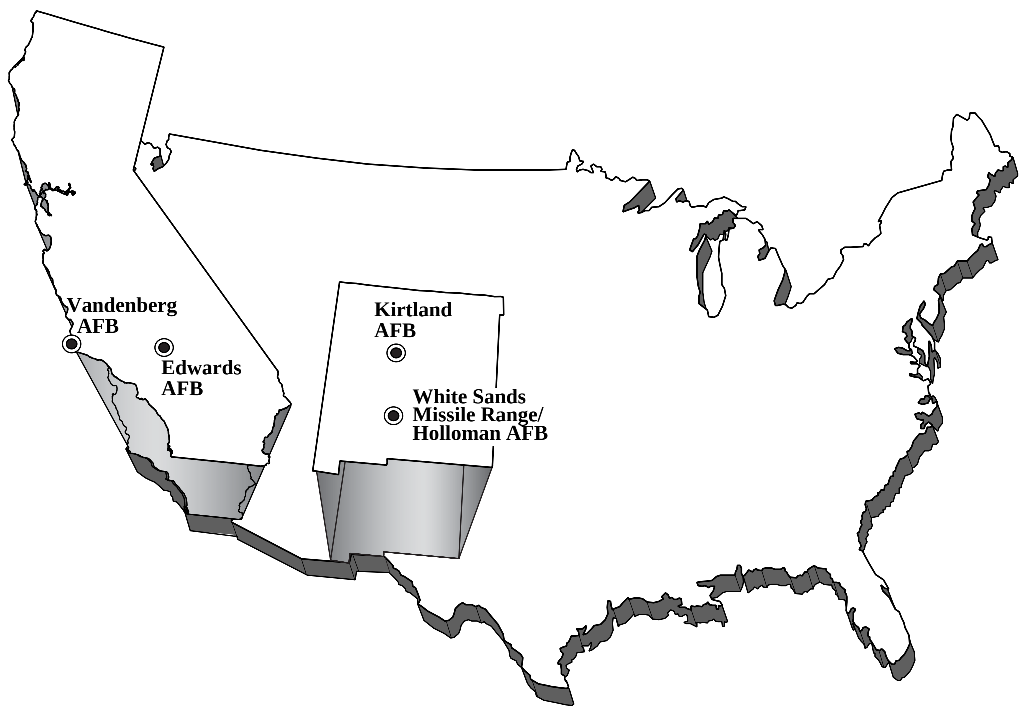
FINAL
SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT
June 2003



AIRBORNE LASER PROGRAM
KIRTLAND AFB, WHITE SANDS MISSILE RANGE/ HOLLOMAN AFB, NEW MEXICO; EDWARDS AFB, VANDENBERG AFB, CALIFORNIA

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AIRBORNE LASER PROGRAM

JUNE 2003

COVER SHEET
FINAL SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT
FOR AIRBORNE LASER PROGRAM
AT KIRTLAND AIR FORCE BASE (AFB) AND WHITE SANDS MISSILE RANGE/HOLLOMAN AFB, NEW MEXICO, AND EDWARDS AFB AND VANDENBERG AFB, CALIFORNIA

a. Responsible Agency: Missile Defense Agency

b. Cooperating Agencies: U.S. Air Force, Federal Aviation Administration (FAA)

c. Proposed Action: Conduct Airborne Laser (ABL) test activities at Edwards AFB, Kirtland AFB, White Sands Missile Range (WSMR)/Holloman AFB, and Vandenberg AFB.

d. Written comments and inquiries regarding this document should be directed to: Mr. George H. Gauger, HQ AFCEE/ECE, 3207 Sidney Brooks, Brooks AFB, Texas 78235-5344; facsimile, (210) 536-3890.

e. Designation: Final Supplemental Environmental Impact Statement (EIS)

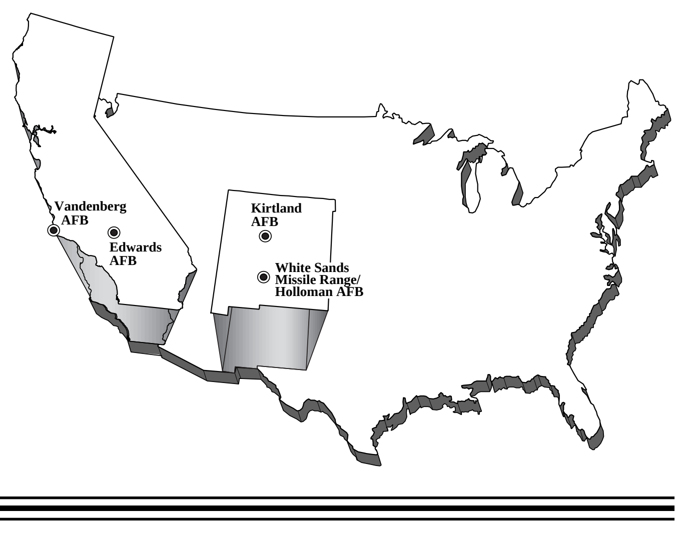
f. Abstract: This Supplemental Environmental Impact Statement has been prepared in accordance with the National Environmental Policy Act to analyze the potential environmental consequences of the Proposed Action and No-Action Alternative. The environmental consequences of testing the ABL were analyzed in the Final Environmental Impact Statement for the Program Definition and Risk Reduction Phase of the Airborne Laser Program, dated April 1997. Since that date, the proposed test activities have been refined sufficiently to warrant analysis in a supplemental EIS. Changes to the test activities that support a supplemental analysis include the addition of a second ABL aircraft, refinement of both ground- and flight-test activities, and analysis of the potential for laser energy to continue off the test ranges. The document includes analysis of local community, airspace, health and safety, hazardous materials and hazardous waste management, air quality, noise, biological resources, cultural resources, and socioeconomics. The Proposed Action involves both ground-level and flight testing of the ABL systems. Two ABL aircraft (Block 2004 and Block 2008 aircraft) would be utilized during test activities. Software upgrades to the Block 2004 aircraft would be tested and added to that test article under a Block 2006 effort. Once upgraded with the newer operating system the Block 2004 aircraft would be designated as the Block 2006 aircraft. Ground-testing activities would be conducted at Edwards AFB within the installations' boundaries and on existing test ranges. Kirtland AFB and WSMR/Holloman AFB have been identified as alternative ground-test locations in the event ground tests cannot be conducted at Edwards AFB. Flight test activities would be conducted at WSMR (including FAA-coordinated airspace and airspace utilized by Fort Bliss), at R-2508 Airspace Complex utilized by Edwards AFB, and at the Western Range over the Pacific Ocean off the coast of Vandenberg AFB. There is a possibility that the aircraft would fly within FAA-controlled airspace while lasing (firing the lasers) missile targets launched at WSMR. Under the No-Action Alternative, ABL test activities would be conducted as analyzed in the 1997 FEIS.

Potential impacts from implementation of the Proposed Action include temporary employment increases, increases in airspace conflicts, management of additional hazardous materials and hazardous waste, negligible increased air pollutant emissions, negligible increased noise, and disturbance of biological resources. Short-term employment increases would not adversely affect the communities near the proposed test locations. Flight test activities would be conducted in controlled airspace (restricted as well as FAA-controlled). The Air Force would conduct laser test activities in accordance with applicable safety standards and would implement appropriate

engineering, administrative, and personal protection equipment controls to prevent exposure to unsafe levels of laser energy. Hazardous materials and hazardous waste would be managed in accordance with applicable regulations and established plans. Air emissions associated with additional personnel and test activities would not affect the regional attainment status at any of the installations. Noise from ground-test activities would not cause an adverse effect as compared to the active runways adjacent to test locations; noise from flight test activities would not cause an adverse effect due to the altitude (approximately 35,000 feet or higher) in which tests would be conducted. No adverse impacts to biological resources is anticipated from proposed ABL test activities.

Potential effects of implementing the No-Action Alternative would be the same as those discussed under the Proposed Action in the 1997 Final EIS.

A copy of the 1997 final EIS and this SEIS are available for viewing on the Air Force Center for Environmental Excellence website at www.afcee.brooks.af.mil/ec/ecproducts.asp.



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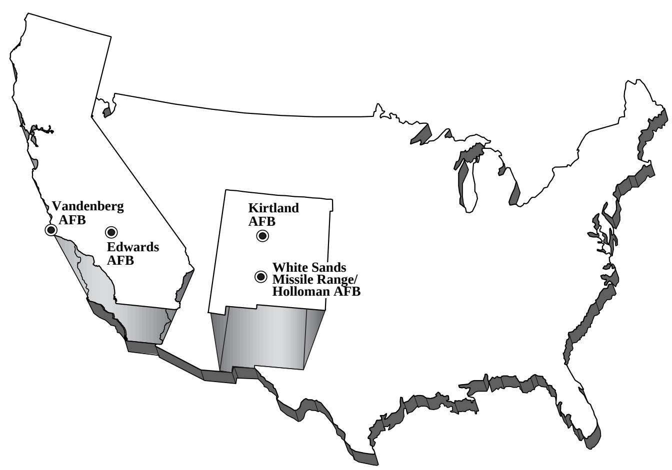


EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

PURPOSE OF AND NEED FOR ACTION

The United States requires a more accurate and effective defense against ballistic missiles by destroying them during the boost phase, just after launch. The United States and its allies have a limited capability to effectively defend against hostile missile attacks. Current capabilities are limited to defense of troops or high-value assets within a small area of a theater of operations as the missile nears its target. 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.

The Airborne Laser (ABL) aircraft is a modified Boeing 747 aircraft that accommodates a laser weapon system and laser-fuel storage tanks. The ABL aircraft incorporates an Active Ranging System (ARS) laser, a Track Illuminator Laser (TILL), and a Beacon Illuminator Laser (BILL); a laser-beam control system designed to focus the beam on target; and a High-Energy Laser (HEL) (i.e., chemical, oxygen, iodine laser [COIL]) designed to destroy the target. The ARS is a lower-power gas laser, and the BILL and TILL are lower-power solid-state lasers. An onboard Battle Management Command Center provides computerized control of aspects of the laser-weapon system, communications, and intelligence. The ABL aircraft would fly at high altitudes and would detect and track launches of ballistic missiles using onboard sensors. Active tracking of the missile with the BILL and TILL would begin at approximately 35,000 feet above mean sea level (MSL).

The purpose of the Proposed Action is to test the ABL system to determine its effectiveness in meeting the need for a more accurate and effective defense against missile attacks. This supplemental environmental impact statement (SEIS) provides information to be considered in making a decision concerning the proposed test activities of the ABL Program at Kirtland Air Force Base (AFB) and White Sands Missile Range (WSMR), New Mexico, and Edwards AFB and Vandenberg AFB, California. The SEIS provides the Missile Defense Agency (formerly the Ballistic Missile Defense Organization) decision maker and the public with the information required to understand the potential environmental consequences of the proposed test activities and the No-Action Alternative.

This SEIS sets forth the supplemental environmental analysis required based upon changes in the proposed test program that have occurred since the Final Environmental Impact Statement for the Program Definition and Risk Reduction Phase of the Airborne Laser Program was published in April 1997. The 1997 Final Environmental Impact Statement (FEIS) has previously examined all test activities and test locations and is considered the No-Action Alternative for this SEIS. The following is a list of new or refined actions that require the preparation of an SEIS:

- Testing of two ABL aircraft (the Block 2004 aircraft and an improved follow-on aircraft, the Block 2008) rather than the individual aircraft addressed in the 1997 FEIS

- Proposed ground testing that was not considered in detail within the 1997 FEIS

- Potential effects due to off-range lasing during test activities

- Potential effects of lowering the test altitude of the ABL aircraft from 40,000 feet to 35,000 feet or higher

- Testing the ARS laser, the BILL, and the TILL systems that were not considered in detail within the 1997 FEIS

- Refinement of proposed ABL test activities (i.e., location of tests, types of tests, and number of tests).

The ABL program is one of the elements of the Missile Defense Agency's (MDA's) ballistic missile defense system, which is intended to provide an effective defense for the United States, its deployed forces, and its friends and allies from limited missile attack during all segments of an attacking missile's flight. The ballistic missile defense system involves separate elements to provide a defense during all three segments of missile flight. Missile flight segments include the boost segment when the missile is under power and thrusting skyward, the midcourse segment when the missile is in a ballistic arc heading toward its target, and the terminal segment, which is the few remaining moments of the missile's flight before striking a target. Each ballistic missile defense system element is designed to work independently to provide a significant military defense.

The ABL element of this ballistic missile defense system is being developed to provide an effective defense to limited ballistic missile threats during the boost segment of an attacking missile's flight. The Air Force began development of the ABL program in 1993. In October 2001, the ABL program was transferred from the Air Force to the Ballistic Missile Defense Organization, which was renamed in January 2002 as the MDA.

The ABL program and the Ground-based Midcourse Defense (GMD) elements of missile defense have each proposed test activities at Vandenberg AFB. The ABL and GMD elements are independent of each other.

ALTERNATIVES INCLUDING THE PROPOSED ACTION

The 1997 FEIS analyzed several alternatives for establishing the Home Base, the Diagnostic Test Range, and the Extended-Area Test Range that are required to effectively demonstrate the ability of the ABL system. The 1997 FEIS considered Edwards AFB and Kirtland AFB as possible Home Base locations; WSMR and China Lake Naval Air Warfare Center as the Diagnostic Test Range; and the Western Range, including Vandenberg AFB and/or the Point Mugu Naval

Air Warfare Center Weapons Division and their operational areas as the Extended-Area Test Range.

The Record of Decision (ROD) for the 1997 FEIS identified Edwards AFB as the Home Base (to support the ABL aircraft and conduct ground-test activities of the ABL systems), WSMR as the Diagnostic Test Range, and the Western Range as the Expanded-Area Test Range (both for supporting proposed flight-test activities of the ABL systems). Based upon operational and environmental concerns, Edwards AFB is considered the primary location for conducting ground-test activities. Kirtland AFB and WSMR/Holloman AFB have been identified as alternative ground-test locations in the event that ground testing is not possible at Edwards AFB.

Proposed Action. The Proposed Action is to conduct test activities of the ABL system at test ranges associated with Kirtland AFB and WSMR/Holloman, New Mexico, and Edwards AFB and Vandenberg AFB, California. Test activities would involve testing the laser components on the ground and in flight to verify that laser components operate together safely and effectively. Two ABL aircraft (Block 2004 and Block 2008 aircraft) would be utilized during test activities. Software upgrades and other improvements to the Block 2004 aircraft would be tested and added to that test article under a Block 2006 effort. Once upgraded with the newer operating system the Block 2004 aircraft would be designated as the Block 2006 aircraft. Ground testing of the ABL system is proposed at Edwards AFB. Kirtland AFB and WSMR/Holloman AFB have been identified as alternative ground-test locations in the event ground tests cannot be conducted at Edwards AFB. Flight testing is proposed at R-2508 Airspace Complex (Edwards AFB), Western Range (Vandenberg AFB), and WSMR (including Federal Aviation Administration [FAA] airspace and airspace utilized by Fort Bliss). MDA proposes to maximize testing efficiencies and realism by conducting ground and flight tests at the proposed locations. MDA may elect to conduct tests at a more limited number of the test location alternatives; however, if a mission conflict or some other reason arises, reasonable test location alternatives are available to continue test activities.

The ABL aircraft would be housed at Edwards AFB. An existing hangar (Building 151) at Edwards AFB would be utilized to house the ABL aircraft. Edwards AFB is also the location where the laser device would be integrated into the aircraft, where ground tests would occur, and is the location for initial aircraft flight tests. Although flight testing of the ABL system would occur within the R-2508 Airspace Complex, Western Range, and WSMR, ABL test flights would begin and end at Edwards AFB. The ABL aircraft could be used to support other Ballistic Missile Defense System (BMDS) incidental exercises and deployments from other locations. If these operations are outside the scope of this SEIS, they would be supported by other environmental analysis as appropriate. The ABL aircraft would also be flown to Kirtland AFB to conduct ground testing. The ABL aircraft would use existing runways at Edwards AFB and Kirtland AFB. If it is determined that the WSMR range is to be used for ground-test activities, the ABL aircraft would be flown to Holloman AFB adjacent to WSMR.

In the event the ABL aircraft is unable to land at Edwards AFB after conducting flight-test activities (e.g., due to Edwards AFB runway closure), pre-planned “divert bases” have been established to which the aircraft would be diverted. The three bases identified include Vandenberg AFB, Holloman AFB, and Kirtland AFB. Although nothing would prevent the ABL aircraft from landing at any suitable base in time of emergency, personnel at these three installations would be specifically trained to support the ABL aircraft and appropriate equipment to handle ABL hazardous materials (e.g., chemical transfer and recovery receptacles) would be in place. Exercise and deployment locations would have sufficient equipment and training to meet the mission needs. The ABL aircraft would remain at these installations until the Edwards AFB runway is cleared for incoming traffic.

A description of the proposed ground- and flight-test activities at the installations is presented below.

Ground-Testing Activities. Ground tests of the lower-power laser systems (i.e., ARS, BILL, TILL, and Surrogate High-Energy Laser [SHEL]) would be performed at Edwards AFB. Ground-testing activities would be conducted from an aircraft parking pad or the end of a runway with the laser beam directed over open land toward ground targets with natural features (e.g., mountains, hills, buttes) or earthen berms as a backstop. The lower-power lasers could also be fired from the System Integration Laboratory at the Birk Flight Test Facility to range targets for atmospheric testing. Appropriate automatic hard-stop limits and/or laser blanking devices would be incorporated into the test design to ensure that laser energy does not extend beyond natural features and backstops. Additionally, the proposed ground-test area would be cleared of personnel prior to initiating test activities. The ARS ground-testing activities could be conducted using a ground-based simulator within Building 151 at Edwards AFB. No open range testing of the high-power HEL (COIL) would be conducted. Ground testing of the HEL would be conducted at Edwards AFB within Building 151 and the System Integration Laboratory (SIL) using a ground-based simulator or an enclosed test cell. In the event that ground testing is not possible at Edwards AFB, ground testing of the ARS, BILL, TILL, and SHEL systems only could be conducted at Kirtland AFB or Holloman AFB from the western end of the base runway, 04-22. The laser systems would be directed westward at targets placed within WSMR. Ground-test activities would involve testing the laser components after they have been integrated into the aircraft.

Flight-Testing Activities. Test flights at ranges associated with WSMR (including airspace utilized by Fort Bliss), Edwards AFB (R-2508 Airspace Complex), and Vandenberg AFB (Western Range) would be used to test the ARS, BILL, TILL, SHEL, and HEL systems.

The ABL tests would include acquisition and tracking of missiles at short-range as well as high-energy tests. These tests would be conducted against instrumented diagnostic target boards carried by balloons, missiles, or aircraft. Missiles would incorporate a flight-termination system, when required, to ensure that debris would be contained on the range in the event the target must be destroyed during flight. Proteus aircraft (a manned aircraft with a target board attached) and Missile Alternative Range Target Instrument (MARTI) drops (balloon with target board attached) would be utilized for testing of the lower-power laser systems (i.e., ARS, BILL, TILL, and SHEL). MARTI drops would also be used for testing the HEL.

During flight tests with the ABL aircraft, up to two "chase aircraft" may be utilized to monitor test activities. The ABL aircraft would fly at or above 35,000 feet. The laser systems would be directed above horizontal and track targets in an upward direction during test activities to minimize potential ground impact or potential contact with other aircraft. The energy from the HEL would heat the missile's booster components and cause a stress fracture, which would destroy the missile. Missile debris would be contained within the range boundaries. The geometry of the tests would preclude operation of the laser except at an upward angle. The onboard sensors and laser clearinghouse ephemeris data would be used to confirm that no other aircraft or satellites are within the potential path of the beam, although controlled airspace would be utilized during ABL test activities and would be verified cleared. Airborne diagnostic testing would revalidate and expand on-the-ground test activities, confirm computer model predictions, and enable complete system tests.

No-Action Alternative. The No-Action Alternative would be a decision to proceed with ABL testing activities as addressed in the 1997 FEIS and associated ROD.

Alternatives Eliminated from Further Consideration. The 1997 FEIS presented a discussion of alternatives considered but eliminated from further consideration with regard to test demonstration methods, laser system types, and test installation/range locations. No other alternatives were considered for this SEIS. This SEIS addresses the Proposed Action and No-Action Alternative only.

SCOPE OF STUDY

Based upon the activities to be addressed and actions that have already been addressed within the 1997 FEIS, resources that have a potential for impact were considered in more detail. The resources analyzed in more detail are: airspace, hazardous materials and hazardous waste management, health and safety, air quality, noise, biological resources, cultural resources, and socioeconomics.

Initial analysis indicated that the 1997 FEIS either addressed the potential environmental concern sufficiently or the proposed test activities would not result in either short- or long-term impacts to utilities, land use and aesthetics, transportation, storage tanks, Installation Restoration Program (IRP) sites, pesticide usage, asbestos, lead-based paint, polychlorinated biphenyls (PCBs), radon, medical/biohazardous waste, soils and geology, water resources, or environmental justice.

The proposed activities addressed in this SEIS do not change the scope, quantity, or quality of the actions analyzed in the 1997 FEIS. Specific issues that were addressed in the 1997 FEIS that do not require additional analysis in this SEIS include:

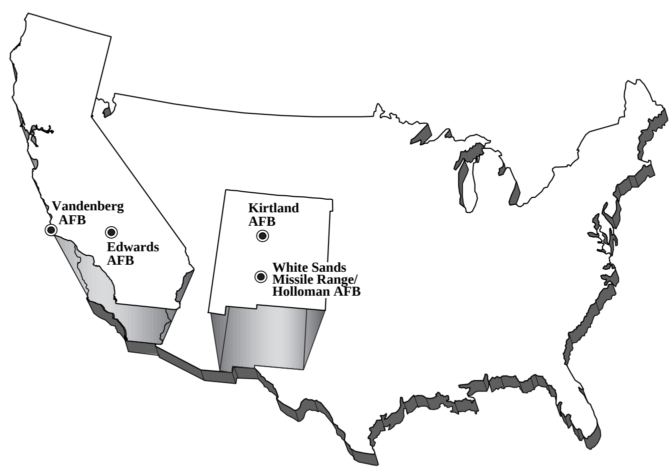
- Selection of “Home Base” and test ranges to be utilized during ABL test activities
- ABL aircraft accident/emergency scenarios
- Upper atmosphere air quality analysis.

SUMMARY OF ENVIRONMENTAL IMPACTS

Following is a brief description of potential environmental impacts of the Proposed Action and No-Action Alternative.

Proposed Action. The current regional airspace restrictions would continue during ABL testing activities. Flight-testing activities occurring within FAA-controlled airspace would be coordinated with the FAA prior to conducting test activities. Hazardous materials used and hazardous waste generated during ABL testing activities would be managed in accordance with applicable federal, state, Department of Defense, and Air Force regulations regarding the use, storage, and handling of hazardous materials, hazardous waste, and hazardous chemicals identified under the Hazardous Materials Management Plan. ABL testing activities would involve ground-level and in-flight lasing. Performance of ABL testing activities in accordance with appropriate safety measures would minimize potential health and safety impacts. There would be short-term, negligible increases in pollutant emissions due to ground- and flight-testing activities at Edwards AFB, Kirtland AFB, Vandenberg AFB, and WSMR/Holloman AFB. The minimal increases would not delay regional progress toward attainment of any air quality standard. The negligible increases in pollutants would not exceed the de minimus threshold of any regional air basin. Due to the location of the ground-test activities and the altitude of the flight-test activities, no residential areas would be exposed to continuous noise levels exceeding 65 decibels (dBA). Because ABL testing activities would be conducted in accordance with applicable regulations and existing standard operating procedures for debris recovery, adverse biological resource and cultural resource impacts are not anticipated. The proposed ABL testing activities would create a long-term increase of approximately 750 personnel at Edwards AFB to support the ABL program and a short-term increase of up to 50 program related temporary personnel during test activities. These personnel would provide a small, positive, yet largely unnoticeable effect on population, income, and employment in the vicinity of the installations.

No-Action Alternative. ABL test activities would proceed in accordance with those actions addressed in the 1997 FEIS and associated ROD. The regional airspace restrictions at the installations would continue due to ongoing mission activities. Management of hazardous materials and waste at the installations would continue in accordance with current practices. Current range safety measures at the installations would continue to ensure public safety and the environment are protected. Based on the 1997 FEIS, no adverse air quality, noise, or biological resources impacts are anticipated.



CHAPTER 1
PURPOSE AND NEED FOR ACTION

1.0 PURPOSE AND NEED FOR ACTION

1.1 INTRODUCTION

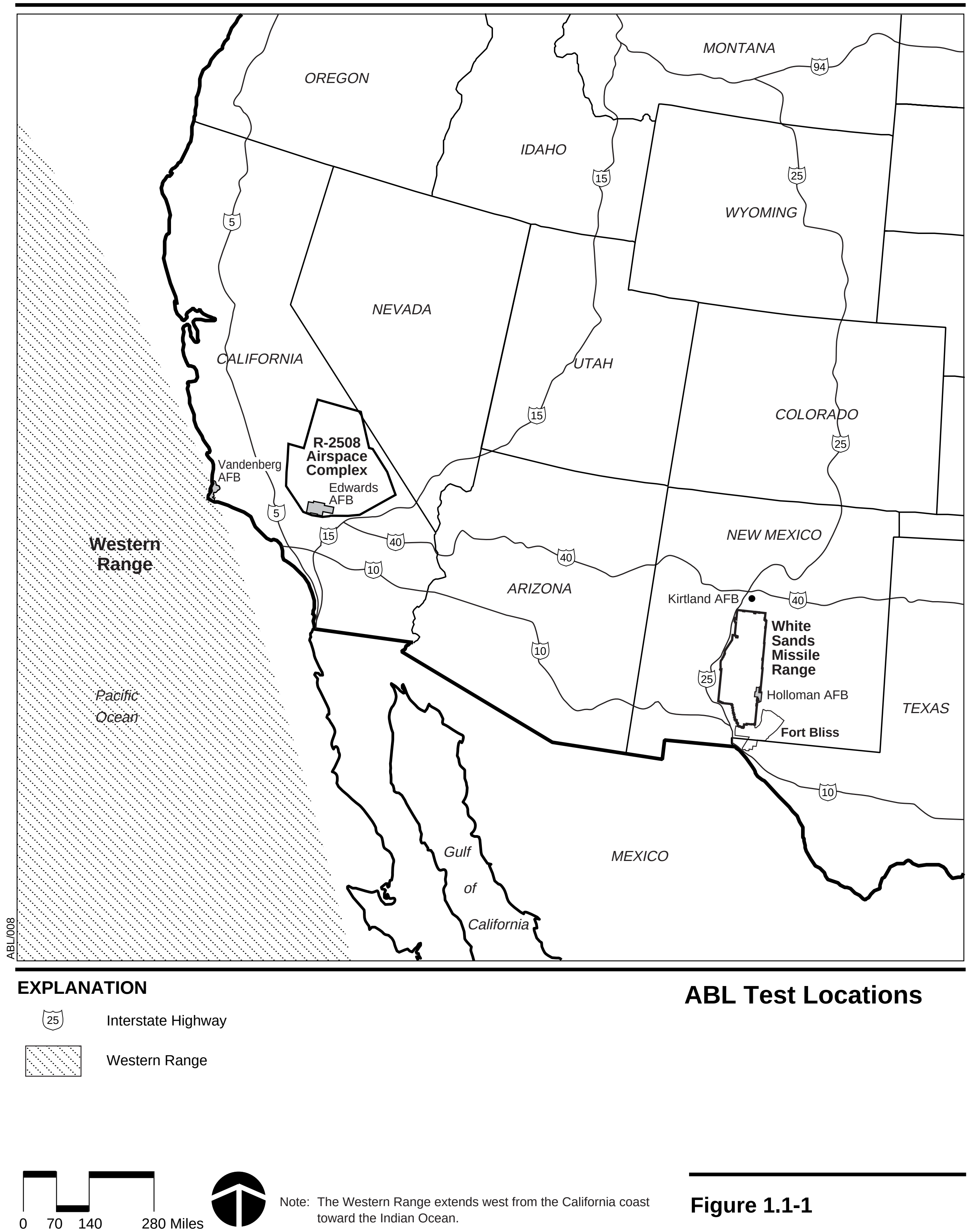
This supplemental environmental impact statement (SEIS) evaluates the potential environmental impacts associated with the proposed changes to the test program of the Airborne Laser (ABL) Program at test ranges associated with Kirtland Air Force Base (AFB) and White Sands Missile Range (WSMR)/ Holloman AFB, New Mexico; and Edwards AFB and Vandenberg AFB, California (Figure 1.1-1). Appendix A presents a glossary of terms, acronyms, and abbreviations used in this document.

This document has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, as amended, the Council on Environmental Quality (CEQ) regulations implementing the procedural provisions of NEPA (40 Code of Federal Regulations [CFR] Parts 1500-1508), and the Air Force Environmental Impact Analysis Process (Air Force Instruction [AFI] 32-7061, as promulgated at 32 CFR Part 989, Air Force policy and procedures). This SEIS sets forth the supplemental environmental analysis required based upon changes in the proposed test program that have occurred since the Final Environmental Impact Statement for the Program Definition and Risk Reduction Phase of the Airborne Laser Program, was published in April 1997. The SEIS does not repeat the lengthy descriptions and analyses presented in the final environmental impact statement (FEIS). The FEIS is incorporated by reference throughout this document. Readers are referred to the FEIS Executive Summary, presented in Appendix B of this document, to understand the context in which this SEIS applies.

A copy of the 1997 FEIS and this draft SEIS are available for viewing on the Air Force Center for Environmental Excellence website at www.afcee.brooks.af.mil/ec/ecproducts.asp.

1.2 PURPOSE AND NEED FOR ACTION

The Secretary of Defense has directed the Missile Defense Agency (MDA) to develop a capability to defend the United States, 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) to provide layered defense in-depth. The ABL is an element of the BMDS and will contribute to the Boost Phase Defense (BPD) Segment. An ABL program definition and risk reduction phase was begun, to design, fabricate, integrate, and test an ABL aircraft with a laser device (designated as the Block 2004 aircraft) as part of the BPD segment in the BMDS. The Block 2004 phase culminates in a lethality demonstration (missile shootdown) against boosting ballistic missile threat-representative targets and delivers one aircraft for integration and testing in the BMDS. This effort has been expanded since the 1997 FEIS to include maturation to a second ABL aircraft, ABL Block 2008, that includes new technologies, with enhanced lethality, and additional operational suitability.



ABL Test Locations

Note: The Western Range extends west from the California coast toward the Indian Ocean.

Figure 1.1-1

The Block 2008 aircraft will be similar to the Block 2004 aircraft (747-400 outfitted with chemical, oxygen, iodine laser [COIL] technology and tracking and ranging lasers) but would utilize approximately 30 percent more chemicals to obtain increased performance. New laser module designs and advances in optics and control systems would be tested in the System Integration Laboratory (SIL) and integrated onto the Block 2008 aircraft. Additionally, software upgrades and other improvements to the Block 2004 aircraft would be tested and added to that test article under a Block 2006 effort. Once upgraded with the newer operating system, the Block 2004 aircraft would be designated as the Block 2006 aircraft. The Block 2006 effort would also develop field transportable hardware to support deployment of the ABL aircraft.

The United States and its allies have a limited capability to effectively defend against hostile ballistic missile attacks. Current capabilities are limited to defense of troops or high-value assets within a small area of a theater of operations as the missile nears its target. 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. Missile launchers are difficult to detect because the launchers and support equipment are highly mobile.

The purpose of this SEIS is to provide information to be considered in making a decision concerning the proposed test activities of the ABL Program at Kirtland AFB, WSMR/Holloman AFB, Edwards AFB, and Vandenberg AFB. The SEIS provides the MDA decision maker and the public with the information required to understand the potential environmental consequences of the proposed test activities and the No-Action Alternative.

The ABL aircraft is a modified Boeing 747 aircraft that accommodates a laser-weapon system. The aircraft would fly at high altitudes and would detect and track launches of ballistic missiles using onboard sensors. Active tracking of the missile Beacon Illuminator Laser (BILL) and Track Illuminator Laser (TILL) would begin at approximately 35,000 feet above mean sea level (MSL). The laser would then be directed 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.

1.3 ENVIRONMENTAL IMPACT ANALYSIS PROCESS

NEPA established a national policy to protect the environment, and ensure that federal agencies consider the environmental effects of actions in their decision making. This policy recognizes humankind's impact on the biosphere and the importance of restoring and maintaining the overall quality of our natural environment. The CEQ is authorized to oversee and recommend national policies to improve the quality of the environment. The CEQ published regulations that describe how NEPA should be implemented. The CEQ regulations encourage federal agencies to develop and implement procedures that address the NEPA process in order to avoid or minimize adverse effects to the environment. For this SEIS, the MDA is using as a model the Air Force environmental impact analysis process as described in Title 32 CFR Part 989.

The draft SEIS is filed with the U.S. Environmental Protection Agency (EPA), and is circulated to the interested public and government agencies for a period of at least 45 days for review and comment. During this period, one or more public hearings are held so that the public can make comments on the draft SEIS. At the end of the review period, all substantive comments received must be addressed. A final SEIS will be produced that contains responses to comments on the draft SEIS, as well as changes to the document, if necessary.

The final SEIS will then be filed with the U.S. EPA and distributed in the same manner as the draft SEIS. Once the final SEIS has been available for at least 30 days, the Record of Decision (ROD) for the action may be signed.

1.3.1 Scoping Process

Regulations implementing NEPA require early participation by the public and interested parties in determining the scope and content of the environmental impact statement (EIS), providing comments regarding the Proposed Action and alternatives, and identifying significant issues related to the Proposed Action. This is called the scoping process. The Air Force initiated the scoping process for the 1997 EIS on 20 March 1995, by publication in the Federal Register (FR) (60 FR 14737) of a Notice of Intent (NOI) to prepare an EIS. Copies of the NOI were sent to federal, state, and local agencies and other parties known or expected to be interested in the Proposed Action. Concerned parties were encouraged to participate in public scoping meetings conducted during April and May 1995, in Albuquerque and Las Cruces, New Mexico, and in Lancaster and Lompoc, California. Public hearings on the draft EIS were held in those communities in December 1996.

Comments and questions received as a result of scoping were used in identifying potential environmental impacts to the quality of the human and natural environment.

The scoping process identifies the significant environmental issues relevant to the proposed ABL test activities, and provides an opportunity for public involvement in the development of the SEIS. The NOI (Appendix C) to prepare an SEIS for ABL Program test actions was published in the Federal Register on 27 March, 2002. The scoping process is not required in the preparation of an SEIS; however, the MDA decided it was appropriate to conduct meetings to inform the public of ABL test activities. Notification of public scoping was made through local newspapers as well as press releases to local officials, media, and newspapers.

Public meetings were held on the following dates to solicit comments and concerns from the general public:

- 1 April 2002 at the Antelope Valley Inn in Lancaster, California
- 3 April 2002 at the Lompoc City Council Chambers in Lompoc, California

- 15 April 2002 at the Albuquerque Marriott in Albuquerque, New Mexico

- 17 April 2002 at the Holiday Inn de Las Cruces in Las Cruces, New Mexico.

At each of these meetings, representatives of the MDA presented an overview of the meeting's objectives, agenda, and procedures, and described the process and purpose for the development of the SEIS. In addition to oral comments, written comments were received during the scoping process. These comments, as well as information from the local community, experience with similar decisions to be made, and NEPA requirements, were used to determine the scope and direction of studies/analyses needed to accomplish this SEIS.

1.3.2 Public Comment Process

The Draft SEIS was made available for public review and comment in September 2002. Copies of the Draft SEIS were made available for review in local libraries and provided to those requesting copies (Appendix D). At public hearings held in California and New Mexico in October 2002, the findings of the Draft SEIS were presented and the public was invited to make comments. All comments were reviewed and addressed, when applicable, and have been included in their entirety in this document. Responses to comments offering new or changes to data and questions about the presentation of data are also included. Comments simply stating facts or opinions, although appreciated, did not require specific response. Chapter 8, Public Comments and Responses, more thoroughly describes the comment and response process.

1.4 CHANGES FROM THE DRAFT SEIS TO THE FINAL SEIS

The text of this SEIS has been revised, when appropriate, to reflect concerns expressed in public comments. The responses to the comments indicate the relevant sections of the SEIS that have been revised. The major comments received on the Draft SEIS were:

- Concern was raised over how much hazardous waste would be produced and how it would be disposed.

- The SEIS should clarify evacuation and debris recovery procedures for test activities affecting White Sands National Monument.

- Concern was raised regarding the potential for harm to the public if there is an accident of the ABL aircraft.

- Concern was expressed over the possibility of the laser being directed downward.

- Concern was expressed regarding the possibility for safety measures to fail during test activities posing a potential high risk to the safety and health of people in the area.

- Concern was raised regarding the influx of 50 people to the Albuquerque area during test activities having an adverse effect on the regions natural resources and economy.

- The existing Storm Water Pollution Prevention Plans should be amended to incorporate any additional activities and pollutant controls dictated by the proposed test activities.

- California commercial and recreational fishing could be impacted, especially below the Western Range, and flight tests may require the closure of one or more of the state or national parks.

Based on more recent studies or comments from the public, the following sections of the SEIS have been updated or revised:

- Text has been revised throughout the SEIS to further clarify the Block 2004 and Block 2008 ABL aircraft activities.

- Text has been added as appropriate to define Block 2006 activities.

- Text has been added as appropriate to describe activities that would occur during incidental exercises and deployments for “targets of opportunity” during the development of the ABL aircraft.

- Text has been added as appropriate to define a test cell at Edwards AFB to utilize the High-Energy Laser (HEL) output rather than dumping to a heat sink.

- Text has been added to Section 2.2.1 to indicate that ground testing from Holloman AFB across the White Sands National Monument could require closure and evacuation of the public.

- Table 3.1-3, Estimated Quantities of Wastes to be Disposed of at Edwards AFB, has been revised to indicate estimated “annual” quantities of wastes to be generated rather than “life of the test program.”

- Table 3.1-9, Estimated Emissions from ABL Testing Activities at Edwards AFB, has been revised based on increased numbers of ground support equipment and increased hours of operation.

- Text has been added to Section 3.3.4.2 to indicate that any debris recovery and restoration activities within the White Sands National Monument would be conducted under terms of a special use permit issued by the National Park Service at White Sands National Monument.

- The text and tables in Sections 3.2.7 and 3.3.7 regarding threatened and endangered species have been updated as appropriate based on input from the U.S. Fish and Wildlife Service.

- Text has been added to Section 3.3.9 regarding annual visitation to White Sands National Monument and the short-term increase of closures from public use of the National Monument, resulting in inconvenience to the public.

1.5 SCOPE OF THE ENVIRONMENTAL REVIEW

The 1997 FEIS considered options for siting a Home Base, a Diagnostic Test Range, and an Expanded-Area Test Range in support of the ABL Program. The decision possibilities included selecting the Proposed Action, selecting one of the alternatives, or selecting the No-Action Alternative. The Assistant Secretary of the Air Force for Acquisitions was the decision maker. A screening process was developed to narrow the number of alternative locations for detailed analysis. This process was designed to identify a number of candidate locations that could meet a threshold of operational considerations necessary to conduct the ABL Program. In addition, the 1997 FEIS also addressed the operational characteristics and potential environmental effects of the HEL.

The ROD for the 1997 FEIS identified Edwards AFB as the Home Base (to support the ABL aircraft and conduct ground-test activities of the ABL systems), 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). Based upon operational and environmental concerns, Edwards AFB is considered the primary location for conducting ground-test activities. Kirtland AFB and WSMR/Holloman AFB have been identified as alternative ground-test locations in the event that ground testing is not possible at Edwards AFB (e.g., mission conflict, weather conditions).

This SEIS is being prepared due to refinement of proposed test activities, and to address various aspects of the proposed ABL tests. The following is a list of new or refined actions that require preparation of an SEIS:

- Assessment of two ABL aircraft (the Block 2004 aircraft and an improved follow-on aircraft, the Block 2008), rather than the individual aircraft addressed in the 1997 FEIS

- Assessment of proposed ground testing that was not considered in detail within the 1997 FEIS

- Assessment of potential effects due to off-range lasing during test activities

- Assessment of effects of lowering the testing altitude of the ABL aircraft from 40,000 feet to 35,000 feet or higher

- Assessment of testing the Active Ranging System (ARS) laser, the BILL, the TILL, and the Surrogate High-Energy Laser (SHEL) systems that were not considered in detail within the 1997 FEIS

- Refinement of proposed ABL test activities (i.e., location of tests, types of tests, and number of tests).

The ABL program is one of the elements of the MDA's BMDS, which is intended to provide an effective defense for the United States, its deployed forces, and its allies from limited missile attack during all segments of an attacking missile's flight. The BMDS involves separate elements to provide a defense during all three segments of missile flight. Missile flight segments include the boost segment when the missile is under power and thrusting skyward, the midcourse segment when the missile is in a ballistic arc heading toward its target, and the terminal segment which is the few remaining moments of the missile's flight before striking a target. Each BMDS element is designed to work independently to provide a significant military defense.

The ABL element of this BMDS is being developed to provide an effective defense to limited ballistic missile threats during the boost segment of an attacking missile's flight. The Air Force began development of the ABL program in 1993. In 2001, the ABL program was transferred from the Air Force to the Ballistic Missile Defense Organization, which was renamed in January 2002 as the MDA.

The ABL and the Ground-based Midcourse Defense (GMD) elements of missile defense have each proposed test activities at Vandenberg AFB. The ABL and GMD elements are independent of each other.

Based upon the activities to be addressed and actions that have already been addressed within the 1997 FEIS, resources that have a potential for impact were considered in more detail. The resources analyzed in more detail include airspace, hazardous materials and hazardous waste management, health and safety, air quality, noise, biological resources, cultural resources, and socioeconomics. The affected environment and the potential environmental consequences relative to these resources are described in Chapter 3.0.

The proposed activities addressed in this SEIS do not change the scope, quantity, or quality of the actions analyzed in the 1997 FEIS. Initial analysis indicated that the 1997 FEIS either addressed the potential environmental concern sufficiently, or the proposed test activities would not result in either short- or long-term impacts to utilities, land use and aesthetics, transportation, storage tanks, Installation Restoration Program (IRP) sites, pesticide usage, asbestos, lead-based paint, polychlorinated biphenyls (PCBs), radon, medical/biohazardous waste, soils and geology, water resources, or environmental justice. A determination was made that further analysis was not warranted for these resources on Holloman AFB because they were considered to be similar to those previously analyzed at WSMR, which is immediately adjacent to Holloman AFB. The reasons for not addressing these resources are briefly discussed in the following paragraphs.

Utilities. Because no substantial permanent employment changes would occur and utility requirements for test activities would not change, impacts to utilities (water, wastewater, electricity, and natural gas) are not expected, and are not further analyzed in this SEIS.

Land Use and Aesthetics. Because proposed test activities would occur on existing test ranges and no new construction would occur, no land use changes would occur. Impacts to land use and aesthetics are not expected, and are not further analyzed in this SEIS.

Transportation. Because no permanent employment changes would occur and procedures are in place to control traffic during proposed test activities, impacts to roadways, air transportation, and rail transportation are not expected, and are not further analyzed in this SEIS. However, potential effects to airspace are addressed in this SEIS.

Storage Tanks. Storage tanks associated with the ABL Program were adequately addressed in the 1997 FEIS. The proposed activities addressed in this SEIS do not change the scope, quantity, or quality of the actions analyzed in the 1997 FEIS. Refinement of the test program has not changed the use or management of storage tanks. The Block 08 ABL aircraft may utilize up to 30 percent more laser fuel. The designated chemical storage facility at Edwards AFB has adequate storage capacity for this fuel. Therefore, storage tanks are not further analyzed in this SEIS.

IRP. There are no IRP sites situated in the vicinity of proposed ground target locations. Therefore, impacts to the IRP are not expected, and are not further analyzed in this SEIS.

Pesticide Usage. The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), 7 United States Code (U.S.C.) Sections 136-136y, regulates the registration and use of pesticides. Pesticide management activities are subject to federal regulations contained in 40 CFR Parts 162, 165, 166, 170, and 171.

The proposed activities would not require an increase in the use of pesticides; therefore, impacts from pesticide usage are not expected, and are not further analyzed in this SEIS.

Asbestos. Asbestos-containing material (ACM) is regulated by the U.S. EPA and the Occupational Safety and Health Administration (OSHA). Asbestos fiber emissions into the ambient air are regulated in accordance with Section 112 of the Clean Air Act (CAA), which established the National Emissions Standards for Hazardous Air Pollutants (NESHAP). The Asbestos Hazard Emergency Response Act (AHERA) (Public Law [P.L.] 99-519 and P.L. 101-637) and OSHA regulations cover worker protection for employees who work around or remediate ACM. Friable ACM is defined as any material containing more than 1 percent asbestos that, when dry, can be crumbled, pulverized, or reduced to powder by hand pressure. Nonfriable ACM is material that contains more than 1 percent asbestos, but does not meet the rest of the criteria for friable ACM.

Because no facility construction or demolition activities are proposed to support test activities, no impacts from asbestos are expected. Therefore, asbestos is not further analyzed in this SEIS.

Lead-Based Paint. Human exposure to lead has been determined to be an adverse health risk by agencies such as OSHA and the U.S. EPA. Sources of exposure to lead are through contact with dust, soil, and paint. In 1973, the Consumer Product Safety Commission (CPSC) established a maximum lead content in paint of 0.5 percent by weight in a dry film of newly applied paint. In 1978, under the Consumer Product Safety Act (P.L. 101-608, as implemented by 16 CFR Part 1303), the CPSC lowered the allowable lead level in paint to 0.06 percent. The Act also restricted the use of lead-based paint in nonindustrial facilities.

Because no facility construction or demolition activities are proposed to support test activities, no impacts from lead-based paint are expected. Therefore, lead-based paint is not further analyzed in this SEIS.

PCBs. Commercial PCBs are industrial compounds produced by chlorination of biphenyls. PCBs are used in electrical equipment, primarily in capacitors and transformers, because they are electrically nonconductive and are stable at high temperatures. PCBs persist in the environment, accumulate in organisms, and concentrate in the food chain.

No PCB-containing equipment would be utilized during proposed test activities. Therefore, impacts from PCBs are not expected, and are not further analyzed in this SEIS.

Radon. Radon is a naturally occurring, colorless, and odorless radioactive gas that is produced by radioactive decay of naturally occurring uranium. Radon is found in high concentration in rocks containing uranium such as granite and shale. Radon that is present in the soil can enter a building through small spaces and openings, accumulating in enclosed areas such as basements. The cancer risk caused by exposure through the inhalation of radon is a topic of concern. There are no federal or state standards regulating radon exposure at the present time. However, the U.S. EPA has made testing recommendations for both residential structures and schools.

Because the proposed test activities would not be conducted in facilities that would be permanently occupied, potential impacts from radon are not expected, and are not further analyzed in this SEIS.

Medical/Biohazardous Waste. Medical/biohazardous waste would not be generated during proposed test activities; therefore, impacts from medical/ biohazardous waste are not expected, and are not further analyzed in this SEIS.

Soils and Geology. Because no facility construction or demolition activities are proposed to support test activities, no ground disturbance would occur. Some soil disturbance would be expected during missile debris recovery actions at WSMR. Any debris from target missiles would be recovered in accordance with WSMR Standard Operating Procedures (SOPs) to minimize potential impacts to soil and to reduce the potential for soil erosion. Impacts to soils and geology are not expected, and are not further analyzed in this SEIS.

Water Resources. Because no facility construction or demolition activities are proposed to support test activities, no ground disturbance would occur that could potentially affect surface water. Some soil disturbance would be expected during missile debris recovery actions at WSMR. Any debris from target missiles would be recovered in accordance with WSMR SOPs to minimize potential impacts to soil and to reduce the potential for erosion. Washdown activities of the ABL aircraft at Edwards AFB would be conducted in accordance with Air Force Flight Test Center (AFFTC) Instruction 32-6, Edwards AFB Wastewater Instruction (Edwards Air Force Base, 1995), and the Edwards AFB Pollution Prevention Plan (Edwards Air Force Base, 1996). These plans include the use of such controls as contaminant dikes, curbs, drainage ditches, evaporation ponds, oil/water separators, and training of personnel in materials handling. Impacts to water resources are not expected, and are not further analyzed in this SEIS.

Environmental Justice. Potential environmental justice impacts were addressed within the 1997 FEIS. No impacts to low-income and minority populations were identified.

Under the Proposed Action, proposed ground-testing activities of the ABL systems would be conducted at Edwards AFB with Kirtland AFB and WSMR/Holloman AFB as alternative ground-test locations. Potential impacts would be contained within the installations' boundaries in areas that are not populated and are restricted to the general public. During proposed flight testing activities of the ABL systems, the ABL aircraft and targets would be at approximately 35,000 feet or higher and would be conducted within controlled airspace over WSMR (including the Northern and Western call-up areas, Federal Aviation Administration [FAA]-coordinated airspace, and Fort Bliss-controlled airspace), the Western Range, and within the R-2508 Airspace Complex. There are no foreseeable impacts outside of the ranges that are not populated and are restricted to the general public. Because ground- and flight-testing activities of the ABL systems would be conducted and contained within the installation/range boundaries (with FAA coordination), no disproportionately high and adverse impacts to low-income and minority populations would occur. Therefore, potential environmental justice impacts are not further analyzed in this SEIS.

The proposed activities addressed in this SEIS do not change the scope, quantity, or quality of the actions analyzed in the 1997 FEIS. Specific issues that were addressed in the 1997 FEIS that do not require additional analysis in this SEIS include:

- Selection of "Home Base" and test ranges to be utilized during ABL test activities
- ABL aircraft accident/emergency scenarios
- Upper atmosphere air quality analysis.

1.6 ENVIRONMENTAL PERMITS AND LICENSES

The ABL Program Office and the regulatory compliance organization at each host installation would work together to apply for or seek to modify various permits or licenses in accordance with federal, state, or local regulatory requirements. Table 1.6-1 provides a summary of the required permits and licenses.

Table 1.6-1. Environmental Permits and Licenses

Attribute	Permit, License, or Entitlement	Activity, Facility, or Category of Persons Required to Obtain the Permit, License, or Entitlement	Regulations	Regulatory Agencies
Air Quality	Title V Operating Permit	GPRA and AGE must be included in Base Title V Operating Permit	CAA (42 U.S.C. Section 7401)	Albuquerque Environmental Health Department; Kern County APCD; Santa Barbara County APCD; New Mexico AQCR 6
Hazardous Materials/ Hazardous Waste	Hazardous material storage authorization and notification	Coordination with base Environmental Departments for authorization and the public for notification of hazardous material storage	RCRA, as amended (42 U.S.C. Section 6901); California Hazardous Waste Control Law (California Health and Safety Code Section 25100); EPCRA; Pollution Prevention Act; Executive Order 13148	EPA; New Mexico Environment Department; California EPA - DTSC
Biological Resources	Coordination with wildlife agencies Biological Assessment	Required for missile launch activities at White Sands Missile Range and Vandenberg AFB May be required if selected launch site has not been previously assessed (all ranges)	ESA (16 U.S.C. Section 1531); Migratory Bird Treaty Act (16 U.S.C. Section 703-71 2); Bald and Golden Eagle Protection Act (16 U.S.C. Section 668); Marine Mammal Protection Act (16 U.S.C. Section 1361); Fish and Wildlife Coordination Act (16 U.S.C. Section 661); Marine Protection Research and Sanctuaries Act (33 U.S.C. Section 1401)	USFWS; NMFS; New Mexico Department of Game and Fish; California Department of Fish and Game; New Mexico Energy, Minerals, and Natural Resources Department, Forestry Division; California Coastal Commission
Cultural Resources	Archaeological Resources Protection Act permit	Excavation and/or removal of archaeological resources from public lands or Indian lands and carrying out activities associated with such excavation and/or removal	Archaeological Resources Protection Act of 1979, 16 U.S.C. Section 470cc	U.S. Department of the Interior – National Park Service; State Historic Preservation Office
Airspace	Coordination with FAA	Required for airspace use at ranges; operation of GPRA near runway areas	FAA (Public Law 85-726)	FAA

AFB = Air Force Base
AGE = aerospace ground equipment
APCD = Air Pollution Control District
AQCR = Air Quality Control Region
CAA = Clean Air Act
DTSC = Department of Toxic Substances Control
EPA = Environmental Protection Agency
EPRCA = Emergency Planning and Community Right-to-Know Act
ESA = Endangered Species Act
FAA = Federal Aviation Administration
GPRA = Ground Pressure Recovery Assembly
NMFS = National Marine Fisheries Service
RCRA = Resource Conservation and Recovery Act
U.S.C. = U.S. Code
USFWS = U.S. Fish and Wildlife Service

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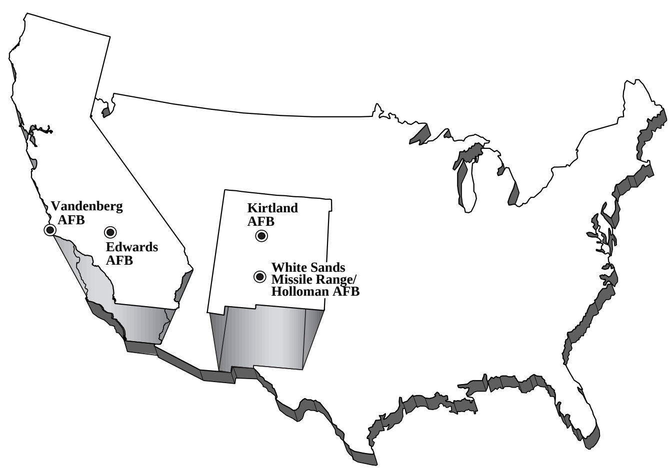


CHAPTER 2
ALTERNATIVES
INCLUDING THE PROPOSED ACTION

2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.1 INTRODUCTION

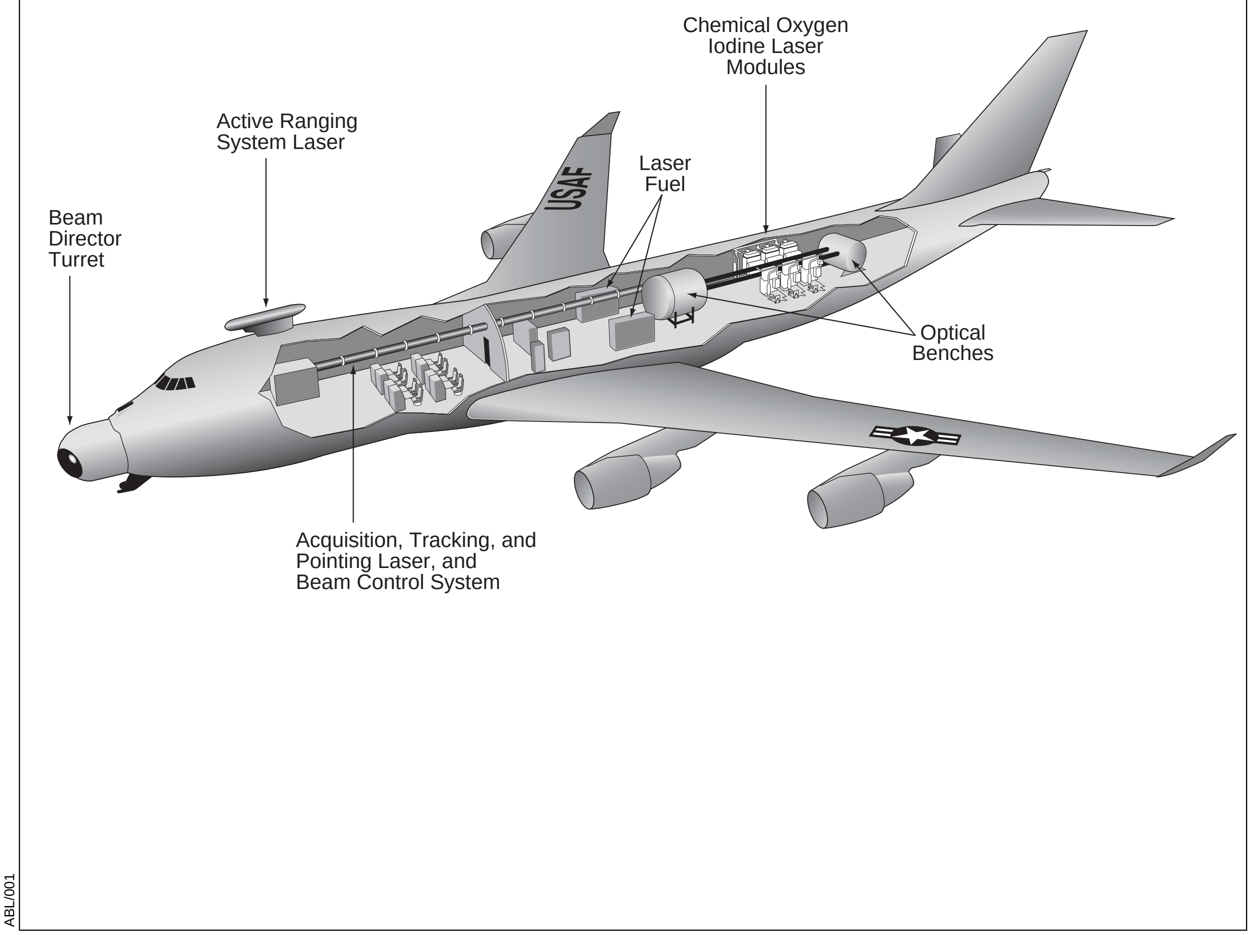
The 1997 FEIS analyzed several alternatives for establishing the Home Base, the Diagnostic Test Range, and the Extended-Area Test Range that are required to effectively demonstrate the ability of the ABL system. The 1997 FEIS considered Edwards AFB and Kirtland AFB as possible Home Base locations; WSMR and China Lake Naval Air Warfare Center as the Diagnostic Test Range; and the Western Range, including Vandenberg AFB and/or the Point Mugu Naval Air Warfare Center Weapons Division and their operational areas, as the Extended-Area Test Range.

The ROD for the 1997 FEIS identified Edwards AFB as the Home Base (to support the ABL aircraft and conduct ground-test activities of the ABL systems), WSMR as the Diagnostic Test Range, and the Western Range as the Expanded-Area Test Range (both for supporting proposed flight-test activities of the ABL systems). Based upon operational and environmental concerns, Edwards AFB is considered the primary location for conducting ground-test activities. Kirtland AFB and WSMR/Holloman AFB have been identified as alternative ground-test locations in the event that ground testing is not possible at Edwards AFB (e.g., mission conflict, weather conditions).

This chapter describes the Proposed Action and No-Action Alternative. The potential environmental impacts of the Proposed Action and No-Action Alternative are summarized in table form at the end of this chapter. The Proposed Action is to conduct test activities of the ABL system at test ranges associated with Kirtland AFB and WSMR/Holloman AFB, New Mexico, and Edwards AFB and Vandenberg AFB, California (see Figure 1.1-1). Test activities would involve testing the laser components on the ground and in flight to verify that laser components operate together safely and effectively. Two ABL aircraft (Block 2004 and Block 2008 aircraft) would be utilized during test activities. Ground testing of the ABL system is proposed at Edwards AFB. In the event that ground testing is not possible at Edwards AFB, Kirtland AFB and WSMR/Holloman AFB have the appropriate facilities and ranges to conduct ground testing of the laser systems. Flight testing is proposed at R-2508 Airspace Complex (Edwards AFB), Western Range (Vandenberg AFB), and WSMR (including FAA-controlled airspace and airspace utilized by Fort Bliss). Software upgrades and other improvements to the Block 2004 aircraft and development of transportable support equipment for the ABL would be accomplished under the Block 2006 effort.

2.1.1 Airborne Laser System Description

The ABL aircraft is a modified Boeing 747 aircraft that accommodates a laser-weapon system and laser-fuel storage tanks. The aircraft incorporates an ARS laser, a laser-beam control system designed to focus the beam on target (a TILL and a BILL), and an HEL (i.e., chemical, oxygen, iodine laser [COIL]) designed to destroy the target, (Figure 2.1-1). A Battle Management Command Center



Conceptual Rendition of ABL Installed on Boeing 747 Aircraft

Figure 2.1-1

provides computerized control of aspects of the laser-weapon system, communications, and intelligence systems onboard the aircraft.

The ABL aircraft would fly at high altitudes, and would detect and track launches of ballistic missiles using onboard sensors. Active tracking of the missile with the BILL and TILL would begin at approximately 35,000 feet above MSL. The HEL would then be directed in an upward direction, 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. Onboard sensors and laser clearinghouse ephemeris data would also be used to confirm that no other aircraft or satellites were within the potential path of the beam, although controlled airspace would be utilized during ABL test activities, and would be verified as cleared. Figure 2.1-2 shows the engagement scenario.

The Block 2004 and Block 2008 ABL aircraft designate capability levels. The Block 2004 aircraft would be tested and integrated into the BMDS testbed. The Block 2004 aircraft would have a contingency capability for providing rudimentary protection of the United States, if directed. The Block 2008 aircraft includes maturation of a second ABL aircraft for development of the Air-Based capability that includes new technologies with enhanced lethality and additional operational suitability.

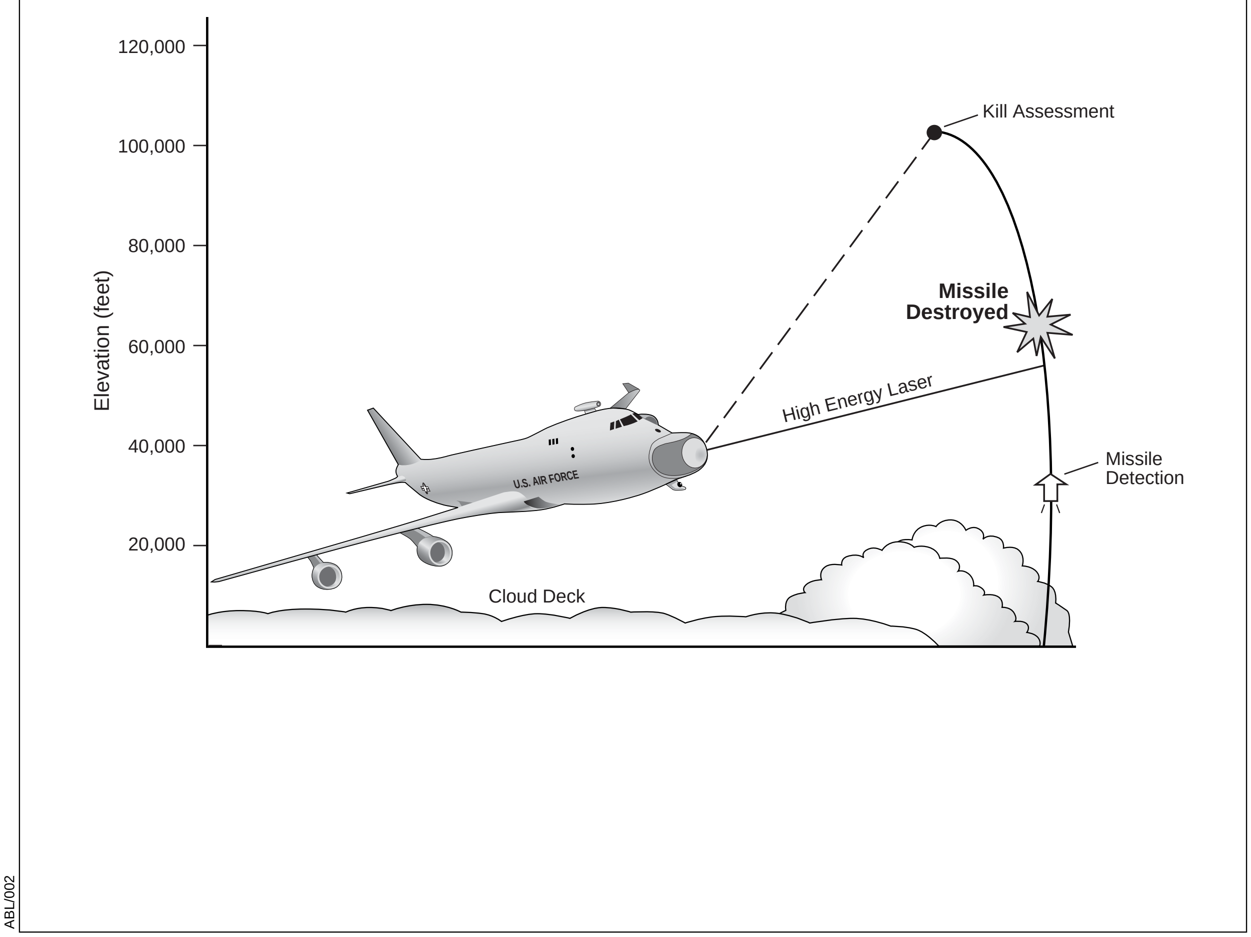
The Block 2004 ABL aircraft would undergo testing first. Once test activities of the Block 2004 aircraft are completed, software upgrades and other improvements through the Block 2006 effort would be accomplished. Shortly afterwards, the follow-on Block 2008 ABL aircraft would then be tested. Proposed ground- and flight-testing activities would be similar for both aircraft.

2.2 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

Two ABL aircraft would be based at Edwards AFB. Edwards AFB is also the location where the laser device would be integrated into the aircraft, where ground tests would occur, and is the location for initial aircraft flight tests.

Although flight testing of the ABL system would occur within the R-2508 Airspace Complex, Western Range, and WSMR, ABL test flights would begin and end at Edwards AFB. The ABL aircraft could be used to support other BMDS incidental exercises and deployments from other locations. These operations would be supported by other environmental analysis as appropriate. The ABL aircraft could also be flown to Kirtland AFB and WSMR/Holloman AFB to conduct ground testing. The ABL aircraft would use existing runways at the installations. Table 2.2-1 shows the possible number of ground and flight tests that would occur at the specified test locations.

In the event the ABL aircraft is unable to land at Edwards AFB after conducting test activities (e.g., due to Edwards AFB runway closure), pre-planned “divert bases” have been established to which the aircraft would be diverted. Two laser chemical handling options are being considered if the ABL aircraft uses a divert base. The first option is to jettison the laser chemicals at a minimum altitude of 15,000 feet. Chemical dispersion modeling, using the same analysis engine as



Conceptual ABL Engagement Scenario

Source: U.S. Air Force, 1997a.

Figure 2.1-2

Table 2.2-1. Airborne Laser Program Tests[a]

	Target[b]	Estimated Number of Targets	Low-Power Engagement (ARS, BILL, TILL, SHEL)	High-Power Engagement (ARS, BILL, TILL, HEL)	Proposed Time Frame (Block 2004/2006)
Edwards AFB					
	Rotoplane (G)	NA	Yes	No	1-2 Q, CY 2004/ 1-3 Q, CY 2006
	Ground Target Board (G)	NA	Yes	No	1-2 Q, CY 2004/ 1-3 Q, CY 2006
	MARTI Drop (F)	50	Yes	Yes	2 Q, CY 2004 to 4 Q, CY 2006
	Proteus Aircraft (F)	50	Yes	No	4 Q, CY 2005 to 4 Q, CY 2007
Kirtland AFB					
	Rotoplane (G)	NA	Yes	No	1-2 Q, CY 2004/ 1-3 Q, CY 2006
	Ground Target Board (G)	NA	Yes	No	1-2 Q, CY 2004/ 1-3 Q, CY 2006
White Sands Missile Range/Holloman AFB					
	Rotoplane (G)	NA	Yes	No	1-2 Q, CY 2004/ 1-3 Q, CY 2006
	Ground Target Board (G)	NA	Yes	No	1-2 Q, CY 2004/ 1-3 Q, CY 2006
	Missile (F)	35	Yes	Yes	3 Q, CY 2004 to 4 Q, CY 2007
	MARTI Drop (F)	50	Yes	Yes	2 Q, CY 2004 to 4 Q, CY 2006
	Proteus Aircraft (F)	50	Yes	No	2 Q, CY 2004 to 4 Q, CY 2007
Vandenberg AFB					
	Missile (F)	25	Yes	Yes	4 Q, CY 2004 to 4Q, CY 2007
Targets of Opportunity					
	Various IR Sources[c]	25	Yes	Yes	1 Q, FY 2004 to 4Q CY 2007
	Various[d]	25	Yes	Flash[e]	3 Q, CY 2004 - 4 Q, CY 2007

Notes:
(a) Table represents the number of proposed ABL tests per aircraft (the Block 2008 aircraft would conduct a similar number of test activities approximately 4 years after start dates shown for Block 2004).
(b) Ground Target Board is a static target used during ground testing. Rotoplane is a Ferris wheel-like ground target used to test the tracking ability of the laser system. MARTI Drop is a balloon with a target board attached used during flight tests. Proteus Aircraft is a manned aircraft with a target board attached that is used during flight tests. The estimated number of targets refers to the number of missile launches, MARTI drop tests, and Proteus aircraft flights that will take place. The ABL aircraft would be in flight during missile, MARTI drop, and Proteus aircraft test activities.
(c) Tests with the Infrared Search and Track (IRST, passive-only sensors) and/or low power engagement conducted as part of test flights already mentioned.
(d) Missile activities under BMDS integration efforts.
(e) Flash of missiles only when it would not interrupt the activities of others. Similar to high-power flashes during MARTI drops.

AFB = Air Force Base
ARS = Active Ranging System
BILL = Beacon Illuminator Laser
CY = calendar year
F = Flight Test
G = Ground Test
HEL = High-Energy Laser
IR = Infrared
NA = not applicable
Q = quarter
SHEL = Surrogate High-Energy Laser
TILL = Track Illuminator Laser

Source: Airborne Laser System Program Office, 2001a.

an approved agricultural model (Bird, et al., 2002) has shown that releases of liquids used by the ABL at this altitude will not reach the ground. The second option would be to land the ABL aircraft with the laser chemicals on board. The three bases identified include Vandenberg AFB, Holloman AFB, and Kirtland AFB. Although nothing would prevent the ABL aircraft from landing at any suitable base in time of emergency, personnel at these three installations would be specifically trained to support the ABL aircraft, and appropriate equipment to handle ABL hazardous materials (e.g., chemical transfer and recovery receptacles) would be in place. Exercises and deployment locations would have sufficient equipment and trained personnel to meet the mission needs. The ABL support equipment that would be pre-deployed at each divert base includes chemical transfer and recovery receptacles to capture laser fluids from the aircraft. The disposal of any chemicals from the ABL aircraft would be conducted through existing contract mechanisms run by the divert base's Environmental Management office. Existing aerospace ground equipment (AGE) at each divert base would be utilized to support the ABL aircraft, as needed (e.g., generator to run the aircraft's electrical system). The ABL aircraft would remain at these installations until the Edwards AFB runway is cleared for incoming traffic.

An existing hangar (Building 151) at Edwards AFB would be utilized to house the ABL aircraft. Estimated quantities of laser-weapon system chemicals that would be stored at Edwards AFB for the Block 2004 ABL aircraft are listed in Table 2.2-2. These chemicals would be delivered by commercial vendors and stored in a conforming and compatible chemical storage facility. The Block 2008 aircraft is anticipated to utilize approximately 30 percent more laser fuel than the Block 2004 aircraft.

Routine maintenance of the aircraft would occur at Edwards AFB, and would be performed by contractor and Air Force personnel using established, on-site equipment. Routine maintenance may include repair of aircraft engines and other equipment, tire changes, engine-oil changes, and washing the aircraft at an existing aircraft wash rack.

ABL testing activities would be conducted in accordance with a Hazardous Material Management Program and pollution prevention program to ensure environmental compliance, and to minimize the use of hazardous materials (U.S. Air Force, 2001b).

Test activities would include testing of both lower- (ARS, BILL, TILL, and SHEL) and high-power (HEL) lasers. These lasers are described briefly below.

Active Ranging System laser (ARS). This is a lower-power carbon dioxide (CO_2) laser. Its purpose is to acquire the target and to assess range to the target.

Track Illuminator Laser (TILL). This laser is a lower-power, diode-pumped, solid-state device. Its purpose is to track the intended target. Reflected light returned to sensors onboard the ABL aircraft is interpreted as information about the targets speed, elevation, and vector.

Table 2.2-2. Estimated Storage Requirements for Bulk Chemicals at Edwards AFB

Chemical Compound	Delivery Method	Storage Quantities	Locations: SIL or Aircraft	GPRA	IMF
Ammonia (Anhydrous)	Liquid DOT <2,000 pound Cylinders	2,000 to 4,000 lb.	X		X
Chlorine	Liquid DOT 2,000 pound Cylinders	1,000 to 2,000 lb.	X		X
Hydrogen Peroxide (50 % concentrate)	Liquid ISO Tanker, Class 1 Tank	8,000 gal.			X
Hydrogen Peroxide (70 % concentrate)	Liquid ISO Tanker, Class 1 Tank	1,000 to 4,000 gal.	X		X
Iodine	Solid (crystalline) 5 kg Packages	65 - 100 lb.	X		X
BHP	Liquid (SIL/IMF transfer with BHP cart)	1,200 gal.	X		X
Lithium Hydroxide (Monohydrate)	Solid (powdered/crystalline 2,200 lb. Totes)	4,400 - 6,600 lb.			X
Sodium Hydroxide (50 % concentrate)	Liquid (IBC/Totes, 300 gal.)	900-1,200 gal.			X
Potassium Hydroxide (50 % concentrate)	Liquid (IBC/Totes, 300 gal.)	900-1,200 gal.			X
Sulfuric Acid (93% conc.-IMF Aspirator Fluid)	Liquid (Drop-Shipped 55 gal drums)	660 gal.			X
Phosphoric Acid (2 Mol. [20 %] TMS/NH3 Scrubber)	Liquid (Delivered ISO-DOT tankers)	8,500 gal.		X	
Sulfuric Acid (25 % concentrate, TRICS-A Scrubber)	Liquid (Delivered ISO-DOT tankers)	2,900 gal.	X		
Sodium Hydroxide (20 % concentrate, TRICS-C Scrubber)	Liquid (Delivered ISO-DOT tanker)	1,700 gal.	X		
Sodium Hydroxide (10 % concentrate, GPRA Cl2 & I2 Scrub)	Liquid (Delivered ISO-DOT tanker)	3,360 gal.		X	
Liquid Nitrogen	Liquid (Drop-Shipped ISO-DOT tankers)	3,500-6,000 gal.			X
Liquid Carbon Dioxide	Liquid (Drop-Shipped ISO-DOT tankers)	34 tons			X
Helium	Gas (Drop-Shipped ISO-DOT tankers)	1,900-3,000 lb.	X		

BHP = basic hydrogen peroxide
DOT = Department of Transportation
gal. = gallon
GPRA = Ground Pressure Recovery Assembly
IBC = Intermediate Bulk Container
IMF = Integrated Maintenance Facility
ISO = International Standards Organization
lb. = pound
SIL = Systems Integration Laboratory
TMS = Thermal Management System
TRICS-A = Transportable Integrated Chemical Scrubber - Ammonia
TRICS-C = Transportable Integrated Chemical Scrubber - Chlorine

Source: Airborne Laser System Program Office, 2002a.

Beacon Illuminator Laser (BILL). This laser is a lower-power, diode-pumped, solid-state device. It is part of a laser-beam control system designed to focus the HEL beam on target.

Surrogate High-Energy Laser (SHEL). The SHEL is a lower-power laser designed to simulate the operating characteristics (wave length) of the HEL.

High-Energy Laser (HEL). The HEL is a high-energy (megawatt-class) laser (i.e., COIL) designed to destroy the target.

The BILL, TILL, and SHEL are solid-state lasers whose active medium is a crystal. Solid-state lasers are rugged, simple to maintain, and capable of generating kW levels of power. Operation at these levels causes thermal expansion of the crystal, which alters the effective cavity dimensions, thus changing the mode structure of the laser. Therefore, the lasers are cooled by liquids (particularly those lasers that produce high repetition rates). The most striking aspect of solid-state lasers is that the output is usually not continuous, but consists of a large number of often separated power bursts (pulsed).

The ARS laser is a CO_2 gas laser. The most common gas composition in CO_2 lasers is a mixture of helium (He), nitrogen (N_2), and CO_2. Additional gases, other than CO_2, are used to increase the efficiency of the laser. The principal difference between CO_2 and other gas lasers (i.e., Helium-Neon [HeNe] lasers) is that the optics must be coated, or made of special materials, to be reflective or transmissive at the far infrared wavelength. CO_2 lasers are highly effective outdoors due to a low atmospheric transmission loss.

The HEL is a COIL. The COIL is a near-infrared laser with a wavelength of 1.315 micrometers (μm). The COIL is a low-pressure flowing gas laser with a high-optical-quality beam that can be focused to small spots for faster metal cutting. The chemicals used in the COIL are all commonly found in industry, with well-known and safe-handling techniques, while the by-products of the COIL lasing operation are salt, water, and oxygen; no greenhouse gases are released. Table 2.2-3 provides laser characteristics for the ARS, BILL, TILL, SHEL, and HEL systems that will be tested under the ABL Program.

A description of the proposed ground-test and flight-test activities at the selected installations is presented in the following sections.

2.2.1 Ground-Testing Activities

Ground tests of the lower-power laser systems (i.e., ARS, BILL, TILL, and SHEL) would be performed at Edwards AFB. Ground-testing activities would be conducted from an aircraft parking pad or the end of a runway, with the laser beam directed over open land toward ground targets with natural features (e.g., mountains, hills, buttes) or earthen berms as a backstop. The ARS would also be tested using a ground-based simulator within Building 151 at Edwards AFB. No open-range testing of the high-power laser (COIL) would be conducted at this location. Ground testing of the HEL would be conducted at Edwards AFB, within the same structure (Building 151) or in the SIL, using a ground-based

Table 2.2-3. Laser Characteristics

Laser System	Wavelength (μm)	Wave form	Lasing Medium	Output Power[c]	Laser Classification[d]	MPE Limits	NOHD
BILL	1.064	Pulsed	SS Nd:YAG[a]	kW	4	3.34 x 10^{-7} J/cm^2 [e] 1.79 x 10^{-4} J/cm^2 [f]	>50km[i]
TILL	1.0296	Pulsed	SS; Yb:YAG[b]	kW	4	1.53 x 10^{-7} J/cm^2 [e] 1.96 x 10^{-4} J/cm^2 [f]	>50km[i]
ARS	11.149	Chopped	CO_2	kW	4	0.1 W/cm^2 [e] 0.1 W/cm^2 [f]	4 km
SHEL	1.319	CW	SS Nd:YAG[a]	W	4	0.0405 W/cm^2 [e] 9.78 W/cm^2 [f]	>50km[i]
HEL	1.315	CW	Chemical	MW	4	0.0128 J/cm^2 [g] 3.1 J/cm^2 [h]	NA[i]

Notes:
(a) Neodymium:Yttrium Aluminum Garnet ($Y_3Al_5O_{12}$).
(b) Ytterbium:Yttrium Aluminum Garnet ($Y_3Al_5O_{12}$).
(c) Exact input power/aperture power is classified.
(d) Classified in accordance with the ANSI Standard Z136.1-2000, *Safe Use of Lasers.*
(e) Ocular MPE in accordance with ANSI Z136.1-2000, *Safe Use of Lasers.*
(f) Skin MPE in accordance with ANSI Z136.1-2000, *Safe Use of Lasers.*
(g) Ocular MPE in accordance with ANSI Z136.1-2000, *Safe Use of Lasers*; based on a glint reflection exposure of 0.1 second.
(h) Skin MPE in accordance with ANSI Z136.1-2000, *Safe Use of Lasers*; based on a glint reflection exposure of 0.1 second.
(i) Dependent on aircraft range to target.

ARS = active ranging system
BILL = Beacon Illuminator Laser
CO_2 = carbon dioxide
CW = continuous wave
HEL = High-Energy Laser
J/cm^2 = joules per square centimeter
km = kilometer
kW = kilowatt
MPE = maximum permissible exposure
MW = megawatt
μm = micrometer
NA = No direct viewing would be possible during HEL test activities.
NOHD = Nominal Ocular Hazard Distance
SHEL = Surrogate High-Energy Laser
SS = solid-state
TILL = Track Illuminator Laser
W = watt
W/cm^2 = watts per square centimeter

simulator or an enclosed test cell. These activities would involve testing the laser components (Block 2004 configuration, upgrades of new technologies, and Block 2008 configuration) on the ground in the SIL and after they are integrated into the aircraft. The ground tests would be conducted to verify that the laser components operate together safely in a simulated flight environment. Photons from the tests may be utilized in an enclosed test cell to evaluate the effect of the HEL on various target-representative materials. In the event of a failure of the ground-based simulator, the laser device would be immediately shut down by safety systems.

The HEL weapon system would be connected to a Ground Pressure Recovery Assembly (GPRA) to test the laser on the ground. On the ground, the GPRA would simulate the atmospheric pressure that occurs naturally when the laser device is operating in the aircraft at an altitude of 35,000 feet or higher. The GPRA would operate for approximately 20 seconds per test, and would draw the exhaust from the laser. The GPRA and scrubbers capture the exhaust from the device and then scrubs it. The GPRA scrubbers operate at an efficiency of better than 95 percent; therefore, the exhaust would be mostly water. In addition, turbo pump exhaust in the form of steam would be ejected from the aircraft. A second vacuum sphere may be required to support the higher throughput of the Block 2008 configuration.

Noise generated by the GPRA (a low-pressure, low-velocity device) during ground tests of the HEL is expected to be approximately 10 decibels (dBA). The associated ejector tubes and turbopumps are expected to generate noise levels of approximately 110 and 134 dBA, respectively, during the short duration (approximately 20 seconds) of the ground test. These noise levels do not take into account attenuation due to their surrounding environments (the SIL building and Building 151); therefore, exterior noise levels are expected to be lower.

Prior to testing the HEL, the chemicals are loaded into the aircraft or SIL. After the basic hydrogen peroxide (BHP) is loaded, residual amounts left in the fill lines would be drained to chemical transfer and recovery receptacles and transported to the Integrated Maintenance Facility (IMF). Once there, the hydrogen ion concentration (pH) would be adjusted (if necessary) and the resultant product water is used to support other processes at the IMF. After the chlorine and ammonia are loaded into the aircraft, residual amounts left in the fill lines are processed through Transportable Integrated Chemical Scrubber (TRICS) units. The chlorine scrubber by-product solution is handled in the same manner as the BHP. The ammonia scrubber by-product solution is contracted for disposal through a commercial waste product disposal company.

Two scenarios exist for handling the laser fuels during ground tests. In the first scenario, if the laser is scheduled to be fired within a short time frame (e.g., less than 5 to 7 days between shots) all the chemicals would remain on board. In the second scenario, if the laser is not scheduled to be fired in less than 5 to 7 days, the BHP would be removed, transported to the IMF, the pH adjusted (if necessary), and the resultant product water used to support other processes at the IMF. Final disposition of this water is to the Edwards AFB wastewater treatment plant. All other chemicals would remain on board the aircraft with excess operational pressures bled off and exhausted through the appropriate scrubbers.

The estimated amount of fluids to be disposed of during ground and flight testing of the HEL is listed in Table 2.2-4. They include fluids off-loaded and disposed of during flight tests.

The ARS laser utilizes a glycol cooling system; the BILL utilizes a water cooling system; and the TILL utilizes Deuterium for its cooling system. These coolants are contained in closed-loop systems, and would be recycled/replaced as needed.

During ground testing of the laser systems, the ABL aircraft would be connected to AGE to provide power and hydraulic control to the aircraft and laser systems. In addition, up to 12 air conditioning units would be utilized to cool the laser

Table 2.2-4. Estimated Quantities of Wastes to be Disposed at Edwards AFB

Waste Type	Estimated Volume[c]
Spent GPRA Ammonia Scrubber Solution	68,000-170,000 gallons
Spent TRICS Ammonia Scrubber Solution	8,700-17,400 gallons
Iodine Solids	20 gallons
Caustic Solids	55 gallons
Rags with Oils, Solvents, and Cleaners	55 gallons
Used Oil	55 gallons
Nitric Acid Solution	55 gallons
Spent Hydrogen Peroxide Solution <8 percent[a]	100-5,000 gallons
Spent Hydrogen Peroxide Solution >= 8 percent[a]	100-5,000 gallons
Sodium, Potassium, and Lithium Hydroxide Solutions (pH<12.5)[a]	100-5,000 gallons
Sodium, Potassium, and Lithium Hydroxide Solutions (pH>=12.5)[a]	100-5,000 gallons
BHP Solution[a]	100-5,000 gallons
System Rinses[a]	100-5,000 gallons
Spent TRICS Chlorine Scrubber Solution[a]	5,100-10,200 gallons
Spent GPRA Laser Effluent Scrubber Solution[a]	3,360-6,720 gallons
Small quantity BHP, mixed hydroxide, hydrogen peroxide solutions and rinse water from IMF chemical laboratory and other operations[a]	100 gallons
IMF Baker Tank Aspirator Drive Fluid[b]	5,000-20,000 gallons (per week)
Soil Contaminated with Sodium, Potassium, and Lithium Hydroxide Solution (trace of hydrogen peroxide is possible) (if spills occur)	1-20 cubic yards

Notes: (a) IMF Baker Tank Aspirator Drive Fluid
(b) May or may not be considered a hazardous waste. Substance will be tested to ensure proper disposal method.
(c) Volumes of wastes to be disposed are annual amounts unless otherwise stated.
BHP = basic hydrogen peroxide
GPRA = Ground Pressure Recovery Assembly
IMF = Integrated Maintenance Facility
pH = measure of acidity
TRICS = Transportable Integrated Chemical Scrubber

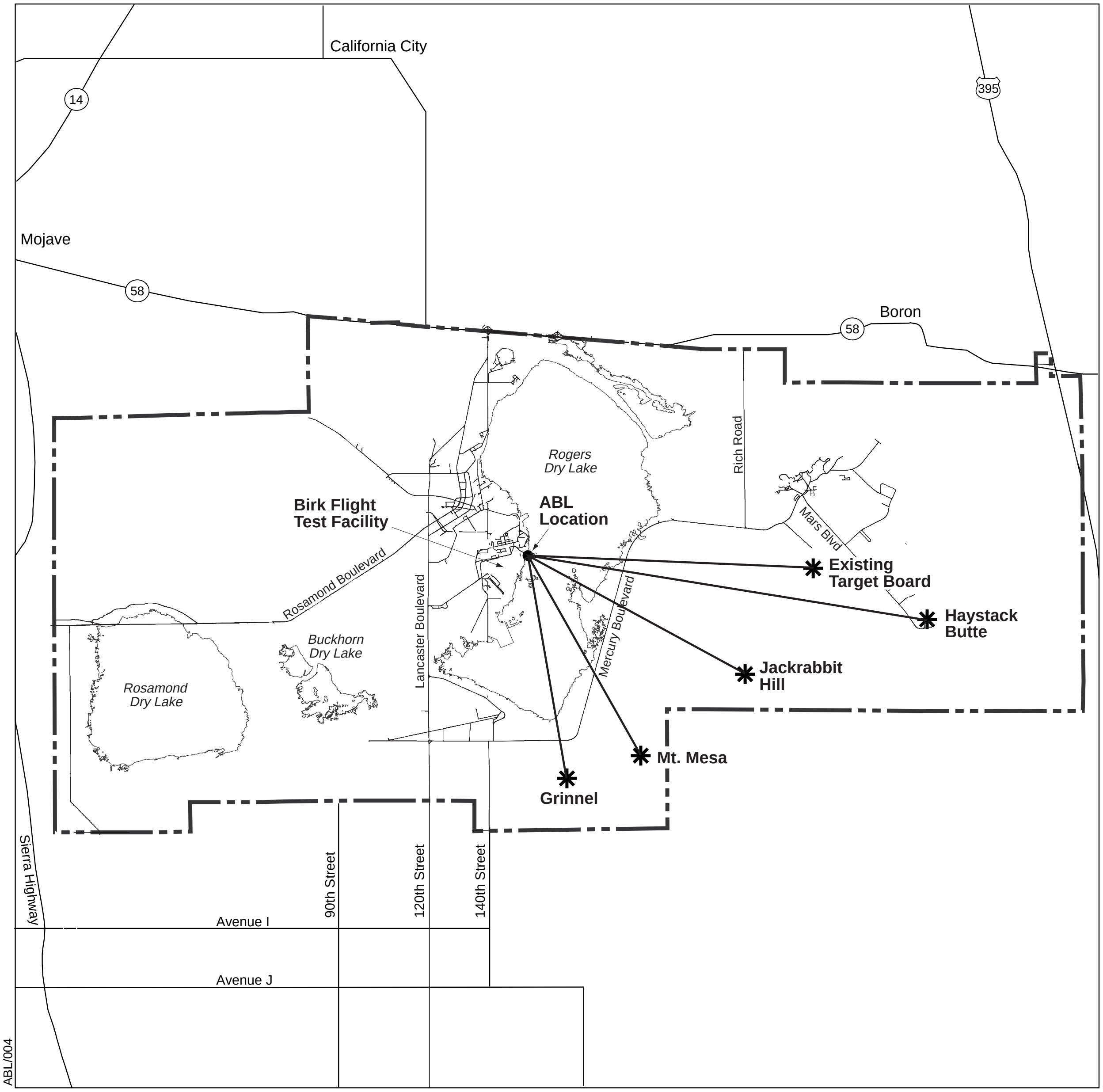
Source: Airborne Laser System Program Office, 2001c.

equipment, and up to 3 portable lighting units would be utilized during nighttime testing activities. Ground-testing activities would occur over an approximate 8-hour period during the early morning or nighttime.

Approximately 750 personnel would relocate to the Edwards AFB area to support the ABL program. In addition, approximately 50 temporary test personnel would be present during ground-testing activities. As an added safety precaution, laser ground tests may require temporary evacuation of areas in the vicinity of the test range. Range safety officials would coordinate with appropriate base authorities to temporarily close roads, as required, during laser-testing activities.

A description of the proposed ground tests is presented below. Edwards AFB is the preferred site for conducting ground-test activities. No ground-testing activities are proposed at Vandenberg AFB and WSMR. In the event that ground testing is not possible at Edwards AFB, ground tests would be conducted at Kirtland AFB or from Holloman AFB using WSMR for target placement.

Edwards AFB. Ground testing of the ARS, BILL, TILL, and SHEL systems would be conducted at Edwards AFB from the end of the runway associated with Building 151 (Figure 2.2-1). Up to 500 rotoplane (Ferris wheel-like rotating target) and 500 ground target board tests would be conducted for the Block 2004



EXPLANATION

- Base Boundary
- (58) State Highway
- (395) U.S. Highway
- ✱ Potential Target Site

Potential Ground-Testing Areas, Edwards AFB

Figure 2.2-1

ABL aircraft. A similar number of tests would be conducted for the Block 2008 ABL aircraft. A target board is a piece of material (e.g., Plexiglass, stainless steel) containing sensors that would be irradiated by the laser ground-testing activities. No high-power engagements would occur. Ground-testing activities would utilize existing ranges, and be conducted in accordance with existing range safety requirements. Laser targets would be positioned within a shroud to prevent the possibility of reflection when the laser beam comes into contact with the surface of the target.

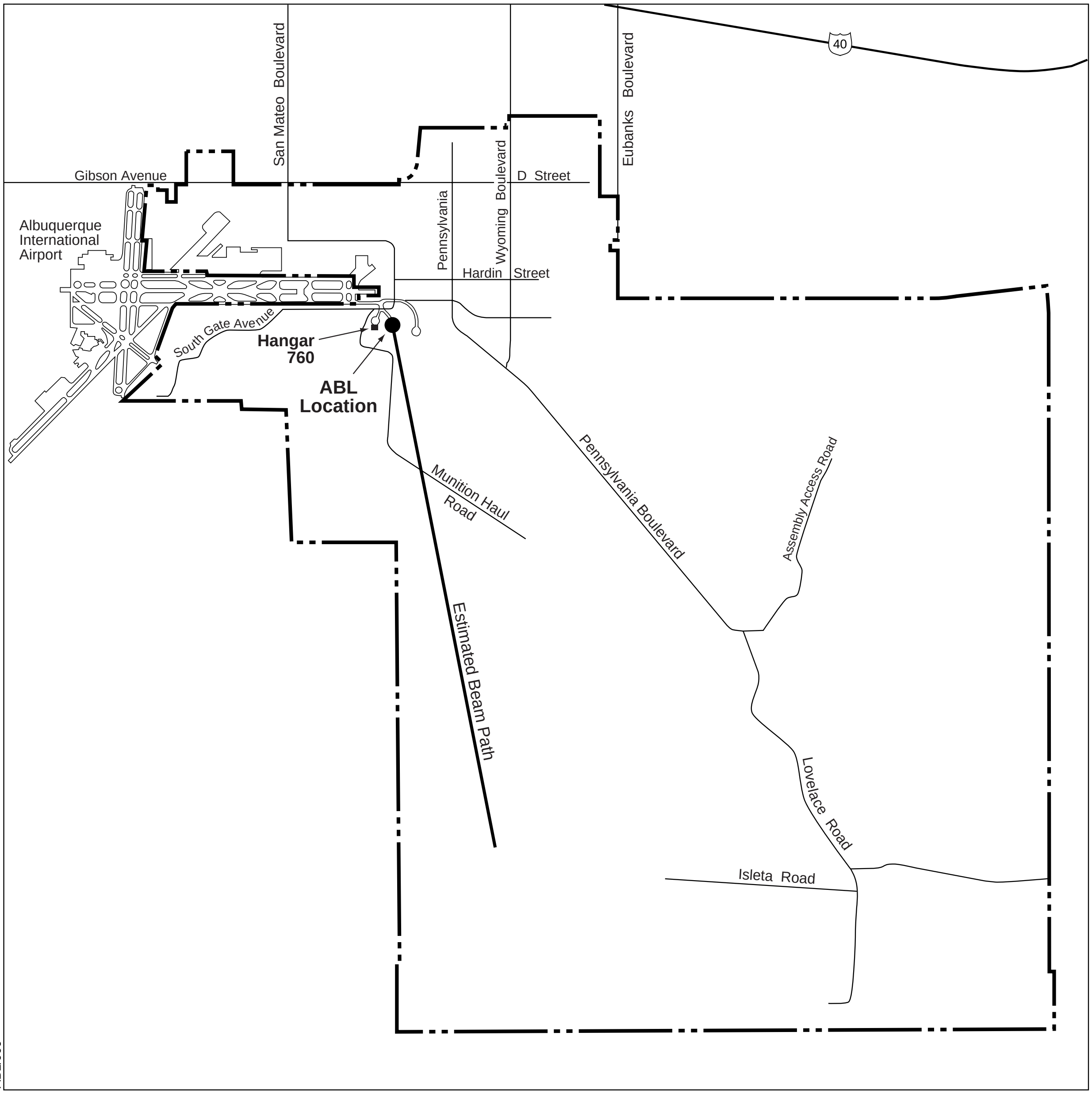
The ARS could also be tested using a ground-based simulator within Building 151.

HEL ground-testing activities would be conducted using a ground-based simulator or enclosed test cell; no open-range testing of the HEL would be conducted. In the event of a failure of the ground-based simulator, the laser device would be immediately shut down by safety systems.

Kirtland AFB. Kirtland AFB has the appropriate facilities and ranges to conduct ground testing of the laser systems should an alternate test locations be necessary. Ground testing of the ARS, BILL, TILL, and SHEL systems would be conducted at Kirtland AFB from Pad 4, adjacent to Building 760 (Figure 2.2-2). Up to 500 rotoplane and 500 ground-target board tests would be conducted for the Block 2004 ABL aircraft. A similar number of tests would be conducted for the Block 2008 ABL aircraft. Ground-testing activities would utilize an existing range and be conducted in accordance with existing range safety requirements. No high-power engagements would occur. The laser test range at Kirtland AFB contains target barriers at distances of 4, 5, and 7 kilometers (km) (2.5, 3.1, and 4.4 miles). Laser targets would be positioned within a shroud to prevent the possibility of reflection when the laser beam comes into contact with the surface of the target.

White Sands Missile Range/Holloman AFB. WSMR and Holloman AFB have the appropriate facilities and ranges to conduct ground testing of the laser systems should an alternate test location be necessary (Figure 2.2-3). Ground testing of the lower-power ARS, BILL, TILL, and SHEL systems only would be conducted at Holloman AFB from the western end of the base runway (runway 04-22). The laser systems would be directed westward at targets placed within WSMR. Testing could occur across the White Sands National Monument and could require closure and evacuation of the public. Up to 500 rotoplane and 500 ground-target board tests would be conducted. Laser targets would be positioned within a shroud to prevent the possibility of reflection when the laser beam comes into contact with the surface of the target. WSMR maintains the appropriate range safety requirements and authorizations to conduct laser testing.

Coordination of local area or road closures for non-essential personnel in line-of-fire and nearby locations would be coordinated with WSMR, White Sands National Monument, Holloman AFB, and San Andres National Wildlife Refuge safety officials. Essential personnel remaining during lasing would be briefed by MDA safety personnel and provided with appropriate personal protective equipment and other direction during the lasing period.



EXPLANATION

Base Boundary

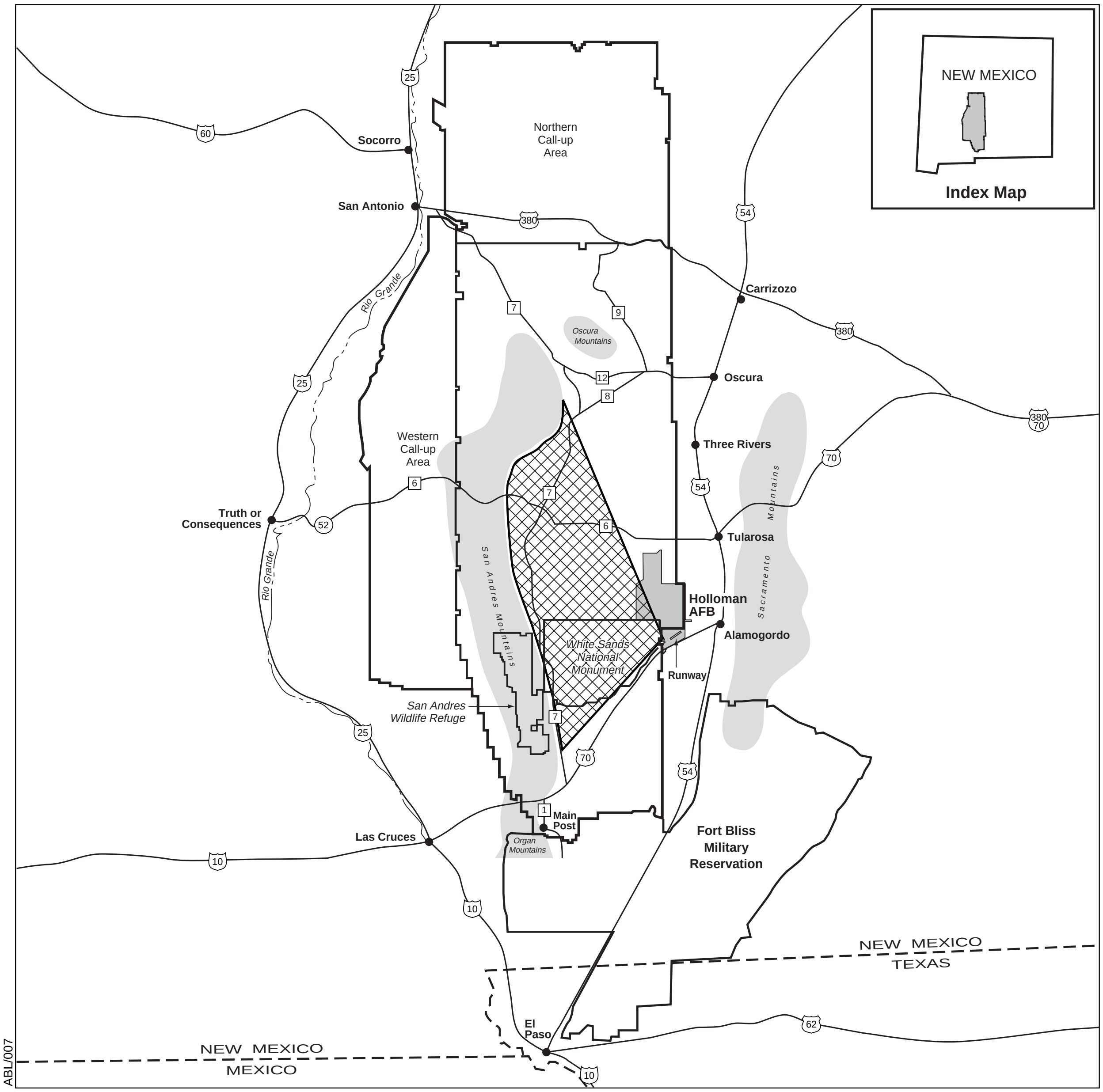
Estimated Beam Path

Interstate Highway

0 .35 .7 1.4 Miles

Potential Ground-Testing Area, Kirtland AFB

Figure 2.2-2



EXPLANATION

Installation Boundary

52 State Highway

54 U.S. Highway

25 Interstate Highway

6 Range Roads

Potential Ground Test Area

0 6.5 13 26 Miles

Potential Ground-Testing Area, White Sands Missile Range/Holloman AFB

Figure 2.2-3

Vandenberg AFB. No ground testing of the laser systems is proposed at Vandenberg AFB.

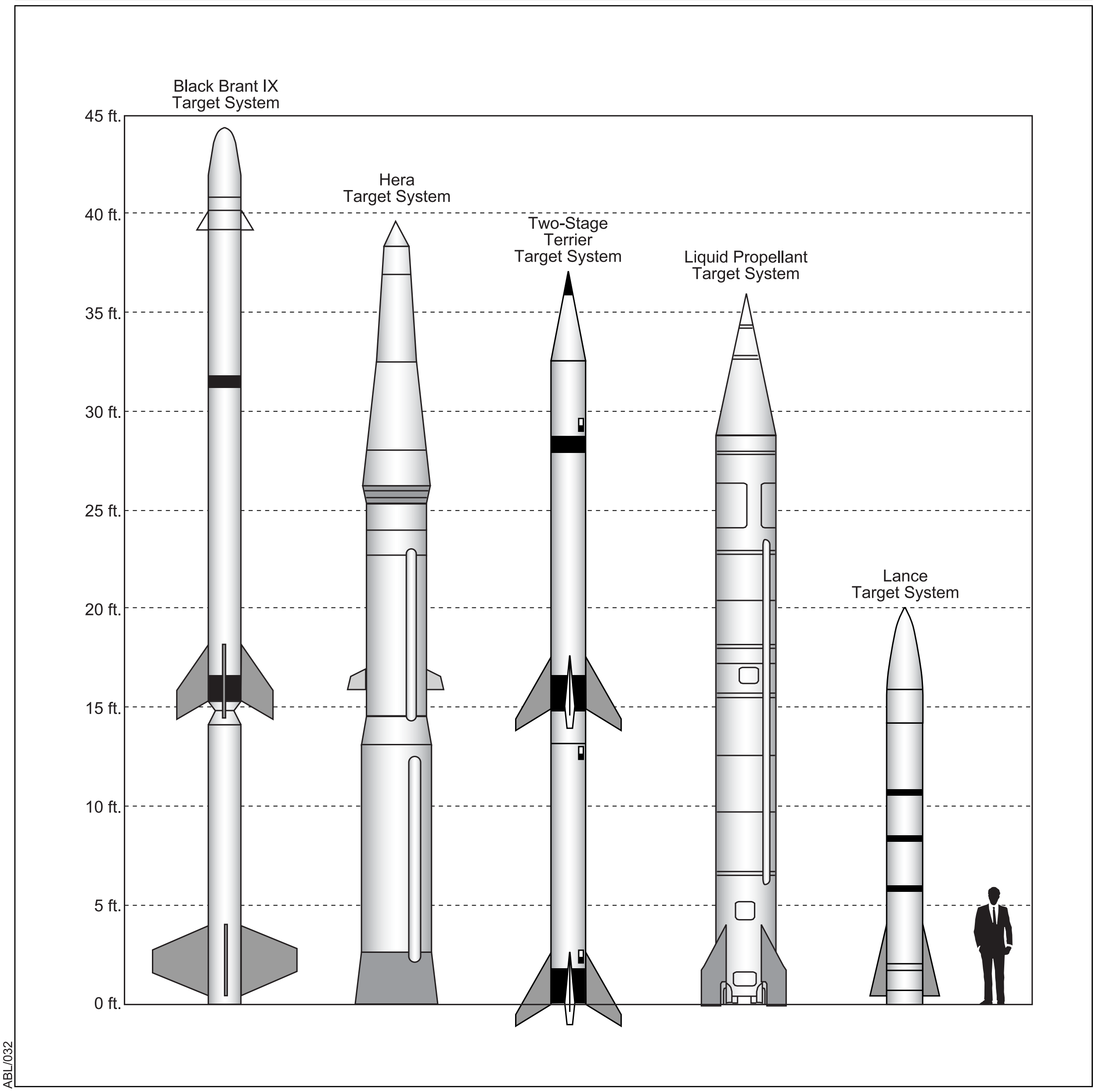
2.2.2 Flight-Testing Activities

Test flights at ranges associated with WSMR, Edwards AFB, and Vandenberg AFB would be used to test the lower-power ARS, BILL, TILL, and SHEL, and the high-power HEL systems.

The ABL tests would include acquisition and tracking of missiles, as well as high-energy tests. These tests would be conducted against instrumented, diagnostic target boards carried by balloons (Missile Alternative Range Target Instrument [MARTI] Drop), missiles, or aircraft.

The MARTI is a diagnostic target for ABL that is similar in size and geometry to a ballistic missile. The overall benefit of the MARTI target is the demonstration of tracking and beam compensation capabilities against dynamic targets. The basic construction consists of a shell of aluminum with aluminum fins attached, coated with paint selected to represent the properties of the paint on ballistic missiles (no fuel would be onboard). The proposed launch site for the balloon with MARTI payload is Space Harbor on WSMR, or Holloman AFB as a back-up location. The balloon would rise to an approximate height of 100,000 feet, and may pass over private and BLM-managed lands, depending on wind conditions aloft. When the balloon is over the target drop box on WSMR and at the desired altitude the MARTI payload would be released. The MARTI would free-fall to 50,000 feet allowing approximately 55 seconds of engagement time, hence multiple engagements per drop are planned. A nominal three engagements per MARTI drop are planned, one high (less compensation required), one mid, and one low (more compensation required) engagement, which will allow coverage of the engagement compensation space. A slow spin would be necessary to stabilize the trajectory. Approximately 60 pounds of flare attached to the rear end of the MARTI would burn during the entire ABL engagement to provide an infrared source for the ARS. The flare would be exhausted prior to the MARTI reaching the ground. After the ABL engagement is complete, a parachute system would be deployed to slow down and recover the complete MARTI unit for reuse. A beacon would be included on the MARTI for tracking by range safety radar. During lower-power engagements, the MARTI would be instrumented with optical sensors for irradiance profile measurements. Sensors on the MARTI would provide BILL, TILL, and SHEL spot profiles and aim point locations as well as jitter measurements within the spatial resolution of the sensor array. During high-power engagements, the MARTI would be instrumented with thermocouple hit sensors to provide HEL spot size and position on the target, integrated energy on target, and jitter measurements within the spatial resolution of the array. In both the high- and lower-power configurations, the target boards would be cylindrical.

Missiles would not carry a payload, and would incorporate a flight-termination system, when required, to ensure that debris would be contained on the range in the event the target must be destroyed during flight. Figure 2.2-4 illustrates the potential target missiles to be utilized during ABL flight-test activities. Range



Representative Target Missiles

Figure 2.2-4

safety personnel are analyzing the potential effect the laser systems may have on the flight termination system to develop appropriate shielding (if necessary) to ensure the termination system would not be affected by the laser systems.

Proteus aircraft, a manned aircraft with a target board attached, would be utilized for testing of the lower-powered laser systems (i.e., ARS, BILL, TILL, and SHEL). The Proteus aircraft would fly at an altitude higher than the ABL aircraft during flight-testing activities.

During flight tests with the ABL aircraft, up to two "chase aircraft" may be utilized to monitor test activities. The ABL aircraft would fly at an altitude above 35,000 feet. The BILL and TILL systems would be directed above horizontal, and track targets in an upward direction during test activities to minimize potential ground impact or potential contact with other aircraft. Based upon this scenario, it has been estimated that if a laser system were to miss the target, the beam trajectory would be such that the beam would depart the controlled airspace above the preapproved altitude as coordinated with the FAA. Other portions of the BMDS may non-intrusively observe/track/monitor these tests as an overall system integration event, leveraging off of the ABL missile launches. As needed, mock warheads with specialized electronic tracking devices would be implemented. This would facilitate faster recovery and response actions at the ranges.

Airborne diagnostic testing would revalidate and expand on-the-ground testing activities, confirm computer model predictions, and enable complete system tests. Airborne tests would also measure the ABL's ability to quickly acquire the next target, ensure proper operation of onboard safety and firing-control procedures, and assess overall system operation.

The American National Standards Institute (ANSI) for Safe Use of Lasers, Z136.1, requires coordination with the FAA when laser programs include the use of Class 3a, 3b, and 4 lasers within navigable airspace. For range safety purposes, airspace control would be conducted in combination with airspace surveillance requirements. Coordination with the U.S. Space Command is required for all Class 3 and 4 laser systems, unless waived by the U.S. Space Command; laser firing time coordination would be accomplished to verify that on-orbit objects are not affected by laser operations (Airborne Laser System Program Office, 2001b).

Once the ground tests are completed with the Block 2004 modules in the SIL, the modules would be transferred to the aircraft for integration and subsequent ground and flight tests. The SIL would become a ground test bed for the ABL. Operations anticipated include 1) adding two modules of the same type/size as the Block 2004 modules in order to help troubleshoot any conditions found in the aircraft, 2) trying new laser system designs and fluids, possibly deuterated hydrogen peroxide ([D_2O_2], an expensive but potentially more effective reactant than hydrogen peroxide in the chemical reaction to create the HEL). D_2O_2 is expensive and would be recycled and reused to the maximum extent possible if used, 3) simulate a fully integrated ABL (adding beam control and battle management and possibly a directional turret similar to the aircraft), and 4) an enclosed chamber to capture/use the photons generated during the test operations. Inside this chamber, target segments or representative missile system parts may be fired upon to evaluate how different materials are affected/destroyed by the high-energy laser. Additional analysis of the construction, remodeling, and operations of this chamber would be done when those details are known.

In addition, ABL activities associated with the MDA lethality program may include development and testing of nuclear, biological, or chemical (NBC) material simulants within a laboratory or other indoor and outdoor test facilities. These activities are analyzed in the Programmatic Environmental Assessment, Theater Missile Defense Lethality Program (U.S. Army Space and Strategic Defense Command, 1993).

Testing under the lethality program involves the use of simulated environmental conditions and simulated NBC agents to determine how each material would react to stresses expected from a typical engagement. The simulant serves as a substitute for live chemical, biological, and bulk payloads, and it mimics the significant qualities of the NBC agent for test purposes. No live NBC agents will be used during flight-test activities. Proposed simulants could include water, tri-ethyl phosphate, tri-butyl phosphate, diatomaceous earth, and other materials. The use of simulants is considered the best available and most practicable approach to obtain required data for testing BMD effectiveness.

Proposed activities associated with the MDA test program, include packaging of simulants within sub-munitions, transportation of simulants and sub-munitions, laboratory and outdoor testing, and disposal of any wastes produced as a result of test activities. Handling procedures for the simulants would follow material safety data sheet (MSDS) recommendations or other appropriate task-specific guidance. Although potential human health effects may result from exposure to any chemical (or simulant), these simulants are safe to use under existing, established laboratory, range, and installation operating procedures. Any hazardous materials used in testing will be handled and disposed of in accordance with existing compliant procedures. The use of simulants and sub-munitions at the test bed at Edwards AFB or test ranges are not anticipated at this time, and further environmental analysis would be conducted, as appropriate, for the ABL to engage in these activities.

As an added safety precaution, target-missile flight tests may require temporary closure of areas in the vicinity of the test range. Laser hazard control regulations and range safety regulations are in place at the test ranges that adequately address outdoor lasing activities to ensure the safety of surrounding receptors. Range safety officials would coordinate with appropriate local authorities to temporarily close highways, sea-lanes, national monuments (i.e., White Sands National Monument), and air traffic routes, as required, during laser-testing activities and missile launches. Typically, closing off an area to the public involves radio announcements, setting up road blocks on highways, and notices to air and sea traffic.

A description of the proposed flight tests at Edwards AFB (R-2508 Airspace Complex), WSMR, and Vandenberg AFB (Western Range) are presented below. No flight-testing activities are proposed at Kirtland AFB.

Edwards AFB (R-2508 Airspace Complex). Up to 50 MARTI Drop (balloon with target board attached) tests would be conducted within the R-2508 Airspace Complex utilized by Edwards AFB during the flight test program (Figure 2.2-5). Approximately 25 of the MARTI Drop tests would involve testing the lower-power ARS, BILL, TILL, and SHEL systems. Approximately 25 MARTI Drop tests would involve testing the lower-power ARS, BILL, and TILL, and the high-power HEL systems. Flights may also include on-board beam dumps to internally check the HEL firing, as well as diagnostic checks of the inertial guidance systems by lazing with the HEL to an inertial point above the horizon (e.g. upward at a star). These star shots may be part of any of the HEL operations.

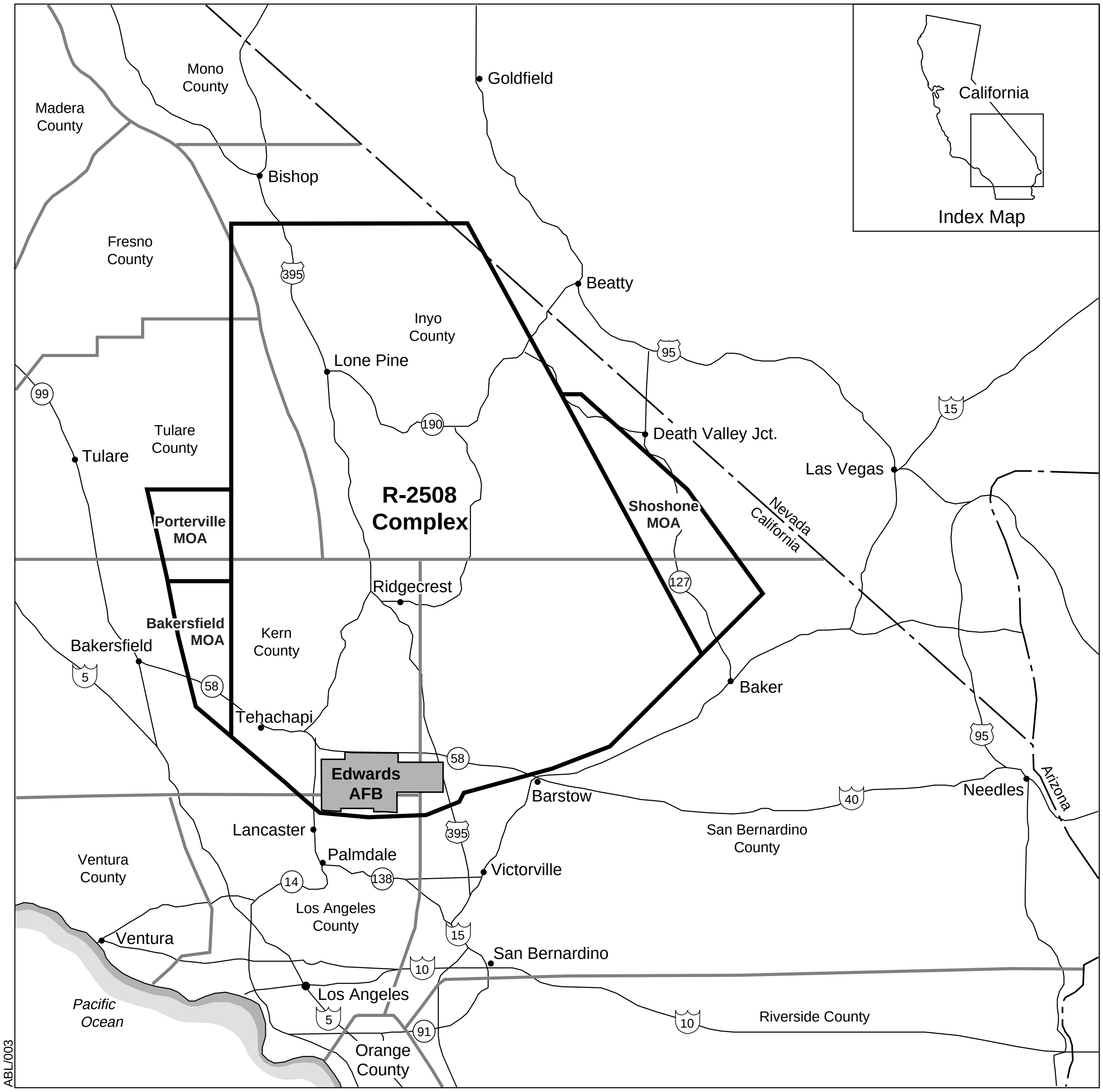
Up to 50 Proteus Aircraft (manned with target board attached) tests would be conducted within the R-2508 Airspace Complex utilized by Edwards AFB. These tests would only involve testing the lower-power ARS, BILL, TILL, and SHEL systems.

White Sands Missile Range. Flight-testing activities would occur over WSMR utilizing WSMR restricted airspace, FAA controlled airspace, and airspace utilized by Fort Bliss. Up to 35 missile flight tests utilizing solid or liquid propellant missiles would occur at WSMR (Figure 2.2-6). Missiles would be launched from existing approved launch areas at WSMR. Approximately ten of these flight tests would involve testing the lower-power ARS, BILL, TILL, and SHEL systems. Approximately 25 flight tests would involve testing the lower-power ARS, BILL, and TILL, and high-power HEL systems. Lasing activities during flight tests at WSMR may involve the ABL aircraft flying at a stand-off position outside of restricted airspace and firing the lasers at targets within WSMR restricted airspace.

Up to 50 MARTI Drop tests would be conducted at WSMR. Approximately 25 of the MARTI Drop tests would involve testing the lower-power ARS, BILL, TILL, and SHEL systems. Approximately 25 MARTI Drop tests would involve testing the lower-power ARS, BILL, TILL, and high-power HEL systems.

Up to 50 Proteus Aircraft tests would be conducted at WSMR. These tests would only involve testing the lower-power ARS, BILL, TILL, and SHEL systems.

Vandenberg AFB (Western Range). Up to 25 missile flight tests would occur at the Western Range utilized by Vandenberg AFB during the flight-test program (Figure 2.2-7). Missiles would be launched from Vandenberg AFB. The potential launch sites include those addressed in the Final Theater Ballistic Missile Targets Programmatic Environmental Assessment (U.S. Air Force, 1997e) (Figure 2.2-8). The trajectory of the target missile would be such that the first stage of the missile and any debris from the destruction of the missile during test activities would occur beyond 3 miles of the coastline. These flight tests would involve testing the lower-power ARS, BILL, TILL, and high-power HEL systems. While infrastructure to support the launching of missile targets exists at these



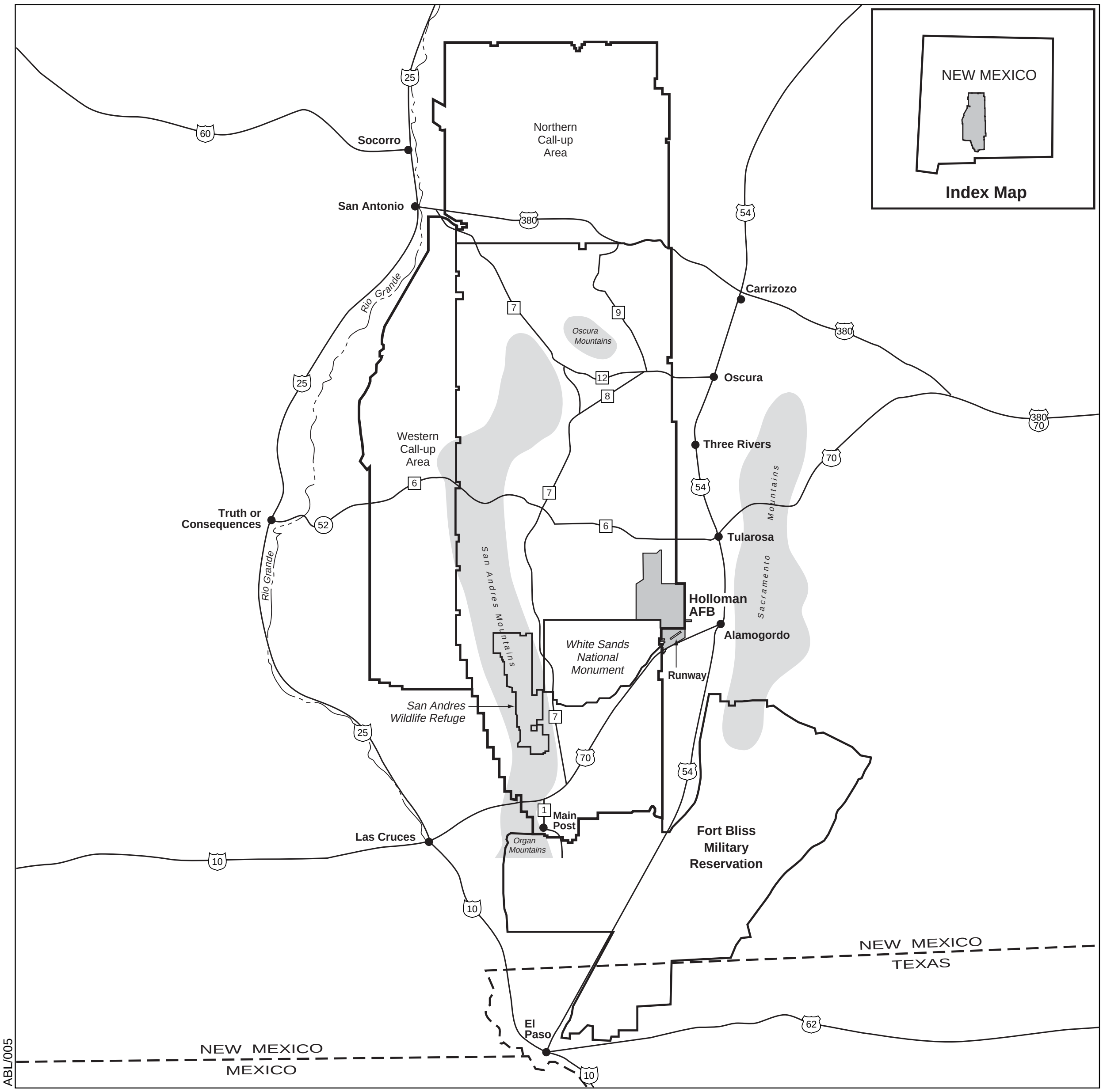
EXPLANATION

- State Boundary
- County Boundary
- R-2508 Complex Boundary
- 15 Interstate Highway
- 395 U.S. Highway
- 58 State Highway

0 10 20 40 Miles

Flight-Testing Range, Edwards AFB (R-2508 Airspace Complex)

Figure 2.2-5



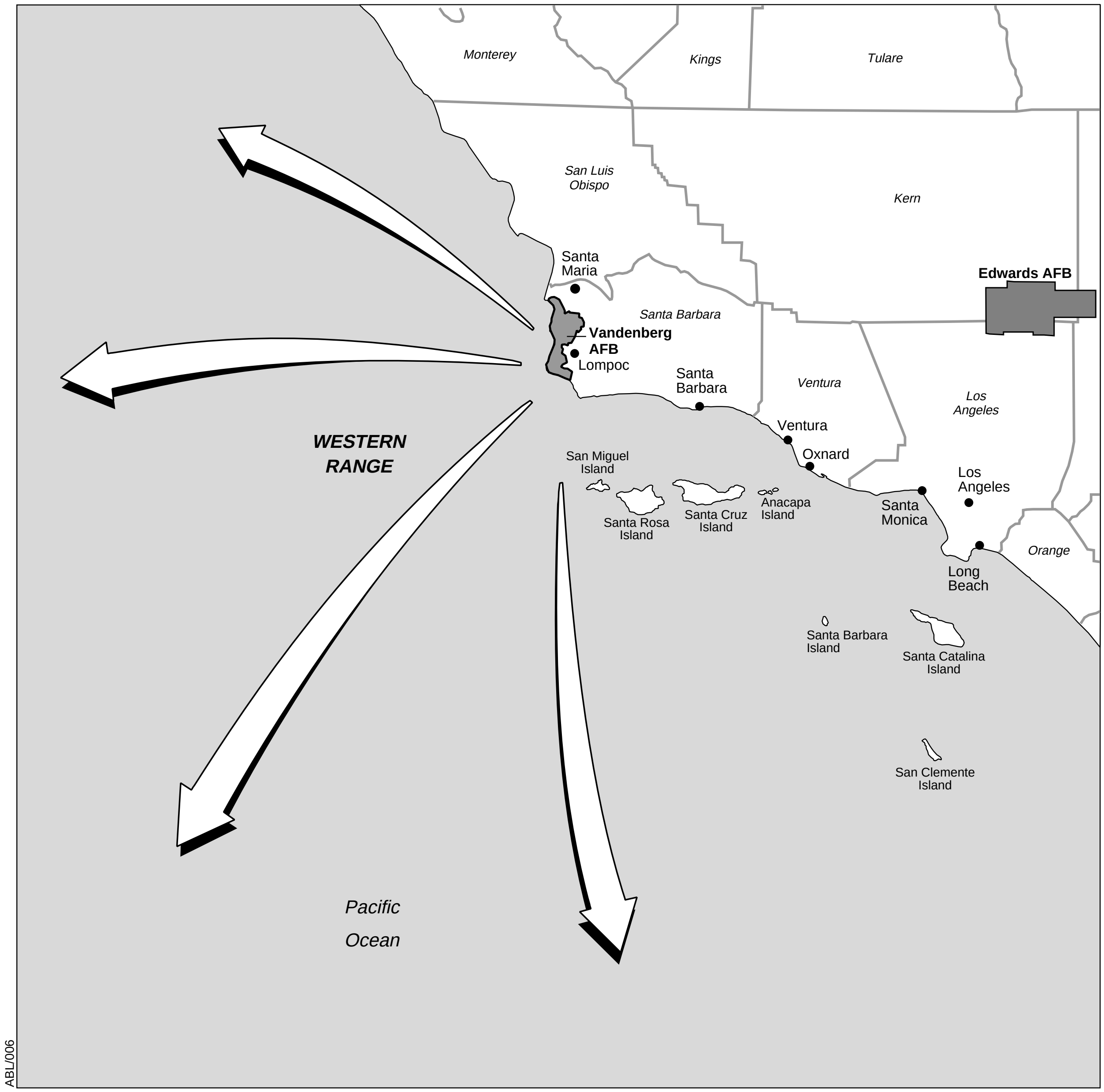
EXPLANATION

- Installation Boundary
- (52) State Highway
- (54) U.S. Highway
- (25) Interstate Highway
- [6] Range Roads

0 6.5 13 26 Miles

Flight-Testing Range, White Sands Missile Range

Figure 2.2-6



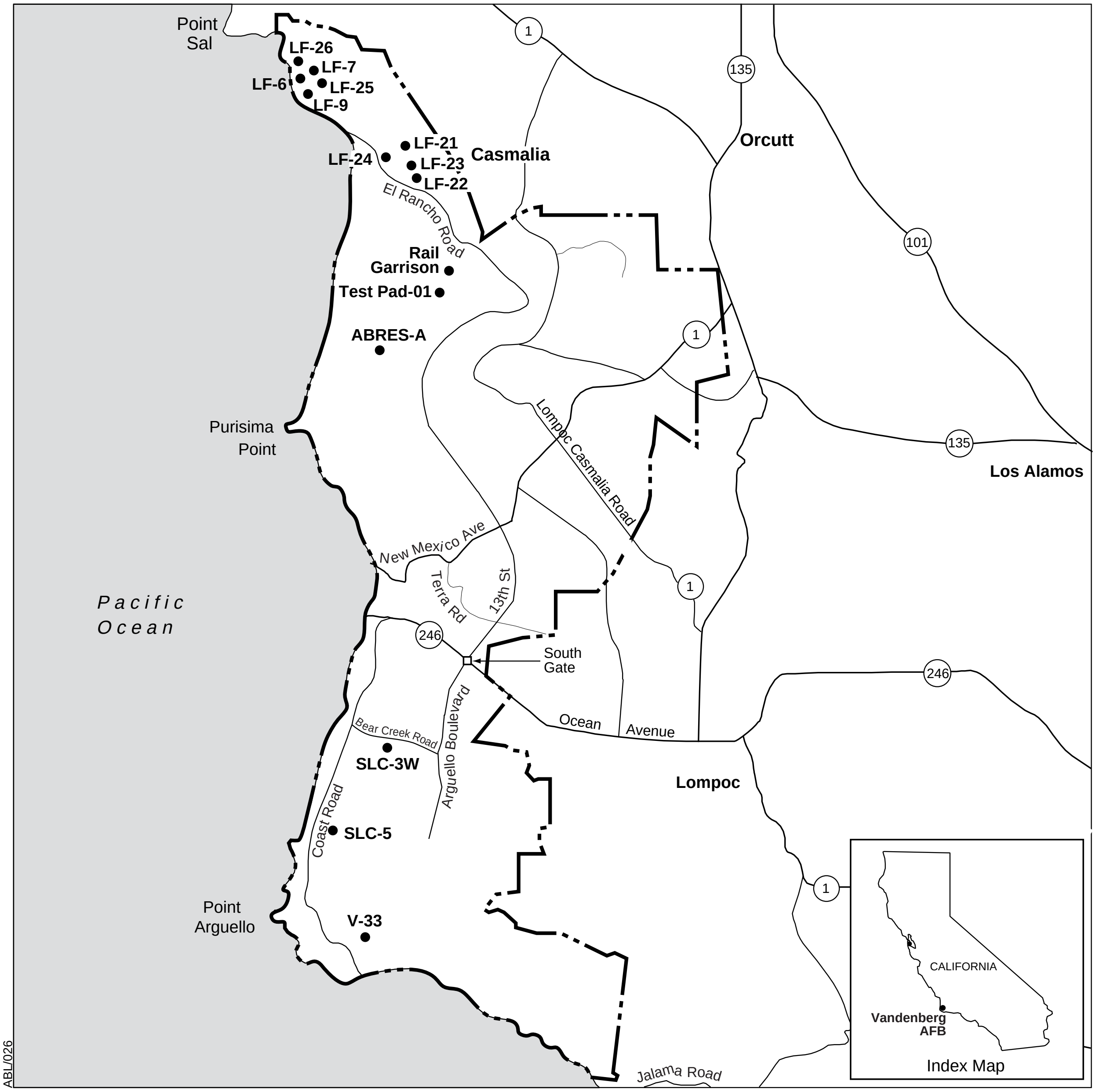
EXPLANATION

Flight-Testing Range, Vandenberg AFB (Western Range)

0 6.5 13 26 Miles

Note: The Western Range extends west from the California coast towards the Indian Ocean.

Figure 2.2-7



EXPLANATION

━ ━ ━	Base Boundary
●	Potential Launch Location
①	State Highway
LF	Launch Facility
SLC	Space Launch Complex
ABRES	Advanced Ballistic Re-entry System

0 1.25 2.5 5 Miles

Source: U.S. Air Force, 1997e.

Vandenberg AFB Potential Target Missile Launch Sites

Figure 2.2-8

launch facilities (i.e., communication lines, electricity, water), a mobile transporter/erector/launcher (TEL) would be brought to the launch site for the actual launching of the target missiles.

Kirtland AFB. No flight testing of the laser systems is proposed at Kirtland AFB.

Exercises and Targets of Opportunity. Interwoven in with the standard flight tests proposed, additional activities to utilize the ABL detection, tracking, and communications capability would be done. The ABL could be used to engage other targets of opportunity. Targets of opportunity come in two forms. The first is a simple infrared (IR) signal given off by a moving military article (aircraft, missile, or similar vehicle) that can be passively observed with the infrared search and track (IRST), and, in the case of unmanned target vehicles, the BILL/TILL/ARS lasers. The second type is for a missile or similar vehicle that is unmanned and the target can handle the flash of the HEL (similar to the MARTI HEL activities where a simple flash is done to the target without destroying it). The IRST, and the lower-power lasers may also be used to detect, track, and monitor flights from other BMDS operations as opportunities became available. During exercises, these same systems would be used to track the targets. In addition, the HEL could flash the targets in a manner similar to the HEL MARTI tests. The activities creating these targets would be covered under other environmental analysis conducted by the element conducting the test.

For exercises, launch and recovery activities would be at facilities capable of handling the 747's weight and take-off distance requirements. As these are operational facilities set up for heavy aircraft, the addition of the few takeoffs and landings anticipated would add negligible impacts to the environment. If chemicals are involved appropriate personnel and equipment would be available to support the mission needs. Areas considered include the continental United States, Alaska, Hawaii, and the Pacific and Atlantic test ranges. These proposed airborne testing activities were not specifically analyzed in the 1997 FEIS; however, they are considered to be captured within the analysis because any impacts associated with the ABL's detection and tracking systems are well within the limits of flight-testing activities analyzed in the document.

2.3 NO-ACTION ALTERNATIVE

Under the No-Action Alternative, ABL test activities would not be conducted as described in Section 2.2. ABL test activities would be conducted as analyzed in the 1997 FEIS.

2.4 ALTERNATIVES ELIMINATED FROM FURTHER CONSIDERATION

CEQ regulations require that an EIS evaluate all reasonable alternatives, briefly discuss those alternatives eliminated from detailed analysis in the environmental impact analysis, and provide the reasons for elimination of any alternatives (40 CFR Part 1502.14[a]). "Reasonable" is defined as practical or feasible from a common sense, technical, and economic standpoint (51 FR 15618, April 25, 1986). The 1997 FEIS presented a discussion of the alternatives considered, but eliminated from further consideration with regard to test demonstration methods, laser system types, and test installation/range locations.

The 1997 FEIS developed a screening process to narrow the number of alternative locations for detailed analysis. This process was designed to identify a number of candidate locations that could meet a threshold of operational considerations necessary to conduct the program. The locational alternatives for the Home Base, the Diagnostic Test Range, and the Expanded-Area Test Range were based on the need for existing facilities and infrastructure to meet the selection criteria and cost considerations. Installations that did not meet any one of the selection criteria were eliminated from consideration. The selection criteria established in the 1997 FEIS still applies to the current ABL test program.

The facility and infrastructure requirements for the Home Base, Diagnostic Test Range, and Expanded-Area Test Range facilities are as follows:

Home Base

- Runway with sufficient capacity to safely take-off and land a Boeing 747 aircraft
- Hangar large enough to accommodate a Boeing 747 without a modification requiring use of Military Construction (MILCON) funds
- Facility that could be modified for use as a System Integration Facility (SIF)
- Facility on a government installation.

Diagnostic Test Range

- Minimum of 150 km (94 miles) separation between the ABL aircraft and target launch point within range boundaries
- Capability to launch and recover test article/debris (missiles, aircraft, or balloons) within the confines of the range
- Positive control of airspace in the vicinity of the range
- Ability to give high priority to the ABL test planning and scheduling.

Expanded-Area Test Range

- Minimum of 300 km (187 miles) separation between the ABL aircraft and target launch point within range boundaries
- Capability to launch multiple missile targets from different locations within the confines of the range
- Positive control of the surface and airspace in the vicinity of the range

- Ability to give high priority to the ABL test planning and scheduling
- Reasonable proximity to the Home Base.

The Western Range was the only location that met the operational criteria for the Expanded-Area Test Range.

2.4.1 Alternatives Considered in the 1997 FEIS but Eliminated from Further Analysis

Demonstration Methods

Simulation and Modeling. Program requirements include the need to demonstrate the ability to track and destroy ballistic missiles with a high-energy laser. Because simulation and modeling as a standalone demonstration method does not validate that capability, it had been considered, but eliminated, from detailed analysis.

Integrated Subscale and Component Tests. Performing only laboratory subscale- and component-level tests that incorporate ABL technology would not allow full-scale integration of flight testing and would, therefore, not adequately prove the viability of the technology. A high-power demonstration from an airborne platform against a missile with its rocket motor still burning is the only way to definitively replicate the vibration, pressure, and atmospheric and dynamic effects associated with operation of both the low-power acquisition, tracking, and pointing laser and the HEL beam required to destroy ballistic missiles.

Laser Systems

Other types of lasers such as carbon dioxide, deuterium fluoride, hydrogen fluoride, free electron, and solid-state lasers were examined for use in the ABL Program. High-power carbon dioxide and deuterium fluoride laser technologies are very mature; however, the beam of these lasers diverge and becomes too large at operational ranges. Since the laser beam cannot maintain a tight focus, sufficient energy cannot be delivered onto the target. Solid-state and free-electron lasers are not sufficiently mature to meet the high-power requirements of the ABL Program. The hydrogen fluoride laser's wavelength causes the beam's energy to be absorbed by the atmosphere, which makes it ineffective at operational ranges. Although the wavelength of both the hydrogen fluoride and the deuterium fluoride lasers can be altered, the technology required to do so is not mature enough for use in the ABL Program. Carbon dioxide, deuterium fluoride, hydrogen fluoride, free-electron, and solid-state lasers have been considered but eliminated from detailed analysis.

Location Alternatives

Home Base. The acceptable characteristics for both the runway and hangar are driven by the ability to accommodate a Boeing 747. The following criteria was chosen for a runway: a minimum length of 10,000 feet, a minimum width of 150 feet, and an adequate weight-bearing capacity for the Boeing 747 aircraft.

The minimum requirements for the hangar were a door width of 205 feet, height of 45 feet, and an overall length of 180 feet.

Performance of ground-test activities at the Home Base dictates the use of an SIF. The Home Base SIF is a facility capable of providing sufficient space (approximately 20,000 square feet situated near the hangar) for component-level tests, integrated subsystem tests, and data reduction and analysis.

All Department of Defense (DOD) installations in the continental United States were examined in the site-selection process for the Home Base. Installations without runways were eliminated. Those installations having the required runway length, width, and load-bearing capacity were evaluated to determine the hangar dimensions and SIF capabilities. Installations without sufficiently large hangars were eliminated from further consideration.

Table 2.4-1 lists the installations that met both the runway and hangar criteria for Home Base and justification for further evaluation or for elimination from further evaluation. Only two installations (Edwards AFB and Kirtland AFB) have facilities that meet all of the criteria and are available for use by the ABL Program. Therefore, the other DOD installations were eliminated from further consideration as the Home Base.

Table 2.4-1. Installations with Adequate Runway and Hangar for the Home Base

Installation	State	Runway Length (feet)	Runway width (feet)	No. of Adequate Available Hangars	Adequate SIF
Dyess AFB	TX	13,500	300	2	None
Edwards AFB	CA	14,994	300	4	Yes
Eglin AFB(a)	FL	10,000	300	0	NA
Fairchild AFB(a)	WA	13,901	300	1	None
Griffiss AFB(b)	NY	11,820	300	2	BRAC
Kirtland AFB	NM	13,775	300	1	Yes
Little Rock AFB	AR	12,000	200	1	None
March AFB	CA	13,300	300	1	None
McChord AFB	WA	10,100	150	4	None
McClellan AFB(b)	CA	10,600	200	0	NA
McGuire AFB	NJ	10,001	200	2	None
Miramar NAS(a)	CA	12,000	200	0	NA
Offutt AFB	NE	11,700	300	1	None
Robins AFB(a)	GA	12,000	300	0	NA
Tinker AFB(a)	OK	11,100	200	0	NA
Travis AFB(a)	CA	11,002	300	0	NA
Vandenberg AFB(a)	CA	15,000	200	0	NA

Notes: (a) Eliminated from consideration because of existing mission commitment
(b) Eliminated from consideration because of targeting for closure by BRAC
AFB = Air Force Base
BRAC = Base Realignment and Closure Commission
NA = not applicable
NAS = Naval Air Station
SIF = System Integration Facility

Test Ranges. Test ranges were evaluated on the basis of the ABL Phase requirements. Test ranges that met the operational requirements were further evaluated considering weather, existing instrumentation, and geographic location. Of the test ranges that met the operations requirements, Poker Flat Research Range, Alaska, was eliminated because of extreme weather conditions and remote-operating costs. The Pacific Missile Range Facility, Kauai, Hawaii, and Wallops Right Facility, Virginia, were eliminated because they lacked land-based instrumentation sites, which is a requirement for monitoring flight-test activities. The Eastern Test Range and Eglin AFB Test Range were considered but not carried forward because a Home Base location in the southeastern United States was not identified using the site-selection process.

No other alternatives were considered for this SEIS. This SEIS addresses the Proposed Action and No-Action Alternative only.

2.5 CUMULATIVE ACTIONS AND IMPACTS

Cumulative impacts result from "the incremental impact of actions when added to other past, present, and reasonable 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).

Other actions within the region were evaluated to determine whether cumulative environmental impacts could result from implementation of the Proposed Action or No-Action Alternative, in conjunction with other past, present, or reasonably foreseeable future actions. Due to the nature of test activities at WSMR and the Western Range, other missile test and rocket launch activities within these ranges to support other military and commercial (e.g., satellite launches) functions would be occurring. These missile tests and rocket launches have been evaluated in EAs and EISs that limit the number of launches and are carefully scheduled/coordinated to prevent cumulative impacts of test launch actions.

The ABL program is one of the elements of the MDA's BMDS, which is intended to provide an effective defense for the United States, its deployed forces, and its allies from limited missile attack during all segments of an attacking missile's flight. The BMDS involves separate elements to provide a defense during all three segments of missile flight. Missile flight segments include the boost segment, the midcourse segment, and the terminal segment. Each BMDS element is designed to work independently to provide a significant military defense.

The ABL element of this ballistic missile defense system is being developed to provide an effective defense to ballistic missile threats during the boost segment of an attacking missile's flight. The GMD element is being developed to provide an effective defense to ballistic missile threats during the midcourse segment of an attacking missile's flight. The ABL and GMD elements of missile defense have each proposed test activities at Vandenberg AFB and could result in a cumulative effect if test activities conflict. However, the ABL and GMD elements are independent of each other and would each meaningfully advance the BMDS even if either of the elements did not go forward.

A future action that could occur in association with the proposed ABL test program is the use of strategic targets (i.e., intercontinental ballistic missiles [ICBMs]) to test the ABL laser systems; however, this action has not yet been fully defined. The specific activities associated with using ICBMs as targets has not been determined such as:

- Assessment of whether the use of ICBMs as targets is a viable option
- Whether or not ICBMs are available for ABL test activities
- The number of ICBMs launches that would be conducted
- The specific launch locations for ballistic missile targets. Four possible launch sites have been identified including: Vandenberg AFB, California; Kodiak Launch Complex, Alaska; Pacific Missile Test Facility, Hawaii; and Cape Canaveral Air Station, Florida.
- Whether the ICBM launches would be from land, sea (from a submarine), or air (from an aircraft), or a combination of these launch options.
- The selection criteria for determining potential launch sites and launch options.
- The specific ABL systems to be tested on the ICBM targets.

Because the specific activities to occur during ICBM launches and associated ABL test activities have not yet been established, a detailed environmental evaluation of the potential impacts is not possible. Once more information is available regarding ICBM launches and the associated ABL test activities, additional evaluation of this action would be made in separate environmental documentation.

2.6 COMPARISON OF ENVIRONMENTAL IMPACTS

A summary comparison of the potential environmental impacts, along with possible mitigation measures, on each biophysical resource (e.g., hazardous materials/hazardous waste management, air quality, biological resources), affected by the Proposed Action and No-Action Alternative is presented in Table 2.6-1. The information presented is based upon the environmental consequence analysis presented in Chapter 3.0 of this SEIS. The assessment of potential impacts is based on the guidelines from the CEQ (40 CFR Part 1508.27).

Table 2.6-1. Summary of Environmental Impacts and Suggested Mitigations from the Proposed Action and No-Action Alternative
Page 1 of 2

Resource Category	Existing Conditions	Proposed Action	No-Action Alternative
• Airspace	Conditions: Regional airspace restrictions due to mission activities	• Impacts: Regional airspace restrictions continue due to ABL testing activities • Mitigation: FAA flight level restrictions to ensure non-participating aircraft are clear of the test area. Relocation of ground test activities at Holloman AFB if runway closure causes mission impacts	• Impacts: Regional airspace restrictions continue due to ongoing mission activities • Mitigation: None required
• Hazardous Materials and Hazardous Waste Management	Conditions: Materials used for mission activities managed in compliance with applicable regulations Wastes generated by mission activities managed in accordance with applicable regulations	• Impacts: Hazardous materials used in support of ABL testing activities. Small quantities of hazardous waste generated from ABL testing activities. • Mitigation: Compliance with applicable regulations and management plans would preclude the need for mitigation measures	• Impacts: No additional hazardous materials used and no hazardous waste generated over that addressed in the 1997 FEIS • Mitigation: None required
• Health and Safety	Conditions: Use of ranges in accordance with applicable regulations. Implementation of appropriate measures to ensure a safe test environment for humans and natural resources	• Impacts: ABL testing activities involving ground-level and altitude lasing. • Mitigation: Performance of ABL testing activities in accordance with applicable regulations and implementation of appropriate safety measures would preclude the need for mitigation measures	• Impacts: Range safety measures continue due to ongoing mission activities • Mitigation: None required
• Air Quality	Conditions: Air pollutant emissions generated from mission activities	• Impacts: Short-term, minor increase in pollutant emissions due to ABL testing activities at Edwards AFB, Kirtland AFB, Vandenberg AFB, and WSMR/Holloman AFB. Increased emissions during ABL testing activities would not delay regional progress toward attainment of any standard. • Mitigation: None required	• Impacts: No increase in pollutant emissions over that addressed in the 1997 FEIS • Mitigation: None required

Table 2.6-1. Summary of Environmental Impacts and Suggested Mitigations from the Proposed Action and No-Action Alternative
Page 2 of 2

Resource Category	Existing Conditions	Proposed Action	No-Action Alternative
• Noise	Conditions: No residential areas exposed to DNL 65 dB or greater due to mission activities	• Impacts: No residential areas exposed to DNL 65 dB or greater due to ABL test activities • Mitigation: None required	• Impacts: No impact • Mitigation: None required
• Biological Resources	Conditions: No additional ground disturbance	• Impacts: Potential impact to biological resources given the nature of flight-test activities and target debris impacts. • Mitigation: ABL test activities would adhere to formal guidance and regulations that exist to protect and preserve biological resources. Debris recovery would be conducted in accordance with existing SOPs to minimize and prevent impacts.	• Impacts: No impact • Mitigation: None required
• Cultural Resources	Conditions: No additional ground disturbance	• Impacts: Potential impacts to cultural resources sites given the nature of flight-testing activities and target debris impacts. • Mitigation: ABL test activities would adhere to formal guidance and regulations that exist to protect and preserve cultural resources. Debris recovery would be conducted in accordance with existing SOPs to minimize and prevent impacts.	• Impacts: No impact • Mitigation: None required
• Socioeconomics	Conditions:	• Impacts: Increase of approximately 750 personnel at Edwards AFB to support ABL mission. Short-term increase of up to 50 program-related temporary personnel during ABL testing activities Minimal impacts on coastal recreational activities and commercial and recreational fishing • Mitigation: None required.	• Impacts: No increase in personnel • Mitigation: None required

ABL = Airborne Laser
db = decibel
DNL = day-night average sound level
FAA = Federal Aviation Administration
SOP = Standard Operating Procedure

2.7 PREFERRED ALTERNATIVE

The Proposed Action is the preferred alternative: Edwards AFB has been selected as the Home Base and will be the primary location for ground-testing activities; White Sands Missile Range has been selected as the Diagnostic Test Range, and the Western Range has been selected as the Expanded-Area Test Range.

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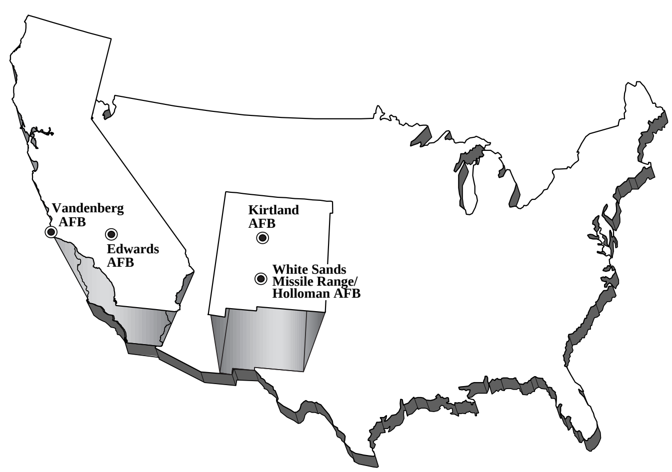
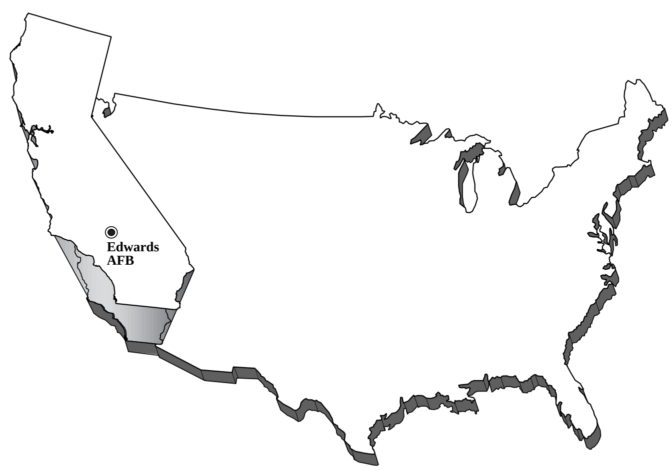


CHAPTER 3
AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES



SECTION 3.1
EDWARDS AIR FORCE BASE

3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 EDWARDS AIR FORCE BASE

3.1.1 Local Community

Background

The military first began operating at the Muroc, California, site in 1933, when the Army Air Corps sent an advance party to design and maintain a bombing range. At the outbreak of World War II, the south end of a dry lake, situated in the area, was used for training fighter pilots and bomber crews. The site was designated Muroc AFB in February 1948, and became Edwards AFB in December 1949 in honor of Captain Glen Edwards, who was killed during a performance test of an experimental jet bomber. The AFFTC was activated at Edwards AFB in June 1951. The AFFTC supports the mission of the Air Force Materiel Command by conducting and supporting tests of aerospace vehicles; flight evaluation and recovery of research vehicles; operation of the U.S. Air Force Test Pilot School; and developing, operating, staffing, supporting and participating in test and evaluation programs for DOD and other government agencies, contractors, and foreign governments.

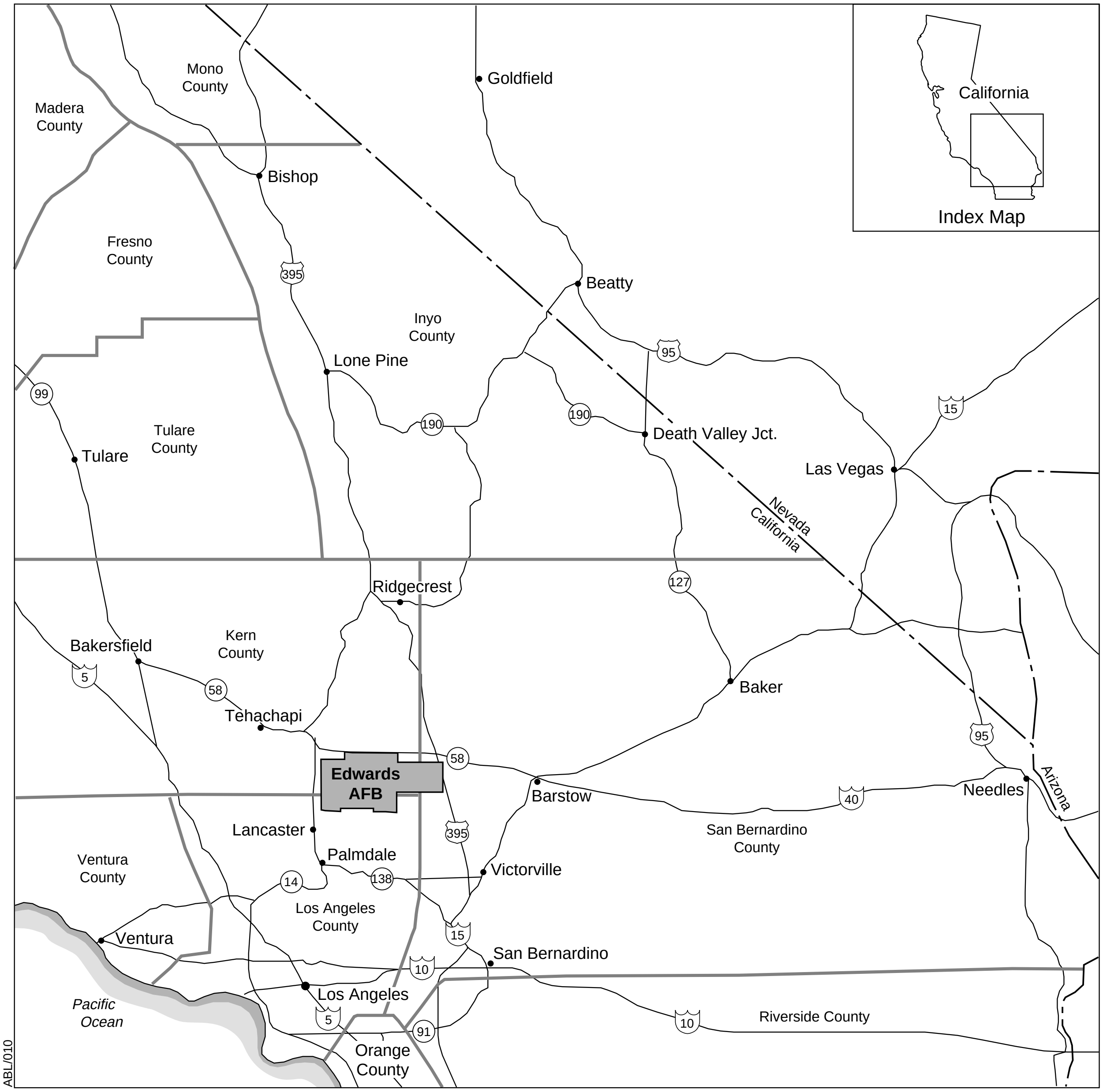
Host organizations at Edwards AFB include the AFFTC, the 95th Air Base Wing, the 412th Test Wing, and Detachment 5 of the Air Force Operational Test and Evaluation Center. Major associated organizations include the National Aeronautics and Space Administration (NASA) Dryden Flight Research Center and the Air Force Research Laboratory. Approximately 14,000 military and civilian personnel are employed on the base, and between 90,000 and 100,000 takeoffs and landings occur each year.

Location

Edwards AFB is situated in Southern California, in the Antelope Valley region of the western Mojave Desert, approximately 100 miles north of Los Angeles, 80 miles southeast of Bakersfield, and approximately 25 miles northeast of Lancaster (Figure 3.1-1). The base encompasses an area of approximately 470 square miles, and includes portions of Kern, Los Angeles, and San Bernardino counties.

The ABL Complex is situated at the Birk Flight Test Facility on South Base, which is operated by the AFFTC (see Figure 2.2-1). Existing state-of-the-art facilities are in place to support flight testing, data collection, and analysis of the ABL Program.

Edwards AFB is partially sheltered from maritime weather by mountains on the west and south. Two mountain passes, the Tehachapi's to the west and Soledad Canyon Pass to the south, allow movement of air from the San Joaquin Valley



EXPLANATION

State Boundary

County Boundary

R-2508 Complex Boundary

Interstate Highway

U.S. Highway

State Highway

0 10 20 40 Miles

Edwards AFB Vicinity Map

Figure 3.1-1

and the Los Angeles Air Basin into the western Mojave Desert. Two large dry lakes on Edwards AFB, Rogers Dry Lake and Rosamond Dry Lake, contain 65 square miles of usable aircraft landing area, including runways up to 7.5 miles long (see Figure 2.2-1).

Weather patterns in the area are characterized by large seasonal temperature differences. Summer temperatures are extremely high, and reach an annual mean maximum of 98 degrees (^{o}) Fahrenheit (F) in July. The lowest mean maximum temperature, 56^{o}F, occurs in January. The average annual precipitation is less than 5 inches, with about 80 percent occurring between November and March. The average annual wind speed is approximately 8 miles per hour (mph). The highest average wind speeds occur during the spring and summer. The prevailing wind direction throughout the year is west-southwest to southwest.

3.1.2 Airspace

Airspace, or that space that lies above a nation and comes under its jurisdiction, is generally viewed as being unlimited. However, it is a finite resource that can be defined vertically and horizontally, as well as temporally, when describing its use for aviation purposes. The scheduling, or time dimension, is a very important factor in airspace management and air traffic control.

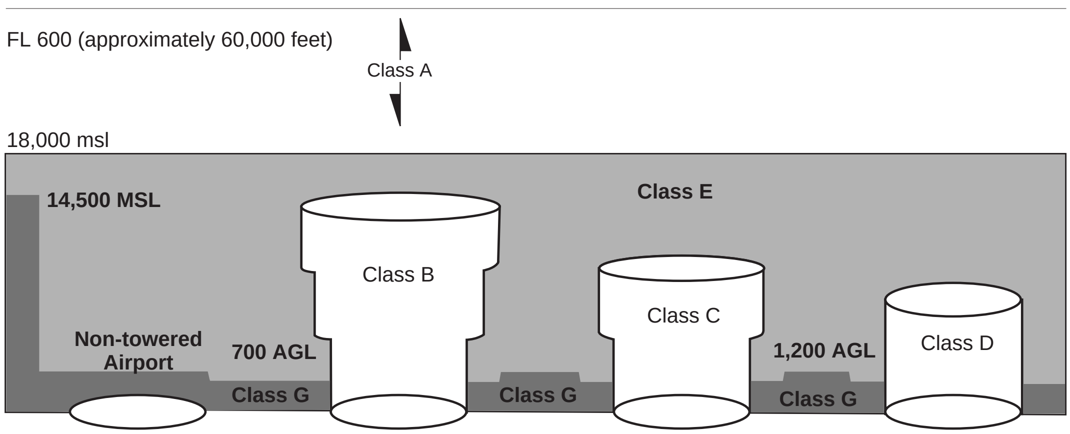
Under P.L. 85-725, the FAA is charged with the safe and efficient use of the nation's airspace, and has established certain criteria and limits to its use. The method used to provide this service is the National Airspace System. This system is " . . . a common network of U.S. airspace; air navigation facilities, equipment and services, airports or landing areas; aeronautical charts, information and services; rules, regulations and procedures, technical information and manpower and material" (Jeppesen Sanderson, Inc., 2000).

Types of Airspace

Controlled and Uncontrolled Airspace. Controlled and uncontrolled airspace is divided into six classes, dependent upon location, use, and degree of control. Figure 3.1-2 depicts the various classes of controlled airspace, and each is described briefly below.

- Class A airspace, which is not specifically charted, is generally that airspace from 18,000 feet above MSL up to and including flight level (FL) 600 (60,000 feet). Unless otherwise authorized, all aircraft must be operated under instrument flight rules.

- Class B airspace is generally that airspace from the surface to 10,000 feet above MSL surrounding the nation's busiest airports in terms of instrument flight rules operations or passenger enplanements. An air traffic control clearance is required for all aircraft to operate in the area, and all aircraft that are so cleared receive separation services within the airspace.



Approximate maximum ceilings:

Class B:	10,000 feet MSL
Class C:	4,000 feet AGL
Class D:	2,500 feet AGL

ABL/029

Source: Illman, 1993.

EXPLANATION

AGL	Above Ground Level
FL	Flight Level
MSL	Mean Sea Level

Types of Controlled Airspace

Figure 3.1-2

Source: Illman, P.E., 1993.

- Class C airspace is, generally, that airspace from the surface to 4,000 feet above ground level (AGL) surrounding those airports that have an operational control tower, are serviced by a radar approach control, and that have a certain number of instrument flight rule operations or passenger enplanements.

- Class D airspace is, generally, that airspace from the surface to 2,500 feet AGL surrounding those airports that have an operational control tower.

- Class E airspace, is controlled airspace that is not Class A, Class B, Class C, or Class D airspace.

- Class G (uncontrolled) airspace, has no specific definition but generally refers to airspace not otherwise designated, and operations are typically below 1,200 feet AGL. No air traffic control service to aircraft operating under either instrument or visual flight rules is provided other than possible traffic advisories when the air traffic control workload permits and radio communications can be established (Illman, 1993).

Special Use Airspace. Complementing the classes of controlled and uncontrolled airspace described above are several types of special use airspace used by the military to meet its particular needs. Special use airspace consists of that airspace wherein activities must be confined because of their nature, or wherein limitations are imposed upon aircraft operations that are not a part of these activities, or both. Except for Controlled Firing Areas, special use airspace areas are depicted on aeronautical charts, which also include hours of operation, altitudes, and controlling agency.

- Restricted Areas contain airspace identified by an area on the surface of the earth within which the flight of aircraft, while not wholly prohibited, is subject to restriction. Activities within these areas must be confined because of their nature, or limitations imposed upon aircraft operations that are not a part of these activities, or both. Restricted Areas denote the existence of unusual, often invisible, hazards to aircraft such as artillery firing, aerial gunnery, or guided missiles. Restricted Areas are published in the Federal Register and constitute Federal Aviation Regulation (FAR) Part 73 (Jeppesen Sanderson, Inc., 1999).

- Military Operations Areas (MOAs) consist of airspace of defined vertical and lateral limits established for the purpose of separating certain non-hazardous military training activities from instrument flight rules traffic. Whenever an MOA is being used, non-participating instrument flight rules traffic may be cleared through an MOA if instrument flight rules separation can be provided by Air Traffic Control. Otherwise, Air Traffic Control will reroute or restrict non-participating instrument flight rules traffic (Jeppesen Sanderson, Inc., 1999).

Military Training Routes (MTRs), a joint venture by the FAA and the DOD, are mutually developed for use by the military for the purpose of conducting low-altitude, high-speed training. The routes above 1,500 feet AGL, identified by three number characters (e.g., IR-206, VR-207), are developed to be flown, to the maximum extent possible, under instrument flight rules. The routes between the surface and 1,500 feet AGL, identified by four number characters (e.g., IR-1206, VR-1207), are generally developed to be flown under visual flight rules. Generally, MTRs are established below 10,000 feet MSL for operations at speeds in excess of 250 knots. However, route segments may be defined at higher altitudes for purposes of route continuity (Aeronautical Information Manual, 2000). Route width is normally 5 nautical miles (nm) on either side of centerline. In addition to the instrument and visual flight rules routes, there are slow-speed, low-altitude routes used for military air operations at or below 1,500 feet at airspeeds of 250 knots or less (National Imagery and Mapping Agency, 2000).

3.1.2.1 Affected Environment.

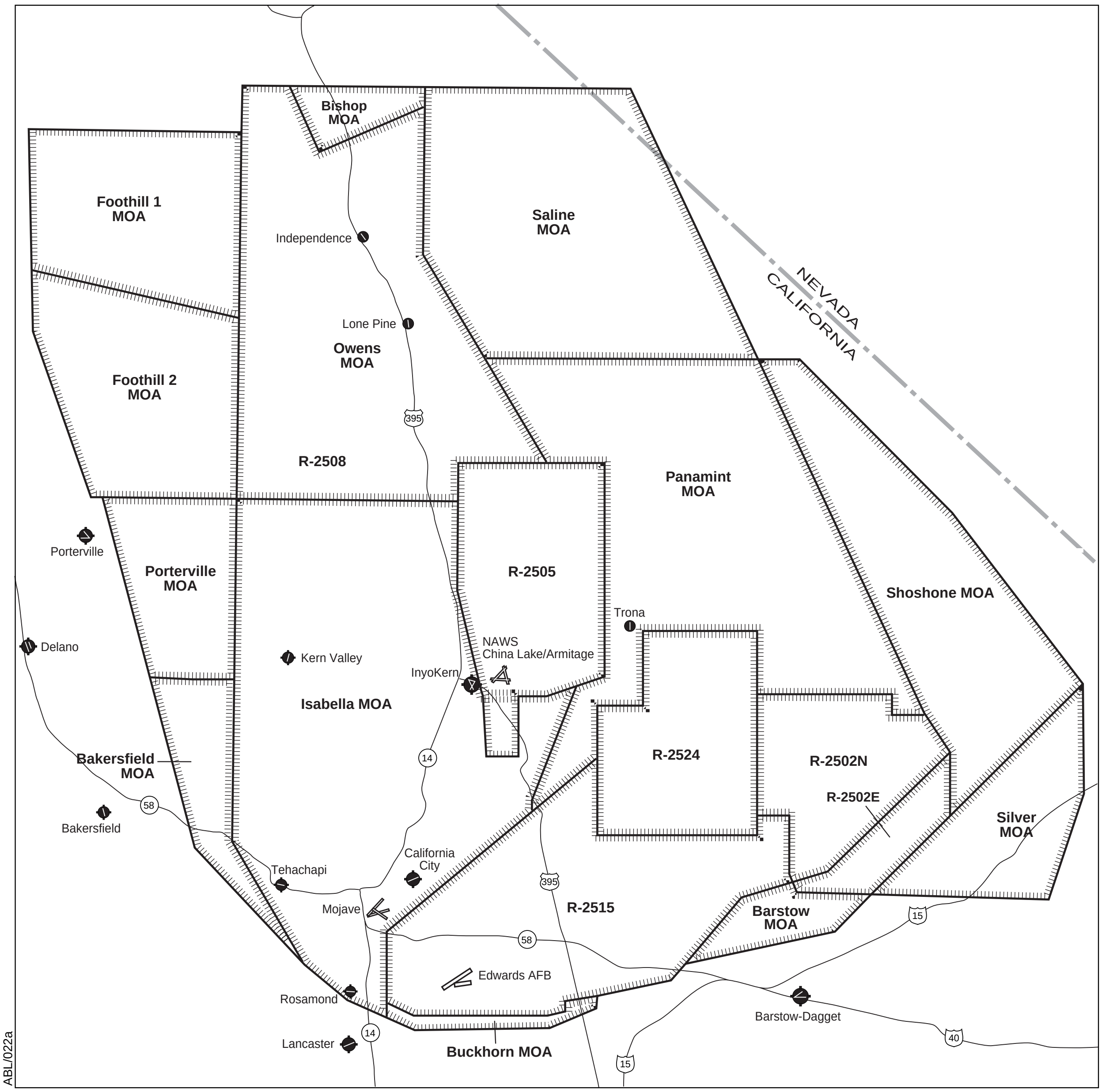
The airspace region of influence (ROI) for Edwards AFB is defined as that area that could be affected by ABL flight-testing activities. For the purposes of this document, the ROI is the R-2508 Airspace Complex and an approximately 36-km (20-nm) zone around the edge of this airspace area. Normally, the special use airspace (SUA) and the Air Traffic Control Assigned Airspace (ATCAA) associated with the R-2508 Complex would be activated for ABL missions. Therefore, the explanation of airspace operations as described in the second section below (Special Use Airspace) is the most significant for ABL operations.

Controlled and Uncontrolled Airspace. Outside of the SUA identified and discussed separately in the next section, most of the airspace in the Edwards AFB ROI is controlled airspace, within which some or all aircraft may be subject to air traffic control (ATC). This airspace comprises Class A airspace from 18,000 feet above MSL up to and including FL 600 (60,000 feet), and Class E airspace below 18,000 feet. Within Class E airspace, separation service is provided for instrument flight rules (IFR) aircraft only, and, to the extent practical, traffic advisories to aircraft operating under VFR. The Class E airspace has a floor of 1,200 feet or greater above the surface, except for the areas around (1) Edwards AFB, Mojave, and Palmdale airports in the southwest part of the ROI; (2) Apple Valley and Barstow-Daggett airports in the southeast part of the ROI; (3) Inyokern and Ridgecrest airports in the central portion of the ROI; and (4) Bakersfield, Delano, and Porterville airports in the west portion of the ROI, where the Class E airspace has a floor of 700 feet above the surface (Figure 3.1-3).

Class D airspace, generally that airspace from the surface to 2,500 feet above the airport elevation surrounding those airports that have an operational control tower surrounds Palmdale, Victorville, General Fox, and Bakersfield airports in the southern and western edges of the ROI, and the Naval Air Weapons Station (NAWS) China Lake airports/airfields (see Figure 3.1-3).

Class G airspace (uncontrolled) generally refers to airspace not otherwise designated and operations are typically below 1,200 feet AGL.

There is no Class B or Class C airspace within the Edwards AFB ROI.



EXPLANATION

Military Operations Area

Airport/Airfield

Military Operations Area (MOA)/Restricted Areas in the Edwards AFB Airspace ROI

0 11.5 23 Nautical Miles

Source: National Aeronautical Charting Office, 2001.

Figure 3.1-3

The distinction between “controlled” and “uncontrolled” airspace is important. Within controlled airspace, service is provided to IFR flights and visual flight rules (VFR) flights in accordance with the airspace classification. Controlled airspace is also that airspace within which aircraft operators are subject to certain pilot qualifications, operating rules, and equipment requirements. For example, for IFR operations in any class of controlled airspace, a pilot must file an IFR flight plan, and receive an appropriate ATC clearance. Within uncontrolled airspace, no ATC service to aircraft operating under VFR is provided other than possible traffic advisories when the ATC workload permits and radio communications can be established (Illman, 1993). IFR ATC service is available if requested.

Special Use Airspace. The R-2508 Airspace Complex lies at the center of the ROI. The complex is composed of 7 Restricted Areas, 10 MOAs, and 12 ATCAA areas. Restricted Area R-2508, the major restricted area from which the complex derives its name, extends from FL 200, upward to an unlimited altitude, and is a shared use airspace. Individual restricted areas, R-2505, R-2506, R-2524, R-2515, R-2502N, and R-2502E, all of which extend from the surface to unlimited, except for R-2506, which extends from the surface to 6,000 feet above MSL, require prior approval for entry (Table 3.1-1).

Table 3.1-1. Special Use Airspace in the Edwards AFB/R-2508 Complex Airspace ROI

Number/Name	Effective Altitude (feet)	Time of Use	Controlling Agency
R-2502E	Unlimited	Continuous[a]	HI-DESERT TRACON
R-2502N	Unlimited	Continuous[a]	HI-DESERT TRACON
R-2505	Unlimited	Continuous[a]	HI-DESERT TRACON
R-2508	FL 200-Unlimited	Continuous[a]	HI-DESERT TRACON
R-2506	To 6,000	SR-SS Mon-Fri	HI-DESERT TRACON
R-2515	Unlimited	Continuous[a]	HI-DESERT TRACON
R-2524	Unlimited	Continuous[a]	HI-DESERT TRACON
Bakersfield MOA	200 AGL[b]	0600-2200 M-F	ZLA CNTR
Barstow MOA	200 AGL[b]	0600-2200 M-F	HI-DESERT TRACON
Bishop MOA	200 AGL[b]	Mon-Fri	ZLA CNTR
Buckhorn MOA	200 AGL[b]	0600-2200 M-F	ZLA CNTR
Isabella MOA	200 AGL[b,c]	0600-2200 M-F	HI-DESERT TRACON
Owens MOA	200 AGL[b,d]	0600-2200 M-F	HI-DESERT TRACON
Panamint MOA	200 AGL[b]	0600-2200 M-F	HI-DESERT TRACON
Porterville MOA	200 AGL[b]	0600-2200 M-F	ZLA CNTR
Saline MOA	200 AGL[b]	0600-2200 M-F	HI-DESERT TRACON
Shoshone MOA	200 AGL[b]	0600-2200 M-F	ZLA CNTR

Notes: (a) Continuous = 24 hours a day and/or 7 days a week.
(b) To but not including FL 180.
(c) Excluding 3,000 feet and below over Domeland Wilderness Area.
(d) Excludes airspace below 3,000 feet over Wilderness Areas, National Parks and Monuments.
AGL = above ground level
CNTR = Center (Air Route Traffic Control Center)
R = Restricted
FL = Flight Level (FL 180 = approximately 18,000 feet)
MOA = Military Operations Area
SR = Sunrise
SS = Sunset
TRACON = Terminal Radar Control
ZLA = Los Angeles ARTCC

Source: National Aeronautics Charting Office, 2001b and 2001c.

The affected airspace use environment in the Edwards AFB airspace ROI is described below in terms of its principal attributes, namely: controlled and uncontrolled airspace; SUA; MTRs; en route airways and jet routes, airports, and airfields; and ATC.

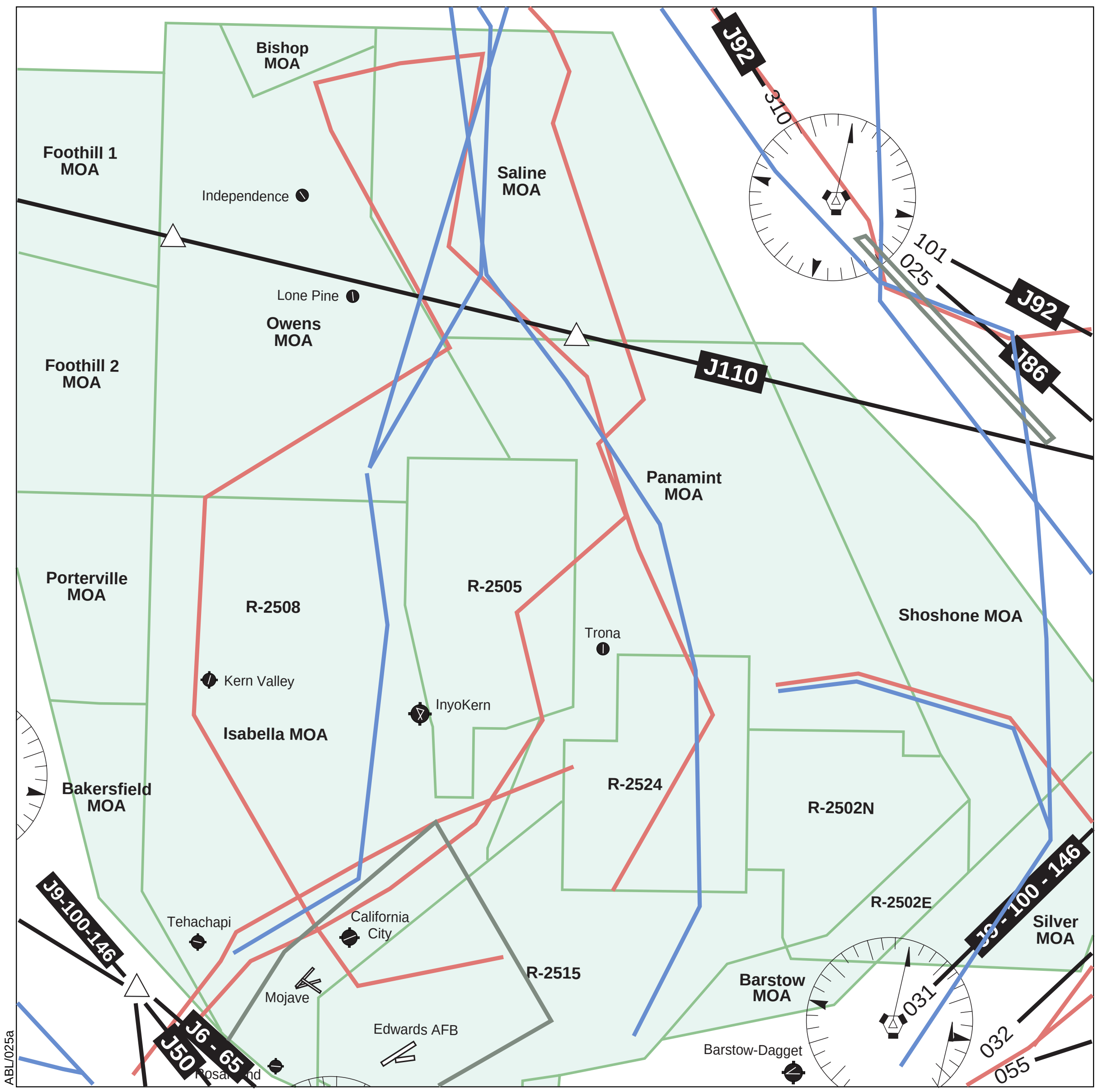
Five of the MOAs (Bishop, Isabella, Owens, Panamint, and Saline) lie below the R-2508 Restricted Area, and extend from 200 feet AGL up to but not including FL 180. The other five MOAs surrounding the Restricted Areas include the Porterville and Bakersfield MOAs on the western side, Buckhorn MOA on the south end and Barstow MOA on the southeast side, and Shoshone MOA on the east side of the complex. These MOAs extend from 200 feet AGL up to but not including FL 180 (see Table 3.1-1). Portions of the four main MOAs (Isabella, Owens, Saline, and Panamint) are situated over Sequoia/Kings Canyon National Parks, John Muir and Domeland Wilderness Areas, and Death Valley National Park, where the lower limit of the MOA is 3,000 feet AGL. MOAs do not include the airspace below 1,500 feet AGL within 3 miles of any charted airport, except Mojave Airport Class D airspace (Joint Policy and Planning Board, 1997).

Associated with and lying above the Isabella, Owens, Panamint, and Saline MOAs are ATCAAs, which are used to fill the airspace gap between the top of the MOAs (FL 180) and the base of the R-2508 Restricted Area (FL 200). When the R-2508 Restricted Area is not activated, the ATCAAs may extend upward to FL 600. ATCAAs are also situated above the peripheral Bakersfield, Barstow, Buckhorn, Porterville, and Shoshone MOAs, which are outside the lateral boundaries of R-2508, to afford additional areas up to FL 600 for segregation of military operations from IFR traffic. Deep Springs ATCAA, extending from FL 240 to FL 600 at the northern tip of the complex, does not have an underlying MOA; and the Bishop MOA (also at the north end of the complex) does not have an overlying ATCAA (see Figure 3.1-3).

There are no Prohibited or Alert SUA areas in the ROI (National Ocean Service, 2001).

Military Training Routes. The R-2508 Airspace Complex contains, and is surrounded by, an extensive network of IFR, VFR, and one Slow Route MTR (Figure 3.1-4). All routes are designated as (military authority assumes responsibility for separation of aircraft [MARSA]) operations established by coordinated scheduling. The route's width is 5.5 km (3 nm) either side of centerline. The routes, originating at Edwards AFB and Naval Air Station (NAS) Lemoore, are authorized for terrain-following operations along their entire route. Hours of operation are normally daylight hours; other hours are by Notice to Airmen (NOTAM), except for VR 1206 and VR 1293, which have continuous hours of operation (National Imagery and Mapping Agency, 2001).

En Route Airways and Jet Routes. There are several en route low-altitude (up to but not including 18,000 feet above MSL) airways that enter or transect the airspace ROI. They include the V12, V12-210, V394, V587, V21-283, and V8-210 airways just to the southeast; the V-12 airway to the south; the V197, V137, and V165-459 airways to the southwest; the V459 and V165 airways running down the west side of the complex; and the V105-135 airway down the east side of the R-2508 Airspace Complex (see Figure 3.1-4).



EXPLANATION

- J6 High Altitude Jet Routes
- IFR Military Training Route
- VFR Military Training Route
- Slow Route
- Restricted, Prohibited Airspace

0 7.5 15 30 Nautical Miles

Source: National Imagery and Mapping Agency, 2001.

High Altitude Jet Routes and Military Training Routes in the Edwards AFB Airspace ROI

Figure 3.1-4

Several high-altitude jet routes cross the ROI above 18,000 feet above MSL: the J9-100-146 and J6 jet routes to the south; the J6-65, J50, and J5-50-65 jet routes to the west; and the J92 and J86 jet routes to the east of the R-2508 Complex. One jet route, J110, actually crosses the north part of the R-2508 Airspace Complex.

In addition to the IFR high-altitude jet routes and low-altitude airways used by commercial aircraft, general aviation aircraft fly unrestricted in accordance with VFR within the R-2508 Airspace Complex MOAs below FL 180 (see Figure 3.1-4).

As an alternative to aircraft flying above 29,000 feet following the published, preferred IFR routes (shown in Figure 3.1-4), the FAA is gradually permitting aircraft to select their own routes as alternatives. This “Free Flight” program is an innovative concept designed to enhance the safety and efficiency of the National Airspace System. The concept moves the National Airspace System from a centralized command-and-control system between pilots and air traffic controllers, to a distributed system that allows pilots, whenever practical, to choose their own route and file a flight plan that follows the most efficient and economical route (Federal Aviation Administration, 1998).

Free Flight is already underway, and the plan for full implementation will occur as procedures are modified, and technologies become available and are acquired by users and service providers. This incremental approach balances the needs of the aviation community and the expected resources of both the FAA and the users. Advanced satellite voice and data communications are being used to provide faster and more reliable transmission to enable reductions in vertical, lateral, and longitudinal separation, more direct flights and tracks, and faster altitude clearances (Federal Aviation Administration, 1998).

Airports/Airfields. In addition to Edwards AFB and NAWS China Lake, there are a number of airports in the airspace ROI. Some airports within the airspace ROI include Independence, Lone Pine, Kern Valley, Trona, Tehachapi Municipal, California City Municipal, Mojave, and Rosamond airports underneath the R-2508 Airspace Complex, as well as a number of private airfields/airstrips. Some airports just outside the R-2508 Airspace Complex include Palmdale, Apple Valley, and Barstow-Daggett to the south and southeast; and Bakersfield, Delano, and Porterville to the west (see Figure 3.1-3).

Air Traffic Control. The majority of the airspace ROI lies within the Los Angeles ARTCC boundaries; the far northwest portion of the ROI is within the Oakland ARTCC (National Aeronautics Charting Office, 2001c). The controlling agency for the Restricted Area and MOAs within the R-2508 Airspace Complex is the High Desert Terminal Radar Approach Control (TRACON), an FAA ATC Facility. During the published hours of use (see Table 3.1-1), the using agency is responsible for controlling all military activity within the SUA, and determining that its perimeters are not violated. When scheduled to be inactive, the using agency releases the airspace back to the controlling agency (High Desert TRACON), and, in effect, the airspace is no longer restricted. If no activity is scheduled during some of the published hours of use, the using agency releases the airspace to the controlling agency for nonmilitary operations during that period of inactivity (Illman, 1993).

In the Class A (positive control areas) airspace from 18,000 to 60,000 feet surrounding the R-2508 Airspace Complex, all operations are conducted under IFR procedures, and are subject to ATC clearances and instructions. Aircraft separation and safety advisories are provided by ATC, the Los Angeles or Oakland ARTCC. In the Class E (general controlled airspace) airspace below 18,000 feet, operations may either be under IFR or VFR: separation service is provided to aircraft operating under IFR only and, to the extent practicable, traffic advisories to aircraft operating under VFR by the Los Angeles or Oakland ARTCC.

3.1.2.2 Environmental Consequences

Proposed Action

Ground-Testing Activities. None of the activities associated with proposed ground-testing activities of the ABL system at Edwards AFB (involving the testing of laser components on the ground before or after they are integrated into the aircraft) would have airspace use impacts. Kilowatt-class ground tests involving free space lasing against a rotoplane or billboard target at the C-6 site would require establishing a controlled firing area (CFA) within the Buckhorn MOA. This CFA would be activated by a NOTAM and pertinent information would be placed on the Edward's Automated Terminal Information System. Because lasing activities would be suspended immediately when ground observers with binoculars scanning the sky near the target location indicate an aircraft might be approaching the area, there would be no impacts to controlled or uncontrolled airspace, SUA, MTRs, en route airways and jet routes, other airfields and airports, or ATC in the airspace use ROI. There would be no need to chart the CFA since they do not cause a nonparticipating aircraft to change its flightpath. Similarly, since none of these activities would restrict a clear view of runways, helipads, taxiways, or traffic patterns from any airport traffic control tower, decrease airport capacity or efficiency, or affect future VFR or IFR traffic, they also would not constitute an obstruction to air navigation.

Flight-Testing Activities

Controlled and Uncontrolled Airspace. No new SUA proposal, or any modification to the existing SUA, would be necessary or contemplated to accommodate the flight-testing activities at Edwards AFB (R-2508 Airspace Complex). Consequently, there would be no reduction in the amount of controlled and uncontrolled navigable airspace in the ROI and, therefore, no impacts to the controlled and uncontrolled airspace in the ROI are expected.

Special Use Airspace. Use of the R-2508 Airspace Complex for the proposed flight-testing activities would not have an adverse impact on activities conducted within the complex. The restricted areas, MOAs, and associated ATCAA's using agency has a scheduling office that is responsible for establishing a real-time activity schedule for the parts of the R-2508 Airspace Complex that would be utilized and forwarded, along with any subsequent changes, to the controlling High-Desert TRACON (Joshua). In addition, the flight tests represent precisely the type of activities for which Restricted Area SUA was created in the early 1960s: namely, to accommodate national security and necessary military activities, and to confine or segregate activities considered to be hazardous to nonparticipating aircraft.

MOAs are joint use airspace, as VFR aircraft are not denied access, and that IFR aircraft may be routed through the airspace when approved separation can be provided from activities in the MOAs. Procedures for use of the MOA airspace by nonparticipating IFR traffic are set forth in letters of agreement executed between the controlling and using agencies.

Because ABL flight-test activities would occur above 35,000 feet, no effect to airspace over national parks and wilderness areas is anticipated. In addition, no new demands would be placed on existing SUA that could not be accommodated by airspace schedulers, and the Proposed Action would not require the assignment of new SUA, or require the modification of existing SUA. Therefore, no impacts to SUA are expected.

Military Training Routes. No change to an existing or planned MTR or slow route would be required as a result of implementation of the Proposed Action; therefore, no impacts to MTRs are expected.

En Route Airways and Jet Routes. Since proposed flight-testing activities would be contained within the existing SUA, there would be no impact to the ROI's en route airways and jet routes that, with one exception, skirt the boundaries of the R-2508 Complex. Consequently, no change to an existing or planned IFR minimum flight altitude, a published or special instrument procedure, or an IFR departure procedure would be required, and no change to a VFR operation from a regular flight course or altitude would be required as a result of implementation of the Proposed Action. However, the J110 jet route (see Figure 3.3-3), which transects R-2508 in the northern half of the airspace ROI, is normally unavailable from sunrise to sunset, Monday through Friday; therefore, the ABL flight-testing activities in the R-2508 Airspace Complex would not cause a change in its availability.

Airports and Airfields. Implementation of the Proposed Action would not restrict access to, or affect the use of, any airfield or airport available for public use, and would not affect airfield/airport arrival and departure traffic flows. Therefore, no impact to the ROI's airports and airfields is expected.

Mitigation Measures. No impacts have been identified; therefore, no mitigation measures would be required.

Cumulative Impacts. No other projects in the airspace ROI have been identified that would have the potential for incremental, additive cumulative impacts to controlled or uncontrolled airspace, SUA, MTRs, en route airways and jet routes, airfields and airports, or ATC.

No-Action Alternative

Controlled/Uncontrolled Airspace. Ongoing activities at Edwards AFB (R-2508 Airspace Complex) would continue to utilize the existing SUA. No new special use airspace proposal, or any modification to the existing SUA, is proposed to accommodate continuing mission activities. Therefore, no impacts to the controlled/uncontrolled airspace in the ROI are anticipated.

Special Use Airspace. The ongoing activities at Edwards AFB would continue to utilize the existing SUA. Although the nature and intensity of utilization varies over time and by individual SUA area, the continuing mission activities represent precisely the kinds of activities that the special use airspace was created for. Restricted Areas contain airspace within which the flight of aircraft, while not wholly prohibited, is subject to restrictions. Activities within these areas must be confined because of their nature or limitations imposed upon aircraft operations that are not part of these activities, or both. As such, the continuing mission activities do not represent an adverse impact to SUA, and do not conflict with any airspace use plans, policies, or controls.

En Route Airways and Jet Routes. Ongoing activities at Edwards AFB would continue to utilize, and be confined to, the existing SUA. Use of the existing en route airways and jet routes by IFR traffic comes under the control of the Los Angeles ARTCC, and, therefore, no adverse impacts to the ROI's airways and jet routes are expected.

In terms of potential airspace use impacts to en route airways and jet routes, the continuing mission activities would be in compliance with DOD Directive 4540.1, Use of Airspace by U.S. Military Aircraft and Firings Over the High Seas, which specifies procedures for conducting aircraft operations and missile/projectile firing, namely the missile/projectile "firing areas shall be selected so that trajectories are clear of established oceanic air routes or areas of known surface or air activity" (Department of Defense, 1981). In addition, before conducting an operation that is hazardous to nonparticipating aircraft, NOTAMs would be sent in accordance with the conditions of the directive specified in Office of the Chief Naval Operations Instruction (OPNAVINST) 3721.20B, DOD NOTAM System.

As noted above, mission activities would continue to utilize the existing SUA, and would not require a change to an existing or planned IFR minimum flight altitude, a published or special instrument procedure, or an IFR departure procedure; or require a VFR operation to change from a regular flight course or altitude. Therefore, no impacts to the surrounding low-altitude airways and/or high-altitude jet routes are expected.

Airports and Airfields. Ongoing activities at Edwards AFB would continue to utilize the existing SUA and would not restrict access to or affect the use of the existing airfields and airports. Operations at Edwards AFB, the R-2508 Airspace Complex, and the many private airfields/airstrips in the ROI would continue as under current conditions. The existing airfield/airport arrival and departure traffic flows would not be affected by the No-Action Alternative, and access to airports/airfields would not be affected. Therefore, no impacts are expected.

Mitigation Measures. The well-defined SUA dimensions and scheduled times of use on aeronautical charts, as well as the positive ATC, would eliminate the need for mitigation measures.

3.1.3 Hazardous Materials and Hazardous Waste Management

Hazardous materials management activities at Air Force installations are governed by specific environmental regulations. For the purpose of the following discussion, the term hazardous materials or hazardous waste refers to those substances defined as hazardous by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. Section 9601 et seq., as amended. In general, this includes substances that, because of their quantity, concentration, or physical, chemical, or infectious characteristics, may present substantial danger to the public health, welfare, or the environment when released. Hazardous waste is further defined in 40 CFR 261.3 as any solid waste that possesses any of the hazardous characteristics of EP toxicity, ignitability, corrosivity, or reactivity, or is listed as a hazardous waste in Subpart D of 40 CFR Part 261. Transportation of hazardous materials is regulated by the U.S. Department of Transportation (DOT) regulations within 49 CFR.

3.1.3.1 Affected Environment.

AFFTC Instruction 32-19, *Hazardous Material Management,* and AFFTC 32-7042, *Edwards AFB Hazardous Waste Management Plan,* ensure compliance with applicable federal, state, local regulations, and Air Force directives related to hazardous materials management.

Base Supply operates on the Hazardous Material Pharmacy concept, which allows base tenants to obtain hazardous materials from assigned distribution centers. The hazardous material pharmacy works with users to identify the exact quantity required, and any appropriate material substitutes. Unopened containers of materials are returned to the Pharmacy for subsequent use. Leftover portions are disposed of in accordance with Edwards AFB Hazardous Waste Management Plan. The Depot Maintenance Hazardous Material Management System database stores information concerning the issue and use of hazardous materials. All users of hazardous materials, including contractors, are required to maintain strict inventories of all hazardous materials, reduce large-quantity bench stocks, and use less hazardous or nonhazardous materials in place of those currently used when possible (U.S. Air Force, 1997a).

A wide variety of hazardous waste is generated at Edwards AFB in connection with flightline, base support, research and development laboratories, and various industrial operations. Hazardous waste generated at Edwards AFB is collected by generators at Initial Accumulation Points. The waste is stored in approved containers, labeled in accordance with state requirements, and managed by trained personnel following procedures detailed in the Edwards AFB Hazardous Waste Management Plan. These materials are either picked up by the Environmental Management Office or are delivered to Accumulation Sites. Within 90 days, the materials are turned over to the Conforming Storage Facility for off-base disposal, which must be accomplished within 1 year from the accumulation start date (U.S. Air Force, 1997a).

Preparedness and spill prevention actions are accomplished in advance to ensure that an accidental fire, explosion, or unplanned release of hazardous material is prevented, if possible, or mitigated and properly cleaned up. Spill prevention, control, and countermeasure procedures, methods, and equipment have been developed and implemented for the ABL System Program Office (SPO) in coordination and compliance with Edwards AFB hazardous material/waste storage and transfer areas.

3.1.3.2 Environmental Consequences

Ground-Testing Activities. Materials used in the BILL, TILL, SHEL, and ARS laser systems include:

- Deuterium oxide (D_2O) (i.e., heavy water)
- He
- N_2
- CO_2
- Water.

Materials used in support of laser system ground activities (i.e., AGE) include:

- Jet propulsion fuel (JP-8)
- Oils
- Lubricants.

The BILL laser system uses water as a coolant, thus producing no hazardous waste during the lasing process. The TILL laser system uses D_2O as a coolant. D_2O is water that contains a significantly higher proportion of deuterium atoms to ordinary hydrogen atoms (heavy water). In this case, D_2O has many of the same properties as water, is a stable isotope, and does not have a regulated maximum contaminant level (MCL) established by the U.S. EPA. The laser coolants operate within a closed-loop system, and are only replaced during general maintenance requirements. The ARS is a CO_2 laser that utilizes Refrigerant 404 in its cooling system. The CO_2 laser uses several inert gases such as He and N_2 for increased operating efficiency, and CO_2 as the prominent lasing medium. None of these inert gases is hazardous; however, they are asphyxiants, and can displace oxygen resulting in an oxygen-deficient atmosphere. Use of compressed gases would comply with 29 CFR Part 1910.101, *Compressed Gases (General Requirements);* in the event that liquid oxygen/nitrogen facilities are required, use of these materials would comply with AFOSH Standard 91-67, *Liquid Nitrogen and Oxygen Safety*.

The IMF at Edwards AFB would be used to store, handle, and mix chemicals for the laser. This conforming and compatible storage area is situated in a remote area approximately 1.2 miles from Building 151. Standard Operating Procedures would be developed for storage, mixing, transportation, use, and disposal of all chemicals to ensure maximum safety to human health and the environment. Fluid Transfer Assembly carts would be used to temporarily store and transport hazardous chemicals. The ABL program would be required to coordinate volumes stored and/or used at any time with the AFFTC/EMC and be responsible for all recordkeeping and compliance reporting of volumes used. Storage and handling areas would consist of concrete pads with associated tanks, piping, valves, relief devices, and related storage and transfer equipment to provide chemical compounds to the required facilities and equipment. The chemical compounds, delivery method, and quantities stored are provided in Table 3.1-2.

COIL chemicals include chlorine (Cl_2), iodine (I_2), and hydrogen peroxide (H_2O_2). Effluents from the operation of the HEL are managed by use of chemical scrubbers and chemical reactions that produce non-toxic by-products. Deuterated hydrogen peroxide (D_2O_2) may be used in place of H_2O_2 in BHP as it is expected to be more effective in generating the laser light; however, due to its expense, it would be recycled to the greatest extent possible. Any hazardous waste generated during the ABL Program would be stored at an approved 90-day accumulation point, which is authorized by Environmental Management (AFFTC/EMC), and disposed of in accordance with AFFTC 32-7042. Estimated quantities of waste generated during ABL ground and flight tests are provided in Table 3.1-3. These quantities include the continued operations of the SIL and test cell to support laser module upgrade testing, as well as testing of new optics and control mechanisms.

An extensive evaluation of the COIL chemicals and the reporting limits based on an accidental release was presented in the Environmental Assessment [EA] for Ground Operations and Testing in Support of the Airborne Laser Program at Edwards AFB (U.S. Air Force, 2001a). The EA concluded that appropriate measures are in place to prevent adverse impacts.

AGE used to support the ground portion of flight-testing activities would be powered using existing stores JP-8; therefore, no additional JP-8 storage capacity would be required.

For exercises at other locations where the ABL aircraft flies with chemicals loaded from Edwards AFB or the exercise location, the operating facility supporting the exercise would have appropriate personnel and equipment available to support the ABL mission needs. Chemical disposal, if needed, would be under the operating facility's standard operating procedures for hazardous waste.

Flight-Testing Activities. Because the Proteus aircraft is operated by BAE Systems situated at Mojave Airport, fuel for the Proteus aircraft would be obtained from Mojave Airport fuel supplies; therefore, no additional fuel storage capacity would be required to meet the demand. In the event of an emergency or operational need during flight and the aircraft must release liquids used by the ABL, it would do this at 15,000 feet or higher. Chemical dispersion modeling has shown that such a release would not reach the ground. An extensive evaluation of the release of ABL chemicals in the upper atmosphere is presented in Section 3.7 of the Final Environmental Impact Statement for the Program Definition and Risk Reduction Phase of the Airborne Laser Program (U.S. Air Force, 1997a). Flight-testing activities would occur over WSMR in New Mexico, the R-2508 Airspace Complex over southern and central California, and the Western Range over the Pacific Ocean off the coast of California (see Sections 3.1.2, 3.3.2, and 3.4.2, Airspace).

Table 3.1-2. Estimated Storage Requirements for Bulk Chemicals at Edwards AFB

Chemical Compound	Delivery Method	Storage Quantities	Locations: SIL or Aircraft	Locations: GPRA	Locations: IMF
Ammonia (Anhydrous)	Liquid DOT <2,000 pound Cylinders	2,000 to 4,000 lb	X		X
Chlorine	Liquid DOT 2,000 pound Cylinders	1,000 to 2,000 lb	X		X
Hydrogen Peroxide (50 percent concentrate)	Liquid ISO Tanker, Class 1 Tank	8,000 gal.			X
Hydrogen Peroxide (70 percent concentrate)	Liquid ISO Tanker, Class 1 Tank	1,000 to 4,000 gal.	X		X
Iodine	Solid (crystalline) 5 kg Packages	65 - 100 lb	X		X
Basic Hydrogen Peroxide (BHP)	Liquid (SIL/IMF transfer with BHP cart)	1,200 gal.	X		X
Lithium Hydroxide (Monohydrate)	Solid (powdered/crystalline 2,200 lb. Totes)	4,400 - 6,600 lb			X
Sodium Hydroxide (50 percent concentrate)	Liquid (IBC/Totes, 300 gal.)	900-1,200 gal.			X
Potassium Hydroxide (50 percent concentrate)	Liquid (IBC/Totes, 300 gal.)	900-1,200 gal.			X
Sulfuric Acid (93% conc.-IMF Aspirator Fluid)	Liquid (Drop-Shipped 55 gal drums)	660 gal.			X
Phosphoric Acid (2 Mol. [20 percent] TMS/NH3 Scrubber)	Liquid (Delivered ISO-DOT tankers)	8,500 gal.		X	
Sulfuric Acid (25 percent concentrate, TRICS-A Scrubber)	Liquid (Delivered ISO-DOT tankers)	2,900 gal.	X		
Sodium Hydroxide (20 percent concentrate, TRICS-C Scrubber)	Liquid (Delivered ISO-DOT tanker)	1,700 gal.	X		
Sodium Hydroxide (10 percent concentrate, GPRA Cl2 & I2 Scrubber)	Liquid (Delivered ISO-DOT tanker)	3,360 gal.		X	
Liquid Nitrogen	Liquid (Drop-Shipped ISO-DOT tankers)	3,500-6,000 gal.			X
Liquid Carbon Dioxide	Liquid (Drop-Shipped ISO-DOT tankers)	34 tons			X
Helium	Gas (Drop-Shipped ISO-DOT tankers)	1,900-3,000 lb	X		

DOT = Department of Transportation
GPRA = Ground Pressure Recovery Assembly
IBC = Intermediate Bulk Container
IMF = Integrated Maintenance Facility
ISO = International Standards Organization
SIL = Systems Integration Laboratory
TMS = Thermal Management System
TRICS-A = Transportable Integrated Chemical Scrubber – Ammonia
TRICS-C = Transportable Integrated Chemical Scrubber – Chlorine

Table 3.1-3. Estimated Annual Quantities of Wastes to be Disposed at Edwards AFB (Page 1 of 2)

Waste Type	Estimated Volume	Notes
Spent GPRA Ammonia Scrubber Solution	68,000-170,000 gallons	Ammonia vapor is scrubbed in a phosphoric acid solution. When the solution is spent, an aqueous 20 percent di-ammonium hydrogen phosphate solution with an estimated pH of 6 to 8 would require removal and disposal. Approximately 8,500 gallons would be generated from each change-out. There would be 8 to 20 scrubber change-outs per year. This solution could potentially be a non-hazardous waste.
Spent TRICS Ammonia Scrubber Solution	8,700-17,400 gallons	Ammonia vapor is scrubbed in a 25 percent sulfuric acid solution. When the solution is spent, ammonium sulphate with an estimated pH of 2 would require removal and disposal. Approximately 2,900 gallons would be generated from each change-out. There would be three to six change-outs per year.
Iodine Solids	20 gallons	Composed of iodine solids with possible inert material. One change-out of the iodine system is anticipated for each of the Block 2004, 2006, and 2008 operations.
Caustic Solids	55 gallons	Composed of gloves, personnel protective equipment, rags, absorbent pads, glassware and other inert solids contaminated with potassium, sodium and lithium hydroxide. The estimated pH of these materials if an equal weight amount of water were added is between 8 and 14.
Rags with Oils, Solvents, and Cleaners	55 gallons	Non-recyclable wiping rags, “pig pads” and other inert solids with oils, solvents such as ethanol and isopropanol and other cleaners.
Used Oil	55 gallons	Motor or hydraulic oils with possible traces of water.
Nitric Acid Solution	55 gallons	The estimated constituents are nitric acid 5 to 30 percent and water 70 to 95 percent.
Spent Hydrogen Peroxide Solution <8 percent[a]	100-5,000 gallons	Concentrations expected between 0.1 and 7.9 percent. pH range expected between 3.5 and 7. H_2O_2 at <6 percent is considered non-hazardous.
Spent Hydrogen Peroxide Solution >= 8 percent[a]	100-5,000 gallons	Concentrations expected between 8 and 35 percent. pH range expected between 2.5 and 7. H_2O_2 at >8 percent is considered an oxidizer.
Sodium, Potassium, and Lithium Hydroxide Solutions (pH<12.5)[a]	100-5,000 gallons	Concentrations expected between 1 and 4.9 percent. pH <12.5. This material may be alkaline.
Sodium, Potassium, and Lithium Hydroxide Solutions (pH>=12.5)[a]	100-5,000 gallons	Concentrations expected between 5 and 70 percent. pH of 14 expected. This material is alkaline and corrosive.
BHP Solution[a]	100-5,000 gallons	Hydroxide concentrations expected between 5 and 50 percent, pH range expected between 10 and 14, hydrogen peroxide concentrations expected between 10 and 35. pH< 12.5 may be non-hazardous.

Table 3.1-3. Estimated Annual Quantities of Wastes to be Disposed at Edwards AFB (Page 2 of 2)

Waste Type	Estimated Volume	Notes
System Rinses[a]	100-5,000 gallons	Could include traces of hydrogen peroxide; sodium, potassium and lithium hydroxides. Expected pH range of 4 to 14. pH between 2 and 12.5 may be non-hazardous.
Spent TRICS Chlorine Scrubber Solution[a]	5,100-10,200 gallons	Chlorine is scrubbed in a 15 to 20 percent sodium hydroxide solution. The spent solution would contain sodium hydroxide, sodium chlorides, hypochlorites and have an estimated pH of 14. Scrubber system capacity is 1,700 gallons. There would be three to six change-outs per year.
Spent GPRA Laser Effluent Scrubber Solution[a]	3,360-6,720 gallons	Laser exhaust scrubbed in a 10 percent sodium hydroxide solution. The spent solution would contain sodium hydroxide with some chloride and iodide salts and has an estimated pH 10 to 12. Scrubber system capacity is 3,360 gallons. There would be three to six change-outs per year.
Small quantity BHP, mixed hydroxide, hydrogen peroxide solutions and rinse water from IMF chemical laboratory and other operations[a]	100 gallons	Could include traces of hydrogen peroxide; sodium, potassium and lithium hydroxides. Expected pH range of 4 to 14.
IMF Baker Tank Aspirator Drive Fluid[b]	5,000-20,000 gallons (per week)	The estimated constituents are as follows: water 85-100 percent, potassium sulfate 0-10 percent, sodium sulfate 0-5 percent, lithium sulfate 0-5 percent, hydrogen peroxide 0-1.5 percent. The pH range is 5 to 9. Based on a review of the estimated constituents, it is believed that this fluid would be classified as a non-hazardous waste
Soil Contaminated with Sodium, Potassium, and Lithium Hydroxide Solution (trace of hydrogen peroxide is possible)	1-20 cubic yards	Concentrations expected between 5 and 10 percent. pH of 10 to 14 expected. This material may be alkaline and corrosive. No free liquids are in this waste.

Notes (a) IMF Baker Tank Aspirator Drive Fluid
(b) May or may not be considered a hazardous waste. Substance will be tested to ensure proper disposal method.

BHP = basic hydrogen peroxide
GPRA = Ground Pressure Recovery Assembly
H_2O_2 = hydrogen peroxide
IMF = Integrated Maintenance Facility
pH = measure of acidity
TRICS = Transportable Integrated Chemical Scrubber

Source: Airborne Laser System Program Office, 2001c.

Mitigation Measures. Because ABL testing activities would be required to comply with applicable federal, state, DOD, and Air Force regulations regarding the use, storage, and handling of hazardous materials and hazardous waste, these activities would not result in substantial environmental impacts, and no mitigation measures would be required.

Cumulative Impacts. No other actions have been identified that would contribute to cumulative impacts such that adverse impacts would result.

No-Action Alternative

Under the No-Action Alternative, ABL ground- and flight-testing activities would not be conducted as described in Chapter 2 of this SEIS. ABL test activities would be conducted as analyzed in the 1997 FEIS. No adverse environmental impacts are anticipated.

Mitigation Measures. No mitigation measures would be required under the No-Action Alternative.

3.1.4 Health and Safety

U.S. Air Force laser operations must comply with Air Force Occupational Safety and Health (AFOSH) Standard 48-139, *Laser Radiation Protection Program*, in order to ensure proper health and safety procedures related to operation of both U.S. Food and Drug Administration (FDA)-approved and military-exempted laser systems. Section 2.2 provides a description of the laser types utilized under the ABL test program.

Laser Hazards

The ANSI Z136 series provides industry standard guidance for laser safety evaluations. Hazard distances and eye protection specifications for lasers are determined from the maximum permissible exposure (MPE) for each laser system. ANSI Z136.1, Safe Use of Lasers, defines the MPE as "the level of laser radiation to which a person may be exposed without hazardous effect or adverse biological change in the eye or skin." The MPE is primarily a function of laser wavelength and exposure duration and will also vary based on pulsed laser output parameters such as pulsewidth and pulse repetition frequency. In general, the safe eye exposure limits are lower than skin exposure limits (except for CO_2 lasers where both are the same because this wavelength is absorbed by the cornea or outer portion of the eye).

Once the MPE has been determined for a laser, this value and the output parameters (such as power and divergence or beam spread) can be used to determine eye and skin hazard distances. In the ANSI standard, the eye hazard distance is referred to as the Nominal Ocular Hazard Distance (NOHD). The NOHD is defined in the standard as "the distance along the axis of the unobstructed beam from a laser … to the human eye beyond which the … exposure … is not expected to exceed the appropriate MPE." Note that the hazard is from looking directly into the beam along its propagation axis. Laser light is predominantly scattered forwards and backwards, whereas relatively little is scattered sideways. When the appropriate hazard distance for a laser is determined the allowable pointing angles and obstructions must be analyzed to determine the Nominal Ocular Hazard Zone (NOHZ). As describe in ANSI Z136.1, the NOHZ is a three dimensional volume of airspace where the laser radiation "during normal operation exceeds the applicable MPE."

Table 2.2-3 summarizes specific laser system parameters and resulting safety parameters calculated using guidance in ANSI Z136.1 (American National Standards Institute, 2000a). The ANSI standard states that a maximum exposure time "of 10 seconds provides an adequate hazard criterion" (in the 0.7 to 1.4 micron laser wavelength range) for all but "unusual viewing conditions." Thus, a 10-second exposure duration was used in the Air Force Research Laboratory Optical Radiation Branch (AFRL/HEDO) analysis for the ARS, TILL, and SHEL systems. The BILL and TILL MPEs are per pulse MPEs (corrected for multiple pulse exposures). In addition, a worst-case 10-second exposure was assumed for the ARS since the exposure limits are constant at the ARS laser wavelength. The MPE limits are determined using the 10-second exposure time and laser wavelength per ANSI Table 5 for eye hazards and ANSI Table 7 for skin hazards.

The ARS beam diverges (spreads out) as soon as it leaves the ARS pod. As such, the hazard distance calculation is relatively straightforward. In contrast, the BILL, TILL, SHEL, and HEL systems can be focused outside the ABL aircraft turret. The focus distance (i.e., this distance where the beam is smallest in size) can be adjusted to accommodate ABL targeting scenarios. The power of the SHEL is low enough that the beam poses no hazard to human skin or eyes when it exits the aircraft turret. However, the beam can become hazardous when the laser spot size, which decreases as range from aircraft increases, becomes small enough (note that this distance varies as the focus point of the ABL turret varies). As an example, if the target distance is 12 km from the aircraft turret, then the SHEL exceeds the ocular MPE (i.e., becomes hazardous to human eyes) approximately 2 km before the target and stays hazardous to approximately 2 km beyond the target. For this same scenario, the SHEL becomes hazardous to human skin at approximately 100 meters before the target and remains hazardous until approximately 100 meters beyond the target (U.S. Air Force, 2000h). As can be shown by hazard analyses based on the ANSI standard, for targets at closer ranges, the hazard distance in front of and beyond the target would be reduced.

The average power of the BILL, TILL, and HEL are large enough that these beams are hazardous to the eye as soon as they exit the ABL turret aperture. The eye and skin hazard distances vary depending upon the range from the aircraft to the target. For the ground-test scenarios described in this SEIS, the BILL and TILL NOHDs can be expected to extend far beyond the target (possibly greater than 10 km). The HEL hazard distance would extend even further beyond the target than the BILL and TILL systems; however, no open-range ground testing of the HEL would occur. Actual BILL and TILL hazard distances for a 12 km ground-test scenario have been calculated (this information is classified). Reference documents written by AFRL/HEDO at Brooks AFB, Texas, provide detailed ABL hazard analyses for specific test scenarios.

Laser Backscatter

In general, a laser beam is attenuated as it propagates through the atmosphere; moreover, the laser beam is often broadened, defocused, and may even be deflected from its initial propagation direction (Weichel, 1990). The attenuation and alteration (i.e., deflection and/or scatter) depends upon the wavelength of the laser, output power of the laser, makeup of the atmosphere, and the day-to-day atmospheric conditions (Weichel, 1990). In general, laser light is predominantly scattered forward and backwards, whereas relatively little is scattered side-ways (Keppler, 2002).

Atmospheric scattering of light (including laser beams) is primarily determined by the physical size of the scatterer. The three types of atmospheric scattering are:

- Rayleigh Scattering
- Mie Scattering
- Nonselective Scattering.

Rayleigh scattering is best known as the scattering effect that results in the sky being a blue color. Blue light's short wavelength causes it to get scattered around 10 times more by oxygen and nitrogen molecules than the longer wavelengths (e.g., red) or the other colors visible to humans. The blue in the sky we see is scattered blue light.

Mie scattering in the atmosphere is caused by the presence of aerosol particles and by small water droplets (Weichel, 1990). Attenuation in the spectral region from 0.3 μm to 4 μm resulting from Mie scattering far exceeds the attenuation due to both Rayleigh and Nonselective scattering (Weichel, 1990). Thus, atmospheric scattering of the ABL laser systems (i.e., BILL, TILL, SHEL, and HEL) would result primarily from Mie scattering. The ARS laser does not operate within this range of wavelengths; therefore, Mie scattering of the ARS is not anticipated.

Nonselective scattering results from the impact of light with large particles such as fog, clouds, rain, or snow. Since the flight tests of the ABL aircraft would occur at altitudes of 35,000 feet and higher and flight tests would only be conducted during clear weather conditions, this scattering effect would not occur. Ground testing of the ABL laser systems would not take place during inclement weather; therefore, Nonselective scattering would not occur.

The scattering effect is managed from a health and safety perspective through the designation of the NOHZ. NOHZ is defined in ANSI Z136.1 as “the space within which the level of the direct, reflected, or scattered radiation during normal operation exceeds the applicable MPE.” The NOHZ, of a laser system that can point in any direction with no obstructions closer than the applicable NOHD, is represented as a three-dimensional sphere (in theory, the NOHZ can have any shape) with radius equal to the NOHD. At any point inside this sphere, exposures would be above the applicable MPE. For ground-testing scenarios, the NOHZ would be represented by a hemisphere or dome extending out into free space above the testing area to an altitude equal to the applicable NOHD and the ground would serve as the impermeable floor of the dome.

AFRL/HEDO at Brooks AFB, Texas, is responsible for assessing hazards associated with all U.S. Air Force laser systems, planning to complete technical analyses, and collecting field test data in the future to assess hazards associated with atmospheric scattering of laser radiation (Keppler, 2002). In addition, AFRL/HEDO plans to install sensors in the cockpit of the ABL aircraft (during both ground and flight tests) to measure laser "backscatter" levels and assess the level of hazard.

3.1.4.1 Affected Environment.

The affected environment at Edwards AFB during ground testing of the lower-power ARS, BILL, TILL, and SHEL systems would include the area identified in Figure 2.2-1. Ground testing would emanate from the east end of the South Base runway taxi ramp associated with the Birk Flight Test Facility, and be projected toward natural backdrops (i.e., hills and buttes) to the east and southeast (see Figure 2.2-1).

The ARS could also be fired into an electronic target acquisition simulator. Laser safety controls (e.g., beam enclosures) would be utilized to eliminate any optical hazards. Building 151 would be used to support testing of the ARS laser. In addition, ground testing of the HEL would be accomplished at the Birk Flight Test Facility within the SIL and Building 151, where the HEL would be connected to a ground-based simulator or test cell (enclosed systems), thus eliminating any optical hazards. Edwards AFB currently conducts open-range laser-testing activities that are managed in accordance with range safety regulations governing Edwards AFB.

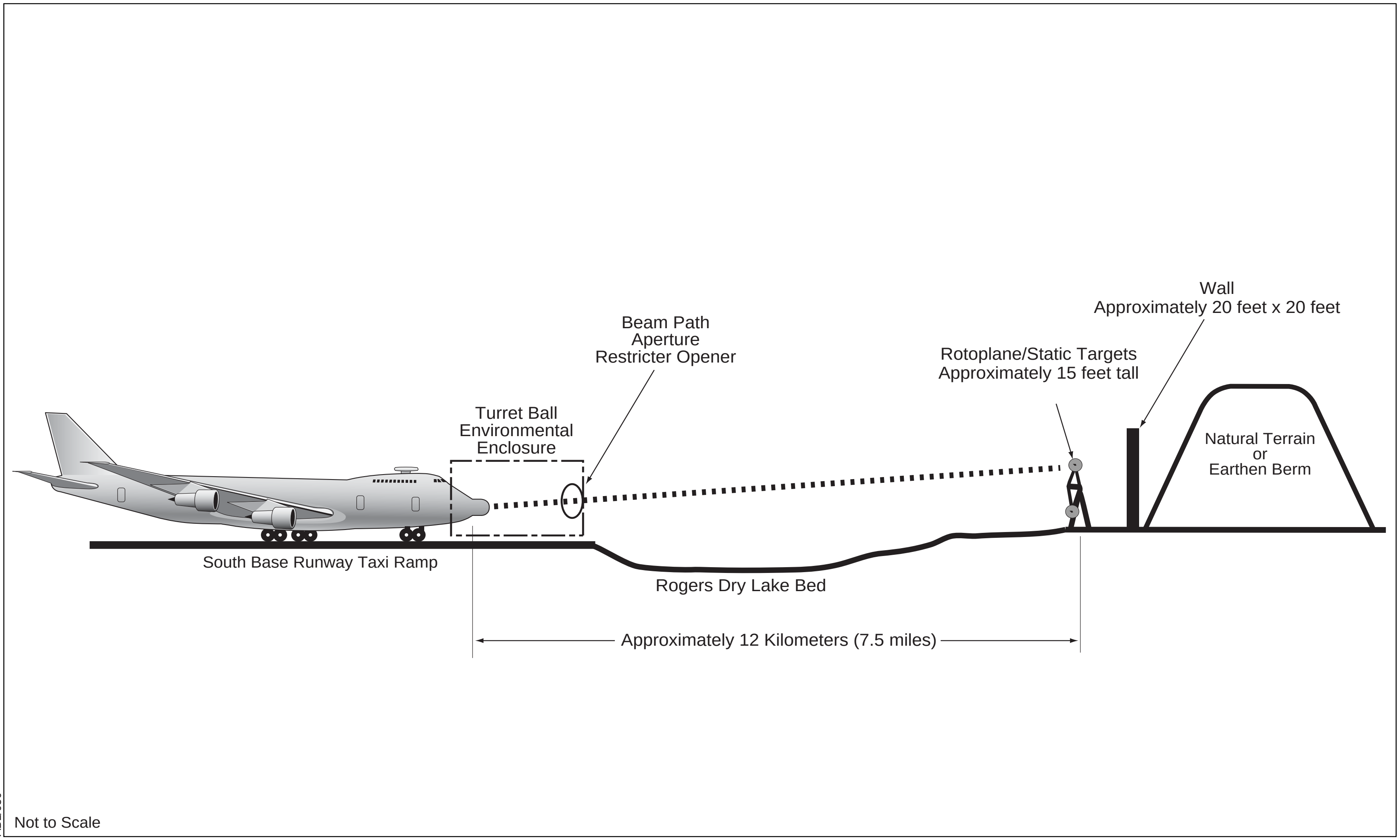
3.1.4.2 Environmental Consequences

Proposed Action

Ground-Testing Activities. Ground-testing of the ARS, BILL, TILL, and SHEL would be completed in accordance with applicable health and safety measures as identified in Section 3.1.4. Lasing activities would be managed under the appropriate range safety regulations governing Edwards AFB. Backdrops, buffer zones, beam path restrictors, and administrative controls (e.g., laser turret restrictions) would be in place during laser ground-testing activities (Figure 3.1-5). Open-range ground testing of the unshrouded laser systems would not be conducted if water is present in the adjacent dry lake. Laser targets used at Edwards AFB would include both rotoplane and target boards. Up to 500 rotoplane and 500 target board tests would be conducted for each of the ABL aircraft.

In order to minimize potential laser hazards, multiple controls would be used to reduce the potential for off-range lasing and accidental lasing of unsuspecting receptors. These controls include:

- Use of backdrops and enclosures
- Horizontal and vertical buffer zones
- Administrative controls (i.e., authorized/trained personnel only)
- Removal of mirror-like reflecting surfaces from the test area.



Ground-Test Setup of Laser Activities, Edwards AFB

Note: Another method of beam control is to orient the laser turret such that it is physically limited to a cleared and restricted target area.

Figure 3.1-5

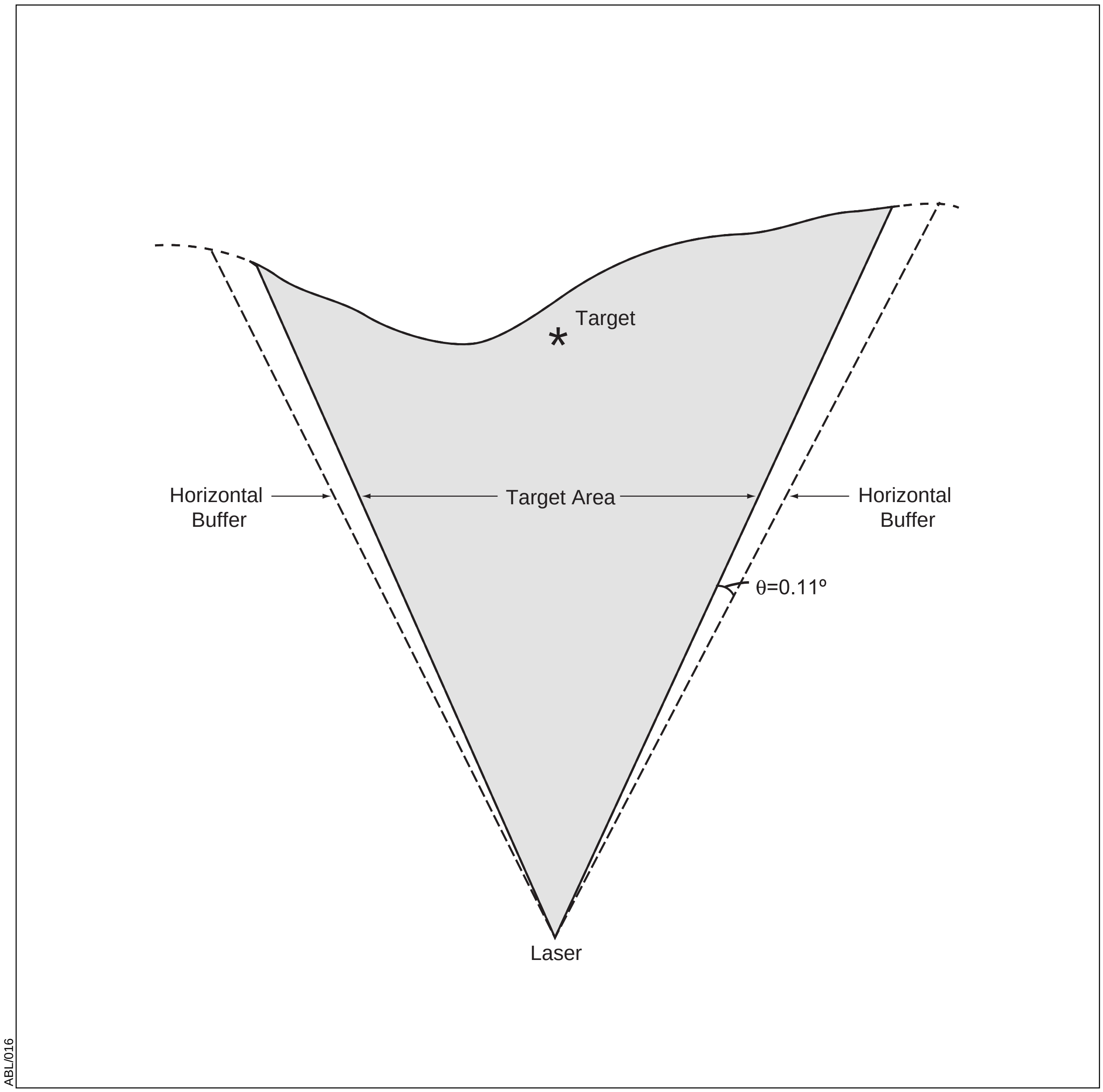
Backdrops and Enclosures. One of the operational hazards associated with these laser systems is that they operate within the near- (e.g., BILL and TILL) and far-infrared (e.g., ARS) wavelengths of the electromagnetic spectrum, which makes these lasers invisible to the unaided eye. Natural backdrops would provide a sufficient vertical boundary preventing anyone from directly viewing the beam or viewing from occurring off range. Backdrops would minimize reflections from leaving the confines of the range. The unlikely, catastrophic failure of the beam control system represents a scenario in which the laser(s) may circumvent backstops and billboards, resulting in potential off-range lasing. Safety interlocks associated with the laser systems are in place to stop lasing activities in the event that the beam control steers the beam from the anticipated beam path.

Horizontal and Vertical Buffers. In accordance with laser range operational procedures, horizontal and vertical buffer zones would be established during ground lasing activities. Buffer zones are used to provide a margin of safety regarding accidental beam shifting or unanticipated beam divergence (Figure 3.1-6). Buffer zones are determined for a specific laser; therefore, the horizontal and vertical buffer zones established for each laser may be different. ANSI Z136.6, Safe Use of Lasers Outdoors, indicates that the buffer zone is established as an angle that is five times the worst-case pointing inaccuracy (American National Standards Institute, 2000b). Based on conducting a ground test at a target 7 km away, the horizontal buffer zone would be approximately 44 feet.

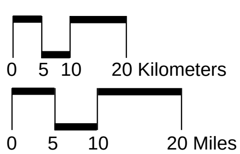
Administrative Controls. Access to the laser range is restricted to authorized and properly trained personnel only, which reduces the possibility of inadvertent exposure to laser (optical) radiation. Prior to any outdoor lasing activities, and in accordance with laser range SOPs, the range is swept to clear all unauthorized personnel from the area. In addition to personnel, the range is cleared of materials with mirror-like surfaces (specular) to minimize reflective hazards prior to lasing activities. Each laser system has SOPs established for its use to ensure operational safety. Also, safety interlocks associated with the laser systems are in place to stop lasing activities in the event that the beam exits the anticipated beam path. Warning signs indicating a laser-controlled area would be posted in accordance with ANSI Z136.1-2000 specifications for the operation of Class 4 lasers. Additional administrative controls are outlined in ANSI Z136.1, *Safe Use of Lasers*, which has been adopted by DOD as the governing standard for laser safety.

As cited by ANSI Z136.1, an adequate hazard criterion, for retinal exposures to nonvisible lasers, should equal 10 seconds. This will account for either incidental viewing or purposeful staring conditions (American National Standards Institute, 2000a). In this case, eye movements provide a natural exposure limitation, eliminating the need for calculations based on exposure durations greater than 10 seconds, except for unusual viewing conditions (American National Standards Institute, 2000a).

In addition to potential direct hazards to the eyes and skin associated with exposure to the laser beam, it is also important to address other hazards associated with the use of lasers (i.e., non-beam hazards). Potential non-beam hazards include:



Example of Horizontal Buffer Zones



Source: ANSI, 2000.

Figure 3.1-6

- Electrocution
- Fire
- Laser-generated air contaminants (LGACs)
- Collateral radiation.

No electrocution hazards would exist outside of the aircraft, as all wiring and electrical support for the lasing activities would be contained within the aircraft.

The irradiance of objects from a Class 4 laser beam presents a fire hazard; however, the target boards and rotoplane target boards would be constructed of flame retardant material, as defined by the National Fire Protection Association (NFPA). Furthermore, the control measures established for the laser range would minimize the potential for any resulting fires to spread beyond the immediate target area or range boundary.

The quantity, composition, and chemical complexity of the LGAC(s) depends greatly upon the beam irradiance (American National Standards Institute, 2000a). When the target irradiance reaches a given threshold, approximately 10^7 watts per square centimeter (W/cm^2) (HEL only), target materials, including plastics, composites, metals, and tissues, may liberate toxic and noxious airborne contaminants (American National Standards Institute, 2000a). Air contaminants can be generated when certain Class 4 laser beams interact with matter (American National Standards Institute, 2000a). Since the target boards would be equipped with infrared sensors to detect the laser beam(s) and sensor data would be transmitted electronically to the testing command and control center, low-power testing would not liberate LGACs because sensing levels are well below levels that would generate LGACs. If high levels are sensed, the laser operations would be terminated, preventing the generation of LGACs.

95 AMDS/SGPB will ensure that appropriate industrial hygiene characterizations of exposure to LGACs are used in accordance with 29 CFR Part 1910.1000, *Air Contaminants*, and AFOSH Standard 48-8, *Controlling Exposures to Hazardous Materials*, so that no occupational overexposures occur. Only the HEL system could exceed LGAC threshold levels; therefore, no LGAC hazard is anticipated during ground-test activities. During flight tests, any LGAC contaminants would be dispersed in the atmosphere above the mixing layer at nonhazardous levels. During HEL operations in the test cell, the atmosphere would pass through a scrubber or verified clean prior to opening or releasing any potential LGAC to the atmosphere.

Potential collateral radiation or broad-band black-body radiation (i.e., Ultraviolet [UV] or blue light) produced as a result of air breakdown at the laser/target interface does not present an immediate hazard to personnel. Since no personnel would be within the immediate lasing area and protective goggles would be worn by personnel, no collateral radiation hazards should exist from the laser ground-testing activities. Once lasing activities are completed, collateral radiation (if any) would cease, and no residual collateral radiation would remain.

The use of backdrops and enclosures, buffer zones, and administrative controls would minimize the health and safety risks associated with ground-based lasing activities at Edwards AFB. These controls would minimize the potential for ocular damage or impairment resulting from exposure to laser (optical) radiation, while also minimizing potential skin damage. Also, any non-beam hazards associated with the laser systems should be adequately controlled based on the in-place controls (discussed above) during lasing operations.

The emissions from the pressure recovery system, composed primarily of water vapor with trace amounts of chlorine and possibly iodine and hydrogen peroxide would be captured and scrubbed. Potential environmental consequences of hazardous materials storage and usage associated with ABL ground- and flight-test activities are presented in Section 3.1.3. No adverse impacts are expected.

Flight-Testing Activities. The primary hazard associated with the flight-testing activities is the reflected laser energy off of a target. At Edwards AFB, the targets include Proteus aircraft and MARTI drops.

Up to 50 MARTI drop tests would be conducted within the R-2508 Airspace Complex utilized by Edwards AFB. Approximately 25 of the MARTI drop tests would involve testing the lower-power ARS, BILL, TILL, and SHEL systems. Approximately 25 MARTI drop test would involve testing the lower-power ARS, BILL, TILL, and high-power HEL systems. Flights may also include on-board beam dumps to internally check the HEL firing, as well as diagnostic checks of the inertial guidance systems by lazing with the HEL to an inertial point above the horizon (e.g. upward at a star). These star shots may be part of any of the HEL operations. The HEL reflection hazard distance has been calculated to be less than 500 meters during missile tests (U.S. Air Force, 2002b). The HEL reflection hazard distance should not exceed this distance during MARTI drop tests at Edwards AFB. All laser engagements of MARTI drop tests would occur at altitudes above 35,000 feet; therefore, public exposure to hazardous levels of direct laser energy would be eliminated.

In addition to the MARTI drop tests, tests using the Proteus aircraft mounted with target boards would be conducted at Edwards AFB. These tests would involve testing the lower-power ARS, BILL, TILL, and SHEL systems. As previously discussed, any laser energy that misses the Proteus aircraft target board would continue upward and away from the ground. The Proteus aircraft would fly above 40,000 feet; therefore, public exposure to hazardous levels of direct laser energy would be eliminated.

Other flight activities from Edwards AFB would include incidental exercises and targets of opportunity. The infrared search and track (IRST), a passive system, and the lower-power lasers would be used to detect, track, and monitor flights from other BMDS operations as opportunities become available. During exercises, these same systems would be used to track targets. In addition, the HEL may be used in a test as MDA desires to support BMDS objectives provided that other environmental analysis has been done to support an HEL shot. These laser engagements would occur at altitudes above 35,000 feet; therefore, public exposure to hazardous levels of direct laser energy would be eliminated.

The U.S. Air Force considers Bird-Air Strike Hazard (BASH) a safety concern for aircraft operations. BASH hazards at Edwards AFB are managed to reduce bird/animal activity relative to aircraft operations. Because Edwards AFB manages BASH concerns and flight-test activities would occur above 35,000 feet, the likelihood of a BASH incident is considered low.

Because ABL testing activities at Edwards AFB would be performed in accordance with applicable regulations, and appropriate safety measures would be implemented, no adverse impacts are expected.

Cumulative Impacts. No other actions have been identified that would contribute to cumulative impacts such that adverse impacts would result.

No-Action Alternative

Under the No-Action Alternative, ABL ground- and flight-testing activities would not be conducted as described in Chapter 2 of this SEIS. ABL test activities would be conducted as analyzed in the 1997 FEIS. No adverse environmental impacts are anticipated.

Mitigation Measures. No mitigation measures would be required under the No-Action Alternative.

3.1.5 Air Quality

Only the emissions in a portion of the total volume of the atmosphere are typically considered when performing an air quality analysis. The quality of air below 3,000 feet AGL is the region of most concern to the human environment. The U.S. EPA generally uses 3,000 feet AGL as the default-mixing height (or depth) across the United States. The mixing height is defined as the height above the surface through which relatively vigorous vertical mixing occurs. The value of this height is set primarily by the atmosphere's local vertical temperature profile. A boundary layer exists at the mixing height that inhibits the rapid vertical transfer of air. Pollutants emitted above the mixing height become diluted in the very large volume of air in the troposphere before they are slowly transported down to ground level. These emissions have little or no effect on ambient air quality. Therefore, the air quality section of this SEIS focuses on emissions below 3,000 feet AGL. The effect of the emergency release of chemicals used by the laser weapons in the troposphere, and the effect of emissions from firings of the HEL during flight tests, are covered in Section 3.7 of the 1997 FEIS.

Air quality in a given location is measured by the concentrations of various pollutants. Pollutant concentrations, expressed in units of parts per million (ppm) or micrograms per cubic meter ($\mu g/m^3$) are determined by the type and amount of pollutants in the atmosphere, the size and topography of the air basin, and the meteorological conditions related to the prevailing climate. The significance of a pollutant concentration is determined by comparison with federal, state, and local ambient air quality standards. These standards establish limits on the maximum allowable concentrations of various pollutants to protect public health and welfare.

In general, air quality is managed by state, regional, and/or local air quality regulatory agencies. These local agencies must enforce the federal standards under the CAA (42 U.S.C. Section 7401), but may also elect to implement more stringent regulations.

The cornerstone of air quality regulation rests on the National Ambient Air Quality Standards (NAAQS) (40 CFR Part 50) for criteria pollutants that pose the greatest threat to air quality. The six criteria pollutants are ozone, carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen oxides (NO_X), lead, and particulate matter equal to or less than 10 microns in diameter (PM_{10}). The NAAQS established acceptable concentration levels for each criteria pollutant. Table 3.1-4 provides a listing of the NAAQS.

Table 3.1-4. National Ambient Air Quality Standards

Pollutant	Averaging Time	National Primary Standard
Ozone	Max Daily 1-hour	0.12 ppm
Carbon monoxide	8-hour	9.0 ppm
	1-hour	35.0 ppm
Sulfur dioxide	Annual Average	0.03 ppm
	24-hour	0.14 ppm
Nitrogen oxides	Annual Average	0.053 ppm
Lead	Maximum Quarterly	1.5 $\mu g/m^3$
PM_{10}	Annual Arithmetic Mean	50 $\mu g/m^3$
	24-Average	150 $\mu g/m^3$

Note: Standards can be expressed as either ppm or $\mu g/m^3$. To convert from ppm to $\mu g/m^3$, multiply ppm by the molecular weight of the compound, and divide the result by 0.0245.
$\mu g/m^3$ = micrograms per cubic meter
PM_{10} = particulate matter equal to or less than 10 microns in diameter
ppm = parts per million

Source: Clean Air Act, 42 U.S.C. Section 7401 et seq.

Areas that exceed the NAAQS are designated as nonattainment areas for the specific pollutant. The fundamental method by which the U.S. EPA tracks compliance with the NAAQS is by designating areas as either attainment, nonattainment, maintenance, or unclassifiable. Areas are given the status of nonattainment when violations of the NAAQS occur. The areas must then comply with more stringent standards until the NAAQS are satisfied. Maintenance areas are those that were previously in nonattainment, but have improved their air quality to meet the NAAQS, and are now in a 10-year probationary period. 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 nonattainment classifications and the associated major level of emissions are shown in Table 3.1-5.

States have the primary responsibility to achieve compliance with the NAAQS, and are required to prepare State Implementation Plans (SIPs) for any regions of noncompliance. After approval by the U.S. EPA, these enforceable plans detail how the state intends to reduce air pollution and meet the NAAQS.

The impact of the criteria pollutant regulations on ABL testing activities is determined by two factors: types and quantities of criteria pollutants estimated to be generated by the test activities, and whether the location of the activities is in a designated attainment, nonattainment, or maintenance area.

Table 3.1-5. Identification of Major Sources

Emission	Nonattainment Area Category	Level of Emissions Defining Major Source (tpy)
Ozone (VOCs or NO_x)	Extreme	10
	Severe	25
	Serious	50
	Moderate	100
	Marginal	100
Carbon monoxide	Moderate	100
	Serious	50
PM_{10}	Moderate	100
	Serious	50

NO_x = nitrogen oxides
PM_{10} = particulate matter equal to or less than 10 microns in diameter
tpy = tons per year
VOC = volatile organic compound

Source: 1990 Clean Air Act Amendments (Public Law 101-549).

Hazardous air pollutants (HAPs) are regulated differently than the criteria pollutants, because they are considered to be (or have the potential to be) carcinogenic, mutagenic, and/or toxic. Under the CAA, the U.S. EPA was tasked to develop NESHAP. Typical sources of HAPs, such as a chemical manufacturing facility, are divided into major and area source categories. Major sources are those that emit 10 tons per year of any one of the listed HAPs, or 25 tons per year of any combination of HAPs. Area sources are those that do not reach these emission levels, but are specifically covered by the regulations because of the nature of their emissions.

The CAA includes special requirements for extremely hazardous substances (EHSs). These are pollutants that could cause death or injury, or require evacuation of the immediate area if an accidental release were to occur. The objective of the statute is to prevent accidental release, and to minimize the consequences of any release. If the total quantity of an EHS present at a facility in a single process exceeds the threshold quantity as listed in 40 CFR Part 68, then the facility is required to complete a safety analysis. This safety analysis includes a risk assessment to determine the public health hazards. A risk management plan must also be developed for worst-case release scenarios. Chlorine and ammonia are listed in 40 CFR Part 68 as EHSs; however, the projected maximum quantity of both substances present at the test locations would be well below the threshold quantity.

The CAA requires Title V operating permits for nearly all stationary sources of significant air emissions, (e.g., entire military installations). The permits generally are issued by a state regulatory agency, and encompass all detailed requirements governing air emissions from the stationary source and related activities such as monitoring, record keeping, and reporting. Before commencing activities at any military installation, permit compliance and paperwork issues would be identified and managed to ensure compliance with the installation Title V permit.

The CAA, as implemented by 40 CFR Part 93, requires that federal agencies not engage in, approve, or support in any way an action that does not conform to applicable State Implementation Plan (SIP) efforts in attaining the NAAQS. The purpose of this requirement is to ensure that emissions from federal actions are consistent with air quality planning goals. MDA actions must not cause nor contribute to any new violation of any standard, increase the frequency or severity of any existing violation of any standard, nor delay the timely attainment of any standard or any required emission reductions or other milestones in any area.

The CAA prohibits federal agencies from engaging in, supporting, licensing, or approving any action that does not conform to an approved state or federal implementation plan to improve the air quality in a region. This requirement was levied to ensure federal activities do not hamper local efforts to meet the NAAQS emission reduction requirements in a nonattainment or maintenance area.

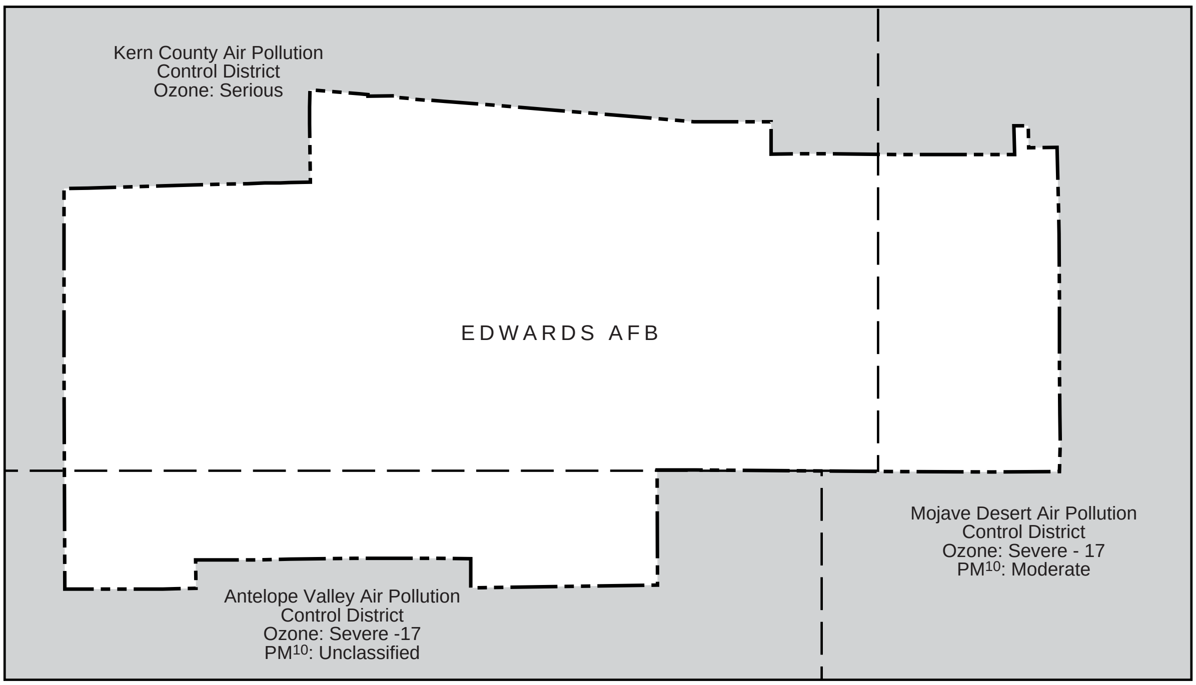
3.1.5.1 Affected Environment.

Information concerning the affected environment and the environmental consequences at the Earth's surface, the planetary boundary layer, and the upper atmosphere were addressed in Sections 3.2.2 and 3.7 of the 1997 FEIS, and are incorporated by reference.

Activities associated with ABL testing activities at Edwards AFB would take place at the Birk Flight Test Facility, situated in Kern County. The Kern County Air Pollution Control District (KCAPCD) administers the air quality program for this area. Edwards AFB is situated in the northwest portion of the Mojave Desert Air Basin. This air basin comprises eastern Kern County and portions of San Bernardino and Los Angeles counties.

ABL testing activities include both ground-level and flight testing. ABL testing activities would be concentrated near the Birk Flight Test Facility (Building 151), and include aircraft take off and landings for the ABL aircraft, F-16 chase aircraft, and Proteus target aircraft. Flight-testing activities would originate from Edwards AFB or on a limited basis from exercise locations, and be conducted within controlled airspace (above 35,000 feet MSL) at the R-2508 Airspace Complex over California; the Western Range over the Pacific Ocean; and WSMR in New Mexico or other exercise location airspace. The ROI for air quality includes the air basin in which Edwards AFB is situated, and focuses on activities that would take place in the immediate area around the Birk Flight Test Facility and runway 24/06.

Kern County is in serious non-attainment for ozone at both federal and state regulatory levels. Portions of Kern and San Bernardino counties are in non-attainment for PM_{10} at both the federal and state regulatory levels. Figure 3.1-7 illustrates the attainment status for the Edwards AFB area. The serious non-attainment designation affects the threshold source size that determines if conformity requirements would apply to the Proposed Action. For volatile organic compounds (VOCs) and NO_X, this threshold is 50 tons per year. The present action does not introduce new stationary sources of NO_X and VOCs and so the New Source Review (NSR) discussion in the 1997 FEIS remains in effect. For PM_{10}, a portion of Edwards AFB is unclassified (attainment).



EXPLANATION

Severe - 17	25 ton limit per pollutant per action per year
Moderate	100 ton limit per pollutant per action per year
Serious	50 ton limit per pollutant per action per year
Unclassified	No established limit
— - - —	Base Boundary
— — —	Air Pollution/Air Quality District Boundary

Not to Scale   Source: 40 CFR 81.305

Current NAAQS Attainment Status, Edwards AFB

Figure 3.1-7

Kern County is in serious non-attainment for the NAAQS maximum 1-hour ozone observation (Table 3.1-6). Other criteria pollutants such as 24-hr average PM_{10} observations nearest Edwards AFB show ambient concentration well below the NAAQS. The maximum 8-hr carbon monoxide (CO) concentrations, while increasing slightly in the most recent years, remain well below the NAAQS.

Table 3.1-6. Summary of Maximum Criteria Pollutant Concentrations in Kern County

Year	Criteria Pollutants			
	CO (8-hr) ppm	PM_{10} (24-hour) $\mu g/m^3$ (MDAPCD Maximum)	Ozone (1-hour) ppb (KCAPCD Maximum)	Ozone (1-hour) ppb (MDAPCD Maximum)
1996	7.7	41	165	130
1997	3.4	130	146	119
1998	3.9	41	165	134
1999	5.0	45	140	119
2000	5.4	44	151	113

CO = carbon monoxide
KCAPCD = Kern County Air Pollution Control District
$\mu g/m^3$ = micrograms per cubic meter
MDAPCD = Mojave Desert Air Pollution Control District
PM_{10} = particulate matter equal to or less than 10 microns in diameter
ppb = parts per billion
ppm = parts per million

Table 3.1-7 shows the 1990 baseline emission inventory estimates for the three air pollution control districts around Edwards AFB. This baseline inventory has been used for planning purposes such as the 1994 SIP, and is the basis for conformity determinations. If the Proposed Action emissions are less than both the de minimis thresholds and 10 percent of the emission inventories in the region, then the requirements of air conformity do not apply. From Table 3.1-7 it can be noted that the de minimis thresholds would be far less than 10 percent of the emission inventories.

Table 3.1-7. 1990 Baseline Emissions and Threshold Values

	1990 Baseline Emissions (tons/year)			10-Percent Threshold (tons/year)			De Minimis Threshold (tons/year)		
District	NO_x	VOC	PM_{10}	NO_x	VOC	PM_{10}	NO_x	VOC	PM_{10}
AVAPCD	10,220	12,775	NA	1,022	1,278	NA	25	25	100
KCAPCD	14,965	6,205	NA	1,497	621	NA	50	50	NA
MDAQMD	41,610	16,790	34,310	4,161	1,679	3,431	25	25	100
Edwards AFB[(a)]	791	590	NA	NA	NA	NA	NA	NA	NA

Note: (a) Edwards AFB 2002 estimated emissions (both mobile and stationary).
AVAPCD = Antelope Valley Air Pollution Control District
KCAPCD = Kern County Air Pollution Control District
MDAQMD = Mojave Desert Air Quality Management District
NA = not applicable
NO_X = nitrogen oxides
PM_{10} = particulate matter equal to or less than 10 microns in diameter
VOC = volatile organic compound

3.1.5.2 Environmental Consequences

Proposed Action

Ground-Testing Activities. The ground-level testing contribution to the total emissions would be minimal. Vehicle miles traveled (VMT) to support laser refueling would be required; and AGE support for test activities would be necessary.

An analysis of potential ammonia and hydrogen peroxide emissions from the GPRA during ground-test activities at Edwards AFB was performed. These substances would be sent through a scrubber with a better than 95 percent efficiency prior to being exhausted to the environment over an approximately 1 minute period from a 60-foot tall release point. Approximately 90,000 pounds of these substances would be sent through the scrubbers on an annual basis. Based on modeling results using only a 95 percent scrubber efficiency for light wind and highly unstable conditions, the maximum concentration of ammonia at 6 feet (2 meters) AGL would be approximately 8 ppm at about 165 feet (50 meters) from the exhaust stack. Based on the temperature and configuration of the exhaust system, only trace amounts (if any) of hydrogen peroxide would occur. These concentrations of ammonia and hydrogen peroxide are well below the Chemical of Concern (COC) level of 200 ppm established by the U.S. EPA; therefore, no adverse effects from these emissions are anticipated. For Block 2008 activities with the higher throughput of exhaust gases, additional support equipment for the vacuum may be required (e.g., a second vacuum sphere to complement the one built for Block 2004 activities). Any construction would be on previously disturbed or paved surfaces. The emissions from the Block 2008 laser modules would still be routed through the appropriate scrubbers and the only impact would be longer run times to handle the larger volumes.

Flight-Testing Activities. The major source of emission changes would be due to the VMT used for flight support, and the additional emissions from the ABL aircraft and the two F-16 chase aircraft takeoff and landings. The number of takeoff and landings would increase from that considered in the 1997 FEIS due to the increase in the number of MARTI drop tests and the substitution of a larger number of Proteus aircraft tests in place of the originally planned drone tests. The increase is also due to the fact that Edwards AFB now operates as the Home Base for ABL testing activities. The specifics of the proposed flights are presented in Table 3.1-8. Block 2006 upgrade flight tests (if needed) would be flown in conjunction with these flight tests for missile, MARTI, and Proteus planned flights.

The emissions resulting from ABL ground- and flight-test activities are summarized in Table 3.1-9. Calculations for the air quality analysis are provided in Appendix F.

A comparison of Table 3.1-7 and Table 3.1-9 indicates that the emissions resulting from the Proposed Action are less than 10 percent of the emissions inventories of the Kern County Air Pollution Control District, Mojave Desert Air Pollution Control District, and Antelope Valley Air Pollution Control District. Under current regulations the requirements of air conformity do not apply to the action.

Table 3.1-8. ABL Testing Activities, Planned Flights (for each Block version)

Flight Description	Year 1	Year 2
Missile[(a)]	20	40
Proteus	50	0
MARTI Drop	25	25
Total[(b)]	95	65

Note: (a) No missile launches are proposed at Edwards AFB, the number of flights is for test activities at WSMR and Vandenberg AFB where missile launches would occur.
(b) For years 3, 4, and 5 of test activities, it is estimated that 36 flights per year would occur.

Table 3.1-9. Estimated Emissions from ABL Testing Activities at Edwards AFB (tons/year)

	Criteria Pollutant			
	VOC		NO_X	
Year	Mobile	Stationary	Mobile	Stationary
Year 1	14.11	0.16	43.81	4.21
Year 2	11.33	0.59	29.37	8.87
Years 3, 4, and 5[(b)]	11.12	0.38	18.34	6.03
De minimis[(a)]	50		50	

Notes: Mobile emissions refers to aircraft and vehicle operations; stationary emissions refer to aircraft support equipment (i.e., AGE).
(a) Kern County Air Pollution Control District de minimis levels provided as test activities would occur solely within this district.
(b) For years 3, 4, and 5 of test activities, it is estimated that 36 flights per year would occur.
NO_X = nitrogen oxides
VOC = volatile organic compound

The accidental release scenarios described in the 1997 FEIS are still valid. The small level of emissions would have no impact on the upper atmosphere, and are not significantly different than those described in Section 3.7 of the 1997 FEIS.

Software upgrades and other improvements to the Block 2004 aircraft would be tested and added to that test aircraft under a Block 2006 effort. Once upgraded with the newer operating system, the Block 2004 aircraft would be designated as the Block 2006 aircraft. The Block 2006 effort would also develop field transportable hardware to support deployment of the ABL aircraft. The increased capability of the Block 2006 aircraft will come primarily as a result of software improvements, but hardware changes may also occur. No significant changes are anticipated from the Block 2004 design and implementation of the ABL, thus the environmental impacts would not be different than already covered by the Block 2004 discussions.

Targets of opportunity create emissions from flight activities. Targets of opportunity come in two forms. The first is a simple infrared (IR) signal given off by a moving military article (e.g., aircraft, missile, or similar vehicle) that can be passively observed with the IRST, and, in the case of unmanned target vehicles tracked by the BILL/TILL/ARS lasers. The second type is for a missile or similar vehicle that is unmanned and the target can handle the flash of the HEL (similar to the MARTI HEL activities where a simple flash is done to the target without destroying it). These opportunity targets would be conducted in conjunction with other flight tests already planned and covered in this SEIS or in lieu of the ones outlined in Table 3.1-8, so no additional impacts are expected from these targets of opportunity activities. Other BMDS elements may also passively observe the ABL tests outlined in this document as targets of opportunity to determine/verify their systems and also test the interoperability of the entire BMDS to defeat ballistic missiles. Environmental impacts from their participation would be covered under other environmental analysis.

For exercises, take-off and landing activities would occur at facilities capable of handling the 747's weight and take-off distance requirements. These are operational facilities already set up for heavy aircraft and the addition of the few takeoffs and landings anticipated would have only temporary and negligible impacts to the environment.

Mitigation Measures. Because emissions from proposed ABL test activities would not exceed the de minimis threshold of 50 tons per year for VOCs and NO_x, no mitigation measures would be required.

Cumulative Impacts. Total emissions from all ABL testing activities at Edwards AFB are expected to have no adverse cumulative impacts on air quality in general, or impacts on the California SIP for KCAPCD. The KCAPCD SIP emission budgets for Edwards AFB are 3,285 tons per year of NO_X and 1,314 tons per year of VOCs. A comparison of emissions given in Table 3.1-9 against these emission budgets indicates that ABL test activities represent approximately 5 percent or less of the emissions budgets, and are less than 10 percent of the 2002 Edwards AFB estimated emissions. Estimated future Edwards AFB emissions given in Table 3.1-7 are well within the KCAPCD SIP emission budgets. Therefore no adverse cumulative impacts on air quality are expected.

No-Action Alternative

Under the No-Action Alternative, ABL ground- and flight-testing activities would not be conducted as described in Chapter 2 of this SEIS. ABL test activities would be conducted as analyzed in the 1997 FEIS. No adverse environmental impacts are anticipated.

Mitigation Measures. No mitigation measures would be required under the No-Action Alternative.

3.1.6 Noise

Noise is generally defined as sound that is undesirable because it (1) is intense enough to damage hearing, (2) interferes with speech communication and sleep, or (3) is annoying. Sound can vary simultaneously in level (or loudness) and frequency content (pitch), while also varying in time of occurrence and duration. The fundamental measure of sound level is expressed in units of dB using a logarithmic scale. Common sounds vary in amplitude over a range of many millions. For instance, an aircraft fly-over may produce pressure amplitude a hundred times greater than a car driving by on a nearby street. On the logarithmic scale, these noise sources would differ by 40 dBA. Table 3.1-10 provides examples of typical indoor and outdoor sound levels.

It is the policy of federal agencies such as the FAA, DOD, Department of Housing and Urban Development (HUD), and the U.S. EPA to assess long-term, cumulative exposure to environmental noises, including aircraft traffic, and rail noise in terms of day-night average sound level (DNL). The Federal Interagency Committee on Urban Noise has published land use compatibility guidelines for noise (1980). Residential land uses are normally compatible with DNL values of 65 dBA and less. The sound exposure level (SEL) is used to compare noise emissions of the various sound sources where ABL testing activities are proposed.

3.1.6.1 Affected Environment.

The ROI for noise exposure at Edwards AFB includes the area around Building 151 and the east end of the taxi apron from which open-range ABL ground-testing activities would emanate. These areas are immediately adjacent to an active runway, and are not near any housing areas. These locations fall within the 70-dBA noise contour of current Edwards AFB operations.

Noise sources at Edwards AFB include subsonic and supersonic aircraft operations, surface traffic, rail service operations, ground tests, and stationary mechanical and electrical equipment. Flight activities over the R-2508 Airspace Complex are described in Section 3.1.2, Airspace. Between January 1995 to September 1995, there were 110 complaints complied by the Central Coordinating Facility. Nine of the complaints were related to noise; the others were related to either low-level flights within the National Parks situated within the R-2508 Airspace Complex, or to sonic booms.

3.1.6.2 Environmental Consequences

Proposed Action

Ground-Testing Activities. Noise generated by the GPRA (a low-pressure, low-velocity device) during ground tests of the HEL is expected to be approximately 10 dBA. The associated ejector tubes and turbopumps are expected to generate noise levels of approximately 110 and 134 dBA during the short duration (approximately 20 seconds) of the ground test. These noise levels do not take into account attenuation due to their surrounding environments (the SIL building and Building 151); therefore, exterior noise levels are expected to be lower. Increased noise levels from use of AGE and other ground support equipment adjacent to the runway during ground-testing activities would not exceed typical flightline noise levels and would not cause adverse effects to residential areas or the local population. No mitigation measures would be required.

Flight-Testing Activities. All ABL flight tests would originate at Edwards AFB. Up to 255 flight tests (to occur at WSMR, R-2508 Airspace Complex, and Western Range) are proposed. Each test would involve one ABL aircraft, and up to two F-16 chase aircraft. The ABL aircraft and F-16 chase aircraft would

Table 3.1-10 Comparative Sound Levels

Common Outdoor Sound Levels	Sound Level (dB)	Common Indoor Sound Levels
	110	Rock Band
Jet Flyover at 1,000 feet		
	100	
		Inside Subway Train (New York)
Gas Lawnmower at 3 feet		
	90	
Diesel Truck at 50 feet		
		Food Blender at 3 feet
Noisy Urban Daytime		Garbage Disposal at 3 feet
	80	
		Shouting at 3 feet
Gas Lawnmower at 100 feet		
		Vacuum Cleaner at 10 feet
	70	
Commercial Area		
		Normal Speech at 3 feet
Heavy Traffic at 300 feet		
	60	
		Large Business Office
		Dishwasher Next Room
	50	
		Small Theater, Large Conference Room (Background)
Quiet Urban Nighttime		
	40	
Quiet Suburban Nighttime		
		Library
	30	Bedroom at Night
Quiet Rural Nighttime		Concert Hall (Background)
	20	
		Broadcast and Recording Studio
	10	
		Threshold of Hearing
	0	

Source: Baranek, 1971.

ABL/019

normally maneuver at high altitudes above 35,000 feet within the R-2508 Airspace Complex. There would also be up to 50 flight tests involving the Proteus aircraft. The ABL program average daily aircraft operations are provided in Table 3.1-11.

Table 3.1-11. ABL Program Average Daily Aircraft Operations

Aircraft	Operation	Daily Average
ABL Aircraft	Arrivals	0.56
	Departures	0.56
	Closed Loop	
F-16	Arrivals	1.14
	Departures	1.14
	Closed Loop	
Proteus	Arrivals	0.19
	Departures	0.19
	Closed Loop	

ABL = Airborne Laser

The increase in DNL noise exposure at Edwards AFB is estimated to be 0.8 dBA. This is estimated by comparing the sum of the energy product of SEL and operations for each aircraft type, with a similar sum that included the Proposed Action. A 10-dB penalty is applied to nighttime operations.

The Proteus aircraft would fly at or above 35,000 feet in a pattern at various distances from the ABL aircraft. Although the tests would occur over an 8-hour period, actual time over R-2508 would be less than 6 hours. The remaining time would involve preflight activities, flight time to and from Edwards AFB, and post-flight activities. The DNL from the aircraft activities over the ranges would be less than 55 dBA. The increase in noise from ABL flight-test activities would not increase Edwards AFB noise contours; therefore, no noise impact are anticipated.

Mitigation Measures. Because there are no adverse impacts anticipated under the Proposed Action, mitigation measures are not required.

Cumulative Impacts. No other actions have been identified that would contribute to cumulative impacts such that adverse impacts would result.

No-Action Alternative

Under the No-Action Alternative, ABL ground- and flight-testing activities would not be conducted as described in Chapter 2 of this SEIS. ABL test activities would be conducted as analyzed in the 1997 FEIS. No adverse environmental impacts are anticipated.

Mitigation Measures. No mitigation measures would be required under the No-Action Alternative.

3.1.7 Biological Resources

3.1.7.1 Affected Environment.

The ROI is the environment within the confines of the Edwards AFB fence line. However, the primary focus of activities is in the immediate area surrounding the Birk Flight Test Facility and areas that target boards would be positioned.

The Endangered Species Act (16 U.S.C. Sections 1531-1544) is intended to protect and restore threatened and endangered species of animals and plants and their habitats. Other federal statutes protecting biological resources include the Migratory Bird Treaty Act (16 U.S.C. Sections 703-712), the Bald Eagle and Golden Eagle Protection Act (16 U.S.C. Section 668-668d), and the Fish and Wildlife Coordination Act (16 U.S.C. Sections 661-667d) and the Sikes Act as amended (16 U.S.C. 670a-670o).

The official California listing of threatened and endangered plants is contained in the California Code of Regulations (CCR) Title 14 Section 670.2. The official California listing of threatened and endangered animals is contained in CCR Title 14 Section 670.5.

Vegetation. The most common plant communities within the ROI are Joshua tree (*Yucca brevifolia*) woodlands, creosote bush scrub, and halophytic-phase saltbush scrub. Joshua tree woodlands are most prevalent east of Rogers Dry Lake. Typically, Joshua tree woodland understories include saltbush or creosote bush that supports a high diversity of annual plant species, including the native desert dandelion (*Malacothrix glabrata*), pincushion (*Chaenactis* sp.), and fiddleneck (*Amsinckia tesselata*) (U.S. Air Force, 1997d).

Creosote bush scrub is dominated by creosote bush (*Larrea tridentata*). It occurs under the same or similar edaphic (soil) conditions as Joshua tree woodlands, and is the most common understory for that community. Creosote bush scrub is distributed throughout the northwest and east portions of the base, and supports the highest plant diversity on base. Common associated species include burrobush (*Ambrosia dumosa*), winterfat (*Krascheninnikovia lanata*), cheesebush (*Hymenoclea salsola*), and Nevada tea (*Ephedra nevadensis*) (U.S. Air Force, 1997d).

Halophytic-phase saltbush scrub occurs in narrow bands around dry lakebeds. Common plants of halophytic-phase saltbush scrub include shadscale (*Atriplex confertifolia*) and four-wing saltbush (*A. canescens*), alkali goldenbush (*Isocoma acradenia* spp. *acradenia*), and rubber rabbitbrush (*Chrysothamnus nauseosus*). The understory comprises primarily kochia (*Kochia californica*), wild rye (*Elymus cinereus*), saltgrass (*Distichlis spicata*), goldfields (*Lasthenia californica*), and alkali pineappleweed (*Chamomilla occidentalis*) (U.S. Air Force, 1997d).

Wildlife. Common mammals on Edwards AFB include the black-tailed jackrabbit (*Lepus californicus*), desert cottontail, coyote, desert kit fox, deer mouse (*Peromyscus maniculatus*), grasshopper mouse (*Onychomys torridus*), little pocket mouse (*Perognathus longimembris*), and Merriam's kangaroo rat. Other common mammals include western pipistrelle (*Pipistrellus hesperus*), little brown bat (*Myotis lucifugus*), and desert woodrat (*Neotoma lepida*) (U.S. Air Force, 1997d).

Common and widespread birds include the turkey vulture (*Cathartes aura*), common raven (*Corvus corax*), sage sparrow (*Amphispiza belli*), and western meadowlark. Common bird species found in creosote scrub include horned lark (*Eremophila alpestris*), black-throated sparrow, and sage sparrow (*Amphispiza belli*). The seasonal inundation of lakebeds and clay pans attracts wading bird species, including black-necked stilt (*Himantopus mexicanus*), American avocet (*Recurvirostra americana*), and greater yellowlegs (*Tringa melanoleuca*). Seasonal waterfowl in both permanent and temporary bodies of water include ducks and geese such as ruddy duck (*Oxyura jamaicensis*), northern mallard (*Anas platyrhynchos*), northern pintail (*Anas acuta*), Canada goose (*Branta canadensis*), and snow goose (*Chen caerulscens*) (U.S. Air Force, 1997d).

Amphibians identified on Edwards AFB are the western toad (*Bufo boreas*) and red-spotted toad (*Bufo punctatus*). Exotic species found include the Pacific tree frog (P*seudacris = [Hylla] regilla*) and the African clawed frog (*Xenopus laevis*). Reptiles common to most habitats on base include the desert spiny lizard (*Sceloporus magister*), side-blotched lizard (*Uta stansburiana*), western whiptail (*Cnemidophorus tigris*), and zebra-tailed lizard (*Callisaurus dracoinides*). The glossy snake (*Arizona elegans*), coachwhip (*Masticophis flagellum*), gopher snake (*Pituophis melano leucus*), and the Mojave green rattlesnake (*Crotalus scutulatus*) are snakes common both regionally and on base (U.S. Air Force, 1997d).

Threatened and Endangered Species. No state or federally listed plant species are found on Edwards AFB. Federally and state-listed species of threatened or endangered wildlife that may be present in the vicinity of the Proposed Action on Edwards AFB are listed in Table 3.1-12. Of these, the desert tortoise (Gopherus agassizii) (federally and state listed as threatened) is most likely to be found in the vicinity of the Birk Flight Test Facility or near the proposed target locations.

Table 3.1-12. Threatened and Endangered Species Known or Expected to Occur at Edwards AFB, California

Common Name	Scientific Name	State Status	Federal Status
American peregrine falcon	*Falco peregrinus anatum*	E	-
Bald eagle	*Haliaeetus leucocephalus*	E	T
Desert tortoise	*Gopherus agassizii*	T	T
Mohave ground squirrel	*Spermophilus mohavensis*	T	–

- = no status indicated
E = endangered
T = threatened

Sensitive Habitats. Approximately 60,800 acres (100 square miles or 21 percent) of Edwards AFB falls within the Fremont-Kramer Desert Tortoise Critical Habitat Unit. The ABL testing area includes desert tortoise critical habitat.

Many playas, ephemeral pools, and drainages exist throughout Edwards AFB, including Rogers, Rosamond, and Buckhorn dry lakes.

Several areas of significant topographic relief occur on base including Leuhman Ridge, Rosamond Hills, Bissell Hills, and the cliffs just to the north of Rosamond Dry Lake. These areas contain nesting habitats for raptors and shelter areas for many mammal species (U.S. Air Force, 1997d).

3.1.7.2 Environmental Consequences

Proposed Action

Ground-Testing Activities. The majority of testing efforts to be conducted at Edwards AFB would be ground based, using either a rotoplane or ground target board. Ground-testing activities would be conducted just prior to sunrise, or just after sunset to minimize atmospheric effects of ground heating and blowing dust. Flight testing is also anticipated to occur during nighttime hours. These actions would minimize any potential harassment or take of desert tortoises, as the desert tortoise would typically be within its burrow at these hours.

According to the Biological Opinion for Routine Operations and Facility Construction Within the Cantonment Areas of Main and South Bases, Edwards Air Force Base, California (U.S. Fish and Wildlife Service, 1991), surveys detected few signs of desert tortoise in the southern portion of Edwards AFB. Surveys conducted in 1993 also detected few signs of desert tortoise in the southern portion of the base (Mitchell et. al., 1993). Actions conducted at the ABL Complex situated at the Birk Flight Test Facility are covered under this biological opinion.

The targeting boards and targets would be placed within the Precision Impact Range Area (PIRA), which is covered under a different biological opinion reflecting its greater tortoise density. These operations are covered under the Biological Opinion for the Precision Impact Range Area, Edwards Air Force Base, California (1-8-94-F-6). Two of the potential target sites, Mt. Mesa and Grinnel, fall within desert tortoise critical habitat, in a Zone 3 Desert Tortoise Management Area.

This area is particularly sensitive to ground-disturbing activities. Under the Biological Opinion, individual projects are limited to 5 acres with a maximum total disturbance of 100 acres. To minimize impact, targeting boards and targets will be transported via existing (dirt or paved) roads. Targets and transport vehicles' final positions will be on preexisting roads; therefore, no ground-disturbing activity would occur.

Noise generated by the GPRA during ground tests of the HEL is expected to be approximately 10 dBA. The associated ejector tubes and turbopumps are expected to generate noise levels of approximately 110 and 134 dBA during the short duration (approximately 20 seconds) of the ground test. These noise levels do not take into account attenuation due to their location within the lower lobe of the fuselage, which is within the SIL; therefore, exterior noise levels are expected to be lower. This noise level is similar to that generated by the current operation of the adjacent runway, and would be relatively infrequent. Therefore, the proposed operation activities would not adversely impact the local biological resources over current conditions.

Flight-Testing Activities. Flight-testing activities associated with Edwards AFB would be conducted at high altitudes (at or above 35,000 feet) over the R-2508 Airspace Complex (see Figure 2.2-4). Other ABL flight-testing activities proposed over WSMR and the Western Range would originate from Edwards AFB. Because these flight tests would occur at high altitudes, no adverse impacts to biological resources are anticipated.

Mitigation Measures. Because there are no adverse impacts anticipated under the Proposed Action, mitigation measures are not required.

Cumulative Impacts. No other actions have been identified that would contribute to cumulative impacts such that adverse impacts would result.

No-Action Alternative

Under the No-Action Alternative, ABL ground- and flight-testing activities would not be conducted as described in Chapter 2 of this SEIS. ABL test activities would be conducted as analyzed in the 1997 FEIS. No adverse environmental impacts are anticipated.

Mitigation Measures. No mitigation measures would be required under the No-Action Alternative.

3.1.8 Cultural Resources

Cultural resources are sites, structures, districts, artifacts, or other physical evidence of human activity considered important to a culture, subculture, or community for scientific, traditional, religious, or other reasons. Cultural resources are generally further divided into archaeological resources (either prehistoric or historic), historic buildings and structures, and traditional resources (e.g., American Indian). Paleontological resources will also be considered in this section.

A number of federal and state laws and regulations protect cultural and paleontological resources. The Antiquities Act and P.L. 74-292 (the National Natural Landmarks Program) regulate impacts to paleontological resources. The National Historic Preservation Act (NHPA) (particularly Sections 106 and 110) is the key federal statute regulating the identification and protection of cultural resources. The NHPA established the National Register of Historic Places (NRHP), the responsibilities of the State Historic Preservation Officer (SHPO), and the Section 106 review and compliance process. The NRHP maintains an inventory of qualifying (listed) cultural resources. The regulations that protect properties listed on the NRHP also extend to those properties that are eligible (based on National Park Service guidelines for integrity) but not yet listed. The responsibilities of the SHPO include participation in the review of proposed federal actions that affect cultural resources. Section 106 is a procedural requirement whereby federal agencies must consider the effects of their actions on cultural resources that are either listed or eligible for listing on the NRHP.

3.1.8.1 Affected Environment.

Edwards AFB has a Cultural Resources Management Plan in place that details the goals, objectives, and priorities for management of the base's numerous historic resources. Specifically, the plan concerns the responsibilities of the Base Historic Preservation Officer (BHPO), the base's inventory and evaluation program, the base's nomination and protection program, a plan to comply with existing legislation concerning Native American consultation, and the curation of cultural materials. This management plan is intended to support a Programmatic Agreement that will constitute SHPO and Advisory Council for Historic Preservation (Council) comment for many management areas.

The ROI for cultural resources is the area within the confines of the Edwards AFB boundary. However, the primary focus of activities is in the immediate area surrounding the Birk Flight Test Facility and areas that target boards would be positioned.

Numerous cultural resource surveys have been conducted at Edwards AFB resulting in the identification of over 2,000 cultural resources, of which roughly half are considered prehistoric, and half are considered historic. Only a relatively small number of prehistoric cultural resources at Edwards AFB have been formally evaluated for eligibility to the NRHP, and of those, approximately 12 have been recommended for inclusion by the BHPO. The northeastern hilly portion of Edwards AFB at elevations greater than 2,500 feet above sea level are not considered sensitive for prehistoric resources. Sensitivity increases westward and is highest in the low-lying areas surrounding dry lake beds. Previously identified prehistoric sites range from villages to small artifact scatters.

A wide variety of historic cultural resources have also been identified at Edwards AFB. These sites range from town sites and mining sites to trash scatters. Numerous buildings and structures at Edwards AFB are or may be NRHP eligible under the World War II or Man-In-Space themes. The northern portion of Rogers Lake has been designated as a National Historic Landmark under the Man-In-Space theme (U.S. Air Force, 1997a).

No traditional Native American sacred or ceremonial sites are not known to occur within the boundaries of Edwards AFB, although it is conceivable that they may exist (U.S. Air Force, 1997a).

Approximately 550 paleontological finds, some as old as 21 million years, have been documented on Edwards AFB. These finds have been recovered from limestone outcrops southeast of Kramer junction and alluvial sediments associated with the Rosamond and Rogers dry lake areas.

3.1.8.2 Environmental Consequences

Proposed Action

Ground-Testing Activities. Ground-testing activities would occur on previously disturbed, paved, or developed land. No construction activity would be necessary for ground-testing activities. Therefore, there are no foreseen impacts to cultural or paleontological resources on Edwards AFB resulting from proposed ground- testing activities by the ABL Program.

Flight-Testing Activities. Flight-testing activities would involve up to 50 MARTI Drop tests and 50 Proteus aircraft tests. Only low-power tests would occur during tests with the Proteus aircraft. Approximately 25 of the MARTI Drop tests would involve low-energy engagements; the remaining tests could involve high-energy engagements. No target debris is anticipated from proposed flight-test activities at Edwards AFB; therefore, no debris recovery or ground disturbance would occur. No adverse impacts to cultural resources are anticipated.

Mitigation Measures. Because no ground disturbance would occur during proposed ground- and flight-test activities at Edwards AFB, no adverse impacts to cultural resources are anticipated. No mitigation measures would be required.

Cumulative Impacts. No other actions have been identified that would contribute to cumulative impacts such that adverse impacts would result.

No-Action Alternative

Under the No-Action Alternative, ABL ground- and flight-testing activities would not be conducted as described in Chapter 2 of this SEIS. ABL test activities would be conducted as analyzed in the 1997 FEIS. No adverse environmental impacts are anticipated.

Mitigation Measures. No mitigation measures would be required under the No-Action Alternative.

3.1.9 Socioeconomics

3.1.9.1 Affected Environment.

The ROI for socioeconomics includes northern Los Angeles and southeastern Kern counties. Within Los Angeles County, the communities most likely to host the personnel associated with the ground- and flight-testing activities are Lancaster and Palmdale, the two largest communities close to Edwards AFB. Rosamond and California City in Kern County may also host personnel. The affected environment is described below in terms of its principal attributes: population, income, employment, and housing.

Population. In 1999, Los Angles County had a population of almost 9.4 million, and Kern County had a population of 640,000 (Bureau of Economic Analysis, 2001a). The communities most likely to host temporary personnel associated with the ABL Program are Lancaster, Palmdale, and Mojave, the closest communities with the largest concentration of available housing and hotels/ motels. Lancaster and Palmdale both have populations of less than 200,000 each. Mojave has a population of 3,800 (Census Bureau, 2001).

Income. In 1999, Los Angeles County had a per capita personal income of $28,276. This ranked 17th in the state, and was 95 percent of the state average of $29,856, and 99 percent of the national average of $28,546. Kern County had a per capita income of $19,886. This ranked 47th in the state, and was 67 percent of the state average of, and 70 percent of the national average (Bureau of Economic Analysis, 2001b).

Employment. Full- and part-time employment in Los Angeles County totaled 5.4 million in 1999, up from 5.3 million in 1989. Kern County had 310,000 full- and part-time employees in 1999, up from 250,000 in 1989 (Bureau of Economic Analysis, 2001a).

Edwards AFB employs approximately 14,000 individuals, 40 percent of whom are military personnel. Lancaster and Palmdale had labor forces of 49,000 and 36,000, respectively, in July 2001, and unemployment rates of 5.9 and 5.8 percent, respectively. Mojave had a labor force of just over 2,100. The unemployment rate for Mojave was 5.3 percent in July 2001 (California Employment Development Department, 2001).

Housing. Los Angeles County had a total of 3.2 million housing units in 2000, with almost 42,000 in Lancaster, 37,000 in Palmdale, and 1,800 in Mojave. Vacancy rates were 4.2 percent for Los Angeles County, 8.4 percent in Lancaster, and 7.6 and 22 percent in Palmdale and Mojave, respectively (U.S. Census Bureau, 2002).

3.1.9.2 Environmental Consequences

Proposed Action

Ground-Testing Activities. Ground-testing activities at Edwards AFB are expected to require up to 750 permanent program-related personnel and up to 50 temporary personnel during the test period. Given the normal daily, weekly, and monthly fluctuation of population, employment, and visitors to both Edwards AFB and local communities in the ROI, the 750 additional program-related personnel and up to 50 temporary personnel during the test period would have a small, positive, yet largely unnoticeable effect on population, income, or employment in the ROI. Because the increase in the number of employees would represent only a 5 percent increase in the number of people employed at Edwards AFB, and just 0.74 percent of the total labor force of the ROI, the impact, although positive, would be small. There would most likely not be any discernable effect on direct, indirect, or induced jobs, income, housing, and related population.

Flight-Testing Activities. Flight-testing activities at Edwards AFB are expected to require up to 750 program-related personnel and up to 50 temporary personnel during the test period. However, as with ground-testing activities, this infusion is not likely to result in any discernable effect of direct, indirect, or induced jobs, income, and related population.

Mitigation Measures. No mitigation measures would be necessary for either the ground-testing or flight-testing activities.

Cumulative Impacts. With no discernible impacts expected for the ABL Program's testing activities, the potential for additive, incremental, cumulative impacts of the ABL Program, in addition to other past, current, or reasonably foreseeable projects is considered remote.

No-Action Alternative

Under the No-Action Alternative, ABL ground- and flight-testing activities would not be conducted as described in Chapter 2 of this SEIS. ABL test activities would be conducted as analyzed in the 1997 FEIS. No adverse environmental impacts are anticipated.

Mitigation Measures. No mitigation measures would be required under the No-Action Alternative.

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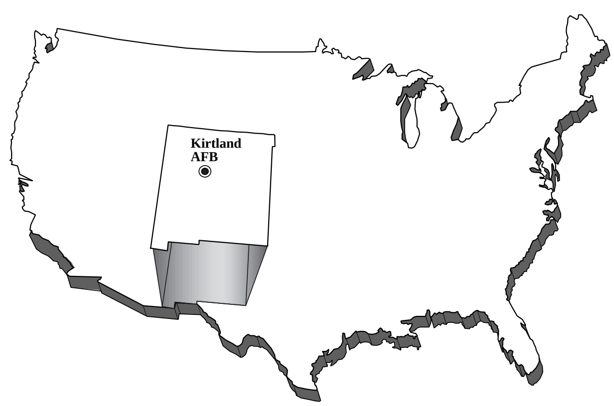


SECTION 3.2
KIRTLAND AIR FORCE BASE

3.2 KIRTLAND AIR FORCE BASE

3.2.1 Local Community

Background

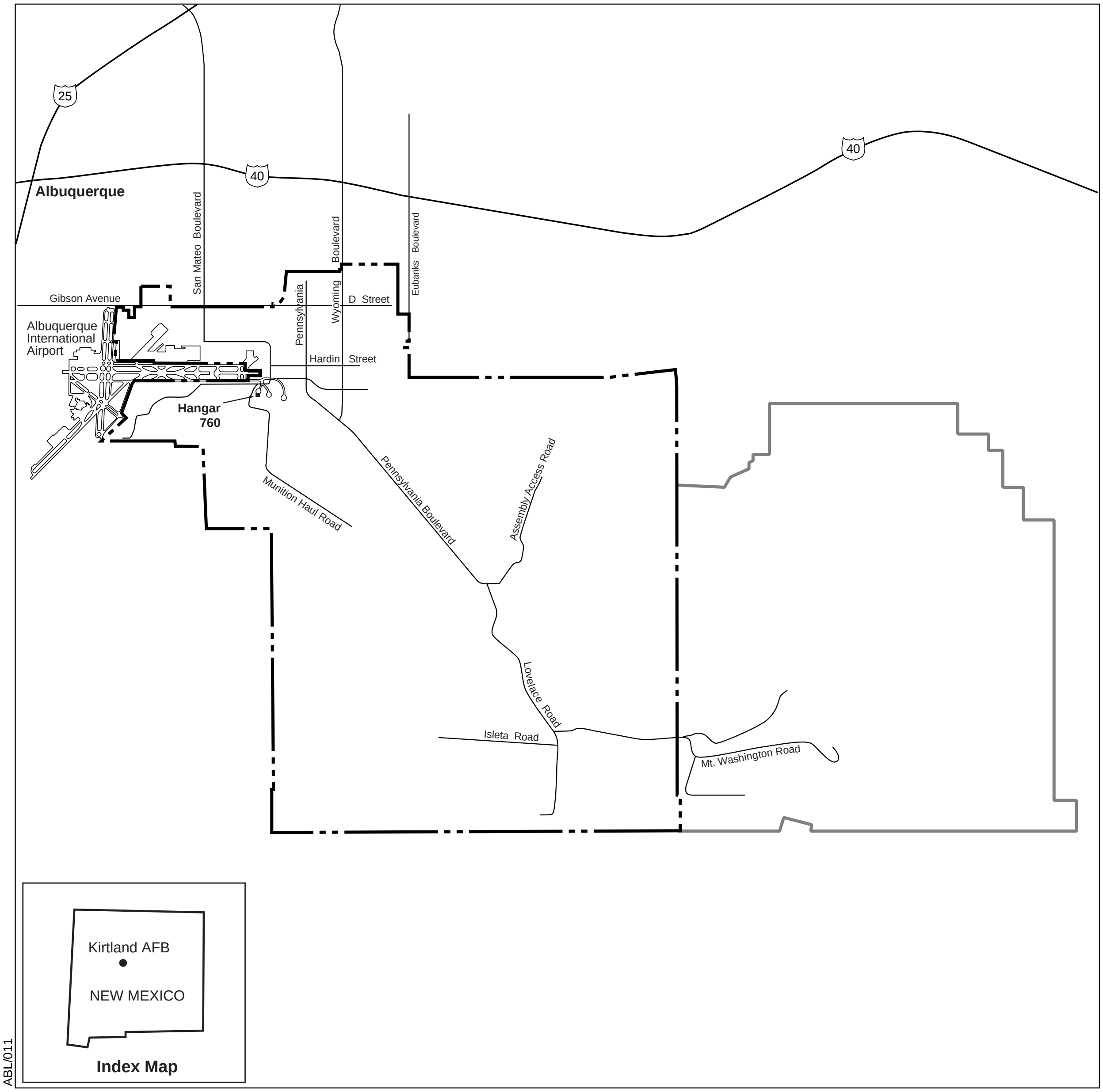
Military activity began at the Kirtland AFB site in 1939 with the leasing of 2,000 acres near the municipal airport for servicing transient military aircraft. Shortly thereafter, Kirtland Field was established, named for Colonel Roy C. Kirtland, a military aviation pioneer. At the same time, the Army Air Force established Sandia Base, a training depot for aircraft mechanics, to the east of Kirtland Field. In September 1945, several units of Los Alamos National Laboratory (LANL) were moved to Sandia Base to provide flight support and test facilities for LANL. These units were the predecessors of Sandia Corporation, now Sandia National Laboratories, the largest tenant unit on Kirtland AFB, which is operated by the U.S. Department of Energy (DOE). Kirtland Field and Sandia Base merged in 1971 under the Air Force, and are now known as Kirtland AFB. Kirtland AFB is presently under control of the Air Force Materiel Command.

Approximately 23,000 people are employed at Kirtland AFB (Kirtland Air Force Base, 1999). An average of 30,000 takeoffs and landings of military aircraft occur each year from Albuquerque International Airport, which shares runway facilities with Kirtland AFB.

Location

Kirtland AFB is situated in central New Mexico, adjacent to the state's largest city, Albuquerque (Figure 3.2-1). The westernmost portion of Kirtland AFB is adjacent to Albuquerque International Airport. The base comprises an area of approximately 51,600 acres, of which nearly 16,000 acres are national forest land withdrawn for Air Force use; 7,500 acres are national forestland withdrawn for DOE use (Kirtland Air Force Base, 1999). The ABL SPO, an approximately 70-acre site, is situated near the southeast end of the east-west runway, just south of South Gate Avenue, in the area of Hangar 760 (see Figure 2.2-2). Facilities include laboratories for test and integration of the laser and laser-beam control subsystems.

The Albuquerque metropolitan area and Kirtland AFB are situated in a river valley (Rio Grande River) bounded by a high plateau on the west and a mountain range (southern Rocky Mountains) on the east. Weather patterns in the area are characterized by low precipitation; wide temperature extremes; frequent drying winds; heavy rain showers, usually of short duration; and erratic, seasonal precipitation. The monthly mean temperature ranges from 33^{o} F in January, to 79^{o}F in July. The annual average temperature is 57^{o}F. The average annual precipitation is 8.3 inches and occurs between June and September. Snowfall occurs between December and March, and averages approximately 10.3 inches annually. The average wind speed for the area is 9 mph. The prevailing wind direction is from the north in the winter, and from the south along the river valley in the summer.



EXPLANATION

Base Boundary

Department of Energy Property

40 Interstate Highway

0 1.125 2.25 Miles

Kirtland AFB Vicinity Map

Figure 3.2-1

3.2.2 Airspace

Only ground-testing activities of the ABL system are proposed at Kirtland AFB. None of the activities (involving testing laser components on the ground after they are integrated into the aircraft) would have airspace impacts. Therefore, no impacts to airspace at Kirtland AFB are anticipated.

3.2.3 Hazardous Materials and Hazardous Waste Management

3.2.3.1 Affected Environment.

The Kirtland AFB Hazardous Material Plan 191-96 provides guidelines, instructions, and procedures to prevent and respond to accidental spills of hazardous materials including a description of appropriate prevention, control, and countermeasures (Kirtland Air Force Base, 1997). The Kirtland AFB Hazardous Waste Management Plan provides guidance to personnel regarding the storage, transportation, use, and disposal of hazardous waste (Kirtland Air Force Base, 2000). These plans incorporate appropriate federal, state, local, and Air Force requirements regarding management of hazardous materials and hazardous waste.

A variety of hazardous materials are utilized and stored at Kirtland AFB to support the wide range of activities conducted on the base. The largest quantities of materials stored on base are petroleum, oil, and lubricants (POL). Kirtland AFB operates on the pharmacy concept, which allows the installation tenants to obtain hazardous materials from assigned distribution centers. Hazardous waste generated at Kirtland AFB is associated with the operation of industrial shops, research and development laboratories, pesticide and herbicide application, radiological testing, fire-control training, and fuel management (U.S. Air Force, 1997).

3.2.3.2 Environmental Consequences

Proposed Action

Ground-Testing Activities. Hazardous material usage related to ground-testing activities at Kirtland AFB would be similar to that discussed for Edwards AFB with the exception that COIL chemicals to support the HEL would not be stored or utilized.

Existing stores of JP-8, and POL at Kirtland AFB would be used to fuel and maintain the AGE used to supply power to the aircraft and laser systems during ground-testing activities. Only small quantities of JP-8 and POLs would be utilized to power AGE equipment and support ground-testing activities. These small quantities would result in a negligible increase in materials requirements from current base operations. Existing pollution prevention and facility response plans (e.g., Spill Prevention Control and Countermeasures Plan) would minimize any potential environmental consequences due to the use of these materials. In accordance with normal operations at Kirtland AFB, existing hazardous waste accumulation points would be used to contain and dispose of any hazardous waste generated from AGE. No hazardous materials would be off-loaded from the ABL aircraft that would be considered a hazardous waste.

Flight-Testing Activities. No flight-testing activities are proposed at Kirtland AFB.

In the event the ABL aircraft is unable to land at Edwards AFB after conducting test activities (e.g., due to Edwards AFB runway closure), Kirtland AFB has been identified as one of three pre-planned “divert bases” in which the aircraft could be diverted. Although nothing would prevent the ABL aircraft from landing at any suitable base in time of emergency, personnel at Kirtland AFB would be specifically trained to support the ABL aircraft and appropriate equipment to handle ABL hazardous materials (e.g., chemical transfer and recovery receptacles) would be in place. The ABL aircraft would remain at Kirtland AFB until the Edwards AFB runway is cleared for incoming traffic.

Mitigation Measures. Because ABL test activities would be required to comply with applicable federal, state, DOD, and Air Force regulations regarding the use, storage, and handling of hazardous materials and hazardous waste, these activities would not result in substantial environmental impacts, and no mitigation measures would be required.

Cumulative Impacts. No other actions have been identified that would contribute to cumulative impacts such that adverse impacts would result.

No-Action Alternative

Under the No-Action Alternative, ABL test activities would not be conducted as described in Chapter 2 of this SEIS. ABL test activities would be conducted as analyzed in the 1997 FEIS. Management of hazardous materials and hazardous waste at Kirtland AFB would continue in accordance with current practices. No adverse impacts are anticipated.

Mitigation Measures. No mitigation measures would be required under the No-Action Alternative.

3.2.4 Health and Safety

3.2.4.1 Affected Environment.

The affected environment at Kirtland AFB includes aircraft parking at Pad 4, which is adjacent to Building 760 and laser range areas (see Figure 2.2-2). The lower-power ground-testing shots of the ARS, BILL, TILL, and SHEL lasers from the ABL aircraft will occur at Pad 4. No HEL ground-testing shots or airborne lasing activities would be performed at Kirtland AFB.

Kirtland AFB Instruction (KAFBI) 48-109, *Laser Hazard Control Program,* implements AFOSH Standard 48-139 and outlines policies, responsibilities, and procedures for laser operations on Kirtland AFB to ensure a safe environment to operate lasers. The Office of Primary Responsibility (OPR) at Kirtland AFB for laser safety/laser hazard control is Bioenvironmental Engineering (377 AMDS/SGPB). Guidance relating to laser safety on military ranges is contained in MIL-HDBK-828A, *Department of Defense Handbook: Laser Safety on Ranges* *and in Other Outdoor Areas*; while ANSI Z136.6-2000, *Safe Use of Lasers Outdoors,* also contains guidance and recommended practices.

3.2.4.2 Environmental Consequences

Proposed Action

Ground-Testing Activities. Ground-testing activities would be conducted in accordance with similar health and safety measures as identified for Edwards AFB. The lower-power ARS, BILL, TILL, and SHEL would be fired downrange (south/southeast) from Pad 4 to multiple target platforms at varying distances, specifically 4, 5, and 7 km downrange (see Figure 2.2-2). Targets used during the firing of the laser systems include billboard-mounted target boards and rotoplane-mounted target boards (Figure 3.2-2). Up to 500 rotoplane and 500 target board tests would be conducted during the course of lasing activities for each of the ABL aircraft.

The U.S. Air Force considers BASH a safety concern for aircraft operations. BASH hazards at Kirtland AFB are managed to reduce bird/animal activity relative to aircraft operations. Because only one landing and take-off of the ABL aircraft would occur during ground-test activities at Kirtland AFB, the likelihood of a BASH incident is considered low.

Because ABL ground-testing activities at Kirtland AFB would be performed in accordance with applicable regulations, and appropriate safety measures would be implemented, no adverse impacts are expected.

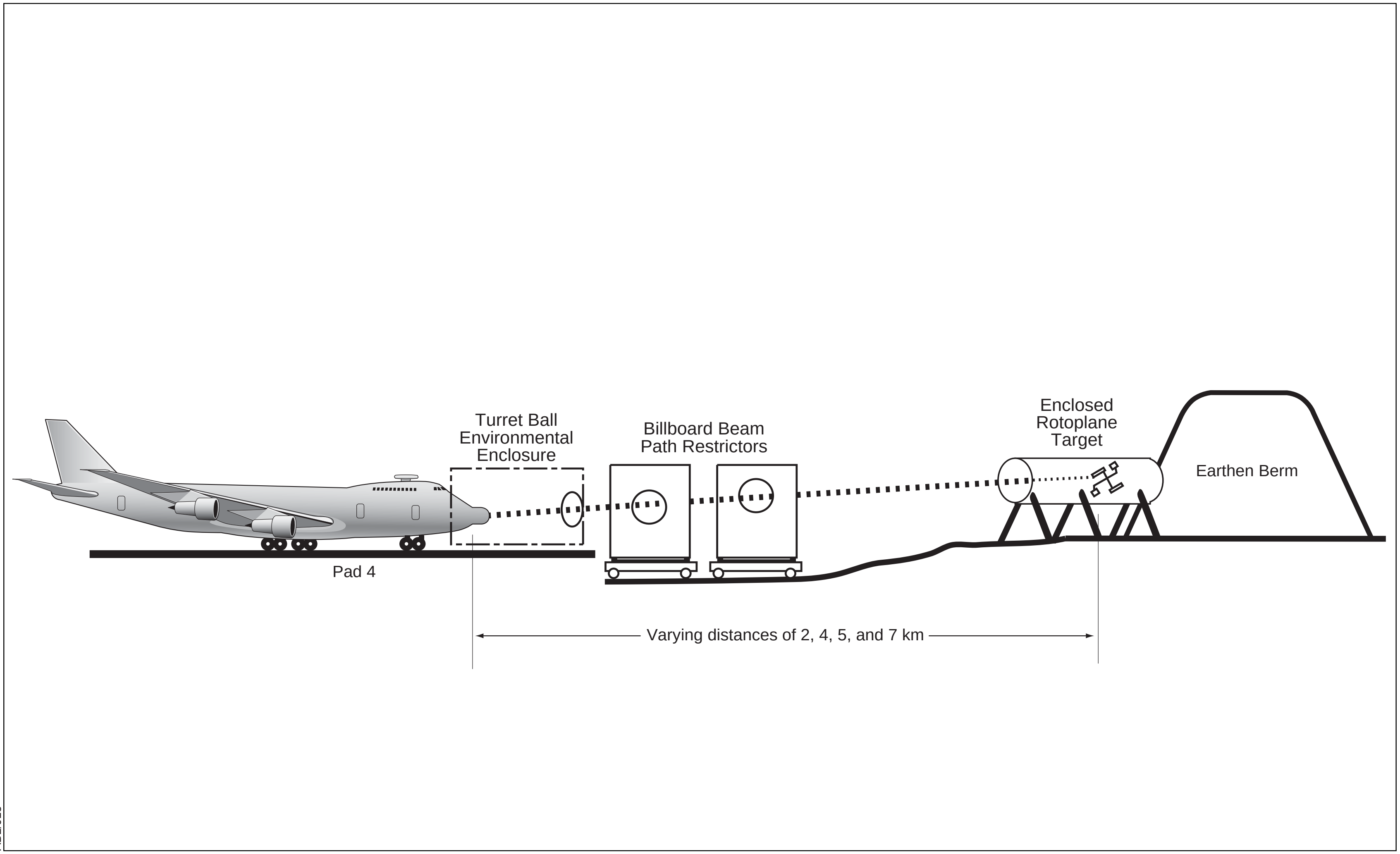
Mitigation Measures. ABL ground- and flight-testing activities would be performed in accordance with applicable regulations, and appropriate safety measures would be implemented. A Process Safety Management Plan would be implemented to cover proper use and handling of highly hazardous chemicals, toxics, and reactives per 29 CFR 1910.119. Therefore, no mitigation measures would be required.

Cumulative Impacts. No other actions have been identified that would contribute to cumulative impacts such that adverse impacts would result.

No-Action Alternative

Under the No-Action Alternative, ABL testing activities would not be conducted as described in Chapter 2 of this SEIS. ABL test activities would be conducted as analyzed in the 1997 FEIS. No adverse environmental impacts are anticipated.

Mitigation Measures. No mitigation measures would be required under the No-Action Alternative.



Ground-Test Setup of Laser Activities, Kirtland AFB

Figure 3.2-2

3.2.5 Air Quality

3.2.5.1 Affected Environment.

Information on the affected environment and the environmental consequences at the Earth's surface, the planetary boundary layer, and the upper atmosphere were addressed in Sections 3.2.2 and 3.7 of the 1997 FEIS, and are incorporated by reference.

The ROI consists of the regional air quality control region in which Kirtland AFB is situated, and where ABL testing activities would occur. Kirtland AFB is situated in Bernalillo County, which is within the Albuquerque-Mid Rio Grande Intrastate Air Quality Control Region (AQCR) (40 CFR Part 81). The Albuquerque/Bernalillo County Air Quality Control Board (AQCB) and the Albuquerque Environmental Health Department (AEHD) administer the air quality program in Bernalillo County.

The Albuquerque/Bernalillo County area remains in attainment for all criteria pollutants. According to the U.S. EPA Aerometric Information Retrieval System (AIRS) database, recent maximum observed concentrations for CO, PM_{10}, and ozone are in attainment of the NAAQS, and are presented in Table 3.2-1. The CO concentrations show a downward trend with time, while the PM_{10} maximum daily concentrations are increasing with time. A single exceedance of the PM_{10} (150 $\mu g/m^3$) NAAQS occurred in 1999.

Table 3.2-1. Summary of Maximum Criteria Pollutant Concentrations in Bernalillo County

	Criteria Pollutants		
Year	CO (8-hour) ppm	PM_{10} (24-hour) $\mu g/m^3$	Ozone (1-hour) ppm
1996	8.3	96	0.111
1997	6.9	100	0.099
1998	6.3	121	0.098
1999	4.9	155	0.099
2000	4.2	146	0.100

CO = carbon monoxide
$\mu g/m^3$ = micrograms per cubic meter
PM_{10} = particulate matter equal to or less than 10 microns in diameter
ppm = parts per million

The 1999 national emissions inventory (U.S. Environmental Protection Agency, 2001) contains an estimate of annual emissions of 180,225 tons per year for CO. Available information suggests that Kirtland AFB contributed 19,255 tons of CO in 1999. This figure is only 10.6 percent of the county total.

3.2.5.2 Environmental Consequences

Proposed Action

Ground-Testing Activities. The emissions from ground-level-testing activities, compared to the total emissions, would be minimal. There would be no take-off or landing of the ABL aircraft other than arrival to Kirtland AFB and departure upon completion of the ground-testing activities. Because only the lower-powered lasers (ARS, BILL, TILL, and SHEL) would be tested, additional VMT to support laser refueling would not be required.

The emission estimates for Kirtland AFB are based upon a single take off and landing of the two ABL aircraft, and an estimated 270 hours of AGE operation in support of ABL ground-testing activities. The emission estimates are summarized in Table 3.2-2. For CO, the estimated emissions are a fraction of a percent of the Bernalillo County total emissions. The estimates for other criteria pollutants generated during ABL ground-test activities would be much lower than that estimates for CO (see Table 3.2.2). The potential air quality impacts from the proposed ABL testing activities at Kirtland AFB are expected to be inconsequential.

Table 3.2-2. Estimated Emissions from ABL Testing Activities at Kirtland AFB (tons/year)

	Criteria Pollutant			
Estimate	VOC	CO	NO_x	PM_{10}
ABL Ground Tests	0.22	6.50	0.18	0.01
Kirtland AFB (2000)	28.83	21.84	29.24	11.44

ABL = Airborne Laser
CO = carbon monoxide
NO_X = nitrogen oxides
PM_{10} = particulate matter equal to or less than 10 microns in diameter
VOC = volatile organic compound

Source: U.S. Air Force, 2000c.

Flight-Testing Activities. No flight-testing activities are proposed at Kirtland AFB.

Mitigation Measures. Because there are no adverse impacts anticipated under the No-Action Alternative, mitigation measures are not required.

Cumulative Impacts. No other actions have been identified that would contribute to cumulative impacts such that adverse impacts would result.

No-Action Alternative

Under the No-Action Alternative, ABL ground-testing activities would not be conducted as described in Chapter 2 of this SEIS. ABL test activities would be conducted as analyzed in the 1997 FEIS. No adverse environmental impacts are anticipated.

Mitigation Measures. No mitigation measures would be required under the No-Action Alternative.

3.2.6 Noise

3.2.6.1 Affected Environment.

The ROI for noise exposure at Kirtland AFB includes the area around Hangar 760. The proposed location for ABL ground-testing activities (aircraft parking Pad-4) is approximately 985 feet south of the east end of the main east-west runway at Albuquerque International Airport. This location falls within the 70-dBA noise contour of current airport operations. The nearest housing area is Kirtland AFB’s Zia Base Housing Complex, situated over 3,000 feet northeast of Hangar 760.

3.2.6.2 Environmental Consequences

Proposed Action

Increased noise levels from use of AGE and other ground support equipment adjacent to the runway during ground-testing activities and the landing and take off of the ABL aircraft would not cause adverse effects to residential areas or the local population.

Mitigation Measures. No mitigation measures would be required under the Proposed Action.

Cumulative Impacts. No other actions have been identified that would contribute to cumulative impacts such that adverse impacts would result.

No-Action Alternative

Under the No-Action Alternative, ABL ground-testing activities would not be conducted as described in Chapter 2 of this SEIS. ABL test activities would be conducted as analyzed in the 1997 FEIS. No adverse environmental impacts are anticipated.

Mitigation Measures. No mitigation measures would be required under the No-Action Alternatives.

3.2.7 Biological Resources

3.2.7.1 Affected Environment.

The ROI is the environment within the confines of the Kirtland AFB fence line. However, the primary focus of activities is in the immediate area surrounding aircraft parking Pad 4 and the laser range to be utilized.

The Endangered Species Act (16 U.S.C. Sections 1531-1544) is intended to protect and restore endangered and threatened species of animals and plants and their habitats. Other federal statutes protecting biological resources include the Migratory Bird Treaty Act (16 U.S.C. Sections 703-712), the Bald Eagle and Golden Eagle Protection Act (16 U.S.C. Section 668-668d), and the Fish and Wildlife Coordination Act (16 U.S.C. Sections 661-667d) and the Sikes Act as amended (16 U.S.C. 670a-670o).

The New Mexico Department of Game and Fish protects threatened and endangered wildlife species under the authority of the New Mexico Wildlife Conservation Act (19 New Mexico Administrative Code [NMAC] Section 33.1). The New Mexico Energy, Minerals, and Natural Resources Department protects threatened and endangered plant species under regulations governing endangered plant species (19 NMAC Section 21.2).

Vegetation. The Rocky Mountain and Great Basin Grasslands and Conifer and Oak Woodlands are the most prevalent vegetative communities at Kirtland AFB. The cantonment is urban landscaped.

Grasslands exhibiting Great Basin characteristics cover the lower elevations in the southwest and north-central portions of Kirtland AFB, between 5,200 and 5,700 feet. Within the withdrawal area, grassland is found as high as 6,900 feet, and Rocky Mountain Grasslands are found at higher elevations, interspersed among the Conifer and Broadleaf Forests.

The Conifer and Oak Woodland Community ranges in elevation from 5,800 to 7,500 feet. This plant community occurs primarily in the south and east portions of the base, and is dominated by Colorado pinyon pine and one-seeded juniper, with an understory of shrubs and grasses.

Conifer and Broadleaf Forest is found above the Conifer and Oak Woodland Community at elevations ranging from 6,500 to 7,988 feet. This habitat occurs within the withdrawal area, and is restricted to higher elevations of the Manzanita Mountains (U.S. Air Force, 2000c).

Wildlife. The Rocky Mountain Grasslands are home to mammals such as the gray wolf (*Canis lupus*), elk (*Cervus elaphus*), desert bighorn sheep (*Ovis canadensis mexicana*), red fox (*Vulpes vulpes*), badger (*Taxidea taxus*), mule deer (*Odocoileus hemionus*), white-tailed jackrabbit (*Lepus townsendii*), grizzly bear (*Ursus arctos*), shrews, and voles. Birds such as the red-railed hawk (*Buteo jamaicensis*), common nighthawk (*Chordeles minor*), American kestrel (*Falco sparverius*), and mountain bluebird (*Salia currucoides*) often inhabit these grasslands. Amphibians and reptiles common to Rocky Mountain Grasslands include the tiger salamander (*Ambystoma tigrinum*), the northern leopard frog (*Rana pipens*), and the wandering garter snake (*Thamnophis elegans vagrans*) (U.S. Air Force, 2000c).

At lower elevations, in the Great Basin Grasslands, a large variety of wildlife species are present. The mammal community is dominated by rodents, rabbits, and hares. These include the desert cottontail (*Sylvilagus audubonii*), Gunnison's prairie dog (*Cynomys gunnisioni*), white-footed deer mouse (*Peromyscus maniculatus*), silky pocket mouse (*Perognathus flavus*), Merriam's kangaroo rat (*Dipodomys merriami*), and the northern grasshopper mouse (*Onychomys leucogaster*). Mammalian predators found in these grasslands include the coyote (*Canis latrana*), badger, kit fox (*Vulpes macrotis*), striped skunk (*Mephitis mephitis*), and bobcat (*Lynx rufous*). Common birds associated with Great Basin Grasslands include the horned lark (*Eremophila alpestris*), scaled quail (*Callipepla squamata*), mourning dove (*Zenaida macroura*), greater roadrunner (*Geococcyx californianus*), American crow (*Corvus brachyrhynchos*), northern mockingbird (*Mimus polyglottos*), crissal thrasher (*Toxostoma crissal*), lark sparrow (*Chordestes grammacus*), black-throated sparrow (*Amphispiza bilineata*), western meadowlark (*Sturnella neglecta*), brown-headed cowbird (*Molothrus ater*), and house finch (*Carpodacus mexicanus*). The birds of prey, or raptors, most commonly found in these grasslands include the northern harrier (*Circus cyaneus*), red-tailed hawk, American kestrel, prairie falcon (*Falco mexicanus*), barn owl (*Tyto alba*), burrowing owl (*Spectyto cunicularia*), long-eared owl (*Asio otus*), and great horned owl (*Bubo virginianus*) (U.S. Air Force, 2000c).

Reptiles and amphibians found within Great Basin Grasslands include the plains spadefoot toad (*Scaphiopus bombifrons*), Great Plains toad (*Bufo cognatus*), western box turtle (*Terrapene ornata*), whiptail lizard (*Cnemidophorus* spp.), lesser earless lizard (*Holbrookia maculata*), and the western diamondback rattlesnake (*Crotalus atrox*).

The Conifer and Oak Woodlands of the southwest United States are home to such mammals as the rock squirrel (*Spermophilus variegatus*), brush mouse (*Peromyscus boylii*), porcupine, black bear (*Ursus americanus*), and mountain lion (*Felis concolor*). Common birds found in the southwestern Conifer and Oak Woodlands include the black-chinned hummingbird (*Archilochus alexandri*), Cassin's kingbird (*Tyrannus vociferans*), scrub jay (*Aphelocoma coerulescens*), mountain chickadee (*Parus gambeli*), western bluebird (*Sialia mexicana*), yellow warbler (*Dendroica petechia*), western tanager (*Piranga ludoviciana*), and Scott's oriole (*Icterus parisorum*). Common raptors found in this habitat include the sharp-shinned hawk (*Accipiter striatus*) and the western screech owl (*Otus kennicottii*). Reptiles and amphibians are generally absent from this type of community. One reptile that can be found is the plateau striped whiptail (*Cnemidophorus velox*) (U.S. Air Force, 2000c).

Threatened and Endangered Species. No protected plant species are found at Kirtland AFB. Federally and state-listed threatened or endangered animal species that may be present in the vicinity of Kirtland AFB are listed in Table 3.2-3. Of these, the Gray vireo (state listed as threatened) is most likely to be found in the area of the Proposed Action. The other species are included owing to their high level of mobility, and the relative closeness of potentially suitable habitat in the nearby Manzanita Mountains.

Sensitive Habitats. At Kirtland AFB, wetlands are situated at the various springs where sufficient moisture occurs at least part of the year. Locations of wetlands on Kirtland AFB include Coyote Springs, Unnamed Spring, Sol se Mete Spring, Lurance Spring, Manzano Spring 1, and Manzano Spring 2 (U.S. Air Force, 2000c). None of these springs is near the proposed ABL testing area.

Table 3.2-3. Threatened and Endangered Species in Bernalillo County, New Mexico

Common Name	Scientific Name	State Status	Federal Status
Animal Species			
Black-footed ferret	*Mustela nigripes*	-	E
Southwestern willow flycatcher	*Empidonax traillii extimus*	-	E
Whooping crane	*Grus americana*	-	E
Rio Grande silvery minnow	*Hybognathus amarus*	-	E
Bald eagle	*Haliaeetus leucocephalus*	T	T
Mountain plover	*Charadrius montanus*	-	PT
Yellow-billed cuckoo	*Coccyzus americanus*	-	C
New Mexico meadow jumping mouse	*Zapus hudsonius luteus*	-	SC
Pecos River muskrat	*Ondatra zibethicus ripensis*	-	SC
Townsend's big-eared bat	*Corynorhinus townsendii*	-	SC
American peregrine falcon	*Falco peregrinus anatus*	E	SC
Arctic peregrine falcon	*Falco peregrinus tundrius*	-	SC
Baird's sparrow	*Ammodramus bairdii*	-	SC
Black tern	*Chlidonias niger*	-	SC
Northern goshawk	*Accipiter gentilis*	-	SC
American peregrine falcon[a]	*Falco peregrinus anatum*	E	–
Mexican spotted owl[a]	*Strix occidentalis lucida*	–	T
Gray vireo[a]	*Vireo vicinior*	T	–
Spotted Bat[a]	*Euderma maculatum*	T	–
Invertebrate Species			
Millipede	*Comanchelus chihuanus*	-	SC

Note: (a) Known or expected to occur at Kirtland AFB.
C = candidate
E = endangered
PT = proposed threatened
SC = species of concern
T = threatened

Source: U.S. Fish and Wildlife Service, 2002a.

3.2.7.2 Environmental Consequences

Proposed Action

Ground-Testing Activities. Only the lower-power lasers (ARS, BILL, TILL, and SHEL) would be ground tested at Kirtland AFB; therefore, the use of a GPRA would not be required. No construction or ground-disturbing activities would occur during ground-testing activities. Laser targets would be placed at established locations with existing earthen backstops within the laser test range. If burrowing owls are discovered in the vicinity of proposed ABL ground test areas, measures would be implemented to avoid harming the owls. Because ground-test activities will utilize an existing laser test range and no construction or ground disturbance would occur, adverse impacts to biological resources are not expected.

Flight-Testing Activities. No flight-testing activities are proposed at Kirtland AFB.

Mitigation Measures. Because there are no adverse impacts anticipated under the Proposed Action, mitigation measures are not required.

Cumulative Impacts. No other actions have been identified that would contribute to cumulative impacts such that adverse impacts would result.

No-Action Alternative

Under the No-Action Alternative, ABL ground-testing activities would not be conducted as described in Chapter 2 of this SEIS. ABL test activities would be conducted as analyzed in the 1997 FEIS. No adverse environmental impacts are anticipated.

Mitigation Measures. No mitigation measures would be required under the No-Action Alternative.

3.2.8 Cultural Resources

3.2.8.1 Affected Environment.

The ROI for cultural resources at Kirtland AFB is the environment within the confines of the Kirtland AFB boundary. However, the primary focus of activities is in the immediate area surrounding Hangar 760, aircraft parking Pad 4, and the laser range to be utilized. No flight-testing activities would take place at Kirtland AFB.

Numerous cultural resource surveys have been conducted at Kirtland AFB resulting, as of 1995, in the identification of approximately 300 cultural resources. These resources consist of almost 300 archaeological sites (including prehistoric, historic, and sites containing both prehistoric and historic components), 10 historic resources (consisting of 2 mining districts, 5 buildings, and 3 aircraft hangars), a potential archaeological district consisting of nuclear bomb structures that may be considered a historic Cold War era district, and a small number of miscellaneous resources.

No traditional Native American sacred or ceremonial sites are known to occur within the boundaries of Kirtland AFB.

Although no paleontological resources have been reported within Kirtland AFB, three geologic formations within the base boundary have the potential to yield such resources (Pleistocene sediments and gravel, Miocene Santa Fe Group, and Pennsylvanian/Mississippian Madera Limestone/Sandia Formation) (U.S. Air Force, 1997a). In addition, several Pleistocene horse and camel bones have been found approximately one mile southwest of the base.

3.2.8.2 Environmental Consequences

Proposed Action

Ground-Testing Activities. Ground-testing activities would occur on previously disturbed, paved, or developed land. No construction activity would be necessary for ground-testing activities. Therefore, there are no foreseen impacts to cultural or paleontological resources on Kirtland AFB resulting from activity proposed by the ABL Program.

Flight-Testing Activities. No flight-testing activities are proposed at Kirtland AFB.

Mitigation Measures. Because no adverse impacts have been identified under the Proposed Action, mitigation measures are not required.

Cumulative Impacts. No other actions have been identified that would contribute to cumulative impacts such that adverse impacts would result.

No-Action Alternative

Under the No-Action Alternative, ABL ground-testing activities would not be conducted as described in Chapter 2 of this SEIS. ABL test activities would be conducted as analyzed in the 1997 FEIS. No adverse environmental impacts are anticipated.

Mitigation Measures. No mitigation measures would be required under the No-Action Alternative.

3.2.9 Socioeconomics

3.2.9.1 Affected Environment.

The ROI for socioeconomics includes Bernalillo County, which contains Kirtland AFB and the city of Albuquerque, New Mexico. The affected environment is described in terms of its principal attributes: population, income, employment, and housing or lodging.

Population. In 1999, Bernalillo County had a population of 525,000 (Bureau of Economic Analysis, 2001a).

Income. In 1999, Bernalillo County had a per capita personal income of $27,287. The county ranked third in the state, and was 125 percent of the state average of $21,836 and 96 percent of the national average of $28,546 (Bureau of Economic Analysis, 2001b).

Employment. Kirtland AFB employs over 23,000 individuals, approximately 35 percent of whom are military personnel. Full- and part-time employment in Bernalillo County totaled almost 390,000 in 1999, up from the 310,000 employed in 1989 (Bureau of Economic Analysis, 2001a).

Housing/Lodging. Because personnel associated with the ABL Program's ground-testing activities are expected to rotate into and out of Kirtland AFB on a temporary basis for the short duration of ground-testing activities, it is anticipated that they will seek accommodations in hotels and motels closest to Kirtland AFB. There are 73 hotels/motels recognized by the American Automobile Association (AAA) in the Albuquerque area, with a total of 9,784 units (American Automobile Association, 2001).

3.2.9.2 Environmental Consequences

Proposed Action

Ground-Testing Activities. Ground-testing activities at Kirtland AFB are expected to require up to 50 program-related temporary personnel for the duration of test activities. Given the normal daily, weekly, and monthly fluctuation of population, employment, and visitors to both Kirtland AFB and local communities in the ROI, the need for up to 50 additional program-related temporary personnel would have a small, positive, yet largely unnoticeable effect on population, income, or employment in the ROI. Socioeconomic impacts would essentially be limited to their expenditures in the local economy, particularly at local hotels/motels and restaurants. Based on a 2002 maximum per diem rate of $103 (U.S. General Service Administration, 2001), the 50 program-related personnel could result in an infusion of approximately $5,150 per day (about $36,050 per week) into the local economy, depending on the duration of their temporary assignments at Kirtland AFB.

However, because it would represent only a 0.3-percent increase in the number of people employed at Kirtland AFB, 0.01 percent of the total labor force of the ROI, and the demand for up to 50 hotel/motel units would only represent 0.5 percent of the 9,784-unit supply in the ROI, the impact, although positive, would be minimal. For example, assuming an average occupancy rate of 70 percent, there would normally be 2,935 unoccupied units available to the 50 program-related personnel at any one time; therefore, there would not be any discernable effect on direct, indirect, or induced jobs, income, and related population.

Flight-Testing Activities. No flight-testing activities are proposed at Kirtland AFB; therefore, no socioeconomic impacts would be anticipated.

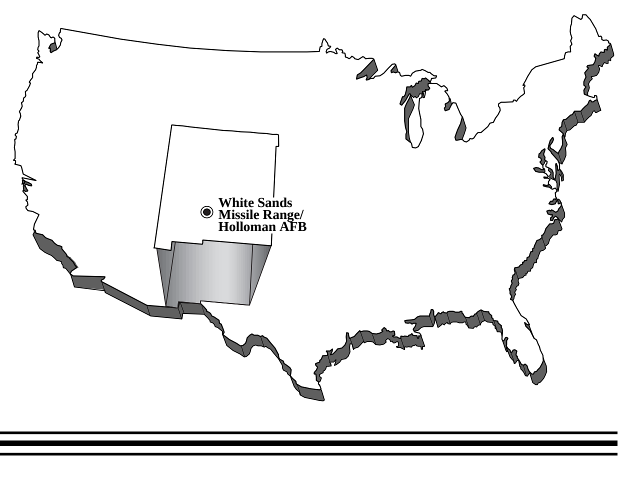
Mitigation Measures. No mitigation measures would be necessary for proposed ground-testing activities.

Cumulative Impacts. With no discernible impacts expected for the ABL Program's ground-testing activities at Kirtland AFB, the potential for additive, incremental, and cumulative impacts of the ABL Program in addition to other past, current, or reasonably foreseeable projects is considered remote.

No-Action Alternative

Under the No-Action Alternative, ABL ground-testing activities would not be conducted as described in Chapter 2 of this SEIS. ABL test activities would be conducted as analyzed in the 1997 FEIS. No adverse socioeconomic impacts within the ROI are anticipated.

Mitigation Measures. No mitigation measures would be required under the No-Action Alternative.



SECTION 3.3
WHITE SANDS MISSILE RANGE/
HOLLOMAN AIR FORCE BASE

3.3 WHITE SANDS MISSILE RANGE/HOLLOMAN AFB

3.3.1 Local Community

Background

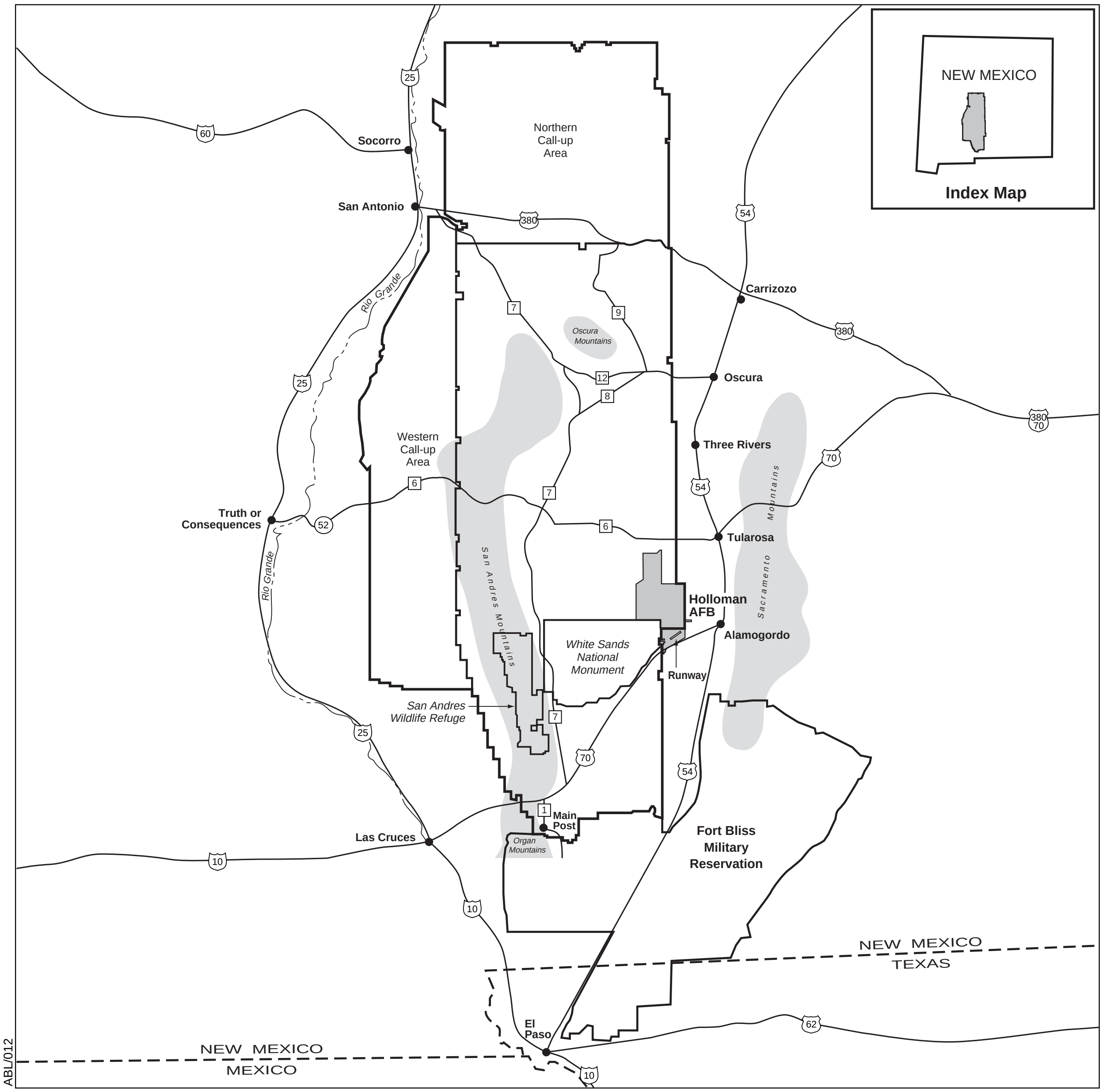
Before World War II, the area of the present WSMR was used by ranchers for grazing cattle and goats. White Sands Proving Grounds was established after the end of World War II. What is now WSMR was the Alamogordo Bombing and Gunnery Range that was used to train military aircrews that flew out of then Alamogordo Army Air Field (AAF) and other AAF bases in southern New Mexico. On May 1, 1958, White Sands Proving Ground was redesignated as WSMR.

Today, WSMR is a Major Range and Test Facility Base designated as a national test range, and is the largest overland test facility in the United States. The range supports missile development and test programs for the U.S. Army, U.S. Navy, U.S. Air Force, NASA, other government agencies, some foreign governments, and private industry. White Sands Space Harbor is an alternate landing site for the space shuttle, and a training site for shuttle pilots. Approximately 6,000 civilian, military, and contractor personnel are employed at WSMR.

Construction at Holloman AFB began with development of the Alamogordo Bombing and Gunnery Range in 1941. The post was elevated to Army Air Base status and christened Alamogordo AAF in 1942. The base was renamed Holloman AFB in 1948, shortly after the Air Force became a separate service branch (U.S. Air Force, 1993). Holloman AFB is currently headquarters for the 49th Fighter Wing and supports a variety of Air Force, DOD, and Army tenant organizations. Holloman AFB is also home to the worlds longest (50,188 feet) and fastest (approaching 10,000 feet per second) Test Track. Holloman AFB supports about 23,000 active duty, Guard and Reserve personnel, retirees, DOD civilians, and their families.

Location

WSMR is situated in south-central New Mexico, and includes approximately 2 million acres in Dona Ana, Otero, Socorro, Sierra, Lincoln, and Torrence counties (Figure 3.3-1). The area available for ABL testing (including WSMR, its Northern and Western Call-up Areas, Holloman AFB, and Fort Bliss) extends approximately 160 miles north to south and 80 miles east to west. Call-up areas are land areas that are not under range control; however, through agreement with the landowners, these areas can be utilized to extend the range boundaries to the west and north for safety reasons. WSMR headquarters is situated approximately 20 miles east of Las Cruces, New Mexico. Holloman AFB, where the ABL aircraft could land to perform ground-test activities in the event ground tests cannot be conducted at Edwards AFB or Kirtland AFB, is situated in Otero County, New Mexico, 8 miles west-southwest of Alamogordo and covers 59,639 acres. Holloman AFB is contiguous to WSMR’s eastern boundary. WSMR surrounds White Sands National Monument to the north, west, and south, and is adjacent to the southwest portion of Holloman AFB. Airspace associated with Fort Bliss to the south and southeast of WSMR could be used during ABL flight-test activities (see Figure 3.3-1).



EXPLANATION

Installation Boundary
State Highway
U.S. Highway
Interstate Highway
Range Roads

0 6.5 13 26 Miles

White Sands Missile Range/Holloman AFB Vicinity Map

Figure 3.3-1

The ABL Program would use existing launch complexes at WSMR to launch missile targets supporting the ABL flight-testing activities. The complexes support both ground-to-ground and ground-to-air missile launches. Missile assembly facilities and temporary storage facilities for missiles are present in the area of the launch complexes. Approved impact points are used for recovery of missiles launched at WSMR.

WSMR is generally bounded on the west and northwest by the San Andres Mountains, on the north by the Oscura Mountains, on the east by U.S. Highway 54, and on the southwest by the Organ Mountains. The regional climate is characterized by an abundance of sunshine throughout the year, very low humidity, scant rainfall, occasional dust storms, and a relatively mild winter. The average annual temperature at the south end of the range is 60°F. The monthly mean temperature in December and January is 44°F, with daily temperatures ranging from 32°F to 56°F. July is the warmest month with a mean temperature of 81°F. Annual precipitation varies from 7 to 11 inches; over one-half occurs between June and September. The average monthly wind speeds are relatively low, and range from 5 to 9 mph. Prevailing winds are from the west, except during July and August, when the wind directions are from the southeast and south-southwest, respectively. The windy season is from March to May, and is characterized by strong westerly winds and periods of blowing dust.

3.3.2 Airspace

3.3.2.1 Affected Environment.

The airspace ROI for WSMR is defined as that area that could be affected by ABL flight-testing activities. For the purposes of this document, the ROI is that airspace over WSMR and an approximately 185-km (100-nm) zone around the range boundaries to the west, north, and east.

The affected airspace use environment in the WSMR airspace ROI is described below in terms of its principal attributes, namely controlled and uncontrolled airspace, SUA, MTRs, en route airways and jet routes, airports and airfields, and ATC.

Controlled and Uncontrolled Airspace. Outside of the SUA identified and discussed separately in the next section, the airspace in the ROI is a mix of controlled and uncontrolled airspace. The controlled airspace comprises Class A airspace from 18,000 feet above MSL up to and including FL 600 (60,000 feet), Class E airspace below 18,000 feet, and either Class C or Class D airspace surrounding airports within the Class E airspace. There is no Class B airspace within the WSMR ROI. The SUA within the ROI is described separately below.

Within Class E airspace, separation service is provided for IFR aircraft only, and, to the extent practical, traffic advisories to aircraft operating under VFR. The Class E airspace has a floor of 1,200 feet or greater above the surface, except for the areas surrounding Alamogordo-White Sands Regional Airport to the east of WSMR, Las Cruces and Truth or Consequences Airports to the west of WSMR, Socorro Airport at the northwest edge of WSMR, and Sierra Blanca Regional Airport to the east of WSMR, where the Class E airspace has a floor of 700 feet above the surface. The ROI overlaps Class C airspace surrounding El Paso

International Airport to the south and Albuquerque International Airport to the north (Figure 3.3-2).

Class G, or uncontrolled airspace, below 14,500 feet lies to the west and southwest of Socorro and Truth or Consequences below and surrounding the Cato, Reserve, and Morenci MOA.

The distinction between “controlled” and “uncontrolled” airspace is important. Within controlled airspace, ATC service is provided to IFR and VFR flights in accordance with the airspace classification. Controlled airspace is also that airspace within which aircraft operators are subject to certain pilot qualifications, operating rules, and equipment requirements. For example, for IFR operations in any class of controlled airspace, a pilot must file an IFR flight plan, and receive an appropriate ATC clearance. Within uncontrolled airspace, no ATC service to aircraft operating under either IFR or VFR is provided other than possible traffic advisories when the ATC workload permits and radio communications can be established (Illman, 1993). White Sands Radar Facility (WSRF) provides clearances for aircraft operating within the WSMR area.

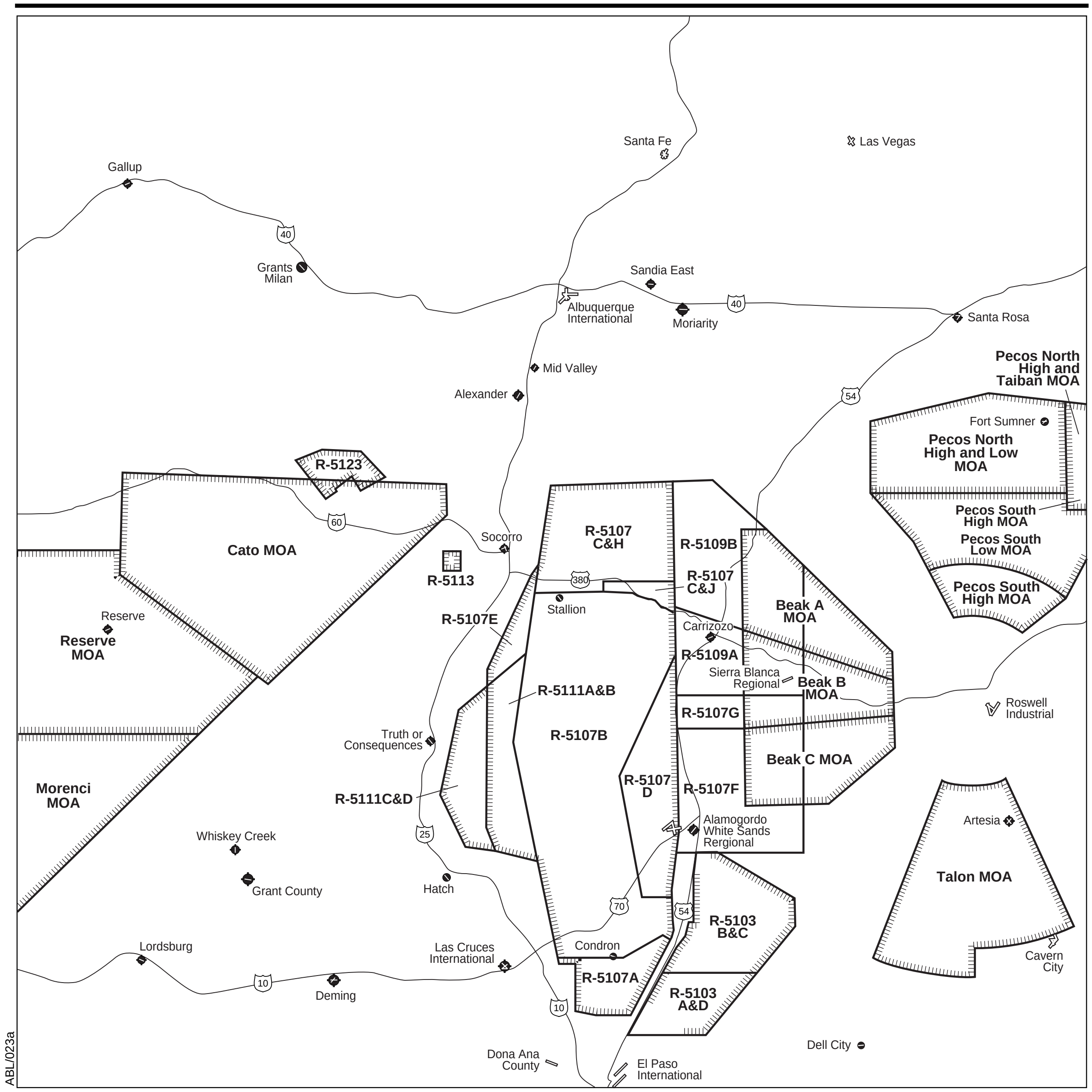
Special Use Airspace. There are 22 Restricted Areas in the WSMR ROI associated with either WSMR, Holloman AFB, or Fort Bliss. Table 3.3-1 lists the individual Restricted Areas, their effective altitude, time of use, and controlling agency. Twelve of the Restricted Areas extend to unlimited altitude, three of them (R-5107A, R-5107B, and R-5107E) from the surface, the balance from various altitudes.

To the east of WSMR’s associated Restricted Areas is the Beak MOA complex. The effective altitude, time of use, and controlling agency of the three MOAs that constitute the complex are identified in Table 3.3-1. There are no Prohibited or Alert SUA areas in the ROI (National Aeronautics Charting Office, 2001e).

Military Training Routes. There are numerous MTRs in the WSMR airspace ROI. Most are concentrated in the northeast portion of the ROI passing through the Beak A and B MOAs and the southeast portion of the ROI through the R-5103B originating out of Holloman AFB. Several routes have ending points within the WSMR Restricted Area complex. The route’s width varies throughout the route. All routes are designated as MARSA operations; these routes are scheduled for use by a military scheduling activity and NOTAMs issued (National Imagery and Mapping Agency, 2001).

En Route Airways and Jet Routes. There are several en route, low-altitude airways (up to but not including 18,000 feet above MSL) that surround the WSMR Restricted Area complex, including V94-611 to the south, V280 to the southeast, V611 to the west, and V264 to the north.

Numerous high-altitude jet routes also pass through the WSMR complex ROI above 18,000 feet above MSL: J4 and J184 to the south; J26 and J15 to the east; J13, J57, and J104 to the west; and J74 to the north. Two jet routes, J65-166 and J108, actually cross the Restricted Area complex (see Figure 3.3-3).



EXPLANATION

Special Use Airspace

Special Use Airspace and Airports/Airfields in the WSMR Airspace ROI

0 24 48 Nautical Miles

Source: National Aeronautical Charting Office, 2001.

Figure 3.3-2

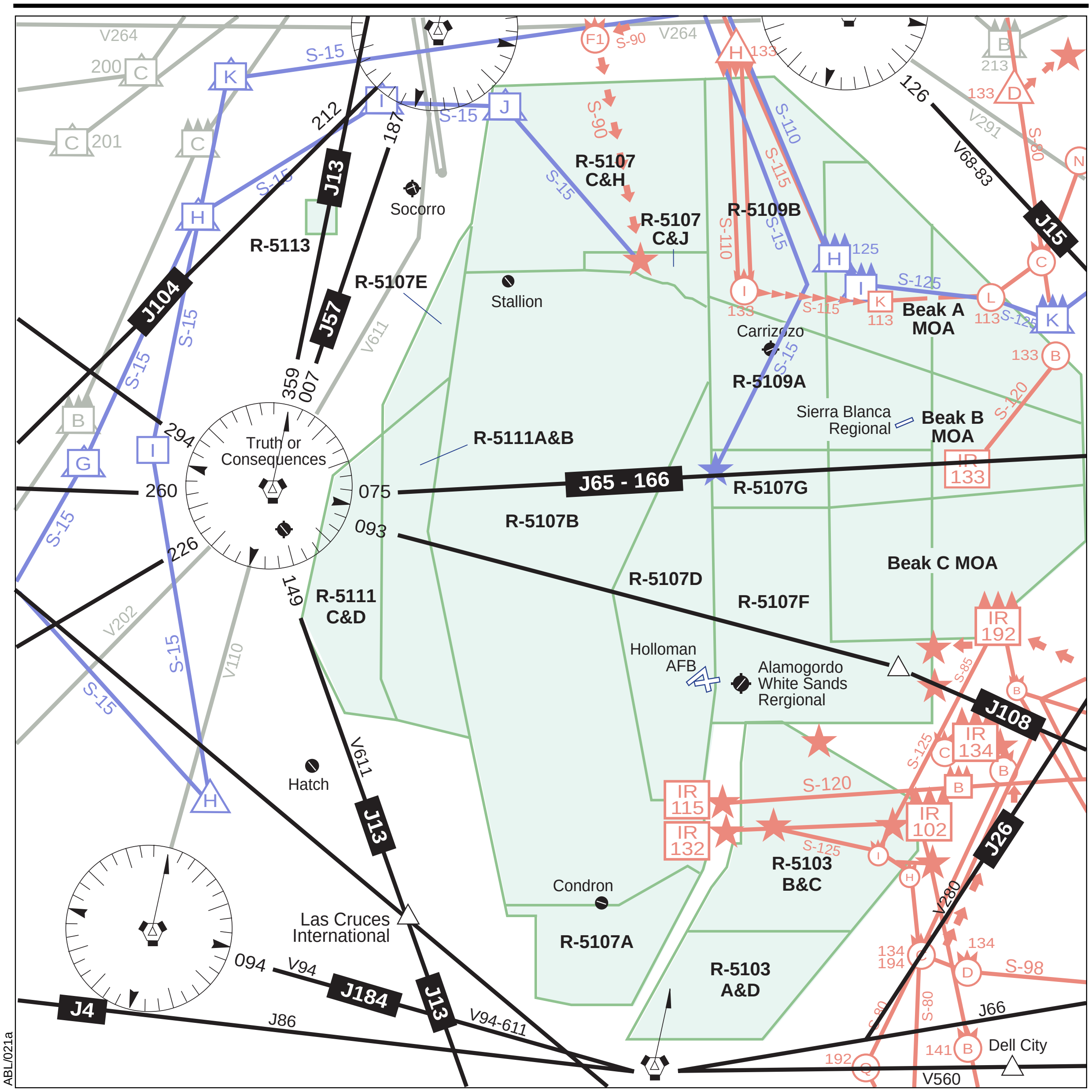
Table 3.3-1. Special Use Airspace in the WSMR Airspace ROI

Number/Name	Effective Altitude (feet)	Time of Use	Controlling Agency
R-5103A	To FL180[a]	0700-2000 M-F[b][d]	ZAB CNTR
R-5103B	To 12,500[d]	0700-2000 M-F[b][d]	ZAB CNTR
R-5103C	12,500 to Unlimited	0700-2000 M-F[b][d]	ZAB CNTR
R-5103D	FL 180 to Unlimited	0700-2000 M-F[b][d]	ZAB CNTR
R-5107A	Unlimited	Continuous[a][b]	ZAB CNTR
R-5107B	Unlimited	Continuous[a]	No A/G
R-5107C	9,000 to Unlimited	Continuous M-F[b]	ZAB CNTR
R-5107D	To 22,000[d]	Continuous	ZAB CNTR
R-5107E	Unlimited	By NOTAM[c][d]	ZAB CNTR
R-5107F	FL 240-FL 450	0701-0659Z M-F[b][d]	ZAB CNTR
R-5107G	FL 240-FL 450	0701-0659Z M-F[b][d]	ZAB CNTR
R-5107H	To 9,000	By NOTAM[c]	ZAB CNTR
R-5107J	To 9,000	Continuous M-F[b]	ZAB CNTR
R-5109A	24,000 to Unlimited	By NOTAM[c][d]	ZAB CNTR
R-5109B	24,000 to Unlimited	By NOTAM[c][d]	ZAB CNTR
R-5111A	13,000 to Unlimited	By NOTAM[c][d]	ZAB CNTR
R-5111B	To 13,000	By NOTAM[c][d]	ZAB CNTR
R-5111C	13,000 to Unlimited	By NOTAM[c][d]	ZAB CNTR
R-5111D	To 13,000	By NOTAM[c][d]	ZAB CNTR
R-5113	To 45,000	0900-1900[e][d]	ZAB CNTR
R-5119	FL 350 To Unlimited	By NOTAM[c][d]	ZAB CNTR
R-5123	Unlimited	By NOTAM	ZAB CNTR
Beak A MOA	12,500 to FL 180	0600-1800 M-F[b][d]	ZAB CNTR
Beak B MOA	12,500 to FL 180	0600-1800 M-F[b][d]	ZAB CNTR
Beak C MOA	12,500 to FL 180	0600-1800 M-F[b][d]	ZAB CNTR
Cato MOA	13,500 to FL 180	0800-2200 M-Sa[d]	ZAB CNTR
Morenci MOA	1,500 AGL to FL 180	0600-2100 M-F[d]	ZAB CNTR
Pecos North High MOA	11,000 to FL 180	0800-2000 M-F[d]	ZAB CNTR
Pecos North Low MOA	500 AGL to 11,000	0800-2000 M-F[d]	ZAB CNTR
Pecos South High MOA	11,000 to FL 180	SR-SS M-F	ZAB CNTR
Pecos South Low MOA	11,000 to FL 180	By NOTAM[d]	ZAB CNTR
Reserve MOA	500 AGL to FL 180	By NOTAM[d]	ZAB CNTR
Taiban MOA	500 AGL to 11,000	0800-2400 M-F[d]	ZAB CNTR
Talon MOA	12,500 to FL 180	SR-SS M-F[b]	ZAB CNTR

Notes:
(a) Continuous = 24 hours a day and/or 7 days a week.
(b) Other times by NOTAM.
(c) 12 hours in advance.
(d) During periods of Daylight Saving Time, effective hours will be 1 hour earlier than shown
(e) 1 June - 30 September

AGL = above ground level
CNTR = Center (Air Route Traffic Control Center)
FL = Flight Level (FL 180 = approximately 18,000 feet)
MOA = Military Operations Area
No A/G = no air to ground communications
NOTAM = Notice to Airmen
R = Restricted
SR = sunrise
SS = sunset
ZAB = Albuquerque ARTCC

Source: NACO, 2001e and 2001f.



EXPLANATION

- J4 High Altitude Jet Routes
- IFR Military Training Route
- VFR Military Training Route
- Low Altitude Training Routes
- Restricted, Prohibited Airspace

0 5.5 11 22 Nautical Miles

Source: National Imagery and Mapping Agency, 2001.

High Altitude Jet Routes and Military Training Routes in the WSMR Airspace ROI

Figure 3.3-3

However, these two jet routes are normally unavailable within the Restricted Areas during daytime hours, Monday through Friday.

As an alternative to aircraft flying above 29,000 feet following the published, preferred IFR routes (shown in Figure 3.3-3), the FAA is gradually permitting aircraft to select their own routes as alternatives. This “Free Flight” program is an innovative concept designed to enhance the safety and efficiency of the National Airspace System. The concept moves the National Airspace System from a centralized command-and-control system between pilots and air traffic controllers, to a distributed system that allows pilots, whenever practical, to choose their own route, and file a flight plan that follows the most efficient and economical route (Federal Aviation Administration, 1998).

“Free Flight” is already underway, and the plan for full implementation will occur as procedures are modified and technologies become available and are acquired by users and service providers. This incremental approach balances the needs of the aviation community and the expected resources of both the FAA and the users. Advanced satellite voice and data communications are being used to provide faster and more reliable transmission to enable reductions in vertical, lateral, and longitudinal separation, more direct flights and tracks, and faster altitude clearances (Federal Aviation Administration, 1998). With full implementation of this program, the amount of airspace in the ROI that is likely to be clear of traffic will decrease as pilots, whenever practical, choose their own route, and file a flight plan that follows the most efficient and economical route, rather than following the published preferred IFR routes across the ROI shown in Figure 3.3-3.

Airports/Airfields. In addition to Holloman AFB, there are two Army Air Fields (Condron and Stallion) and several airports within the WSMR airspace ROI, including Alamogordo-White Sands Regional, Carrizozo, Sierra Blanca Regional, Fort Sumner, Roswell Industrial, Artesia, Cavern City and Dell City, to the east; Dona Ana County, El Paso International, West Texas, and Fabens to the south; Las Cruces International, Truth or Consequences, Deming, Hatch, Grant County, Whisky Creek, Lordsburg, Reserve, and Socorro to the west; and Albuquerque International, Grants Milan, Alexander, Mid Valley, Sandia East, Moriarity, Santa Fe, Las Vegas, and Santa Rosa to the north (see Figure 3.3-2). In addition, there are numerous private airfields/airstrips in the WSMR airspace ROI.

Air Traffic Control. The WSMR airspace ROI lies within the Albuquerque Air Route Traffic Control Center’s (ARTCC's) boundaries (National Oceanic and Atmospheric Administration, 2001d). In the Class A (positive control areas) airspace from 18,000 to 60,000 feet, all operations are conducted under IFR procedures, and are subject to ATC clearances and instructions. Aircraft separation and safety advisories are provided by ATC, the Albuquerque ARTCC. In the Class E (general controlled airspace), below 18,000 feet, operations may be either under IFR or VFR; separation service is provided to aircraft operating under IFR only and, to the extent practicable, traffic advisories to aircraft operating under VFR, by the Albuquerque ARTCC.

The controlling agency for the Restricted Areas and MOAs within the WSMR airspace ROI is Albuquerque ARTCC with the exception of R-5107B, which is solely used by DOD, and the controlling agency is WSMR. During the published hours of use (see Table 3.3-1), the using agency is responsible for controlling all military activity within the restricted airspace, and determining that its perimeters are not violated. When scheduled to be inactive, the using agency releases the airspace back to the controlling agency (Albuquerque ARTCC), and, in effect, the airspace is no longer restricted. If no activity is scheduled during some of the published hours of use, the using agency releases the airspace to the controlling agency for nonmilitary operations during that period of inactivity (Illman, 1993).

3.3.2.2 Environmental Consequences

Proposed Action

Ground-Testing Activities. Ground tests at WSMR/Holloman AFB (if necessary) would be conducted within SUA. WSMR flight safety would determine any airspace protection. Only ground testing of the lower-power laser systems (i.e., ARS, BILL, TILL, and SHEL) would be conducted at Holloman AFB from the western end of the base runway (runway 04-22) in the event ground testing was not possible at Edwards AFB or Kirtland AFB. The laser systems would be directed westward at targets placed within WSMR. Laser targets would be positioned within a shroud to limit the possibility of deflection (and potential impacts to surrounding airspace) when the laser beam comes into contact with the surface of the target. WSMR also maintains the appropriate range safety requirements and authorizations to conduct laser testing. No impacts to controlled or uncontrolled airspace, en-route airways and jet routes, or ATC in the airspace ROI are anticipated. Ground-test activities would only be conducted at Holloman AFB/WSMR if test activities could not be conducted at Edwards AFB or Kirtland AFB (the two primary locations to conduct ground testing). In the event that ground tests are conducted at Holloman AFB, impacts could occur to the Holloman AFB flying mission due to parking the ABL aircraft and associated support equipment at the western end of the base runway (runway 04-22). This set up would prevent aircraft from taking-off or landing (i.e., closure of the runway). In order to avoid operational impacts at Holloman AFB, other less frequently or unused runways, taxiways, or aircraft apron locations could be identified/dedicated to support the ABL aircraft during the short period of ground-testing activities. If a suitable ground test location that avoids Holloman AFB mission activities cannot be identified, the ABL ground-test program would be postponed until conditions at Edwards AFB or Kirtland AFB are suitable.

Flight-Testing Activities

Controlled and Uncontrolled Airspace. No new SUA proposal, or any modification to the existing SUA, would be necessary to accommodate the flight-testing activities at WSMR. WSRF would ensure that the flight-test area (both controlled and uncontrolled airspace) is clear prior to implementing test activities. The FAA may (when appropriate) implement flight-level restrictions for non-participating aircraft to ensure they are clear of the test area. An analysis of laser safety characteristics is provided in Section 3.1.4. Therefore, no impacts to the controlled or uncontrolled airspace in the ROI are expected.

Special Use Airspace. Use of the SUA associated with WSMR for the proposed flight-testing activities would not have an adverse impact on activities conducted within the airspace complex. The restricted areas, MOAs, and associated

ATCAAs using agency has a scheduling office that is responsible for establishing a real-time activity schedule for the parts of the airspace complex that would be utilized and forwarded, along with any subsequent changes, to the controlling ARTCC. In addition, the flight tests represent precisely the types of activities for which the Restricted Area SUA was created in the early 1960s: namely, to accommodate national security and necessary military activities, and to confine or segregate activities considered to be hazardous to nonparticipating aircraft.

MOAs are joint use airspace, as VFR aircraft are not denied access, and IFR aircraft may be routed through the airspace when approved separation can be provided from activities in the MOAs. Procedures for use of the MOA airspace by nonparticipating IFR traffic are set forth in letters of agreement executed between the controlling and using agencies.

In addition, no new demands would be placed on existing SUA that could not be accommodated by airspace schedulers. The Proposed Action would not require the creation of new SUA or require the modification of existing SUA. Direct laser energy that misses the target would exit restricted airspace above 45,000 feet and continue upward eventually exiting the Earth's atmosphere. Airspace above 45,000 feet would be cleared through coordination with the FAA and possible flight-level restrictions. Therefore, no impacts to SUA are expected.

Military Training Routes. No change to an existing or planned MTR or slow route would be required as a result of implementing of the Proposed Action; therefore, no impacts to MTRs in the ROI are expected.

En Route Airways and Jet Routes. Since proposed flight-testing activities would be contained within the existing SUA, no adverse impacts to the ROI's en route airways and jet routes within the WSMR SUA complex are anticipated. Consequently, no change to an existing or planned IFR minimum flight altitude, a published or special instrument procedure, or an IFR departure procedure would be required. No change to a VFR operation from a regular flight course or altitude would be required as a result of implementation of the Proposed Action.

The J13 and J57 high-altitude jet routes, which pass through the R-5119 Restricted Area in the northwest portion of the WSMR SUA complex, and the J65-166 and J108 high-altitude jet routes, which cross through the R-5107G, R-5107D, and R-5107B Restricted Areas in the middle of the complex, could be affected by proposed test activities. The J65-166 and J108 high-altitude jet routes are normally unavailable within the Restricted Area, Monday through Friday; therefore, the ABL flight-testing activities at WSMR would not change their availability. However, if ABL flight-testing activities use the R-5119 Restricted Area, air traffic using the J13 and J57 high-altitude jet routes through the Restricted Area would have to change their course or planned flight altitude.

Airports and Airfields. Implementation of flight-test activities would not restrict access to, or affect the use of, any airfield or airport available for public use, and would not affect airfield/airport arrival and departure traffic flows. Therefore, no impact to the ROI's airports and airfields are expected.

Mitigation Measures. Avoidance of the R-5119 Restricted Area would mitigate the potential adverse impacts to the J13 and J57 high-altitude jet routes that transit through the Restricted Area. In order to avoid operational impacts at Holloman AFB, other less frequently or unused runways, taxiways, or aircraft apron locations could be identified/dedicated to support the ABL aircraft during the short period of ground-testing activities. If a suitable ground-test location that avoids Holloman AFB mission activities cannot be identified, the ABL ground-test program would be postponed until conditions at Edwards AFB or Kirtland AFB are suitable.

Cumulative Impacts. Impacts to the J13 and J57 high-altitude jet routes transiting through the R-5119 Restricted Airspace could occur. Unless these two jet routes' use of the segment through the R-5119 Restricted Airspace is also impeded by other activities at WSMR, there would not be any incremental, additive impact on airspace.

It is unlikely that ground-test activities would be conducted at Holloman AFB/WSMR since Edwards AFB and Kirtland AFB have been identified as the two primary locations to conduct ground testing; however, in the event that ground tests are conducted at Holloman AFB, cumulative impacts could occur to the Holloman AFB flying mission due to parking the ABL aircraft and associated support equipment at the western end of the base runway (runway 04-22). This set up would prevent aircraft from taking-off or landing (i.e., closure of the runway). In order to avoid cumulative effects to the flying mission at Holloman AFB, other less frequently or unused runways, taxiways, or aircraft apron locations could be identified/dedicated to support the ABL aircraft during the short period of ground-testing activities. If a suitable ground-test location that avoids Holloman AFB mission activities cannot be identified, the ABL ground-test program would be postponed until conditions at Edwards AFB or Kirtland AFB are suitable.

In addition, during ABL flight-testing activities, cumulative effects to the Holloman AFB flying mission could occur. These effects would be due to the ABL test activities utilizing restricted airspace that is also utilized by Holloman AFB aircraft. This potential cumulative effect would be avoided through scheduling of test activities so that mission conflicts would not occur.

No-Action Alternative

Controlled/Uncontrolled Airspace. Ongoing activities at WSMR would continue to utilize the existing SUA. No new SUA proposal, or any modification to the existing SUA, would be required to accommodate continuing mission activities. No impacts to the controlled/uncontrolled airspace in the ROI are expected from the No-Action Alternative.

Special Use Airspace. The ongoing activities at WSMR would continue to utilize the existing SUA. Although the nature and intensity of utilization varies over time and by individual SUA area, the continuing mission activities represent precisely the types of activities for which the SUA was created. Restricted Areas contain airspace within which the flight of aircraft, while not wholly prohibited, is subject to restrictions. Activities within these areas must be confined because of their nature or limitations imposed upon aircraft operations that are not part of these activities, or both. As such, the continuing mission activities would not represent an adverse impact to SUA, and would not conflict with any airspace use plans, policies, or controls.

En Route Airways and Jet Routes. Ongoing activities at WSMR would continue to utilize, and be confined to, the existing SUA. Use of the existing en route airways and jet routes by IFR traffic comes under the control of the Albuquerque ARTCC; therefore, no adverse impacts to the ROI's airways and jet routes are expected.

In terms of potential airspace use impacts to en route airways and jet routes, the continuing mission activities would be in compliance with DOD Directive 4540.1, which specifies procedures conducting aircraft operations and for missile/projectile firing, namely the missile/projectile "firing areas shall be selected so that trajectories are clear of established oceanic air routes or areas of known surface or air activity" (Department of Defense, 1981).

Mission activities at WSMR would continue to utilize the existing SUA, and would not require a change to an existing or planned IFR minimum flight altitude, a published or special instrument procedure, or an IFR departure procedure, or require a VFR operation to change from a regular flight course or altitude. No impacts to the surrounding low-altitude airways and/or high-altitude jet routes are expected from the No-Action Alternative.

Airports and Airfields. Ongoing activities at WSMR would not restrict access to or affect the use of the existing airfields and airports. Operations at WSMR and the many private airfields/airstrips in the ROI would continue to operate at current levels. Existing airfield/airport arrival and departure traffic flows would not be affected by the No-Action Alternative, and access to airports/airfields would not be affected. Therefore, no impacts are expected under the No-Action Alternative.

Mitigation Measures. No mitigation measures would be required under the No-Action Alternative.

3.3.3 Hazardous Materials and Hazardous Waste Management

3.3.3.1 Affected Environment.

A variety of hazardous materials are utilized and stored at WSMR to provide range-infrastructure support activities and at Holloman AFB to support mission activities. These include cleaning solvents, paints, motor fuels, and other petroleum products. These materials are issued through the facility supply system to individual users. The majority of these materials are consumed in operational processes, and the remaining materials are collected as hazardous waste. Specific types and quantities of materials can vary depending upon specific system and test-configuration requirements. Each agency utilizing WSMR is responsible for procurement and management of its hazardous materials. All use of hazardous materials by WSMR users requires approval and coordination with WSMR safety and environmental organizations (U.S. Air Force, 1997).

Users of hazardous materials are responsible for the proper collection and disposal of hazardous waste generated as a result of their activity. This includes both waste generated during preflight activities at WSMR facilities, and waste generated following test operations.

WSMR Regulation 200-1, *Environmental Hazardous Waste Management,* provides guidelines for handling and management of hazardous waste, and ensures compliance with federal, state, and local laws regulating the generation, handling, treatment, storage, and disposal of hazardous waste. Under this regulation, hazardous waste generated during activities at WSMR is initially collected at the point of generation. Waste is containerized and segregated by waste type. From the initial collection point, all hazardous waste is collected and brought to a central collection facility for off-site shipment and disposal. Each range user is responsible for the cost of disposal of hazardous waste from its activities.

Holloman AFB maintains a Hazardous Materials Management Plan; a Hazardous Waste Management Plan to ensure compliance with applicable federal, state, and local regulations; and Air Force directives related to hazardous materials and hazardous waste management. Holloman AFB also maintains a Spill Prevention and Response Plan in accordance with AFI 32-4002, Hazardous Materials Emergency Planning and Response Program. The Plan complies with U.S. EPA spill prevention, control, and countermeasures requirements; Emergency Planning and Community Right-to-Know Act (EPCRA); and OSHA requirements. The Plan provides guidance for the identification of possible hazardous material sources, the discovery and reporting of a hazardous materials release, and procedures to follow in the event a release occurs.

3.3.3.2 Environmental Consequences

Proposed Action

Ground-Testing Activities. In the event that ground testing is not possible at Kirtland AFB or Edwards AFB, WSMR has the appropriate facilities and ranges to conduct ground-testing of these laser systems from adjacent Holloman AFB, and can provide ground support should an alternate test location be necessary. Ground testing occurring at WSMR from Holloman AFB would be coordinated with the WSMR Environment and Safety Directorate to ensure regulations are strictly followed and to ensure protection of sensitive resources. Because only the lower-power systems (i.e., ARS, BILL, TILL, and SHEL) would be ground tested at WSMR/Holloman AFB, hazardous materials management related to ground-testing activities would be similar to the ground-testing activities discussed for Kirtland AFB.

Flight-Testing Activities. Because the Proteus aircraft is operated by BAE Systems situated at Mojave Airport, California, fuel for the Proteus aircraft would be obtained from Mojave Airport fuel supplies; therefore, no fuel storage would be required at WSMR to support the aircraft. Hazardous materials used for range testing operations would include cleaning solvents, paint compounds, explosive material, and toxic propellants. Liquid propellants (hypergolic and cryogenic) would be used in missile flight systems. The Environmental Assessment for Liquid Propellant Targets at White Sands Missile Range (Missile Defense Agency, 2002) evaluated the environmental hazards associated with liquid propellant fuels at WSMR, and concluded that no significant impacts would result.

Based on an analysis of remaining propellant, at the time of destruction by the HEL, the missile targets could have 135 kilograms (kg) (300 pounds) to 700 kg (1,500 pounds) of propellant onboard (up to 220 gallons), and would be at an altitude of more than 35,000 feet. Depending on the type of missile target and the intensity of the target destruction, the total number of fragments could range from 60 to 3,000 fragments with most fragments weighing between 20 to 200 grams and the largest fragments being 100 to 200 kg (large intact target missile sections) (Science Applications International Corporation, 2002). Most of the remaining fuel onboard would be vaporized and quickly mixed with the surrounding air during the destruction of the missile. Any missile debris and fuel released after a test event would be handled in accordance with the WSMR Installation Spill Contingency Plan, and WSMR Environmental Safety Directorate would determine what range clearances and remediation action would be necessary.

The 1997 FEIS evaluated the potential environmental impact from the impact of missile targets and any remaining unspent missile propellant, and concluded that appropriate measures are in place to prevent adverse impacts. The existing hazardous materials storage and handling capabilities at WSMR and Holloman AFB would permit proper handling of all materials. Limited quantities of hazardous waste may be generated by the proposed target missile pre-launch activities at WSMR (U.S. Air Force, 1997). During ABL flight tests utilizing lower-power laser systems, it is expected that target missiles would impact into designated impact areas within the range boundaries. During ABL flight tests utilizing the HEL, it is expected that missile components would impact in separately designated impact zones within the range boundaries. Any debris from target missile impact areas would be recovered in accordance with WSMR SOPs. Missile debris and oxidizer or fuel released after a test would be handled in accordance with the WSMR Installation Spill Contingency Plan. Missile debris would be loaded onto a truck, and transported to an approved range residue accumulation point for analysis of ABL test results. The debris would be characterized to determine if it is hazardous waste. Hazardous waste would be disposed of via permitted procedures through the WSMR Hazardous Waste Storage Facility. Test activities at WSMR would be conducted in accordance with Army Regulation (AR) 200-1, *Environmental Protection and Enhancement*.

In the event the ABL aircraft is unable to land at Edwards AFB after conducting test activities (e.g., due to Edwards AFB runway closure), Holloman AFB (adjacent to WSMR) has been identified as one of three pre-planned “divert bases” in which the aircraft could be diverted. Although nothing would prevent the ABL aircraft from landing at any suitable base in time of emergency, personnel at Holloman AFB would be specifically trained to support the ABL aircraft and appropriate equipment to handle ABL hazardous materials (e.g., chemical transfer and recovery receptacles) would be in place. The ABL aircraft would remain at Holloman AFB until the Edwards AFB runway is cleared for incoming traffic.

Mitigation Measures. Because ABL testing activities would be required to comply with applicable federal, state, DOD, Air Force, and Army regulations regarding the use, storage, and handling of hazardous materials and hazardous waste, these activities would not result in substantial environmental impacts, and no mitigation measures would be required.

Cumulative Impacts. No other actions have been identified that would contribute to cumulative impacts such that adverse impacts would result.

No-Action Alternative

Under the No-Action Alternative, ABL ground- and flight-testing activities would not be conducted as described in Chapter 2 of this SEIS. ABL test activities would be conducted as analyzed in the 1997 FEIS. No adverse environmental impacts are anticipated.

Mitigation Measures. No mitigation measures would be required under the No-Action Alternative.

3.3.4 Health and Safety

3.3.4.1 Affected Environment.

While no ground-testing activities are scheduled to be performed at WSMR/Holloman AFB, WSMR has the appropriate facilities and ranges to conduct ground testing of the lower-power laser systems (i.e., ARS, BILL, TILL, and SHEL) should an alternate test location be necessary. The affected environment for ground-testing activities at WSMR would include rangeland between the Holloman AFB runway and the San Andres Mountain range to the west (see Figure 2.2-3).

Extensive lasing activities have occurred in the past at WSMR due to the presence of the High-Energy Laser Systems Test Facility (HELSTF), where testing and research is performed on multiple-types of laser systems. WSMR has multiple laser ranges in operation, and has experience in the health and safety requirements necessary for these types of operations. Holloman AFB activities would meet AFOSH standards and health and safety personnel would be briefed as necessary to support ground operations at Holloman AFB.

Highway closures due to launches at WSMR are a common occurrence and well understood and anticipated by local motorists between Las Cruces and Alamogordo. Highway 70, which crosses the southern part of WSMR, is in the evacuation area for flight tests originating in south WSMR. As a safety precaution, an agreement with the state of New Mexico allows WSMR to establish roadblocks on U.S. Highway 70 and 380. Under the agreement, a roadblock may last no longer than 1 hour and 15 minutes. U.S. Highway 70 is subject to an average of approximately one roadblock per week. U.S. Highway 380 is subject to approximately 1 roadblock per month. WSMR maintains a roadblock information hotline to provide up-to-date roadblock information to the public. Electronic courtesy billboards are situated outside the cities of Las Cruces and Alamogordo to inform drivers of upcoming roadblocks. Many local radio stations also broadcast daily roadblock information (WSMR, 1998).

3.3.4.2 Environmental Consequences

Proposed Action

Ground-Testing Activities. In the event that ground shots are performed at WSMR/Holloman AFB, sufficient backdrops are situated along the San Andres Mountains to provide vertical boundaries to contain any direct beams or reflections. Only ground testing of the lower-power laser systems (i.e., ARS, BILL, TILL, and SHEL) would be conducted at Holloman AFB from the western end of the base runway (runway 04-22). The laser systems would be directed westward, away from populated areas, at targets placed within WSMR. Range areas to be utilized during ground testing would be cleared using existing WSMR procedures to ensure no access to restricted areas (e.g., road blocks and notifications). Laser targets would be positioned within a shroud to limit the possibility of deflection (and potential impacts to the surrounding environment) when the laser beam comes into contact with the surface of the target. Existing WSMR laser hazard control regulations and WSMR range safety regulations adequately address outdoor lasing activities to ensure the safety of surrounding receptors.

Coordination of other local area or road closures for non-essential personnel in line-of-fire and nearby locations would be coordinated with White Sands National Monument, Holloman AFB, and San Andres National Wildlife Refuge safety officials. Essential personnel remaining during lasing activities would be briefed by MDA safety personnel and provided with appropriate personal protective equipment and other direction during the lasing period.

Flight-Testing Activities. Flight tests of the ABL systems would utilize existing launch facilities at WSMR, and would be conducted within both FAA and WSMR controlled airspace. The primary hazard associated with flight-testing activities is the reflected laser energy off of a target. At WSMR, the targets include missiles and target boards (i.e., Proteus aircraft, MARTI drops).

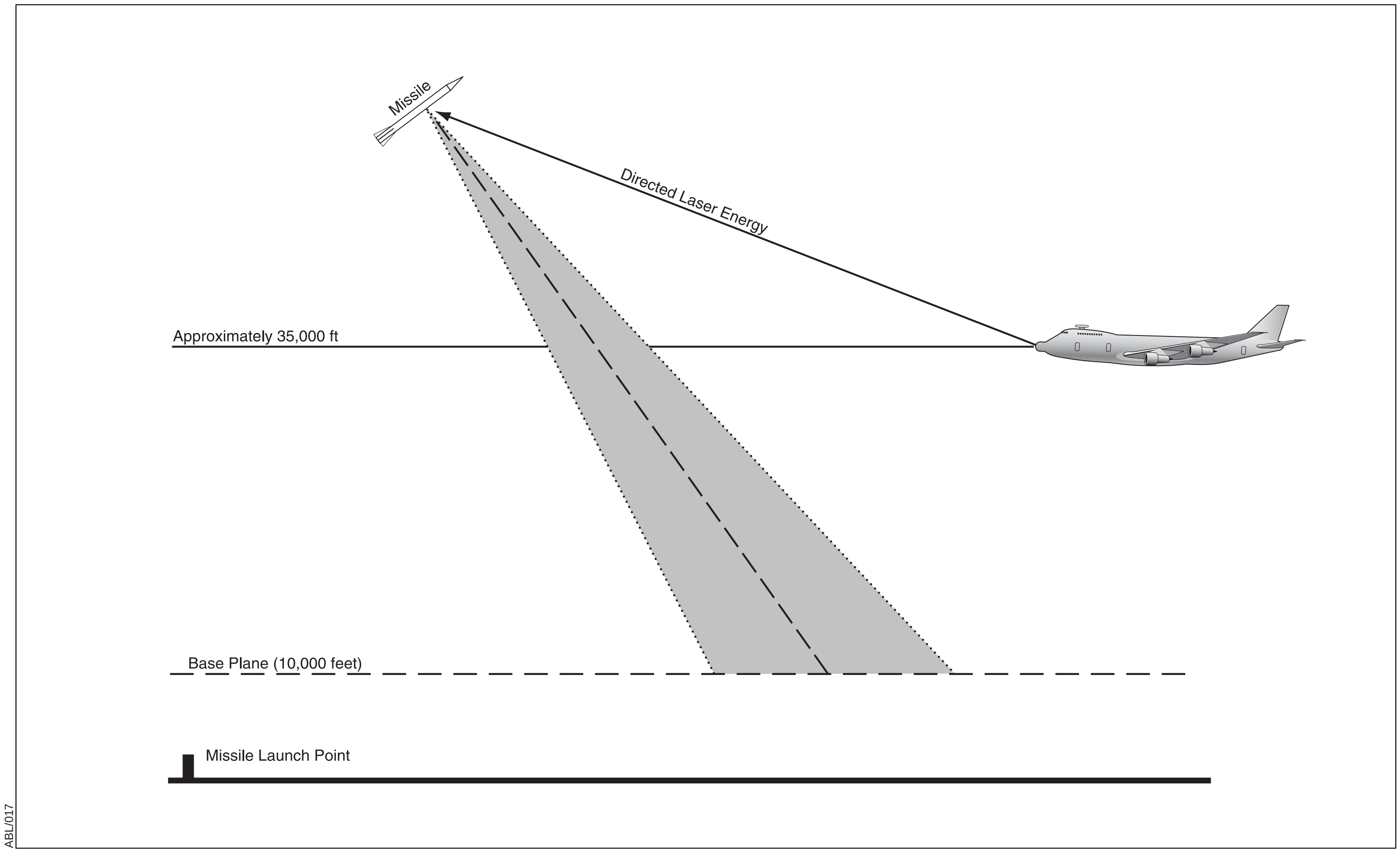
Multiple missile systems would be used during flight-testing activities. Of the estimated 35 missile flights for each of the Block 2004 and 2008 aircraft, the BILL, TILL, SHEL, and ARS systems would be active; however, only 15 missile flights for each aircraft would possibly involve the use of the HEL. In addition, the ABL could be used to monitor or engage (up to HEL with appropriate additional environmental analysis) targets of opportunity from other BMDS element testing. The reflected laser energy hazards for the HEL have been extensively investigated, and possible reflection scenarios (i.e., diffuse, specular, and glint reflections) predicted. A detailed evaluation is available in Appendix F of the Final Environmental Impact Statement for the Program Definition and Risk Reduction Phase of the Airborne Laser Program, Volume 1, 1997. The possibility of public exposure to hazardous levels of direct, non-reflected laser energy would be eliminated by the decision to restrict laser firing angles above the horizontal plane from the ABL aircraft's altitude of 35,000 feet or higher. However, because of the missile's flight path angle, when intercepted by the laser beam, reflections from the target missile surface, could be directed downward (Figure 3.3-4). Flight-test activities would be configured so that any hazardous reflected energy would be contained within range boundaries. The targets in all HEL engagements would be flying at altitudes above 35,000 feet. Because the diffusely reflected energy is spread over a large area, the energy density rapidly decreases to below MPE levels as specified in ANSI Z136.1. An evaluation of both specular and glint reflections from the HEL is provided in Appendix F of the 1997 FEIS, showing that reflections received at the base plane (i.e., elevation of 10,000 feet) are well below the MPE values. Because of the speeds of the ABL aircraft and targets, potential specular and glint reflected energy patterns would sweep across the surface of the earth at high velocities and in a relatively tight pattern. Potential exposure durations from both specular and glint reflections have been calculated to be very short (less than 0.01 second) (U.S. Air Force, 1997a).

Direct laser energy that misses the target would exit restricted airspace above 45,000 feet and continue upward eventually exiting the Earth's atmosphere. Coordination with the U.S. Space Command is required for Class 3 and 4 laser systems, unless waived by U.S. Space Command; laser firing time coordination would be accomplished to verify that on-orbit objects are not affected by laser operations (U.S. Air Force, 2001b).

Flight-test activities may involve off-range lasing, where the laser systems are fired from FAA-controlled airspace at targets within WSMR-controlled airspace or where the laser energy exits the WSMR airspace boundary; however, it would exit at an upward angle, and away from routinely flown airspace (Figure 3.3-5). White Sands Radar Facility (WSMR) would ensure that the flight-test area (both controlled and uncontrolled airspace) is clear prior to implementing test activities. The FAA may (when appropriate) implement flight-level restrictions for non-participating aircraft to ensure they are clear of the test area. No hazards associated with reflected laser energy should exist for aircraft, as the airspace to be utilized would be cleared of aircraft before lasing activities commence.

The 1997 FEIS analyzed the health and safety hazards associated with the transportation and preparation of targets, launch of targets, and the target debris impact connected with ABL flight-testing activities. The evaluation determined that the existing range safety for both on- and off-range scenarios was sufficient to minimize any potential non-lasing hazards associated with missile targets. The debris catalog for missile targets at WSMR would be referenced prior to conducting test activities.

WSMR Ground and Flight Safety determines the dimensions of the safety zone surrounding the launch and impact area, which areas of WSMR are evacuated for each mission, activation of the flight-termination system in the event of missile failure, missile intercept safety zones, and oversees the testing of missiles (U.S. Army Space and Missile Defense Command, 2001). Missile test activities at WSMR are carefully scheduled/coordinated to prevent potential conflicts between other proposed test activities. Missile firings cannot be scheduled or



EXPLANATION

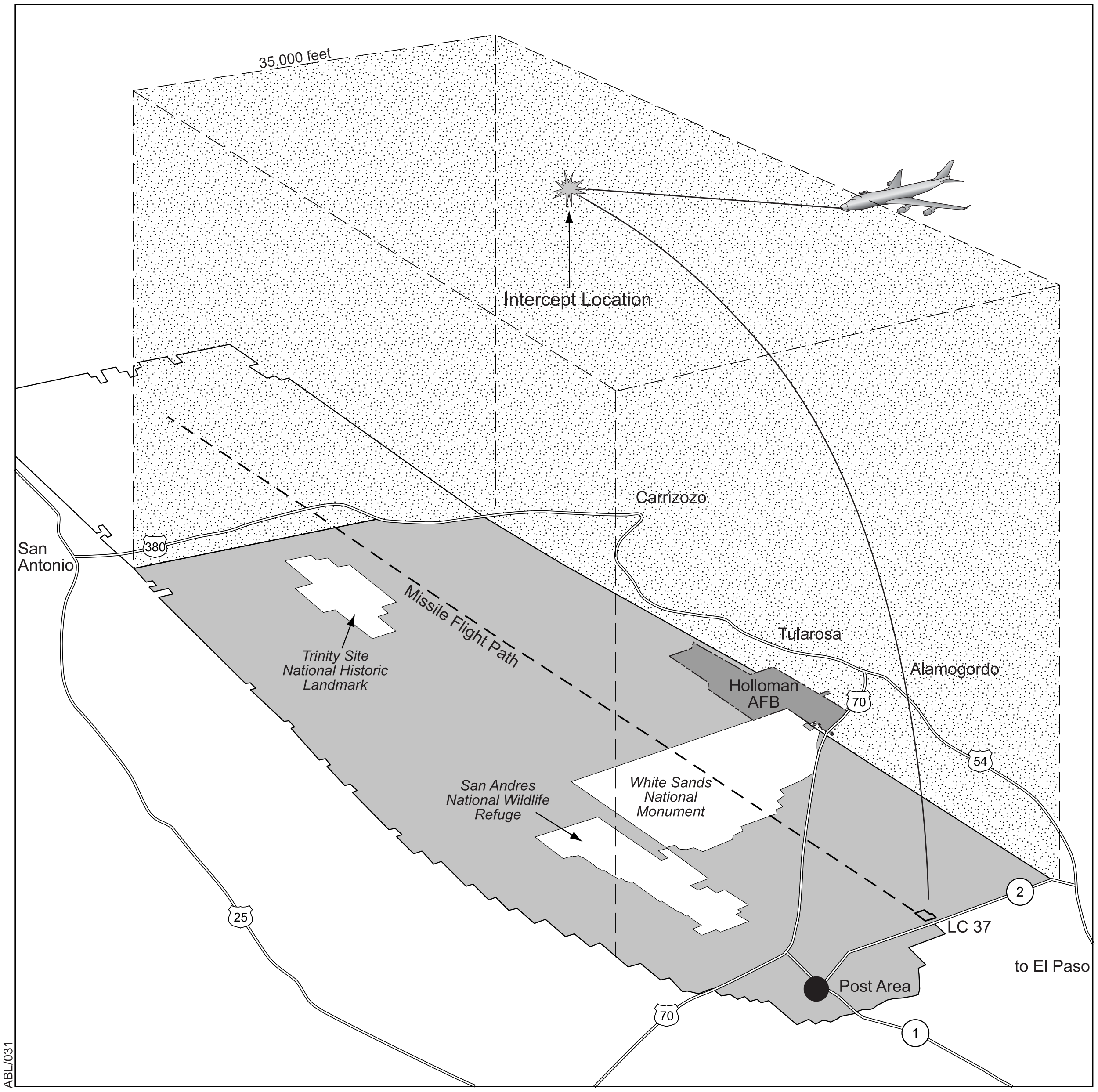
Reflected Laser Energy (Highly dependent upon interception angle, atmospheric interference, and reflectivity of missile surface)

Source: U.S. Air Force, 1997a.

Note: Base Plane is an imaginary horizontal surface where biological resources (both human and animal) are likely to be situated below.

Potential Laser Energy Reflection from Missile Engagements

Figure 3.3-4



EXPLANATION

Restricted Airspace

White Sands Missile Range, Off-Range Engagement Scenario

Not to Scale

Note: Commercial aircraft typically fly below 35,000 feet.

Figure 3.3-5

conducted without the final approval of the Missile Flight Safety Officer at WSMR. WSMR personnel would take the necessary precautions to minimize the potential for adverse health and safety impacts on the general public within the surrounding communities near WSMR, as well as WSMR personnel. SOPs have been developed on the range for the planning, safety evaluation, and conduct of flight testing. Any program involving missile flight safety must undergo a thorough safety review, a risk analysis, and preparation of SOPs. The documentation is reviewed by project directors and WSMR Missile Flight Safety. Evacuations, clearances, and road closures would be implemented to ensure worker and public health and safety. Roadblocks would be established before launch activities begin and appropriate ground and air surveillance sweeps would occur to ensure the appropriate areas are evacuated. U.S. Highways 70 and 380 are regularly closed during missile tests at WSMR. An agreement with the state of New Mexico identifies appropriate procedures to follow when establishing roadblocks or designated roads surrounding WSMR. Any debris from target missile impact areas would be recovered in accordance with WSMR SOPs.

The use of missiles as targets during flight-test activities would result in debris impacting the ground due to the successful intercept of a missile target by the HEL, or by the WSMR Range Officer terminating the missile flight due to a malfunction. The debris analysis of ABL test targets performed in 2002 determined that missile debris would be contained within the range boundaries (Science Applications International Corporation, 2002).

Missile debris would be recovered by WSMR personnel following policies and procedures outlined in WSMR Regulation 70-8, *Security, Recovery, and Disposition of Classified and Unclassified Test Material Impacting On-Range and Off-Range*. Missile debris recovery operations would be conducted utilizing existing roads, helicopter, or by foot. Recovery operations generally last less than 1 day. Debris would be recovered immediately as part of a continuous effort to keep WSMR clear of debris. WSMR would supply a debris-recovery team to locate and recover the debris and, if required, dispose of or destroy contaminated, classified, or hazardous materials according to the pertinent regulations (U.S. Army Space and Strategic Defense Command, 1995). The team would be assisted by WSMR environmental personnel to minimize disturbances to cultural, biological, and other resources. If deemed necessary, e.g., the recovery area is in an area with a high probability of threatened or endangered species or cultural resources, a qualified biologist and/or an archaeologist would accompany the search and recovery team. Previous debris-pattern modeling completed for prior missile intercept tests, does not predict any debris falling on the San Andres National Wildlife Refuge or the White Sands National Monument (U.S. Army Space and Strategic Defense Command, 1995). Any areas disturbed by the recovery operations would be restored, as necessary, after recovery operations have been completed. Any debris recovery and restoration activities within the White Sands National Monument would be conducted in accordance with a special use permit issued by the National Park Service at White Sands National Monument.

An estimated 50 Proteus aircraft tests would be conducted at WSMR for each of the Block 2004 and 2008 aircraft. Target boards attached to the Proteus aircraft would serve as the in-flight laser target. ARS, BILL, TILL, and SHEL lasing activities would be conducted. No high-energy engagements of the Proteus aircraft would occur. As previously discussed, any laser energy that misses the Proteus aircraft target board would continue upward and away from the ground. The Proteus aircraft would fly at altitudes above the ABL aircraft to eliminate public exposure to hazardous levels of laser energy.

In addition to missile and Proteus aircraft engagements, up to 50 MARTI drops from high-altitude balloons would be used as targets for each of the Block 2004 and 2008 aircraft. MARTI drop tests would be conducted at WSMR, involving testing of the lower-power ARS, BILL, TILL, SHEL, and high-energy HEL systems. Reflective energy patterns from the MARTI drop tests would be similar to the missile and Proteus engagements. During MARTI drop engagements, approximately 60 pounds of flare would be attached to the MARTI to provide an infrared source for the ABL. The flare would be exhausted within one minute, well before the MARTI reaches the ground. After the ABL engagement is complete, a parachute system would be deployed to slow down and recover the complete MARTI unit for reuse. A beacon would be included on the MARTI for tracking by range safety radar. Recovery of the MARTI would be conducted in accordance with WSMR Regulation 70-8 as discussed for recovery of missile targets.

Potential health and safety impacts could be expected from the fire danger that could occur with the 60 pounds of explosive flare that is attached to the target. Toxicity is not a concern because the primary material used to generate the infrared source, magnesium, is not highly toxic, and it is highly unlikely that humans or animals would ingest flare material. The flare would be ignited within the boundaries of WSMR at an altitude of approximately 100,000 feet and would be fully expended (i.e., burn out) in 41 seconds, long before the canister or the MARTI reaches the ground, one to two minutes later. Real-time tracking of the MARTI would show right away if the flare did not ignite. If the flare does not ignite, the dropped canister would be handled by WSMR’s Explosive Ordinance Division personnel, in accordance with standard WSMR operating procedures.

In addition, the ABL could be used to monitor or engage (up to HEL with appropriate additional environmental analysis and range safety clearance) targets of opportunity from other WSMR testing.

BASH is considered a safety concern for aircraft operations. BASH hazards at Holloman AFB and WSMR are managed to reduce bird/animal activity relative to aircraft operations. Because only one landing and take-off would occur during ground-testing activities at Holloman AFB and flight-test activities would occur above 35,000 feet, the likelihood of a BASH incident is considered low.

Because ABL flight-testing activities at WSMR would be performed in accordance with applicable regulations, and appropriate safety measures would be implemented, no adverse impacts are expected.

Mitigation Measures. ABL ground- and flight-testing activities would be performed in accordance with applicable regulations, and appropriate safety measures would be implemented. Therefore, no adverse impacts are expected, and no mitigation measures would be required.

Cumulative Impacts. No other actions have been identified that would contribute to cumulative impacts such that adverse impacts would result.

No-Action Alternative

Under the No-Action Alternative, ABL ground- and flight-testing activities would not be conducted as described in Chapter 2 of this SEIS. ABL test activities would be conducted as analyzed in the 1997 FEIS.

Mitigation Measures. No mitigation measures would be required under the No-Action Alternative.

3.3.5 Air Quality

3.3.5.1 Affected Environment.

Information on the affected environment and the environmental consequences at the Earth's surface, the planetary boundary layer, and the upper atmosphere were addressed in Sections 3.2.2 and 3.7 of the 1997 FEIS, and are incorporated by reference.

The ROI consists of the regional air quality control region in which WSMR and Holloman AFB are situated, and where ABL testing activities would occur. The southern two-thirds of WSMR is situated in New Mexico AQCR 6, which includes Dona Ana, Sierra, Lincoln, Torrance, and Otero counties. These counties, along with six in Texas, are part of the U.S. EPA El Paso-Las Cruces-Alamogordo Interstate Air Quality Control Region 153 (40 CFR Part 81.82).

The state of New Mexico ambient air monitoring network has no monitoring sites on or near WSMR, but does have one in Las Cruces. This monitoring site is situated on the west side of the Organ Mountains, and does not accurately represent conditions on the east side of the mountains, where WSMR and Holloman AFB are situated.

Based upon the U.S. EPA AIRS database for Las Cruces, the region is in attainment of the NAAQS for all criteria pollutants.

The launching of missiles would occur from existing launch sites at WSMR. Aircraft flights (i.e., ABL aircraft, F-16 chase aircraft, and Proteus aircraft) supporting ABL testing activities at WSMR would originate from Edwards AFB, California.

3.3.5.2 Environmental Consequences

Proposed Action

Ground-Testing Activities. In the event that WSMR/Holloman AFB are used to perform ground tests of the ABL systems, potential air quality impacts would be similar to those discussed for Kirtland AFB. No adverse impacts would be anticipated from conducting ground-testing activities at WSMR/Holloman AFB.

Flight-Testing Activities. The ground-level emissions from ABL flight-testing activities would occur from missile setup and launch activities and debris recovery. Table 3.3-2 provides a comparison of the annual emissions of criteria pollutants at WSMR, with the total emissions in the six-county area covered by WSMR. WSMR emissions are a small fraction of the total county emissions.

Table 3.3-2. Estimated Annual Emissions of Criteria Pollutants in the WSMR Area (tons/year)

	Criteria Pollutant			
Emission Inventory	VOCs	CO	NO_x	PM_{10}
1999 – 6 county	21,888	153,084	30,661	144,475
1994 – WSMR	276	1,118	1,376	289
ABL Tests (year 1)	0.27	2.61	0.52	0.53
ABL Tests (year 2)	0.23	1.90	0.20	0.30
ABL Tests (total)	0.50	4.51	0.72	0.83

ABL = Airborne Laser
CO = carbon monoxide
NO_X = nitrogen oxides
PM_{10} = particulate matter equal to or less than 10 microns in diameter
VOC = volatile organic compound
WSMR = White Sands Missile Range

Emissions associated with missile targets and drop targets are based on a per flight scaling of emissions estimates found in Appendix E of the 1997 FEIS. This includes VMT estimates for service vehicles and target recovery vehicles. During flight-test activities for each of the Block 2004 and 2008 aircraft, up to 35 target missiles would be launched, and there would be up to 50 Proteus missions and 50 MARTI drops. Proteus emissions from flights over WSMR would occur much higher than 3,000 feet, and only a small fraction of the total fuel load would be burned over WSMR.

Estimated emissions are less than 1 percent of the six-county total emissions. The increase in criteria pollutant emissions would not produce significant changes in air quality at WSMR.

Flight-test activities over WSMR would occur above the mixing layer. There would be some revisions to the upper air emissions estimated in the 1997 FEIS. The number and schedule of planned missile flights have changed. Most of the emissions would still be released into the planetary boundary layer and troposphere, and have been accounted for in the upper atmosphere analysis presented in the 1997 FEIS. The changes in the amounts of emissions are insignificant. The accidental release scenarios described in the 1997 FEIS are still valid, and the amount of pollutants released would be insignificant.

Mitigation Measures. Because there are no adverse impacts anticipated under the Proposed Action, mitigation measures are not required.

Cumulative Impacts. No other actions have been identified that would contribute to cumulative impacts such that adverse impacts would result.

No-Action Alternative

Under the No-Action Alternative, ABL ground- and flight-testing activities would not be conducted as described in Chapter 2 of this SEIS. ABL test activities would be conducted as analyzed in the 1997 FEIS. No adverse environmental impacts are anticipated.

Mitigation Measures. No mitigation measures would be required under the No-Action Alternative.

3.3.6 Noise

3.3.6.1 Affected Environment.

WSMR serves as a multiservice test range by supporting research, development, combat training, and testing programs for missiles, instrumentation, and weapons systems. On average, there are approximately 1,000 missiles per year including air-to-air/surface missions, surface-to-air missile missions, surface-to-surface missile missions, dispenser and bomb drop missions, and target system missions. Other noise sources include numerous annual research rocket missions, as well as gunnery range activities; approximately 600 supersonic and subsonic air combat training missions per month; 70 aircraft test program support missions per month; helicopter training activities; and ordnance explosions.

The following is a summary of current noise sources summarized from the WSMR Range-Wide Environmental Impact Statement (White Sands Missile Range, 1998). Many of the air activities occur over a large range of altitudes, resulting in a range of noise levels at the ground. As the slant distance increases, the noise decreases due to dissipation of sound energy by 6 dBA per doubling of distance, and additional reduction due to atmospheric effects. Noise levels from aircraft also vary with thrust and, if flying supersonic, with speed and maneuver. Typical noise sources and the range of noise levels occurring at WSMR are presented in Table 3.3-3.

In addition to the above activities, there are high-explosive tests and other ground armament testing and training exercises that occur on a regular basis at WSMR.

The ROI for noise exposure at Holloman AFB includes the area at the western end of the base runway (runway 04-22) from which open-range ground-testing activities would emanate. This area is associated with an active runway and is not near any housing areas. Noise sources at Holloman AFB include aircraft operations, surface traffic, ground tests (e.g., high-speed sled track), and stationary mechanical and electrical equipment.

3.3.6.2 Environmental Consequences

Proposed Action

Ground-Testing Activities. In the event that ground testing at WSMR/Holloman AFB is required, potential noise impacts would be similar to those discussed for Kirtland AFB.

Table 3.3-3. Typical Noise Levels in the Vicinity of WSMR/Holloman AFB

Vehicle/Activity	Distance (feet)	Noise Level (dB)	Noise Metric
Supersonic Aircraft	Not given	>115	L_{max}
UH-1H	1,000	80	L_{max}
HAWK Missile Launch	1,000	150	L_{peak}
QF-100 Drone	1,000	96	SEL
Low-Altitude Jet	Not given	65-70	L_{max}
NASA Rocket Engine	Not given	104-125	L_{max}
C-12	1,000	72	L_{max}
F-16 (Afterburner Power)	5,000, 10,000, 20,000	92, 83, 71	L_{max}
Military Helicopters	200, 500	99, 92	SEL
Drones	2,000	<85	L_{max}
Large-scale Exercise (150 aircraft, 24-hr sorties)	Varies	66	L_{dn}
Surface-to-Air Missiles	21, 100	122, 71	L_{max}

dB = decibel
NASA = National Aeronautics and Space Administration
L_{dn} = A-weighted day-night average sound level
L_{max} = A-weighted maximum instantaneous sound level
L_{peak} = Maximum instantaneous level
SEL = A-weighted sound exposure level

Source: White Sands Missile Range, 1998.

Flight-Testing Activities. An estimated 35 target missiles, 50 MARTI drops, and 50 Proteus aircraft flights are proposed to occur over WSMR for each of the Block 2004 and 2008 aircraft. Each test would involve the ABL aircraft and up to two F-16 chase aircraft. The ABL aircraft and F-16 aircraft would maneuver at high altitudes above 35,000 feet.

The target missiles would be launched from the existing launch complexes at WSMR. The noise levels from these missile launches would be similar to those described in Table 3.3-3. The impacts from missile activity would be similar to that which currently occurs, and are described in the WSMR Range-Wide EIS (White Sands Missile Range, 1998). Noise levels from an F-16 representative chase aircraft would be lower than shown in Table 3.3-3, as they would be flown at much higher altitudes.

The Proteus aircraft would fly at altitudes higher and at various distances from the ABL aircraft. Although the tests would occur over an 8-hour period, actual time over WSMR would be less than 3 hours. The remaining time would involve preflight activities, flight time to and from Edwards AFB and postflight activities. The DNL from the program aircraft activities over the range is estimated to be less than 55 dBA; no noise impacts are anticipated.

Mitigation Measures. Because there are no adverse impacts anticipated under the Proposed Action, mitigation measures are not required.

Cumulative Impacts. No other actions have been identified that would contribute to cumulative impacts such that adverse impacts would result.

No-Action Alternative

Under the No-Action Alternative, ABL ground- and flight-testing activities would not be conducted as described in Chapter 2 of this SEIS. ABL test activities would be conducted as analyzed in the 1997 FEIS. No adverse environmental impacts are anticipated.

Mitigation Measures. No mitigation measures would be required under the No-Action Alternative.

3.3.7 Biological Resources

3.3.7.1 Affected Environment.

The ROI for biological resources is the environment within the confines of the WSMR property line including the Northern and Western Call-up Areas. The ROI for biological resources at Holloman AFB includes the area at the western end of the base runway (runway 04-22) from which open-range ground-testing activities would emanate and areas over which the laser could be fired. This area is associated with an active runway and is a paved surface. However, the primary focus of activities is in the missile-launch and recovery areas. Because ABL flight tests using Fort Bliss airspace would occur above 35,000 feet, Fort Bliss is not considered part of the ROI for biological resources.

The Endangered Species Act (16 U.S.C. Sections 1531-1544) is intended to protect and restore threatened and endangered species of animals and plants and their habitats. Other federal statutes protecting biological resources include the Migratory Bird Treaty Act (16 U.S.C. Sections 703-712), the Bald Eagle and Golden Eagle Protection Act (16 U.S.C. Section 668-668d), and the Fish and Wildlife Coordination Act (16 U.S.C. Sections 661-667d) and the Sikes Act as amended (16 U.S.C. 670a-670o).

The New Mexico Department of Game and Fish protects threatened and endangered wildlife species under the authority of the New Mexico Wildlife Conservation Act (19 NMAC Section 33.1). The New Mexico Energy, Minerals, and Natural Resources Department protects threatened and endangered plant species under regulations governing endangered plant species (19 NMAC Section 21.2).

Vegetation. WSMR is situated in south-central New Mexico, within the north end of the Chihuahuan Desert region. The relatively warm, dry climate associated with this region is the primary factor influencing the vegetation in the area. Vegetation in this area includes Chihuahuan desert scrub, closed-basin scrub, and desert grasslands. At elevations above the desert scrub and grasslands regions, plains-mesa grasslands may occur. Both desert and plains-mesa grasslands form a broad, savanna-like ecotone at higher elevations, with the coniferous woodlands that dominate the cooler highlands of the Oscura and San Andres mountains. Junipers (*Juniperus* spp.) characterize the tree story of this transitional area. As slopes become steeper, the savanna develops a more woodland character, and mountain scrub vegetation forms part of the habitat mosaic. Pinyon pines (*Pinus edulis*) become more common until near the summits of the mountain ranges (White Sands Missile Range, 1998). The area in which the ABL aircraft would be parked at Holloman AFB is paved.

Wildlife. The diversity of landforms and vegetation types found on WSMR and adjacent Holloman AFB accounts for the relatively high number of mammals; 86 mammal species are found or are expected to occur on WSMR. Small mammals that are common at WSMR include Merriam's kangaroo rat, Ord's kangaroo rat (*Dipodomys ordii*), and deer mouse (*Peromyscus maniculatus*). Approximately 20 species of bat occur or are expected to occur on WSMR. The most common larger mammals are the coyote, common gray fox (*Urocyon cinereoargenteus*), and kit fox. Mountain lions are found in and adjacent to mountainous areas throughout WSMR. Bobcats are generally found in the desert, grassland, and mountainous habitats. Native species of ungulates include the mule deer, pronghorn (*Antilocapra americana*), desert bighorn sheep, and elk (*Cervus elaphus*). The oryx (*Oryx gazella*) is an introduced ungulates that is common to WSMR (White Sands Missile Range, 1998).

There are 307 bird species identified or expected to occur on WSMR. The most common birds on WSMR are the black-throated sparrow, northern mockingbird, mourning dove, and western kingbird (*Tyrannus verticalis*). Raptors include the Swainson's hawk (*Buteo swainsoni*), red-tailed hawk, golden eagle (*Aquila chrysaetos*), American kestrel, prairie falcon, and peregrine falcon (*Falco peregrinus*). The burrowing owl (*Athene cunicularia*), great-horned owl, and barn owl are also found on WSMR. Several birds are associated with aquatic habitats including waterfowl (ducks and geese), wading birds (herons and egrets), and shorebirds (plovers and sandpipers) (White Sands Missile Range, 1998).

The reptiles of WSMR include 2 genera of turtle, 12 genera of lizards, and 21 genera of snakes. The ornate box turtle (*Terrapene ornata*) is the only turtle known to occur on WSMR. The yellow mud turtle (*Kinosternon flavescens*) is expected to occur on WSMR. The Texas banded gecko (*Coleonyx brevis*), roundtail horned lizard (*Phrynosoma modestum*), checkered whiptail (*Cnemidophorus grahamii*), bullsnake (*Pituophis melanoleucus*), blackneck garter snake (*Thamnophis cyrtopsis*), plains blackhead snake (*Tantilla nigriceps*), and western diamondback rattlesnake are common to WSMR (White Sands Missile Range, 1998).

The amphibians of WSMR include one genus of salamander and five genera of frogs. The tiger salamander, red-spotted toad (*Bufo punctatus*), green toad, (*Bufo debilis*), and woodhouse toad (*Bufo woodhousi*) are common on WSMR. The White Sands pupfish (*Cyprinidon tularosa*) is the only native fish known to occur on WSMR. Introduced fish include the largemouth bass (*Micropterus salmonoides*) and the mosquitofish (*Gambusia affinis*) (White Sands Missile Range, 1998).

Threatened and Endangered Species. Twenty-two listed threatened and endangered plant species and 27 listed threatened and endangered animal species may be present in the vicinity of WSMR and Holloman AFB (Table 3.3-4).

Table 3.3-4. Threatened and Endangered Species in Dona Ana, Lincoln, Otero, Sierra, and Socorro Counties, New Mexico (Page 1 of 3)

Scientific Name	Common Name	State Status	Federal Status
Plant Species			
Coryphantha sneedii var. sneedii	Sneed pincushion cactus	_	E
Echinocereus fendleri var. kuenzleri	Kuenzler hedgehog cactus	-	E
Argemone pleiacantha ssp. Pinnatisecta	Sacramento prickly poppy	-	E
Euphydryas anicia cloudcrofti	Sacramento Mountains checkerspot butterfly	-	PE
Cereus greggii var. greggii	Desert night-blooming cereus	-	SC
Perityle cernua	Nodding rock-daisy	-	SC
Scrophularia laevis	Organ Mountain figwort	-	SC
Opuntia arenaria	Sand prickly pear	-	SC
Chenopodium cycloides	Sandhill goosefoot	-	SC
Draba standleyi	Standley whitlow-grass	-	SC
Allium gooddingii	Goodding's onion	-	SC
Chaetopappa elegans	Sierra Blanca cliff daisy	-	SC
Cirsium wrightii	Wright's marsh thistle	-	SC
Chrysothamnus nauseous var. texensis	Guadalupe rabbitbrush	-	SC
Lepidospartum burgessii	Gypsum scalebroom	-	SC
Escobaria villardii	Villard's pincushion cactus	-	SC
Coryphantha duncanii	Duncan's pincushion cactus	-	SC
Talinum humile	Pinos Altos flame flower	-	SC
Amsonia fugatei	Fugate's blue-star	-	SC
Acarospora clauzadeana [=Biatorella clauzadeana]	Unknown lichen[B]	(b)	(b)
Pseudocymopterus longiradiatus	Desert parsley[a]	SC	–
Hymenoxys vaseyi	Vasey's bitterweed[a]	SC	–
Perityle staurophylla var. *homoflora*	San Andres rockdaisy[a]	SC	–
Pertiyle staurophylla var. *staurophylla*	New Mexico rockdaisy[a]	SC	–
Escobaria organensis	Organ Mountain pincushion cactus[a]	E	–
Escobaria sanbergii	Sandberg's pincushion cactus[a]	SC	–
Peniocereus greggii var. *greggii*	Night-blooming cereus[a]	E	SC
Silene plankii	Plank's campion[a]	SC	–
Apacheria chiricahuensis	Cliff brittlebush[a]	SC	–
Ephedra coryi	Cory's jointfir[a]	SC	–
Astragalus castetteri	Castetter's milkvetch[a]	SC	–
Agastache cana	Mosquito plant[a]	SC	–
Hedeoma pulcherrima	Mescalero pennyroyal[a]	SC	–
Hedeoma todsenii	Todsen's pennyroyal[a]	E	E
Oenothera organensis	Organ Mountain evening primrose[a]	SC	SC
Polygala rimulicola var. *mescalerorum*	Mescalero milkwort[a]	E	SC
Penstemon alamosensis	Alamo beard tongue[a]	SC	SC
Penstemon neomexicanus	New Mexico beard tongue[a]	SC	–
Penstemon ramosus	Branching beard tongue[a]	SC	–
Animal Species			
Cyprinodon tularosa	White Sands pupfish[a]	T	SC
Haliaeetus leucocephalus	Bald eagle[a]	T	T
Falco femoralis septentrionalis	Northern aplomado falcon[a]	E	E
Hybognathus amarus	Rio Grande silvery minnow	-	E
Mustela nigripes	Black-footed ferret	-	E
Grus americana	Whooping crane	-	E
Oncorhynchus gilae	Gila trout	-	E
Strix occidentalis lucida	Mexican spotted owl	-	T

Table 3.3-4. Threatened and Endangered Species in Dona Ana, Lincoln, Otero, Sierra, and Socorro Counties, New Mexico (Page 2 of 3)

Scientific Name	Common Name	State Status	Federal Status
Animal Species (Continued)			
Rana chiricahuensis	Chiricahua leopard frog	-	T
Charadrius melodus	Piping plover	-	T
Charadrius montanus	Mountain plover	-	PT
Coccyzus americanus	Yellow-billed cuckoo	-	C
Cynomys ludovicianus	Black-tailed prairie dog	-	C
Lasiurus blossevillee	Western red bat	-	SC
Ondatra zibethicus ripensis	Pecos River muskrat	-	SC
Falco peregrinus tundrius	Arctic peregrine falcon	-	SC
Corynorhinus townsendii	Townsend's big-eared bat	-	SC
Falco peregrinus anatus	American peregrine falcon	E	SC
Ammodramus bairdii	Baird's sparrow	-	SC
Zapus hudsonius luteus	New Mexico meadow jumping mouse	-	SC
Tamias minimis atristriatus	Penasco (Least) chipmunk	-	SC
Accipiter gentilis	Northern goshawk	-	SC
Aneides hardii	Sacramento mountain salamander	-	SC
Thomomys umbrinus guadalupensis	Guadalupe southern pocket gopher	-	SC
Oncorhynchus clarki virginalis	Rio Grande cutthroat trout	-	SC
Catostomus clarki	Desert sucker	-	SC
Catostomus insignis	Sonora sucker	-	SC
Idionycteris phyllotis	Allen's big-eared bat	-	SC
Catostomus plebeius	Rio Grande sucker	-	SC
Falco peregrinus anatum	American Peregrine falcon[a]	T	–
Sterna antillarum athalassos	Interior least tern[a]	E	E
Columbina passerina	Common ground-dove[a]	E	–
Cynanthus latirostris	Broad-billed hummingbird[a]	T	–
Calypte costae	Costa's hummingbird[a]	T	–
Empidonax traillii extimus	Southwestern willow flycatcher[a]	–	E
Vireo bellii	Bell's vireo[a]	T	–
Vireo vicinior	Gray vireo[a]	T	–
Pelecanus occidentalis	Brown pelican[a]	E	E
Charadrius montanus	Mountain plover[a]	--	PT
Chlidonias niger	Black tern[a]	--	SC
Phlalacrocorax brasilianus	Neotropic cormorant[a]	E	--
Plegadis chihi	White faced ibis[a]	--	SC
Geomysbursarius arenarius	Desert pocket gopher[a]	--	SC
Neotoma micropus luecophaea	White Sands woodrat[a]	--	SC
Myotis ciliolabrum	Western small-footed myotis bat[a]	SC	SC
Corynorhinus (=Plecotus) townsedii townsedii	Townsends big-eared bat[a]	SC	SC
Ammodramus bairdii	Baird's sparrow[a]	T	–
Passerina versicolor	Varied bunting[a]	T	–
Canis lupus baileyi	Mexican gray wolf[a]	E	E
Euderma maculatum	Spotted bat[a]	T	–
Tamias quadrivittatus australis	Organ Mountains Colorado chipmunk[a]	T	–
Tamias quadrivittatus oscuraensis	Oscura Mountains Colorado chipmunk[a]	T	–
Panthera onca	Jaguar[a]	E	–
Ovis canadensis mexicanus	Desert bighorn sheep[a]	E	–

Table 3.3-4. Threatened and Endangered Species in Dona Ana, Lincoln, Otero, Sierra, and Socorro Counties, New Mexico (Page 3 of 3)

Scientific Name	Common Name	State Status	Federal Status
Invertebrate Species			
Thermosphaeroma thermophilus	Socorro isopod	-	E
Tryonia alamosae	Alamosa tryonia (springsnail)	-	E
Pyrgulopsis neomexicana	Socorro pyrg (springsnail)	-	E
Pyrgulopsis chupaderae	Chupadera pyrg (springsnail)	-	C
Comanchelus chihuanus	Millipede	-	SC
Limenitis archippus obsolete	Desert viceroy butterfly	-	SC
Lytta mirifica	*Anthony blister beetle*	-	SC
Sonorella todseni	Dona Ana talussnail	-	SC
Deronectes neomexicana	Bonita diving beetle	-	SC
Speyeria atlantis capitanensis	Sacramento Mountains silverspot butterfly	-	SC
Icaricia icariodes	Sacramento Mountains blue butterfly	-	SC
Oreohelix pilsbryi	Mineral Creek mountainsnail	-	SC

Notes: (a) Known or suspected to occur at WSMR and Holloman AFB.
(b) Currently this lichen has no Federal or State status. This lichen has Natural Heritage Program rankings of Global Ranking. G1 and State Ranking, S1 (G1/S1=critically imperiled because of extreme rarity making it especially vulnerable to extinction), and is considered a sensitive species at Holloman AFB because of its restrictive microhabitat requirements.

C = candidate
E = endangered
PE = proposed endangered
PT = proposed threatened
SC = species of concern
T = threatened

Source: White Sands Missile Range, 2001; U.S. Fish and Wildlife Service, 2002b.

Sensitive Habitats. Two sensitive habitat types have been identified at WSMR. The black grama/longleaf Mormon tea habitat occurs on the shoulders of fans and bajadas at elevations between 4,000 and 6,000 feet. The pinyon pine/Scribner needlegrass woodland occurs in the Oscura Mountains on gentle to moderate slopes at elevations between 7,900 and 8,700 feet. Wetlands are dispersed throughout WSMR, the majority of which are considered lacustrine, which are generally associated with ponds and lakes. Palustrine wetlands were also identified within WSMR. Other sensitive areas identified at WSMR include cliffs, the San Andres National Wildlife Refuge, Malpais areas, Agropyron meadows, Strawberry Peak, caves and mines, cactus community vegetation, and mound springs complex (White Sands Missile Range, 1998). The White Sands pupfish essential habitat occurs at Salt Creek, Mound Springs, Malris Spring, Salt Marsh, and Lost River. The area in which the ABL aircraft would be parked at Holloman AFB is paved; no sensitive habitats have been identified.

3.3.7.2 Environmental Consequences

Proposed Action

Ground-Testing Activities. In the event that ground testing is not possible at Edwards AFB or Kirtland AFB, WSMR has the appropriate facilities and ranges to conduct ground testing of the laser systems from adjacent Holloman AFB, and can provide ground support should an alternate test location be necessary. Potential impacts to biological resources would be similar to the ground-testing activities discussed for Kirtland AFB (see Section 3.2.7.2).

Lasers are currently used on WSMR in various programs. An analysis of these laser programs indicated that there was a potential of physical injury to wildlife. According to a study performed in 1980 by the U.S. Army regarding laser activity at WSMR, there have been negligible cumulative impacts on wildlife populations.

Big game species such as bighorn sheep in mountainous areas were not affected at all, and open range species such as quail and coyotes were only slightly impacted (White Sands Missile Range, 1998). Ground-test activities would be conducted, to the extent possible, outside of the migratory time periods to minimize potential impacts. Because ground-test activities at WSMR/Holloman AFB would only involve the lower-power ARS, BILL, TILL, and SHEL systems for a short period of time (approximately 20 seconds per laser test) within a small area of the range, and precautions to prevent laser energy from straying off target would be implemented, adverse impacts to biological resources are not expected.

Flight-Testing Activities. ABL flight-testing activities to be conducted at WSMR would involve routine range activities including missile preparation and launching, routine debris impacts, and the use of the low- and high-energy lasers. In addition, MARTI drops and Proteus aircraft would also be utilized during flight tests of the ABL systems.

An analysis of the effects from monolithic and missile-debris as a result of HEL destruction of the target missile is provided in Appendix G of the 1997 FEIS. As an example, monolithic impact of the missile 130 km (81 miles) from the launch point would have an extremely low probability of hitting any sensitive plant or animal species, and the effect of the propellant remaining onboard would be localized to a small area.

Based on an analysis of remaining propellant at the time of destruction by the HEL, the missile targets could have 135 kg (300 pounds) to 700 kg (1,500 pounds) of propellant onboard (up to 220 gallons), and would be at an altitude of more than 35,000 feet. Depending on the type of missile target and the intensity of the target destruction, the total number of fragments could range from 60 to 3,000 fragments with most fragments weighing between 20 to 200 grams and the largest fragments being 100 to 200 kg (large intact target missile sections) (Science Applications International Corporation, 2002). Most of the remaining fuel onboard would be vaporized and quickly mixed with the surrounding air during the destruction of the missile. Any missile debris and fuel released after a test event would be handled in accordance with the WSMR Installation Spill Contingency Plan, and WSMR Environment and Safety Directorate would determine what range clearance and remediation actions would be necessary.

Target missile trajectories would be planned to avoid debris impact in the San Andres National Wildlife Refuge, Holloman AFB, and other sensitive areas and to adhere to requirements of the agreement between the National Park Service and WSMR with regard to debris impact in the White Sands National Monument. Target missile debris would be contained within the WSMR boundaries and could result in the negligible loss of some vegetation over a small portion of WSMR. The types of vegetation that could be impacted include, desert scrub, forest, and grassland. Adverse impacts to vegetation are not expected.

Flight test activities could potentially harm the White Sands pupfish (*Cyprinodon tularosa*), a species listed as threatened by the New Mexico Department of Game and Fish (NMDGF). Although target missile impacts in pupfish habitat is neither planned nor anticipated, possible effects of such an impact include debris and liquid propellant releases from destroyed target missiles and debris recovery operations. The possibility, however, of target debris directly impacting an individual pupfish is very small since wetlands occur on less than two percent of WSMR (White Sands Missile Range, 1998). The species' habitat is limited to Salt Creek, Mound Springs, Malris Spring, Salt Marsh, and Lost River. These habitats represent a small portion of the entire wetlands found on WSMR. Adverse effects to this species are not expected.

After each test flight, hazardous debris would be recovered as quickly as possible. Part of the missile tests may include mock warheads with specialized electronic tracking devices. These devices would help determine the actual debris pattern as part of the test but would also facilitate faster recovery and response actions at the range, resulting in less ecological damage (i.e., the recovery team can go directly to the debris and not have to search for it); reducing the impact to the environment. The recovery team would likely utilize a light lift utility helicopter in rough terrain. Debris recovery flights would involve gradual descents to pick up the debris, followed by a flight of the recovery helicopter at an altitude that would avoid startling or disturbing wildlife. Adverse impacts to wildlife species due to low-level helicopter flights are not expected. Should recovery effects be necessary on Holloman AFB, best management practices as delineated by Holloman AFB would be followed to minimize impacts to sensitive environments.

Four wheel drive vehicle recovery operations would be under taken only if absolutely necessary, with a minimum of disturbance, and in accordance with existing WSMR SOPs. A qualified biologist would accompany the debris recovery team if deemed necessary.

An analysis of the potential impacts associated with the operation of the HEL was discussed in the 1997 FEIS. This analysis showed that laser activities would not have significant impacts upon the wildlife at WSMR (U.S. Air Force, 1997). Largely, this results from the high altitude at which the proposed laser activity would occur (35,000 feet or higher), and from the test geometry that would prevent the laser systems using the nose turret from being engaged in a downward direction.

Mitigation Measures. Because flight-test activities would be conducted at 35,000 feet or higher and existing SOPs are in place to minimize potential ground disturbance during recovery of missile debris, no adverse impacts are anticipated under the Proposed Action, mitigation measures are not required.

In the event that target debris impacts White Sands pupfish habitat, specific operational steps for emergency responses would be determined on a case-by-case basis in accordance with the WSMR Missile Mishap Plan, Annex P to the Disaster Control Plan. In general, a typical response action includes the following:

- Render the missile or debris safe
- Stop the flow of acid and/or fuel
- Neutralize the acid or fuel in the stream (or body of water) sufficiently far downstream to avoid a continuing hazard to wildlife
- Install surface skimmers and absorptive materials downstream from the lead edged of contamination to collect the fuel
- Monitor the pH along the stream to ascertain that a reasonable pH has been established
- Remove petroleum products from stream surfaces and return the damaged area to an environmentally sound level (Missile Defense Agency, 2002).

Cumulative Impacts. No other actions have been identified that would contribute to cumulative impacts such that adverse impacts would result.

No-Action Alternative

Under the No-Action Alternative, ABL ground- and flight-testing activities would not be conducted as described in Chapter 2 of this SEIS. ABL test activities would be conducted as analyzed in the 1997 FEIS. No adverse environmental impacts are anticipated.

Mitigation Measures. No mitigation measures would be required under the No-Action Alternative.

3.3.8 Cultural Resources

3.3.8.1 Affected Environment.

WSMR maintains several agreement documents and plans regarding the management of cultural resources on WSMR including a Programmatic Memorandum of Agreement among WSMR, the New Mexico SHPO, and the Council (1985) addressing the protection and management of historic properties on the range; an Memorandum of Understanding (MOU) with the SHPO addressing land use management for the Trinity National Historic Landmark; an MOU with the National Park Service regarding overflight and recovery activities within the range; a Cooperative Agreement with the New Mexico Bureau of Mines & Mineral Resources designed to improve the management of paleontological resources; a Cultural Resources Management Plan; and a Historic Preservation Plan.

The ROI for cultural resources is the area within the confines of the WSMR boundary. However, the primary focus of activities is in the immediate area of designated debris impact areas and areas that ground-based target boards would be positioned.

Numerous cultural resource surveys and identification efforts have been conducted at WSMR. These surveys have covered many thousands of acres (approximately 150,000 acres) and have resulted in the identification of thousands of cultural resources. However, due to the large extent of the property that has never been surveyed (over 93 percent as of 1997) the total number of resources present is not known. The total number of sites is predicted to be approximately 27,000 (U.S. Army Space and Strategic Defense Command, 1995).

Survey efforts at WSMR have resulted in the identification of the following cultural resources of unknown eligibility status:

- Approximately 6,000 prehistoric sites
- Five protohistoric sites, all located in the WSMR call-up areas
- 241 Euro American sites characterized by the beginning of homesteading, ranching, and mining
- 34 buildings and structures representing the military occupation of the area and including Plywood City, a Cold War-period site, Sierra Chapel, a World War II temporary, mobilization-type facility, and rocket engine test facilities.

In addition, a review of the NRHP and the New Mexico State Register of Cultural Properties indicated that there are three National Register-listed properties within the WSMR boundaries:

- The Trinity Site, both an NRHP-listed site and a National Historic Landmark, consisting of several structures;
- Launch Complex (LC) 33, an NRHP-listed site and a National Historic Landmark consisting of an Army blockhouse and a gantry crane that were used to launch V-2 and Viking rockets in the late 1940s
- The White Sands National Monument Historic District, also a New Mexico state-registered site.

Finally, in addition to the White Sands National Monument Historic District, there are two other New Mexico state-registered sites: the Mockingbird Gap site and the Parabolic Dune Hearth Mounds.

Traditional resources within WSMR are expected to be associated with the Mescalero Apache, whose lands are on the northern periphery of WSMR, the Lipan Apache Tribe, and the Chiricahua Apache. Traditional cultural properties are known to exist in the WSMR region, and Apache tribal leaders indicate that the Oscura Mountains (situated in the northern portion of the range) are used for traditional religious purposes. Salinas Peak, in the San Andres Mountains, is a sacred site for the Chiricahua Apache.

Within the WSMR boundary, numerous paleontological sites have been recorded (prehistoric mammal tracks). There are no National Natural Landmarks within WSMR.

At Holloman AFB, several prehistoric sites lie within the potential ground-test area where the laser beam will pass over.

3.3.8.2 Environmental Consequences

Proposed Action

Ground-Testing Activities. In the event that ground testing at WSMR/Holloman AFB is required, such testing would occur on previously disturbed, paved, or developed land. No construction activity would be necessary; therefore, there are no foreseen impacts to cultural or paleontological resources at WSMR/Holloman AFB.

Flight-Testing Activities. Flight-testing activities associated with the ABL Program would involve routine range activities including missile preparation and launching, routine debris impacts, and the use of low- and high-energy lasers. In addition to target missiles, MARTI Drop tests and Proteus aircraft would be utilized to test the laser systems. The use of missiles as targets during flight-test activities would result in debris impacting the ground surface due to the successful intercept of a missile target by the HEL, or by the WSMR Range Officer terminating the missile flight due to a malfunction. Such ground impacts could potentially impact cultural or paleontological resources at WSMR. However, missile debris would be recovered by WSMR personnel following policies and procedures outlined in WSMR Regulation 70-8, *Security, Recovery, and Disposition of Classified and Unclassified Test Material Impacting On-Range and Off-Range*. Missile debris recovery operations would be conducted utilizing existing roads, helicopter, or by foot. Recovery operations generally last less than 1 day. Debris would be recovered immediately as part of a continuous effort to keep WSMR clear of debris. WSMR would supply a debris-recovery team to locate and recover the debris and, if required, dispose of or destroy contaminated, classified, or hazardous materials according to the pertinent regulations (U.S. Army Space and Strategic Defense Command, 1995).

The debris-recovery team would be assisted by WSMR environmental personnel in order to minimize disturbances to cultural or paleontological resources. If deemed necessary, e.g., the recovery area is in an area with a high probability of cultural or paleontological resources, a qualified archaeologist would accompany the search and recovery team. Previous debris-pattern modeling completed for prior missile intercept tests, does not predict any debris falling on the White Sands National Monument (U.S. Army Space and Strategic Defense Command, 1995). Any areas disturbed by the recovery operations would be restored, as necessary, after recovery operations have been completed. These recovery strategies and related SOPs would mitigate potentially adverse effects to cultural or paleontological resources.

Mitigation Measures. Because no ground disturbance would occur during placement of ground targets, and designated debris impact areas have been established with existing SOPs in place to recover any missile debris, no adverse impacts are anticipated.

Cumulative Impacts. No other actions have been identified that would contribute to cumulative impacts such that adverse impacts would result.

No-Action Alternative

Under the No-Action Alternative, ABL ground- and flight-testing activities would not be conducted as described in Chapter 2 of this SEIS. ABL test activities would be conducted as analyzed in the 1997 FEIS. No adverse environmental impacts are anticipated.

Mitigation Measures. No mitigation measures would be required under the No-Action Alternative.

3.3.9 Socioeconomics

3.3.9.1 Affected Environment.

The ROI for socioeconomics includes Dona Ana and Otero counties, New Mexico. Within the two counties, Las Cruces and Alamogordo are the two communities most likely to host the temporary personnel associated with the potential ground-testing activities and proposed flight-testing activities at WSMR/Holloman AFB. White Sands National Monument is visited by approximately 500,000 people annually and is the most visited National Park Service site in New Mexico. The affected environment is described below in terms of its principal attributes: population, income, employment, and housing or lodging.

Population. In 1999, Dona Ana County had a population of 170,000, and Otero County had a population of 54,000 (Bureau of Economic Analysis, 2001a). The communities most likely to host temporary personnel associated with the ABL Program are Las Cruces and Alamogordo, the closest communities with the largest concentration of hotels/motels. In 1999, Las Cruces had a population of 74,000, and Alamogordo had a population of 36,000 (Census Bureau, 2001).

Income. In 1999, Dona Ana County had a per capita personal income of $17,003. This ranked 23rd in the state, and was 78 percent of the state average of $21,836, and 60 percent of the national average of $28,546. Otero County had a per capita income of $18,945. This ranked 15th in the state, and was 87 percent of the state average and 66 percent of the national average (Bureau of Economic Analysis, 2001b).

Employment. Full- and part-time employment in Dona Ana County totaled 73,000 in 1999, up from 57,000 in 1989. Otero County had 28,000 full- and part-time employees in 1999, up from 26,000 in 1989 (Bureau of Economic Analysis, 2001a).

WSMR employs approximately 6,000 individuals, 6 percent of whom are military personnel. Labor force data are not available for the cities of Las Cruces and Alamogordo; however, using the respective county employment to population ratios, it is calculated that Las Cruces and Alamogordo have labor forces of approximately 32,000 and 19,000 respectively. Unemployment rates are not available.

Housing/Lodging. Because personnel associated with the ABL Program's testing activities are expected to be required on a temporary basis for the short duration of each test event, it is anticipated that they will seek accommodations in hotels and motels closest to WSMR. There are 21 hotels/motels recognized by the AAA, with a total of 1,599 units in Las Cruces. Alamogordo, situated to the east of WSMR, has 8 hotels/motels, with a total of 545 units (American Automobile Association, 2001).

3.3.9.2 Environmental Consequences

Proposed Action

Ground-Testing Activities. In the event that ground-testing activities are necessary at WSMR/Holloman AFB, potential socioeconomic impacts would be similar to those discussed under flight-testing activities for WSMR. Ground-testing activities from Holloman AFB could result in a short-term increase in the number of closures of public use of White Sands National Monument, resulting in inconvenience to the public. No socioeconomic impacts are anticipated.

Flight-Testing Activities. Flight-testing activities at WSMR are expected to require up to 50 program-related, temporary personnel for short-periods surrounding each test event. Given the normal daily, weekly, and monthly fluctuation of population, employment, and visitors to both WSMR and local communities in the ROI, the need for up to 50 additional program-related temporary personnel would have a small, positive, yet largely unnoticeable effect on population, income, or employment in the ROI. Socioeconomic impacts would essentially be limited to expenditures by the temporary personnel in the local economy, particularly at local hotels/motels and restaurants. Based on a 2002 maximum per diem rate of $85 (U.S. General Service Administration, 2001), the 50 program-related personnel could result in an infusion of approximately $4,250 per day (about $29,750 per week) into the local economy, depending on the duration of their temporary assignments at WSMR.

However, because the increase in the number of temporary employees would represent only a 0.6-percent increase in the number of people employed at WSMR, 0.05 percent of the total labor force of the ROI, and the demand for up to 50 hotel/motel units would only represent 2.3 percent of the 2,144 unit supply in the ROI, the impact, although positive, would be small. For example, assuming an average occupancy rate of 70 percent, there would normally be 643 unoccupied units available to the 50 program-related personnel at any one time, and so there would most likely not be any effect on direct, indirect, or induced jobs, income, and related population.

Mitigation Measures. No mitigation measures would be necessary for either the potential ground-testing activities, or the proposed flight-testing activities.

Cumulative Impacts. With no discernible impacts expected for the ABL Program's ground- and flight-testing activities at WSMR/Holloman AFB, the potential for additive, incremental, cumulative impacts of the ABL Program in addition to other past, current, or reasonably foreseeable projects is considered remote.

No-Action Alternative

Under the No-Action Alternative, ABL ground- and flight-testing activities would not be conducted as described in Chapter 2 of this SEIS. ABL test activities would be conducted as analyzed in the 1997 FEIS. No adverse socioeconomic impacts within the ROI are anticipated.

Mitigation Measures. No mitigation measures would be required under the No-Action Alternative.

SECTION 3.4
VANDENBERG AIR FORCE BASE

3.4 VANDENBERG AIR FORCE BASE

In December 1997, the Air Force released the Final Theater Ballistic Missile Targets Programmatic Environmental Assessment that 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 (U.S. Air Force, 1997e). The associated Finding of No Significant Impact (FONSI) was published in January 1998 (U.S. Air Force, 1998d). Flight tests are needed to provide targets to fully validate system design and operational effectiveness of theater defensive missiles and other defense systems (e.g., ABL) utilized by the various DOD services. 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. Target missile launch sites evaluated in the EA include LF-06; LF-07; LF-09; LF-21; LF-22; LF-23; LF-24; LF-25; LF-26; Test Pad-01; Rail Garrison Peacekeeper; ABRES-A, sites 1, 2, and 3; Space Launch Complex (SLC)-3W; SLC-5; and V-33 (Figure 3.4-1). Expanded target launch capabilities at Vandenberg AFB are required to support future Navy, Air Force, and Army missile testing operations in the Western Range. The resources evaluated in the EA included air quality, biological resources, cultural resources, hazardous materials and waste, health and safety, land use, and noise. This EA is incorporated by reference throughout this SEIS.

3.4.1 Local Community

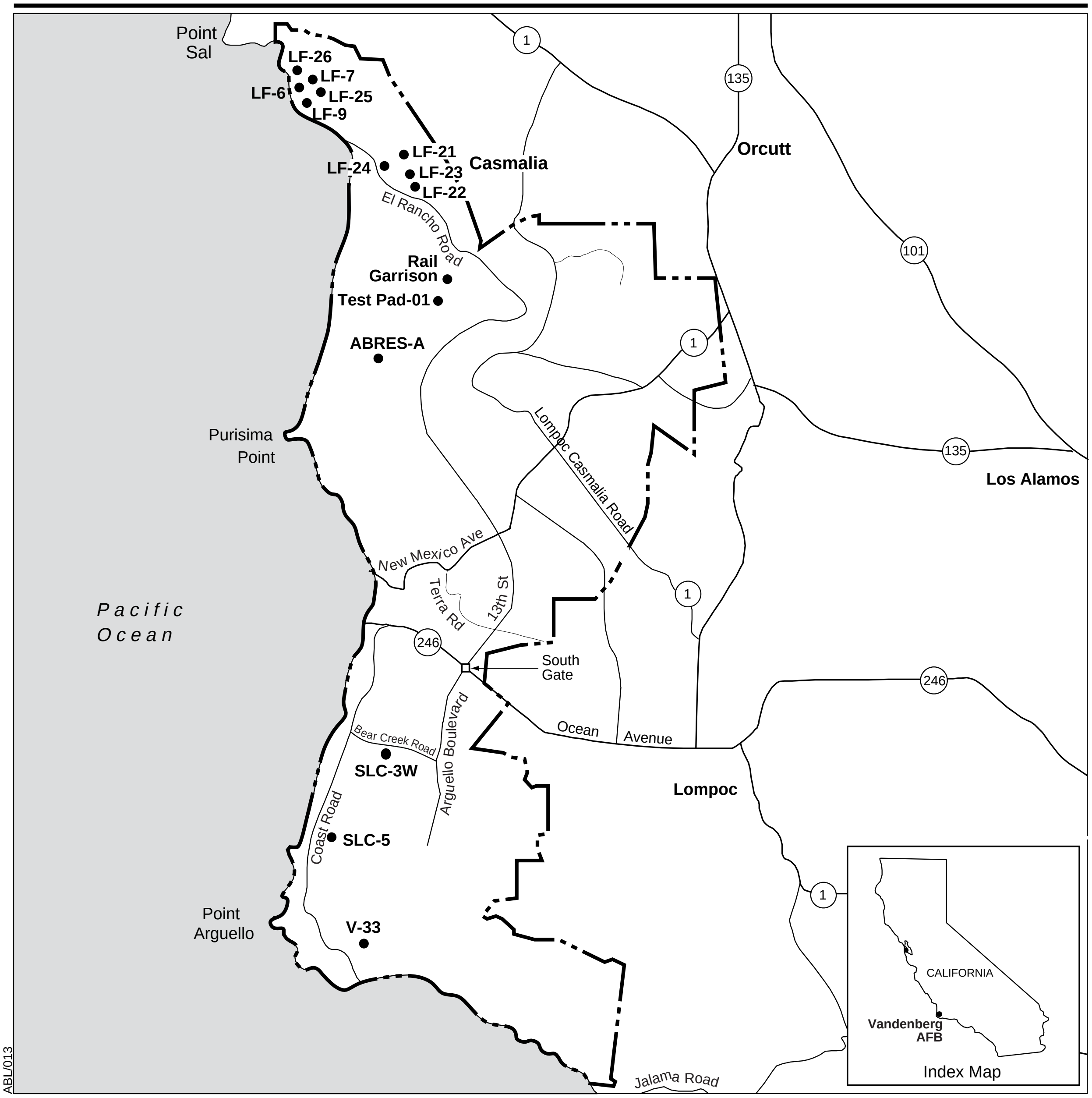
Background

Vandenberg AFB was originally activated as Camp Cooke in 1941, and provided infantry training for soldiers until the camp was inactivated in 1946. The Air Force acquired the base in 1957 for use as a missile launch center and for aeronautical operations. The newly activated West Coast Missile Center was transferred to the Air Force's Air Research and Development Command (now Air Force Materiel Command) and renamed Cooke AFB. In 1958, the installation was transferred to the Strategic Air Command, and renamed Vandenberg AFB in honor of General Hoyt Vandenberg, the Air Force Chief of Staff from 1948 to 1953. Air Force Space Command took control of the installation in January 1991.

The host unit at Vandenberg AFB is the 30th Space Wing, which is responsible for launching satellites into orbit. Vandenberg AFB also provides launch facilities for testing of intercontinental ballistic missiles and is the site of military, NASA, and commercial space launches accomplished on the West Coast. An average of 14 government-launched missiles occurred annually between 1990 and 1995, and an average of 15 government-launched missiles per year were projected between 1996 and 2005 (U.S. Air Force, 1995).

Location

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 3.4-1).



EXPLANATION

Base Boundary

Potential Launch Location

State Highway

LF Launch Facility

SLC Space Launch Complex

ABRES Advanced Ballistic Re-entry System

0 1.25 2.5 5 Miles

Source: U.S. Air Force, 1997e.

Vandenberg AFB Vicinity Map

Figure 3.4-1

ABL test activities would utilize existing launch sites at Vandenberg AFB that are addressed in the Theater Ballistic Missile Targets Programmatic Environmental Assessment to launch target missiles (see Figure 3.4-1).

The airspace of the Western Range begins at the Vandenberg AFB launch areas and extends west over the Pacific Ocean (see Figure 2.2-6). The West Coast Offshore Operating Area (WCOOA) is managed by the 30th Space Wing as an adjunct to the Western Range. The area is a combination of restricted and warning areas, as well as FAA-controlled airspace.

The climate is characterized as dry and subtropical. The Pacific Ocean is a moderating influence on temperatures and moisture content of the air. The weather is warm and dry from May to November and wet and cool from December to April. The average annual temperature is 55°F with a high of 74°F in September and a low of 38°F in January. Average annual rainfall is approximately 13 inches. The wettest month is February, and the driest is July. The widely varying topography causes a great variation in local wind direction and speed. In general, winds are stronger on the higher ridgelines and along the beaches. The annual surface wind speed is approximately 7 mph, usually from the west-northwest. Coastal fog, which occurs primarily during July through September, is usually confined to late evenings and early mornings.

3.4.2 Airspace

3.4.2.1 Affected Environment.

The airspace ROI for Vandenberg AFB (Western Range) is defined as that area that could be affected by the ABL flight-testing activities. For the purposes of this document, the ROI is the Western Range and an approximately 36-km (20-nm) zone around the edge of the range boundaries.

The affected airspace use environment in the Vandenberg AFB (Western Range) airspace ROI, which, except for the airspace above Vandenberg AFB, lies entirely offshore, is described below in terms of its principal attributes, namely: controlled and uncontrolled airspace; SUA; MTRs; en route airways and jet routes, airports and airfields; and ATC.

Controlled and Uncontrolled Airspace. Outside of the SUA identified and discussed separately in the next section, the domestic airspace in the ROI, including the airspace overlying the waters within 12 nm of the coast, is controlled airspace, within which some or all aircraft may be subject to ATC. This controlled airspace comprises Class A airspace from 18,000 feet above MSL, up to and including FL 600 (60,000 feet), and Class E airspace below 18,000 feet. The Class A and E airspace also includes designated international airspace beyond 12 nm of the coast within areas of domestic radio navigational signal or ATC radar coverage, and include the offshore Warning Areas identified in the SUA subsection below. Within Class E airspace, separation service is provided for IFR aircraft only, and, to the extent practical, traffic advisories to aircraft operating under VFR.

The distinction between "controlled" and "uncontrolled" airspace is important. Within controlled airspace, ATC service is provided to IFR flights and VFR flights in accordance with the airspace classification. Controlled airspace is also that airspace within which aircraft operators are subject to certain pilot qualifications, operating rules, and equipment requirements. For example, for IFR operations in any class of controlled airspace, a pilot must file an IFR flight plan, and receive an appropriate ATC clearance. Within uncontrolled airspace, no ATC service to aircraft operating under VFR is provided other than possible traffic advisories when the ATC workload permits, and radio communications can be established (Illman, 1993). IFR ATC service is available if requested.

Special Use Airspace. The Vandenberg AFB (Western Range) airspace ROI comprises four Restricted Areas (R-2516, R-2517, 2534A, and R-2534B), each extending to an unlimited altitude, immediately above and around Vandenberg AFB; two Restricted Areas (R-2535A and R-2535B) over San Nicolas Island; and 27 separate Warning Areas off the coast of southern California (see Figure 3.4-2). Their effective altitude, times used, and controlling agency are provided in Table 3.4-1.

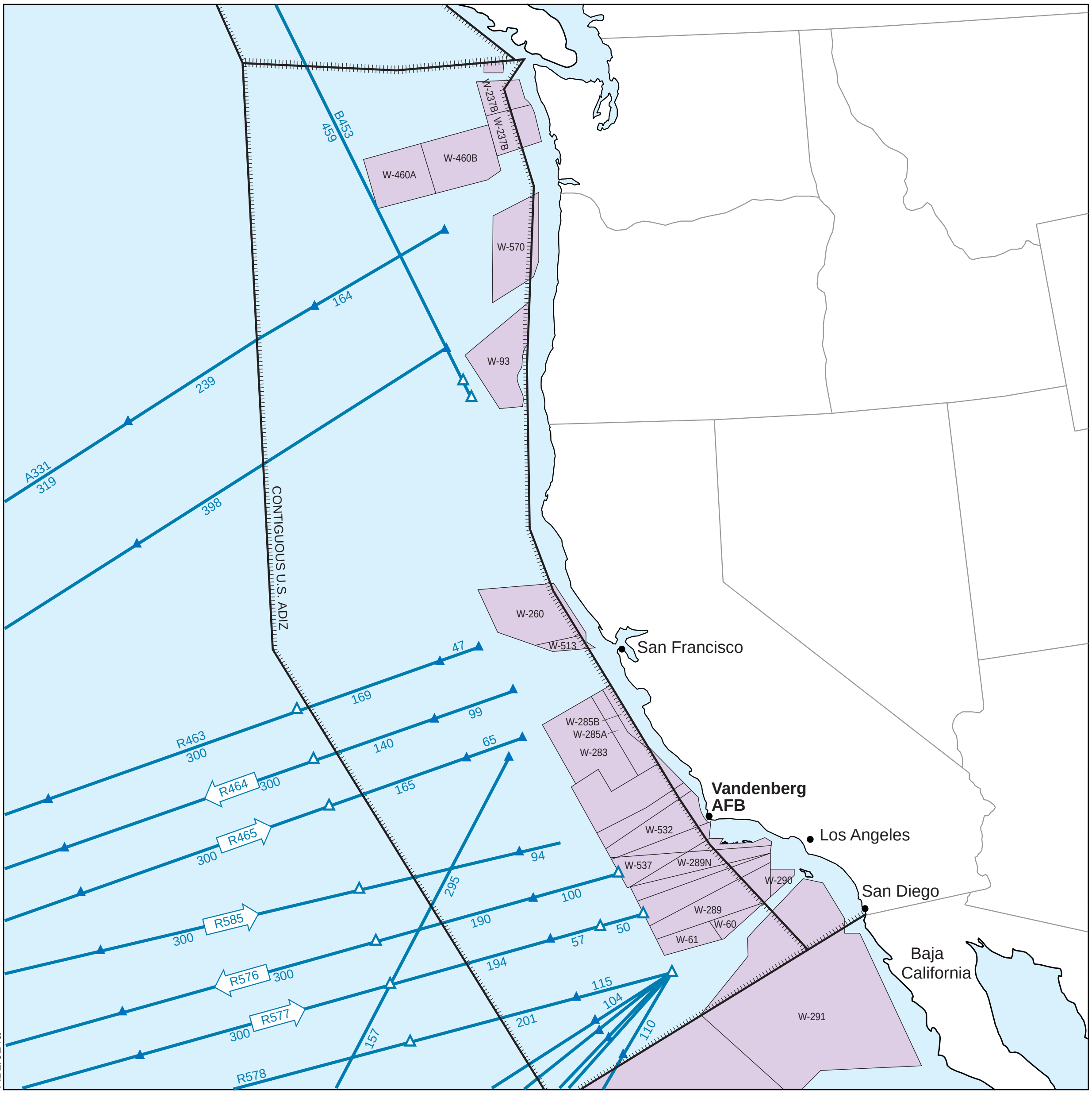
Table 3.4-1. Special Use Airspace in the Vandenberg AFB/Western Range Airspace ROI

Number	Effective Altitude (feet)	Time of Use	Controlling Agency
R-2516	Unlimited	Continuous[(a)]	ZLA CNTR
R-2517	Unlimited	Continuous[(a)]	No A/G
R-2519	FL 200-Unlimited	Continuous[(a)]	ZLA CNTR
R-2534A	500 AGL to Unlimited	Intermittent by NOTAM	ZLA CNTR
R-2534B	500 AGL to Unlimited	Intermittent by NOTAM	ZLA CNTR
R-2535A	To 100,000	0600-2200 M-F	ZLA CNTR
R-2535B	To 100,000	0600-2200 M-F	ZLA CNTR
W-60	Unlimited	Intermittent	ZLA CNTR
W-61	To FL 500	Intermittent	ZLA CNTR
W-289	Unlimited	Intermittent	ZLA CNTR
W-289N	To FL 240	Intermittent	ZLA CNTR
W-290	To FL 800	Intermittent	ZLA CNTR
W-412	To 3,000	SR-SS	ZLA CNTR
W-532	Unlimited	Intermittent	ZLA CNTR
W-537	Unlimited	Intermittent	ZLA CNTR

Note: (a) Continuous = 24 hours a day and/or 7 days a week.
AGL= Above Ground Level
CNTR = Center (Air Route Traffic Control Center)
FL = Flight Level (FL 180 = approximately 18,000 feet)
No A/G = No Air to Ground Communication
NOTAM = Notice to Airmen
R = Restricted
SR = Sunrise
SS = Sunset
W = Warning Area
ZLA = Los Angeles ARTCC

Source: National Aeronautics Charting Office, 2001a, and 2001d.

There are no Prohibited or Alert SUA areas in the ROI (National Ocean Service, 2001).



EXPLANATION

Flight Path

ADIZ Air Defense Identification Zone

0 87.5 175 Nautical Miles

Source: National Aeronautical Charting Office, 2001.

Special Use Airspace, Control Area Extensions Corridor, and North Pacific Routes

Figure 3.4-2

Military Training Routes. The Vandenberg AFB (Western Range) airspace ROI is bordered on the east by a number of MTRs whose starting points are just outside the east edge of the ROI off the coast. All routes are designated for MARSA operations established by coordinated scheduling. The route's width is 5.5 km (3 nm) either side of centerline. The routes' originating activity, from south to north, are Marine Corps Air Station (MCAS) Miramar for IR-211; NAWS Point Mugu for IR 200; NAS Lemoore for VR-1262, IR-207, VR-202, VR-1261, VR-1251, and VR-1250, all off the coast of California. All of the MTRs starting points are outside (east of) the offshore Warning Areas.

Hours of operation are normally daylight hours; other hours are as indicated by NOTAM, except for IR-211 and IR-346, which have continuous hours of operation, and VR-331, which operates between 0700-1600 hours, Monday through Friday (National Imagery and Mapping Agency, 2001).

En Route Airways and Jet Routes. While there are numerous domestic en route, low-altitude (up to but not including 18,000 feet above MSL) airways that run northwest to southeast, up and down the California coast, none of them is in the Vandenberg AFB airspace ROI, lying well to the east with the exception of one unpublished route (i.e., Pacific Route Airway). All of these airways are inland, with the exception of V27, which passes offshore south of Santa Barbara, east of Vandenberg AFB, and leaves the coast again north of Morro Bay. Similarly, there are several domestic high-altitude jet routes crossing northwest to southeast, to the east of the airspace ROI above 18,000 feet above MSL. However, they all pass inland over the central California coast ranges (see Figure 3.4-2).

The overseas high-altitude jet routes cross the western part of the airspace ROI via nine control area extension (CAE) corridors off the California coast (see Figure 3.4-2). These corridors can be opened or closed at the request of a user in coordination with the FAA. An MOA exists between users and the FAA to stipulate the conditions under which the CAEs can be closed to civil traffic. Under most circumstances, at least one CAE must remain available for use by general aviation and commercial air carriers.

As an alternative to aircraft flying above 29,000 feet following the published, preferred IFR routes (shown in Figure 3.4-2), the FAA is gradually permitting aircraft to select their own routes as alternatives. This "Free Flight" program is an innovative concept designed to enhance the safety and efficiency of the National Airspace System. The concept moves the National Airspace System from a centralized command-and-control system between pilots and air traffic controllers to a distributed system that allows pilots, whenever practical, to choose their own route, and file a flight plan that follows the most efficient and economical route (Federal Aviation Administration, 1998).

Free Flight is already underway, and the plan for full implementation will occur as procedures are modified, and technologies become available and are acquired by users and service providers. This incremental approach balances the needs of the aviation community and the expected resources of both the FAA and the users. Advanced satellite voice and data communications are being used to provide faster and more reliable transmission to enable reductions in vertical, lateral, and longitudinal separation, more direct flights and tracks, and faster altitude clearances (Federal Aviation Administration, 1998). With full implementation of this program, the amount of airspace in the ROI that is likely to be clear of traffic will decrease as pilots, whenever practical, choose their own route and file a flight plan that follows the most efficient and economical route, rather than following the published preferred IFR routes across the ROI shown in Figure 3.4-2.

In addition to the IFR high-altitude jet routes and low-altitude airways used by commercial aircraft, general aviation aircraft fly unrestricted in accordance with VFR within the MOAs below FL 180.

Airports/Airfields. In addition to Vandenberg AFB, Naval Offshore Landing Field San Nicolas, and Naval Auxiliary Landing Field San Clemente Island, there is just one airport, Catalina on Santa Catalina Island, in the Vandenberg AFB airspace ROI (see Figure 3.4-2).

Air Traffic Control. The airspace ROI within the 12-nm territorial Waters of the United States is managed by the Los Angeles ARTCC (National Oceanic and Atmospheric Administration, 2001). The controlling agency for the Restricted Areas is the Los Angeles ARTCC. The offshore Warning Areas are under Los Angeles ARTCC control. During the published hours of use (see Table 3.4-1), the using agency is responsible for controlling all military activity within the SUA, and determining that its perimeters are not violated. When scheduled to be inactive, the using agency releases the airspace back to the controlling agency (Los Angeles ARTCC). If no activity is scheduled during some of the published hours of use, the using agency releases the airspace to the controlling agency for nonmilitary operations during that period of inactivity (Illman, 1993).

In the Class A (positive control areas) airspace from 18,000 to 60,000 feet, all operations are conducted under IFR procedures, and are subject to ATC clearances and instructions. Aircraft separation and safety advisories are provided by ATC, the Los Angeles or Oakland ARTCC. In the Class E (general controlled airspace) airspace below 18,000 feet, operations may be under either IFR or VFR: separation service is provided to aircraft operating under IFR only and, to the extent practicable, traffic advisories to aircraft operating under VFR, by the appropriate ARTCC.

The airspace beyond the 12-nm limit is in international airspace. For this reason, the procedures of the International Civil Aviation Organization (ICAO), outlined in ICAO Document 4444-RAC/501, Rules of the Air and Air Traffic Services, are followed in this airspace (ICAO, 1985, 1994). ICAO Document 4444-RAC/501 is the equivalent ATC manual to the FAA Handbook 7110.65, Air Traffic Control. However, the ICAO is not an active ATC agency, and has no authority to allow aircraft into a particular sovereign nation’s Flight Information Region or Air Defense Identification Zone, and does not set international boundaries for ATC purposes. Rather, the ICAO is a specialized agency of the United Nations, whose objective is to develop the principles and techniques of international air navigation, and to foster planning and development of international air transport.

FAA Air Traffic Service outside the United States' airspace is provided in accordance with Article 12 and Annex 11 of the ICAO Convention. The FAA acts as the United States' agent for aeronautical information to the ICAO, and air traffic in the region is managed by the Los Angeles, Oakland, and Seattle ARTCCs. Domestic Warning Areas and Warning Areas are established in international airspace to contain activity that may be hazardous, and to alert pilots of nonparticipating aircraft to the potential danger.

3.4.2.2 Environmental Consequences

Proposed Action

Ground-Testing Activities. No ground-testing activities are proposed at Vandenberg AFB.

Flight-Testing Activities

Controlled and Uncontrolled Airspace. No new SUA proposal, or any modification to the existing SUA, would be necessary to accommodate the flight-testing activities at the Vandenberg AFB (Western Range). Consequently, there would be no reduction in the amount of controlled and uncontrolled navigable airspace in the ROI and, therefore, no impacts to the controlled or uncontrolled airspace in the ROI are expected.

Special Use Airspace. Use of the Western Range for the proposed flight-testing activities would not have an adverse impact on activities conducted within the range. The SUA using agency has a scheduling office that is responsible for establishing a real-time activity schedule for those restricted areas and parts of the Western Range that would be utilized and forwarded along with any subsequent changes to the controlling ARTCC. In addition, the flight tests represent precisely the types of activities for which the SUA was created in the early 1960s: namely, to accommodate national security and necessary military activities, and to confine or segregate activities considered to be hazardous to nonparticipating aircraft.

Restricted Areas were designated to contain hazards to nonparticipating aircraft. Offshore Warning Areas consist of airspace over domestic or international waters in which hazardous activity may be conducted. The purpose of such Warning Areas is to warn nonparticipating pilots of the potential danger. This designation corresponds to the "Danger Area" designation of ICAO. As such, the flight-testing activities would not represent an adverse impact to SUA, and would not conflict with any airspace use plans, policies and controls.

In addition, no new additional demands would be placed on existing SUA, and the Proposed Action would not require the assignment of new SUA, or require the modification of existing SUA. Consequently, there would be no adverse impacts to SUA.

Military Training Routes. No change to an existing or planned MTR or slow route would be required as a result of implementation of the Proposed Action; therefore, no impacts to MTRs are expected.

En Route Airways and Jet Routes. Since proposed flight-testing activities would be contained within the existing SUA, there would be no impact to the ROI's en route airways and jet routes. There are no airways or jet routes that pass through or near the Restricted Areas in the airspace ROI. Although there are a number of CAE corridors through, or close to, the Warning Areas that are part of the Western Range, there is a scheduling agency for the Warning Areas, and the procedures for scheduling this airspace are performed in accordance with FAA regulations and agreements with the controlling FAA facilities, the Los Angeles ARTCC. Flight-testing schedules would be provided to the ARTCCs, as stipulated in letters of agreement between the agencies involved.

Airspace schedulers have evolved scheduling procedures to meet the operational pressures of conducting the flight-testing activities in the Western Range airspace. The FAA ARTCCs are responsible for air traffic flow control or management to ensure the smooth passage of air traffic through the CAE corridors. They provide separation services to aircraft operating on IFR flight plans, and principally during the en route phases of the flight. They also provide traffic and weather advisories to airborne aircraft. By appropriately containing the ABL flight-testing activities to the Restricted Areas and the Warning Areas that comprise the Western Range, nonparticipating traffic would be advised or separated accordingly, thus avoiding adverse impacts to the low-altitude airways and high-altitude jet routes that use the CAE corridors, which are designed just for this purpose. Thus, although aircraft transiting the area may be required to change course to use a different CAE corridor during the ABL Program's flight-testing activities, this is already the normal, accepted procedure for the Western Range; no adverse impacts to en route airways and jet routes are expected.

Airports and Airfields. Implementation of the Proposed Action would not restrict access to, nor affect the use of, any airfield or airport available for public use, and would not affect airfield/airport arrival and departure traffic flows. Therefore, no impact to the ROI's airports and airfields are expected.

Mitigation Measures. No impacts have been identified; therefore no mitigation measures would be required.

Cumulative Impacts. Due to the nature of test activities at the Western Range, other missile test and rocket launch activities within the range to support other military (e.g., GMD element) and commercial (e.g., satellite launches) functions would be occurring. These missile tests and rocket launches have been addressed in EAs and EISs that limit the number of launches and are carefully scheduled/coordinated to prevent cumulative airspace impacts from other launch actions.

No other projects in the airspace ROI have been identified that would have the potential for incremental, additive cumulative impacts to controlled or uncontrolled airspace, SUA, MTRs, en route airways and jet routes, airfields and airports, or ATC.

No-Action Alternative

Controlled/Uncontrolled Airspace. Ongoing activities at Vandenberg AFB (Western Range) would continue to utilize the existing over-water SUA and altitude reservations. No new SUA proposal, or any modification to the existing SUA, would be required to accommodate continuing mission activities. Therefore, no impacts to the controlled/uncontrolled airspace in the ROI are expected.

Special Use Airspace. The ongoing activities at Vandenberg AFB would continue to utilize the existing SUA. Although the nature and intensity of utilization varies over time and by individual SUA area, the continuing mission activities represent precisely the types activities for which the SUA was created. Restricted Areas were designated to contain hazards to nonparticipating aircraft. Offshore Warning Areas consist of airspace over domestic or international waters in which hazardous activity may be conducted. The purpose of such Warning Areas is to warn nonparticipating pilots of the potential danger. This designation corresponds to the “Danger Area” designation of ICAO. As such, the continuing mission activities would not represent an adverse impact to SUA, and would not conflict with any airspace use plans, policies, or controls.

En Route Airways and Jet Routes. Ongoing activities at Vandenberg AFB would continue to utilize, and be confined to, the existing SUA. Use of the existing en route airways and jet routes by IFR traffic comes under the control of the Los Angeles ARTCC, and, therefore, no adverse impacts to the ROI’s airways and jet routes are expected.

Those portions of the Vandenberg AFB (Western Range) airspace ROI outside the 12-nm limit are situated in international airspace. Because it is international airspace, the procedures of the ICAO, outlined in ICAO Document 4444-RAC/501, Rules of the Air and Air Traffic Services, are followed (International Civil Aviation Organization, 1984, 1994). ICAO Document 4444-RAC/501 is the equivalent ATC manual to the FAA Handbook 7110.65, Air Traffic Control. The FAA acts as United States, agent for aeronautical information to the ICAO, and air traffic in that portion of the ROI is managed by the same ARTCCs identified above for domestic airspace.

In terms of potential airspace use impacts to en route airways and jet routes, the continuing mission activities would be in compliance with DOD Directive 4540.1, Use of Airspace by U.S. Military Aircraft and Firings Over the High Seas, which specifies procedures for conducting aircraft operations and for missile/projectile firing (the targets used for the ABL Program), namely the missile/projectile “firing areas shall be selected so that trajectories are clear of established oceanic air routes or areas of known surface or air activity" (Department of Defense, 1981). In addition, before conducting an operation that is hazardous to nonparticipating aircraft, NOTAMs would be sent in accordance with the conditions of the directive specified in OPNAVINST 3721.20B. The hazard area as defined by the range safety officer would be cleared prior to launch activities.

As noted above, mission activities at Vandenberg AFB would continue to utilize the existing over-water SUA, and would not require a change to an existing or planned IFR minimum flight altitude, a published or special instrument procedure, or an IFR departure procedure, or require a VFR operation to change from a regular flight course or altitude. The MOA with the FAA for the unpublished route (i.e., Pacific Route Airway) eliminates potential impacts to that route. Therefore, no impacts to the surrounding low-altitude airways and/or high-altitude jet routes are expected from the No-Action Alternative.

Airports and Airfields. Ongoing activities at Vandenberg AFB would not restrict access to or affect the use of the existing airfields and airports. Operations at Vandenberg AFB, Santa Catalina airport, and the many private airfields/airstrips in the ROI would continue to operate at current levels. Existing airfield/airport arrival and departure traffic flows would not be affected by the No-Action Alternative, and access to airports/airfields would not be affected. Therefore, no impacts are expected under the No-Action Alternative.

Mitigation Measures. No mitigation measures would be required under the No-Action Alternative.

3.4.3 Hazardous Materials and Hazardous Waste Management

3.4.3.1 Affected Environment.

The 30 Space Wing (SW) Plan 32-7086, *Hazardous Materials Management Plan*, and 30 SW Plan 32-7043-A, *Hazardous Waste Management Plan* ensure compliance with applicable federal, state, local regulations, and Air Force directives related to hazardous materials and hazardous waste management. Vandenberg AFB also maintains a *Hazardous Materials Emergency Response Plan* (30 SW Plan 32-4002), and a *Spill Prevention Control and Countermeasures Plan* (32-4002-C) that address emergency response actions and spill prevention, control, and countermeasures requirements. The plans provides guidance for the identification of hazardous material sources, the discovery and reporting of a hazardous materials release, and procedures to follow in the event of a release (U.S. Air Force, 1999e; U.S. Air Force, 2001g).

Hazardous materials are used and stored as a result of many processes throughout Vandenberg AFB. Vandenberg AFB uses the Pharmacy Concept to distribute hazardous materials to Air Force customers. As part of this process, customers are required to return the unused portions of the materials to Base Supply for subsequent use or disposal. All hazardous materials must be approved for use by Vandenberg AFB before they are brought onto the base; only authorized users may use the hazardous materials (U.S. Air Force, 2001f).

Hazardous materials used in conjunction with range testing operations (i.e., missile launches) include cleaning solvents, various paint compounds, explosive materials, and toxic propellants. Specific types and quantities of materials can vary depending upon specific system and test configuration requirements. Each agency utilizing Vandenberg AFB is responsible for procurement, distribution to the work areas, and management of its hazardous materials (U.S. Air Force, 2001f). Vandenberg AFB has a Process Safety Management Plan in place to identify and manage processing, storage, and use of highly hazardous chemicals, toxics, and reactives identified in 29 CFR 1910.119.

Hazardous waste management procedures used at Vandenberg AFB must be in compliance with federal, state, and local requirements; DOD and Air Force regulations also apply. The Vandenberg AFB Hazardous Waste Management Plan ensures appropriate control, and reporting measures are in place regarding the collection, storage, and disposal of hazardous waste generated at Vandenberg AFB (U.S. Air Force, 2000e).

3.4.3.2 Environmental Consequences

Proposed Action

Ground-Testing Activities. No ground-testing activities are proposed at Vandenberg AFB.

Flight-Testing Activities. The ABL aircraft would originate from Edwards AFB, and flight-test activities would occur over the Western Range off the coast of California (see Sections 3.2.2, 3.3.2, and 3.4.2, Airspace).

Hazardous materials used during missile launch preparation would be similar to those currently used, and would be transported to the missile preparation area using ground-support equipment without the need for revised procedures. Limited quantities of hazardous waste may be generated by the proposed target-missile pre-launch activities. This waste includes unused or contaminated cleaning solvents, or unused lubricants or hydraulic fluids. Similar waste types are currently generated at Vandenberg AFB. Unused solvents and any other unused materials would be returned to the base supply or removed from the base by the user upon completion of activities to minimize hazardous waste. Motor fuels and cleaning solvents are collected and disposed of routinely. The pre-fueled missile targets use liquid propellants, and are not expected to generate any hazardous waste.

At the time of destruction by the HEL, the missile targets would have no more than 220 kg (485 pounds) of propellant onboard (about 70 gallons), would be more than 25 km (15.5 miles) down range, and at an altitude of more than 35,000 feet. The remaining fuel onboard would be vaporized and quickly mixed with the surrounding air during the destruction of the missile. The release of propellant is not expected to have a measurable effect on the ecosystem of the Western Range.

In the event the ABL aircraft is unable to land at Edwards AFB after conducting test activities (e.g., due to Edwards AFB runway closure), Vandenberg AFB has been identified as one of three pre-planned “divert bases” in which the aircraft could be diverted. Although nothing would prevent the ABL aircraft from landing at any suitable base in time of emergency, personnel at Vandenberg AFB would be specifically trained to support the ABL aircraft and appropriate equipment to handle ABL hazardous materials (e.g., chemical transfer and recovery receptacles) would be in place. The ABL aircraft would remain at Vandenberg AFB until the Edwards AFB runway is cleared for incoming traffic.

Mitigation Measures. Because flight-testing activities would be required to comply with applicable federal, state, DOD, and Air Force regulations regarding the use, storage, and handling of hazardous materials and hazardous waste, these activities would not result in substantial environmental impacts, and no mitigation measures would be required.

Cumulative Impacts. Other missile test and rocket launch activities within the Western Range to support other military and commercial functions would be occurring. These missile tests and rocket launches have been addressed in EAs and EISs that evaluate the quantities of hazardous materials utilized and any wastes generated during launch activities. In addition, these launch activities are covered by the Hazardous Materials Management Plan and Hazardous Waste Management Plan maintained by the 30 SW. Cumulative impacts to hazardous materials and hazardous waste management activities from other launch actions are not anticipated.

No other actions have been identified that would contribute to cumulative impacts such that adverse impacts would result.

No-Action Alternative

Under the No-Action Alternative, flight-testing activities would not be conducted as described in Section 2 of this SEIS. ABL flight-test activities would be conducted as analyzed in the 1997 FEIS. No adverse environmental impacts are anticipated.

Mitigation Measures. No mitigation measures would be required under the No-Action Alternative.

3.4.4 Health and Safety

3.4.4.1 Affected Environment.

The affected environment at Vandenberg AFB includes those launch facilities evaluated in the Theater Ballistic Missile Targets Programmatic Environmental Assessment and the airspace (Western Range) in which ABL flight-testing activities would occur. Range activities involving the use of lasers would be conducted in accordance with Eastern and Western Range (EWR) 127-1, Range Safety Requirements. In addition, the participating ranges (i.e., WSMR, Edwards AFB, and Vandenberg AFB) along with the ABL SPO tailored and generated the Range Safety Requirements Document for the ABL program, which will also be applicable. This document captures requirements contained in EWR 127-1 as well as those applicable laser safety requirements from each range.

Because of the potential for Vandenberg AFB operations to affect off-base areas, Vandenberg AFB plays a prime role in regional emergency planning (Environmental Science Associates, 1996; U.S. Air Force, 1989a). As an example, the city of Lompoc and Vandenberg AFB have entered into a mutual aid agreement that allows emergency units from either Lompoc or Vandenberg AFB to provide assistance in the event of an emergency. A “hotline” exists between the city of Lompoc and Vandenberg AFB in order to immediately notify the city in case of a major accident on the base. In the event of an emergency involving a launch mishap in Lompoc, Vandenberg AFB would assume control, and could set up a national defense area if protected material were involved in the accident.

Danger zones have been established off the Santa Barbara County coast between Point Sal and Point Conception. These danger zones were established to meet security requirements, and reduce the hazard to persons and property during a launch-related activity. Impact limit areas are established through the designation of debris impact areas for each specific launch. These impact limit areas are plotted for all launches.

Zone closures are announced daily over various radio frequencies, and posted in harbors along the coast. The 30 SW Flight Analysis notifies the 30 Range Squadron (RANS) of areas that are hazardous to aircraft (i.e., impact debris areas for all normally jettisoned and impacting stages) 30 working days prior to launch. The 30 RANS notifies the FAA, Los Angeles or Oakland ARTCCs, so that the information can be disseminated through an NOTAM. Restricted airspace areas are 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 head is maintained and coordinated between the Aeronautical Control Officer and FAA to ensure that aircraft are not endangered by launches. The Air Route Surveillance Radar surveys the restricted and Warning Area airspace beginning 15 minutes prior to the scheduled launch time, and until the launch is complete.

The 30 RANS also ensures that a Notice to Mariners within the impact debris areas is disseminated beginning 30 working days prior to launch. Information regarding impact debris areas is distributed to surface vessels when the 30 RANS sends written notification of impact debris areas to be published weekly in the U.S. Coast Guard (USCG) Long Beach Broadcast to Mariners. Broadcasts by USCG Long Beach provide the latest available hazard information to offshore surface vessels.

The 30 RANS has developed procedures related to evacuating or sheltering personnel on offshore oil rigs during launch operations. These procedures pertain to offshore platforms situated west of 120° 15 minutes longitude. The 30 SW Chief of Safety notifies 30 RANS of future launches, and 30 RANS notifies the Minerals Management Service (MMS), Department of the Interior, to notify the oil rig personnel of a future launch. The MMS first notifies the oil rig operator 10 to 15 days before a launch to prepare for possible sheltering or evacuation. The second notice is given 24 to 36 hours before the launch, confirming the requirement to shelter or evacuate. The third notice is given by Frontier Control to provide final notice before, during, and after securing the operation. Additional notices are sent as required.

Point Sal State Beach, Ocean Beach County Park, and Jalama Beach County Park may be closed on the day of a missile launch. Although direct overflight of the beaches does not occur, there is the possibility of debris from a launch anomaly impacting the beaches. In order to protect park visitors, Vandenberg AFB, the County Parks Department, the County Sheriff, and the California Highway Patrol have agreed to close the parks upon request during launches that could affect the beaches.

3.4.4.2 Environmental Consequences

Proposed Action

Ground-Testing Activities. No ground testing of the laser systems is proposed at Vandenberg AFB.

Flight-Testing Activities. The primary hazard associated with the flight-testing activities is the reflected laser energy off of a target missile debris falling within the Western Range boundaries.

Up to 25 missile flight tests would occur at the Western Range. Airborne lasing activities would be limited to the Western Range boundaries (see Figure 2.2-6). These flight tests would involve testing of the lower-power ARS, BILL, and TILL, and the high-power HEL system. Any laser energy that misses the targeted missile would continue upward and away from the ground. The reflected laser energy hazards for the HEL have been extensively investigated, and possible reflection scenarios predicted. A detailed evaluation is available in Appendix F of the Final Environmental Impact Statement for the Program Definition and Risk Reduction Phase of the Airborne Laser Program, Volume 1, 1997. The possibility of public exposure to hazardous levels of direct, non-reflected laser energy would be eliminated by the decision to restrict laser firing angles above the horizontal plane from the ABL aircraft's altitude of above 35,000 feet. However, because of the missile's flight path angle when intercepted by the laser beam reflections from the target missile surface could be directed downward (see Figure 3.3-4). The targets in all laser engagements would be flying at altitudes equal to or greater than the altitude of the ABL aircraft. Direct laser energy that misses the target would exit restricted airspace above 45,000 feet and continue upward and eventually exit the Earth's atmosphere. This may involve off-range lasing where the laser energy exits the Western Range airspace boundary; however, it would exit at an upward angle, and away from routinely flown airspace. In addition, the ABL could be used to monitor or engage (up to HEL with appropriate additional environmental analysis) targets of opportunity from other Western Range testing. Range activities involving the use of lasers would be conducted in accordance with EWR 127-1, Range Safety Requirements.

BASH is considered a safety concern for aircraft operations. BASH hazards at Vandenberg AFB are managed to reduce bird/animal activity relative to aircraft operations. Because flight-test activities would occur above 35,000 feet, the likelihood of a BASH incident is considered low.

Because ABL flight-testing activities at Vandenberg AFB (Western Range) would be performed in accordance with applicable regulations, and appropriate safety measures would be implemented, no adverse impacts are expected.

As discussed under the affected environment, 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. The State and County beaches potentially affected during launch activities would be closed. Vandenberg AFB, the County Parks Department, the County Sheriff, and the California Highway patrol have agreed to close the beaches upon request during launches that affect the beaches in order to protect visitors. No adverse impacts are anticipated.

Mitigation Measures. ABL testing activities would be performed in accordance with applicable regulations, and appropriate safety measures would be implemented; therefore, no adverse impacts are expected, and no mitigation measures would be required.

Cumulative Impacts. Due to the nature of test activities at the Western Range, other missile test and rocket launch activities within the range to support other military and commercial functions would be occurring. These missile tests and rocket launches have been addressed in EAs and EISs that limit the number of launches and are carefully scheduled/coordinated to prevent cumulative impacts of launch actions.

No other actions have been identified that would contribute to cumulative impacts such that adverse impacts would result.

No-Action Alternative

Under the No-Action Alternative, ABL flight-testing activities would not be conducted as described in Chapter 2 of the SEIS. ABL test activities would be conducted as analyzed in the 1997 FEIS. No adverse environmental impacts are anticipated.

Mitigation Measures. No mitigation measures would be required under the No-Action Alternative.

3.4.5 Air Quality

3.4.5.1 Affected Environment.

Information on the affected environment and the environmental consequences at the Earth's surface, the planetary boundary layer, and the upper atmosphere were addressed in Sections 3.2.2 and 3.7 of the 1997 FEIS, and are incorporated by reference.

No ground-testing activities would be conducted at Vandenberg AFB. The only surface emissions would be from missile targets and launch support activities. Flight-testing activities would occur at altitudes of approximately 35,000 feet. The launching of missiles would be from launch sites evaluated in the Theater Ballistic Missile Targets Programmatic Environmental Assessment. Only missile launches are proposed; no aircraft takeoff or landings would occur at Vandenberg AFB. Flight-testing activities would originate from Edwards AFB, California, and be conducted within controlled airspace (above 35,000 feet) at the Western Range, over the Pacific Ocean, off the coast of Vandenberg AFB. The ROI for air quality includes the air basin in which Vandenberg AFB is situated.

Vandenberg AFB is situated in the north portion of California's South Central Coast Air Basin, and in the Santa Barbara County Air Pollution Control District.

Santa Barbara County is a moderate ozone non-attainment region, as demonstrated by the maximum ozone daily 1-hour maximum concentrations shown in Table 3.4-2. Santa Barbara is in attainment for CO. Although a single exceedance of the PM_{10} NAAQS limit has occurred, Santa Barbara, under present rules, remains in attainment for PM_{10}.

Table 3.4-2. Summary of Maximum Criteria Pollutant Concentrations in Santa Barbara County

Year	Criteria Pollutants		
	CO (8-hour) ppm	PM_{10} (24-hour) $\mu g/m^3$	Ozone (1-hour) ppb
1996	4.9	78	134
1997	4.1	168	137
1998	4.6	73	125
1999	4.2	99	135
2000	3.1	64	128

CO = carbon monoxide
$\mu g/m^3$ = micrograms per cubic meter
PM_{10} = particulate matter equal to or less than 10 microns in diameter
ppb = parts per billion
ppm = parts per million

3.4.5.2 Environmental Consequences

Proposed Action

Ground-Testing Activities. No ground-testing activities are proposed at Vandenberg AFB.

Flight-Testing Activities. The ground-level impacts from the ABL flight-testing activities would be from missile setup, missile launch, and debris recovery activities. Table 3.4-3 provides a comparison of the annual emissions of criteria pollutants at Vandenberg AFB with the total emissions in Santa Barbara County. The Vandenberg AFB emissions of VOCs and NO_x are a small fraction of the total county emissions.

Table 3.4-3. Estimated Annual Emissions of Criteria Pollutants in Santa Barbara County and at Vandenberg AFB (tons/year)

	Criteria Pollutant			
Emission Inventory	VOCs	CO	NO_x	PM_{10}
1999 – Santa Barbara	15,810	106,463	55,448	17,933
1994 – Vandenberg AFB	340	NA	119	NA
ABL Flight Tests	0.17	1.19	0.12	0.02
De minimis	100	100	100	100

ABL = Airborne Laser
CO = carbon monoxide
NA = not applicable
NO_x = nitrogen oxides
PM_{10} = particulate matter equal to or less than 10 microns in diameter
VOC = volatile organic compound

The estimate of criteria pollutant emissions is based on the number of proposed missile launches, and includes VMT estimates for service vehicles. Up to 25 missile targets would be launched during flight-testing activities for each of the Block 2004 and 2008 aircraft. The resulting emission estimates are presented in Table 3.4-3. The estimated emissions are below the de minimis conformity determination level of 100 tons per year, and are less than 1 percent of the Santa Barbara County total emissions. The criteria pollutant emissions due to missile launch activities would produce insignificant changes in air quality over the Vandenberg AFB area (Western Range).

There are minor changes to the upper air emissions estimated in the 1997 FEIS primarily due to the increased number of missile launches. Most of the emissions still are released into the planetary boundary layer and troposphere, and have been accounted for in the previous analysis presented in the 1997 FEIS. The changes in the amounts of emissions are insignificant. For example, based on the increase in the number of proposed missile launches, the amount of HCl released is still minute, on the order of 1.4 pounds per year, which is far below the 10-ton threshold. The accidental release scenarios described in the 1997 FEIS are still valid. The small level of emissions would have no impact on the upper atmosphere, and are not significantly different than those described in Section 3.7 of the 1997 FEIS.

Mitigation Measures. Because there are no adverse impacts anticipated under the Proposed Action, mitigation measures are not required.

Cumulative Impacts. Other missile test and rocket launch activities within the Western Range to support other military and commercial functions would be occurring. These missile tests and rocket launches have been addressed in EAs and EISs that limit the number of launches and evaluate the air emissions associated with launch activities. Cumulative air quality impacts of other launch actions are not anticipated.

No other actions have been identified that would contribute to cumulative impacts such that adverse impacts would result.

No-Action Alternative

Under the No-Action Alternative, ABL flight-testing activities would not be conducted as described in Chapter 2 of this SEIS. ABL test activities would be conducted as analyzed in the 1997 FEIS. No adverse environmental impacts are anticipated.

Mitigation Measures. No mitigation measures would be required under the No-Action Alternative.

3.4.6 Noise

3.4.6.1 Affected Environment.

Aircraft using the Vandenberg AFB airfield (transports, bombers, and fighter jets) are a source of noise in the region. Missile launches are more intense sources of noise in the region; however, launches occur only occasionally, and are of limited duration. Currently, Delta, Peacekeeper, and Minuteman missiles are launched from northern Vandenberg AFB. On southern Vandenberg AFB, Atlas and Titan rockets are launched. SLC-5 is currently inactive, and SLC-6 is currently being modified to launch Boeing rockets. A list of missile launches that have occurred over the past several years is presented in Table 3.4-4.

3.4.6.2 Environmental Consequences

Proposed Action

Ground-Testing Activities. No ground-testing activities are proposed at Vandenberg AFB.

Flight-Testing Activities. Up to 25 target missile flight tests are proposed to occur over the Western Range for each of the Block 2004 and 2008 aircraft. Each test would involve the ABL aircraft and up to two F-16 chase aircraft. The ABL aircraft and F-16 chase aircraft would maneuver at high altitudes above 35,000 feet.

The target missiles would be launched from existing launch areas at Vandenberg AFB. The noise levels from these missile launches would be similar to those described in Table 3.3-3. The noise from these surface-to-air missiles would be much less than the larger missiles currently fired from Vandenberg AFB. No impact from the ABL aircraft or F-16 chase aircraft are anticipated due to the elevation of the proposed test activities.

Mitigation Measures. Because there are no adverse impacts anticipated under the Proposed Action, mitigation measures are not required.

Cumulative Impacts. Other missile test and rocket launch activities within the Western Range to support other military and commercial functions would be occurring. These missile tests and rocket launches have been addressed in EAs and EISs that limit the number of launches and evaluate noise associated with launch activities. Cumulative noise impacts of other launch actions are not anticipated.

Table 3.4-4. Vandenberg AFB Missile Launches
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Date	Missile Type
December 7, 2001	Delta II
December 4, 2001	Minuteman II
November 7, 2001	Minuteman III
October 18, 2001	Delta II
October 4, 2001	Titan IV
September 21, 2001	Taurus
September 8, 2001	Atlas IIAS
August 31, 2001	BVT-2 Boost Vehicle
July 27, 2001	Peacekeeper
July 15, 2001	Minuteman II
February 7, 2001	Minuteman III
November 21, 2000	Delta II
September 28, 2000	Minuteman III (two launches)
September 21, 2000	Titan II
August 17, 2000	Titan IV
July 19, 2000	Minotaur/OSPSLV
July 7, 2000	Minuteman II
June 9, 2000	Minuteman III
June 7, 2000	Pegasus XL
May 28, 2000	Minuteman II
May 24, 2000	Minuteman III
March 25, 2000	Delta II
March 12, 2000	Taurus
March 8, 2000	Peacekeeper
January 18, 2000	Minuteman II
December 20, 1999	Taurus
December 18, 1999	Atlas IIAS
December 12, 1999	Titan II
November 13, 1999	Minuteman III
October 2, 1999	Minuteman II
September 24, 1999	Athena II
August 20, 1999	Minuteman III (two launches)
June 19, 1999	Titan II
May 22, 1999	Titan IV
May 17, 1999	Pegasus XL
April 27, 1999	Athena II
April 15, 1999	Delta II
March 10, 1999	Peacekeeper
March 4, 1999	Pegasus XL
February 23, 1999	Delta II
February 10, 1999	Minuteman III
December 5, 1998	Pegasus XL
November 6, 1998	Delta II
October 3, 1998	Taurus

Table 3.4-4. Vandenberg AFB Missile Launches
Page 2 of 2

Date	Missile Type
September 18, 1998	Minuteman III
September 8, 1998	Delta II
June 24, 1998	Minuteman III (two launches)
June 3, 1998	Minuteman III
May 17, 1998	Delta II
May 13, 1998	Titan II
May 7, 1998	Peacekeeper
April 1, 1998	Pegasus XL
March 29, 1998	Delta II
February 25, 1998	Pegasus XL
February 20, 1998	Minuteman III
February, 18, 1998	Delta II
February 10, 1998	Taurus
January 15, 1998	Minuteman II
December 20, 1997	Delta II
November 8, 1997	Delta II
November 5, 1997	Peacekeeper
October 23, 1997	Titan IV
September 26, 1997	Delta II
September 17, 1997	Peacekeeper
August 29, 1997	Pegasus XL
August 22, 1997	LMLV-1
August 20, 1997	Delta II
August 1, 1997	Pegasus XL
July 9, 1997	Delta II
June 23, 1997	Minuteman II
June 18, 1997	Minuteman III
May 21, 1997	Minuteman III
May 8, 1997	Peacekeeper
May 5, 1997	Delta II
April 3, 1997	Titan II SLV

Source: U.S. Air Force, 2001d

No other actions have been identified that would contribute to cumulative impacts such that adverse impacts would result.

No-Action Alternative

Under the No-Action Alternative, ABL flight-testing activities would not be conducted as described in Chapter 2 of this SEIS. ABL test activities would be conducted as analyzed in the 1997 FEIS. No adverse environmental impacts are anticipated.

Mitigation Measures. No mitigation measures would be required under the No-Action Alternative.

3.4.7 Biological Resources

3.4.7.1 Affected Environment.

The ROI for ABL testing activities from Vandenberg AFB would be limited to the preparation, launch, flight, aircraft command and control and debris fallout of target missiles from the proposed launch locations and the Western Range. The potential launch locations evaluated in the Theater Ballistic Missile Targets Programmatic Environmental Assessment are along the coastline at the north and south ends of Vandenberg AFB (see Figure 3.4-1).

The Endangered Species Act (16 U.S.C. Sections 1531-1544) is intended to protect and restore threatened and endangered species of animals and plants and their habitats. Other federal statutes protecting biological resources include the Migratory Bird Treaty Act (16 U.S.C. Sections 703-712), the Bald Eagle and Golden Eagle Protection Act (16 U.S.C. Section 668-668d), the Marine Mammal Protection Act (16 U.S.C. Section 1361), the Marine Protection Research and Sanctuaries Act (33 U.S.C. Section 1401), and the Fish and Wildlife Coordination Act (16 U.S.C. Sections 661-667d), and the Sikes Act as amended (16 U.S.C. 670a-670o).

The official California listing of threatened and endangered plants is contained in CCR Title 14 Section 670.2. The official California listing of threatened and endangered animals is contained in CCR Title 14 Section 670.5.

The Magnuson-Stevens Fishery Conservation and Management Act was passed in 1976 to provide the National Marine Fisheries Service (NMFS) legislative authority for fisheries regulations in the United States, in the area between three miles to 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 NMFS for approval. In 1996, the Magnuson-Stevens Fishery Conservation and Management Act was reauthorized and changed extensively by amendments called the Sustainable Fisheries Act. Among other changes, these amendments emphasize the importance of habitat protection to healthy fisheries and strengthen the ability of the NMFS and Councils to protect the habitat needed by the fish they manage. The habitat is called “Essential Fish Habitat” and is broadly defined to include those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.

Vegetation. Vandenberg AFB occupies a transition zone between the cool, moist conditions of northern California and the semi-desert conditions of southern California. Many plant species and plant communities reach their southern or northern limits in this area. Natural vegetation types include southern foredunes; southern coastal, central dune, central coastal, and Ventura coastal sage scrub; chaparral including central maritime chaparral; coast live oak woodland and savanna; grassland; tanbark oak and southern bishop pine forest; and wetland communities including saltmarsh and freshwater marsh, riparian forests, scrub, and vernal pools (U.S. Air Force, 1998a).

Plant communities in the vicinity of the proposed launch areas include central coastal sage scrub, chaparral, grassland, wetlands, eucalyptus (non-native woodland), and ruderal areas. Ruderal vegetation is characterized by disturbance-tolerant, mostly non-native species, primarily introduced grasses (U.S. Air Force, 1998a).

Coastal strand occurs along Vandenberg AFB's beaches. Native beach plants include beach saltbush, sea rocket, sand verbena, beach morning glory, and beach burr. European beachgrass and ice plant, non-native species, are pervasive and spreading on most Vandenberg AFB beaches (U.S. Air Force, 1998a).

Wildlife. Vandenberg AFB contains a number of habitat types that support a rich diversity of wildlife. The coastline, nearshore waters, and Channel Islands also support a wide variety of aquatic life, including marine mammals, birds, and fish (U.S. Air Force, 1998a).

Small carnivores include raccoons, long-tailed weasels (*Mustela frenata*), and striped skunks. Feral pigs forage in riparian zones, and mule deer are found in several habitat types. Other carnivores include the bobcat, black bear, gray fox, and coyote. Amphibians such as ensatina (*Ensatina eschscholtzii*), blackbelly slender salamander (*Batrachoseps nigriventris*), and pacific treefrogs (*Pseudacris regilla*) may occur in coastal sage and chaparral communities, and are also found along with western toads in riparian woodland areas. Reptiles such as the western skink (*Eumeces skiltouranus*), western fence lizard (*Sceloprus occidentalis*), southern alligator lizard (*Elgaria multicarinata*), and gopher snakes (*Pituophis melanoleucus*) are common on Vandenberg AFB (U.S. Air Force, 1998a).

An abundance and diversity of marine birds are found along the offshore waters and Channel Islands. As many as 30 species of seabirds are known to occur in the open ocean off the continental shelf. The Channel Islands are inhabited by breeding colonies of marine birds including Leach's and ashy storm-petrels; Brandt's, double-crested, and pelagic cormorants; pigeon guillemots; and Cassin's auklets (U.S. Air Force, 1998a).

California sea lions (*Zalophus californianus*) and northern fur (*Callorhinus ursinus*), northern elephant (*Mirounga angustirostris*), and harbor seals (*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. Purisima Point and Rocky Point are the primary haul-out sites on Vandenberg AFB (U.S. Air Force, 1998a).

Small-toothed whales, bottlenose (*Tursiops truncatus*), common (*Delphinus delphis*), and Pacific white-sided dolphins (*Lagenorhynchus obliguidens*); and killer whales (*Orcinus orca*) are common near Vandenberg AFB and the Channel Islands. The gray whale (*Eschrichtius robustus*) (a former federally listed endangered species, now designated as recovered) is found close to shore, off south Vandenberg AFB, during migration between November and May. Minke whales (*Balaenoptera acutorostrata*) have been reported within a few miles of the leeward side of the Channel Islands (U.S. Air Force, 1998a).

Threatened and Endangered Species. Federally and state-listed species of threatened or endangered plants and animals that may be present in the vicinity of Vandenberg AFB are listed in Table 3.4-5. Six of the mammals include federally endangered whales that are found only in low densities in waters off Vandenberg AFB. In addition, the NMFS indicates that the following marine mammal species may also be found in the region: minke whales, beaked whales, fin whales (*Balnoptera musculus*), killer whales, bottlenose dolphins, common dolphins, striped dolphins (*Stenella coeruleoalba*), Risso's dolphin (*Grampus griseus*), Pacific white-sided dolphins, northern right whale dolphins (*Lissodelphis borealis*), and Dall's porpoise (*Phocoenoides dalli*).

Table 3.4-5. Threatened and Endangered Species Known or Expected to Occur at Vandenberg AFB, California

Common Name	Scientific Name	State Status	Federal Status
Plant Species			
Beach Layia	*Layia camosa*	E	E
Gambel's watercress	*Rorippa gambellii*	T	E
Gaviota tarplant	*Hemizonia increscens spp. villosa (= Deinandra i.v.)*	E	E
Lompoc yerba santa	*Eriodictyon capitatum*	R	E
Surf thistle	*Cirsium rhothophilum*	T	–
Animal Species			
Southern sea otter	*Enhydra lutris nereis*	–	T
Sei whale	*Balaenoptera borealis*	–	E
Finback whale	*Balaenoptera physalus*	–	E
Blue whale	*Balaenoptea* musculus	–	E
Humpback whale	*Megaptera novaengliae*	–	E
Sperm whale	*Physeter macrocephalus*	–	E
Right whale	*Balaena glacialis*	–	E
California least tern	*Sterna antillarum browni*	E	E
California brown pelican	*Pelecanus occidentalis californicus*	E	E
Western snowy plover	*Charadrius alexandrinus nivosus*	–	T
Bald eagle	*Haliaeetus leucocephalus*	T	T
American peregrine falcon	*Falco peregrinus anatum*	E	–
Southwestern willow flycatcher	*Empidonax traillii extimus*	–	E
Least Bell's vireo	*Bireo bellii pusillus*	–	E
Belding's savannah sparrow	*Passerculus sanwichensis beldingi*	E	–
California red-legged frog	*Rana aurora draytonii*	–	T
Arroyo toad	*Bufo microscaphus californicus*	–	E
Coho salmon	*Oncorhynchus kisutch*	–	T
Unarmoured three-spined stickleback	*Gasterosteus aculeatus williamsoni*	E	E
Tidewater goby	*Eucyclogobius newberryi*	–	E
Steelhead trout	*Oncorhynchus mykiss*	–	T

E = endangered
R = rare
T = threatened

Sensitive Habitats. Environmentally sensitive habitats on Vandenberg AFB include butterfly trees, marine mammal hauling grounds, seabird nesting and roosting areas, white-tailed kite (*Elanus caeruleus*) habitat, and wetlands. The Monarch butterfly (*Danaus plexippus*) is a regionally rare and declining insect known to overwinter in the eucalyptus and cypress groves on Vandenberg AFB.

There are 3 miles of coastline designated as a marine ecological reserve; this 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 an MOA to limit access to this area to scientific research and military operations (U.S. Air Force, 1998a).

Seabird nesting and roosting areas are situated on the Channel Islands and on Vandenberg AFB. White-tailed kite foraging habitat includes grassland and open coastal sage scrub. Kites are expected to forage in these habitats primarily during the fall and winter (U.S. Air Force, 1998a).

Wetlands have been mapped by the U.S. Fish and Wildlife Service on Vandenberg AFB. The Santa Ynez River watershed drains approximately 900 square miles of land; approximately 45 square miles occur on Vandenberg AFB. The river supports many sensitive species, and becomes intermittent during the summer as water levels drop (U.S. Air Force, 1998a).

Several plant communities that occur on Vandenberg AFB are also considered sensitive because they contain sensitive plant species and/or are of limited extent. These include riparian woodlands and associated freshwater herbaceous vegetation.

3.4.7.2 Environmental Consequences

Proposed Action

Ground-Testing Activities. No ground-testing activities are proposed at Vandenberg AFB.

Flight-Testing Activities. Flight-test activities involved with the Western Range off the coast of Vandenberg AFB would involve routine range activities including missile preparation and launching, routine debris impacts off the coast, and use of the lower-power targeting lasers (i.e., ARS, BILL, TILL, and SHEL) and the high-power HEL.

Since the test missiles are much smaller than any of the space launch vehicles, the potential disturbance to the indigenous pinnipeds population is expected to be less. Test missile launches are scheduled to begin no earlier than 2003, and an Incidental Harassment and Take Permits has not yet been submitted. As test plans are detailed and finalized, the appropriate permits would be obtained by the base as part of their standard launch protocol.

The trajectory of the target missiles would be such that the first stage of the missile and any debris from the destruction of the missile during test activities would occur no closer than 3 miles of the coastline. Launches from any location would not result in intercept debris falling within 3 miles of the coast.

Under non-accident conditions, the only chemicals that could threaten vegetation and wildlife at Vandenberg AFB are those in the exhaust plume of the missile. Appendix D of the 1997 FEIS addressed the potential effects of missile exhaust plumes. These chemicals would be produced in trace quantities during missile launches, and would not have a measurable effect on biological resources.

An analysis of the effects from monolithic and missile-debris as a result of HEL destruction of the target missile is provided in Appendix G of the 1997 FEIS. As an example, monolithic impact of the target missile 130 km (81 miles) from the launch point would have an extremely low probability of hitting any marine mammals, and the effect of the propellant remaining onboard would be localized to a small volume of water for a short period of time.

Depending on the type of missile target and the intensity of the target destruction, the total number of fragments could range from 60 to 3,000 fragments with most fragments weighing between 20 to 200 grams and the largest fragments being 100 to 200 kg (large intact target missile sections) (Science Applications International Corporation, 2002). An analysis of the effect on migrating gray whales caused by the impact of missile debris falling approximately 10 km (6 miles) off the shore of Vandenberg AFB was also conducted. Gray whales were selected as a representative species likely to be in areas impacted by missile debris. While other species may be present in the debris fall-out zone, none is likely to be found in densities higher than the maximum densities assumed for the gray whale. The analysis in the 1997 FEIS suggested that, during peak migration densities, a whale could be struck and killed by falling debris with an expected probability of 0.00001. Missile launches occurring at other than peak migration times would present significantly lower risks to migrating whales.

The U.S. Navy analyzed boost phase intercept of ballistic missiles in this area as well as near shore intercepts (U.S. Navy, 2002). While the launch rates were lower (three boost and eight near shore events per year), their analysis is directly applicable over the same marine environment. Based on their analysis for theater missile defense (TMD) activities, the ABL program would expose an estimated additional 0.005 marine mammals to injury or mortality from debris, direct contact, or shock waves in non-Territorial waters. An additional 3.2 marine mammals per year would be exposed to temporary threshold shifts, probably mild, in non-Territorial waters. Any additional injuries or deaths are unlikely to occur in Territorial waters. An additional 0.35 marine mammals per year would be exposed to temporary threshold shifts, probably mild, in Territorial waters.

To further reduce the impact on marine mammals, the aerial range clearance activities would include a National Marine Fisheries Service-approved biological observer prior to conducting lethal shot activities. Special emphasis would be given to the projected impact zone. If marine mammals are observed in or near the predicted impact area, the observer, through the pilot, would contact the Operations Conductor, who would then delay or move the launch. The Operations Conductor would contact the Environmental Coordinator or the Environmental Project Office for additional guidance. The decision to delay or move the launch depends on the exact number, location, behavior and movement of the marine mammals observed.

Based on an analysis of remaining propellant at the time of destruction by the HEL, the missile targets could have 135 kg (300 pounds) to 700 kg (1,500 pounds) of propellant on board (up to 220 gallons), and would be at an altitude of more than 35,000 feet. Most of the remaining fuel on board would be vaporized and quickly mixed with the surrounding air during the destruction of the missile. The release of any remaining propellants would have no measurable effect on the aquatic ecosystem of the Western Range. The U.S. Navy came to the same conclusion in their analysis, showing the boost phase intercepts would produce total polynuclear aromatic hydrocarbons (PAHs) of 24 kg per event, resulting in an estimated 33 micrograms per liter (μg/l) concentration in the top 3 feet of water (due to the density of the materials) (U.S. Navy, 2002). In addition, they showed each boost phase intercept would put 18.3 kg of batteries into the ocean, with an estimated concentration in sediments at 0.11 ppm per event. Impacts from debris or battery constituents would be less than significant.

An analysis of the impacts associated with the operation of the HEL was discussed in the 1997 FEIS. This analysis showed that laser activities would not have significant impacts upon the wildlife at Vandenberg AFB (Western Range) (U.S. Air Force, 1997). Largely, this results from the high-altitude at which the proposed laser activity would occur (approximately 35,000 feet or greater), and from the test geometry that would prevent the HEL from being engaged in a downward direction.

Two Essential Fish Habitat zones (Coastal Pelagic and Groundfish) occur within the sea range, both extending from the coastline out to 200 miles (320 km). Activities analyzed would not have adverse direct or indirect impacts on ocean waters or marine sediments necessary to fish for spawning, breeding, feeding, or growth to maturity. Although some hazardous constituents would enter the ocean as a result of sea range testing activities, resultant saltwater concentrations of constituents of concern would be below criteria established for protection of aquatic life. Potential impacts from proposed ABL test activities on Essential Fish Habitat in Territorial and non-Territorial waters would be less than significant.

Mitigation Measures. Because there are no adverse impacts anticipated under the Proposed Action, mitigation measures are not required.

Cumulative Impacts. Other missile test and rocket launch activities within the Western Range to support other military and commercial functions would be occurring. These missile tests and rocket launches have been addressed in EAs and EISs that limit the number of launches and evaluate the potential effects to biological resources as a result of launch activities. Cumulative impacts on biological resources from other launch actions are not anticipated.

No other actions have been identified that would contribute to cumulative impacts such that adverse impacts would result.

No-Action Alternative

Under the No-Action Alternative, ABL flight-testing activities would not be conducted as described in Chapter 2 of this SEIS. ABL test activities would be conducted as analyzed in the 1997 FEIS. No adverse environmental impacts are anticipated.

Mitigation Measures. No mitigation measures would be required under the No-Action Alternative.

3.4.8 Cultural Resources

3.4.8.1 Affected Environment.

The ROI for cultural resources is the environment within the confines of the Vandenberg AFB boundary. However, the primary focus of activities is the proposed target missile launch locations.

Numerous cultural resource surveys have been conducted at Vandenberg AFB resulting in the identification of approximately 1,600 cultural resources. The earliest evidence of occupation in the region was approximately 7000 Before Christ (B.C.) (U.S. Air Force, 1997a). Previously identified prehistoric cultural remains at Vandenberg AFB range from village and camp sites to resource processing sites to both painted and incised rock art. The San Antonio Terrace National Register District, located in the northwest portion of Vandenberg AFB contains 146 recorded prehistoric sites.

A number of facilities on Vandenberg AFB under 50 years of age demonstrate importance under the Man-In-Space theme, the Cold War historic context, or for scientific and technological achievements. These sites are potentially NRHP eligible (U.S. Air Force, 1997a).

Turtle Pond on the San Antonio Terrace, along with other sites, is considered to be a traditional resource area by the Santa Ynez Band of Mission Indians.

Paleontological resources found in the vicinity include fossils of both vertebrate and invertebrate animals. Remnants of mammoth and horse fossils approximately 45,000 years old have been found at southern Vandenberg AFB. In addition, fish and crab remains and whale bone have been discovered. The Miocene Monterey Formation and Later Miocene deposits identified at northern Vandenberg AFB have yielded imprints of algae, fish fragments, coprolites, and whale bone (U.S. Air Force, 1997a).

3.4.8.2 Environmental Consequences

Proposed Action

Ground-Testing Activities. No ground-testing activities of the laser systems is proposed at Vandenberg AFB.

Flight-Testing Activities. The ABL aircraft would originate at Edwards AFB and conduct flight-testing activities over the Western Range off the coast of California. Flight-testing activities at Vandenberg AFB would consist of the launching of missiles from existing coastal launch sites. High-energy engagements would take place over the ocean, beyond 3 miles of the coastline. Target missile debris would land in the ocean well away from the coastline. Debris falling offshore would pose no threat to Vandenberg AFB cultural resources. No adverse impacts are anticipated.

Mitigation Measures. Because there are no adverse impacts anticipated under the Proposed Action, mitigation measures are not required.

Cumulative Impacts. Other missile test and rocket launch activities within the Western Range to support other military and commercial functions would be occurring. These missile tests and rocket launches have been addressed in EAs and EISs that limit the number of launches and evaluate the potential effects to cultural resources as a result of launch activities. Cumulative impacts to cultural resources from other launch actions are not anticipated.

No other actions have been identified that would contribute to cumulative impacts such that adverse impacts would result.

No-Action Alternative

Under the No-Action Alternative, ABL flight-testing activities would not be conducted as described in Chapter 2 of this SEIS. ABL test activities would be conducted as analyzed in the 1997 FEIS. No adverse environmental impacts are anticipated.

Mitigation Measures. No mitigation measures would be required under the No-Action Alternative.

3.4.9 Socioeconomics

3.4.9.1 Affected Environment.

The ROI for socioeconomics includes Santa Barbara County, with the exception of commercial fishing. Within Santa Barbara County, the communities mostly likely to host the temporary personnel associated with the ground- and flight-testing activities are Lompoc and Santa Maria. The commercial fishing ROI is more extensive, and potentially covers the ocean area beneath the Warning Areas of the Western Range. The affected environment is described below in terms of its principal attributes, namely: population, income, employment, and housing or lodging. Because of special circumstances, commercial and recreational fishing and recreational resources are also described in this section.

Population. In 1999, Santa Barbara County had a population of 391,000 (Bureau of Economic Analysis, 2001a). The communities most likely to host temporary personnel associated with the ABL Program are Lompoc and Santa Maria, the two closest communities with the largest concentration of hotels/motels, and perhaps Buellton and Solvang. Lompoc has a population of 41,000; Santa Maria, 77,000; Buellton, 3,800; and Solvang, 5,300 (Census Bureau, 2001).

Income. In 1999, Santa Barbara County had a per capita personal income of $30,218. The county ranked 12th in the state, was 101 percent of the state average of $29,856, and 106 percent of the national average of $28,546 (Bureau of Economic Analysis, 2001b).

Employment. Full- and part-time employment in Santa Barbara County totaled 244,000 in 1999, up from 214,000 in 1989. While separate statistics are not readily available for the commercial and recreational fishing industry, the “agricultural services, forestry, fishing and other” sector accounted for just 4 percent of the total in 1999, up from about 3 percent in 1989 (Bureau of Economic Analysis, 2001a).

Vandenberg AFB employs 8,800 individuals, 15 percent of whom are military personnel. Lompoc had a labor force of 18,150, with an unemployment rate of 3.7 percent in July of 2001. Santa Maria had a labor force of 31,300, and an unemployment rate of 3.9 percent in July, 2001. Buellton had a labor force of 2,100, and an unemployment rate of 2 percent. Solvang had a labor force of almost 2,800, and an unemployment rate of 2.5 percent in July, 2001 (California Employment Development Department, 2001).

Housing/Lodging. Because personnel associated with ABL flight-testing activities are expected to rotate into Vandenberg AFB on a temporary basis for the short duration of each test event, it is anticipated that they will seek accommodations in hotels and motels closest to Vandenberg AFB. There are 10 hotels/motels recognized by the AAA in Lompoc and Santa Maria, with a total of 1,108 units, split almost evenly between the two communities. A little further away, the community of Buellton has 4 hotels/motels with 414 units, and Solvang has 13 hotels/motels with 633 units (American Automobile Association, 2001).

Commercial and Recreational Fishing. The most heavily fished area of the Port Region 5 (Port San Luis – Monterey), California Department of Fish and Game, is along the rocky coast from Cape San Martin (north of San Simeon), south to Purisima Point, just off Vandenberg AFB. The fishing season is year-round, weather permitting. In Port Region 6 (Santa Barbara – Ventura), extending from the Santa Maria River to Sequit Point, fishing occurs along the mainland and around the Channel Islands (California Department of Fish and Game, 2001). Marine traffic in the coastal waters off Vandenberg AFB consists mostly of fishing vessels from Morro Bay, Port San Luis, Santa Barbara, Ventura, and Port Hueneme.

Several types of fishing are conducted in several areas within the ROI. Commercial fishing occurs in the ocean; private or rental vessels utilize bays and sheltered coastal areas; local fisherman use beaches and banks along natural shorelines, including habitats from sandy beaches to rocky outcrops, and man-made structures such as piers, docks, fishing floats, jetties and breakwaters (California Department of Fish and Game, 2001). The state and county beach parks along the coast are especially popular for surf fishing.

Recreation. There are three public access beaches on, or immediately adjacent to, Vandenberg AFB. These include Point Sal State Beach at the northernmost border of the base; Ocean Beach County Park (day use only), at the end of Highway 246, approximately mid-way down the western coastal edge of Vandenberg AFB; and, at the southernmost tip of the base, Jalama Beach County Park.

All three beaches, which are popular surf fishing areas, are open to the public except during missile launches, when the access roads may be closed, and visitors are evacuated under an evacuation agreement between Vandenberg AFB and the County of Santa Barbara. Jalama Beach County Park permits overnight camping.

3.4.9.2 Environmental Consequences

Proposed Action

Ground-Testing Activities. No ground-testing activities are proposed at Vandenberg AFB; therefore, no socioeconomic impacts would be anticipated.

Flight-Testing Activities. Flight-testing activities at Vandenberg AFB are expected to trigger the rotation of up to 50 program-related, temporary personnel into and out of Vandenberg AFB for short periods surrounding each test event. Given the normal daily, weekly, and monthly fluctuation of population, employment, and visitors to both Vandenberg AFB and local communities in the ROI, the rotation of up to 50 program-related, temporary personnel would have a small, positive, yet largely unnoticeable effect on population, income, or employment in the ROI.

Socioeconomic impacts would essentially be limited to their expenditures in the local economy, particularly at local hotels/motels and restaurants. Based on a 2002 maximum per diem rate of $152 (U.S. General Service Administration, 2001), the 50 program-related personnel could result in an infusion of approximately $7,600 per day (about $53,200 per week) into the local economy, depending on the duration of their temporary assignments at Vandenberg AFB.

However, because it would represent only a 0.06-percent increase in the number of people employed at Vandenberg AFB, and an even smaller percent of the total labor force of the ROI, and the demand for up to 50 hotel/motel units would only represent 2.3 percent of the 2,155 unit supply in the ROI, the impact, although positive, would be small. For example, assuming an average occupancy rate of 70 percent, there would normally be 646 unoccupied units available to the 50 program-related personnel at any one time; therefore, there would most likely not be any discernable effect on direct, indirect, or induced jobs, income, and related population.

Commercial and Recreational Fishing. There is the potential for impacts to local commercial and recreational fishing in the waters offshore of Vandenberg AFB and below the Warning Areas of the Western Range. However, ocean vessels would be notified in advance of launch activity by the 30 RANS as part of their routine operations through a Notice to Mariners by the 11th Coast Guard District to warn vessels of test operations and the potential hazards. All efforts are made to ensure that the flight corridors are clear of vessels. However, there is only a very small probability of any flight test-related debris impacting any point along the corridor, and there is only limited occupancy of the Western Range area by commercial and recreational fishing vessels. Moreover, since this is done on a regular basis for missile launches from Vandenberg AFB, potential impacts to commercial and recreation fishing vessels and fishing activities are not expected to be substantial.

Recreational Activities. Flight-testing activities have the potential for impacts on local recreational activities, because they may require the temporary closure of one or more of the state and county parks in the ROI. Activation of launch hazard areas for launch sites in northern Vandenberg AFB would have an impact on recreational use of Point Sal State Park. Closure of the access road is expected to affect very few individuals.

Depending on the launch sites used for the ABL Program, activation of its launch hazard area may impact Ocean Beach County Park, and require temporary closure. Again, assuming a typical 8-hour day for beach visitation, closure would nominally affect as many as 30 visitors during the peak season, and as few as 19 visitors during the off-season.

While undoubtedly inconvenient for the individuals involved, the relatively small number of park visitors that could be affected, along with the fact that existing evacuation agreements are in effect, impacts to recreational use of the three parks would not be substantial. Similarly, both the park authorities and most local residents are fully aware of the closure and evacuation potential.

Cumulative Impacts. With some impacts to recreational use of state and county parks, there is the potential for additive, incremental, cumulative impacts of the ABL Program when added to other past, current, or reasonably foreseeable projects. However, the total number and frequency of beach and park closures would be consistent with existing agreements with park authorities; therefore, cumulative impacts would be minimized.

Mitigation Measures. No specific mitigation measures would be necessary for ABL flight-test activities. The total number and frequency of beach and park closures would be consistent with existing agreements with park authorities; therefore, no mitigation measure would be required.

No-Action Alternative

Under the No-Action Alternative, ABL flight-testing activities would not be conducted as described in Chapter 2 of this SEIS. ABL test activities would be conducted as analyzed in the 1997 FEIS. No adverse environmental impacts are anticipated.

Mitigation Measures. No mitigation measures would be required under the No-Action Alternative.

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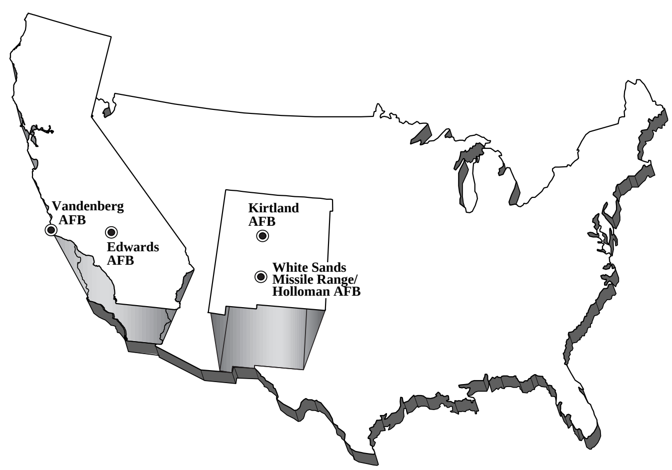

CHAPTER 4
CONSULTATION AND COORDINATION

4.0 CONSULTATION AND COORDINATION

The federal and state agencies/organizations contacted during preparation of this SEIS are listed below:

FEDERAL

Federal Aviation Administration
National Marine Fisheries Services
National Park Service
U.S. EPA, Region 6
U.S. EPA, Region 9
U.S. Fish and Wildlife Service

STATE

California
California Coastal Commission
California Department of Fish and Game
California Environmental Protection Agency
State Historic Preservation Officer
Native American Heritage Commission
Santa Inez Band of Chumash Indians
Kawaiisu
Tataviam
Kitanemuk
Serrano

New Mexico
New Mexico Environment Department
New Mexico Department of Game and Fish
New Mexico Department of Minerals and Natural Resources
State Historic Preservation Officer
Sandia Pueblo
Isleta Pueblo
Jemez Pueblo
Mescalero Apache
Chiricahua Apache
Lipan Apache

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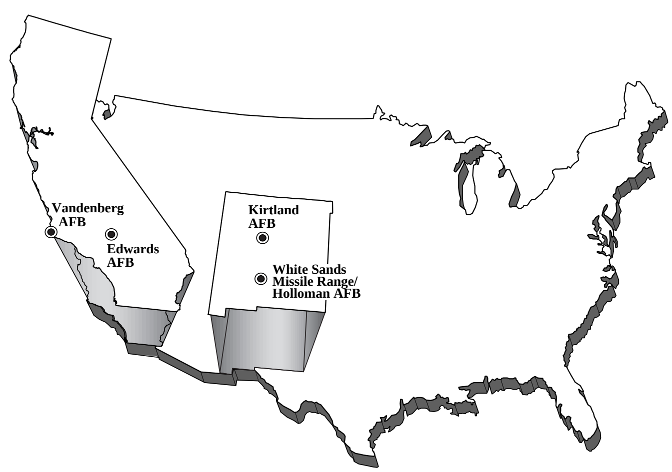

CHAPTER 5
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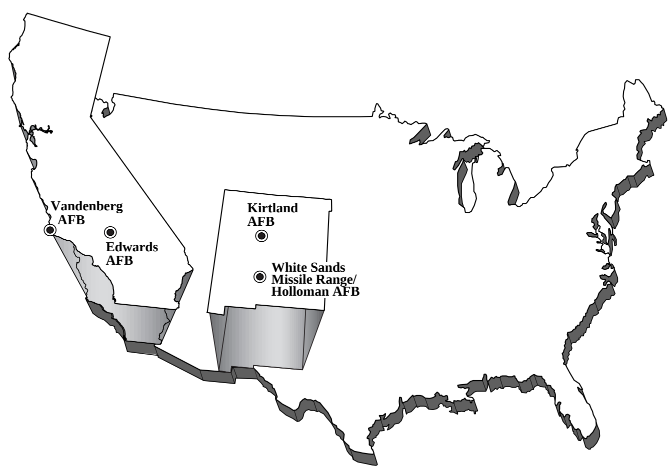

CHAPTER 6
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6.0 BIBLIOGRAPHY

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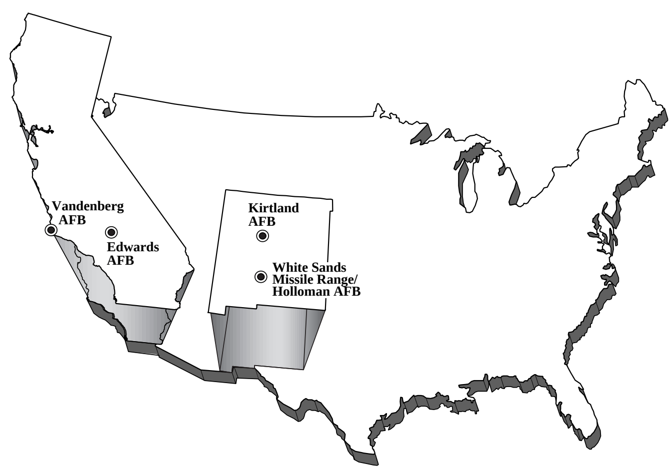

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