destruction) would not be conducted.

2.3.2 Alternatives Considered but Eliminated from Further Study

The Observe Debris Only Alternative was eliminated from further consideration. Under this alternative, the ABL test activities would be conducted; however, the debris would only be observed, no sinking of the debris would occur. This alternative was eliminated from further consideration because any debris observed to be approaching the shore would require sinking or removal to avoid becoming a hazard.

3.0 AFFECTED ENVIRONMENT

3.1 INTRODUCTION

This chapter describes the existing environmental conditions within the area potentially affected by proposed ABL debris management activities. It provides information to serve as a baseline from which to identify and evaluate potential environmental effects resulting from the Proposed Action. The environmental components addressed include relevant natural or human environments likely to be affected by the Proposed Action and No-Action Alternative.

Based upon the nature of the activities that would occur under the Proposed Action and No-Action Alternative, it was determined that the potential exists for the following resources to be affected or to create environmental effects: health and safety, hazardous waste management, water resources, air quality, and biological resources.

The region of influence (ROI) to be studied will be defined for each resource area affected by the proposed activities. The ROI determines the geographical area to be addressed as the Affected Environment.

3.2 HEALTH AND SAFETY

The potential health and safety issues associated with proposed ABL test activities (i.e., laser hazards, range and air space clearance/closure, and road and beach closures) have been addressed in the Supplemental EIS for the Airborne Laser Program (Missile Defense Agency, 2003). These health and safety issues are discussed briefly; however, the discussion of health and safety issues in this EA focuses on potential impacts from implementing debris management activities (i.e., after the LFTS target missile debris falls to the ocean) and additional range clearance measures (i.e., range clearance aircraft operations). The ROI for health and safety encompasses those areas that could potentially be affected by floating debris and personnel exposed to hazardous debris during debris assessment activities.

As discussed in the Supplemental EIS for the Airborne Laser Program, based on the ABL test description (e.g., target trajectory, anticipated debris impact area), the range safety officer establishes the hazard area to meet security requirements and reduce the hazard to people and property during a launch-related activity. Impact limit areas and boat exclusion zones are established through the designation of debris impact areas for each specific launch. A Notice to Mariners regarding the boat exclusion zone is disseminated prior to launching the LFTS target missile and conducting ABL test activities. Hazard area closures are announced daily over various radio frequencies, and posted in harbors along the coast. Harbormasters from Ventura to Morro Bay are notified regarding the boat exclusion zone.

During ABL test activities, restricted airspace areas would be active and controlled according to EWR 127-1, Range Safety Requirements, Safety Operating Instructions, 30 SW regulations, and FAA directives and regulations. Control of air traffic in FAA-designated areas around the launch site and where the ABL aircraft is flying would be maintained and coordinated between the Aeronautical Control Officer and FAA to ensure that aircraft are not endangered by launches or ABL test activities.

The ROI (shoreline and coastal waters off Vandenberg AFB) is typically free of man-made floating debris hazards.

3.3 HAZARDOUS WASTE MANAGEMENT

The ROI for hazardous waste management encompasses those areas that could potentially be exposed to drifting debris and LFTS fuel/oxidizer released during ABL test activities. The initial impact area of the LFTS target missile debris is anticipated to be within the Pacific Ocean at least 10 km (6 miles) off the coast of Vandenberg AFB.

Management of hazardous waste must comply with the Resource Conservation and Recovery Act (RCRA), as amended by the Hazardous and Solid Waste Amendments of 1984 (42 U.S.C. Section 6901-6992), which is administered by the U.S. EPA unless otherwise exempted through Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) actions. Title C, Part 261 identifies which solid wastes are classified as hazardous waste. RCRA requires that hazardous wastes be treated, stored, and disposed to minimize the present and future threat to human health and the environment. Guidance in Air Force Instruction (AFI) 32-7042, Solid and Hazardous Waste Compliance, provides a framework for complying with environmental standards applicable to hazardous waste.

Hazardous wastes at Vandenberg AFB and Naval Base Ventura County are regulated by RCRA (Title 40 CFR 260-280) and the California EPA, Department of Toxic Substances Control, under California Health and Safety Code (Title 22, Division 20, Chapter 6.5, Sections 25100 through 25159) and the California Administrative Code (Sections 25100 through 67188). These regulations require that hazardous waste be handled, stored, transported, disposed of, or recycled according to defined procedures.

The Vandenberg AFB Hazardous Waste Management Plan (30 SW Plan 32-7043-A) and the Navy Region Southwest Hazardous Waste Management Plan (U.S. Navy, 2005) implement the above regulations and outlines the procedures for disposing of hazardous waste. Implementing the procedures outlined in the plan ensures the proper identification, management, and disposition of hazardous waste, and compliance with applicable federal, state, and Air Force/Navy requirements.

The ROI off the coast of Vandenberg AFB is typically free of man-made floating debris and hazardous wastes, and has a pH value of approximately 8.1.

3.4 WATER RESOURCES

The ROI for water resources are those areas potentially affected by LFTS target missile debris and LFTS fuel/oxidizer released during ABL test activities. The initial impact area of the LFTS target missile debris is anticipated to be within the Pacific Ocean at least 10 km (6 miles) off the coast of Vandenberg AFB.

Water resource regulations focus on the right to use water and protection of water quality. The principal federal laws protecting water quality are the Clean Water Act (CWA), as amended (33 U.S.C. § 1251 et seq.) and the Safe Drinking Water Act (42 U.S.C. § 300f et seq.). Both laws are enforced by the U.S. EPA. The CWA establishes the basic structure for regulating discharges of pollutants into the waters of the United States. The CWA protects wetlands and other aquatic habitats through a permitting process that ensures development and other activities are conducted in an environmentally sound manner. The Safe Drinking Water Act is directed at protection of drinking water supplies.

Within California, the Porter-Cologne Water Quality Control Act (California Water Code §13000-13999.10) gives the State Water Resources Control Board (SWRCB) and nine Regional Water Quality Control Boards responsibility for protection of the waters within their regions. Vandenberg AFB and central California coastal waters (from shore out to 4.8 km or 3 miles) fall within the jurisdiction of the Central Coast Regional Water Quality Control Board. The regional boards are also responsible for implementing provisions of the CWA delegated to states, such as the National Pollutant Discharge Elimination System, which regulates point (e.g., industrial) and non-point (e.g., storm water) sources of pollutants.

The SWRCB adopted the Water Quality Control Plan for Ocean Waters in 1974, as amended. The amended plan (The Ocean Plan) establishes beneficial uses and water quality objectives for waters of the Pacific Ocean adjacent to the California coast outside of enclosed bays, estuaries, and coastal lagoons. The Ocean Plan prescribes effluent quality requirements and management principals for waste dischargers and specific waste discharge prohibitions. It also contains a prohibition against discharge of specific hazardous substances and sludge, bypass of untreated waste, and discharges that impact Areas of Biological Significance.

In compliance with Section 307 (c) (1) of the CZMA, the MDA has prepared a Coastal Zone consistency determination for proposed ABL debris management activities and submitted it to the California Coastal Commission for concurrence (Appendix C). The ROI off the coast of Vandenberg AFB where LFTS target missile debris is anticipated to land is typically free of man-made floating debris and has a pH value of approximately 8.1.

3.5 AIR QUALITY

Air quality in a given location is defined by the concentration of various pollutants in the atmosphere. The ROI for air quality includes the air basin in which Vandenberg AFB is situated. Vandenberg AFB is situated in the northern portion of California's South Central Coast Air Basin, and in the Santa Barbara County Air Pollution Control District (SBCAPCD).

The federal Clean Air Act (CAA), 42 U.S.C. 7401-7671(q), amended in November 1990, stipulates that emissions sources must comply with the air quality standards and regulations that have been established by federal, state, and county regulatory agencies. These standards and regulations focus on (1) the maximum allowable ambient pollutant concentrations, and (2) the maximum allowable emissions from individual sources.

The U.S. EPA established the federal standards for the permissible levels of certain pollutants in the atmosphere. The National Ambient Air Quality Standards (NAAQS) have been established for seven criteria pollutants: ozone, nitrogen dioxide (NO_2), particulate matter equal to or less than 10 microns in diameter (PM_{10}), particulate matter equal to or less than 2.5 microns in diameter ($PM_{2.5}$), carbon monoxide (CO), sulfur dioxide (SO_2), and lead. Ozone is a secondary pollutant formed in the atmosphere by photochemical reactions of previously emitted pollutants, or precursors. The ozone precursors are nitrogen oxide (NO_X) and volatile organic compounds (VOCs). The California Air Resources Board (CARB) has established the California Ambient Air Quality Standards (CAAQS) for these air pollutants, and also for visibility reducing particles, sulfates, hydrogen sulfide, and vinyl chloride. Both the NAAQS and the CAAQS are shown in Table 3-1.

The U.S. EPA designates all areas of the United States as having air quality better than (attainment) or worse than (nonattainment) the NAAQS. Pollutants in an area may be designated as unclassifiable when there is insufficient ambient air quality data for the U.S. EPA to form a basis for an attainment status. Under the CAA, the nonattainment classifications for CO and PM_{10} were further divided into moderate and serious categories. Ozone nonattainment was divided into marginal, moderate, serious, severe, and extreme categories. The CARB also designates areas that exceed the CAAQS as nonattainment for the specific pollutant.

Vandenberg AFB is within the SBCAPCD, which is in attainment for NAAQS criteria pollutants. For the CAAQS, this district does not meet the state 1-hour and 8-hour ozone standard or the 24-hour and annual standard for PM_{10}.

Major new or modified stationary sources in the area would be subject to Prevention of Significant Deterioration (PSD) review to ensure that these sources do not result in significant adverse deterioration of the clean air in the area.

3.6 BIOLOGICAL RESOURCES

Biological resources that could be affected by proposed ABL debris management activities include a variety of aquatic plants and animals. The ROI for biological resources encompasses areas that could be impacted by LFTS fuel/oxidizer and debris released during ABL test activities. The impact area for LFTS target missile debris is the Pacific Ocean at least 10 km (6 miles) off the coast of

Table 3-1. National and California Ambient Air Quality Standards

Pollutant	Averaging Time	California Standards[a,c]	National Standards[b]	
			Primary[c,d]	Secondary[c,e]
Ozone	1-hour	0.09 ppm (180 µg/m^3)	--	Same as primary standard
	8-hour[f]	0.07 ppm	0.08 ppm (157 µg/m^3)	Same as primary standard
Carbon monoxide	8-hour	9 ppm (10 mg/m^3)	9 ppm (10 mg/m^3)	--
	1-hour	20 ppm (23 mg/m^3)	35 ppm (40 mg/m^3)	--
Nitrogen dioxide	Annual Average	0.03 ppm (56 µg/m^3)	0.053 ppm (100 µg/m^3)	Same as primary standard
	1-hour	0.18 ppm (338 µg/m^3)	--	--
Sulfur dioxide	Annual Average	--	0.03 ppm (80 µg/m^3)	--
	24-hour	0.04 ppm (105 µg/m^3)	0.14 ppm (365 µg/m^3)	--
	3-hour	--	--	0.5 ppm (1,300 µg/m^3)
	1-hour	0.25 ppm (655 µg/m^3)	--	--
PM_{10}	Annual Arithmetic Mean	20 µg/m^3 [g]	--	Same as primary standard
	24-hour	50 µg/m^3	150 µg/m^3	Same as primary standard
$PM_{2.5}$	Annual Arithmetic Mean	12 µg/m^3[g]	15 µg/m^3[f]	Same as primary standard
	24-hour	--	35 µg/m^3[f]	Same as primary standard
Lead	30-day	1.5 µg/m^3	--	--
	Quarterly	--	1.5 µg/m^3	Same as primary standard
Sulfates	24-hour	25 µg/m^3	--	--
Hydrogen sulfide	1-hour	0.03 ppm (42 µg/m^3)	--	--
Vinyl chloride	24-hour	0.01 ppm (26 µg/m^3)	--	--
Visibility reducing particles	8-hour (10 a.m. to 6 p.m., Pacific Standard Time)	In a sufficient amount to produce an extinction coefficient of 0.23 per kilometer-visibility of 10 miles or more due to particles when the relative humidity is less than 70 percent.	--	--

Notes: (a) California standards for ozone, carbon monoxide, sulfur dioxide (1 hour and 24 hour), nitrogen dioxide, PM_{10}, $PM_{2.5}$, and visibility reducing particles are values that are not to be exceeded. The sulfates, lead, hydrogen sulfide, and vinyl chloride standards are not to be equaled or exceeded.

(b) National standards (other than ozone, particulate matter, and those based on annual averages or annual arithmetic mean) are not to be exceeded more than once a year. The ozone standard is attained when the fourth highest 8-hour concentration in a year, averaged over 3 years, is equal to or less than the standard. For PM_{10}, the 24-hour standard is attained when 99 percent of the daily concentrations, averaged over 3 years, are equal to or less than the standard. For $PM_{2.5}$, the 24-hour standard is attained when 98 percent of the daily concentrations, averaged over 3 years, are equal to or less than the standard. Contact the U.S. EPA for further clarification and current federal policies.

(c) Concentrations are expressed first in units in which they were promulgated. Equivalent units given in parentheses are based on a reference temperature of 25 degrees Celsius (°C) and a reference pressure of 760 millimeters (mm) of mercury. All measurements of air quality are to be corrected to a reference temperature of 25°C and a reference pressure of 760 mm of mercury (1,013.2 millibar); ppm in this table refers to parts per million by volume, or micromoles of pollutant per mole of gas.

(d) National Primary Standards: The levels of air quality necessary, with an adequate margin of safety to protect the public health.

(e) National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of pollutant.

(f) New federal 8-hour ozone and $PM_{2.5}$ standards were promulgated by the U.S. EPA on July 18, 1997. Contact U.S. EPA for further clarification and current federal policies.

(g) On June 20, 2003, the CARB approved the recommendations to revise the PM_{10} annual average standard to 20 µg/m^3 and to establish an annual average standard for $PM_{2.5}$ of 12 µg/m^3. These standards will take effect upon final approval by the Office of Administrative Law.

µg/m^3 = micrograms per cubic meter
$PM_{2.5}$ = particulate matter equal to or less than 2.5 microns in diameter
PM_{10} = particulate matter equal to or less than 10 microns in diameter
ppm = parts per million

Vandenberg AFB. Given the distance of the impact area from the shoreline, it is anticipated that impacts would likely be restricted to surface waters (i.e., waters above the thermocline where sea surface temperatures range between 10 degrees [˚] Celsius [C] to 26˚ C [50˚ Fahrenheit (F) to 79˚ F]) with minimal impact to deeper water and seafloor organisms. In addition, because the impact area would be at least 10 km (6 miles) off the coast, minimal debris is anticipated to drift to shore. As such, surface waters in the offshore area are the primary focus for biological resources of concern for this EA. Anomalies related to the impact event, such as flight termination resulting in LFTS target missile debris falling to the ocean prematurely, are not planned events and are not addressed in this EA.

Based on the premise that the ROI focuses on surface waters in the LFTS target missile impact area at least 10 km (6 miles) off the coast, primary biological resources that could be impacted include a variety of at-sea organisms. Potentially affected aquatic animals include a number of threatened and endangered species. For discussion purposes, the biological resources are separated into the following sections: aquatic plants and animals (subsections for plankton, fish, seabirds, marine mammals, and sea turtles), threatened and endangered species, and sensitive habitats. Relevant legislation pertaining to biological resources in the offshore surface waters beyond the 4.8-km (3-mile) limit is briefly discussed below.

The Fishery Conservation and Management Act (16 U.S.C. 1801-1882; 90 Stat. 331) provides legislative authority to the NOAA Fisheries Service for fisheries regulations in the United States in the area between 4.8 and 322 km (3 and 200 miles) offshore. The Pacific Fishery Management Council covers the area offshore of the states of California, Oregon, and Washington. Councils prepare Fishery Management Plans that are submitted to the NOAA Fisheries Service for approval. As amended and reauthorized in 1996 in the Magnuson-Stevens Fishery Conservation and Management Act (Public Law [P.L.] 104-297), the act was changed extensively by amendments called the Sustainable Fisheries Act. Among other changes, the amendments emphasize the importance of habitat protection to healthy fisheries and strengthen the ability of the NOAA Fisheries Service and Councils to protect the habitat needed by the fish that are managed. The habitat is called “Essential Fish Habitat” (EFH) and is broadly defined to include those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.

The Endangered Species Act (16 U.S.C. Sections 1531-1544) is intended to protect, maintain, and restore ecosystems upon which threatened and endangered species depend, to provide for the conservation of threatened and endangered species, and to take steps appropriate to achieve these purposes.

The Migratory Bird Treaty Act (16 U.S.C. Sections 703-712) stipulates that all migratory birds and their parts (including eggs, nests, and feathers) are fully protected. The Act implements the United States' commitment to four international conventions (with Canada, Japan, Mexico, and Russia) for the protection of a shared migratory bird resource. Each of the conventions protects selected species of birds that are common to any two or more countries.

The Marine Mammal Protection Act (16 U.S.C. 1361-1407, P.L. 92-522, October 21, 1972, 86 Stat. 1027) established a Federal responsibility to conserve marine mammals with management vested in the Department of Interior for the sea otter and the Department of Commerce for cetaceans and pinnipeds, other than the walrus. The 1976 amendments (P.L. 94-265) clarified the offshore jurisdiction of the statute as the 200-mile Exclusive Economic Zone. The Marine Mammal Protection Act Amendments of 1994 (P.L. 103-238, April 30, 1994, 108 Stat. 532) clarify that the Secretary of Commerce has the authority to protect essential marine mammal habitat.

The Marine Protection Research and Sanctuaries Act (P.L. 92-532; October 23, 1972; 86 Stat. 1052 and 1061. Titles I and II are codified at 33 U.S.C. 1401-1445. Title III is codified at 16 U.S.C. 1431-1445) includes a provision that authorizes the Secretary of Commerce to coordinate a research and monitoring program with U.S. EPA and the U.S. Coast Guard that is designed as a long-term research program to study the "possible long-range effects of pollution, overfishing, and man-induced changes of ocean ecosystems."

The Sikes Act (16 U.S.C. 670a-670o, 74 Stat. 1052), as amended (P.L. 86-797, approved September 15, 1960) provides for cooperation by the Departments of the Interior and Defense with State agencies in planning, development, and maintenance of fish and wildlife resources on military reservations throughout the United States.

3.6.1 Aquatic Plants and Animals

Aquatic plants and animals in the affected environment of the offshore surface waters of the expected ABL debris fallout area consist of a range of plants and animals including plankton, fish, seabirds, marine mammals, and sea turtles. The following provides information for each of these biological resource groups. Appendix A contains a discussion of species that could possibly occur with the ROI.

3.6.1.1 Plankton.

Organisms that are unable to maintain their distribution against the movement of water masses are referred to as “plankton.” Primary plankton groups of interest in offshore surface waters include phytoplankton (plants) and zooplankton (animals). Characteristics of phytoplankton and zooplankton in the ROI and the Southern California Bight in particular are described in Hardy (1993) and Dawson and Pieper (1993).

Briefly, phytoplankton are generally small, unicellular or colonial plants that utilize carbon dioxide (present as dissolved bicarbonate in seawater) and light energy to create more complex organic compounds through photosynthesis. The process is termed primary production. Phytoplankton and their primary production generally form the base of the marine food web in surface waters. Primary production from phytoplankton supports grazing zooplankton, fish, and, through their decay, marine bacteria. Production of zooplankton generally depends on both the quantity and quality of their phytoplankton food supply. For example, fecundity (egg production) of zooplankton in the Southern California Bight has been determined to depend on the nutritive value (i.e., nitrogen content) of phytoplankton on which they feed. Fish production, in turn, can be dependent on the growth and productivity of phytoplankton and zooplankton. Empirical indices indicate that fishery yield can increase exponentially with increasing primary production in a variety of marine and freshwater environments. Furthermore, spatial and temporal patterns of phytoplankton occurrence are important to fisheries. The success of larval fish and their subsequent recruitment into an adult fish population often depend on spatial and temporal co-occurrence of fish larvae with an abundance of their plankton food source.

Primary production in the Southern California Bight is strongly influenced by basic physical processes, including wind, which affect both the stability of the water column and subsequent mixing and nutrient input to the euphotic zone [uppermost layer of water that receives sufficient light for photosynthesis]. These processes change on a variety of temporal and spatial scales. An important controlling process is the advection of nutrient-rich, lower-salinity water from the north in the offshore, southerly flow of the California Current System. Time series data indicate that the strength of this cold current flow is positively correlated with increasing plankton biomass. In addition, the upward transport of denser subsurface water during seasonal upwelling along the coast brings nutrient-rich cold water to the surface to support seasonal and localized primary production events. In general, plankton abundance and primary production in the area of the Southern California Bight are higher nearshore than offshore.

3.6.1.2 Fish.

Approximately 480 species of fish inhabit the Southern Californian Bight (Cross and Allen, 1993). The great diversity of species in the area occurs for several reasons: 1) the ranges of many temperate and tropical species extend into and terminate in the Southern Californian Bight; 2) the area has complex bottom topography and a complex physical oceanographic regime that includes several water masses and a changeable marine climate (Horn and Allen, 1978; Cross and Allen, 1993); and 3) the islands and nearshore areas provide a diversity of habitats that include soft bottom, rock reefs, extensive kelp beds, and estuaries, bays, and lagoons.

Point Conception is recognized as a boundary for the distribution of certain fish species, especially for southern species (Cross and Allen, 1993). South of Point Conception, northern species tend to move into deep, colder water or upwelling areas. A few southern species occupy warm nearshore habitats such as bays and estuaries north of Point Conception. There are also seasonal migrations of temperate and subtropical species into the Southern Californian Bight and invasions of tropical species during warm-water years and northern species during cold-water years (Cross and Allen, 1993).

Midwater or mesopelagic fish are pelagic and inhabit depths of 50 to 600 meters (164 to 1,969 feet). Many of these fish are strong swimmers; they migrate to surface waters each night and return to deep water during the day; have well developed eyes, swim bladders, and photophores; and are countershaded. In contrast, bathypelagic fish that inhabit the deepest waters are generally weak swimmers; have no or reduced eyes, swim bladders, and photophores; and are black or brown in color (Brown, 1974).

There are about 120 species of midwater fishes in the Southern Californian Bight. Only a small percentage of them are important species commercially. Northern species are associated with the lower mesopelagic zone where Pacific subarctic water is the dominant water mass and are most common in winter and spring when intrusions of this northern water mass are greatest. Southern species are most common during summer and fall when water of southern origin intrudes. Central Pacific species are represented by only a few species (Cross and Allen, 1993).

Within the general area of the Southern California Bight, sampling in three deep-water areas indicated that three to nine species accounted for approximately 90 percent of individuals taken in each of the Santa Barbara Basin, the Santa Cruz Basin, and the Rodriguez Dome area (Brown, 1974). The depth ranges of some epipelagic (upper dwelling) and demersal (bottom dwelling) species or their juvenile or larval stages extend into the mesopelagic zone. These species include Pacific hake (*Merluccius productus*), Pacific mackerel (*Scombar japonicus*), swordfish (*Xiphias gladius*), and sablefish (*Anoplopoma fimbria*).

3.6.1.3 Seabirds.

The Southern California Bight in general comprises critical habitat for numerous seabird species. More than 195 species of birds in general use coastal or offshore aquatic habitats in the Bight, and more than 20 species of seabirds breed in the Bight, primarily in the California Channel Islands (Mason et al., 2004). The Southern California Bight is the only region in California supporting breeding brown pelicans (*Pelecanus occidentalis*), black storm-petrels (*Oceanodroma melania*), and xantus' murrelets (*Synthliboramphus hypoleucus*). The region also contains almost half of the world population of ashy storm-petrels (*Oceanodroma homochroa*). In addition, numerous seabirds migrate through or winter in the Southern California Bight region. Population numbers are not accurately documented; however, breeding birds number in the thousands and migratory populations number in the millions.

In general, seabirds, together with sea ducks (scoters), loons, and grebes, constitute the greatest biomass of birds that use the Southern California Bight. Of the seabirds, the shearwaters, storm-petrels, phalaropes, gulls, terns, and auklets are generally the most numerous.

Based on seabird surveys conducted in the early 1990s, populations of several species of seabirds were reported to increase compared with the 1970s, including populations for brown pelicans, cormorants, and western gulls (*Larus occidentalis*), but populations for other seabirds were reported to decrease, including populations for cassin's auklets (*Ptychoramphus aleuticus*) and xantus' murrelets.

In a survey conducted from May 1999 to January 2002 (Mason et al., 2004), 54 species of seabirds comprising 12 families and 135,545 birds were identified for the Southern California Bight. Seabird densities were greater along island and mainland coastlines than at sea and were usually greatest during January surveys. Seabird densities at sea were greatest near the northern Channel Islands during January and north of Point Conception during May and lowest at sea in the southwestern portion of the study area in all survey months.

On coastal transects, seabird densities were greatest along central and southern portions of the mainland coastline from Point Arguello to Mexico. Estimates indicated absolute numbers of 981,000 ± 144,000 seabirds (mean ± 1 standard error) in the region during January, 862,000 ± 95,000 during May, and 762,000 ± 172,000 during September.

On at-sea transects, California gulls, western grebes (*Aechmophorus occidentalis*), and casssin's auklets were most abundant during January surveys, whereas sooty shearwaters (*Puffinus griseus*), phalaropes, and western gulls (*Larus occidentalis*) were most abundant during May and September surveys. On coastal transects, California gulls (*Larus californicus*), western grebes, western gulls, and surf scoters (*Melanitta perspicillata*) were most abundant during January; western grebes, western gulls, surf scoters, and brown pelicans were most abundant during May; and sooty shearwaters, western gulls, western grebes, brown pelicans, and Heermann's gulls (*Larus heermanni*) were most abundant during September. Estimated seabird abundance for all species from the 1999 to 2002 survey compared to surveys in 1975 to 1978 and 1980 to 1983 indicated reductions in overall numbers of 14%, 57%, and 42% during January, May, and September, respectively. Notable species with reduced densities from 1999 to 2002 compared to 1975 to 1978 and 1980 to 1983 included common murres (*Uria aalge*; 75% in each season), sooty shearwaters (55% during May and 27% during September), and Bonaparte's gulls (*Larus philadelphia*; 95% in each season). Conversely, species with increased densities included brown pelicans (167%), xantus' murrelets (125%), cassin's auklets (100%), ashy storm-petrels (450%) and western gulls (55%) during May, and Brandt's cormorants (450%) during September.

Migratory birds addressed by the Migratory Bird Treaty Act and potentially present in the general area of the ROI include species such as the western or Clark's grebe (*Aechmophorus clarkii*), sooty shearwater, Leach's storm-petrel (*Oceanodroma leucorhoa*), ashy storm-petrel, black storm-petrel (*Oceanodroma melania*), brown pelican (*Pelecanus occidentalis*), Brandt's cormorant (*Phalacrocorax penicillatus*), double-crested cormorant (*Phalacrocorax auritus*), pelagic cormorant (*Phalacrocorax pelagicus*), red-necked phalarope (*Phalaropus lobatus*), red phalarope (*Phalaropus fulicaria*), western gull, California gull, surf scoter, xantus' murrelet, and cassin's auklet (*Ptychoramphus aleuticus*) (Orthmeyer et al., 2000; Mason et al., 2004).

3.6.1.4 Marine Mammals.

At least 34 species of marine mammals have been identified from sightings or strandings in the Southern California Bight (Bonnell and Dailey, 1993). These include various members of the Order Cetacea for toothed whales (*Suborder Odontoceti*) and baleen whales (*Suborder Mysticeti*), as well as members of the Order Carnivora for seals and sea lions (*Suborder Pinnipedia*) and sea otters (*Suborder Fissipedia*).

Some of the species are migrants that pass through the area on their way to calving or feeding grounds located elsewhere. Some are seasonal visitors that remain for only a few weeks to exploit a particular food resource. Other species have resident populations in the area for many months or year-round. At least nine species generally can be found in the study area in moderate or high numbers either year-round or during annual migrations into or through the area. These include the Dall's porpoise (*Phocoenoides dalli*), Pacific white-sided dolphin (*Lagenorhynchns obliquidens*), Risso's dolphin (*Grampus griseus*), bottlenose dolphin (*Tursiops truncatus*), short-beaked and long-beaked common dolphins (*Delphinus delphis* and *D. capensis*), northern right whale dolphin (*Lissodelphis borealis*), Cuvier's beaked whale (*Ziphius cavirostris*), and gray whale (*Eschnchtius robustus*).

Several species of whales that occur in the general area are listed as federally threatened or endangered. The northern right whale (*Eubalaena glacialis*), humpback whale (*Megaptera novaeangliae*), blue whale (*Balaenoptera musculus*), fin whale (*Balaenoptera physalus*), and sei whale (*Balaenoptera borealis*) are currently federally listed as endangered species and protected by the Endangered Species Act of 1973 (16 U.S.C. § 1531) (Braham 1991). The gray whale (*Eschrichtius robustus*) has been removed from the endangered list due to an increase in population numbers (National Marine Fisheries Service, 1993).

The southern sea otter (*Enhydra lutris nereis*), Stellar sea lion (*Eumetopias jubatus*), and Guadalupe fur seal (*Arctocephalns townsend*) are listed as a federally threatened species that occurs along the coast of central California; however, they are rarely seen in offshore waters of the Western Range (i.e., where debris would impact the ocean).

Marine mammals are protected by the Marine Mammal Protection Act. Several of the federally listed endangered species have also been listed as "strategic stocks" under the Marine Mammal Protection Act. The specific definition of a "strategic stock" is complex, but in general it is a stock in which human activities may be having a deleterious effect on the population and may not be sustainable. The stocks of blue, fin, Sei, and humpback whales occurring off California are considered "strategic" (Barlow et al., 1997). In addition, the California stock of the sperm whale (*Physeter macrocephalus*) has been designated as "strategic."

The California sea lion (*Zalophus californianus*), northern fur seal (*Callorhinus ursinus*), northern elephant seal (*Mirounga angustirostris*), and harbor seal (*Phoca vitulina*) use the northern Channel Islands as haul-out (nesting), mating, and pupping areas. Harbor seals haul-out at a total of 19 sites between Point Sal and Jalama Beach along the mainland coast. Purisima Point and Rocky Point are the primary haul-out sites on Vandenberg AFB. The NOAA Fisheries Service reissued Vandenberg AFB a 5-year letter of authorization in 2004 for the incidental take of marine mammals for programmatic operations on the base. This authorization allows limited exposure of pinnipeds to missile launches and aircraft/helicopter overflights.

3.6.1.5 Sea Turtles.

Four species of sea turtles may occur in the general area of the ROI for the ABL test activities: juvenile loggerhead (*Caretta caretta*), leatherback (*Dermochelys coriacea*), green or black (*Chelonia mydas* and *C. agassizii*, respectively), and olive ridley (*Lepidochelys olivacea*). The black sea turtle is possibly only a subspecies of the green sea turtle (Pritchard, 1997). Loggerhead and green/black sea turtles may be encountered in the ROI year-round, but the highest frequency of occurrence is during summer. Leatherbacks are rarely encountered in the ROI during winter, but are the most common sea turtle during summer. Olive ridley sea turtles are rarely encountered.

The distribution of sea turtles is strongly affected by seasonal changes in ocean temperature (Hubbs, 1960; Radovich, 1961). In general, sightings increase during summer as warm water moves northward along the coast (Stinson, 1984). Sightings may also be more numerous in warm years compared to cold years.

Young loggerhead, green/black, and olive ridley sea turtles are believed to move offshore into open ocean convergence zones where abundant food attracts sea turtles and other predators (Carr, 1987; National Research Council, 1990; NMFS/USFWS, 1996a, b; Hunter and Mitchel, 1966; Gooding and Magnuson, 1967). An eastern tropical Pacific survey reported that sea turtles were present during 15 percent of observations in flotsam habitats. Over 60 percent of green/black and olive ridley sea turtles observed in California waters were in waters less than 50 meters (164 feet) in depth (Stinson, 1984). Green/black sea turtles were often observed along shore in areas of eelgrass. Loggerhead and leatherback sea turtles were observed over a broader range of depths out to offshore areas with water depths of 1,000 meters (3,280 feet). When sea turtles reach subadult size, they move to the shallow, nearshore benthic feeding grounds of adults (Carr, 1987; National Research Council, 1990; NMFS/USFWS, 1996a, b). Aerial surveys off California, Oregon, and Washington have shown that most leatherbacks occur in slope waters and that few occur over the continental shelf (Eckert 1993). Tracking studies have shown that migrating leatherback sea turtles often travel parallel to deepwater contours ranging in depth from 200 to 3,500 meters (660 to 11,500 feet) (Morreale et al., 1994).

In general, green/black and olive ridley sea turtles occupy shallow nearshore zones and pelagic leatherbacks and juvenile loggerheads may be found over all water depths. However, sea turtles typically remain submerged for several minutes to several hours depending upon their activity state (Standora et al., 1984). Long periods of submergence complicate detection and census estimates.

3.6.2 Threatened and Endangered Species

A number of federally-listed threatened and endangered species are potentially present in offshore surface waters of the ABL debris impact area (U.S. Fish and Wildlife Service, 2005). These species include the Pacific brown pelican (*Pelecanus occidentalis*), six species of whales (Sei whale [*Balaenoptera borealis*], finback whale [*Balaenoptera physalus*], blue whale [*Balaenoptera musculus*], humpback whale [*Megaptera novaeangliae*], sperm whale [*Physeter catodon* [=*macrocephalus*]], and right whale [*Balaena glacialis*]); the southern sea otter (*Enhydra lutris nereis*), Stellar sea lion, and Guadalupe fur seal; and four species of sea turtles (loggerhead [*Caretta caretta*], leatherback [*Dermochelys coriacea*], green or black [*Chelonia mydas* and *C. agassizii*, respectively], and olive ridley [*Lepidochelys olivacea*]) (Orthmeyer et al., 2000; Mason et al., 2004; Pierson et al., 2004; California Coastal Commission, 2002).

A letter was sent to the USFWS and NOAA Marine Fisheries Service as required for initiation of informal consultation under Section 7 of the Federal Endangered Species Act. In response, the USFWS has indicated that it concurs with the determination that testing the ABL may affect, but is unlikely to adversely affect threatened and endangered species (Appendix C). A response letter from NOAA Marine Fisheries requested further clarification of ABL debris management activities (Appendix C). These comments were addressed and the NOAA Marine Fisheries Service has concurred with the MDA determination that the Proposed Action is not likely to adversely affect any listed species (Appendix C).

3.6.3 Sensitive Habitats

The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA; 16 U.S.C. §§ 1801 - 1882) were implemented "to identify and protect important marine and anadromous fish habitat." In accordance with these amendments, NOAA Fisheries Service has developed Fishery Conservation Management Plans that identify EFH. EFH is defined in the MSFCMA as "...those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." The MSFCMA requires federal agencies to consult with the NOAA Fisheries Service to ensure that their actions do not adversely affect EFH.

Three EFH zones have been identified off the west coast of the United States: 1) Coastal Pelagic, 2) Groundfish, and 3) Pacific Salmon. Two of the three EFH zones (Coastal Pelagic and Groundfish) occur in the general ROI for the ABL test activities because the EFH zones extend from the coastline out to 322 km (200 miles) offshore. The Coastal Pelagic EFH includes surface waters or, more specifically, waters above the thermocline where sea surface temperatures range between 10° C to 26° C (50° F to 79° F). Therefore, the offshore components of the Coastal Pelagic EFH are in the debris fallout zone for ABL testing activities. The Groundfish EFH includes benthic habitat and surface waters along the immediate coastline.

The coastline from Point Sal to Rocky Point has been designated as a marine ecological reserve (see Figure 1-1). This reserve includes a beach area south of Rocky Point used by harbor seals as haul-out and pupping areas. Vandenberg AFB and the California Department of Fish and Game have a Memorandum of Agreement (MOA) to limit access to this area to scientific research and military operations (U.S. Air Force, 1998a; California Fish and Game Commission, 2007).

4.0 ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

This chapter presents the results of the analysis of potential environmental effects from implementing the proposed debris management actions, including the Proposed Action and the No-Action Alternative. Changes to the natural and human environments that may result from the Proposed Action and No-Action Alternative were evaluated relative to the existing environment as described in Chapter 3.0. The potential for significant environmental consequences was evaluated utilizing the context and intensity considerations as defined in CEQ regulations for implementing the procedural provisions of NEPA (40 CFR Part 1508.27).

4.2 COMPARISON OF ENVIRONMENTAL CONSEQUENCES

Table 4-1 presents a comparative analysis of the Proposed Action and No-Action Alternative for each resource (i.e., health and safety, hazardous waste management, water resources, air quality, and biological resources) evaluated in this EA. A more detailed discussion of potential effects follows. Neither the Proposed Action nor the No-Action Alternative is anticipated to have a significant impact on the environment.

4.3 HEALTH AND SAFETY

As discussed under the affected environment, and evaluated in the Supplemental EIS for the Airborne Laser Program, Vandenberg AFB has established procedures in place to ensure a safe environment to conduct ABL flight-test activities. Restricted airspace areas would be controlled according to EWR 127-1 Range Safety Requirements, Safety Operating Instructions, 30 SW regulations, and FAA directives and regulations. Notice to Mariners and Notice to Airmen would be disseminated. Established procedures exist and would be implemented related to evacuating or sheltering personnel on off-shore oilrigs during launch operations. Any state and county beaches potentially affected during launch activities would be closed.

The trajectory of the target missiles would be such that the missile and any debris from the destruction of the missile during test activities would occur at least 10 km (6 miles) from the coastline (see Figures 2-4 to 2-7).

4.3.1 Proposed Action

4.3.1.1 Range Clearance.

An aircraft (equipped with FLIR radar) would take off from Vandenberg AFB prior to launching the LFTS target missile to aid in surface clearance of the anticipated debris impact area. This aircraft would continue surface clearance until required to vacate the hazard area, at which time the aircraft would either return to the

Table 4-1. Summary of Environmental Impacts
Page 1 of 4

Resource	Proposed Action	No-Action Alternative
Health and Safety	**Impact** • Operation of the range clearance aircraft and debris boat would be conducted in accordance with established standard operating procedures and would not be operated during adverse weather/ocean conditions • Floating debris and LFTS fuel/oxidizer released would have several potential hazards associated with debris assessment actions including: lowered pH, fuel remaining in LFTS tanks, and potential to cut or puncture the skin of debris assessment personnel • The pH of the ocean would be lowered in the immediate vicinity of the release for approximately 5 hours; over this 5-hour period, the oxidizer plume could migrate approximately 3.2 km (2 miles) to the south or 1 km (0.6 mile) towards shore and the pH of the water would return to non-hazardous levels • Based on the debris migration modeling and debris destruction actions, LFTS target missile debris is not anticipated to reach the shore or the Channel Islands. Shore evaluations would be conducted over three days post intercept to ensure the public is safe from the possibility of debris washing ashore • Personnel involved in assessment of debris would wear appropriate PPE for both debris hazards (e.g., sharp edges, chemicals) and ocean hazards (e.g., cold water, drowning). Should an intact tank of oxidizer be identified, additional PPE (including appropriate respiratory protection) would be used • Appropriate measures would be in place to ensure the health and safety of personnel involved in debris assessment and to ensure no harm to the general public would occur; therefore, no significant impact to health and safety are anticipated **Management** • Appropriate safety measures would be implemented during LFTS target missile debris assessment activities	**Impact** • Potential health and safety impacts would be similar to those described under the Proposed Action • No observation and no debris destruction would occur • Debris management activities associated with operation of the debris boat would not be conducted • Operation of the range clearance aircraft would be conducted in accordance with established standard operating procedures and would not be operated during adverse weather conditions **Management** • Debris is not anticipated to reach the shore or Channel Islands; however, shoreline evaluations would be implemented to ensure the public is safe from the possibility of debris washing ashore

Table 4-1. Summary of Environmental Impacts
Page 2 of 4

Resource	Proposed Action	No-Action Alternative
Hazardous Waste Management	**Impact** • The RQ for nitric acid (454 kg or 1,000 pounds) and for nitrogen dioxide (4.5 kg or 10 pounds) would be exceeded • Because the estimated quantity of kerosene fuel (223 liters or 59 gallons) that could be released would likely result in a “visible sheen” on the surface of the water, CERCLA reporting for petroleum products releases would be triggered • The pH of the ocean would be lowered in the immediate vicinity of the release for approximately 5 hours; over this 5-hour period, the oxidizer plume could migrate approximately 3.2 km (2 miles) to the south or 1 km (0.6 mile) towards shore and the pH of the water would return to non-hazardous levels • Over a 24-hour period the debris could migrate approximately 27 km (17 miles) to the south or approximately 6.4 km (4 miles) towards the shore • Management of any hazardous wastes in accordance with applicable regulations would preclude any significant impacts **Management** • No management measures would be required	**Impact** • Potential impacts would be similar to that described under the Proposed Action • Because no observation or destruction of LFTS target missile debris would occur, there is a possibility that debris could reach the shore and/or the Channel Islands **Management** • Shoreline evaluations would be implemented to identify any debris that washes ashore • Any debris that washes ashore would be disposed in accordance with applicable regulations

Table 4-1. Summary of Environmental Impacts
Page 3 of 4

Resource	Proposed Action	No-Action Alternative
Water Resources	**Impact** • Temporary impacts in water quality would occur from release of fuel/oxidizer • The pH of the ocean would be lowered in the immediate vicinity of the release for approximately 5 hours; over this 5-hour period, the oxidizer plume could migrate approximately 3.2 km (2 miles) to the south or 1 km (0.6 mile) towards shore and the pH of the water would return to nonhazardous levels **Management** • No management measures would be required	**Impact** • Potential impacts to water resources would be the same as those described under the Proposed Action **Management** • No management measures would be required
Air Quality	**Impact** • Debris management activities would result in short-term air quality impacts • Total emissions from debris management activities include 0.49 tpy of VOCs and 4.52 tpy of NO_X, and 0.22 tpy of PM_{10} • Emissions associated with debris management activities would not hinder maintenance of the CAAQS or NAAQS • Debris boat operations would be permitted in accordance with SBCAPCD Rule 201 and 202 **Management** • No management measures would be required	**Impact** • Potential air quality impacts would be similar to those described under the Proposed Action • Debris management activities associated with operation of the debris boat would not be conducted; the clearance/monitoring aircraft would be used prior to and after LFTS target missile launch • Total emissions from debris management activities include 36 kg/yr (0.04 tpy) of VOCs and only almost no emissions of NO_X **Management** • No management measures would be required

Table 4-1. Summary of Environmental Impacts
Page 4 of 4

Resource	Proposed Action	No-Action Alternative
Biological Resources	**Impact** • Potential impacts to aquatic plants and animals in surface waters of the offshore ABL impact area would likely be of limited spatial extent and duration (i.e., chemicals would relatively rapidly dilute in the water column, evaporate to the atmosphere, and degrade/disappear based on anticipated half-lives of days to weeks in surface waters) • Relatively low log K_{ow} values favor low bioaccumulation in aquatic organisms that could serve as forage items for higher tropic level consumers such as seabirds, marine mammals, and sea turtles • Solid debris (e.g., metal and plastic debris from missile parts) may be harmful to exposed organisms due to entanglement (leading to drowning or strangulation) or physical injury (e.g., cuts, bruises, etc.) • Shoreline evaluations would be implemented to identify and remove any debris that washes ashore • Experienced biological monitors would participate in the shoreline evaluations to determine if any damage/impact to shoreline environments occurred, to monitor debris disposal actions (if necessary), and to identify any potentially affected species that have come ashore after making contact with floating debris or fuel/oxidizer **Management** • The USFWS and NOAA Fisheries Service have been consulted regarding potential effects to biological resources from implementation of proposed debris management activities, and recommendations from these agencies will be considered prior to implementing debris management activities	**Impact** • Potential impacts to biological resources would be similar to those described under the Proposed Action **Management** • Debris is not anticipated to reach the shore or Channel Islands; however, shoreline evaluations would be implemented to identify and remove any debris that washes ashore • Experienced biological monitors would participate in the shoreline evaluations to determine if any damage/impact to shoreline environments occurred, to monitor debris disposal actions (if necessary), and to identify any potentially affected species that have come ashore after making contact with floating debris or fuel/oxidizer

CAAQS = California Ambient Air Quality Standards
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
EFH = Essential Fish Habitat
km = kilometer
K_{ow} = octanol-water partition coefficient
LFTS = Liquid Fueled Target System
NAAQS = National Ambient Air Quality Standards
NOAA = National Oceanic & Atmospheric Administration
NO_X = nitrogen oxide
pH = hydrogen ion concentration
PPE = personal protection equipment
RQ = reportable quantity
SBCAPCD = Santa Barbara County Air Pollution Control District
tpy = tons per year
USFWS = U.S. Fish and Wildlife Service
VOC = volatile organic compound

Vandenberg AFB airfield (if time allows) or move to a position outside the hazard area established by the range safety officer.

The debris boat would be stationed outside the boat exclusion zone established by the range safety officer. The debris boat would not port at Vandenberg AFB.

The range clearance aircraft and debris boat operations would be conducted in accordance with established standard operating procedures and would not be operated during adverse weather/ocean conditions; therefore, no significant impact to the human environment are anticipated from their operation.

4.3.1.2 Debris Tracking.

The debris boat would be stationed outside the exclusion zone during ABL test activities and use of the boat during adverse weather conditions would not occur. As a result, no significant impact to the human environment is anticipated.

4.3.1.3 LFTS Debris Assessment.

Drifter data from the Scripps Institute was utilized to determine the potential movement of the debris after it reaches the ocean. Of the trajectories of 18 drifters deployed near the anticipated impact site, the four drifter trajectories (R-315, R-452, R-539, and R-352) that represent potential drift either furthest south or nearest to the coast are presented in Figure 4-1.

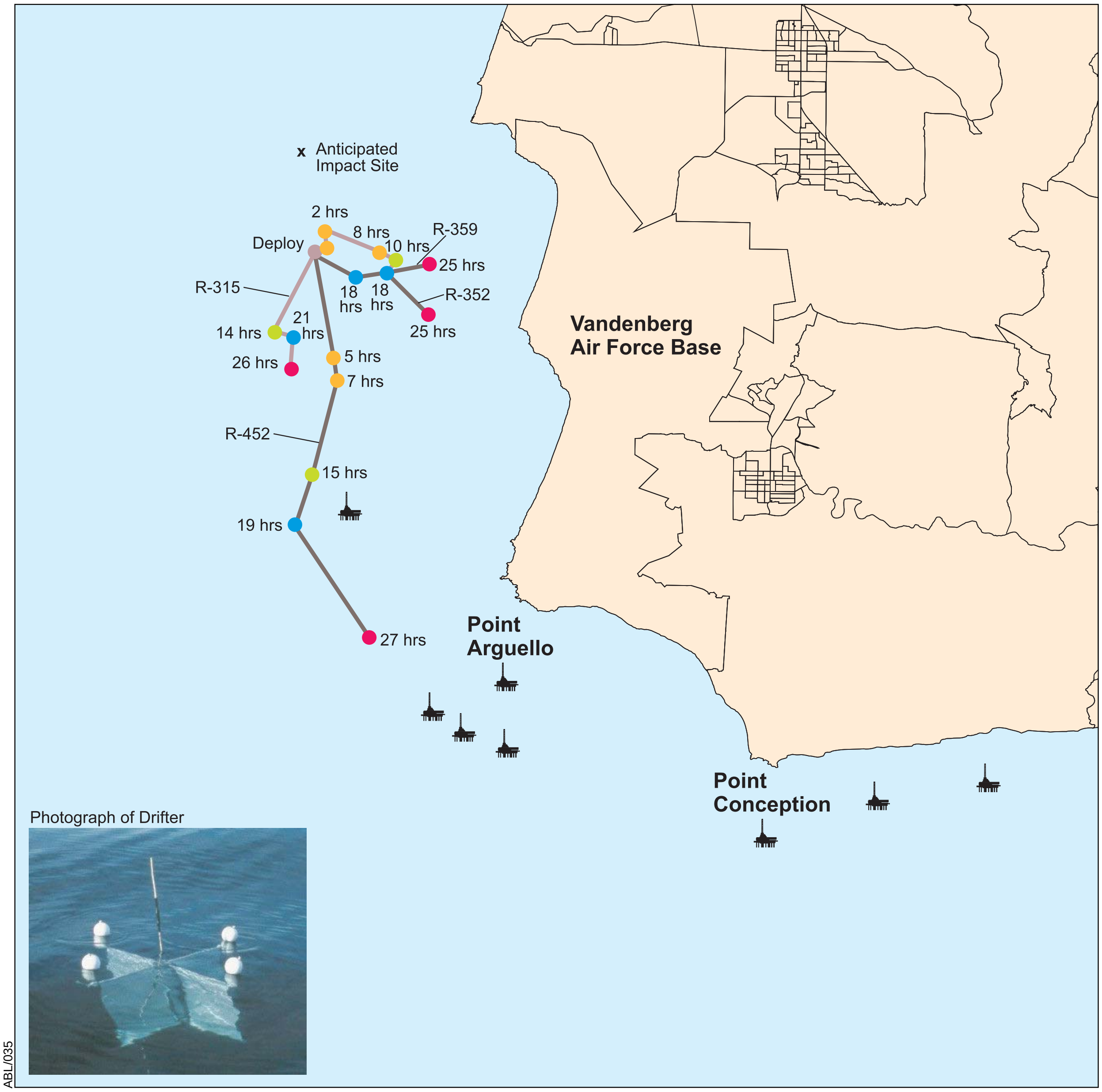
Based on this drifter data, debris modeling was conducted to evaluate several aspects of the LFTS target missile debris:

- Migration of the debris and fuel/oxidizer once it is in the ocean
- Extent of migration after 24 hours
- Expected concentration at various time periods.

Floating debris and LFTS fuel/oxidizer released would have several potential hazards associated with debris assessment actions including:

- Lowered pH of the ocean water
- Potential fuel remaining in LFTS tanks
- Potential to cut or puncture the skin of debris assessment personnel.

Based on modeling and calculations, the pH of the ocean would be lowered to the point of being hazardous in the immediate vicinity of the release for approximately 5 hours. Over a 5-hour period, the oxidizer plume could migrate approximately 3.2 km (2 miles) to the south or 0.8 km (0.5 mile) towards shore and the pH of the water would return to nonhazardous levels. Over a 24-hour period the debris could migrate approximately 27 km (17 miles) to the south or approximately 6.4 km (4 miles) towards the shore (see Figure 4-1). After a 24-hour period, modeling of the debris migration becomes highly speculative due to numerous factors affecting the drift of material.



EXPLANATION

Drifter Transmission Points Time (hours)

- 0
- 1-8
- 9-16
- 17-24
- 25-32

R-452 Drifter Trajectory
R-315 Drifter Trajectory
R-352 Drifter Trajectory
R-539 Drifter Trajectory
Oil Platform

0 2.75 5.5 Miles
0 1.7 3.4 km

Estimated Debris Migration

Figure 4-1

Based on the debris migration modeling and debris assessment actions, LFTS target missile debris is not anticipated to reach the shore or the Channel Islands. However, shore evaluations would be conducted over three days after intercept to ensure the public is safe from the possibility of debris washing ashore.

Because the pH of the water would be lowered in the immediate vicinity of the debris, safety is a critical factor in conducting debris assessment. Due to the oxidizer reactivity with water and potential pH concerns, divers would not be placed into the water.

Personnel involved in assessment of debris would require appropriate PPE for both debris hazards (e.g., sharp edges, chemicals) and ocean hazards (e.g., cold water, drowning). No inhalation hazard is anticipated from the debris. However, should an intact tank of oxidizer be identified, additional PPE (including appropriate respiratory protection) would be used.

Appropriate measures would be in place to ensure the health and safety of personnel involved in debris assessment activities and to ensure no harm to the general public would occur; therefore, no significant impact to health and safety are anticipated.

Management Measures. Appropriate safety measures as discussed above would be implemented during LFTS target missile debris assessment activities; therefore, no adverse impacts are expected.

4.3.2 No-Action Alternative

Under the No-Action Alternative, ABL test activities would be conducted; however, no observation and no debris destruction would occur.

Target/debris tracking and debris assessment and disposal activities would not occur under the No-Action Alternative. Debris management activities associated with operation of the debris boat (i.e., buoy placement and debris observation, photography, and destruction) would not be conducted under the No-Action Alternative.

4.3.2.1 Range Clearance.

As discussed under the Proposed Action, an aircraft would take off from Vandenberg AFB prior to launching the LFTS target missile to aid in surface clearance of the anticipated debris impact area. This aircraft would continue surface clearance until required to vacate the hazard area, at which time the aircraft would either return to the Vandenberg AFB airfield or move to a position outside the hazard area established by the range safety officer. No significant impacts to the human environment are anticipated from its operation.

4.3.2.2 Debris Tracking.

Unlike the Proposed Action, a debris boat would not be used to place a tracking buoy or search for LFTS target missile debris; therefore, no potential impacts from debris boat operations would occur.

4.3.2.3 LFTS Debris Assessment.

The debris boat would not be used to support observation, photography, and destruction of LFTS target missile debris; therefore, no potential impacts from debris boat operations or personnel involved in debris assessment activities (e.g., low pH, sharps, chemical hazards) would occur.

The pH of the ocean would be lowered in the immediate vicinity of the release for approximately 5 hours; however, over a 5-hour period, the oxidizer plume could migrate approximately 3.2 km (2 miles) to the south or 0.8 km (0.5 mile) towards shore and the pH of the water would be back to non-hazardous levels. Therefore, the general public is not expected to be affected by lowered ocean pH.

However, because no observation or destruction of LFTS target missile debris would occur, there is a possibility that debris could reach the shore and/or the Channel Islands. This would pose a potential health hazard to individuals in these areas. Because the debris would be drifting for more than 24 hours before possibly reaching the shore, the primary hazard to the public would be from sharp edges of the debris causing a cutting hazard. However, the worst case health and safety concern would result if the fuel tanks remained intact after reaching the ocean and eventually drifted to shore. These tanks with any remaining fuel/oxidizer could pose a hazard to the general public if contact is made.

Management Measures. Debris is not anticipated to reach the shore or Channel Islands; however, shoreline evaluations would be implemented to ensure the public is safe from the possibility of debris washing ashore. Any debris that washes ashore would be disposed of in accordance with applicable regulations.

4.4 HAZARDOUS WASTE MANAGEMENT

This section provides a discussion of the consequences resulting from hazardous wastes associated with the Proposed Action and No-Action Alternative.

4.4.1 Proposed Action

As currently modeled, the worst case amount of fuel and oxidizer remaining at the time of destruction would be approximately 223 liters (59 gallons) of kerosene fuel, 19 liters (5 gallons) of initiator fuel, and 636 liters (168 gallons) of IRFNA oxidizer. These substances would be released as a hazardous material rather than a hazardous waste. Under this scenario, the reportable quantity (RQ) for the release of kerosene fuel and initiator fuel would not be reached. However, the RQ for two constituents of IRFNA would be exceeded. As shown in Table 4-2, the RQ for nitric acid 453 kg (1,000 pounds), which is the main constituent of IRFNA, and for nitrogen dioxide 4.5 kg (10 pounds) would be exceeded. Because the estimated 223 liters (59 gallons) of kerosene fuel that could be released would likely result in a “visible sheen” on the surface of the water, CERCLA reporting to the National Response Center for petroleum products and coal tar distillates releases would be triggered.

Table 4-2. ABL Fuel/Oxidizer/Initiator Fuel Reportable Quantities

Constituent Name	CAS #	Specific Gravity	Pounds per gallon	EPA Reportable Quantity (lbs)	% of Product	Quantity Released (lbs, gals)	Exceedance (Y/N)
Inhibited Red Fuming Nitric Acid (IRFNA) [168 gallons, 908 kg, 2,002 lbs]							
Nitric Acid	7697-37-2	1.41	11.76	1,000	86	1,720 lbs, 146 gal	Y
Nitrogen Dioxide	10544-72-6	1.58	13.18	10	13	262 lbs, 20 gal	Y
Hydrofluoric Acid	7664-39-3	1.20	10.00	100	1	20 lbs, 2 gal	N
Fuel (kerosene with coal tar distillates) [59 gallons, 189 kg, 417 lbs][b]							
Ethylbenzene	100-41-4	0.867	7.23	1,000	60[a]	62.5 lbs, 8.7 gal	N
Toluene	108-88-3	0.865	7.21	1,000	60[a]	62.5 lbs, 8.7 gal	N
Mixed xylenes	1330-20-7	0.860	7.15	1,000	60[a]	62.5 lbs, 8.8 gal	N
Cymene (methyl isopropyl benzene)	99-87-6	0.860	7.15	NL	60[a]	62.5 lbs, 8.8 gal	N
Kerosene	8008-20-6	0.820	6.84	NL	40	167 lbs, 24.4 gal	N
Initiator Fuel [5 gallons, 15 kg, 35 lbs]							
Triethylamine	121-44-8	0.730	6.08	5,000	50	15.2 lbs, 2.5 gal	N
Dimethylaniline	121-69-7	0.956	7.97	100	50	19.9 lbs, 2.5gal	N

Notes: (a) Indicates percentage of fuel; however, the specific percentage of the mix is not known. An equal concentration of the mixture was used for analysis purposes.
(b) Because the release of kerosene fuel would likely result in a "visible sheen" on the surface of the water, CERCLA reporting for petroleum products and coal tar distillates releases would be triggered.
CAS = Chemical Abstract
EPA = Environmental Protection Agency
gal = gallons
kg = kilograms
lbs = pounds
N = no
NL = not listed in 40 CFR 302
Y = yes

Source: Missile Defense Agency, 2005a.

The estimated quantities (i.e., 223 liters [59 gallons] of kerosene fuel, 19 liters [5 gallons] of initiator fuel, and 636 liters [168 gallons] of IRFNA) that would remain on board at the time of destruction are very conservative and represent the earliest time (approximately 43 seconds after launch) that the laser could impact the target. In addition, the quantities of fuel and oxidizer represent what could remain in the tanks at the time of destruction; this does not consider the possibility that some quantity of these substances would be consumed at the time of destruction or could disperse as the debris falls to the ocean.

When the fuel and oxidizer make initial contact with the ocean, they would displace an equal quantity of ocean water. As these substances mix with the water it is anticipated that the debris and fuel/oxidizer plume would be approximately 4.45 km^2 (1,100 acres) in size. Based on modeling and calculations, the pH of the ocean would be lowered in the immediate vicinity of the release for approximately 5 hours. Over this 5-hour period, the oxidizer plume could migrate approximately 3.2 km (2 miles) to the south or 0.8 km (0.5 mile) towards shore and the pH of the water would return to non-hazardous levels.

Over a 24-hour period the debris could migrate approximately 27 km (17 miles) to the south or approximately 6.4 km (4 miles) towards the shore (see Figure 4-1). After a 24-hour period, modeling of the debris migration becomes highly speculative due to numerous factors affecting the drift of material. Management of any hazardous wastes in accordance with applicable regulations would preclude any significant impacts.

Management Measures. No management measures would be required.

4.4.2 No-Action Alternative

Potential impacts regarding hazardous waste management would be similar to those discussed under the Proposed Action.

However, because no observation or destruction of LFTS target missile debris would occur, there is a possibility that debris could reach the shore and/or the Channel Islands. As discussed in Section 4.2.2.3, this debris would pose a potential health hazard to individuals in these areas. Because the debris would be drifting for more than 24 hours before possibly reaching the shore, the primary hazard to the public would be from sharp edges of the debris causing a cutting hazard. If the fuel tanks remained intact after reaching the ocean, these tanks with any remaining fuel/oxidizer would be treated as hazard waste and would require disposal.

Management Measures. Because there is a possibility of debris reaching the shore or Channel Islands, shoreline evaluations would be implemented to identify any debris that washes ashore. Disposal of any debris that washes ashore would be conducted in accordance with applicable regulations.

4.5 WATER RESOURCES

4.5.1 Proposed Action

As discussed in Section 4.4, Hazardous Waste Management, the worst case amount of fuel and oxidizer remaining at the time of destruction would be approximately 223 liters (59 gallons) of kerosene fuel, 19 liters (5 gallons) of initiator fuel, and 636 liters (168 gallons) of IRFNA oxidizer (see Table 4-2). The estimated quantities that would remain on board at the time of destruction are very conservative. The quantities of fuel and oxidizer represent what could remain in the tanks at the time of destruction; this does not consider the possibility that some quantity of these substances would be consumed at the time of destruction or could disperse as the debris falls to the ocean.

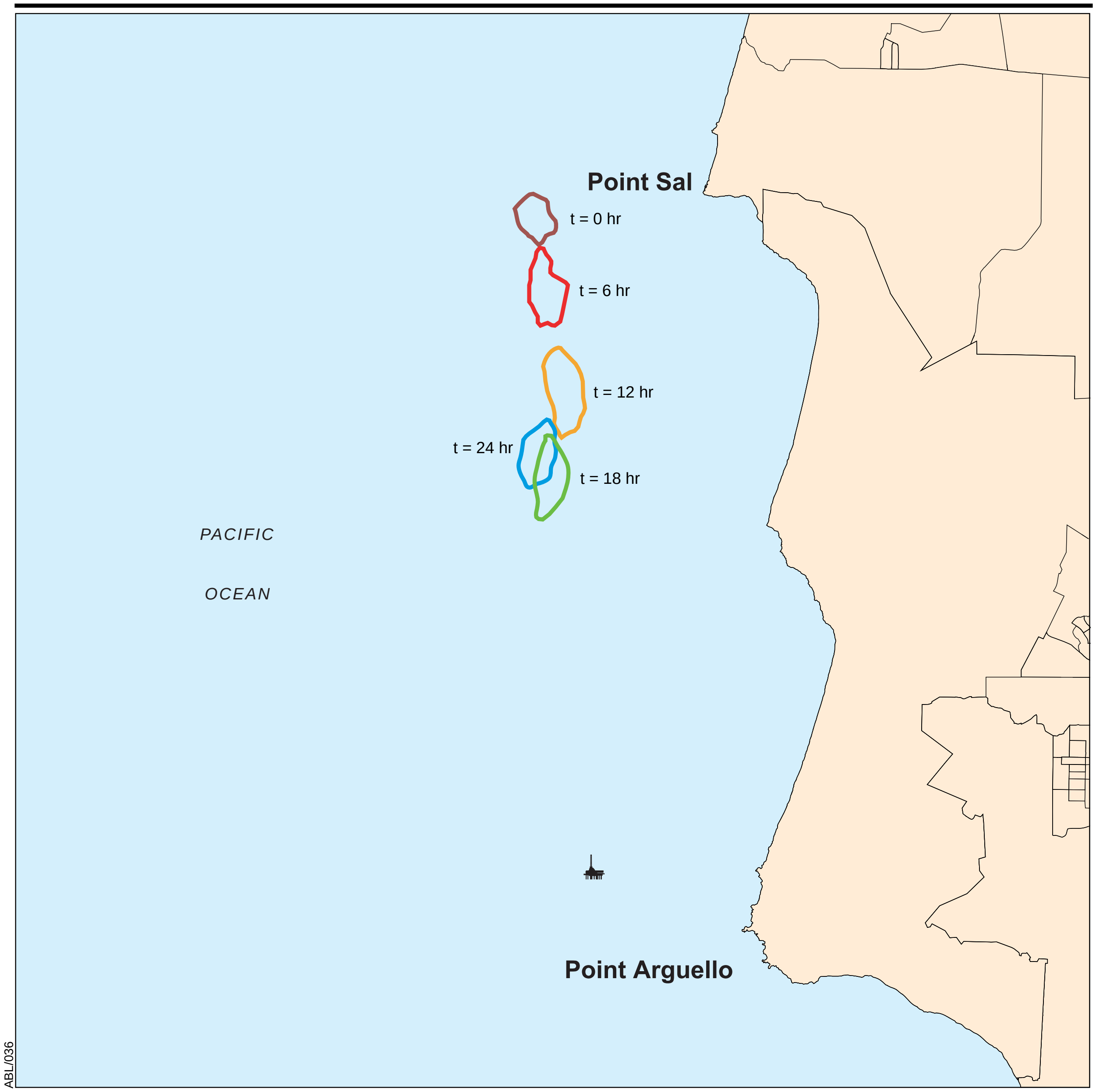
When the fuel and oxidizer make initial contact with the ocean, they would displace an equal quantity of ocean water. The IRFNA would first mix with a small amount of ocean water resulting in localized heating and a low pH. As these substances mix with the water it is anticipated that the debris and fuel/oxidizer plume would be approximately 4.45. km^2 (1,100) acres in size (Figure 4-2). This plume could migrate approximately 3.2 km (2 miles) to the south or 0.8 km (0.5 mile) towards shore over a 5-hour period.

Inhibited Red Fuming Nitric Acid, or IRFNA, is highly concentrated nitric acid (HNO_3) (approximately 86 percent) with NO_2 (approximately 13 percent), which gives it the red color, and hydrofluoric acid (HF) (approximately 0.6-0.7 percent). HF is the corrosion inhibitor and serves to create a film on the interior of the metal tank to protect against corrosion. When the concentrated acid comes into contact with water it dissolves readily giving off heat (heat of dissolution).

Assuming 636 liters (168 gallons) of IRFNA is released in the ocean and the contents react with a volume of water of 3 million liters (800,000 gallons) [roughly the amount of water in an Olympic-size pool], the estimated temperature change would be on the order of 0.1 °C, roughly 0.18 °F. In comparison, if the volume of water is decreased to 10,000 liters (2,640 gallons), corresponding to a dilution factor of 10, the temperature increase would be on the order of 35 °C (95 °F). This scenario would be representative of the localized area where the initial release of IRFNA occurs and would result in the ocean water temperature rising from approximately 17 °C (63 °F) to 52 °C (126 °F). The reaction of nitric acid and ocean water would be exothermic (releasing heat) and would reach completion almost instantaneously resulting in the formation of hydronium ion (H_3O^+) and nitrous ion (NO_2^-) byproducts.

Figure 4-3 illustrates the maximum concentration and contaminated volume of IRFNA over time. As Figure 4-3 shows, concentrations are expected to decrease rapidly after initial release. The results of the hydrodynamic model illustrate the mixing characteristics of the plume. The results of the reactive model illustrate the contaminated ocean water volume due to the release of IRFNA. While the reactive model does not represent the mixing characteristics like the hydrodynamic model, it does consider the decay of the IRFNA due to neutralization and buffering capacity of the ocean water.

The acid would not react but rather would completely dissociate into nitrate ion $(NO_3)^-$ and H^+ ions, thereby increasing the pH locally until it dissipates. Short-term degradation of the water quality would be expected in the immediate vicinity of where the release occurs. The ocean pH is anticipated to return to non-hazardous levels (pH above 4.5) within approximately 5 hours (National Oceanic and Atmospheric Administration, 2005). The NO_2 would react with the water to



EXPLANATION

Estimated Fuel Plume Migration

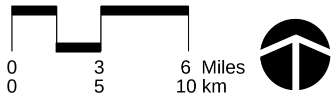
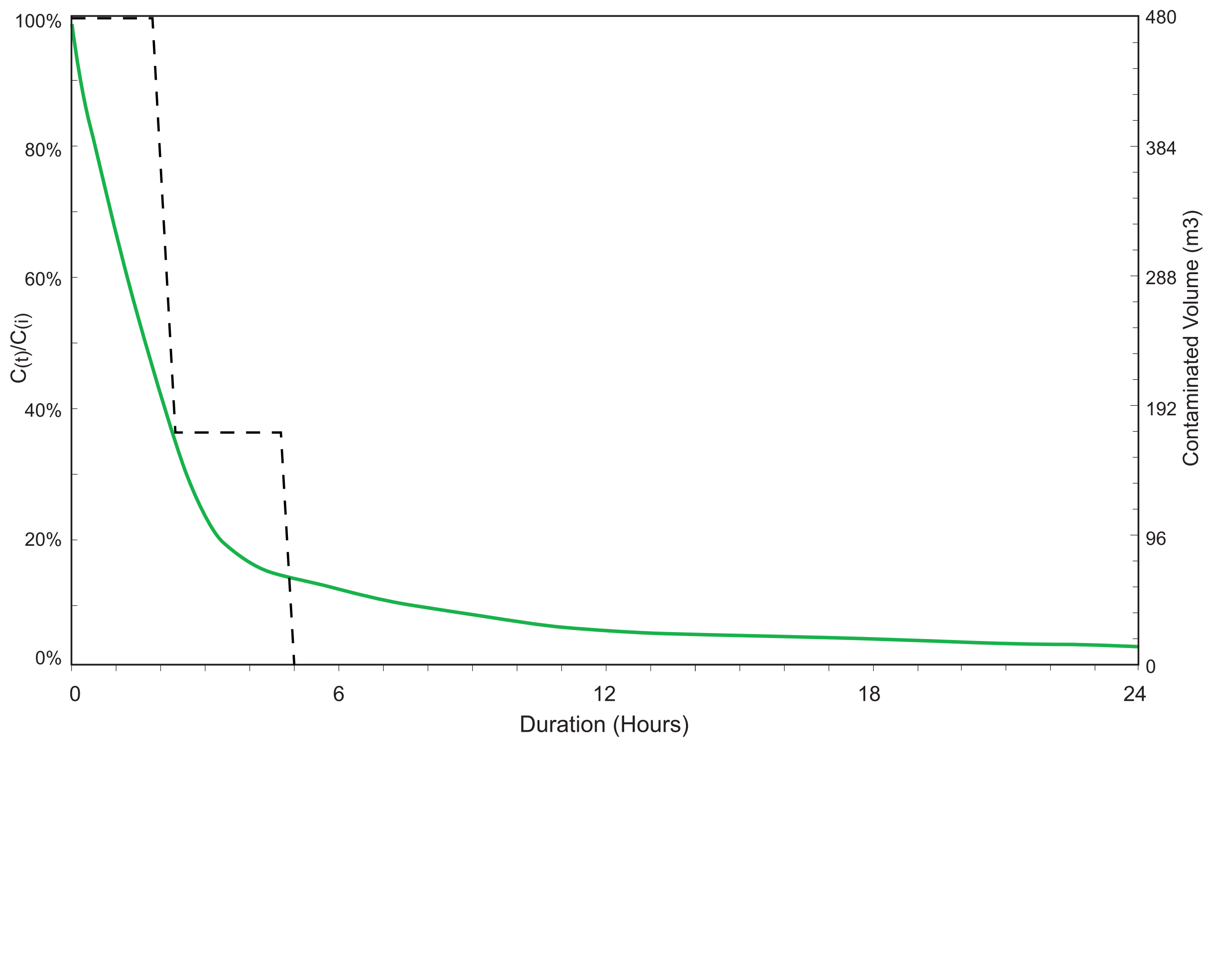


Figure 4-2



EXPLANATION

Hydrodynamic Model - Maximum Concentration (non-reactive [Kerosene Fuel])

Reactive Model - Contaminated Volume (reactive [IRFNA])

Concentration and Contaminated Volume as a Function of Time

NOTES: 1) $C_{(t)}$: Maximum observed concentration at time = t
2) $C_{(i)}$: Initial maximum observed concentration
3) Contaminated volume values were taken from the results of NOAA Hazardous Material Division nitric acid/ocean water reaction analysis.
IRFNA = Inhibited Red Fuming Nitric Acid

Figure 4-3

form more nitric acid and nitrous acid (HNO_2). The latter would also dissociate into NO_2^- and H^+ ions. Therefore, the concentration of nitrate and nitrite would increase locally where the debris impacts the ocean. After this initial reaction, the nitric acid in seawater would be neutralized by the natural buffering capacity of seawater and mixed by the ocean currents in the region to background levels. The pH of the ocean was calculated for three different dilution scenarios and is shown in Table 4-3.

Table 4-3. Estimated pH at Various Dilution Scenarios

	Ocean Volume		Ocean Volume Dimensions		
Estimated pH	(gallons)	Cubic m (Cubic ft)	Length m (ft)	Width m (ft)	Depth m (ft)
0	168	0.636 (22.5)	0.8 (2.6)	0.8 (2.6)	1 (3.3)
2.85	800,000	3,028 (106,944)	17.4 (57)	17.4 (57)	10 (33)
8.56	230,000,000	870,645 (30,746,528)	295 (968)	295 (968)	10 (33)

ft = feet
m = meter
pH = hydrogen ion concentration

As can be seen in Table 4-3, the localized pH will be low when the IRFNA initially comes into contact with the ocean. As the seawater dilutes the IRFNA, the pH will increase back to the natural pH of approximately 8.1. The analysis did not account for borate concentrations within ocean water; therefore, the larger dilution analysis shows a pH value that is slightly above the normal ocean pH (pH of approximately 8.1). The ocean pH is anticipated to return to a non-hazardous level (pH above 4.5) within approximately 5 hours.

Because LFTS target missile debris and fuel/oxidizer would impact the ocean more than 10 km (6 miles) from shore and the temporary decrease in the pH of the ocean would return to non-hazardous levels within approximately 5 hours, no significant, long-term, adverse impacts to water quality are anticipated.

The MDA has prepared a CZMA consistency determination for proposed ABL debris management activities and submitted it to the California Coastal Commission for concurrence (Appendix C).

Management Measures. No management measures would be required.

4.5.2 No-Action Alternative

Potential impacts to water resources would be the same as discussed under the Proposed Action.

Management Measures. No management measures would be required.

4.6 AIR QUALITY

4.6.1 Proposed Action

Areas where ambient concentration levels are below the NAAQS for a criteria pollutant are designated as being in “attainment.” Areas where a criteria pollutant level equals or exceeds the NAAQS are designated as being in "nonattainment." Based on the severity of the pollution problem, nonattainment areas are categorized as marginal, moderate, serious, severe, or extreme. Where insufficient data exist to determine an area's attainment status, it is designated unclassifiable or in attainment. The Proposed Action would occur within the Santa Barbara County Air Pollution Control District, which is in attainment for NAAQS criteria pollutants. For the CAAQS, this district does not meet the state 1-hour and 8-hour ozone standard or the 24-hour and annual standard for PM_{10}.

Major new or modified services in the area would be subject to PSD review to ensure that these sources do not result in significant adverse deterioration of the clean air in the area. The Proposed Action does not include any new or modified stationary emission sources; therefore, no PSD impacts would occur.

The emissions analysis was conducted for proposed aircraft and ship operations associated with the debris management activities. These operations include:

- Piper Navajo aircraft operating a total of 64 hours with 16 landing and takeoffs (LTOs) (four hours each flight in eight pre-launch flights and eight post-launch flights).

- Debris boat (MV Independence Ship) operating a total of 192 hours (24 hours per event and eight total events) with the following emitting sources:
  - Two 1,250-horse power (hp) Cummins main engines
  - Two 500-hp Cummins thruster engines
  - Two 370-hp Cummins diesel generators
  - One 80-hp Cummins emergency diesel generator.

4.6.1.1 Aircraft Emissions.

Aircraft engines emit VOCs and NO_X during all phases of operation whether climbout, approach, or cruise. Based on the estimated total number of LTOs and the total number of cruise hours under the Proposed Action, the overall aircraft operational emissions were estimated using the methods, emission factors, default engine type for the Navajo aircraft, and default time in mode during each LTO obtained from the following references:

- The Procedures of Emission Inventory Preparation, Volume IV: Mobile Sources (U.S. Environmental Protection Agency, 1992).

- Navajo aircraft engine emission factors, time in mode, etc. provided in FAA Emissions and Dispersion Modeling System (EDMS, Version 4.2).

Total estimated NO_X and VOC emissions with potential to result from the proposed aircraft operations are summarized in Table 4-4. According to the EDMS model, PM_{10} emission factors are generally not available for aircraft engines; therefore, no PM_{10} emissions are predicted in the analysis for operation of the Piper Navajo aircraft.

Table 4-4. Total Piper Navajo Aircraft Emissions[(a)]

Mode	Total LTOs	Time in mode (minute/LTO)	Emission Factor (kg/hour)		Total Emissions (tons)	
			VOCs	NO_X	VOCs	NO_X
Takeoff	16	1	2.80	0.08	0.001	0.001
Climbout	16	2	1.54	0.02	0.001	0.001
Approach	16	5	0.60	0.06	0.001	0.001
Taxi and Queue	16	26	0.77	0.004	0.004	0.001
Cruise (simulated as climbout)		3,840	1.54	0.02	0.109	0.001
Total Aircraft Emissions					**0.116**	**0.005**

Note: (a) PM_{10} emission factors are generally not available for aircraft engines according to EDMS model; therefore, no PM_{10} emissions are considered in the analysis for Piper Navajo aircraft operations.
kg = kilogram
LTO = landing and takeoff
NO_X = nitrogen oxide
VOC = volatile organic compound

4.6.1.2 Debris Boat Emissions.

In accordance with SBCAPCD Rule 201 a permit to operate the debris boat would be coordinated prior to initiating debris management activities. The conditions of the permit would ensure that operation of the debris boat complies with applicable local, state, and federal laws, rules, and regulations.

Estimates of debris boat diesel engine and generator exhaust emissions were based on the estimated hours of usage and emission factors associated with each diesel engine and generator on the ship. It was conservatively assumed that all on-ship diesel engines and generators would operate continuously over the entire ship maneuvers for a total of 192 hours under the Proposed Action. Emission factors for NO_X and VOCs related to heavy-duty diesel equipment were obtained from *Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression-Ignition* (U.S. Environmental Protection Agency, 2004a). Load factors were obtained from *Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling* (U.S. Environmental Protection Agency, 2004b).

Emission factors in grams of pollutant per hour per horsepower were multiplied by the estimated running time and the diesel equipment's associated average horsepower provided by the U.S. EPA to calculate total grams of pollutant from each piece of equipment. Finally, these total grams of pollutant were converted to tons of pollutant.

The U.S. EPA recommends the following formula to calculate hourly emissions from non-road engine sources:

$$M_i = N \times HP \times LF \times EF_i$$

where:

M_i = mass of emissions of ith pollutant during inventory period
N = source population (units)
HP = average rated horsepower
LF = typical load factor
EF_i = average emissions of ith pollutant per unit of use (e.g., grams per hp-hour).

The calculations of potential maximum emissions from ship operations are provided below:

Operational Hours = 192 hours (24 hours in each of eight events)
Total NO_X Emissions = 192 hours x [(2 x 1,250 + 2 x 500 + 2 x 370) (hp) x 8.38 grams/hp-hr + 80 hp x 8.30 grams/hp-hr] x 59%
= 4,100,190 grams = 4,100 kilograms
= 4.52 tons
Total VOC Emissions = 192 hours x [(2 x 1,250 + 2 x 500 + 2 x 370) (hp) x 0.68 grams/hp-hr + 80 hp x 0.99 grams/hp-hr] x 59%
= 335,580 grams = 335 kilograms
= 0.37 tons

Total PM_{10} Emissions = 192 hours x [(2 x 1,250 + 2 x 500 + 2 x 370) (hp) x 0.402 grams/hp-hr + 80 hp x 0.722 grams/hp-hr] x 59%
= 199,630 grams
= 0.22 tons

As shown in Table 4-5, the conservatively estimated total emission levels for the Proposed Action (operation of the debris boat and clearance/monitoring aircraft) would be negligible. The Record of Non Applicability (RONA) is presented in Appendix B.

Table 4-5. Total Emission Levels under the Proposed Action

Emission Source	Pollutant (tons)		
	VOC	NO_X	PM_{10}
Aircraft	0.12	0.00	NA
Debris Boat	0.37	4.52	0.22
Totals	0.49	4.52	0.22

NA = not applicable
NO_X = nitrogen oxide
PM_{10} = particulate matter equal to or less than 10 microns in diameter
VOC = volatile organic compound

Management Measures. Because debris boat operations would be permitted in accordance with SBCAPCD Rule 201 and there are no adverse air quality impacts under the Proposed Action, management measures are not required.

4.6.2 No-Action Alternative

Under the No-Action Alternative, target/debris tracking and debris assessment activities would not occur. Debris management activities associated with operation of the debris boat (i.e., buoy placement and debris observation, photography, and destruction) would not be conducted under the No-Action Alternative. The clearance/monitoring aircraft would be used prior to and after LFTS target missile launch to ensure no surface vessels are present and to aid in biological monitoring.

Total emissions from the clearance/monitoring aircraft are presented in Table 4-5. Based on the emissions presented in Table 4-4, the estimated total emission levels for the No-Action Alternative (operation of the clearance/monitoring aircraft) would be negligible.

Management Measures. No management measures would be required under the No-Action Alternative.

4.7 BIOLOGICAL RESOURCES

4.7.1 Proposed Action

Biological resources that could be affected by proposed ABL debris management activities include a variety of aquatic plants and animals in the ROI that could be impacted by LFTS fuel/oxidizer and debris. The impact area is the Pacific Ocean at least 10 km (6 miles) off the coast of Vandenberg AFB. Given the distance of the impact area from the shoreline, it is anticipated that impacts would likely be restricted to surface waters (i.e., where sea surface temperatures range between 10˚ C to 26˚ C (50˚ F to 79˚ F) with minimal impact to deeper water and seafloor organisms at the location because of water depths of several hundred feet. In addition, because the impact area would be at least 10 km (6 miles) from the coast, minimal debris is likely to drift to shore. As such, surface waters in the offshore area are the primary focus for biological resources of concern. The resources at the offshore location consist of plankton, fish, seabirds, marine mammals, and sea turtles, along with a number of threatened and endangered species and the Coastal Pelagic EFH zone.

Shoreline evaluations would be implemented to identify and remove any debris that washes ashore. Experienced biological monitors would participate in the shoreline evaluations to determine if any damage/impact to shoreline environments occurred, to monitor debris removal actions (if necessary), to ensure no harassment of hauled out pinnepeds occurs, and to identify any potentially affected species that have come ashore after making contact with floating debris or fuel/oxidizer.

The USFWS and NOAA Fisheries Service have been consulted regarding potential effects to biological resources from implementation of proposed debris management activities (Appendix C). As discussed below, potential adverse effects to biological resources in offshore surface waters could occur from both chemical impacts and physical impacts.

4.7.1.1 Chemical Impacts.

As discussed in Section 4.3, an upper-limit estimate for chemical components in a test missile at the time of destruction is 636 liters (168 gallons) of IRFNA oxidizer, 223 liters (59 gallons) of kerosene fuel, and 19 liters (5 gallons) of initiator fuel (see Table 4-2). These quantities are conservative and do not consider the likelihood that some portion of those quantities might be consumed or destroyed during the destruct event and/or debris fallout to the ocean surface. Regardless, if these upper-limit quantities would reach the ocean surface, they are estimated to disperse over an area approximately 1,100 acres in size (see Figure 4-2). Trajectory estimates predict the associated oxidizer plume at the ocean's surface could migrate 3 km (2 miles) to the south or 0.8 km (0.5 mile) towards shore over a 5-hour period.

As the major chemical component reaching the ocean surface, the 168 gallons of IRFNA consists of HNO_3 (approximately 86 percent), NO_2 (approximately 13 percent), and HF (approximately 0.6-0.7 percent). As addressed in Section 4.4.1, the concentrated acid mixture would rapidly dissolve in an exothermic (i.e., heat releasing) reaction with ocean water. For perspective, if 168 gallons of IRFNA reacts with a volume of 800,000 gallons of ocean water (i.e., 800,000 gallons = 3,028 cubic meters, or a volume of water 17.4 meters by 17.4 meters on the surface and 10 meters deep), the estimated temperature rise in the water from the exothermic reaction would be 0.1 °C and the pH would decrease to somewhat below 3 (versus an ambient seawater pH of 8.1) (see Table 4-3). With additional time and dilution, the pH would increase relatively rapidly (e.g., pH estimated to be up to 4.5 after only 5 hours; see Section 4.4.1). In addition, the nitric acid in the IRFNA mixture will dissociate to H_3O_+ and NO_{3-}. Nitrate is an important nutrient for phytoplankton growth.

In addition to considerations for temperature and pH, chemicals in the fuel mixture can be toxic to organisms in ocean surface waters. National Recommended Water Quality Criteria (NRWQC) for salt water (U.S. Environmental Protection Agency, 2002) address toxicity thresholds for aquatic organisms. The NRWQC threshold of a Criteria Continuous Concentration (CCC) is a chronic level intended to estimate the highest concentration to which an aquatic community can be exposed indefinitely without resulting in an unacceptable adverse effect. Available NRWQC CCC values for salt water for components in the fuel mixture are summarized in Table 4-6. NOAA Ocean Services has identified a maximum volume of contaminated ocean water for pH to be a value less than 4.5 (National Oceanic and Atmospheric Administration, 2005). Based on this information, it would seem reasonable that pH in ocean surface water within the impact area would return relatively rapidly to non-hazardous levels (i.e., initial pH could be somewhat below 3 in a body of water only 17.4 meters by 17.4 meters on the surface and 10 meters deep, and pH would be back to non-hazardous levels within approximately 5 hours).

While toxicity information as NRWQC is limited, information is also presented in Table 4-6 for characteristics related to aquatic fate and behavior for chemicals in the fuel mixture (e.g., vapor pressure, water solubility, octanol-water partition coefficients [log K_{ow}], and aerobic half-life in surface water). This information

Table 4-6. ABL Fuel/Oxidizer/Initiator Fuel Reportable Quantities, Ecological Benchmarks, and Physical-Chemical Properties

		Ecological Benchmarks	Physical-Chemical Properties:					Aquatic Fate Considerations:	
Constituent Name	CAS #	NRWQC CCC saltwater(a)	Vapor Pressure (mm Hg at 25°C)	(°C at 760 mm Hg)	Water Solubility (mg/liter at 25°C)	log Kow(b)	Surface Water / Aerobic Half-Life(c)	Anticipated Aquatic Fate	Reference: Physical-Chemical Properties and Anticipated Aquatic Fate
Inhibited Red Fuming Nitric Acid (IRFNA) [168 gallons, 908 kg, 2,002 lbs]									
Nitric Acid (HNO_3)	7697-37-2	pH 6.5-8.5(d)	62	122	(completely soluble)			Will rapidly dilute due to high solubility. Will cause short-term, localized low pH.	http://www.camd.lsu.edu/msds/n/nitric_acid.htm#Physical
Nitrogen Dioxide (NO_2)	10544-72-6	(nr)	720 (20°C)	20.9				Will likely evaporate based on high vapor pressure. Primary environmental health concerns directed toward gas state.	http://www1.boc.com/uk/sds/special%5Cnitrogen_dioxide.pdf
Hydrofluoric Acid (HF)	7664-39-3	pH 6.5-8.5(d)	14 (20°C)	180	(completely soluble)			Will rapidly dilute due to high solubility. Will cause short-term, localized low pH.	http://www.camd.lsu.edu/msds/h/hydrofluoric_acid.htm
Fuel (kerosene with coal tar distillates) [59 gallons, 189 kg, 417 lbs]									
Ethylbenzene	100-41-4	(NA)	9.53	136.2	161	3.15	Low: 72 hours (3 days) High: 240 hours (10 days)	Will evaporate relatively rapidly with a half-life ranging from hours to a few weeks. Biodegradation will be relatively rapid after a population of degrading microorganisms becomes established (will depend on body of water and temperature). Surface water/aerobic half-lives (72-240 hours) based on scientific judgement for aqueous biodegradation (unacclimated) in sea water die-away test (Van der Linden, A.C. 1978; in Howard et al. 1991). Significant bioconcentration in aquatic biota (fish) is not expected due to relatively low Kow.	Howard, P.H. 1989. Handbook of Environmental Fate and Exposure Data for Organic Chemicals. Volume I: Large Production and Priority Pollutants. Lewis Publishers, Chelsea, MI. 574 p. Howard, P.H., R.S. Boethling, W.F. Jarvis, W.M. Meylan, and E.M. Michalenko. 1991. Handbook of Environmental Degradation Rates. Lewis Publishers, Chelsea, MI. 725 p.
Toluene (Methylbenzene)	108-88-3	(NA)	28.4	110.6	534.8	2.73	Low: 96 hours (4 days) High: 528 hours (22 days)	Will be lost by both volatilization and biodegradation. The predominant process will depend on water temperature, mixing conditions, and existence of acclimated microorganisms. Half-life will range from days to several weeks. Surface water/aerobic half-lives (96-528 hours) based on scientific judgement for aqueous biodegradation (unacclimated) in sea water die-away test (Wakeham, S.G. 1983; in Howard et al. 1991). Will not significantly hydrolyze, directly photolyze, adsorb to sediment, or bioconcentrate in aquatic organisms (due to relatively low Kow). (also see individual xylenes)	Howard, P.H. 1990. Handbook of Environmental Fate and Exposure Data for Organic Chemicals. Volume II: Solvents. Lewis Publishers, Chelsea, MI. 546 p. Howard, P.H., R.S. Boethling, W.F. Jarvis, W.M. Meylan, and E.M. Michalenko. 1991. Handbook of Environmental Degradation Rates. Lewis Publishers, Chelsea, MI. 725 p.
Mixed xylenes	1330-20-7	(nr)	(see individual xylenes)	(see individual xylenes)	(see individual xylenes)	(see individual xylenes)	Low: 168 hours (1 week) High: 672 hours (4 weeks)	Surface water/aerobic half-lives (168-672 hours) based on scientific judgement for aqueous biodegradation (unacclimated) in soil column study simulating an aerobic river/ground water infiltration system (high half-life: Kuhn, E.P. et al. 1985; in Howard et al. 1991) and aqueous screening test data (Bridie, A.L. et al. 1979; in Howard et al. 1991) for o-, m-, and p-isomers.	(see individual xylenes) Howard, P.H., R.S. Boethling, W.F. Jarvis, W.M. Meylan, and E.M. Michalenko. 1991. Handbook of Environmental Degradation Rates. Lewis Publishers, Chelsea, MI. 725 p.
1,2-xylene (o-xylene)	95-47-6	(nr)	6.6	144.4	175	3.12	Low: 168 hours (1 week) High: 672 hours (4 weeks)	Volatilization is a dominant removal process. Surface water/aerobic half-lives (168-672 hours) based on scientific judgement for aqueous biodegradation (unacclimated) in soil column study simulating an aerobic river/ground water infiltration system (high half-life: Kuhn, E.P. et al. 1985; in Howard et al. 1991) and aqueous screening test data (Bridie, A.L. et al. 1979; in Howard et al. 1991). Little bioconcentration is expected due to low Kow.	Howard, P.H. 1990. Handbook of Environmental Fate and Exposure Data for Organic Chemicals. Volume II: Solvents. Lewis Publishers, Chelsea, MI. 546 p. Howard, P.H., R.S. Boethling, W.F. Jarvis, W.M. Meylan, and E.M. Michalenko. 1991. Handbook of Environmental Degradation Rates. Lewis Publishers, Chelsea, MI. 725 p.
1,3-xylene (m-xylene)	108-38-3	(nr)	8.3	139.3	146	3.20	Low: 168 hours (1 week) High: 672 hours (4 weeks)	Volatilization is a dominant removal process. Surface water/aerobic half-lives (168-672 hours) based on scientific judgement for aqueous biodegradation (unacclimated) in soil column study simulating an aerobic river/ground water infiltration system (high half-life: Kuhn, E.P. et al. 1985; in Howard et al. 1991) and aqueous screening test data (Bridie, A.L. et al. 1979; in Howard et al. 1991). Little bioconcentration is expected due to low Kow.	Howard, P.H. 1990. Handbook of Environmental Fate and Exposure Data for Organic Chemicals. Volume II: Solvents. Lewis Publishers, Chelsea, MI. 546 p. Howard, P.H., R.S. Boethling, W.F. Jarvis, W.M. Meylan, and E.M. Michalenko. 1991. Handbook of Environmental Degradation Rates. Lewis Publishers, Chelsea, MI. 725 p.
1,4-xylene (p-xylene)	106-42-3	(nr)	8.7	137-138	156	3.15	Low: 168 hours (1 week) High: 672 hours (4 weeks)	Volatilization is a dominant removal process. Surface water/aerobic half-lives (168-672 hours) based on scientific judgement for aqueous biodegradation (unacclimated) in soil column study simulating an aerobic river/ground water infiltration system (high half-life: Kuhn, E.P. et al. 1985; in Howard et al. 1991) and aqueous screening test data (Bridie, A.L. et al. 1979; in Howard et al. 1991). Little bioconcentration is expected due to low Kow.	Howard, P.H. 1990. Handbook of Environmental Fate and Exposure Data for Organic Chemicals. Volume II: Solvents. Lewis Publishers, Chelsea, MI. 546 p. Howard, P.H., R.S. Boethling, W.F. Jarvis, W.M. Meylan, and E.M. Michalenko. 1991. Handbook of Environmental Degradation Rates. Lewis Publishers, Chelsea, MI. 725 p.
Cymene (methyl isopropyl benzene)	99-87-6 or 25155-15-1	(nr)	1.53 (204 Pa)	177.1	34.15	4.10		Will likely volatize relatively rapidly due to relatively high vapor pressure property	Mackay, D., W.-Y. Shiu, and K.-C. Ma. 1992. Illustrated Handbook of Physical-Chemical Properties and Environmental Fate for Organic Chemicals. Vol. I: Monoaromatic Hydrocarbons, Chlorobenzenes, and PCBs. Lewis Publishers, Boca Raton, FL. 697 p.
kerosene	8008-20-6	(nr)	5 (38°C) (hydrocarbon mixture)	175-325 (hydrocarbon mixture)	(hydrocarbon mixture)	(hydrocarbon mixture)		Multi-component mixture of hydrocarbons resulting from boiling-point range cut in petroleum distillation process. Could cause short-term, localized surface slick on water's surface(b), but will likely volatize quickly due to relatively high vapor pressure property	http://www.jtbaker.com/msds/englishhtml/k2175.htm; http://www.sefsc.noaa.gov/HTMLdocs/kerosene.htm

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Table 4-6. ABL Fuel/Oxidizer/Initiator Fuel Reportable Quantities, Ecological Benchmarks, and Physical-Chemical Properties

		Ecological Benchmarks	Physical-Chemical Properties:					Aquatic Fate Considerations:	
Constituent Name	CAS #	NRWQC CCC saltwater(a)	Vapor Pressure (mm Hg at 25°C)	(°C at 760 mm Hg)	Water Solubility (mg/liter at 25°C)	log Kow(b)	Surface Water / Aerobic Half-Life(c)	Anticipated Aquatic Fate	Reference: Physical-Chemical Properties and Anticipated Aquatic Fate
Initiator Fuel [5 gallons, 15 kg, 35 lbs]									
Triethylamine	121-44-8	(nr)	57.07	89.3	55,000	1.45		Will volatilize (estimated half-life 9.3 hours in a model river) and rapidly dilute due to high water solubility. Little bioconcentration is expected due to low Kow.	Howard, P.H. 1990. Handbook of Environmental Fate and Exposure Data for Organic Chemicals. Volume II: Solvents. Lewis Publishers, Chelsea, MI. 546 p.
Dimethylaniline	121-69-7	(nr)	0.797 (106.3 Pa)	193.1	1,105	2.31	Low: 19.3 hours (0.8 days) High: 1925 hours (80.2 day)	Will photooxidize, volatilize, and dilute. Surface water/aerobic half-lives (19.3-1925 hours) based on photooxidation half-life in water (in Howard et al. 1991). Little bioconcentration is expected due to low Kow.	Mackay, D., W.-Y. Shiu, and K.-C. Ma. 1995. Illustrated Handbook of Physical-Chemical Properties and Environmental Fate for Organic Chemicals. Vol. IV: Oxygen, Nitrogen, and Sulfur Containing Compounds. Lewis Publishers, Boca Raton, FL. 962 p. Howard, P.H., R.S. Boethling, W.F. Jarvis, W.M. Meylan, and E.M. Michalenko. 1991. Handbook of Environmental Degradation Rates. Lewis Publishers, Chelsea, MI. 725 p.

(a) U.S. EPA. 2002. National Recommended Water Quality Criteria: 2002. EPA-822-R-02-047. November 2002.
(b) Kow = octanol/water partition coefficient, which relates to tendence to bioaccumulate in biological tissues
(c) Howard, P.H., R.S. Boethling, W.F. Jarvis, W.M. Meylan, and E.M. Michalenko. 1991. Handbook of Environmental Degradation Rates. Lewis Publishers, Chelsea, MI. 725 p.
(d) NOAA Ocean Services has identified a pH of less than 4.5 as hazardous for ocean water.
°C = degrees Centigrade temperature
Hg = mercury
mg = milligrams
mm Hg = millimeters mercury pressure
(NA) = identified in NRWQC list, but no CCC saltwater criteria provided (U.S. EPA 2002)
(nr) = not identified in NRWQC list
NRWQC CCC (Criteria Continuous Concentration) = a chronic criterion that estimates the highest concentration of a material in surface water to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect
Pa = Pascals (1 mm Hg = 133.3 Pa)

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provides additional perspective for potential impacts to aquatic plants and animals. For example, IRFNA components of nitric and hydrofluoric acids readily react with and are completely soluble in water, plus they have relatively high vapor pressures that favor evaporation to the atmosphere. As such, reductions in pH are likely to remain localized and be of relatively short duration as the acids disperse and dilute in the water column and evaporate to the atmosphere. NO_2 has a relatively high vapor pressure, which indicates it is likely to evaporate to the atmosphere. Kerosene components in the fuel mixture (i.e., ethylbenzene, toluene, mixed xylenes, cymene, and the general kerosene base) have significant vapor pressures that suggest likely evaporation losses to the atmosphere and significant water solubilities that suggest likely dissolution/dilution losses to the water column. Available information indicates relatively short aerobic half-lives in surface waters (days to weeks). Finally, log K_{ow} values are relatively low (i.e., generally below 4), which indicates a low potential for bioaccumulation in aquatic organisms. Low bioaccumulation is important for forage items likely to be consumed by seabirds, marine mammals, and sea turtles. Initiator fuel components (i.e., triethylamine and dimethylaniline) are characterized by high water solubility's, which favor dispersion and dilution in the water column, and low log K_{ow} values, which have a low potential for bioaccumulation in aquatic organisms.

The information in Table 4-6 suggests that any adverse impacts to aquatic plants and animals in surface water of the offshore ABL impact area would likely be of limited spatial extent and duration (i.e., chemicals will relatively rapidly dilute in the water column, evaporate to the atmosphere, and degrade/disappear based on anticipated half-lives of days to weeks in surface waters). Furthermore, relatively low log K_{ow} values indicate low bioaccumulation in aquatic organisms that could serve as forage items for higher tropic level consumers such as seabirds, marine mammals, and sea turtles. Based on the discussion above, the potential temporary impacts to biological resources from chemical components are not be considered significant.

4.7.1.2 Physical Impacts.

Shock waves resulting from debris impacting the ocean surface has potential to harm aquatic organisms, including fish, seabirds, marine mammals, and sea turtles. Damage caused by a shock wave varies greatly with the source of the shock wave and the type of animal. The short rise time from overpressure of a shock wave is the physical effect most likely to harm organisms. Most shock-wave related injuries occur to organisms having air- or gas-containing organs (Yelverton, 1981). Seabirds, marine mammals, and sea turtles have lungs and many species of fish have swim bladders with gas-filled organs used for buoyancy control. Seabirds, marine mammals, and sea turtles with lungs and fish with swim bladders are vulnerable to effects of shock waves, whereas invertebrates and fish without swim bladders are less vulnerable (Yelverton, 1981; Young, 1991). During exposure to shock waves, air and gas in lungs and swim bladders oscillate in a manner that may result in rupture of internal organs. Most fish impacted by shock waves die within 1 to 4 hours, and almost all do so within 24 hours (Yelverton et al., 1975; Yelverton, 1981). However, occurrence of shock-wave related events (e.g., debris splash down) is likely to be a localized situation.

At the velocity of its normal descent, the LFTS target missile motor would hit the ocean surface at a speed of approximately 60 m (200 feet) per second. The LFTS target missile motor would have considerable kinetic force that would transfer to the ocean water upon impact resulting in a shock wave. Modeling studies for Minuteman III missile flight tests have shown that the underwater noise pulse levels would be on the order of 0.4 to 0.8 pounds per square inch (psi) at a range of 50 m (164 feet) from the impact point (U.S. Air Force, 2004). At this distance, the resulting shock wave is not expected to cause any injuries to marine mammals and sea turtles. However, for distances that are much closer to the impact point, the shock wave might damage internal organs and tissues, or prove fatal to the animals. As increasing distance from the impact point, pressure levels would decrease, as would the risk for injury to animals.

If any portion of the LFTS target missile were to strike a marine mammal or sea turtle near the water surface, the animal likely would be killed; however, risk of injury from direct impact are considered extremely small. Recent studies off the California coast have determine that there is a very low probability for marine mammals to be killed by falling boosters, targets, or other missile debris, or from the resulting shockwave of a missile impacting the water (Naval Air Warfare Center Weapons Division Point Mugu, 1998, 2002).

In addition, solid debris from ABL test fallout (e.g., metal and plastic debris from missile parts) may be harmful for exposed organisms. A primary hazard from persistent metal and plastic parts in surface waters can include entanglement leading to drowning or strangulation (Kullenberg, 1994), or physical injury (e.g., cuts, bruises, etc.).

Despite the potential for adverse physical impacts (e.g., shock waves, entanglement, physical injury), most solid items in ABL test fallout (e.g., metal and plastic debris from missile parts) are anticipated to sink relatively quickly. As such, these solid items are not likely to pose threats to organisms associated with surface waters because of the localized, offshore nature of the impact area and the likely short duration during which debris could be present in the surface water. Therefore, the potential temporary impacts to biological resources from physical impacts would not be considered significant.

4.7.1.3 Aquatic Plants and Animals.

Based on the above information for potential chemical and physical impacts, the following summarizes potential environmental consequences of the Proposed Action for likely groups of aquatic plants and animals in offshore surface waters of the ABL impact area.

Any impact related to falling debris would likely be localized and of short duration, especially for an offshore, open ocean location. The entire quantity of chemicals in the fuel/oxidizer/initiator fuel mixture is assumed to be no more than 636 liters (168 gallons) of IRFNA, 223 liters (59 gallons) of kerosene mixture, and 19 liters

(5 gallons) of initiator fuel mixture. These quantities represent what could remain in the tanks at the time of destruction; this does not consider the possibility that some quantity of these substances would be consumed at the time of destruction or could disperse as the debris falls to the ocean. Even if chemicals related to the fuel mixture reach the water's surface, the acid components of the IRFNA (i.e., nitric and hydrofluoric acids) would rapidly dissolve and disperse in the water (essentially completely soluble in water), nitrogen dioxide would rapidly vaporize (high vapor pressure), and the hydrocarbon components in the kerosene mixture would likely disappear relatively rapidly due to evaporation (i.e., relatively high vapor pressures), dissolution in the ocean water (i.e., relatively high water solubilities), and short surface water half-lives (due to aqueous biodegradation and/or photolysis).

Plankton. There is limited likelihood for large-scale impacts to lower trophic level organisms such as plankton. While plankton have limited mobility and would likely be adversely impacted by reductions in pH due to the acid components in IRFNA, the impact should be localized and of short duration, and it is reasonable to anticipate that the plankton would rapidly repopulate the affected waters. Furthermore, nitric acid in IRFNA would dissociate to nitrate, which is an important nutrient for phytoplankton production. Therefore, it is unlikely there would be significant or long-term impacts to plankton, which serve as important constituents in local marine food webs in the offshore impact area.

Fish. There is limited likelihood for large-scale impacts to fish in the general debris impact area. Mobile organisms such as fish have the capacity to move away from the impact area if they encounter detectable noxious conditions (e.g., elevated water temperature, lowered pH, or presence of detected chemicals). Occurrence of shock-wave related events due to debris splash down would likely be localized. In summary, it is unlikely there would be significant or long-term impacts to fish, which also serve as important constituents in local marine food webs (e.g., forage items for higher trophic level consumers such as seabirds, marine mammals, and humans).

Seabirds. There is limited likelihood for large-scale impacts to seabirds. Mobile organisms such as seabirds have the capacity to move away from the impact area if they encounter detectable noxious conditions (e.g., elevated water temperature, lower pH, or presence of unpalatable or unpleasant chemicals). Occurrence of shock-wave related events due to debris splash down is likely to be localized. In summary, it is unlikely there would be significant or long-term impacts to seabirds in the offshore impact area for ABL test activities.

ABL test are anticipated to occur during night-time hours, which would minimize potential impacts to seabirds that forage during daylight hours for sight-related feeding activities.

Marine Mammals. There is limited likelihood for large-scale impacts to marine mammals in the general debris impact area. Mobile organisms such as marine mammals have the capacity to move away from the impact area if they encounter detectable noxious conditions (e.g., elevated water temperature, lower pH, or presence of unpalatable or unpleasant chemicals) in the local waters.

Occurrence of shock-wave related events due to debris splash down is likely to be localized. Therefore, it is unlikely there would be significant or long-term impacts to marine mammals in the offshore impact area for ABL test activities.

Sea Turtles. There is limited likelihood for large-scale impacts to sea turtles in the general debris impact area. Mobile organisms such as sea turtles have the capacity to move away from the impact area if they encounter detectable noxious conditions (e.g., elevated water temperature, lower pH, or presence of unpalatable or unpleasant chemicals). Occurrence of shock-wave related events due to debris splash down is likely to be localized. In summary, it is unlikely there would be significant or long-term impacts to sea turtles in the offshore impact area for ABL test activities.

4.7.1.4 Threatened and Endangered Species.

Based on the above information for potential chemical and physical impacts, the following summarizes potential environmental consequences of the Proposed Action for threatened and endangered species in the offshore ABL impact area.

There is limited likelihood for large-scale impacts to any of the federally listed threatened and endangered species. Any impact related to falling debris would likely be localized and of short duration, especially for an offshore, open ocean location. The entire quantity of chemicals in the fuel/oxidizer/initiator fuel mixture is assumed to be no more than 636 liters (168 gallons) of IRFNA, 223 liters (59 gallons) of kerosene mixture, and 19 liters (5 gallons) of initiator fuel mixture. These quantities represent what could remain in the tanks at the time of destruction; this does not consider the possibility that some quantity of these substances would be consumed at the time of destruction or could disperse as the debris falls to the ocean. Even if chemicals related to the fuel mixture reach the water's surface, the acid components of the IRFNA would rapidly dissolve and disperse in the water (essentially completely soluble in water), nitrogen dioxide would rapidly vaporize (high vapor pressure), and the hydrocarbon components in the kerosene mixture would likely disappear relatively rapidly due to evaporation (i.e., relatively high vapor pressures), dissolution in the ocean water (i.e., relatively high water solubilities), and short surface water half-lives. In addition, hydrocarbon components in the kerosene fuel mixture have relatively low log K_{ow} values, which indicates a low potential for bioaccumulation in surface-water-related forage items (e.g., fish). Furthermore, mobile organisms such as seabirds, marine mammals, and sea turtles comprising threatened and endangered species have the capacity to move away from the impact area if they encounter detectable noxious conditions in the local waters.

Occurrence of shock-wave related events due to debris splash down is likely to be localized. Based on the discussion above, it is unlikely there would be impacts to federally listed threatened and endangered species in the offshore impact area from ABL test activities.

ABL test are anticipated to occur during night-time hours, which would minimize impacts for seabirds such as the brown pelican that forages during daylight hours for sight-related feeding activities.

Based on this analysis, MDA believes that a determination of “may affect, not likely to adversely affect” for listed species is appropriate for the Proposed Action. MDA has sent informal consultation letters to the USFWS and NOAA Fisheries Service (Appendix C) requesting input in the following areas:

1) Confirmation that our list of threatened and endangered species in Section 3 is current and complete; and

2) Concurrence regarding the determination that the Proposed Action is not likely to adversely affected listed species or critical habitat.

A concurrence letter received from the USWFS and NOAA Fisheries Service is included in Appendix C.

4.7.1.5 Sensitive Habitats.

Based on the above information for potential chemical and physical impacts, the following summarizes potential environmental consequences of the Proposed Action for sensitive habitats in the offshore ABL impact area. The Coastal Pelagic EFH zone includes surface waters or, more specifically, waters above the thermocline where sea surface temperatures range between 50° F to 79° F (10° C to 26° C). Therefore, the offshore components of the Coastal Pelagic EFH are in the debris fallout zone for ABL test activities.

There is limited likelihood for large-scale impacts to fish resources in the Coastal Pelagic EFH zone. Any impact related to falling debris would likely be localized and of short duration, especially for an offshore, open ocean location. The entire quantity of chemicals in the fuel/oxidizer/initiator fuel mixture is assumed to be no more than 636 liters (168 gallons) of IRFNA, 223 liters (59 gallons) of kerosene mixture, and 19 liters (5 gallons) of initiator fuel mixture. These quantities represent what could remain in the tanks at the time of destruction; this does not consider the possibility that some quantity of these substances would be consumed at the time of destruction or could disperse as the debris falls to the ocean. Even if chemicals related to the fuel mixture reach the water’s surface, the acid components of the IRFNA would rapidly dissolve and disperse in the water (essentially completely soluble in water), nitrogen dioxide would rapidly vaporize (high vapor pressure), and the hydrocarbon components in the kerosene mixture would likely disappear relatively rapidly due to evaporation (i.e., relatively high vapor pressures), dissolution in the ocean water (i.e., relatively high water solubilities), and short surface water half-lives (due to aqueous biodegradation and/or photolysis). In addition, hydrocarbon components in the kerosene fuel mixture (e.g., ethylbenzene, toluene, xylenes, cymene, triethylamine, and dimethylaniline) have relatively low log K_{ow} values, which indicate a low potential for bioaccumulation in fish. Furthermore, mobile organisms such as fish have the capacity to move away from the impact area if they encounter detectable noxious conditions in the local water column.

The distance of the impact area from the shoreline (i.e., at least 10 km [6 miles] off the coast) should result in minimal impact to the offshore sea bottom for deepwater groundfish habitat because water depths will be several hundred feet in the planned offshore impact area. In addition, the offshore nature of the impact area (i.e., at least 10 km [6 miles] off the coast) should result in minimal debris drifting to shore, which would minimize impacts to Groundfish EFH along the immediate coastline and any upriver extent of saltwater intrusion in river mouths. Experienced biological monitors would participate in shoreline evaluations to determine if any damage/impact to shoreline environments occurred.

Occurrence of shock-wave related events due to debris splash down is likely to be localized. Therefore, it is unlikely there would be substantial or long-term impacts to fish resources in the Coastal Pelagic EFH zone.

Management Measures. Because no significant impacts to biological resources are anticipated, no management measures would be required. However, the USFWS and NOAA Fisheries Service have been consulted regarding potential effects to biological resources, and recommendations from these agencies will be considered prior to implementing debris management activities.

4.7.2 No-Action Alternative

Potential impacts for biological resources would be similar to those discussed under the Proposed Action. However, because no observation or destruction of LFTS target missile debris would occur, there is a possibility that physical debris (e.g., floating metal and plastic parts from missile fallout) could reach the shore and/or the Channel Islands. That debris could pose a potential hazard to seabirds and marine mammals (e.g., seals and sea lions) in particular. Because such debris would be drifting for more than 24 hours before possibly reaching shore, the primary hazard would be from sharp edges of the debris causing physical injuries (e.g., cuts, bruises, or other physical harm).

Management Measures. Debris is not anticipated to reach the shore or Channel Islands; however, shoreline evaluations would be implemented to ensure biological resources on those shorelines are safe from the possibility of debris washing ashore. Debris that washes ashore would be disposed in accordance with applicable regulations.

Experienced biological monitors would participate in the shoreline evaluations to determine if any damage/impact to shoreline environments occurred, to monitor debris removal actions (if necessary), and to identify any potentially affected species that have come ashore after making contact with floating debris or fuel/oxidizer.

4.8 COMPATIBILITY OF THE PROPOSED ACTION WITH OBJECTIVES OF FEDERAL, STATE, REGIONAL, AND LOCAL LAND USE PLANS AND POLICIES

The Proposed Action promotes the MDAs intention to develop a capability to defend the United States, deployed forces, U.S. allies, friends, and areas of vital interest from ballistic missile attack. Vandenberg AFB has established procedures in place to ensure a safe environment to conduct ABL flight-test activities. Restricted airspace areas would be controlled according to EWR 127-1 Range Safety Requirements, Safety Operating Instructions, 30 SW regulations, and FAA directives and regulations. Notice to Mariners and Notice to Airmen would be disseminated. Established procedures would be implemented (if necessary) to evacuate or shelter personnel on off-shore oil platforms during launch operations. Any state and county beaches potentially affected during launch activities would be closed in accordance with existing agreements. The Proposed Action would not adversely affect federal, state, regional, or local land use plans and policies.

4.9 RELATIONSHIP BETWEEN SHORT-TERM USES OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY

The Proposed Action and No-Action Alternative would not affect the long-term productivity of the environment because no significant environmental impacts are anticipated, provided appropriate tracking, monitoring, and disposal actions identified in this EA are implemented. Natural resources would not be depleted.

4.10 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Implementation of the Proposed Action or No-Action Alternative would result in an irreversible or irretrievable commitment of small quantities of resources such as fuel, LFTS target missiles, and labor.

4.11 CUMULATIVE ENVIRONMENTAL CONSEQUENCES

Cumulative impacts result from "the incremental impact of actions when added to other past, present, and reasonably foreseeable future actions, regardless of what agency undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time" (Council on Environmental Quality, 1978).

No other reasonably foreseeable actions with regards to hazardous waste management, water resources, and biological resources have been identified that could be considered as contributing to a potential cumulative impact on the environment along with impacts associated with implementation of debris management activities. Health and safety and air quality are the only resource areas for which potential cumulative impacts could occur.

Vandenberg AFB has established procedures in place to ensure a safe environment to conduct ABL test activities (e.g., range closure, restricted airspace, Notice to Mariners, Notice to Airmen, evacuating or sheltering personnel on off-shore oilrigs, and road and beach closures). Therefore, cumulative impacts from conducting the seven LFTS target missile launches, one "dress rehearsal", and associated debris management activities would not result in significant cumulative environmental consequences when combined with other activities within the Western Range. Other missile or rocket launches have been addressed and are carefully scheduled and coordinated to prevent cumulative impacts of launch operations.

Emission levels from proposed ABL flight-test activities evaluated in the Supplemental EIS for the Airborne Laser Program (Missile Defense Agency, 2003) when combined with emission levels from proposed debris management activities are not anticipated to result in cumulative impacts to regional air quality (Table 4-7).

Table 4-7. Cumulative Emissions (Debris Management and ABL Flight Tests)

Emission Source	Pollutant (tons)		
	VOC	NO_X	PM_{10}
Debris Management (Aircraft, Debris Boat)	0.49	4.52	0.22
ABL Flight Test	0.17	0.12	0.02
Totals	0.66	4.64	0.24

ABL = Airborne Laser
NO_X = nitrogen oxide
VOC = volatile organic compound

Source: Missile Defense Agency, 2003.

Other missile test and rocket launch activities within the Western Range to support other military and commercial functions have been addressed in EAs and EISs. An average of 14 government-launched missiles occur annually at Vandenberg AFB. Because a limited number of launches occur annually and these launches have been evaluated in other NEPA documentation, cumulative air quality impacts of other launch actions are not anticipated.

5.0 CONSULTATION AND COORDINATION

The federal and state agencies listed below were contacted during preparation of this EA.

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NOAA Fisheries Services
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7.0 BIBLIOGRAPHY

Barlow, J., K.A. Forney, P.S. Hill, R.L. Brownell Jr., J.V. Carretta, D.P. DeMaster, F. Julian, M.S. Lowry, T. Ragen and R.R. Reeves, 1997. U.S. Pacific Marine Mammal Stock Assessments: 1996, NOAA-TM-NMFS-SWFSC-248.

Barlow, J., P. Scott Hill, F.A. Forney, and D.P. DeMaster, 1998. U.S. Pacific Marine Mammal Stock Assessments: 1998, NOAA-TM-NMFS-SWFSC-In press.

Bonnell, M.L. and M.D. Dailey, 1993. Marine mammals, p. 604-681 In: Dailey, M.D., D.J. Reish, and J.W. Anderson (eds.), Ecology of the Southern California Bight: A Synthesis and Interpretation. University of California Press, Berkeley, CA.

Braham, H.W., 1991. Endangered Whales: Status Update, A Report on the 5-year Status of Stocks Review under the 1978 Amendments to the U.S. Endangered Species Act, Unpublished report.

Brown, D.W., 1974. Hydrography and Midwater Fishes of Three Contiguous Areas off Santa Barbara, California. Natural History Museum of Los Angeles County, Contributions in Science 261: 1-30.

California Coastal Commission, 2002. Resolution Supporting the Conservation of Sea Turtles. California Coastal Commission, San Francisco, CA, December, 2002.

California Fish and Game Commission, 2007. California Fish and Game Commission Preferred Alternative for Implementation of the Marine Life Protection Act in the Central California Coast Region (Pigeon Point to Point Conception), August.

Carr, A.F., 1987. The impact of non-degradable marine debris on the ecology and survival outlook of sea turtles, *Mar. Poll. Bull.* 18: 352-356.

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, NOAA-TM-NMFS-SWFSC-388.

Council on Environmental Quality, 1978. Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act.

Cross, J.N. and L.G. Allen, 1993. Fishes, p 459-540 in Dailey, M.D., D.J. Reish and J.W. Anderson (eds.), Ecology of the Southern California Bight: A Synthesis and Interpretation. University of California Press, Berkeley, CA.

Dawson, J.K. and R.E. Pieper, 1993. Zooplankton, p 266-303 in Dailey, M.D., D.J. Reish and J.W. Anderson (eds.), Ecology of the Southern California Bight: A Synthesis and Interpretation. University of California Press, Berkeley, CA.

Eckert, K.L., 1993. The Biology and Population Status of Marine Turtles in the Northern Pacific Ocean. NOAA Tech. Memo, NMFS-SEFSC-186.

ENSR International, 2001. Final USAF Environmental Assessment for Harbor Activities Associated with the Delta IV Program at Vandenberg Air Force Base, July.

Gooding, R.M. and J.J. Magnuson, 1967. Ecological significance of a drifting object to pelagic fishes. *Pac. Sci. 2*1:486-497.

Hardy, J.T., 1993. Phytoplankton, in Dailey, M.D., D.J. Reish and J.W. Anderson (eds.), Ecology of the Southern California Bight: A Synthesis and Interpretation, University of California Press, Berkeley, CA.

Horn, M.H. and L.G. Allen, 1978. A distributional analysis of California coastal marine fishes. *J. Biogeogr.*

Howard, P.H., 1989. Handbook of Environmental Fate and Exposure Data for Organic Chemicals. Volume I: Large Production and Priority Pollutants.

Howard, P.H., 1990. Handbook of Environmental Fate and Exposure Data for Organic Chemicals. Volume II: Solvents.

Howard, P.H., R.S. Boethling, W.F. Jarvis, W.M. Meylan, and E.M. Michalenko, 1991. Handbook of Environmental Degradation Rates.

Hubbs, C.L., 1960. The biogeography of Baja California and adjacent Seas Part II. Marine Biotas. The marine vertebrates of the outer coast. Systo. Zool. 4: 134-147.

Hunter, J.R. and C.T. Mitchel, 1966. Association of fishes with flotsam in offshore waters of Central America, *Fish. Bull.* 66:13-29.

Kullenberg, G., 1994. Marine Mammals and Marine Debris. The Pilot June.

Mackay, D., W.Y. Shiu, and K.C. Ma., 1992. Illustrated Handbook of Physical-Chemical Properties and Environmental Fate for Organic Chemicals. Vol. I: Monoaromatic Hydrocarbons, Chlorobenzenes, and PCBs.

Mackay, D., W.Y. Shiu, and K.C. Ma., 1995. Illustrated Handbook of Physical-Chemical Properties and Environmental Fate for Organic Chemicals. Vol. IV: Oxygen, Nitrogen, and Sulfur Containing Compounds.

Mason, J.W., G.J. McChesney, W.R. McIver, H.R. Carter, J.Y. Takekawa, R.T. Golightly, J.T. Ackerman, D.L. Orthmeyer, W.M. Perry, J.L. Yee, M.O. Pierson, and M.D. McCrary, 2004. At-Sea Aerial Surveys of Seabirds in the Southern California Bight: 1999-2002. Pages 11-109 in Takekawa, J.Y., H.R. Carter, D.L. Orthmeyer, R.T. Golightly, J.T. Ackerman, G.J. McChesney, J.W. Mason, J. Adams, W.R. McIver, M.O. Pierson, and C.D. Hamilton, 2004. At-sea distribution and abundance of seabirds and marine mammals in the Southern California Bight: 1999-2003. Unpublished summary report, U.S. Geological Survey, Western Ecological Research Center, Vallejo, CA; and Humboldt State University, Department of Wildlife, Arcata, CA.

Missile Defense Agency, 2002. Environmental Assessment: Liquid Propellant Target, White Sands Missile Range, New Mexico, September.

Missile Defense Agency, 2003. Final Supplemental Environmental Impact Statement for the Airborne Laser Program, June.

Missile Defense Agency, 2004. Environmental Assessment for the Use of Tributyl Phosphate (TBP) in the Intercept Debris Measurement Program (IDMP) at White Sands Missile Range, April.

Missile Defense Agency, 2005a. Debris Management Plan, July.

Missile Defense Agency, 2005b. Environmental Assessment for MUDPACK II Tests, April.

Morreale, S.A., E.A. Standora, F.V. Paladino, and J.R. Spotila, 1994. Leatherback Migrations Along Deepwater Bathymetric Contours, P.109-110 in Proc. 13th Annual.

National Marine Fisheries Service, 1993. Environmental Assessment on Proposed Regulations Governing the Taking of Marine Mammals Incidental to the Underwater Detonation of Conventional Explosives in the Offshore Waters of the Outer Sea Test Range of the Naval Air Warfare Center, Pt. Mugu, California.

NMFS and USFWS, 1996a. Recovery Plans for U.S. Pacific Populations of the Leatherback Turtle (*Dermochelys coriacea*).

NMFS and USFWS, 1996b. Recovery Plans for U.S. Pacific Populations of the Olive Ridley Turtle (*Lepidochelys olivacea*).

National Oceanic and Atmospheric Administration, 2005. *Nitric Acid Dispersion Modeling*, June.

National Research Council, 1990. The Decline of the Sea Turtles.

Naval Air Warfare Center Weapons Division, Point Mugu, 1998. Point Mugu Sea Range Marine Mammal Technical Report, December. .

Naval Air Warfare Center Weapons Division, Point Mugu, 2002. Final Environmental Impact Statement/ Overseas Environmental Impact Statement, March.

Orthmeyer, D.L., H.R. Carter, J.Y. Takekawa, and R.T. Golightly (eds.), 2000. At-Sea Distribution of Seabirds and Marine Mammals in the Southern California Bight: 2000 Progress Report.

Pierson, M.O., J.W. Mason, M.D. McCrary, G.J. McChesney, W.R. McIver, H.R. Carter, R.T. Golightly, D.L. Orthmeyer, J.Y. Takekawa, W. Perry, and J.L. Yee, 2004. At-Sea Aerial Surveys of Marine Mammals in the Southern California Bight: 1999-2002. Pages 110-198 in Takekawa, J.Y., H.R. Carter, D.L. Orthmeyer, R.T. Golightly, J.T. Ackerman, G.J. McChesney, J.W. Mason, J. Adams, W.R. McIver, M.O. Pierson, and C.D. Hamilton, 2004. At-sea distribution and abundance of seabirds and marine mammals in the Southern California Bight: 1999-2003. Unpublished summary report, U.S. Geological Survey, Western Ecological Research Center, Vallejo, CA; and Humboldt State University, Department of Wildlife, Arcata, CA.

Pritchard, P.C.H., 1997. Evolution, Phylogeny, and Current Status, in Lutz, P.L. and J.A. Musick (eds.), The Biology of Sea Turtles.

Radovich, J., 1961. Relationships of Some Marine Organisms of the Northeast Pacific to Water Temperatures, Particularly during 1957 through 1959, *California Fish and Game* 112:1-62.

Science Applications International Corporation, 2002. Debris Analysis of ABL Test Targets.

Standora, E.A., J.R. Spotila, J.A. Keinath, and C.R Schoop, 1984. Body Temperatures, Diving Cycles, and Movement of a Sub-adult Leatherback Turtle, *Dermochelys coriacea. Herp.* 40:169-176.

Stinson, M.L., 1984. Biology of Sea Turtles in San Diego Bay, California, and the Northeastern Pacific Ocean, Masters Thesis, San Diego State University.

U.S. Air Force, undated. Draft Integrated Natural Resources Management Plan, Vandenberg Air Force Base, California.

U.S. Air Force, 1997a. Final Environmental Impact Statement for the Program Definition and Risk Reduction Phase of the Airborne Laser Program.

U.S. Air Force, 1997b. Final Theater Ballistic Missile Targets Programmatic Environmental Assessment, December.

U.S. Air Force, 1997c. Eastern & Western Range 127-1, Range Safety Requirements, October.

U.S. Air Force, 1998a. Final Environmental Impacts Statement, Evolved Expendable Launch Vehicle Program, April.

U.S. Air Force, 1998b. Biological Opinion for the Theater Ballistic Missile Targets Program, Vandenberg Air Force Base, Santa Barbara County, California (1-8-98-F-24), May.

U.S. Air Force, 2000. Hazardous Waste Management Plan, 30 SW Plan 32-7043-A, November.

U.S. Air Force, 2001a. Final, Theater Ballistic Missile Targets Programmatic Environmental Assessment, Vandenberg Air Force Base, California, December.

U.S. Air Force, 2001b. Range Safety Requirements Document, Airborne Laser Program, July.

U.S. Air Force, 2004. Environmental Assessment for Minuteman III Modification, December.

U.S. Army Space and Missile Defense Command, 2005. Small Missile Launch Site, Coordinating Draft Environmental Assessment, March.

U.S. Environmental Protection Agency, 1992. The Procedures of Emission Inventory Preparation, Volume IV: Mobile Sources.

U.S. Environmental Protection Agency, 1993. Determining Conformity of General Federal Actions to State or Federal Implementation Plans, November.

U.S. Environmental Protection Agency, 2002. National Recommended Water Quality Criteria: 2002, EPA-822-R-02-047, November.

U.S. Environmental Protection Agency, 2004a. Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression-Ignition, April.

U.S. Environmental Protection Agency, 2004b. Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling, April.

U.S. Fish and Wildlife Service, 2005. *Species Information: Threatened and Endangered Animals and Plants.* < http://www.fws.gov/endangered/wildlife.html>

U.S. Geological Survey, 2002. At Sea Distribution of Seabirds and Marine Mammals in the Southern California Bight.

U.S. Navy, 2005. Hazardous Waste Management Plan, Navy Region Southwest, June.

www.inchem.org/documents/ehc/ehc/ehc112.htm, 2005. International Programme on Chemical Safety, Environmental Health Criteria 112, Tri- n –Butyl Phosphate.

www.bt.ucsd.edu/bt_safety.html, 2005. Bacillus thuringiensis, Animal Safety.

Yelverton, J.T., 1981. Underwater Explosion Damage Risk Criteria for Fish, Birds, and Mammals. Paper presented at the 102nd meeting of the Acoustical Society of America.

Yelverton, J.T., D.R. Richmond, W. Hicks, K. Saunders, and E.R. Fletcher, 1975. The Relationship Between Fish Size and their Response to Underwater Blast. Rep. by Lovelace foundation for Medical Education and Research, Albuquerque, New Mexico for Defense Nuclear Agency, Report No. 3677T.

Young, G.A., 1991. Concise Methods of Predicting the Effects of Underwater Explosions on Marine Life, Naval Surface Weapons Center, White Oak, Silver Spring, Maryland, NTIS AD A241310.

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APPENDIX A
DESCRIPTIONS OF BIOLOGICAL SPECIES THAT COULD BE PRESENT IN THE AFFECTED AREA

BIOLOGICAL SPECIES POTENTIALLY PRESENT IN THE AFFECTED AREA

Seabirds

The following descriptions of distributions for individual seabirds are extracted from Mason et al. (2004).

Brown Pelican (*Pelecanus occidentalis*)

The brown pelican subspecies (*P. occidentalis californicus*) breeds from California to the Pacific coast of southern Mexico and the Gulf of California. Greatest pelican abundance in the Southern California Bight occurs in late summer and early fall coincident with dispersal of birds from breeding colonies in Mexico; abundance is lowest after breeding brown pelicans return to breeding colonies in Mexico in early winter. During the late 1960s and early 1970s, brown pelicans experienced extremely poor breeding success due to eggshell thinning caused by contamination by the chlorinated pesticide dichloro diphenyl trichloroethane (DDT). Reproductive success did not rebound until the late 1970s. From 1969 to 1978, fewer than 800 nests were estimated on West Anacapa Island. In 1991, 10,680 breeding brown pelicans were estimated on West Anacapa Island and 1,236 were estimated on Santa Barbara Island.

Double-crested Cormorant (*Phalacrocorax auritus*)

Double-crested cormorants are the most numerous and widely distributed of the six North American cormorants and are rarely observed far from land. Along the Pacific coast, the subspecies *P. auritus albociliatus* breeds from southern British Columbia, Canada to Sinaloa, Mexico (west coast of central Mexico mainland) in marine and estuarine habitats. Double-crested cormorants experienced reduced breeding success in the mid-twentieth century due to the chlorinated pesticide DDT. In 1969, severe eggshell thinning from DDT contamination was discovered in double-crested cormorants breeding on West Anacapa Island and South Los Coronados Island, Mexico. Reduced breeding success continued until the early 1970s at the West Anacapa Island colony, but thereafter, breeding success improved. In 1991, the estimated 10,040 birds in the Southern California Bight represented greater than a fourfold increase in numbers compared with 1975 to 1978 estimates. In the Southern California Bight, breeding colonies were located on Prince (less than 1 kilometer [km] north of San Miguel Island), West Anacapa, Santa Barbara, and Sutil islands (less than 1 kilometer east of Santa Barbara Island). Only a few double-crested cormorants were observed at sea from 1975 to 1983 and these were less than 3 km from breeding colonies. In surveys in 1999 to 2002 (Mason et al., 2004), double-crested cormorants were consistently observed near Point Loma and Palos Verdes, south of Point Buchon, north of Morro Bay, along the mainland coast of the Santa Barbara Channel, and near the four northern Channel Islands and San Nicolas Island. Approximately 86 percent of the double-crested cormorants were observed less than 1 km from shore; however, during May and September, individuals were occasionally observed 20 to 30 km northwest of Santa Barbara Island.

Brandt's Cormorant (*Phalacrocorax penicillatus*)

Brandt's cormorants nest along the Pacific coast from southern Vancouver Island, British Columbia, Canada to southern Baja California, Mexico, including the Gulf of California. They are one of the most widely distributed and abundant breeding seabirds in the Southern California Bight and breed in dense colonies on all eight of the Channel Islands except Santa Catalina Island. The population size of Brandt's Cormorants decreased in the 1950s and 1960s due to breeding failures caused by contamination by the chlorinated pesticide DDT. At Santa Barbara and San Nicolas Islands, abundance of cormorants decreased by 50 to 90 percent from the 1950s to 1977. In 1991, however, 29,400 breeding birds were estimated at 31 active breeding colonies in the Southern California Bight (13 of the colonies were newly discovered). This represents an almost four-fold increase in the numbers of Brandt's Cormorants since 1975 to 1978 (7,600 birds). From 1975 to 1983, Brandt's cormorants occurred primarily in shallow waters les than 10 km from shore and less than 25 km from island or mainland roosts or colonies. Along mainland coasts, birds consistently occurred in large roosts near Point Loma, Palos Verdes, Point Sal, and Point Buchon. Brandt's cormorants were present at Santa Catalina Island during January and San Clemente Island during January and September. During May, however, reduced densities occurred in the southeastern Southern California Bight and increased densities occurred in the northern Southern California Bight where breeding colonies were located.

Pelagic Cormorant (*Phalacrocorax pelagicus*)

Pelagic cormorants, despite their name, are the least pelagic of the cormorants occurring in the Southern California Bight and are rarely observed more than a few kilometers from shore. Pelagic cormorants breed along the Pacific coast from northern Alaska to Los Coronados Islands in northern Baja California, Mexico and occur south to central Baja California, Mexico. They breed on all Channel Islands except San Nicolas, San Clemente, and Santa Catalina Islands. In 1991, estimated 2,700 birds were estimated in the Southern California Bight, a threefold increase compared with estimates during 1975 to 1978. In a study in the mid-late 1980s, few pelagic cormorants were observed; most were observed north of Point Conception less than 10 kilometers from shore. Similarly, Mason et al. (2004) observed most birds were less than 10 km from shore, but unlike the previous study more than 80 of the birds occurred south of Point Conception near San Miguel, Santa Rosa, and Santa Cruz Islands. Along the mainland coastline during May and September, Mason et al. (2004) consistently observed birds near Point Buchon and Morro Bay during May and September. Although pelagic cormorants bred on Santa Barbara Island in 1991, Mason et al. (2004) did not observe birds near the island during May from 1999 to 2002. The few birds they observed during September surveys, however, occurred less than 10 km from Santa Barbara Island.

Cassin's Auklet (*Ptychoramphus aleuticus*)

Cassin's auklets are one of the most widely distributed alcids of the Pacific Ocean and breed from the western tip of the Aleutian Archipelago, Alaska to central Baja California, Mexico. Cassin's auklets are the third most abundant species breeding in the Southern California Bight. From 1975 to 1983, Cassin's auklets were observed year-round throughout California waters from the mid-continental shelf out to 150 kilometers from shore, but in late spring and summer, auklets were concentrated near breeding colonies. From August through October, birds were distributed throughout the Southern California Bight west of San Clemente Island, and over the continental shelf and slope from San Miguel Island to Point Buchon. In contrast, from 1999 to 2002, Mason et al. (2004) observed that Cassin's auklet distribution varied markedly with survey month, but birds generally were observed more than 10 km from shore in all survey months. During May, birds were concentrated in the northwest portion of the Santa Barbara Channel and at sea north of Point Conception. During September, most auklets were observed north of Point Conception and were widely distributed across the Southern California Bight during January primarily west of San Nicolas Island. During September, Mason et al. (2004) observed Cassin's auklets primarily in deeper water seaward of the continental slope.

Common Murre (*Uria aalge*)

Common murres are the most abundant breeding seabird in California. Along the eastern Pacific coast, murres breed on islands from western Alaska to Hurricane Point, Monterey County in central California. Common murres generally winter from the southern limit of sea ice in the Bering Sea to southern California but have been observed as far south as San Quintin, Baja California, Mexico, in times of cooler sea surface temperatures. Historically, common murres bred in the Southern California Bight on Prince Island, (less than 1 km north of San Miguel Island), but as a result of egg gathering for private collections, the colony was extirpated in 1912. In central California (Point Conception to 38º 50'N latitude), common murre breeding populations declined by 53 percent from 1980 to 1986 and continued to decline through 1989. The central California breeding population was estimated to be 194,000 - 224,000 in 1980 to 1982 and 90,200 by 1989. Declines in the breeding population were attributed to several factors including reduced reproductive success associated with the severe 1982 - 1983 El Niño, mortality from oil spills and gill net fisheries, and human disturbance at breeding colonies. During the nesting season (April through July), common murres were observed in waters that were less than 150 m deep, and 75 percent occurred less than 40 km from breeding colonies. From 1980 to 1983, common murres occurred south of Point Sur only outside the nesting season. Even in the winter, murres still were most abundant within 50 km of breeding colonies. From 1975 to 1983, large numbers (20,000 - 30,000) occurred within the Santa Barbara Channel and from Morro Bay to Point Arguello (30,000) during the fall and winter, but not during the spring and summer. From 1999 to 2002, Mason et al. (2004) observed only 232 Common Murres and more than 85 percent were north of Point Conception. More than 90 percent of murres occurred within 20 km from shore in waters less than 150 m deep.

Xantus' Murrelet (*Synthliboramphus hypoleucus*)

Xantus' murrelets are one of the most southerly distributed alcids with a limited breeding range extending from the Southern California Bight to central Baja California, Mexico. There are two subspecies of xantus' murrelets: *S. h. scrippsi* nests primarily in California and *S. h. hypoleuca* nests primarily in Baja California, Mexico. Both subspecies were recently listed as threatened by the California Department of Fish and Game and have been petitioned for Federal listing under the Endangered Species Act. Xantus' murrelets breed on all Channel Islands except Santa Rosa and San Nicolas Islands. In 1991, 1,400 breeding birds (81 percent of the California population) were estimated on Santa Barbara Island and the colony was considered to be stable or declining slightly. Xantus' murrelets typically occur near breeding colonies in December and January. Observations have noted birds concentrated around Santa Barbara Island during the breeding months (March to May) and distributed north of Point Conception from August through October 20,100 km from shore. During May in 1999 to 2001, greatest densities have been observed near Santa Barbara and Anacapa Islands and north of Point Conception along the coast; 88 percent of murrelets occurred within 40 km of shore and correspondingly 87 percent occurred in waters that were less than 1,400 m deep.

Western Gull (*Larus occidentalis*)

Western gulls breed on offshore islands and rocks from central Baja California, Mexico, to Washington and winter in nearshore waters from the southern tip of Baja California, Mexico to Vancouver Island, Canada. The North American population has been estimated at 40,000 pairs. Western gulls are the most widely distributed and the second most abundant breeding seabird in the Southern California Bight. Large breeding colonies occur at San Miguel, Santa Barbara, Anacapa, and San Nicolas Islands. In 1991, 28,000 breeding birds were estimated to be in the Southern California Bight, a 144 percent increase in numbers compared with surveys conducted in the late 1970s. Western gulls were observed along California coastlines during all months and seldom farther than 25 km seaward of the shelf break. Western gulls were more restricted to areas near breeding colonies from April to August, and from November through February, were distributed more evenly throughout the Southern California Bight. In contrast, Mason et al. (2004) observed western gulls throughout the Southern California Bight during 1999 to 2002 in all seasons, on all at-sea and coastal transect lines, and along all mainland and island coastlines. More than 96 percent of observed western gulls occurred within 20 km of shore.

California Gull (*Larus californicus*)

California gulls are one of the most common gulls in California's offshore waters. They breed at numerous sites on inland lakes from Mono Lake to San Francisco Bay, California, and from southern Colorado to Manitoba, Canada. Beginning in late summer, California gulls winter on the eastern Pacific coast from southern British Columbia, Canada, to southern Baja California, Mexico, and the Gulf of California. They undergo a northward migration during early fall to southern British Columbia coastal waters and move south during late fall reaching maximum abundances off central and southern California during January and February. Breeding adults begin returning to inland colonies in February. They have been determined to be the most abundant gulls in nearshore waters in the fall and winter. From 1975 to 1978, California gulls arrived in the Southern California Bight during late September or October. Surveys conducted from mainland and island coasts indicated maximum abundances in the Southern California Bight were from January through March. From 1999 to 2002, Mason et al. (2004) observed California gulls near mainland and island coastlines in all survey months and throughout the Southern California Bight during January. California gulls were observed on 86 percent of transects and 84 percent occurred within 1 km of shore.

<u>Heermann's Gull</u> (*Larus heermanni*)

Heermann's gulls nest in dense colonies in desert habitats on only a few islands adjacent to productive ocean areas. In 1981, the world breeding population was estimated at 260,000 individuals, 95 percent of which bred on Isla Rasa in the Gulf of California, Mexico. Small numbers also have bred on two islands on the Pacific coast of Baja California, Mexico. Post-breeding arrival of Heermann's gulls off southern California have been reported from late April to June and departure to breeding areas in Mexico in early fall. From 1975 to 1978, they occurred consistently from Morro Bay to the Santa Barbara Channel and near San Diego. In all survey months from 1999 to 2002, Mason et al. (2004) observed Heermann's gulls near Palos Verdes. During January and September, Mason et al. consistently observed birds along the mainland coast from Point Sal to Gaviota and near Huntington Beach, San Diego, and Santa Rosa, Santa Cruz, Anacapa, and San Clemente Islands. More than 86 percent of observed Heermann's gulls occurred within 1 km of shore.

<u>Bonaparte's Gull</u> (*Larus philadelphia*)

Bonaparte's gulls winter on the Pacific Coast from southern British Columbia, Canada to southern Baja California and Nayarit, Mexico. Off California, gulls arrived during September to October, reaching maximum numbers in late October to November. Numbers declined through the winter and increased again during March to May. Although dispersed widely throughout shelf and slope waters, greatest numbers of birds occurred within 40 km of shore. From 1999 to 2002, Mason et al. (2004) noted birds occurred only during January and May with more than 99 percent of observed Bonaparte's gulls south of Point Conception and more than 90 percent of birds were less than 40 km from shore.

<u>Sooty Shearwater</u> (*Puffinus griseus*)

Sooty and short-tailed shearwaters are difficult to distinguish from the air and are often considered together. Sooty shearwaters are one of the most abundant seabirds of the Pacific Ocean. Shearwaters breed on islands near New Zealand, Chile, and Australia from October to May and migrate to the northern Pacific Ocean from May to September. In the 1970s, an estimated four million sooty shearwaters occurred off California. From 1987 to 1994, sooty shearwater numbers decreased by 80 to 90 percent coincident with increased sea surface temperatures throughout the California Current System. Maximum numbers off southern California occurred during May in the shelf waters off Point Conception. From 1999 to 2002, Mason et al. (2004) noted that sooty shearwaters were distributed throughout the Southern California Bight during May and concentrated near the northern Channel Islands.

<u>Ashy Storm-Petrel</u> (*Oceanodroma homochroa*)

There are an estimated 10,000 ashy storm-petrels off of California and Baja California, Mexico. Ashy storm-petrels occur year-round in waters of the continental slope and slightly farther to sea and do not migrate or disperse far from breeding locations. In the Southern California Bight, birds breed on Los Coronados Islands, Baja California, Mexico, and all California Channel Islands except Santa Rosa, San Nicolas, and Santa Catalina. The state of California designated ashy storm-petrels a species of special concern and the U.S. Fish and Wildlife Service designated the species as a bird of conservation concern. In 1991, 3,135 birds were estimated in the Southern California Bight but differences in survey protocols and efforts from past studies made trends in population size difficult to assess. Off southern California, ashy storm-petrels have been observed in greatest abundance near San Miguel Island from April to June. After October, birds occurred near San Clemente and Santa Catalina Islands, over the Santa Rosa-Cortes Ridge, and in the western Santa Barbara Channel to Point Buchon. From 1999 to 2002, Mason et al. (2004) observed ashy storm-petrels throughout the Southern California Bight with aggregations between Santa Cruz and San Nicolas Islands, in the western Santa Barbara Channel, and 10 to 70 km offshore from San Miguel Island to Point Buchon.

<u>Black Storm-Petrel</u> (*Oceanodroma melania*)

Black storm-petrels breed primarily on the Channel Islands, off the west coast of Baja California, Mexico, and on islands in the Gulf of California, Mexico. In the Southern California Bight, storm-petrels breed on Santa Barbara, Sutil, and Los Coronados Islands, and possibly on Prince (less than 1 km north of San Miguel Island) and San Clemente Islands. Breeding numbers are difficult to estimate because black storm-petrels nest in inaccessible burrows or crevices and are active at breeding colonies only at night. In 1991, 274 breeding birds were estimated at Santa Barbara and Sutil Islands representing more than 54 percent increase from 1975 to 1978. Black storm-petrels have been observed in all months with maximum abundances in August and September. From 1975 to 1978, birds occurred primarily off California south of Point Conception and within 50 km of the mainland, although aggregations of birds also were observed at Forty Mile Bank (30 km southeast of San Clemente Island), near Santa Barbara Island, and along the Santa Rosa-Cortes Ridge. From 1999 to 2001 during September and May, Mason et al. (2004) noted that black storm-petrels occurred between Cortez Bank and San Diego, within 40 km of the northern Channel Islands, and 50 to 100 km from Point Buchon during September.

Western Grebe (*Aechmophorus occidentalis*)

Western and Clark's grebes are difficult to distinguish from the air and are often combined in counts. Western grebes breed on lakes from northwestern Canada to northern Baja California, Mexico and east to Minnesota. Along the Pacific coast, western grebes winter from southern British Columbia, Canada to southern Baja California and Sinaloa, Mexico. From 1975 to 1978 in the Southern California Bight, western grebes were abundant from October through May in the eastern Santa Barbara Channel and rare near the Channel Islands and offshore. From 1999 to 2002, Mason et al. (2004) noted that western grebes were distributed along mainland and island coasts throughout the Southern California Bight and aggregations of grebes were consistently observed during all survey months near Morro Bay, Point Sal, and Palos Verdes, and from 75 km north of San Diego to the Mexican border.

Surf Scoter (*Melanitta perspicillata*)

Surf scoters breed on the west coast of North America from the western Aleutian Islands, Alaska to British Columbia, Canada and at several inland sites to eastern Canada. Scoters primarily winter from the eastern Aleutian Islands and southeast Alaska to central Baja California, Mexico and in the northern Gulf of California to central Sonora, Mexico. From 1975 to 1978, surf scoters arrived in the Southern California Bight during November and December with maximum abundances from December through March. In the winter from 1975 to 1978, they most often occurred in nearshore waters in the eastern Santa Barbara Channel, along northern shores of the northern Channel Islands, in Santa Monica Bay, and from south of Dana Point to San Diego. From 1999 to 2002, Mason et al. (2004) recorded surf scoters in all survey months and consistently observed them near San Diego and Morro Bay and in the eastern Santa Barbara Channel.

Red-necked Phalarope (*Phalaropus lobatus*)

Red-necked phalaropes winter at sea and migrate south to areas in tropical oceans primarily off the coast of Peru and Chile. Departure times for the southward migration are protracted and red-necked phalaropes appear in the Southern California Bight from mid-June to late October and again when returning north from mid April to early June.

Red Phalarope (*Phalaropus fulicarius*)

Red phalaropes are almost entirely pelagic outside the breeding season, but may occur on bays and coastal estuaries. Red phalaropes have been noted to migrate into the Southern California Bight between April and May and migrate out between August and November. From 1999 to 2002, Mason et al. (2004) noted that red phalaropes were rare during January, scattered throughout the study area during May, and distributed north of the northern Channel Islands and Point Conception during September.

Marine Mammals

Harbor Porpoise (*Phocoena phocoena*)

Harbor porpoises do not have a special status in California and fewer than 200 individuals are expected to be found within the Point Mugu Sea Range (Sea Range). However, the species is common inshore of the northern part of the Sea Range. They are more abundant in the Sea Range during autumn and winter than during spring and summer. They dive to depths less than 660 feet (200 meters [m]) and feed mainly on bottom-dwelling fish and invertebrates.

Dall's Porpoise (*Phocoenoides dalli*)

The Dall's porpoise does not have a special status. It is the most abundant cetacean in the North Pacific Ocean. During the winter, it is common throughout the Sea Range and approximately 9,500 individuals are present in this area at that time. There are seasonal changes in distribution and abundance; these changes are likely related to changes in water temperature. During the spring and autumn, lower numbers are present in the Sea Range. Relatively few Dall's porpoises are present in the southern part of the Sea Range during summer, but low to moderate numbers remain in the northern part. Juveniles are more likely to be found close to shore and large adults farther offshore. Females with calves remain mainly outside of the Sea Range. Dall's porpoises feed primarily at night on fish and cephalopods.

Pacific White-sided Dolphin (*Lagenorhynchus obliquidens*)

The Pacific white-sided dolphin does not have a special status and it is probably the most abundant delphinid in temperate waters of the North Pacific Ocean. It is widely distributed throughout the Sea Range except for shallow and nearshore areas. The number present in the Sea Range at any time of year may be highly variable and there may be year-to-year or seasonal shifts in abundance that are related to changes in water temperature and/or changes in prey abundance. In most years, this species is abundant in the Sea Range during autumn to spring when an estimated 23,000 to 28,000 animals are present. Most Pacific white-sided dolphins move northward during summer when only about 1,000 individuals remain in the Sea Range. As many as 25,000 animals are found in non-Territorial Waters and as many as 9,500 in Territorial Waters. Mean group size in the study area is about 80 animals. Pacific white-sided dolphins feed primarily on fish at night in the epipelagic zone where they may dive to depths of 700 feet (210 m) or more.

Risso's Dolphin (*Grampus griseus*)

Risso's dolphin does not have a special status and is common throughout the range and throughout the year. Maximum numbers are present in the Sea Range during autumn and winter when about 32,000 animals, or most of the California population, are expected to be present. Lowest numbers are present during summer when about 11,600 animals are present in the Sea Range. Numbers present in specific areas are highly variable and are likely related to sea surface temperature and the abundance of squid, their major prey. Estimated numbers of Risso's dolphins in Territorial Waters vary from 75 individuals (spring) to 8,272 (winter) and numbers in non-Territorial Waters vary from 7,034 (summer) to 40,647 (autumn). The mean group size in the Sea Range is 42 (or 25 if five large groups are excluded); one group of 2,500 has been sighted. Both adult and immature Risso's dolphins are likely to occur in the Sea Range at all times of year.

Bottlenose Dolphin (*Tursiops truncates*)

There are two stocks of bottlenose dolphins in and near the Sea Range: a coastal stock and an offshore stock. Neither stock has a special status but the coastal stock is small and is vulnerable to any population declines. Coastal bottlenose dolphins have not been identified within the Sea Range although they are commonly sighted in coastal and nearshore areas east and southeast of the Sea Range. Offshore bottlenose dolphins are present year-round but are more abundant during summer, when approximately 2,900 dolphins are present. Highest densities of bottlenose dolphins are found in the southeastern part of the Sea Range. During summer about 60 percent of the bottlenose dolphins in the Sea Range are found in Territorial Waters. During other times of the year, they are probably more common in non-Territorial than Territorial Waters. Bottlenose dolphins are opportunistic feeders that regularly forage near the bottom on fish.

Common Dolphin (*Delphinus* spp.)

The common dolphin does not have a special status, and the population off the coast of California has increased substantially in the past 20 years. There are two species: the long-beaked common dolphin, found within 50 nautical miles (nm) (90 km) of shore, and the short-beaked common dolphin, found to greater than 300 nm (560 km) from shore. Most studies have not distinguished the two species so they are treated together here. The common dolphin is the most common cetacean in the Sea Range but it exhibits large seasonal changes in distribution and abundance, probably related to seasonal changes in water temperatures. During autumn to spring, common dolphins are most common in the southeastern part of the Sea Range, and south and east of there. During summer, their numbers decrease in the Sea Range as they disperse northward. In autumn to spring, an estimated 220,000 to 240,000 common dolphins are found in the Sea Range. During summer, about 150,000 common dolphins are scattered throughout the Sea Range. Within the Sea Range, roughly equal proportions of common dolphins are found in Territorial and non-Territorial Waters during winter to summer. During autumn, only about 38 percent are found in Territorial Waters. The mean group size within the Sea Range is 141 individuals, but group sizes vary with species, season, and geographic location. The short-beaked common dolphin feeds primarily on squid and Pacific hake and occasionally northern anchovy. The long-beaked common dolphin feeds equally on hake and anchovy.

Northern Right Whale Dolphin (*Lissodelphis borealis*)

The northern right whale dolphin has not been assigned any special status and the trends in population size are unknown. It is abundant throughout the inner half of the Sea Range during winter and spring when approximately 87,000 and 77,000 animals, respectively, may be present. During autumn, smaller numbers are present in the same area; many animals have moved north of the Sea Range. During summer, only 4,000 animals are present in the Sea Range, most in the northern part. During all times of year the majority (greater than 90 percent) of northern right whale dolphins are found in non-Territorial Waters. Mean group size within the Sea Range was 89 individuals (214 groups) but groups of up to 2,500 animals have been documented. Northern right whale dolphins feed on squid, lanternfish, and other mesopelagic fish at depths less than 985 feet (300 m).

Short-finned Pilot Whale (*Globicephala macrorhynchus*)

The California population of the short-finned pilot whale is considered a strategic stock under the MMPA (Barlow et al., 1997). Its distribution changed following the El Nino event of 1982-1983 and it has only recently started to return to its former range in California. It is found primarily south and east of the Sea Range. During most years, at most a few tens of animals may be found in the Sea Range, primarily during autumn and winter. However, if oceanographic conditions are suitable, large numbers and a large fraction of the California population might be found in the Sea Range. In former years, short-finned pilot whales occurred in groups averaging about 20 animals, and they fed primarily on squid.

Cuvier's Beaked Whale (*Ziphins cavirostris*)

Cuvier's beaked whale does not have a special status. Beaked whales are distributed throughout offshore waters of the Sea Range throughout the year. About 2,000 Cuvier's beaked whales may occur on the Sea Range. This species is found in small groups averaging 2.3 individuals and feeds on squid and fish found in deep water in offshore areas.

Sperm Whale (*Physeter macrocephalus*)

The sperm whale is listed as endangered under the Endangered Species Act (ESA). The stock that occurs in the Sea Range is considered to be depleted and a strategic stock (Carretta et al., 2006). It is found throughout deep offshore waters warmer than 59° F (15° C) and is present throughout offshore waters of the Sea Range in all seasons except possibly spring. The sperm whale is probably present in largest numbers during autumn and winter when about 3,700 to 5,000 may be present in the Sea Range. Almost all sperm whales are expected to be found in non-Territorial Waters. This species is generally found in small groups (with a mean number of 5.6 individuals). Sperm whales dive to great depths (to 9,840 feet [3,000 m]) and feed on medium to large cephalopods.

Striped Dolphin (*Stenella coeruleoalba*)

Striped dolphins are abundant in eastern tropical Pacific waters where they form large mixed schools with spinner and spotted dolphins. Approximately 7,900 striped dolphins are found in the Sea Range during summer. Because the striped dolphin is a pelagic species and there has not been adequate survey coverage in offshore waters during seasons other than summer, its abundance in the outer Sea Range is unknown during autumn to spring. All of the estimated 7,900 striped dolphins occurring in the Sea Range during summer are found in non-Territorial Waters.

Spinner Dolphin (*Stenella longirosfris*)

Spinner dolphins are common in nearshore areas off Central America; however, no spinner dolphins have been identified in or near the Sea Range. Therefore, no or at most a few spinner dolphins are expected to be present in the Sea Range. If they are present, they are likely to be in Territorial Waters.

Spotted Dolphin (*Stenella attenuata*)

Spotted dolphins are typically found in tropical and temperate pelagic waters. No sightings of spotted dolphins have been made at sea in California waters; however, a stranding has been reported approximately 25 nm (46 km) north and east of the Sea Range. No, or at most a few, spotted dolphins are likely to occur in the Sea Range.

Rough-toothed Dolphin (*Steno bredanensis*)

Rough-toothed dolphins are typically found in tropical and warm temperate waters. This species has not been positively identified alive in coastal temperate waters; however, a few specimens have been collected from central and northern California. None to a few rough-toothed dolphins might be present in the Sea Range during summer. They are most likely to be found in Territorial Waters.

Killer Whale (*Orcinus orca*)

Killer whales are sighted occasionally in California waters; however, no resident populations have been identified (Forney et al., 1995). It is estimated that approximately 750 killer whales occur in waters off California (Forney et al., 1995). Approximately 360 killer whales are estimated to be present in the Sea Range throughout the year. Approximately 12 percent (43) of them are in Territorial Waters and 88 percent (317) are in non-Territorial Waters.

False Killer Whale (*Pseudorca crassidens*)

False killer whales occur predominantly in tropical to subtropical pelagic waters and have rarely been reported north of Baja California. This species is a sporadic visitor in California waters and records of strandings and sightings along the California coast are rare. None to a few false killer whales may be present in the Sea Range during summer, primarily in non-Territorial Waters.

Baird 's Beaked Whale (*Berardius bairdii*)

Baird's beaked whales are infrequently encountered along the continental slope and throughout deep waters of the eastern North Pacific. Little is known about their seasonal movements or distribution, but it is suspected that they move into continental slope waters during the late spring through early autumn period and move farther offshore during other periods (Barlow et al., 1997). The best estimate of the number of Baird's beaked whales off California is 380 (Barlow and Gerrodette, 1996). Approximately 150 Baird's beaked whales are present in the Sea Range, with greater than 150 probably being present from late spring to early autumn and fewer than 150 present during the rest of the year. All Baird's beaked whales are expected to be found in non-Territorial Waters.

Mesoplodont Beaked Whales (*Mesoplodon* spp.)

Mesoplodont beaked whales (including Hubbs', Hector's, gingko-toothed, Blainville's, and Stejneger's beaked whales as a group) are distributed throughout deep waters and along the continental slopes of the eastern North Pacific. These five species are known to occur near or in the Sea Range. All beaked whales are difficult to identify so most beaked whale sightings are not identified to the species level. None of the five species is listed as endangered under the ESA or depleted or a strategic stock under the MMPA. The available data about occurrence of particular mesoplodont species in and near the Sea Range has come mostly from stranding records. The paucity of sightings and strandings precludes any determination of spatial or seasonal patterns in mesoplodont beaked whale distribution or abundance.

It is estimated that approximately 2,100 mesoplodont beaked whales are present in offshore waters within 300 nm (556 km) of the California coast (Barlow and Gerrodette, 1996). Approximately 570 mesoplodont beaked whales are present in the Sea Range throughout the year, primarily in non-Territorial Waters.

Pygmy Sperm Whale (*Kogia breviceps*)

The pygmy sperm whale normally remains seaward of the continental shelf. Only one pygmy sperm whale was sighted in the Sea Range during studies since 1990. The best estimate of the California population size for pygmy sperm whales is 3,145 (Barlow and Sexton, 1996). A few pygmy sperm whales are probably present in autumn in non-Territorial Waters in the Sea Range. Pygmy sperm whales are found singly or in groups of up to 6 individuals. Their diet consists of squid, benthic fish, and crabs, suggesting that they dive to considerable depths when feeding.

Dwarf Sperm Whale (*Kogia simus*)

The dwarf sperm whale may inhabit waters over or near the edge of the continental shelf or the open sea, primarily south of the Sea Range. Thus, occasional dwarf sperm whales may be found in the Sea Range during summer and early autumn, when water temperatures are high; however, they are unlikely to be present at other times of year. There is no good estimate of the California population size for the dwarf sperm whale; however, is has been estimated that there are about 890 dwarf sperm whales in California waters (Barlow and Gerrodette, 1996). This species is found singly or in small groups of up to about 6 animals. Their diet consists of squid, benthic fish, and crabs.

Mysticetes (Baleen Whales)

All species of baleen whales that occur in the Sea Range have extensive ranges in the North Pacific, extending from high-latitude feeding grounds in the summer to subtropical calving grounds in the winter (Bonnell and Dailey, 1993).

Blue, fin, and humpback whales are present in southern California offshore waters during the summer and autumn months (Heyning and Lewis, 1990). Minke whales appear to be present year-round off the Channel Islands (Rice, 1974; Leatherwood et al., 1987). In the autumn and winter, migrating gray whales are abundant both close to shore and in offshore migration corridors along and between the Channel Islands. Northern right, sei, and Bryde's whales are uncommon or rare in the area.

Northern Right Whale (*Eubalaena glacialis*)

The northern right whale is federally listed as endangered under the ESA and the North Pacific stock is considered a strategic stock under the MMPA. No live northern right whales have been seen in the Sea Range proper during the last 100 years. The scarcity of sightings and the very low population numbers indicate that it is very unlikely that right whales will be encountered in the Sea Range.

Gray Whale (*Eschrichtius robustus*)

The gray whale no longer has a special status since its removal from the "endangered" list. During its autumn migration southward and its winter migration northward, most of the approximately 23,100 gray whales in the eastern North Pacific stock pass through or inshore of the Sea Range. The southbound migration begins in late December, peaks in early-to-mid January and extends through February. The northbound migration begins in mid-February, peaks in March and extends through May.

North of Point Conception, the migration corridor is largely inshore of the Sea Range. In the SCB, gray whales follow three general routes through or near the Sea Range: 1) a nearshore route follows the coast and is primarily east of the Sea Range; 2) an inshore route that goes from Point Conception to the Channel Islands, east to Santa Cruz Island, southeast to Santa Barbara Island and thence east and southeast to Santa Catalina and San Clemente islands; and 3) an offshore route that goes from Point Conception to the western Channel Islands, southeast to San Nicolas Island, and southeast from there. Survey data suggest that about 86 percent of gray whales traverse Territorial Waters within the Sea Range during their southbound migration in autumn and that 73 percent traverse Territorial Waters during their northbound migration in winter. Gray whales do not spend much time feeding in the Sea Range and typically pass through it in a few days or less. Northbound mothers and calves travel more slowly than other whales and tend to be seen later in the season than other northbound gray whales.

Humpback Whale (*Megaptera novaeangliae*)

The humpback whale is listed as endangered under the ESA. The stock that occurs in the Sea Range is depleted and designated as a strategic stock (Carretta et al., 2006). The population that occurs in the Sea Range winters as far south as Costa Rica and summers as far north as southern British Columbia; however, most individuals of this stock are found off Mexico during winter and off central and northern California during summer.

There are about 600 animals in this population and the stock size appears to be increasing slowly. Most of these whales pass through the Sea Range during their north-south migration to and from feeding areas farther north but only a fraction of the population is present in the Sea Range at one time. Feeding concentrations totaling approximately 220 humpback whales are found in the Sea Range during summer.

Almost half of the feeding whales are found in Territorial Waters. Humpback whales are rarely found in the Sea Range during winter and only a fraction of the population is present in the Sea Range during the spring and autumn migration periods. During the spring and autumn periods most whales are found in non-Territorial Waters. Humpbacks are found singly or in small groups (average 2.9 individuals) and they feed primarily on krill.

Blue Whale (*Balaenoptera musculns*)

The blue whale is listed as endangered under the ESA. The stock that occurs in the Sea Range is depleted and designated as a strategic stock (Carretta et al., 2006). The population that occurs in the Sea Range winters off Central America and summers as far north as northern California. This species is common in offshore areas of the Sea Range during late spring and summer. There are about 1,800 animals in this population and it appears to be increasing, although some of the apparent increase is likely due to changes in distribution rather than population increase. Most of this population summers in and north of the Sea Range. Feeding concentrations of up to 100 blue whales are found near the Sea Range during summer in some years. Waters west of San Nicolas Island are often used for feeding. Blue whales are rarely found in the Sea Range during autumn and early winter and only very small numbers are found there during late winter and early spring. During summer there are approximately 1,600 blue whales in the Sea Range; only 135 (8 percent) of them are found in Territorial Waters. Blue whales usually are found singly or in small groups (average 2.5 individuals). They feed in deep offshore waters primarily on krill, often near the surface (less than 52 feet [16 m]) but sometimes to considerably deeper depths.

Fin Whale (*Balaenoptera physalns*)

The fin whale is listed as endangered and depleted, and the stock that occurs in the Sea Range is designated as a strategic stock (Barlow et al., 1997). The population that occurs in the Sea Range winters offshore of Mexico and southern California and summers in the Sea Range and possibly as far north as Washington. This species is one of the most commonly encountered large cetaceans in the Sea Range. During summer, an estimated 1,480 fin whales are present in the continental slope and offshore areas of the Sea Range in non-Territorial Waters. During summer, the highest concentrations tend to be found in offshore waters north of Point Conception.

During other times of year, an estimated 182-492 fin whales are present, primarily in the southern part of the Sea Range and primarily in non-Territorial Waters. This population appears to be increasing. Fin whales are generally found in small groups (average 3.5 individuals); however, groups of 130 and 81 animals have been found in the Sea Range. They feed on euphausiids, copepods, squid, and small schooling fish.

Sei Whale (*Balaenoptera borealis*)

The sei whale is listed as endangered and depleted, and the stock that occurs in the Sea Range is designated as a strategic stock (Barlow et al., 1997). This species is rare in the continental slope and offshore areas of the Sea Range during spring and summer and is not seen during other times of the year. There is no estimate of the size of the stock that inhabits California waters but the number is presumed to be small. None to a few tens of sei whales may occur in the Sea Range, primarily during spring and summer and primarily in offshore waters. Sei whales are generally found in small groups averaging 2 to 5 individuals. They feed on copepods, euphausiids, amphipods, squid, and small schooling fish.

Bryde's Whale (*Balaenoptera edeni*)

Bryde's whale is not federally listed as endangered under the ESA and is not considered depleted or a strategic stock under the MMPA. This species is rarely seen in or near the Sea Range. The best estimate of the California population size is 24 (Barlow et al., 1997). At any given time, the number on the Sea Range could vary from none to the entire California population. Bryde's whales are more likely to be found in non-Territorial Waters but are occasionally sighted in nearshore areas.

Minke Whale (*Balaenoptera acutorostrata*)

Minke whales found in the Sea Range are not federally listed as endangered under the ESA or depleted or a strategic stock under the MMPA. Their seasonal distributions and movements are not well known because they are inconspicuous as compared with other baleen whales. Available data suggest that minke whales move into nearshore and continental slope waters of the southeastern part of the Sea Range during late spring and leave in late summer. During the remainder of the year they may disperse into offshore waters and possibly south of the Sea Range.

During summer, many of the minke whales that inhabit offshore waters of California may be found in the southeastern part of the Sea Range, particularly south of and offshore of the Channel Islands. About 180 minke whales are present in the Sea Range throughout the year. Minke whales in the Sea Range usually occur in groups of 1 to 3 individuals, and probably feed on euphausiids and small shoaling fish.

Pinnipeds

Six species of pinnipeds occur in the Sea Range. The four most abundant species include the harbor seal (*Phoca vitulind*)*,* northern elephant seal (*Mirounga angustirostris*)*,* California sea lion (*Zalophus californianus*)*,* and northern fur seal (*Callorhinus ursinus*)*.* These four species breed on land within the Sea Range.

Two of the six pinniped species on the Sea Range are less common. The Guadalupe fur seal (*Arctocephalus townsendi*) is an occasional visitor to the Channel Islands and breeds only on Guadalupe Island, Mexico, which is approximately 250 nm (460 km) south of the Sea Range. The Steller sea lion (*Eumetopias jubatus*) was once abundant in the region, but numbers have declined rapidly since 1938.

Harbor Seal (*Phoca vitulina*)

The harbor seal does not have a special status and the California population has dramatically increased in size since the mid-1960s. In some areas, including parts of the Channel Islands, the populations are stable or declining either because numbers may have reached the carrying capacity of the available habitat or due to interspecific competition with northern elephant seals. Individual harbor seals spend considerably more time in the water than they do on land, except during the molting period, which peaks in late May to early June and for adult females, during the pupping and nursing period from late February to mid-May. The California stock includes 28,000 to 35,600 seals, of which 3,600 to 4,600 inhabit coastal haul-out sites and waters in the Sea Range. During most of the year they remain near their haul-out sites and most feeding occurs in nearshore waters 30 to 130 feet (10 to 40 m) deep (nursing females) or 260 to 390 feet (80 to 120 m) deep (others). Their diet consists of rockfish, spotted cusk-eel, octopus, plainfin midshipman, and shiner surfperch.

Northern Elephant Seal (*Mirounga angustirostris*)

Northern elephant seals do not have a special status and the California population has dramatically increased in size since the early 1900s. They spend 8 to 10 months of the year feeding in offshore waters north of the Sea Range and most of the remaining time hauled out on beaches where they give birth to pups, breed, and molt. They migrate through the Sea Range four times per year during movements to and from haul-out sites. The California stock is estimated to be approximately 84,000 seals of which about 71,000 (85 percent) use islands within the Sea Range. Two-thirds of the seals in the Sea Range use haul-out sites on San Miguel Island, 32 percent on San Nicolas Island, and small numbers on Santa Rosa, Santa Cruz, Anacapa, and Santa Barbara islands. Maximum numbers are present at sea in the Sea Range during winter and lowest numbers occur during spring and summer.

Different age and sex categories have somewhat differing annual cycles and different migration patterns. Most northern elephant seals seen at sea in the Sea Range are moving between haul-out sites for breeding, pupping, and molting and feeding areas north of the Sea Range. Almost all feeding occurs outside of the Sea Range, mainly far to the north, on bottom-dwelling fishes, squid, and numerous other prey species. Northern elephant seals routinely dive to depths of 492 to 2,625 feet (150 to 800 m) to feed and spend 2 to 3 minutes on the surface after dives lasting 21 to 25 minutes.

California Sea Lion (*Zalophus californianus*)

The California sea lion does not have a special status and its population has been increasing at 8.3 percent per year since 1983. It is the most commonly seen pinniped at sea in the Sea Range. More than 95 percent of the U.S. stock, or more than 159,000 to 179,000 animals, is associated with haul-out sites in the Sea Range, primarily on San Miguel and San Nicolas islands. Adult males haul out from mid-May to late July to defend territories and breed. After the breeding season they migrate north of the Sea Range to feeding areas as far north as Puget Sound and British Columbia where they remain until the following spring. Females give birth to their pups in mid-June to mid-July and breed 3 to 4 weeks later.

Adult females and probably most subadults remain near the haul-out sites throughout the year and spend most of their time feeding at sea. Numbers appear to be lowest in offshore waters of the Sea Range (approximately 72,000) during summer when females are molting or nursing their pups, adult males are feeding north of the Sea Range, and pups are still nursing. Total numbers in offshore waters appear similar at other times of year (approximately 130,000 to 160,000), except at the peak of the breeding and pupping season in mid-June to early July when a large fraction of adult males and females is hauled out at rookeries. The principal prey species in the Sea Range are northern anchovy, Pacific whiting, and market squid. Most (75 percent) dives are less than 3 minutes in duration and to depths of 70 to 160 feet (20 to 50 m), although dives of up to 10 minutes and 900 feet (274 m) have been recorded. The longer and deeper dives tend to be during the day and the shorter and shallower dives during the night.

Northern Fur Seal (*Callorhinns ursinus*)

The northern fur seal does not have a special status and the San Miguel Island stock has increased steadily since recolonization in the late 1950s to about 10,000 animals now. This stock remains in or near the Sea Range throughout the year. In addition, some of the females and juveniles from the eastern Pacific stock migrate south into offshore waters of the Sea Range during autumn and winter. During autumn and winter, approximately 22,900 and 44,600 northern fur seals, respectively, are present in offshore waters of the Sea Range. When not hauled out on land almost all (98-99 percent) are found in non-Territorial Waters except during summer when pups are commonly found in the water near their haul-out sites. Northern fur seals feed in the upper water layers (mean dive depth is approximately 225 feet [69 m]) in deep offshore waters on pelagic fish and squid. An average dive is less than 3 minutes in duration.

Guadalupe Fur Seal (*Arctocephalns townsendi*)

The Guadalupe fur seal is considered fully protected by the State of California and is federally threatened; the only remaining stock is considered depleted and a strategic stock (Carretta et al., 2006). This species has been seen occasionally in the Sea Range (46 sightings from 1969-1986); however, the entire population (7,400 animals) is centered on Guadalupe Island, Mexico, approximately 250 nm (460 km) south of the Sea Range. The population has been growing at 13.7 percent per year since 1954 and may be expanding its range. Little is known about its foraging behavior and food preferences.

Steller Sea Lion (*Eumetopias jubatus*)

The Steller sea lion is threatened and the stock occurring in California waters is considered a strategic stock (Barlow et al., 1997). Stocks in southwestern Alaska have declined to about half of their 1956-1960 levels. The Eastern stock, which includes the California population, has remained stable since 1965; however, colonies in California declined from 6,000 to 7,000 in 1970 to approximately 2,000 in 1989. Steller sea lions now are rarely sighted in the Sea Range and no animals have been sighted at former colonies on San Miguel Island since 1983.

Fissipeds

Sea Otter (*Enhydra lutris*)

The southern sea otter (*Enhydra lutris nereis*) occurs along the coast of central California between Point Ano Nuevo and Purisima Point, and a small experimental population has been translocated to San Nicolas Island.

The southern sea otter is threatened and depleted and this stock is considered a strategic stock. The present population size in California is about 2,400 animals and has been increasing at 5-7 percent per year. The primary range is along the central California coast north of and inshore of the northern part of the Sea Range. However, the sea otter is expanding its range southward along the coast, including a recent expansion south of Point Conception into the Santa Barbara area. Sea otters prefer rocky shorelines and water about 66 feet (20 m) deep. They feed on benthic invertebrates, including mussels, clams, crabs, abalone, sea urchins, and sea stars. Their predation on the latter species may help to maintain the kelp forests. Sea otters are very rarely seen in offshore waters in the Sea Range.

Sea Turtles

The following information for individual sea turtles is extracted from Pritchard (1997).

Green Sea Turtle (*Chelonia mydas*)

The green sea turtle is a circumglobal species, although most of its important nesting and feeding grounds lie within the tropics. It has major nesting colonies on mainland shores (such as northwestern Costa Rica, or the coast of eastern Surinam), on barrier reef islands (Queensland, Australia; d'Entrecasteaux Reef, Ne Caledonia), and on remote oceanic islands (e.g., Ascension Island, Atol das Rocas). In many places it has long been harvested for meat and eggs. Demand for international commerce is now an insignificant factor, but has been replaced with increasing demand for subsistence and local markets by indigenous people, whose population increase has often not been matched by an increase in real wealth or political opportunity.

Black Sea Turtle (*Chelonia agassizii*)

The black sea turtle, which is possibly only a subspecies of the green sea turtle, is confined to the eastern Pacific. The species is protected in the Galapagos Islands and is nominally protected in Mexico also, where the important nesting grounds in Maruata Bay are patrolled by teams from the Universidad de Michoacan. Nonetheless, individuals from both the mainland and Galapagos nesting grounds are caught in uncontrolled numbers in Peruvian waters, and are also subject to illegal harvest on the Mexican and Central American Pacific coasts, including the Gulf of California. Furthermore, marine conservation efforts in the Galapagos Islands have been subjected to severe challenges by settlers and fishermen.

Loggerhead Sea Turtle (*Caretta caretta*)

The loggerhead sea turtle is little sought for its flesh, and although the eggs are gathered in some parts of the world, direct take for human consumption is not a major factor in its survival prospects. Rather, this species has an "antitropical" distribution that not only fragments its overall range into well-separated enclaves in the northern and southwestern Indian Ocean, eastern Australia, Japan, southeastern U.S., the Mediterranean, and southern Brazil, but also brings the species into contact with industrial and development stresses ranging from massive incidental capture in Atlantic shrimp trawls to resort and recreational development of nesting beaches. At present, it appears that nesting populations are declining as a result of incidental catch in both southern Queensland, Australia and the U.S. north of Cape Canaveral. However, larger populations in Florida south of Cape Canaveral and also the relatively small population in Natal, South Africa, are increasing.

Olive Ridley Sea Turtle (*Lepidochelys olivacea*)

The olive ridley sea turtle, although having relatively localized nesting, remains the most numerous species of sea turtle in the world as a result of the continued existence of a few sites of enormously aggregated nesting – two in Pacific Costa Rica, one in Pacific Mexico, and two or three in northeastern India, with some minor sites in Nicaragua and scattered nesting along certain other tropical mainland shores. Whether or not the existence of such numbers of turtles on these few nesting beaches is reason to believe that no problems exist is debatable. In all cases except for the limited egg harvest program at Playa Ostional, Costa Rica, these “arribada” beaches are nominally protected, although incidental take by trawlers is significant in both Costa Rica and India, and the Indian sites may also be threatened by fishery development plans along the Orissa coast.

Leatherback Sea Turtle (*Dermochelys coriacea*)

None of the major nesting grounds for the leatherback sea turtle were discovered before the 1950s, and many of them only in the 1960s and 1970s. Therefore, it is impossible to compare contemporary population estimates with those earlier in the twentieth century. The leatherback does not feature in international commerce, and its juvenile stages (indeed, all stages between hatchling and adult) remain so cryptic that it is unlikely that humans have any effect upon them. However, subsistence take of eggs, and sometimes of nesting adults also, has been intense, especially in the Eastern Pacific and Guyana, and while Asiatic nesting colonies (such as that in Terengganu, Malaysia) are generally exploited for eggs rather than meat, this can be equally devastating. At present, the Atlantic colonies (especially in Trinidad, Suriname, and French Guiana) appear to be reasonably secure and even increasing, as is the small nesting colony in Natal, South Africa, and adjacent Mozambique. However, the Terengganu colony has collapsed in recent years, and serious declines have been documented in Pacific Mexico and Costa Rica, a result of the combination of beach slaughter, egg collection, and serious incidental captures by fishing gear in the open sea.

APPENDIX B

RECORD OF NON-APPLICABILITY

Record of Non-Applicability

Record of Non-applicability of Conformity Rule (40 Code of Federal Regulations [CFR] Part 52, subpart W) for proposed debris management activities within the Western Range and Vandenberg Air Force Base (AFB)

Project Title: Implement debris management activities as outlined in the Airborne Laser (ABL) Debris Management Plan at Vandenberg AFB, California

Description of Proposed Action: The Proposed Action evaluates the potential environmental impacts of proposed debris management activities associated with ABL tests, which involve launching Liquid Fueled Target System (LFTS) target missiles from Vandenberg AFB and destroying the target by the ABL over the Western Range. The Proposed Action involves the observation, photography, and destruction of LFTS target missile debris. Seven LFTS target missile launches are proposed. In addition, a "dress rehearsal" would also be conducted where no LFTS target missile would be launched; however, all aspects of pre-launch, launch, and post launch debris management activities would be conducted to ensure communications/logistics of the debris management actions function as planned. For analysis purpose, the Proposed Action assumes that all seven target launches and the "dress rehearsal" involves debris management activities.

Anticipated Date and Duration of Proposed Action: ABL test activities are anticipated to occur no sooner than fiscal year (FY) 2009 and would be completed in FY 2014.

Reason for Using Record of Non-Applicability: Conformity under the Clean Air Act, Section 176 has been evaluated for the above-described action per 40 CFR 51, and the requirements of the rule are not applicable because the area is in attainment of the National Ambient Air Quality Standard (NAAQS) criteria pollutant.

Emission Thresholds: Vandenberg AFB is within the Santa Barbara County Air Pollution Control District. This district is in attainment for all NAAQS criteria pollutants.

Emission Calculations:

Aircraft engines emit VOCs and NO_X during all phases of operation whether climbout, approach or cruise. Based on the estimated total number of landing and takeoffs (LTOs) and the total number of cruise hours under the Proposed Action, the overall aircraft operational emissions were estimated using the methods, emission factors, default engine type for the Navajo aircraft, and default time in mode during each LTO obtained from the following references:

- The Procedures of Emission Inventory Preparation, Volume IV: Mobile Sources
- Navajo aircraft engine emission factors, time in mode, etc. provided in Federal Aviation Administration (FAA) Emissions and Dispersion Modeling System (EDMS, Version 4.2).

Total estimated NO_X and VOC emissions with potential to result from the proposed aircraft operations are summarized in Table 1. According to the EDMS model, PM_{10} emission factors are generally not available for aircraft engines; therefore, no PM_{10} emissions are predicted in the analysis for operations of the Piper Navajo aircraft.

Estimates of ship diesel engine and generator exhaust emissions were based on the estimated hours of usage and emission factors associated with each diesel engine and generator on the ship. It was conservatively assumed that all on-ship diesel engines and generators would operate continuously over the entire ship maneuvers for a total of 192 hours under the Proposed Action. Emission factors for NO_X and VOCs related to heavy-duty diesel equipment were obtained from *Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression-Ignition*. Load factors were obtained from *Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling*.

Table 1. Total Piper Navajo Aircraft Emissions[a]

Mode	Total LTOs	Time in mode (minute/LTO)	Emission Factor (kg/hour)		Total Emissions (tons)	
			VOCs	NO_X	VOCs	NO_X
Takeoff	16	1	2.80	0.08	0.001	0.001
Climbout	16	2	1.54	0.02	0.001	0.001
Approach	16	5	0.60	0.06	0.001	0.001
Taxi and Queue	16	26	0.77	0.004	0.004	0.001
Cruise (simulated as climbout)		3,840	1.54	0.02	0.109	0.001
Grand Total Emissions					0.116	0.005

Note: (a) PM_{10} emission factors are generally not available for aircraft engines according to EDMS model; therefore, no PM_{10} emissions are considered in the analysis for Piper Navajo aircraft operations.
kg = kilogram
LTO = landing and takeoff
NO_X = nitrogen oxide
VOC = volatile organic compound

Emission factors in grams of pollutant per hour per horsepower were multiplied by the estimated running time and each diesel equipment associated average horsepower provided by the U.S. Environmental Protection Agency (EPA) to calculate total grams of pollutant from each piece of equipment. Finally, these total grams of pollutant were converted to tons of pollutant.

The U.S. EPA recommends the following formula to calculate hourly emissions from non-road engine sources:

M_i = N x HP x LF x EF_i

where:
M_i = mass of emissions of i^{th} pollutant during inventory period
N = source population (units)
HP = average rated horsepower
LF = typical load factor
EF_i = average emissions of i^{th} pollutant per unit of use (e.g., grams per horsepower-hour).

The calculations of potential maximum emissions from ship operations are provided below:

Operational Hours = 192 hours (24 hours in each of eight events)
Total NOX Emissions = 192 hours x [(2 x 1,250 + 2 x 500 + 2 x 370) (hp) x 8.38 grams/hp-hr + 80 hp x 8.30 grams/hp-hr] x 59%
= 4,100,190 grams
= 4.52 tons.

Total VOC Emissions = 192 hours x [(2 x 1,250 + 2 x 500 + 2 x 370) (hp) x 0.68 grams/hp-hr + 80 hp x 0.99 grams/hp-hr] x 59%
= 335,580 grams
= 0.37 tons.

Total PM_{10} Emissions = 192 hours x [(2 x 1,250 + 2 x 500 + 2 x 370) (hp) x 0.402 grams/hp-hr + 80 hp x 0.722 grams/hp-hr] x 59%
= 199,630 grams
= 0.22 tons.

Total emissions resulting from proposed activities are presented in Table 2.

Table 2. Total Emission Levels under the Proposed Action

Emission Source	Pollutant kg (tons)		
	VOC	NO_X	PM_{10}
Aircraft	0.12	0.00	NA
Ship	0.37	4.52	0.22
Totals	0.49	4.52	0.22

NA = not applicable
NO_X = nitrogen oxide
PM_{10} = particulate matter equal to or less than 10 microns in diameter
VOC = volatile organic compound

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APPENDIX C

REGULATORY CONSULTATION LETTERS

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ventura Fish and Wildlife Office
2493 Portola Road, Suite B
Ventura, California 93003

IN REPLY REFER TO:
PAS 569.612.6045

September 22, 2006

Beatrice L. Kephart
Chief, Environmental Flight
30 CES/CEV
806 13th Street, Suite 116
Vandenberg Air Force Base, California 93437-5242

Subject: Airborne Laser Testing Program, Vandenberg Air Force Base, Santa Barbara County, California.

Dear Ms. Kephart:

We have reviewed your letter, dated July 11, 2006, requesting our concurrence that testing the Airborne Laser (ABL) program and its debris management activities may affect, but is not likely to adversely affect the federally endangered brown pelican (*Pelicanus occidentalis*) or threatened southern sea otter (*Enhydra lutris nereis*). We received your letter on July 17, 2006.

The Air Force proposes to test the ABL program by destroying a target missile over the Pacific Ocean. The Missile Defense Agency plans to begin the proposed activities in mid-2007 (at the earliest) and would complete the program within 5 years. Four target launches are proposed, plus a dress rehearsal where a target missile would not be launched but related pre-launch, launch, and post-launch debris management activities would occur.

During the ABL test flights, the Air Force would launch the target missile from Launch Facility-06 (LF-06) on Vandenberg Air Force Base. A modified Boeing 747 fit with the laser-weapon system would be launched from Edwards Air Force Base and would travel at an elevation of 35,000 feet or higher. The aircraft would destroy the target missile at a minimum elevation of 40,000 feet, within 3.5 to 15.5 miles from the coastline. The launches are proposed to occur between midnight and 4 a.m.

The target missile is a single-stage, liquid-fueled missile composed of a payload, guidance and control, and propulsion sections. The payload section would house telemetry and flight termination instrumentation and the propulsion section would contain the propellant tanks, rocket engine, and associated valves, plumbing, and interface structure. When fully fueled, the missile would contain approximately 295 gallons of kerosene fuel, 15 gallons of initiator fuel, and 490 gallons of inhibited Red Fuming Nitric Acid oxidizer. The target missiles would not carry live warheads.

The Air Force foresees several different scenarios that could potentially occur when the ABL impacts the target missile. The distribution of the fallout debris and remaining propellants would vary, depending on the breakup pattern and whether the target missile is destroyed at the time of impact or is stopped in its intended flight trajectory and falls into the ocean. Most solid debris is expected to sink soon after falling into the ocean and would not reach the shore. The Air Force would sink any floating debris to avoid creating a safety or navigational hazard and would not attempt to recover the sunken debris.

The impact related to falling debris would be localized and of short duration. If and when the chemicals related to the fuel mixture empty out of the target missile, the fuel components would most likely dissolve in the water because the components are essentially water soluble and have short surface water half-lives or the fuel components would rapidly vaporize due to high vapor pressures.

We have previously analyzed the effects from launching missiles from LF-06 in the Biological Opinion for the Theater Missile Targets Program (1-8-98-F-24). In addition, no other federally listed species are known to occur in the vicinity of LF-06. Because the debris fallout would be of short duration, the propellants contained in the missiles have short half-lives in water, and the Air Force would sink any floating debris to keep it away from the shoreline, we concur with your determination that testing the Airborne Laser Program may affect, but is not likely to adversely affect brown pelicans or southern sea otters.

If you have any questions, please contact Nic Huber of my staff at (805) 644-1766, extension 249.

Sincerely,

Steve Henry
Assistant Field Supervisor
San Luis Obispo/Northern Santa Barbara

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802- 4213

NOV 9 2006

In response refer to:
151422SWR2006PR00647:CCF

Beatrice L. Kephart
Chief, Environmental Flight
30 CES/CEV
1515 Iceland Avenue, Rm 181C
Vandenberg Air Force Base, California 93437-5319

Dear Ms. Kephart:

This letter responds to your letter, dated July 11, 2006, requesting informal consultation on the proposed testing of the Missile Defense Agency's (MDA) Airborne Laser (ABL), as part of the nation's Ballistic Missile Defense System. On August 9, 2006, your staff forwarded a copy of a draft Environmental Assessment (EA) for the proposed debris management activities associated with ABL tests for review. The ABL platform is a modified Boeing 747 aircraft that accommodates a laser-weapon system, which essentially uses a High-Energy Laser (HEL) designed to destroy a target. Aircraft flights would originate at Edwards Air Force Base (AFB), while target missiles would be launched from Vandenberg AFB. The overall length of the target missile is approximately 11.6 meters, and when fully fueled, it would contain approximately 295 gallons of kerosene fuel, 15 gallons of initiator fuel, and 490 gallons of Inhibited Red Fuming Nitric Acid (IRFNA) oxidizer. The HEL would destroy the target at approximately 40,000 feet or higher, and the trajectory of the missile target would be such that any debris from the destruction of the target would fall a minimum of 3.5 miles from the coastline off Vandenberg AFB (termed the "Western Range"). Launches would occur during night-time hours (between midnight and 4AM). The MDA plans to begin ABL testing activities no sooner than mid-2007, and such activities would be completed within five years. Four target launches are proposed. NOAA's National Marine Fisheries Service (NMFS) has reviewed the draft EA and has the following general comments.

Endangered Species Act Comments

Table 1 in the attachment to your letter contains a list of marine species listed under the Endangered Species Act (ESA) which may be found within the action area, defined as the target missile impact area and located at least 3.5 miles off the coast of Vandenberg AFB. The southern distinct population segment (DPS) of green sturgeon (*Acipenser medirostris*) was recently listed as a threatened species (April 7, 2006; 71 FR 17757). This DPS consists of coastal and Central Valley populations south of the Eel River, with the only known spawning population in the Sacramento River. While less is known about the green sturgeon's distribution south of its spawning grounds, anecdotal information suggests that they may be found in waters off southern California and therefore may be found in the action area. In addition, some populations of salmonids (*Oncorhynchus spp.*), listed under the ESA, may be found in the action area during their oceanic phase. Because these species are listed under the ESA and under NMFS' jurisdiction, they should be included in this consultation. Critical habitat for these species or for listed marine mammals and sea turtles has not been designated in any areas within or near the action area.

At this time, until our specific comments are addressed, NMFS cannot concur with your determination that the proposed action may affect but is not likely to adversely affect listed marine species under our jurisdiction. Specific comments are provided in Attachment A.

Marine Mammal Protection Act Comments

Potential impacts to marine mammals from this project include: (1) harm or harassment of any marine mammal(s) located near the debris impact zone due to impacts from falling debris or encounters with fallen debris; and/or (2) ingestion or inhalation of any remaining propellants, following destruction of the target missile. While pinnipeds hauling out on north Vandenberg AFB may be harassed due to the noise impacts of launching the target missile, the Air Force is already covered under the Marine Mammal Protection Act (MMPA) for this take under a letter of authorization from NMFS.

All marine mammals are protected under the MMPA. Under the MMPA, it is illegal to "take" a marine mammal without prior authorization from NMFS. "Take" is defined as harassing, hunting, capturing, or killing, or attempting to harass, hunt, capture, or kill any marine mammal. "Harassment" is defined as any act of pursuit, torment, or annoyance which has the potential to injure a marine mammal in the wild, or has the potential to disturb a marine mammal in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering. Given the proposed biological monitoring prior to the test and the post-launch monitoring and destruction of debris, NMFS has determined that the potential for harassment of marine mammals is low. However, NMFS is particularly concerned about impacts to gray whales (*Eschrichtius robustus*) during their southbound and northbound migratory periods. Typically, gray whales are found further offshore during their southbound migration (December through March). During the northbound migration (March through June), gray whale cow-calf pairs generally swim within one mile from shore, while adults not associated with a calf and juvenile gray whales could also be observed in nearshore areas during both the southbound and northbound migrations. NMFS recommends that the MDA consider avoiding testing the ABL during the gray whale migration period, particularly during the southbound migration.

In the unlikely event that any marine mammal or sea turtle under NMFS' jurisdiction is found to be deceased as a result of an ABL test, it should be reported immediately (within 48 hours) to NMFS' Stranding Coordinator, Mr. Joseph Cordaro at (562) 980-4017. Specific comments are provided in Attachment A.

Magnuson-Stevens Fishery Conservation and Management Act (MSA)

Because the proposed project occurs within essential fish habitat (EFH) for various federally managed fish species within the Pacific Groundfish and Coastal Pelagics Fishery Management Plans, you may want to consider preparing an EFH assessment to address potential impacts from the propellant or debris.

Thank you for coordinating with the Southwest Regional Office. If you have any questions regarding EFH, please feel free to contact Mr. Bryant Chesney at (562) 980-4037. If you have any questions regarding protected resources, please feel free to contact Ms. Christina Fahy at (562) 980-4023 or Ms. Monica DeAngelis at (562) 980-3232.

Sincerely,

Mark Helvey

for Rodney R. McInnis
Regional Administrator

Attachment A

Specific Comments

Page	Section	Comment
1-7	Noise	The Draft EA concludes that because debris management activities are occurring more than 3 miles from shore that no adverse impacts from noise are anticipated. Any noise or shock wave impacts to marine resources resulting from missile debris impacting the water should be analyzed. Pg. 4-23 provides some analysis of potential physical impacts.
2-12	First Paragraph	"LFTS launch and debris management activities would occur no sooner than fiscal year 2008 and would be completed within 1 to 3 years." Attachment 1 to your letter states that MDA plans to begin testing activities no sooner than mid-2007, and the launches would be completed within 5 years. Please clarify which is correct.
2-14, 2-15	Biological monitoring	NMFS recommends the biological monitor also survey the area for the presence of sea turtles. How far below the surface can a FLIR radar detect marine mammals? How is a "group" of marine mammals defined, for purposes of delaying the operation? Although the draft EA states that any ABL tests would be delayed if a group of marine mammals are within the target area, there is an implication that if visibility is compromised, that the ABL test activity would proceed. Please confirm.
2-17, 2-18	Debris Assessment and Disposal	How would floating LFTS debris be sunk? In the event that the fuel tank and/or oxidizer tank remains intact, the EA states that guns would be used to shoot holes in the tank. What is the possibility of an explosion occurring, should this take place? What is the risk of marine mammals or sea turtles to exposure to the fuel or oxidizer, or debris, given the risk to humans?
2-19	Biological Monitoring	NMFS recommends that any beach surveys conducted to determine if debris has washed up should avoid harassment of hauled out pinnipeds. NMFS recommends that a biological monitor be present in the debris vessel, if possible, to determine what, if any, effects to biological resources. Any report submitted by Vandenberg AFB on effects to biological species from ABL test activities should be submitted to NMFS prior to the next planned test.
2-23	Biological Resources Impact	Please describe in more detail the risk of solid debris to biological resources. What is the likelihood of entanglement or physical injury to marine mammals or sea turtles, given any encounters with solid debris, and given the risk to humans (as described in Table 2-1)?
4-2	LFTS Debris Assessment	LFTS fuel/oxidizer released would cause lowered pH of the ocean water, to the point of being hazardous in the immediate vicinity of the release for approximately 5 hours. How is immediate vicinity defined, and would it be hazardous to any marine mammals or sea turtles in the immediate vicinity?
4-5	LFTS Debris Assessment	If tanks with any remaining fuel/oxidizer drifted to shore without observation or destruction (No-Action Alternative), they could also pose a hazard to marine mammals on shore (i.e. pinnipeds), if contact is made.
4-23	Physical impacts	NMFS recommends including the estimated low risk of debris (and shock wave associated with it) impacting a marine mammal or sea turtle due to the ABL tests (referenced in Naval Air Warfare Center Weapons Division Point Mugu, 1998). Similar to the comment for page 2-23, is there any further description of solid debris that may elucidate the potential for entanglement or physical injury to exposed marine organisms?
4-26	Threatened/ Endangered Species	While mobile marine organisms have the capacity to move away from the impact area if they encounter detectable noxious conditions, what are the risks to these organisms should they encounter these conditions and do not swim away from the area?

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213

In Response Refer to:
2007/06906

OCT 19 2007

Ms. Beatrice L. Kephart
Chief, Environmental Flight
30 CES/CEV
1515 Iceland Ave, Rm 181C
Vandenberg AFB, California 93437-5319

Dear Ms. Kephart,

NOAA's National Marine Fisheries Service (NMFS) reviewed the Missile Defense Agency's (MDA) revised environmental assessment (EA), dated July 2007, regarding the management of debris from Airborne Laser (ABL) tests conducted from Vandenberg Air Force Base (AFB) in California. The potential impacts of the test itself have already been addressed in an Environmental Impact Statement (EIS, 2003). This EA addresses the impact of debris management and removal as a result of launching Liquid Fueled Target System (LFTS) target missiles from Vandenberg AFB and destroying the targets over the Western Range. MDA previously acknowledged the possibility of negative impacts on species protected by the Endangered Species Act (ESA) which may be in the area during these proposed activities, in an initial request for informal consultation dated July 11, 2006. The listed species under the jurisdiction of NMFS that may be affected include six species of whales (sei whale [*Balaenoptera borealis*], fin whale [*Balaenoptera physalus*], blue whale [*Balaenoptera musculus*], humpback whale [*Megaptera novaeangliae*], sperm whale [*Physeter macrocephalus*], and right whale [*Balaena glacialis*]); the Steller sea lion (*Eumetopias jubatus*) and Guadalupe fur seal (*Arctocephalus townsendi*); and four species of sea turtles (loggerhead [*Caretta caretta*], leatherback [*Dermochelys coriacea*], green [*Chelonia mydas*], and olive ridley [*Lepidochelys olivacea*]). In addition, some populations of salmonids (*Oncorhynchus spp.*) may be located in the action area, and possibly the southern distinct population segment (DPS) of green sturgeon (*Acipenser medirostris*) as well. NMFS has already provided comments to a draft EA concerning the proposed debris management activities in a letter dated November 9, 2006. Responses to those comments, in addition to a revised draft EA, were received by NMFS via electronic mail on September 7, 2007. MDA has determined that the proposed action is not likely to adversely affect any listed species, and requests NMFS' concurrence with this determination.

NMFS agrees with MDA's determination. Comments that were provided by NMFS concerning the impact of debris on marine mammals and sea turtles have been adequately addressed by the debris management plan outlined in the EA. The area where debris management activities are likely to occur will be monitored for the presence of listed species by biological observers before ABL tests are conducted. This should minimize the potential of adverse effects of falling debris and debris removal activities, which are already extremely remote. Tracking and evaluation of the debris field will allow

MDA to ensure that appropriate measures are taken to intervene should a situation develop that might potentially pose an entanglement threat to listed species. Any potential harmful chemical effects produced by unspent rocket fuel will be rapidly mitigated by dilution in the open surface waters of the ocean. Analysis indicates the affected area would not exceed the approximate size of an Olympic swimming pool, and subsequent chemical reactions with the ocean water would reach completion quickly (Table 4-3, Draft EA). The species of concern in this consultation all possess the natural ability to evacuate or avoid a hostile environment of this size if confronted. Therefore, MDA will not take any additional action to deal with the unspent fuel. The sum total probability of any significant adverse effects occurring as a result of ABL debris management is discountable enough to justify NMFS' concurrence with MDA in this matter.

This concludes informal section 7 consultation for the proposed action. Consultation must be reinitiated where discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and: (1) if new information becomes available revealing effects of the action on listed species in a manner or to an extent not previously considered; (2) if the agency action is subsequently modified in a manner that causes an effect to listed species that was not considered; or (3) if a new species or critical habitat is designated that may be affected by this action. If you have any questions or need additional information, please contact Dan Lawson at (562) 980-3209 or Dan.Lawson@noaa.gov or Christina Fahy at (562) 980-4023 or Christina.Fahy@noaa.gov.

Sincerely,

Russell M Strach
for
Rodney R. McInnis
Regional Administrator

cc: Ken Rock (MDA)

DEPARTMENT OF THE AIR FORCE
30TH SPACE WING (AFSPC)

JUL 1 1 2006

30 CES/CEV
1515 Iceland Ave Rm 181C
Vandenberg AFB CA 93437-5319

Mr. Rodney R. McInnis
Regional Administrator
NOAA Marine Fisheries Service
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach CA 90802-4213

Dear Mr. McInnis

The Missile Defense Agency (MDA) is developing an Airborne Laser (ABL) as part of our nation's Ballistic Missile Defense System. Part of the development process involves testing the ABL against target missiles and destroying them over the open ocean. MDA is currently working closely with the Air Force in preparing an Environmental Assessment (EA) for proposed debris management activities associated with ABL testing at Vandenberg Air Force Base, California. The EA evaluates the potential environmental effects associated with managing the debris that would result from the tests.

MDA's analysis indicates that the potential to adversely affect federally listed threatened or endangered species is very limited. Modeling indicates that impacts related to debris would be localized and of short duration. As a result, MDA concludes that it is unlikely there will be any measurable or observable effect on any threatened or endangered species from ABL debris management activities.

Pursuant to Section 7 of the Endangered Species Act (ESA) and the National Environmental Policy Act (NEPA), we are requesting an informal consultation for this EA. The attachment provides a summary of the proposed action and MDA's analysis of potential environmental effects.

For the reasons described in the attachment, we believe a determination of "may affect, not likely to adversely affect" for listed species is appropriate for proposed ABL activities. We are requesting your input in the following areas:

a. Confirmation that our threatened, endangered, candidate, and proposed species list in this letter is current and complete.

b. Concurrence regarding our determination that there is limited potential to adversely affect listed species or critical habitat.

Your assistance with the Air Force's and MDA's continuing efforts to identify biological resources early in the EA process is greatly appreciated. Please direct any questions to the undersigned at (805) 605-7924 or Mr. Crate Spears, MDA Environmental Manager, at (703) 697-4123. We thank you for your cooperation.

Sincerely

BEATRICE L. KEPHART, GS-14
Chief, Environmental Flight

Attachment:
Summary of Proposed Action and
Potential Environmental Effect

Attachment 1
Summary of Proposed Action and Potential Environmental Effects

Background for ABL Aircraft and Target Missile

The ABL platform is a modified Boeing 747 aircraft that accommodates a laser-weapon system. The aircraft incorporates a laser-beam control system designed to focus the laser on the target and a High-Energy Laser (HEL) designed to destroy the target. Aircraft flights would originate at Edwards AFB. Target missiles would be launched from Vandenberg AFB. The aircraft would fly at high altitudes (35,000 feet or higher) and detect and track launches of target missiles using onboard sensors. Active tracking of a missile would begin when the target breaks clear of the clouds at a minimum of 35,000 feet. The HEL would then be directed in an upward position toward the missile. The energy from the laser would heat the missile body canister causing an overpressure and/or stress fracture, which would destroy the missile. The geometry of the tests would preclude operation of the laser except at an upward angle.

The target is a single-stage, liquid-fueled missile with an inertial guidance system. The missile is composed of a payload section, guidance and control section, and propulsion section. The propulsion section consists of the propellant tanks (fuel and oxidizer), rocket engine, and associated valves, plumbing, and interface structure. Target missiles would not carry live warheads. The payload section would house telemetry and flight termination instrumentation.

The overall length of the target missile is approximately 11.6 meters (38 feet). When fully fueled, the missile would contain approximately 295 gallons (825 kilograms [kg]) of kerosene fuel (with coal tar distillates), 15 gallons (30 kg) of initiator fuel, and 490 gallons (2,920 kg) of Inhibited Red Fuming Nitric Acid (IRFNA) oxidizer. The kerosene fuel is composed of approximately 60 percent coal tar distillate (aromatic components) consisting of benzene, toluene, mixed xylenes, and cymene (methyl isopropyl benzene), with the balance being kerosene. The initiator fuel is a 50/50 mixture of triethylamine/dimethylanilines. The IRFNA oxidizer is composed of approximately 86 percent nitric acid, 13 percent nitrogen dioxide, and 0.6 to 0.7 percent hydrofluoric acid.

Proposed Action

The Proposed Action involves the observation, photography, and destruction of the target missile. Because of the potential human health and safety issues associated with recovering target missile debris in the open ocean, we have decided to let the debris sink (and sink any floating debris), rather than attempt to recover it. Four target launches are proposed. In addition, a “dress rehearsal” would be conducted where no target would be launched, but related pre-launch, launch, and post launch debris management activities would be conducted. MDA plans to begin ABL testing activities no sooner than mid-2007 and the proposed target missile launches would be completed within 5 years.

During ABL flight tests, missile targets would be launched from Launch Facility 6A (LF-6A) on North Vandenberg AFB. Launches would occur during night-time hours, approximately between the hours of midnight and 4 AM. The ABL aircraft would fly at an altitude above 35,000 feet, where the infrared search and track (IRST) sensor, active ranging system (ARS) laser, Beacon Illuminator Laser (BILL), and Track Illuminator Laser (TILL) would acquire and track the target. The HEL would destroy the target at an altitude of approximately 40,000 feet (12.2 kilometers [km]) or higher. The trajectory of the missile target would be such that any debris from the destruction of the target missile during test activities would fall a minimum of 3.5 miles (6 km) from the coastline. Depending on the time required for the ABL to destroy the target versus missile time of flight, debris could fall up to 15.5 miles (25 km) from the coastline. Several different scenarios are foreseeable during ABL test activities.

a. The laser beam impacts the target missile and destroys it at the point of impact. In this case, the propellants would either be consumed on impact or the fuel tanks would rupture and the propellants would then dissipate in the air. The maximum amount of propellant remaining at the time of destruction would be approximately 59 gallons (189 kg) of kerosene fuel, 5 gallons (15 kg) of initiator fuel, and 168 gallons (908 kg) of IRFNA oxidizer. Debris from the target would fall to the ocean.

b. The laser beam impacts the target missile causing a split in the missile without destroying it. In this case, the target would tumble to the ocean with the fuel and oxidizer tanks intact. The maximum amount of propellant remaining in the fuel tanks at the time of destruction would be the same as in scenario 1.

c. The laser beam impacts the target missile causing a hole in the canister. In this case, the target would continue in a shortened trajectory with the fuel and oxidizer tanks intact. The IRFNA would continue to spew out of the motor in flight until pressure was gone. It is estimated that no more than approximately 59 gallons (189 kg) of kerosene fuel, 5 gallons (15 kg) of initiator fuel, and 50 gallons (290 kg) of IRFNA oxidizer would remain in the tanks.

d. The laser beam impacts the target missile destroying the fuel tank and breaking the missile into two pieces: the payload section and the oxidizer tank/motor section. In this case, the two pieces of the target missile would fall to the ocean with the oxidizer tank intact. Because the fuel tank would be destroyed, the kerosene fuel is expected to be consumed during the destruction. However, the IRFNA oxidizer tank would remain intact. The maximum amount of oxidizer remaining in the tank at the time of destruction would be approximately 168 gallons (908 kg).

e. The laser beam misses the target missile. In this case, the target would continue in a ballistic arc (approximately 180 to 220 miles [290 to 355 km] down-range) to the ocean as an intact missile. The maximum amount of propellant remaining in the fuel tanks at the time of impact would be approximately 10 gallons (28 kg) of kerosene fuel, 0 gallons (0 kg) of initiator fuel, and 50 gallons (290 kg) of IRFNA oxidizer.

The distribution of the fallout debris and remaining propellants, after destruction of the target missile, would vary, depending on the breakup pattern and whether the target is destroyed at the time of impact or is stopped in its intended flight trajectory and falls into ocean waters. Most solid debris is expected to sink soon after contacting the ocean and would not reach the shore. Any floating debris (e.g., an intact fuel tank) would be sunk to avoid creating a safety or navigational hazard. No attempt would be made to recover sunken debris.

A range clearance/biological monitoring aircraft would support debris management activities prior to and after launch for all test activities. Likewise, a small boat would support tracking buoy placement and debris assessment and disposal for all test activities. A visual survey of the debris field would be conducted to assess the size of the debris field and determine the best approach for monitoring.

Region of Influence

The target missile impact area[1] is the Pacific Ocean at least 3.5 miles (6 km) off the coast of Vandenberg AFB. Given the distance of the impact area from the shoreline and the physical properties of the fuel/oxidizer, it is anticipated that impacts would likely be restricted to surface waters (i.e., waters shallower than the thermocline) with minimal impact to deeper water and seafloor organisms at the location because of water depths of several hundred feet. In addition, based on modeling of potential drift scenarios and debris management actions, debris is not anticipated to drift to shore. As such, surface waters in the offshore area are the primary focus for biological resources of concern.

Threatened and Endangered Species

Federally listed threatened and endangered species that could be present in offshore surface waters of the ABL debris impact area include the Pacific brown pelican, six species of whales (Sei whale, Finback whale, Blue whale, Humpback whale, Sperm whale, and Right whale), the Stellar sea lion, the Guadalupe fur seal, the Southern sea otter, and four species of sea turtles (Loggerhead, Leatherback, Green or Black, and Olive ridley) (Table 1). The U.S. Fish and Wildlife Service (USFWS) does not have regulatory jurisdiction for marine mammal species that include various species of whales; the National Oceanic & Atmospheric Administration (NOAA) Fisheries Service is being consulted regarding these species. The NOAA Fisheries Service also is being consulted regarding Marine Mammal Protection Act and Essential Fish Habitat issues.

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[1] The target missile impact area includes the "action area," as defined in 50 CFR §402.02.

Table 1
Federally and State-Listed Threatened and Endangered Species with Potential to Occur off the Coast of Vandenberg AFB

Species	Federal Status	State Status
Mammals		
Sei whale (*Balaenoptera borealis*)*	Endangered	-
Finback whale (*Balaenoptera physalus*)*	Endangered	-
Blue whale (*Balaenoptera musculus*)*	Endangered	-
Humpback whale (*Megaptera novaeangliae*)*	Endangered	-
Sperm whale (*Physeter catodon [=macrocephalus]*)*	Endangered	-
Right whale (*Balaena glacialis*)*	Endangered	-
Southern sea otter (*Enhydra lutris nereis*)	Threatened	-
Stellar sea lion (*Eumetopias jubatus*)	Threatened	-
Guadalupe fur seal (*Artocephalns townsendi*)	Threatened	-
Birds		
Brown pelican (*Pelecanus occidentalis*)	Endangered	Endangered
Reptiles		
Green (Black) sea turtle (*Chelonia (agassizii) mydas*)	Threatened	-
Loggerhead sea turtle (*Caretta caretta*)	Threatened	-
Leatherback sea turtle (*Dermochelys coriacea*)	Endangered	-
Olive ridley sea turtle (*Lepidochelys olivacea*)	Threatened	-

* NOAA Fisheries Service consultation in progress.

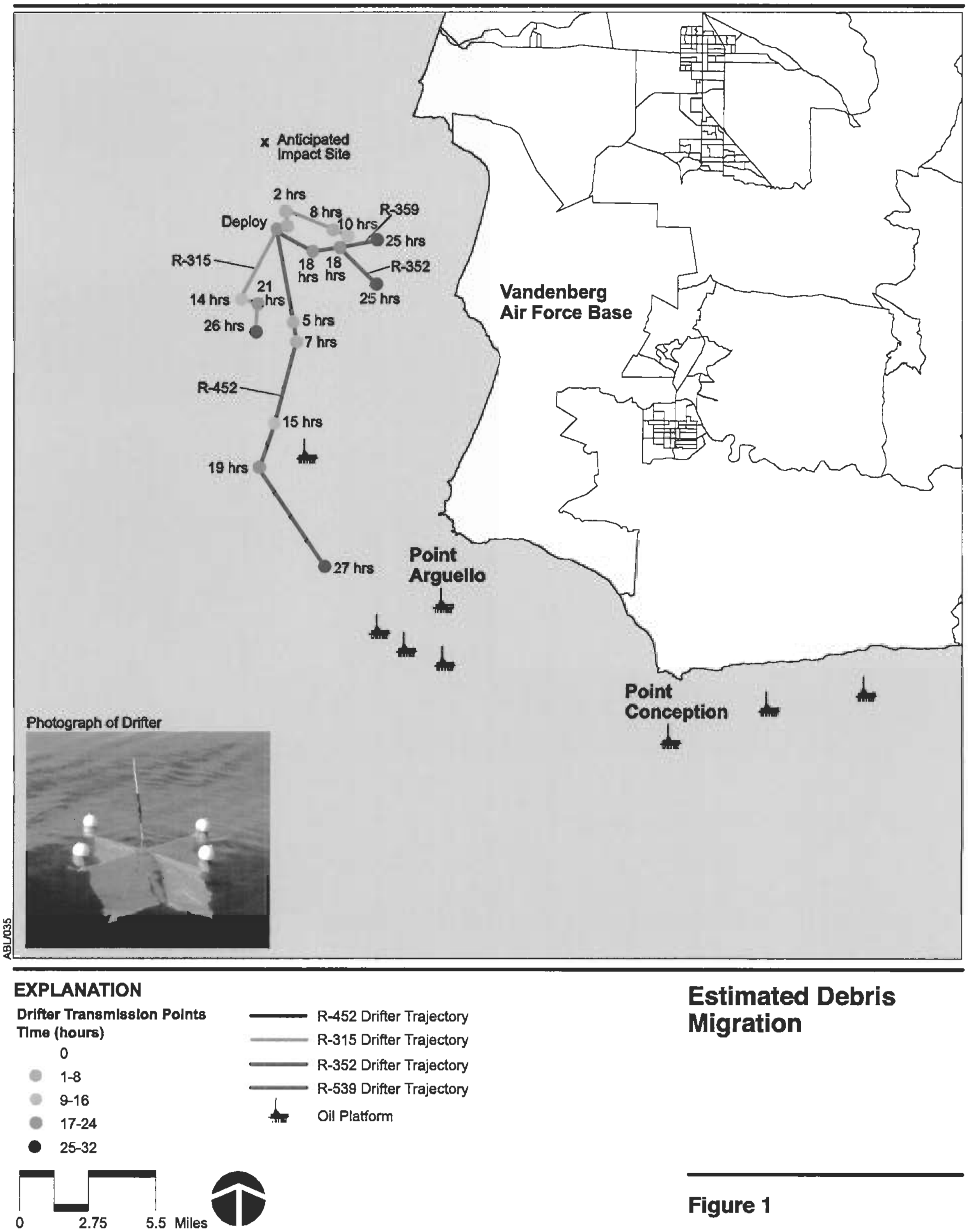
Ocean Currents and Fuel/Oxidizer Reaction with Water

MDA used drifter data from the Scripps Institute to determine the potential movement of debris after it reaches the ocean. Our analysis of potential drifter pathways resulting from test activities identified the four drifter courses (R-315, R-452, R-539, and R-352) presented in Figure 1. These four drifter pathways represent potential drift that extends furthest south or nearest to the coast.

Based on chemical dispersion modeling performed by NOAA's Office of Response and Restoration[2] for this effort, the pH of seawater in the immediate vicinity of the release would be lowered to the point of being hazardous (i.e., below 4.5 pH) for approximately 5 hours. Over a 5-hour period, the oxidizer plume is expected to cover an area of 1,100 acres (~1.7 square miles) and could migrate approximately 2 miles (3 km) to the south or 0.5 mile (1 km) toward the coast before the pH of the water would return to a safe level (i.e., above 4.5 pH). The modeling shows that over a 24-hour

[2] NOAA Ocean Service, Office of Response and Restoration, June 22, 2005. Fax from Dr. Jim Farr, Project Hydrology Modeler, Hazardous Materials Response Division, to Mr. Serkan Mahmutoglu, Earth Tech.

period, floating debris could migrate approximately 17 miles (27 km) to the south or approximately 4 miles (6 km) towards the shore.



Estimated Debris Migration

Figure 1

DEPARTMENT OF THE AIR FORCE
30TH SPACE WING (AFSPC)

JUL 1 1 2006

30 CES/CEV
1515 Iceland Ave Rm 181C
Vandenberg AFB CA 93437-5319

Ms. Diane Noda
Field Supervisor
U.S. Fish and Wildlife Service
2493 Portola Road, Suite B
Ventura CA 93003

Dear Ms. Noda

The Missile Defense Agency (MDA) is developing an Airborne Laser (ABL) as part of our nation's Ballistic Missile Defense System. Part of the development process involves testing the ABL against target missiles and destroying them over the open ocean. MDA is currently working closely with the Air Force in preparing an Environmental Assessment (EA) for proposed debris management activities associated with ABL testing at Vandenberg Air Force Base, California. The EA evaluates the potential environmental effects associated with managing the debris that would result from the tests.

MDA's analysis indicates that the potential to adversely affect federally listed threatened or endangered species is very limited. Modeling indicates that impacts related to debris would be localized and of short duration. As a result, MDA concludes that it is unlikely there will be any measurable or observable effect on any threatened or endangered species from ABL debris management activities.

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For the reasons described in the attachment, we believe a determination of "may affect, not likely to adversely affect" for listed species is appropriate for proposed ABL activities. We are requesting your input in the following areas:

a. Confirmation that our threatened, endangered, candidate, and proposed species list in this letter is current and complete.

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Your assistance with the Air Force's and MDA's continuing efforts to identify biological resources early in the EA process is greatly appreciated. Please direct any questions to the undersigned at (805) 605-7924 or Mr. Crate Spears, MDA Environmental Manager, at (703) 697-4123. We thank you for your cooperation.

Sincerely

BEATRICE L. KEPHART, GS-14
Chief, Environmental Flight

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The overall length of the target missile is approximately 11.6 meters (38 feet). When fully fueled, the missile would contain approximately 295 gallons (825 kilograms [kg]) of kerosene fuel (with coal tar distillates), 15 gallons (30 kg) of initiator fuel, and 490 gallons (2,920 kg) of Inhibited Red Fuming Nitric Acid (IRFNA) oxidizer. The kerosene fuel is composed of approximately 60 percent coal tar distillate (aromatic components) consisting of benzene, toluene, mixed xylenes, and cymene (methyl isopropyl benzene), with the balance being kerosene. The initiator fuel is a 50/50 mixture of triethylamine/dimethylanilines. The IRFNA oxidizer is composed of approximately 86 percent nitric acid, 13 percent nitrogen dioxide, and 0.6 to 0.7 percent hydrofluoric acid.

Proposed Action

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During ABL flight tests, missile targets would be launched from Launch Facility 6A (LF-6A) on North Vandenberg AFB. Launches would occur during night-time hours, approximately between the hours of midnight and 4 AM. The ABL aircraft would fly at an altitude above 35,000 feet, where the infrared search and track (IRST) sensor, active ranging system (ARS) laser, Beacon Illuminator Laser (BILL), and Track Illuminator Laser (TILL) would acquire and track the target. The HEL would destroy the target at an altitude of approximately 40,000 feet (12.2 kilometers [km]) or higher. The trajectory of the missile target would be such that any debris from the destruction of the target missile during test activities would fall a minimum of 3.5 miles (6 km) from the coastline. Depending on the time required for the ABL to destroy the target versus missile time of flight, debris could fall up to 15.5 miles (25 km) from the coastline. Several different scenarios are foreseeable during ABL test activities.

a. <u>The laser beam impacts the target missile and destroys it at the point of impact.</u> In this case, the propellants would either be consumed on impact or the fuel tanks would rupture and the propellants would then dissipate in the air. The maximum amount of propellant remaining at the time of destruction would be approximately 59 gallons (189 kg) of kerosene fuel, 5 gallons (15 kg) of initiator fuel, and 168 gallons (908 kg) of IRFNA oxidizer. Debris from the target would fall to the ocean.

b. <u>The laser beam impacts the target missile causing a split in the missile without destroying it</u>. In this case, the target would tumble to the ocean with the fuel and oxidizer tanks intact. The maximum amount of propellant remaining in the fuel tanks at the time of destruction would be the same as in scenario 1.

c. <u>The laser beam impacts the target missile causing a hole in the canister</u>. In this case, the target would continue in a shortened trajectory with the fuel and oxidizer tanks intact. The IRFNA would continue to spew out of the motor in flight until pressure was gone. It is estimated that no more than approximately 59 gallons (189 kg) of kerosene fuel, 5 gallons (15 kg) of initiator fuel, and 50 gallons (290 kg) of IRFNA oxidizer would remain in the tanks.

d. <u>The laser beam impacts the target missile destroying the fuel tank and breaking the missile into two pieces: the payload section and the oxidizer tank/motor section</u>. In this case, the two pieces of the target missile would fall to the ocean with the oxidizer tank intact. Because the fuel tank would be destroyed, the kerosene fuel is expected to be consumed during the destruction. However, the IRFNA oxidizer tank would remain intact. The maximum amount of oxidizer remaining in the tank at the time of destruction would be approximately 168 gallons (908 kg).

e. <u>The laser beam misses the target missile</u>. In this case, the target would continue in a ballistic arc (approximately 180 to 220 miles [290 to 355 km] down-range) to the ocean as an intact missile. The maximum amount of propellant remaining in the fuel tanks at the time of impact would be approximately 10 gallons (28 kg) of kerosene fuel, 0 gallons (0 kg) of initiator fuel, and 50 gallons (290 kg) of IRFNA oxidizer.

The distribution of the fallout debris and remaining propellants, after destruction of the target missile, would vary, depending on the breakup pattern and whether the target is destroyed at the time of impact or is stopped in its intended flight trajectory and falls into ocean waters. Most solid debris is expected to sink soon after contacting the ocean and would not reach the shore. Any floating debris (e.g., an intact fuel tank) would be sunk to avoid creating a safety or navigational hazard. No attempt would be made to recover sunken debris.

A range clearance/biological monitoring aircraft would support debris management activities prior to and after launch for all test activities. Likewise, a small boat would support tracking buoy placement and debris assessment and disposal for all test activities. A visual survey of the debris field would be conducted to assess the size of the debris field and determine the best approach for monitoring.

Region of Influence

The target missile impact area[1] is the Pacific Ocean at least 3.5 miles (6 km) off the coast of Vandenberg AFB. Given the distance of the impact area from the shoreline and the physical properties of the fuel/oxidizer, it is anticipated that impacts would likely be restricted to surface waters (i.e., waters shallower than the thermocline) with minimal impact to deeper water and seafloor organisms at the location because of water depths of several hundred feet. In addition, based on modeling of potential drift scenarios and debris management actions, debris is not anticipated to drift to shore. As such, surface waters in the offshore area are the primary focus for biological resources of concern.

Threatened and Endangered Species

Federally listed threatened and endangered species that could be present in offshore surface waters of the ABL debris impact area include the Pacific brown pelican, six species of whales (Sei whale, Finback whale, Blue whale, Humpback whale, Sperm whale, and Right whale), the Stellar sea lion, the Guadalupe fur seal, the Southern sea otter, and four species of sea turtles (Loggerhead, Leatherback, Green or Black, and Olive ridley) (Table 1). The U.S. Fish and Wildlife Service (USFWS) does not have regulatory jurisdiction for marine mammal species that include various species of whales; the National Oceanic & Atmospheric Administration (NOAA) Fisheries Service is being consulted regarding these species. The NOAA Fisheries Service also is being consulted regarding Marine Mammal Protection Act and Essential Fish Habitat issues.

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[1] The target missile impact area includes the "action area," as defined in 50 CFR §402.02.

Table 1
Federally and State-Listed Threatened and Endangered Species with Potential to Occur off the Coast of Vandenberg AFB

Species	Federal Status	State Status
Mammals		
Sei whale (*Balaenoptera borealis*)*	Endangered	-
Finback whale (*Balaenoptera physalus*)*	Endangered	-
Blue whale (*Balaenoptera musculus*)*	Endangered	-
Humpback whale (*Megaptera novaeangliae*)*	Endangered	-
Sperm whale (*Physeter catodon [=macrocephalus]*)*	Endangered	-
Right whale (*Balaena glacialis*)*	Endangered	-
Southern sea otter (*Enhydra lutris nereis*)	Threatened	-
Stellar sea lion (*Eumetopias jubatus*)	Threatened	-
Guadalupe fur seal (*Artocephalns townsendi*)	Threatened	-
Birds		
Brown pelican (*Pelecanus occidentalis*)	Endangered	Endangered
Reptiles		
Green (Black) sea turtle (*Chelonia (agassizii) mydas*)	Threatened	-
Loggerhead sea turtle (*Caretta caretta*)	Threatened	-
Leatherback sea turtle (*Dermochelys coriacea*)	Endangered	-
Olive ridley sea turtle (*Lepidochelys olivacea*)	Threatened	-

* NOAA Fisheries Service consultation in progress.

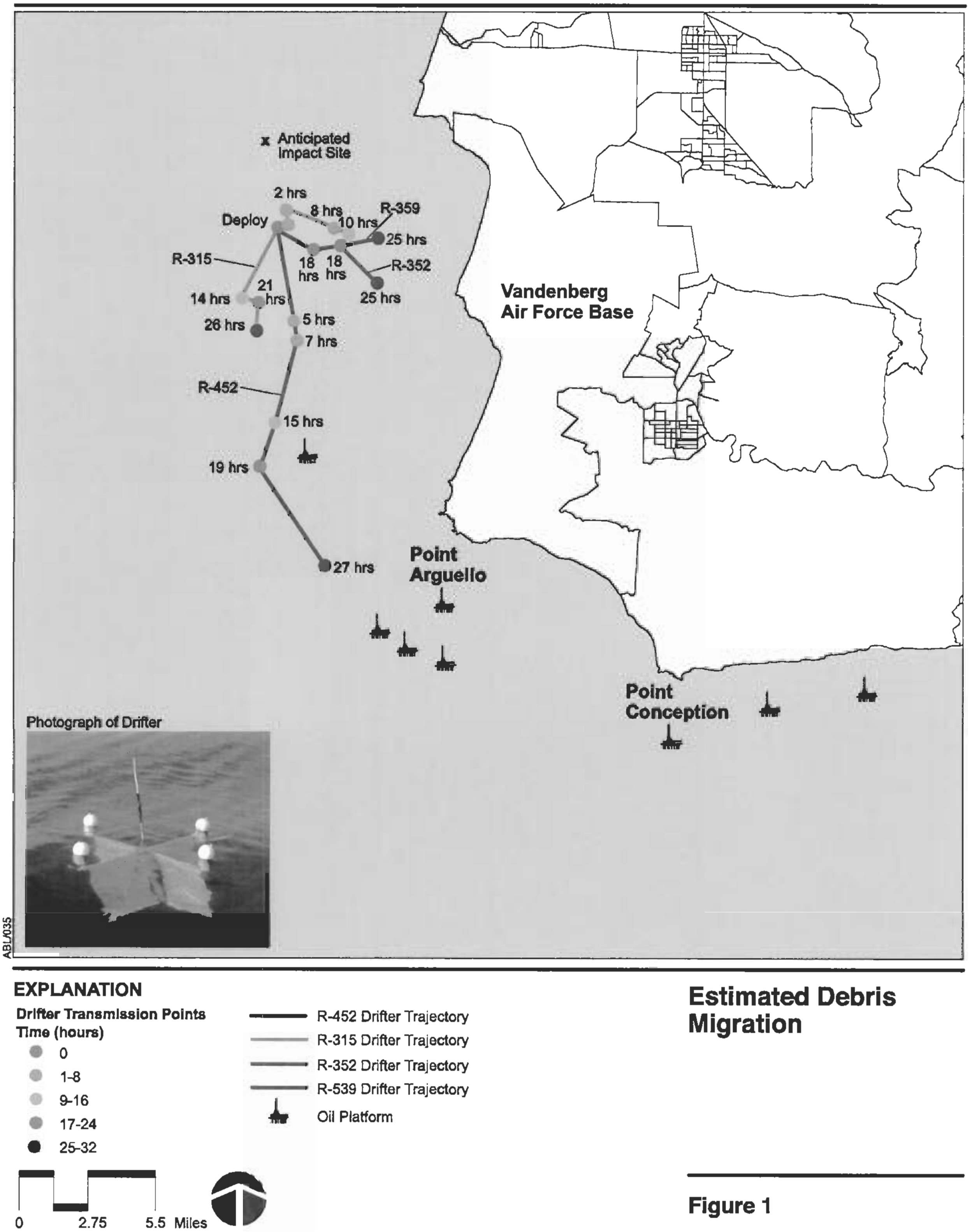
Ocean Currents and Fuel/Oxidizer Reaction with Water

MDA used drifter data from the Scripps Institute to determine the potential movement of debris after it reaches the ocean. Our analysis of potential drifter pathways resulting from test activities identified the four drifter courses (R-315, R-452, R-539, and R-352) presented in Figure 1. These four drifter pathways represent potential drift that extends furthest south or nearest to the coast.

Based on chemical dispersion modeling performed by NOAA's Office of Response and Restoration[2] for this effort, the pH of seawater in the immediate vicinity of the release would be lowered to the point of being hazardous (i.e., below 4.5 pH) for approximately 5 hours. Over a 5-hour period, the oxidizer plume is expected to cover an area of 1,100 acres (~1.7 square miles) and could migrate approximately 2 miles (3 km) to the south or 0.5 mile (1 km) toward the coast before the pH of the water would return to a safe level (i.e., above 4.5 pH). The modeling shows that over a 24-hour

[2] NOAA Ocean Service, Office of Response and Restoration, June 22, 2005. Fax from Dr. Jim Farr, Project Hydrology Modeler, Hazardous Materials Response Division, to Mr. Serkan Mahmutoglu, Earth Tech.

period, floating debris could migrate approximately 17 miles (27 km) to the south or approximately 4 miles (6 km) towards the shore.



Estimated Debris Migration

Figure 1