Missile Defense Agency
Ballistic Missile Defense System (BMDS)

Programmatic Environmental Impact Statement

January 2007

VOLUME 2
APPENDICES A - J

Department of Defense
Missile Defense Agency
7100 Defense Pentagon
Washington, DC 20301-7100

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ACRONYMS AND ABBREVIATIONS

ABL	Airborne Laser
ABM	Anti-Ballistic Missile
ACHP	Advisory Council on Historic Preservation
AFB	Air Force Base
AFRL	Air Force Research Laboratory
AFSPC	Air Force Space Command
Ait	atmospheric interceptor technology
ALCOR	Advanced Research Project Agency Lincoln C-band Observable Radar
Al_2O_3	Aluminum Oxide (alumina)
ANSI	American National Standards Institute
AMOS	Air Force Maui Optical and Supercomputing Station
ARS	Active Ranging System
ARTCC	Air Route Traffic Control Center
ASIP	Arrow System Improvement Program
AST	Office of Commercial Space Transportation
AWS	Arrow Weapon System
BC/FC	Beam Control/Fire Control
BILL	Beacon Illuminator Laser
BMC2	Battle Management/Command and Control
BMC3	Battle Management/Command, Control and Communications
BMC4I	Battle Management Command, Control, Communications, Computers and Intelligence
BMD	Ballistic Missile Defense
BMDO	Ballistic Missile Defense Organization
BMDS	Ballistic Missile Defense System
BMEWS	Ballistic Missile Early Warning System
BOA	Broad Ocean Area
BTS	Bureau of Transportation Statistics
C2BM	Command and Control/Battle Management
C2BMC	Command and Control, Battle Management, and Communications
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
Cl	Atomic Chlorine
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COIL	Chemical Oxygen Iodine Laser
COMSATCOM	Commercial Satellite Communications
D&T	Development and Test

dB	Decibel
dBA	A-weighted decibel
DoD	Department of Defense
DOT	Department of Transportation
DSP	Defense Support Program
EA	Environmental Assessment
EIS	Environmental Impact Statement
EKV	Exoatmospheric Kill Vehicle
EM	Electromagnetic
EMR	Electromagnetic Radiation
EO	Executive Order
EPA	Environmental Protection Agency
ESG	Engagement Sequence Group
ESQD	Explosive Safety Quantity Distance
ETR	Extended Test Range
EWR	Early Warning Radar
FAA	Federal Aviation Administration
FBX-T	Forward Based X-Band Radar Transportable
FL	Flight Level
FM	Flight Mission
FR	Federal Register
FTS	Flight Termination System
FY	Fiscal Year
GBR-P	Ground-Based Radar Prototype
GEO	Geosynchronous Earth Orbit
GFC	Ground-based Midcourse Defense Fire Control
GFC/C	Ground-based Midcourse Defense Fire Control/Communications
GMD	Ground-Based Midcourse Defense
GT	Integrated Ground Test
H_2	Hydrogen
H_2O	Water
HAA	High Altitude Airship
HAIR	High Accuracy Instrumentation Radar
HALO	High Altitude Observatory
HAP	Hazardous Air Pollutant
HEL	High Energy Laser
HCl	Hydrogen Chloride
ICAO	International Civil Aviation Organization
ICBM	Inter-Continental Ballistic Missile
IDC	Initial Defensive Capability
IDLH	Immediately Dangerous to Life and Health
IDO	Initial Defensive Operations
IDT	In-Flight Interceptor Communication System Data Terminal

IEEE	Institute of Electrical and Electronics Engineers
IFR	Instrument Flight Rules
INF	Intermediate-Range Nuclear Forces
IRST	Infrared Search and Track
ISS	International Space Station
ISTEF	Innovative Science and Technology Experimentation Facility
KEI	Kinetic Energy Interceptor
KLC	Kodiak Launch Complex
LEO	Low Earth Orbit
Lidar	Light Detection and Ranging
LRAD	Long Range Atmospheric Defense
MARTI	Missile Alternative Range Target Instrument
MDA	Missile Defense Agency
MDIE	Missile Defense Integration Exercises
MEADS	Medium Extended Air Defense System
mg/m^3	Milligrams per cubic meter
MILSATCOM	Military Satellite Communications
MOA	Military Operating Area
MPE	Maximum Permissible Exposure
MSL	Mean Sea Level
MSSS	Maui Space Surveillance System
MSX	Midcourse Space Experiment
N_2	Nitrogen
NAAQS	National Ambient Air Quality Standards
NAS	National Airspace System
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
NFIRE	Near-Field Infrared Experiment
NMD	National Missile Defense
NO_2	Nitrogen Dioxide
NO_X	Nitrogen Oxides
NOA	Notice of Availability
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRC	National Research Council
OCONUS	Outside the Continental United States
OSHA	Occupational Safety and Health Administration
PAC-3	PATRIOT Advanced Capability-3
PAVE PAWS	Position and Velocity Extraction Phased Array Warning System
PEIS	Programmatic Environmental Impact Statement
PEL	Permissible Exposure Limit
ppb	parts per billion

ppm	parts per million
PM	Particulate Matter
PM_{10}	Particulate Matter with diameter 10 microns or less
$PM_{2.5}$	Particulate Matter with diameter 2.5 microns or less
PMRF	Pacific Missile Range Facility
RCC	Range Commanders' Council
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
RTS	Ronald Reagan Ballistic Missile Defense Test Site
SBIRS	Space-Based Infrared Sensor
SBX	Sea-Based X-Band Radar
SDI	Strategic Defense Initiative
SHEL	Surrogate High Energy Laser
SIFT	System Integration Flight Test
SIL	Systems Integration Laboratory
SIP	State Implementation Plan
SM	Standard Missile
SO_2	Sulfur Dioxide
SO_X	Sulfur Oxides
SPCC	Spill Prevention, Control and Countermeasure
START	Reduction and Limitation of Strategic Offensive Arms Treaty
STEL	Short Term Exposure Limit
STSS	Space Tracking and Surveillance System
THAAD	Terminal High Altitude Area Defense
TILL	Track Illuminator Laser
TLV	Threshold Limit Value
TMD	Theater Missile Defense
TPS-X	Transportable System Radar
UCAR	University Corporation for Atmospheric Research
UNEP	United Nations Environment Programme
U.S.	United States
USAF	United States Air Force
USAKA	U.S. Army Kwajalein Atoll
USFWS	U.S. Fish and Wildlife Service
U.S.C.	United States Code
USGS	United States Geological Survey
VFR	Visual Flight Rules
VOC	Volatile Organic Compound
WASP	Widebody Airborne Sensor Platform
WSMR	White Sands Missile Range
XBR	X-Band Radar

APPENDIX A
CONSULTATION AND COORDINATION

CONSULTATION AND COORDINATION

Relevant legislative requirements dictated which entities the Missile Defense Agency (MDA) consulted, and although there are three main resource areas that require consultation and programmatic agreements, MDA worked with additional organizations to ensure completeness of the National Environmental Policy Act (NEPA) process.

The MDA met with the Council on Environmental Quality (CEQ) to discuss general consultation requirements, but formal consultation and a programmatic agreement with CEQ were not required due to the general nature of CEQ's involvement with the NEPA process. Based on requirements in the Fish and Wildlife Preservation Act and the Endangered Species Act, the MDA consulted with the United States (U.S.) Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries Service) to determine what effects the proposed Ballistic Missile Defense System (BMDS) will have on wildlife and critical habitat. Based on requirements in the National Historic Preservation Act, the MDA consulted with the Advisory Council on Historic Preservation (ACHP) to determine what effects the proposed BMDS will have on historic properties.

Agency	Date Consulted	Point of Contact	Address
ACHP	11 February 2004	Dave Berwick Army Affairs Coordinator, Office of Federal Agency Programs	1100 Pennsylvania Avenue, NW, Room 803 Washington, DC 20004 Phone: (202) 606-8531
		Don Klima Director, Office of Federal Agency Programs	1100 Pennsylvania Avenue, NW, Room 809 Washington, DC 20004 Phone: (202) 653-8503
CEQ	19 December 2003	Horst Greczmiel Associate Director for NEPA Oversight	722 Jackson Place, N.W. Washington, DC 20503 Phone: (202) 395-5750
NOAA Fisheries	14 January 2004	Steve Kokkinakis NEPA Coordinator, U.S. Department of Commerce, NOAA	1315 East-West Highway Silver Spring, Maryland 20910 Phone: (301) 713-1622 ext.189
		David Kaiser Federal Consistency and Regulatory Coordinator, Coastal Programs Division, N/ORM3	1315 East-West Highway Silver Spring, Maryland 20910 Phone: (301) 713-3155 ext.144

Agency	Date Consulted	Point of Contact	Address
		John Hansel Office of Protected Resources	1315 East West Highway Silver Spring, MD 20910 Phone: (301) 713-2332
USFWS	4 February 2004	John Fay Staff Biologist, Division of Consultation, Habitat Consultation Planning, Recovery and State Grants, USFWS Endangered Species Program	4401 North Fairfax Drive Room 420 Arlington, Virginia 22203 Phone: (703) 358-2106
		Rick Sayers Chief, Division of Consultation, Habitat Consultation Planning, Recovery and State Grants, USFWS Endangered Species Program	4401 North Fairfax Drive Arlington, Virginia 22203 Phone: (703) 358-2106
		Laura Henze National Sikes Act Coordinator, Branch of Resource Management Support	4401 North Fairfax Drive Arlington, Virginia 22203 Phone: (703) 358-2398

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APPENDIX B
PUBLIC INVOLVEMENT

PUBLIC INVOLVEMENT

The CEQ implementing regulations for NEPA describe the public involvement requirements for agencies (40 Code of Federal Regulations [CFR] 1500-1508). Public participation in the NEPA process not only provides for and encourages open communication between the MDA and the public, but also promotes better decision-making. Throughout preparation of the BMDS Programmatic Environmental Impact Statement (PEIS), the MDA aimed to

- Obtain meaningful input concerning the issues that should be addressed in the BMDS PEIS,
- Provide interested parties, especially the public, with accurate and timely information concerning the MDA's efforts to meet NEPA requirements in the BMDS PEIS process,
- Ensure meaningful public involvement during scoping and the public review of the Draft PEIS,
- Ensure that the MDA responded to inquiries and comments in a timely manner and discuss how input was considered, and
- Ensure that the MDA recognized and responded to changing stakeholder needs for input and involvement in a timely and informative way.

B.1 Scoping

The CEQ implementing regulations for NEPA require an open process for determining the scope of issues related to the proposed action and alternatives. The scope consists of the range of actions, alternatives, and impacts to be considered in the PEIS. Scoping is a useful tool for discovering alternatives to a proposed action, identifying significant impacts, eliminating insignificant issues, communicating information, consulting with agencies and organizations, and soliciting public comments. During scoping, the MDA invited the participation of Federal, state, and local agencies, Native American Tribes, environmental groups, organizations, citizens, and other interested parties to assist in determining the scope and significant issues to be evaluated in the BMDS PEIS.

Scoping for the development of the BMDS PEIS began with the publication of the Notice of Intent (NOI) in the *Federal Register* (FR) (Vol. 68, No. 70 FR 17784) on April 11, 2003. The NOI announced the MDA's intent to prepare a PEIS on the proposed BMDS; provided information on the proposed action and reasonable alternatives, including the no action alternative; listed the dates and locations of scoping meetings; and provided contact information for submitting comments to the MDA. The NOI is shown in Exhibit B-1.

Exhibit B-1. Notice of Intent

SUPPLEMENTARY INFORMATION: The Advisory Committee to the U.S. Section to ICCAT will meet in two open sessions to receive and discuss information on (1) the 2002 ICCAT meeting results and U.S. implementation of ICCAT decisions; (2) 2003 ICCAT and NMFS research and monitoring activities; (3) 2003 Commission activities; (4) results of the Committee's Species Working Group deliberations; and (5) Advisory Committee operational issues. The public will have access to the open sessions of the meeting, but there will be no opportunity for public comment.

The Advisory Committee will go into executive session during the afternoon of April 30, 2003, to discuss sensitive information relating to (1) post ICCAT 2002 discussions and negotiations, including upcoming ICCAT working group meetings on trade and on monitoring and compliance; (2) the Atlantic Tunas Convention Act required consultation on the identification of countries that are diminishing the effectiveness of ICCAT; and (3) other matters relating to the international management of ICCAT species. In addition, the Committee will meet in its Species Working Groups for a portion of the afternoon of April 30 and part of the morning of May 1, 2003. These sessions are not open to the public, but the results of the deliberations of the Species Working Groups will be reported to the full Advisory Committee during the Committee's afternoon open session on May 1.

Special Accommodations

The meeting location is physically accessible to people with disabilities. Requests for sign language interpretation or other auxiliary aids should be directed to Kim Blankenbeker at (301) 713–2276 at least 5 days prior to the meeting date.

Dated: April 8, 2003.

Richard W. Surdi,

Acting Deputy Director, Office of Sustainable Fisheries, National Marine Fisheries Service.

[FR Doc. 03–8934 Filed 4–10–03; 8:45 am]

BILLING CODE 3510–22–S

DEPARTMENT OF THE DEFENSE

Office of the Secretary

Notice of Intent To Prepare a Programmatic Environmental Impact Statement for the Ballistic Missile Defense System

AGENCY: Missile Defense Agency, Department of Defense.

ACTION: Notice of intent.

SUMMARY: The Missile Defense Agency (MDA) is publishing this notice to announce its intent to prepare a Programmatic Environmental Impact Statement (PEIS) in accordance with the National Environmental Policy Act of 1969 and the Council on Environmental Quality implementing regulations. This PEIS will assess environmental issues associated with the proposed action, foreseeable future actions, and their reasonable alternatives, including the no action alternative, and as appropriate, cumulative effects. This PEIS will support decisions to meet the fundamental objectives of the MDA's mission to test, develop, transfer to deployment, and to plan for decommissioning activities for a Ballistic Missile Defense System to defend the forces and territories of the United States (U.S.), its Allies, and friends against all classes of ballistic missile threats, in all phases of flight.

Scoping: Public scoping meetings will be conducted as a part of the PEIS process to ensure opportunity for all interested government and private organizations, and the general public to identify their issues of concern they believe should be addressed in the content of the PEIS. Schedule and location for the public scoping meetings are:

- April 30, 2003, 6 p.m., Doubletree Hotel, 300 Army Navy Dr., Arlington, VA.
- May 06, 2003, 6 p.m., Sheraton Grand Hotel, 1230 J. St., Sacramento, CA.
- May 08, 2003, 6 p.m., Sheraton Hotel, 401 E. 6th Ave., Anchorage, AK.
- May 13, 2003, 6 p.m., Doubletree Hotel, 1956 Ala Moana Blvd., Honolulu, HI

For those that cannot attend the public scoping meetings, written comments via the U.S. mail, or e-mail are encouraged. Comments should clearly identify and describe the specific issue(s) or topics that the PEIS should address. Comments are welcomed anytime throughout the PEIS process. Formal opportunities for comment and participation include: (1) Public scoping meetings; (2) anytime during the process via mail, telephone, fax, or e-mail; (3) during review, public hearings, and comment on the Draft PEIS; and, (4) review of the Final PEIS. Interested parties may also request to be included on the mailing list for public distribution of the PEIS.

To ensure sufficient time to consider issues identified during the public scoping meeting period, comments should be submitted to one of the addresses listed below no later than June 12, 2003. Additional information regarding the development of the BMDS PEIS is available on the public participation Web site *http://www.acq.osd.mil/bmdo.*

ADDRESSES: Written comments, statements, and/or questions regarding scoping issues should be addressed to: MDA BMDS PEIS, c/o ICF Consulting, 9300 Lee Highway, Fairfax, VA 22031, Phone (Toll Free) 1–877–MDA–PEIS (1–877–632–7347), Fax (Toll Free) 1–877–851–5451, E-mail *bmds.peis@mda.osd.mil,* Web site *http://www.acq.osd.mil/bmdo.*

Dated: April 7, 2003.

L.M. Bynum,

Alternate OSD Federal Register Liaison Officer, Department of Defense.

[FR Doc. 03–8897 Filed 4–10–03; 8:45 am]

BILLING CODE 5001–08–M

DEPARTMENT OF DEFENSE

Department of the Air Force

Proposed Collection; Comment Request

AGENCY: Department of Defense Medical Examination Review Board, Department of Defense.

ACTION: Notice.

In compliance with section 3506(c)(2)(A) of the Paperwork Reduction Act of 1995, the Department of Defense Medical Examination Review Board announces the proposed public information collection and seeks public comment on the provisions thereof. Comments are invited on: (a) Whether the proposed collection of information is necessary for the proper performance of the functions of the agency, including whether the information shall have practical utility; (b) the accuracy of the agency's estimate of the burden of the proposed information collection; (c) ways to enhance the quality, utility, and clarity of the information to be collected; and (d) ways to minimize the burden of the information collection on respondents, including through the use of automated collection techniques or other forms of information technology.

DATES: Considerations will be given to all comments received by June 10, 2003.

ADDRESSES: Written comments and recommendations on the proposed information collection should be sent to Department of Defense Medical Examination Review Board (DoDMERB), 8034 Edgerton Drive, Suite 132, USAF Academy, CO 80840–2200, Attention: CMSgt Jaime P. Bouchard.

FOR FURTHER INFORMATION CONTACT: To request more information on this

The MDA developed a web site, http://www.mda.mil/mdalink/html/mdalink.html, to provide information on the BMDS PEIS and solicit scoping comments. The web site includes a schedule and summaries of the scoping meetings; background information about the NEPA process, the BMDS, and the PEIS; and links to relevant web sites. In addition, the web site provides an electronic comment form for individuals to submit scoping comments directly to the MDA. The MDA also established a toll-free phone line, toll-free fax, e-mail address, and mailbox for submittal of public comments and questions.

The MDA held public scoping meetings in accordance with CEQ regulations. The purpose of the scoping meetings was to solicit input from the public on concerns regarding the proposed activities, as well as information and knowledge of issues relevant to analyzing the environmental impacts of the BMDS. The public scoping meetings also provided the public with an opportunity to learn more about the MDA's proposed action and alternatives. MDA personnel were available at the scoping meetings to explain the objectives of the BMDS PEIS process.

The scoping meetings consisted of informal poster sessions; formal presentations by MDA officials on the proposed BMDS, the NEPA process, and public involvement; and a formal public comment session. The MDA provided background and information materials to those who attended the scoping meetings and provided numerous ways to submit comments and obtain additional information. A court reporter was present at each of the meetings to document the proceedings, including public comments, for the administrative record. Issues highlighted at the public scoping meetings were posted on the BMDS PEIS web site.

Scoping Meeting Legal Notices

In addition to announcing the public scoping meetings in the NOI, the MDA placed paid legal notices in local and regional publications. Exhibit B-2 summarizes the publications in which the scoping meetings were advertised, including publication dates.

Exhibit B-2. Local and Regional Publications and Dates

Scoping Meeting Location	Newspaper	Publication Date(s)
Arlington, VA	Journal Newspapers: Alexandria County, VA; Arlington County, VA; Fairfax County, VA; Montgomery County, MD; Prince George's County, MD; Prince William County, VA	April 24, 2003 April 25, 2003
Sacramento, CA	Sacramento Bee	April 30, 2003 May 4, 2003
	Lompoc Record	April 29, 2003 May 1, 2003 May 2, 2003 May 4, 2003
Anchorage, AK	Anchorage Daily News	April 30, 2003 May 4, 2003
	Fairbanks Daily News-Miner	May 1, 2003
	Kodiak Daily Mirror	April 30, 2003 May 2, 2003
Honolulu, HI	Honolulu Star-Bulletin	May 4, 2003 May 6, 2003
	Honolulu Advertiser	May 5, 2003 May 7, 2003
	Garden Island Newspaper, Kauai, HI	May 5, 2003 May 7, 2003
	The Environmental Notice (Office of Environmental Quality Control)	May 8, 2003

Scoping Meeting Notification Letter

The MDA sent letters and a copy of the NOI to state governors, mayors, and members of Congress indicating the MDA's intent to prepare a PEIS for the BMDS and dates of scoping meetings. Exhibit B-3 lists the recipients of the scoping meeting notification letter. An example of the notification letter is also included in Exhibit B-4.

Exhibit B-3. Scoping Meeting Notification List

City of Honolulu Jeremy Harris, Mayor Honolulu Hale 530 South King Street Honolulu, HI 96813	City of Kodiak Carolyn L. Floyd, Mayor 710 Mill Bay Road Kodiak, AK 99615
County of Kauai Brian J. Baptiste, Mayor Office of the Mayor 4444 Rice Street, Suite 235 Lihue, HI 96766	Brigadier General Craig E. Campbell The Adjutant General Alaska Air National Guard Fort Richardson, AK 99505
City of Sacramento Heather Fargo, Mayor 730 I Street, Suite 321 Sacramento, CA 95814	Major General Paul D. Monroe, Jr. The Adjutant General 9800 Goethe Road Sacramento, CA 95827
City of Lancaster Frank C. Roberts, Mayor 44933 North Fern Avenue Lancaster, CA 93534	Major General Robert G. F. Lee The Adjutant General 3049 Diamond Head Road Honolulu, HI 968-4495, CA 95827
City of Lompoc Dick DeWees, Mayor 100 Civic Center Plaza Lompoc, CA 93438	Honorable Frank H. Murkowski Governor of Alaska P.O. Box 110001 Juneau, AK 99811-0001
City of Anchorage Mayor George Wuerch 632 West 6th Avenue, Suite 840 Anchorage, AK 99519-6650	Honorable Gray Davis Governor of California State Capital Building Sacramento, CA 95814
City of Fairbanks Rhonda Boyles, Mayor 809 Pioneer Road Fairbanks, AK 99707	Honorable Linda Lingle Governor of Hawaii State Capital Executive Chambers Honolulu, HI 96813
Delta Junction Thomas “Roy” Gilbertson, Mayor P.O. Box 1069 Delta Junction, AK 99737	Honorable Neil Abercrombie House of Representatives Washington, DC 20515
City of Delta Junction City Official P.O. Box 229 Delta Junction, AK 99737-0229	Honorable Daniel Akaka United States Senate Washington, DC 20510
Honorable Barbara Boxer United States Senate Washington, DC 20510	Honorable Dianne Feinstein United States Senate Washington, DC 20510

Exhibit B-3. Scoping Meeting Notification List

Honorable Daniel Inouye United States Senate Washington, DC 20510	Honorable Don Young House of Representatives Washington, DC 20515
Honorable Robert Matsui House of Representatives Washington, DC 20515	Honorable Lisa Murkowski United States Senate Washington, DC 20510
Honorable Ted Stevens Chairman Subcommittee on Defense Committee on Appropriations United States Senate Washington, DC 20510	Honorable Jerry Lewis Chairman Subcommittee on Defense Committee on Appropriations House of Representatives Washington, DC 20515
Honorable Duncan Hunter Chairman Committee on Armed Services House of Representatives Washington, DC 20515	Honorable John Warner Chairman Arms Service Committee United States Senate Washington, DC 20510

Exhibit B-4. Example of Scoping Meeting Notification Letter

DEPARTMENT OF DEFENSE
MISSILE DEFENSE AGENCY
7100 DEFENSE PENTAGON
WASHINGTON, DC 20301-7100

APR 7 2003

Honorable Don Young
House of Representatives
Washington, DC 20515

Dear Representative Young:

The Missile Defense Agency (MDA) is preparing a Programmatic Environmental Impact Statement (PEIS) to address the potential environmental effects associated with research, development, test, evaluation, deployment, and decommissioning of the Ballistic Missile Defense System (BMDS). The BMDS is a system of systems consisting of layered defenses using complementary sensors and weapons to engage threat ballistic missiles in all phases of flight. Since completing our 1994 PEIS, we have been developing and testing new technologies and are now preparing a new PEIS to reflect our current mission and the evolving BMDS. The BMDS PEIS will provide the framework to plan and evaluate the range of complex activities comprising the BMDS from test and development through fielding and decommissioning.

The MDA is holding scoping meetings in April and May 2003 to encourage public participation and to solicit public comment on the proposed activities. The attached Notice of Intent provides the meeting dates and locations in your congressional area.

Please contact Ms. Pamelia Bain, MDA Legislative Affairs, at (703) 697-8980, if you have any questions regarding this matter.

Sincerely,

RONALD T. KADISH
Lieutenant General, USAF
Director

Enclosure:
As stated

Communications with Media

The MDA's Office of the Director of Communications notified local media representatives about the public scoping meetings and distributed press releases. Exhibit B-5 lists the media representatives contacted by the MDA. An example of the press release is also included in Exhibit B-6.

Exhibit B-5. Media Representatives Contacted

Scoping Meeting Location	Media Organizations Contacted	
	Newspaper	**Radio/Television**
Arlington, VA	Bill Gertz, Washington Times Bradley Graham, Washington Post Northern Virginia Journal Rowan Scarborough, Washington Times	Brian Hartman, ABC News Jeff Seldin, WTOP News WTTG-TV
	Newspaper	
Sacramento, CA	J. Hulse, Santa Barbara News Press P. Dinsmore, Sacramento Bee R. Rodriguez, Sacramento Bee R. Rodriguez, Santa Barbara News Press Valerie Mercado, Lompoc Record	
	Newspaper	**Radio/Television**
Anchorage, AK	Alaska Journal of Commerce Anchorage Daily News Fairbanks Daily News-Miner Juneau Empire Kodiak Daily Mirror Valdez Star	APRN-Anchorage B. Miller, KTVF Channel 11 NBC KIMO Channel 13 ABC KTUU Channel 2 NBC KTVA Channel 11 CBS
	Newspaper	**Radio/Television**
Honolulu, HI	Garden Island Newspaper Honolulu Advertiser Steven Petranik, Honolulu Star Bulletin Tony Summer, Honolulu Star Bulletin	Brenda Salgado, 9 CBS (KGMB) Jon Shimabakura, News 8 NBC Mark Matsunaga, Fox 2 Michael Gaede, Fox 2 Wanda Wehr, News 4

Exhibit B-6. Example of Scoping Meeting Press Release

Missile Defense Agency to Hold Public Scoping Meeting

Arlington, Virginia – The Missile Defense Agency (MDA) is hosting a scoping meeting on Wednesday April 30th from 6-9 p.m. at the Doubletree Hotel in Arlington, VA. The scoping meeting is being held as part of preparation of a Programmatic Environmental Impact Statement (PEIS) on the Ballistic Missile Defense System.

This PEIS will assess environmental issues associated with the proposed action, foreseeable future actions, and their reasonable alternatives, including the no action alternative, and as appropriate, cumulative effects. This PEIS is being conducted in accordance with the National Environmental Policy Act of 1969 and the Council on Environmental Quality implementing regulations.

Public scoping meetings are conducted as part of the PEIS process to ensure opportunity for all interested government and private organizations, and the general public to identify issues of concern they believe should be addressed in the content of the PEIS.

This PEIS will support decisions to meet the fundamental objectives of the MDA's Mission to test, develop, transfer to deployment and to plan for decommissioning activities for a Ballistic Missile Defense System to defend the forces and territories of the United States, it's Allies, and friends against all classes of ballistic missile threats, in all phases of flight.

In addition to attending the meeting, the public may submit comments until June 12, 2003 using the following resources:

US Mail: MDA BMDS PEIS, c/o ICF Consulting 9300 Lee Highway Fairfax, VA 22301

Toll-free 1-877-851-5451 (please leave your name, address and comments)

Email: bmds.peis@mda.osd.mil

Website: http://www.acq.osd.mil/bmdo/peis/html/home.html

Media wishing to attend the meeting or having any further questions should contact Major Catherine Reardon, 703-697-8491; Mr. Chris Taylor, 703-697-8001 or Mr. Rick Lehner, 703-697-8997.

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Summary of Public Scoping Meetings

Exhibit B-7 provides a summary of attendees and comments provided at the public scoping meetings.

Exhibit B-7. Public Scoping Meeting Attendees and Comments Provided

City	Date	Number of Attendees	Number of Attendees Providing Oral Comments	Number of Attendees Providing Written Comments
Arlington, VA	April 30, 2003	15	0	0
Sacramento, CA	May 6, 2003	19	8	2
Anchorage, AK	May 8, 2003	19	4	5
Honolulu, HI	May 13, 2003	8	3	0

Approximately 14 protesters in Sacramento and 12 protesters in Anchorage gathered prior to and during the scoping meetings. Representatives from a television station and a radio station attended the Anchorage meeting and interviewed MDA representatives. One meeting participant in Honolulu videotaped the scoping meeting to be broadcast on local public television.

Regulator and Agency Outreach Efforts

While on travel for scoping meetings, MDA personnel provided informational briefings to various regulatory and agency officials. In Alaska, a briefing was given to officials within the Department of Environmental Conservation and to a member of the U.S. Army Corps of Engineers. In Hawaii, a briefing was given to an interagency environmental group created by the Space and Missile Defense Command, which meets quarterly to address relevant environmental issues in Hawaii. Attorneys with the U.S. Army Pacific and U.S. Army Alaska Staff Judge Advocate offices were briefed as well.

Summary of Scoping Comments

The MDA requested scoping comments be submitted by June 12, 2003 to be considered in developing the Draft BMDS PEIS. Following completion of scoping, the MDA categorized comments received according to content and analyzed the comments to determine issues of priority to the interested parties, level of detail to be included in the

Draft BMDS PEIS, sources of information to be used, and issues to be addressed and evaluated in the Draft BMDS PEIS.

During scoping, MDA received a total of 285 comments via e-mail (62 percent), toll-free fax (11 percent), the BMDS PEIS web site (three percent), mail (12 percent), toll-free phone line (five percent), and during the scoping meetings (oral - five percent and written - two percent). Approximately 84 percent of comments were from private citizens, less than four percent represented non-government organizations, less than one percent represented government agencies, and less than seven percent represented other groups including media and religious organizations. Approximately 21 percent of comments received appeared to be derived from NGO-provided templates or form letters.

The MDA identified key issues addressed in the scoping comments and sorted the comments based on these issue areas. The comments included issues both within and outside of the scope of the Draft BMDS PEIS. Types of issues considered "in scope" related to the resource areas analyzed in the Draft BMDS PEIS; feasible alternatives; laws and regulations; affected regions; specific hazards, such as perchlorate contamination and debris; and BMDS activities, such as decommissioning.

The majority of comments were considered to be outside the scope of the Draft BMDS PEIS. These comments were related to the opposition to the BMDS, especially with regard to the use of space as a weapons platform; concern that the program would bankrupt the economy and that Federal funds should be channeled to address socioeconomic problems, better health care and insurance coverage, and education; and concern that the BMDS would create an arms race, especially in space. Other key issues included opposition to development of nuclear weapons and concern that missile defense could be a first strike capability for U.S. worldwide military domination.

Exhibit B-8 summarizes the number of comments received from the public related to resource areas; human health and environmental impacts; alternatives; and Department of Defense (DoD) policy, budget, and program issues. Many comments received addressed multiple issues. Exhibit B-9 includes representative examples of the comments received for each topic. Inclusion of representative excerpts seeks to eliminate duplicative comments that were received on each topic.

Exhibit B-8. Issues Addressed in Scoping Comments

Type of Issue	Issue	Number of Comments
Resource Areas (In Scope)	Air Quality	7
	Airspace	2
	Biological Resources	12
	Cultural and Historical Resources	3
	Environmental Justice	1
	Geology and Soils	6
	Hazardous Materials and Hazardous Waste	18
	Health and Safety	27
	Land Use	9
	Noise	0
	Socioeconomics	6
	Transportation	0
	Utilities	4
	Visual Resources	0
	Water Resources	13
Other Issues (In Scope)	Perchlorate	14
	Debris	4
	Effects from testing or use of nuclear or radioactive materials	20
	Local/international laws	5
	Areas to be affected	6
	Alternatives	13
	Decommissioning	4
	Deployment	1
	Need to obtain input from scientists and technical experts	6
	General effects on environment	15
DoD Budget and Policy (Out of Scope)	Consideration of high cost of BMDS	145
	Less funding is available for other services	184
	BMDS destabilizes the world and increases the risk of an arms race	134
	BMDS decreases security	82
	BMDS benefits only corporations and GOP contributors	109
DoD Program (Out of Scope)	Opposition to BMDS	264
	Support for BMDS	4
	BMDS will not work	77

Exhibit B-8. Issues Addressed in Scoping Comments

Type of Issue	Issue	Number of Comments
	Opposition to nuclear weapons and weapons of mass destruction	76
	BMDS will lead to weaponization of space	108
	There is no threat to the U.S. and its allies	87
	BMDS does not address or raises the threat	51
	BMDS purpose is offensive, not defensive	79

Exhibit B-9. Scoping Comment Excerpts

Issue Area	Comment Number[1]	Comment Excerpt
Health and safety	E0179	The PEIS should give quantitative information on the reliabilities of the boosters to be used to launch targets for BMDS tests. I asked for this information in my comments on the 1994 BMD draft PEIS. The entire response in the 1994 BMD final PEIS (response 0047.014 on page 8-46) was "All boosters considered for use in BMD testing activities will have undergone rigorous reliability evaluation. Only highly reliable boosters will be used in order to protect the public and to ensure mission accomplishment." This response is inadequate for any meaningful assessment of the risks from launch failures.
Debris Health and safety	E0179	There are unresolved safety issues involving Strategic Target System and Terminal High Altitude Area Defense (THAAD) launches at PMRF. No detailed hazard areas have been shown for Strategic Target System launches at azimuths other than 280 degrees. Similarly, no diagrams showing the THAAD hazard area were given in the 2002 THAAD EA and no detailed analysis was cited to justify the reduction in the hazard area radius from 20,000 feet in the 1998 Pacific Missile Range Facility (PMRF) EIS to 10,000 feet in the THAAD EA.
Effects from testing/use of nuclear/radioactive materials	E0179	In addition to "hit-to-kill" interceptors and directed-energy weapons, there have been reports that interceptors armed with nuclear weapons are also being considered for missile defenses. The PEIS should indicate what research and development work is being planned for such weapons.
Local/international laws	E0179	The PEIS should examine in detail treaty compliance of various BMDS tests. In particular, the PEIS should examine INF Treaty restrictions on long-range air-launched targets. The PEIS should also examine Intermediate-Range Nuclear Forces (INF) and START Treaty restrictions on sea-launched targets. If compliance reviews have been done, references should be cited.

[1] The Comment Number column provides the number assigned to each scoping comment that was received. E = e-mail, F = fax, P = phone, M = mail, SMO = scoping meeting oral, SMW = scoping meeting written.

Exhibit B-9. Scoping Comment Excerpts

Issue Area	Comment Number[1]	Comment Excerpt
Air Geology and Soils Water Obtain input from scientists and technical experts	F0015 (M0029, M0030)[2]	If ballistic missile defense is coordinated with resumption of underground nuclear weapons testing, global fall-out, tectonic plates and geology are involved. Sea-based assets can obviously affect the ocean and air/space assets can affect the atmosphere. The complex questions involved here easily overwhelm any one particular professional group's expertise: thus, the more scientific input, the better.
Obtain input from scientists and technical experts	F0015 (M0029, M0030)	What more can be done to ensure meaningful response from leading scientific research in related fields and from the state Environmental Protection Agencies and other affected state agencies? At the very least, specialists in astrophysics, health physics, meteorology, climatology & atmospheric science, geology, soil science, limnology, oceanography, marine biology, medicine and psychology have vital but not all-inclusive expertise that should be part of the scoping process.
Effects from testing/use of nuclear or radioactive materials	F0015 (M0029, M0030)	The military has had discussion of nuclear-tipped interceptors: if a policy shift is planned from plain hit-to-kill technology to nuclear-tipped hits, will a new PEIS process be conducted? Nuclear-tipped BMDS increases potential for global fall-out. Indeed, radioactive fall-out from a terminal anti-ballistic missile (ABM) hitting an incoming nuclear missile can still pose grave consequences for the area presumed to be "protected" by the ABM.
Biological resources	F0015 (M0029, M0030)	Will the test platform in the Pacific Ocean involve use of sonar with its potential effects on marine mammal life? Will land-based assets involve extensive radar facilities in remote areas? Risks to endangered species have been raised as a concern at Vandenberg AFB as an example of environmental impact caused by facilities.

[2] The same comments were submitted via fax and mail (twice).

Exhibit B-9. Scoping Comment Excerpts

Issue Area	Comment Number[1]	Comment Excerpt
Hazardous Materials/Waste Health and Safety Perchlorate	F0015 (M0029, M0030)	What waste will be produced by the development, testing, deploying and decommissioning activities of BMDS and how will this waste be handled? Will any of this waste constitute hazardous materials? The answer is likely to be yes, given that perchlorate contamination results from rocket fuel. Perchlorate disrupts thyroid hormone function in humans and other animals.
Air	F0015 (M0029, M0030)	Directed energy missile defense systems sound like they involve lasers. What effects will use of such lasers during testing or actual activation have on the layers of our atmosphere, including ozone and green house gas effects? Will this have an effect on global warming? How will communication and weather satellites be affected by space-based platforms?
Perchlorate	F0021	▪ Perchlorate at site 8 at Vandenberg AFB. ▪ Perchlorate throughout the state of California, principally in the Colorado River where irrigation water laced with perchlorate has contaminated Imperial Valley. ▪ Vandenberg AFB uses ammonium perchlorate.
Health and Safety	F0021	▪ Perchlorate has been shown to cause fetal damage and serious harm to children as well as nursing mothers. ▪ Missile explosions happen and are dangerous which cause beach closures to keep the burning, toxic cinders from harming people and animals, yet harm is unavoidable.
Hazardous Materials/Waste Land Use	F0021	Aerospace corporations such as Boeing Rocketdyne and Boeing Delta Mariner should not be allowed to operate until all toxic emittants and water contaminants are removed. Boeing should not be allowed to sell its Santa Susana lab land until all contaminants are cleaned thoroughly.
Biological Resources	F0021	Sea life should not be 'taken', harassed, or tortured for missile defense and should be banned.
Land Use	F0021	Housing and agricultural land in Northern Santa Barbara and Southern San Luis Obispo should be thoroughly tested for rocket toxics immediately. No housing projects should be

Exhibit B-9. Scoping Comment Excerpts

Issue Area	Comment Number[1]	Comment Excerpt
		considered around Vandenberg AFB unless the land is thoroughly tested for toxics. This includes Providence Landing.
Socioeconomics	F0021	Fishing and recreational activities should not be suspended for missile defense.
Effects from testing/use of nuclear or radioactive materials	F0021	Vandenberg AFB should identify toxic depleted uranium from 1990 launches if they exist. No depleted uranium or other radioactive materials should be used in rocket launches.
Health and Safety	F0021	High energy chemical lasers are dangerous and should not be used for missile defense; not in tests as planned for 2004 at Vandenberg AFB, not in deployment.
Effects from testing/use of nuclear or radioactive materials	F0022	▪ Whether or not any low-yield nuclear material will be used in/on the BMDS experimental weapon systems, satellites, interceptors, target missiles, boosters, X-Band Radar (XBR) Systems, etc. ▪ If any low-yield nuclear material will be stored at Research Development Test Sites. If yes, list test site locations. ▪ If depleted uranium will be used in/on target missiles, interceptors, satellites, booster, etc.
Areas to be affected	F0022	▪ List the Research Development Test Sites where target missiles will be launched to be intercepted by the Airborne Laser. ▪ Poker Flats Rocket Range is listed as a Research, Development Test Site Location on the Intermediate Nuclear Forces Treaty Memorandum of Understanding list (INF Treaty MOU), as is the Kodiak Launch Complex, Kodiak, Alaska, but Poker Flats has been ignored in Environmental Assessments or Environmental Impact Statements in connection to a defense test site location. Include information on Poker Flats if it will play a part in the BMDS testing. Also explain the connection these two site locations

Exhibit B-9. Scoping Comment Excerpts

Issue Area	Comment Number[1]	Comment Excerpt
		have in relationship to the INF Treaty MOU. One could assume that nuclear material could be tested at these two locations (low-yield nuclear-tipped interceptor launches e.g.)
Health and Safety	F0022	▪ List any potential accidental or environmental hazards which could occur if the Airborne Laser misses its target. ▪ Include detailed information on how High-Powered Microwaves (Directed Energy) will be used as part of the BMDS and the environmental hazards associated with their transmission into the atmosphere and ionosphere (include human EMR hazards).
Health and Safety Hazardous Materials/Waste Land Use Water	F0022	The Pentagon is willing to use U.S. citizens as guinea pigs by jeopardizing the safety and health of the public living near the locations of the Research and Development Test Sites in order to test the new weapons systems, with no regard to environmental hazards from “exploding” missiles and hazardous missiles which will have a detrimental effect on the land, water, and environment which will be passed on to future generations.
Information Source	F0027	▪ Are the overall binary effects on the environment of all the components listed in the MTCR Report: July 1, 1993; ITEM 4 – Category 11: Propellants and constituent chemicals for propellants (3) available to the public for independent scientific peer review via FOIA or any other method? ▪ What effects do laser weapons and halogens, i.e., propellants and constituent chemicals for propellants listed in the MTCR report: July 1, 1993; ITEM 4 – Category 11 have on the environment? ▪ Perchlorate Found in Plants, Animals at Six Sites in U.S. in 2001.
Orbital Debris	F0027	In addition to existing rocket and jet fuel contamination, already lower orbital space is full of space trash such as a fork, tools, and thousands of pieces of junk which are a hazard to astronauts, spacecraft, and the space station.
Hazardous Materials/Waste	F0031 (M0035)	The Scope of the BMDS PEIS should consider impacts of hazardous waste and materials and on Health and safety, Land use, Water Resources, and Biological resources of

Exhibit B-9. Scoping Comment Excerpts

Issue Area	Comment Number[1]	Comment Excerpt
Health and Safety Land Use Water Biological Resources		environmental contamination from toxic and hazardous components of rocket fuels and explosives.
Perchlorate	F0031 (M0035)	Toxic environmental contamination from ammonium perchlorate and other toxic and hazardous ingredients in rocket fuels clearly need to be included in the scope of the BMDS PEIS.
Perchlorate Information Sources	F0031 (M0035)	▪ Ammonium Perchlorate is well characterized as a thyroid hormone disruptor (http://www.ewg.org/reports/rocketscience/chap3.html). At high enough concentrations, perchlorate can affect thyroid gland functions, where it is mistakenly taken up in place of iodine. ▪ While most contaminated samples are in the 4 to 20 ppb levels, surveys of California water sources show several sites with perchlorate levels from 4 to 820 ppb. (http://www.ewg.org/reports/rocketwater/table1.php) ▪ The Missile Technology Control Regime (http://www.fas.org/asmp/campaigns/missiles/techannex.htm) lists several additional chemicals used as fuels or propulsive substances
Health and Safety Land Use Water Biological Resources	F0031 (M0035)	What is the composition of each rocket fuel, the toxicity of each individual component and the combined mixtures and what are the effects on Health and safety, Land Use, Water Resources and Biological resources? What are the exposures following storage, testing and use of such missile defense systems?
Decommissioning	F0031 (M0035)	Finally, how will these chemicals and mixtures be disposed at decommissioning and what are the effects on Health and Safety, Land use, Water resources, Biological resources?

Exhibit B-9. Scoping Comment Excerpts

Issue Area	Comment Number[1]	Comment Excerpt
Health and Safety	F0031 (M0035)	The scope of the BMDS PEIS should consider impacts on Health and Safety.
Effects from testing or use of nuclear or radioactive materials	F0031 (M0035)	▪ The Scope of the BMDS PEIS should consider Health and Safety with regards to the issues of nuclear fallout and resulting radioactive contamination leading to morbidity and mortality. ▪ The scope of the BMDS PEIS should consider environmental effects of the potential use of nuclear tipped interceptors or systems components on health and safety.
Utilities Health and Safety	F0031 (M0035)	The scope of the BMDS PEIS needs to consider effects on utilities, health and safety resulting from destruction of electrical circuits, civilian computers, medical equipment, utilities, etc. from ElectroMagnetic Pulses (EMP) generated by high altitude nuclear detonations. This definitely needs to be considered in the scope of the BMDS if any BMDS "advanced system" will use nuclear detonations.
Biological Resources Health and Safety	F0031 (M0035)	The scope of the BMDS PEIS needs to consider if high powered land, sea, air or spaced based BMDS lasers will endanger the health and safety of wildlife and humans.
Local/International Laws Alternatives	F0031 (M0035)	The scope of the BMDS PEIS needs to consider alternatives to the BMDS including restoring and enhancing arms control and nuclear disarmament treaties, and the US acting as a leader in disarmament rather than hyper-armament.
Alternatives	F0031 (M0035)	▪ Alternative 4: Preserving Space for non-military purposes. ▪ Alternative 5: Deployment of a much more limited land and or sea based BMDS that would offer protection from specific rogue nations on the US homeland.
Obtain input from scientist and technical experts	F0031 (M0035)	The following Non-Governmental Organizations should be considered as sources of information that should be considered on the direct, indirect, and cumulative environmental effects of the proposed land, sea, air, and spaced based BMDS along with interacting with US offensive first strike weapon systems: Global Network against Weapons and Nuclear Power in Space, Federation of American Scientists Military Space

Exhibit B-9. Scoping Comment Excerpts

Issue Area	Comment Number[1]	Comment Excerpt
		Page, Western States Legal Foundation, Union of Concerned Scientists, Physicians for Social Responsibility.
Biological Resources	F0031 (M0035)	The scope of the BMDS PEIS needs to consider effects on Biological Resources, including endangered species. Also will the BMDS be exempted from protection of threatened and endangered species as President Bush has requested for essentially all military facilities? How many endangered species will be lost, i.e., become extinct?
Hazardous Materials/Waste	M0027	There are still massive amounts of contamination left in the environment at military installations.
Health and Safety	M0027	The shift of resources away from cleanup and toward buildup means that the burden of military contaminants on human health and the environment will be growing rather than diminishing.
Perchlorate	M0027	Specific contaminants of concern include: perchlorates, PCBs, and petroleum products, among others.
Socioeconomics	M0027	The socioeconomic impact of decommissioning. The world is already littered with U.S. military waste. There are hundreds of facilities that were supposed to have been decommissioned, and yet are still there.
Air Quality Biological Resources Cultural and Historic Resources Geology and Soils Land Use Water Socioeconomics	M0027	The potential environmental impact of the facilities in Alaska, including: impacts from construction; possible impacts from rocket explosions in Alaska; impacts to air quality, water resources, wildlife, and of course impacts to Native people and subsistence uses of the environment.

Exhibit B-9. Scoping Comment Excerpts

Issue Area	Comment Number[1]	Comment Excerpt
Areas to be affected	M0027	Impacts to the community of Greely, which is already overwhelmed by the influx of commerce and construction workers to the area, and which lacks adequate health care and infrastructure to handle the growth.

B.2 Public Comment Period

The Notice of Availability of the Draft PEIS was published in the FR by the Environmental Protection Agency (EPA) on September 17, 2004. The NOA announced the availability of the Draft PEIS, initiated the public comment period for the NEPA process, and requested comments on the Draft PEIS. The MDA also published a NOA in the FR on September 17, 2004, which provided information on the proposed action and alternatives, listed the dates and locations of the public hearings, and provided contact information for submitting comments to the MDA. The NOA is shown in Exhibit B-10.

Exhibit B-10. Notice of Availability for the Draft BMDS PEIS

Furthermore, section 704(i)(1)(C) of the Act stipulates that the Department shall issue a countervailing duty order under section 706(a) of the Act effective with respect to entries of merchandise the liquidation of which was suspended, if the underlying investigation was completed. Finally, section 704(i)(1)(E) of the Act stipulates that the Department shall notify the petitioner, interested parties to the investigation, and the ITC of termination of the Agreement.

The GOB's request for termination of the Agreement is effective September 26, 2004. Because the GOB is withdrawing from the Agreement, the Department finds that suspension of the underlying investigation will no longer be in the public interest as of that date (*see* section 704(d)(1) of the Act). Therefore, the Department will direct U.S. Customs and Border Protection ("CBP") to suspend liquidation of all entries of hot-rolled flat-rolled carbon-quality steel products from Brazil effective September 26, 2004. Accordingly, pursuant to section 704(i)(1)(C) of the Act, the Department hereby issues a countervailing duty order effective September 26, 2004, which is 60 days from the official filing date of the termination request of the GOB.

Countervailing Duty Order

In accordance with section 706(a)(1) of the Act, the Department will direct CBP to assess, beginning on September 26, 2004, a countervailing duty equal to the amount of the net countervailable subsidy determined or estimated to exist.

We will instruct CBP to require a cash deposit for each entry equal to the countervailing duty ad valorem rates found in the Department's *Final Determination* of July 19, 1999, as listed below. These suspension-of-liquidation instructions will remain in effect until further notice. The "All Others Rate" applies to all producers and exporters of subject merchandise not specifically listed. The final countervailing duty ad valorem rates are as follows:

Manufacturer/exporter	Margin (percent)
Companhia Siderurgica Nacional ("CSN")	6.35
Usinas Siderurgicas de Minas Gerais, S.A ("USIMINAS")	9.67
Companhi Siderurgic Paulista ("COSIPA")	9.67
All others	7.81

This notice constitutes the countervailing duty order with respect to hot-rolled flat-rolled carbon-quality steel products from Brazil. Interested parties may contact the Department's Central Records Unit, room B–099 of the main Commerce building, for copies of an updated list of countervailing duty orders currently in effect. This notice is published in accordance with sections 704(i) and 777(i) of the Act. This order is published in accordance with section 706(a) of the Act.

Dated: September 13, 2004.

James J. Jochum,

Assistant Secretary for Import Administration.

[FR Doc. E4–2231 Filed 9–16–04; 8:45 am]

BILLING CODE 3510–DS–P

DEPARTMENT OF DEFENSE

Office of the Secretary

Notice of Availability of the Ballistic Missile Defense System Draft Programmatic Environmental Impact Statement

AGENCY: Missile Defense Agency, Department of Defense.

ACTION: Notice of availability and request for comment.

SUMMARY: In accordance with National Environmental Policy Act (NEPA) regulations, the Missile Defense Agency (MDA) is initiating a public review and comment period for a Draft Programmatic Environmental Impact Statement (PEIS). This notice announces the availability of the Ballistic Missile Defense System (BMDS) Draft PEIS, which analyzes the potential impacts to the environment as MDA proposes to develop, test, deploy, and plan for decommissioning activities to implement an integrated MDBS. This Draft PEIS addresses the integrated BMDS and the development and application of new technologies; evaluates the range of complex programs, architecture, and assets that comprise the BMDS; and provides the framework for future environmental analyses as activities evolve and mature. The Draft PEIS has been prepared in accordance with NEPA, as amended (42 U.S.C. 4321, *et seq.*), and the Council on Environmental Quality Regulations for implementing the procedural provisions of NEPA (40 CFR parts 1500–1508).

DATES: The public comment period for the NEPA process begins with the publication of this notice and request for comments in the Federal Register. Public hearings will be conducted as a part of the PEIS development process to ensure opportunity for all interested government and private organizations and the general public to provide comments on the environmental areas considered in the Draft PEIS. Schedule and location for the public hearings are:

- October 14, 2004, 6:30 p.m., Marriott Crystal City, 1999 Jefferson Davis Highway, Arlington, VA.
- October 19, 2994, 6 p.m., Sheraton Grand Hotel, 1230 J. St., Sacramento, CA.
- October 21, 2004, 6:30 p.m., Sheraton Hotel, 401 E. 6th Ave., Anchorage, AK.
- October 26, 2004, 6 p.m., Best Western Hotel, 3253 N. Nimitz Hwy, Honolulu, HI.

Copies of the Draft PEIS will be made available for review at various libraries. A list of library locations and a downloadable electronic version of the Draft PEIS are available on the MDA public access Internet Web site: *http://www.acq.osd.mil/mda/peis/html/home.html.* To ensure all comments are addressed in the Final PEIS, comments should be received at one of the addressed listed below no later than November 17, 2004.

ADDRESSES: Written and oral comments regarding the Draft PEIS should be directed to MDA BMDS PEIS, c/o ICF Consulting, 9300 Lee Highway, Fairfax, VA 22031, phone (Toll-Free) 1–877–MDA–PEIS (1–877–632–7347), Fax (Toll-Free) 1–877–851–5451, e-mail *mda.bmds.peis@icfconsulting.com,* or Web site *http://www.acq.osd.mil/mda/peis/html/home.html.*

FOR FURTHER INFORMATION CONTACT: Please call Mr. Rick Lehner, MDA Director of Communications at (703) 697–8997.

SUPPLEMENTARY INFORMATION: The MDA has a requirement to develop, test, deploy, and prepare for decommissioning the BMDS to protect the United States (U.S.), its deployed forces, friends, and allies from ballistic missile threats. The proposed action would provide an integrated BMDS using existing infrastructure and capabilities, when feasible, as well as emerging and new technologies, to meet current and evolving threats in support of the MDA's mission. Conceptually, the BMDS would be a layered system of weapons, sensors, Command and Control, Battle Management, and Communications (C2BMC), and support assets; each with specific functional capabilities, working together to defend against all classes and ranges of threat ballistic missiles in all phases of flight. Multiple defensive weapons would be used to create a layered defense comprised of multiple intercept opportunities along the incoming threat missile's trajectory. This would provide a layered defense system of capabilities designed to back up one another.

This Draft PEIS considers two alternative approaches for implementing the integrated BMDS. In Alternative 1, the MDA would develop, test, deploy, and plan to decommission land-, sea-, and air-based platforms for BMDS weapons components and related architecture and assets. The BMDS envisioned in Alternative 1 would include space-based sensors but would not include space-based weapons. In Alternative 2, the MDA would develop, test, deploy, and plan to decommission land-, sea-, air-, and space-based platforms for weapons and related architecture and assets. Alternative 2 would be identical to Alternative 1, with the addition of space-based defensive weapons.

Under the No Action Alternative, the MDA would not test, develop, deploy, or plan for decommissioning activities to implement an integrated BMDS. Instead, the MDA would continue existing test and development of discrete missile defensive systems as stand-alone defensive capabilities. Under the No Action Alternative, individual components would continue to be tested to determine the adequacy of their stand-alone capabilities, but would not be subjected to integrated system-wide tests. In addition, the C2BMC architecture would be designed around the needs of individual components and would not be designed to manage an integrated system.

The approach and methods for deployment and decommissioning of components under the No Action Alternative would be the same as under the proposed action. This alternative would not meet the purpose of or need for the proposed action or the specific direction of the President and the U.S. Congress to defend the U.S. against ballistic missile attack.

Potential impacts of Alternative 1 and Alternative 2 were analyzed in the Draft PEIS, including impacts to air quality, airspace, biological resources, geology and soils, hazardous materials and waste, health and safety, noise, transportation, orbital debris, and water resources. The impacts of the No Action Alternative would be the same as the impacts of developing and testing individual components, which would continue to comply with NEPA analyses and documentation requirements on a program-specific basis. Potential cumulative impacts of the proposed action are also addressed in the Draft PEIS.

Dated: September 10, 2004.

L.M. Bynum,

Alternate OSD Federal Register Liaison Officer, Department of Defense.

[FR Doc. 04–20813 Filed 9–16–04; 8:45 am]

BILLING CODE 5001–06–M

DEPARTMENT OF DEFENSE

Department of the Army

Department of Defense Historical Advisory Committee; Meeting

AGENCY: Department of the Army, DoD.

ACTION: Notice of open meeting.

SUMMARY: In accordance with section 10(a)(2) of the Federal Advisory Committee Act (Pub. L. 92–463), announcement is made of the following committee meeting:

Name of Committee: Department of Defense Historical Advisory Committee.

Date: October 28, 2004.

Time: 9 a.m. to 4:30 p.m.

Place: U.S. Army Center for Military History, Collins Hall, Building 35, 103 Third Avenue, Fort McNair, DC 20319–5058.

Proposed Agenda: Review and discussion of the status of historical activities in the United States Army.

FOR FURTHER INFORMATION CONTACT: Dr. Jeffrey J. Clarke, U.S. Army Center of Military History, ATTN: DAMH–ZC, 103 Third Avenue, Fort McNair, DC 20319–5058; telephone number (202) 685–2709.

SUPPLEMENTARY INFORMATION: The committee will review the Army's historical activities for FY 2004 and those projected for FY 2005 based upon reports and manuscripts received throughout the period. And the committee will formulate recommendations through the Chief of Military History to the Chief of Staff, Army, and the Secretary of the Army for advancing the use of history in the U.S. Army.

The meeting of the advisory committee is open to the public. Because of the restricted meeting space, however, attendance may be limited to those persons who have notified the Advisory Committee Management Office in writing at least five days prior to the meeting of their intention to attend the October 28, 2004 meeting.

Any members of the public may file a written statement with the committee before, during, or after the meeting. To the extent that time permits, the committee chairman may allow public presentations or oral statements at the meeting.

Dated: August 19, 2004.

Jeffrey J. Clarke,

Chief Historian.

[FR Doc. 04–20956 Filed 9–16–04; 8:45 am]

BILLING CODE 3710–08–M

DEPARTMENT OF DEFENSE

Department of the Army

Availability of Non-Exclusive, Exclusive License or Partially Exclusive Licensing of U.S. Patent Concerning Collapsible and Portable Work Station

AGENCY: Department of the Army, DoD.

ACTION: Notice.

SUMMARY: In accordance with 37 CFR part 404.6, announcement is made of the availability for licensing of U.S. Patent No. US 6,776,105 B2 entitled "Collapsible and Portable Work Station" issued August 17, 2004. This patent has been assigned to the United States Government as represented by the Secretary of the Army.

FOR FURTHER INFORMATION CONTACT: Mr. Robert Rosenkrans at U.S. Army Soldier Systems Center, Kansas Street, Natick, MA 01760, Phone: (508) 233–4928 or E-mail: *Robert.Rosenkrans@natick.army.mil.*

SUPPLEMENTARY INFORMATION: Any licenses granted shall comply with 35 U.S.C. 209 and 37 CFR part 404.

Brenda S. Bowen,

Army Federal Reserve Liaison Officer.

[FR Doc. 04–20957 Filed 9–16–04; 8:45 am]

BILLING CODE 3710–08–M

DEPARTMENT OF DEFENSE

Department of the Army

Availability of Non-Exclusive, Exclusive License or Partially Exclusive Licensing of U.S. Patent Concerning Method for Making a Disposable Package for an Agent Activatable Substance and a Package Made Thereby

AGENCY: Department of the Army, DoD.

ACTION: Notice.

SUMMARY: In accordance with 37 CFR part 404.6, announcement is made of the availability for licensing of U.S. Patent No. US 6,766,797 B1 entitled "Method for Making a Disposable Package for an Agent Activatable Substance and a Package Made Thereby" issued July 27, 2004. This patent has been assigned to the United

A downloadable version of the Draft BMDS PEIS was available on the BMDS PEIS public information web site. The web site also provided information on the Draft BMDS PEIS, the NEPA process, contact information for submitting comments on the Draft PEIS, and links to documents incorporated by reference in the Draft PEIS.

The MDA established a toll-free phone line, toll-free fax, e-mail address, and mailbox for submittal of public comments and questions. In addition, the BMDS PEIS web site provided an electronic comment form for individuals to submit comments. The MDA also held four public hearings to solicit comments on the Draft BMDS PEIS. The public hearings were held in Arlington, Virginia, October 14, 2004; Sacramento, California, October 19, 2004; Anchorage, Alaska, October 21, 2004; Honolulu, Hawaii, October 26, 2004. The public hearings consisted of information poster sessions; formal presentations by MDA officials on the Draft BMDS PEIS; and a formal public comment session. A court reporter was present at each public hearing to document the proceedings and record public comments for the administrative record. Transcripts from each public hearing are included at the end of this appendix.

In addition to announcing the public hearing in the NOA, the MDA placed paid legal notices in local and regional publications. Exhibit B-11 summarizes the publications in which the public hearings were advertised, including publication dates.

Exhibit B-11. Local and Regional Publications and Dates for Public Hearing Announcements

Public Hearing Notification	Newspaper	Publication Date(s)
Arlington, VA	Journal Newspapers: Alexandria County, VA; Arlington Country, VA; Fairfax County, VA; Montgomery County, MD; Prince George's County, MD; Prince William County, VA	October 7, 2004 October 8, 2004
	Washington Times	October 11, 2004 October 12, 2004
Sacramento, CA	Sacramento Bee	October 13, 2004 October 16, 2004
	Lompoc Record	October 13, 2004 October 14, 2004 October 15, 2004
Anchorage, AK	Anchorage Daily News	October 13, 2004 October 16, 2004

Exhibit B-11. Local and Regional Publications and Dates for Public Hearing Announcements

Public Hearing Notification	Newspaper	Publication Date(s)
	Kodiak Daily Mirror	October 13, 2004 October 15, 2004
	Fairbanks Daily News Miner	October 13, 2004 October 16, 2004
Honolulu, HI	Honolulu Star-Bulletin	October 18, 2004 October 19, 2004
	Honolulu Advertiser	October 16, 2004 October 19, 2004
	Garden Island Newspaper, Kauai, HI	October 18, 2004 October 19, 2004
	The Environmental Notice (Office of Environmental Quality Control)	October 8, 2004

Release of the Draft PEIS Notification Letter

The MDA sent letters and a copy of the NOA to state governors, mayors, and members of Congress indicating the MDA's release of the Draft BMDS PEIS and dates of the public hearings. A copy of the Draft PEIS notification letter is shown in Exhibit B-12.

Exhibit B-12. Draft BMDS PEIS Notification Letter

DEPARTMENT OF DEFENSE
MISSILE DEFENSE AGENCY
7100 DEFENSE PENTAGON
WASHINGTON, DC 20301-7100

SEP 6 [illegible]

The Honorable John Warner
Chairman
Committee on Armed Services
United States Senate
Washington, DC 20510

Dear Mr. Chairman:

For many years the plan for our nation's missile defense systems was to develop, test, and deploy them as separate weapons systems. As stewards of our environmental resources, the Military Services and Federal Agencies such as the Strategic Defense Initiative Organization and the Ballistic Missile Defense Organization successfully completed dozens of environmental analyses to assess and mitigate the potential environmental impacts of these individual systems and to inform the public regarding those potential impacts, as required by the National Environmental Policy Act (NEPA). In January 2002, the Department of Defense created the Missile Defense Agency (MDA) to establish and carry out a single program of research and development work to develop an integrated Ballistic Missile Defense System (BMDS). Since that time, MDA has been and will continue to be a strong steward of our global environment and has completed numerous environmental analyses that have provided extensive details of potential environmental impacts as well as measures to mitigate any impacts which could be associated with BMDS elements' activities.

The MDA's primary mission is to plan and execute an evolutionary, capability-based acquisition approach to develop and deploy missile defense capabilities as soon as possible. Based on this evolutionary approach and following the spirit of the NEPA, MDA developed a Draft Programmatic Environmental Impact Statement (PEIS) to address the potential environmental effects associated with the development, testing, deployment, and planning for decommissioning of the BMDS. The BMDS would use existing infrastructure and capabilities, when feasible, to reduce costs and environmental impacts and to meet current and evolving threats from ballistic missiles. The Draft PEIS provides an overarching and comprehensive NEPA analysis of MDA's ongoing and planned activities and addresses the MDA requirement to develop and field an integrated BMDS capable of providing a layered defense for the United States, its deployed forces, friends, and allies from ballistic missile threats of all ranges in all phases of flight.

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The MDA plans to release the Draft PEIS for public review and comment later this month and will also hold public hearings in October 2004 to solicit public comment in accordance with the NEPA public involvement process. The enclosed Notice of Availability provides the dates and locations of the public hearings.

Please contact Ms. Pamelia Bain, MDA Director of Legislative Affairs, at (703) 695-8520, if you have questions regarding this matter. The document can be downloaded from MDA's web site at www.acq.osd.mil/mda/peis/html/home.html or obtained on CD-ROM by contacting Ms. Bain.

Sincerely,

HENRY A. OBERING III
Lieutenant General, USAF
Director

Enclosure:
As stated

cc:
The Honorable Carl Levin
Ranking Member

The MDA distributed CD-ROMs containing an electronic copy of the two-volume Draft BMDS PEIS to members of the public requesting a copy. A complete list of the Draft BMDS PEIS Distribution list is available in Section 7.0.

Comments Received on the Draft PEIS

The MDA received approximately 8,500 comments on the Draft PEIS during the public comment period. Summaries of comments and responses to comments are provided in Appendix K.

Public Hearing Transcripts

Exhibits B-13 through B-16 contain the transcripts from the four public hearings the MDA held on the Draft BMDS PEIS.

Exhibit B-13. Arlington, Virginia Public Hearing Transcripts

U.S. DEPARTMENT OF DEFENSE

MISSILE DEFENSE AGENCY

* * *

PUBLIC HEARING ON

DRAFT BALLISTIC MISSILE DEFENSE SYSTEM

PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT

* * *

Thursday, October 14, 2004

7:00 p.m.

Potomac Ballroom
Crystal City Marriott
1999 Jefferson Davis Highway
Arlington, Virginia

I N D E X

P R O C E E D I N G S

MR. DUKE: I'd like to go ahead and get started. I'd like to welcome you all to tonight's meeting. This public hearing is for the Missile Defense Agency's Ballistic Missile Defense System Draft Programmatic Environmental Impact Statement.

This public hearing is being held in accordance with the National Environmental Policy Act, or NEPA. My name is Marty Duke and I am the Missile Defense Agency's Program Manager for the development of the Programmatic Environmental Impact Statement.

I would like to introduce Colonel Mark Graham, who is from the Missile Defense Agency's Office of General Counsel. Colonel Graham will talk about the Programmatic Environmental Impact Statement, the NEPA process, and the BMDS capabilities and components. Also, I would like to introduce Peter Bonner and Deb Shaver, who are with ICF Consulting. Ms. Shaver is the ICF Consulting Program Manager and technical lead for the PEIS, and Mr. Bonner will facilitate tonight's meeting.

Again, I would like to thank you all for coming out tonight, and now, I'd like to turn the meeting over to Peter, who will go over tonight's meeting agenda and discuss some of the administrative points on how to provide public comments.

Thank you.

MR. BONNER: Good evening. I would also like to welcome you all to tonight's session. First, let's dispense with a few tongue twisters. We can't be in D.C. without some acronyms to start.

During this evening, as we move through the presentation, we will refer to the Missile Defense Agency as MDA. As we review it, we'll look at the Ballistic Missile Defense System--I've got to get it out myself here--which we'll refer to as BMDS, and the Programmatic Environmental Impact Statement as PEIS.

At this hearing we will discuss the development of MDA's Draft BMDS PEIS. After that, we will discuss the proposed action, which is the implementation of an integrated BMDS. The activities involved in implementing the BMDS have been analyzed for their potential environmental impact.

Finally, we will provide a forum to collect public comments on the Draft PEIS. It is our goal to have an open and informative public process.

Let's talk about the agenda for this evening. To ensure MDA has sufficient time to receive oral comments this evening, we will spend the next 30 to 40 minutes presenting information about the BMDS, the NEPA process and our analysis in producing the draft PEIS. The presentation will discuss the following: What is a programmatic EIS? What is the BMDS? How were potential impacts analyzed in the BMDS PEIS? And how does one submit public comments for the draft PEIS? What are the results of the analysis?

After the presentation, we'll have a 15-minute break when any of you who want to make public comments will have an opportunity to go back and sign up for those. I see some of you have already done that at the registration table. After the break, each speaker will be called in the order they signed up to come up and make their statements. Following the public statements MDA representatives will be available in the poster area to answer questions and have discussions. Note that questions and discussions back in the poster area during that 15-minute break or after the session will not be recorded for public comment. All the questions can be formally submitted to MDA through one of the other available methods.

The most important aspect of tonight's meeting is your public comments, and we want to hear from you.

All public statements provided tonight will be recorded for a transcript. Remember that the Programmatic EIS is just a draft document. This is your opportunity to provide comments on that document before it is finalized and before a final decision is made.

We are here to listen firsthand to your suggestions and concerns. Please limit your comments to five minutes to give everyone an opportunity to speak. I don't think we're going to have a big problem with that this evening.

The purpose of this meeting is to gather your comments. We will attempt to answer your questions clarifying the points we make in the presentation tonight. Substantive questions recorded tonight will be carefully considered in the preparation of the Final PEIS.

If you wish to provide written comments, forms are available at the registration table. You may leave written comments with us at the registration table or you can mail them to us. You can email them. The email system is temporarily unavailable right now, or you can fax them to MDA using the information provided. To allow time to consider and respond to comments in the Final PEIS, all comments must be received no later than November 17.

Colonel Graham will now discuss the BMDS PEIS and the NEPA process. Colonel Graham?

COLONEL GRAHAM: Thank you, Peter.

Good evening. NEPA Analysis NEPA establishes our broad national framework for protecting the environment. NEPA requires Federal agencies to consider the environmental impacts of their proposed actions and reasonable alternatives to those actions early in the decision-making process. The NEPA process is intended to help public officials make decisions based on understanding environmental consequences and take actions that protect, restore, and enhance the environment.

In the past, the national approach to missile defense focused on the development of individual missile defense elements or programs, such as Patriot, the Airborne Laser, and ground-based interceptors. These actions were appropriately addressed in separate NEPA analyses that MDA, its predecessor agencies, and executing agents prepared for these systems.

The aim of missile defense has been refocused by the Secretary of Defense to develop an integrated Ballistic Missile Defense System that would be a layered system of components working together capable of defending against all classes and ranges of threat ballistic missiles in all phases of flight.

Because the integrated Ballistic Missile Defense System is a large program made up of many projects implemented over time on a worldwide basis, MDA has determined that a programmatic NEPA analysis would be appropriate. Therefore, the MDA has prepared a Programmatic EIS to analyze the environmental impacts of implementing the proposed program.

A Programmatic EIS, or a PEIS, analyzes the broad envelope of environmental consequences in a wide-ranging Federal program like the Ballistic Missile Defense System. A PEIS looks at the overall issues in a proposed program and considers related actions together to review the program comprehensively. A PEIS is appropriate for projects that are broad in scope, are implemented in phases, and are widely dispersed geographically.

A PEIS creates a comprehensive, global analytical framework that supports subsequent analysis of specific activities at specific locations, which could then be tiered from the PEIS. The Programmatic EIS is intended to serve as a tiering document for subsequent specific Ballistic Missile Defense System analyses and includes a road map for considering impacts and resources areas in developing future documents.

This road map identifies how a specific resource area can be analyzed and also includes thresholds for considering the significance of environmental impacts to specific resource areas. This means that ranges, installations, and facilities at which specific program activities may occur in the future could tier their documents from the PEIS and have some reference point from which to start their site-specific analysis.

The Ballistic Missile Defense System Programmatic EIS analyzes the potential environmental impacts of developing, testing, deploying, and planning for decommissioning for the proposed program. The Programmatic EIS evaluates proposed Ballistic Missile Defense System technology, components, assets, and programs and considers future development and application of new technologies.

The proposed action considered in the BMDS Programmatic EIS is for the MDA to develop, test, deploy, and to plan for decommissioning activities for an integrated Ballistic Missile Defense System using existing infrastructure and capabilities, when feasible, as well as emerging and new technologies, to meet current and evolving threats.

When feasible, the MDA would use existing infrastructure to implement the BMDS and would incorporate new technologies and capabilities as they become available. This would ensure that the program could provide defense for both current and future ballistic missile threats.

The purpose of the proposed action is to incrementally develop and deploy a Ballistic Missile Defense System, the performance of which can be improved over time, and that layers defenses to intercept ballistic missiles of all ranges in all phases of flight. The proposed action is needed to protect the United States, its deployed forces, friends, and allies from threat ballistic missile [sic].

In this Programmatic EIS, the MDA considers two alternative approaches to implementing the BMDS system in addition to the No Action Alternative. The alternative approaches address the use of weapons components from land-, sea-, air-, and space-based platforms.

Alternative One is to develop, test, deploy, and plan to decommission an integrated Ballistic Missile Defense System that includes land-, sea-, and air-based weapons platforms. The BMDS envisioned in Alternative One would include space-based sensors, but would not include space-based defensive weapons.

Alternative Two is to develop, test, deploy, and plan to decommission an integrated Ballistic Missile Defense System that includes land-, air-, sea-, and space-based weapons platforms. Alternative Two would be identical to Alternative 1, with the addition of space-based defensive weapons.

The Council on Environmental Quality regulations implementing NEPA also require the consideration of the No Action Alternative. Under the No Action Alternative, the MDA would not develop, test, deploy or plan for decommissioning activities for an integrated Ballistic Missile Defense System. Please note that under the No Action Alternative, MDA would continue existing development and testing of individual elements as stand-alone defensive capabilities. Individual systems would continue to be tested but would not be subjected to system integration tests.

Alternatives One and Two provide different weapons platforms options for implementing an integrated Ballistic Missile Defense System, while the No Action Alternative continues the traditional approach of developing individual missile defense elements, such as the Airborne Laser, Patriot, and ground-based interceptors.

I will now discuss how MDA categorized the Ballistic Missile Defense System into relevant components and life cycle activities that could be considered to provide the programmatic overview of the environmental impacts of implementing the proposed action.

MDA's goal in developing an integrated Ballistic Missile Defense System is to develop an integrated system that will provide a layered defense. The Ballistic Missile Defense System would be capable of destroying threat ballistic missiles in the boost, mid-course, and terminal phases of flight and would defend against short, medium, intermediate and long-range threat ballistic missiles.

Finally, the Ballistic Missile Defense System would integrate sensors and weapons through a command control, battle management, and communications network, which we call C2BMC. With this capability, the integrated Ballistic Missile Defense System would establish a defense against the threat of ballistic missiles.

The BMDS is a complex system of systems. To be able to perform a meaningful impact analysis, we considered the Ballistic Missile Defense System in terms of its components: weapons, sensors, C2BMC, and support assets. These components are the building blocks that can be assembled with specific functional capabilities and can be operated together or independently to defeat threat ballistic missiles.

Testing was considered for each component; however, the integrated Ballistic Missile Defense System needs to be tested at the system level and was analyzed separately using realistic system integration flight test scenarios. Let's look at each of these components.

Weapons: the Ballistic Missile Defense System weapons would provide defense against threat ballistic missiles. They include interceptors and directed energy weapons in the form of high-energy lasers that would be used to negate threat missiles. Interceptors would use hit-to-kill technology, either through direct impact or directed fragmentation. The Ballistic Missile Defense System weapons are designed to intercept threat ballistic missiles in one or more phases of flight and could be activated from land, sea-, air-, or space-based platforms.

The Ballistic Missile Defense System sensors would provide the relevant tracking data for threat ballistic missiles. Sensors detect and track threat missiles; and assess whether a threat has been destroyed. Sensors provide the information needed to locate and track a threat missile to support coordinated and effective decision-making against the threat.

There are four basic categories of sensors considered for the Ballistic Missile Defense System: we have radars, infrared, optical, and laser sensors. Radars send a signal out and detect the same signal as it bounces off an object. Infrared sensors are passive sensors that detect and track heat or infrared radiation from an object. Optical sensors are passive sensors, too, that collect light energy or radiation emitted from an object, and laser sensors use laser energy to illuminate and detect the object's motion.

Radars and lasers emit radiation while infrared and optical sensors detect radiation that has been emitted. The Ballistic Missile Defense System sensors would operate from multiple platforms, such as land, sea, air, or space.

The data collected by the Ballistic Missile Defense System sensors would travel through the communication system to command and control where a battle management decision on whether to use a defensive weapon would be made. The C2BMC would integrate and coordinate equipment and operators through command and control and integrated fire control centers. C2BMC would enable military commanders to receive and process information, make decisions, and communicate those decisions regarding the engagement of threat missiles.

The C2BMC would include fiber optic cable, computer terminals, and antennas and would operate from land-, sea-, air-, and space-based platforms.

Our last category of components is support assets. Support assets would be used to facilitate development, testing, and deployment of Ballistic Missile Defense System components. Support assets are one of three types: support equipment, infrastructure, or test assets. Support equipment includes general transportation and portable equipment such as automobiles, ships, aircraft, rail, and generators. Infrastructure includes docks, shipyards, launch facilities, airports and air stations. Test assets include test range facilities, targets, countermeasure devices, simulants, and observation vehicles.

Now that we've discussed the components, Mr. Marty Duke will describe how they can be integrated into the Ballistic Missile Defense System.

MR. DUKE: This slide depicts the integration of the various components of the proposed BMDS we have just discussed. The use of multiple defensive weapons and sensors operating from a variety of platforms integrated through a single C2BMC system would create a layered defense allowing several opportunities to intercept and destroy threat missiles.

For example, one weapon could engage a threat missile in its boost phase, and another could be used to intercept the threat missile in later phases if initial intercept attempts were unsuccessful.

Components are incorporated into the BMDS through the life cycle phases of the system acquisition process. These life cycle phases are development, testing, deployment, and decommissioning. New components would undergo initial development testing, while existing components would be tested to determine their readiness for use. Work on a given technology would stop if testing failed to demonstrate effectiveness or if functional capability needs changed.

Components and elements would be deployed as testing demonstrates that they are sufficiently capable of defending against threat ballistic missiles. In most cases, a component would be deployed when testing demonstrates that it is capable of operating within the integrated BMDS and the associated safety and health procedures are developed and adequate. This process concludes with decommissioning, which would occur when and where appropriate.

To determine the environmental impacts, this PEIS analyzes the proposed BMDS components by considering the various life cycle phase activities of each component as well as the operating environments in which the activities are taking place. This slide tries to depict the multi-dimensional complexities involved in considering the impacts of implementing an integrated BMDS in terms of its components, acquisition life cycle phases, and operating environments.

Because of the complex nature of the project, an analysis strategy was developed to effectively yet efficiently consider the broad range of environmental impacts from the proposed BMDS. First, the existing condition of the affected environment was characterized for the locations where various BMDS activities are proposed to occur. Next, MDA determined the resource areas that could potentially be affected by implementing the proposed BMDS. Finally, impacts of the BMDS were analyzed in four steps.

In step 1, we identified and characterized life cycle phase activities. In step 2, we identified activities with no potential for impact and dismissed them from further analysis. In Step 3, we identified similar activities across life cycle phases and combined them for analysis. And in Step 4, we conducted the impacts analysis for all remaining activities. The first three steps were used to categorize and reduce the number of unique life cycle activities thereby reducing the redundancy in preparing the impacts analysis.

The affected environment includes all land, air, water, and space environments where proposed BMDS activities are reasonably foreseeable. The affected environments have been considered in terms of the broad ocean area, the atmosphere, and nine terrestrial biomes. A biome is a geographic area with similar environments or ecologies. Climate, geography, geology, and distribution of vegetation and wildlife determine the distribution of the biomes. These biomes encompass both U.S. and non-U.S. locations where the BMDS could be located or operated.

The resource areas considered in this analysis are those resources that can potentially be affected by implementing the proposed BMDS. NEPA analyses generally consider the resource areas listed on the screen, except for orbital debris. Because missile defense development and test activities include the launch and intercept of missiles, space-based communications and other satellites, and potential for space-based interceptors, MDA considered orbital debris and its impacts on the Earth.

The PEIS discusses all resource areas, provides a methodology for analysis, and suggests thresholds of significance to provide the reader with a roadmap for performing future site-specific analyses tiering from this PEIS. These discussions outline the type of information that would be needed to conduct site-specific analyses and identify the steps necessary to ensure that potential impacts are appropriately considered.

The resource areas, highlighted on the slide with a red star, require site-specific information for analysis and are those more effectively addressed in subsequent tiered analyses for specific activities.

Once we decided to consider the affected environment and the resource areas of concern, we used the four-step process I mentioned earlier. I will discuss each step in more detail. In step 1 of the impacts analysis, MDA identified and characterized the activities associated with each BMDS component. Each life cycle phase has activities applied to each component. For example, development can include planning, research, systems engineering, and site preparation and construction. Testing can include manufacturing, site preparation and construction, transportation, activation, and launch activities. Deployment can include manufacturing, site preparation and construction, transportation, activation, launch, operation and maintenance, upgrades, and training. And finally, decommissioning includes demilitarization and disposal.

Once life cycle activities were identified, it was determined that some of those activities had no potential for impact. Activities such as planning and budgeting, systems engineering, and tabletop exercises are generally categorically excluded in various Department of Defense NEPA regulations and therefore were not further analyzed in this PEIS.

Other activities for specific components, such as transportation, maintenance and sustainment, and manufacturing, were not analyzed in this PEIS, because they have been evaluated in previous NEPA analyses and were found to have no significant environmental impacts.

The remaining activities were then examined to determine which activities had similar environmental impacts. For example, impacts associated with site preparation and construction in the development phase would be similar to or the same as impacts from site preparation and construction activities in the deployment phase. Under step 3, similar activities occurring in different life cycle phases were identified and considered together to reduce redundancy.

The final step was to determine the impact associated with each remaining activity under the proposed action. The significance of an impact is a function of the nature of the receiving environment and the receptors in that environment. For example, an interceptor launch creates the same emissions no matter where it is launched. Whether those emissions cause impacts and the significance of those impacts depend upon the environment into which they are released.

The PEIS analyzes these emissions by component for each resource area and life cycle activity where a potential for impact was identified. Impacts were distinguished based on the different operating environments, land, sea, air, and space. The analysis also considered specific impacts for individual biomes where activities could occur. The impacts of system integration testing were considered separately from the impacts of individual BMDS component testing because integration testing would involve using multiple components in the same test.

To deal effectively with integration testing, MDA looked at two generic system integration flight test scenarios which involved different numbers of launches and intercepts.

The impacts analysis for Alternative One considers the use of land-, sea-, and air-based platforms for BMDS weapons. The analysis includes the use of space-based sensors but not space-based weapons. The analysis is specific for each resource area based on the impacts from the activities associated with the BMDS component.

The impacts analysis for Alternative Two includes the use of interceptors from land-, sea-, air-, and space-based platforms for the BMDS weapons. The impacts associated with the use of interceptors from land, sea, and air platforms would be the same as those discussed for Alternative One; therefore, the analysis in Alternative Two focuses on the impacts of using interceptors from space-based platforms.

The fundamental difference between Alternative One and Two is that Alternative Two includes the analysis of space-based platforms for interceptors.

The cumulative impacts of implementing the BMDS were also considered. Cumulative impacts are defined as impacts that result from the incremental impacts of the proposed action when added to other past, present, and reasonably foreseeable future actions. Because this proposed action is worldwide in scope and potential application, only activities similar in scope have been considered for cumulative impacts.

Under Alterative One, worldwide launch programs for commercial and government programs were determined to be activities of similar scope. Therefore, the impacts of the BMDS launches were considered cumulatively with the impacts from other worldwide government and commercial launches.

Alternative Two includes placing defensive interceptors in space, which involves adding additional structures to space for extended periods of time.

The International Space Station was determined to be an action that is international in scope and has a purpose of placing structures in space for extended periods of time. Therefore, the impacts of the use of space-based weapons platforms were considered cumulatively with the impacts of the International Space Station.

The next few slides provide broad summaries of the impacts analysis by BMDS component and Test Integration for Alternatives One and Two, the No Action Alternative, and the cumulative impacts for Alternatives One and Two. Please note that the results are extremely high level suitable for a brief presentation. Additional details have been provided in some of the posters that you see behind us. The impacts analysis may also be found in the Executive Summary impact tables and in Section 4 of the Draft PEIS.

It is important to note that no environmental showstoppers were found in this programmatic impact analysis. As the next few slides show, there are potential impacts associated with the various activities needed to implement the BMDS; however, they would be appropriately addressed in subsequent tiered NEPA analyses with mitigation actions as required to ensure less than significant impacts.

This slide shows a summary of the broad potential for environmental impacts associated with BMDS weapons activities as examined for each resource area for Alternatives One and Two. Again, please note that this is a very high-level depiction of the results of the analysis, and additional details of the weapons analysis may be found in the tables in the Executive Summary of the Draft PEIS. However, one can see from these slides general activities and resource areas that should be considered in subsequent tiered NEPA analyses.

This slide shows the impacts summary for the BMDS sensors. Note that the impacts are the same for Alternatives One and Two and include space-based sensor platforms. This summary also shows how MDA categorization of activities helped to simplify the analysis.

For example, the activation of radars would not impact air quality because the only emissions resulting from radars would be from supporting diesel generators, which are addressed under support assets. However, radars generate electromagnetic radiation; which could potentially impact biological resources.

Although C2BMC is the glue that enables the integrated BMDS to function effectively as a system, this component creates little potential for environmental impacts.

Impacts associated with Support Assets are mainly those that would be caused by site preparation and construction of infrastructure and by using test assets such as countermeasures and simulants during testing.

Test integration overall has the most potential for impacts, because it includes the use of several components during increasingly realistic test scenarios. Although this programmatic analysis showed the potential for impacts, the existing environment at the proposed test location and the specific test activities planned will determine the nature and extent of the impacts.

The No Action Alternative would continue the development and testing of individual weapons, sensors, C2BMC, and support assets and would not include integration testing of these components. The environmental impacts of the No Action Alternative would be the same as the impacts resulting from continued development and testing of individual missile defense elements.

The decision not to deploy a fully integrated BMDS could result in the inability to respond to a ballistic missile attack on the U.S. or its deployed forces, allies, or friends in a timely and successful manner. Further, this alternative would not meet the purpose or need of the proposed action or the specified direction of the President and the U.S. Congress.

We examined the impact of worldwide launches for cumulative impacts. Launches can create cumulative impacts by contributing to global warming and ozone depletion. Potential launch emissions that could affect global warming include carbon monoxide and carbon dioxide, or CO_2. Unlike CO_2, carbon monoxide is not a greenhouse gas; but, it can contribute indirectly to greenhouse gas effects.

The cumulative impacts on global warming of emissions from BMDS launches would be insignificant compared to emissions from other industrial sources, such as energy generation. The BMDS launch emissions load of CO_2 and carbon monoxide would only be five percent of the emissions load from worldwide launches. In addition, CO_2 and carbon monoxide from 10 years of BMDS and worldwide launches combined would account for much less than one percent of CO_2 and carbon monoxide emissions from U.S. industrial sources in a single year.

Chlorine is of primary concern with respect to ozone depletion. Launches are one of the man-made sources of chlorine in the stratosphere. The cumulative impacts on stratospheric ozone depletion from launches would be far below the effect caused by other natural and man-made sources. The emission load of chlorine from both BMDS and other launches worldwide occurring between 2004 and 2014 would account for about half of one percent of the industrial chlorine load just from the U.S. in a single year.

The orbital debris produced by BMDS activities would generally be small and would consist primarily of launch vehicle hardware, old satellites, bolts, and paint chips. It may also be possible for debris from an intercept to become orbital debris. However, orbital debris produced by BMDS activities would occur in low-earth orbit, where debris would gradually drop into successively lower orbits and eventually reenter the atmosphere.

Therefore, orbital debris from BMDS activities would not pose a long-term hazard to the International Space Station or other orbiting structures. In addition, collision avoidance measures would further reduce the potential for orbiting debris to damage orbiting structures such as the International Space Station.

I would like to reiterate that our impact analysis indicated no showstoppers or expected areas of significant impact. However, many resource areas showed potential for impacts, indicating that these areas need to be considered in subsequent analysis tiered from this PEIS.

Now, I would like to turn the meeting over to Peter Bonner.

MR. BONNER: Okay; now that we've looked at the proposed BMDS and the potential impacts from its implementation, let's talk about the PEIS schedule. The Notice of Intent was released in April of 2003 in the Federal Register and published in the Federal Register on April 11. The MDA released the Draft PEIS just this past September. The public comment period on the draft, which is currently underway, will continue through November 17. After that, the MDA will consider all comments received and incorporate the appropriate changes in the PEIS.

The release of the Final PEIS to the public will be in December 2004 or January 2005. After that, there will be a 30-day waiting period before the MDA can issue its final Record of Decision, or ROD.

Let me turn to submitting comments on the draft PEIS, including your comments tonight. You can provide your comments either orally or in writing. The oral or written comments will be given equal consideration in preparing the Final PEIS. If you would like to make a public statement at tonight's meeting, please sign up at the registration table. Each speaker will be given five minutes, as I said before.

The public statements by tonight's speakers will be recorded by the court reporter to ensure that we accurately get all of your comments for the Draft PEIS. There is also a toll-free telephone number for you to submit comments, and please refer to your handouts for that toll-free telephone number.

You can also submit your comments in writing to us. There are four ways to do that. One is if you have your comments tonight, give them to us, and we'll record them in the Draft PEIS for consideration. Use the comment forms provided and submit them tonight; fax or email your comments. The email system, as I said before, is temporarily unavailable right now but will be back up; or use the electronic comment form provided on the MDA BMDS PEIS Website.

The information on the screen lists the various ways you can do this. The information is also listed on the comment forms at the registration table. For additional information, please visit the Website. There's lots of information on there. It provides descriptions of the topic areas talked about this evening as well as links for obtaining some additional information.

We encourage you to sign up to receive a hard copy of the Executive Summary of the final PEIS and a CD-

ROM containing the entire document of the PEIS when it becomes available. Signing up for that is also available at the registration table.

The Final PEIS will also be available in PDF format to be downloaded from the BMDS PEIS web site, and hard copies will be in local libraries. A list of these libraries is also available on the BMDS PEIS web site, and we've got the URL for the Website right there.

Marty?

MR. DUKE: Yes, I just want to remind everyone that no decision on this project is going to be made tonight. We are here to listen to your concerns both oral and written, so as we finalize the draft, that we know what your concerns are and can address those in the final PEIS.

Again, the final comments, please, we need to have them submitted by November 17, 2004, and at this point, I'd like to take a 15-minute break to set up for the public statements. Again, please take this time, if you haven't had the opportunity, to sign up at the table. Thank you, and we look forward to your comments.

MR. BONNER: Okay; please take your seats. Let's get started. I have the list of registered speakers. I will call each person to the front of the room to speak. Please limit your comments to five minutes. At four minutes, I will hold up my expertly made sign.

[Laughter.]

MR. BONNER: That you've got one minute left.

If you have a written version of your oral comments, we ask that you provide it so that we can keep a record of that statement. When providing your public statements, please remember to state your name and your affiliation and speak clearly and distinctly for the meeting recorder.

If you do not wish to give an oral or public statement here tonight, please consider providing your comments through one of the other available methods that we talked about earlier. We're seeking an open process and have tried to develop many avenues for you to provide input to that process.

Is Victoria Samson here? Victoria, if you'd come up to the microphone.

MS. SAMSON: Hi. Thank you. My name is Victoria Samson. I'm with the Center for Defense Information

The draft Ballistic Missile Defense Programmatic Environmental Impact Statement, dated September 1, 2004, is supposed to give an objective and thorough assessment of the effects various missile defense architectures would have on the environment. However, it has obviously been shaped to give credibility to the Bush administration's continued assertions that the only way the United States can be protected from an ICBM attack is with a heavily tiered system.

The draft PEIS dismisses any real concerns about harmful negative consequences from developing such a system and, in doing so, invalidates itself and its conclusions. To begin with, the so-called No-Action Alternative examined in this document is misleadingly named. It does not detail a scenario where no action is taken. Rather, it describes a system where the MDA would continue existing development and testing of discrete systems as stand-alone missile defense capabilities. Individual systems would continue to be tested but would not be subjected to system integration tests.

This is hardly no action, and it allows for an indeterminate amount of missile defense development, since there are currently no final or fixed architectures and no set operational requirements for the proposed BMDS. The way this draft PEIS is structured, even if MDA was limited to the No-Action Alternative, it would not find its actions very much constrained.

Alternative Two, which includes the usage of space-based interceptors or SBIs, is questionable for many reasons. It looks at the effect of using SBIs in lieu of terrestrial-based ones; however, the BMDS that is repeatedly envisioned by MDA and Pentagon officials is one where targets would be engaged at all stages in their flight, from all types of launch platforms.

To look only at the usage of a single SBI is to willfully ignore the concept of operations that has been used to justify this massive defense system. The American Physical Society, in its boost-phase intercept study released in July 2003, estimated that a constellation of at least 1,000 SBIs would be required to provide a minimal defense against liquid-fueled ICBMs.

Granted, testing would be of a much lesser nature than a complete constellation, but at some point presumably the system would be tested at some fraction of its full strength. This draft PEIS does not take into consideration that possibility.

This draft PEIS also does not look at what would be required to develop a space-based test bed, dismissing the concept as being too speculative to be analyzed in this PEIS. It does not say when such a concept would be analyzed. Finally, this document admits if Alternative Two were selected, additional environmental analysis could be needed as the technologies intended to be used became more defined and robust.

But again, that is what this document is supposed to do: examine the environmental effects of the proposed action. By sweeping it under the nebulous responsibility of future studies, it relieves the MDA of liability of negative consequences stemming from SBIs.

The draft PEIS fails to fully address the effects of debris, not just orbital but rocket fragments, fuel and so forth. It scratches the surface barely of potential harmful consequences that could plausibly result from the alternatives listed, and it immediately dismisses the few consequences that are divulged. Debris that could fall into the ocean would become diluted and would cease to be of concern. Debris that survived reentry is not to be worried about, as it would fall into a preestablished footprint.

Even if it didn't, debris is more likely to terminate in water than on land, because water covers 75 percent of the Earth's surface. Debris from spills or intercepts in the air is assumed to dissipate before it hits the ground.

Yet this is making a real leap of faith in how these actions would affect the environment, and doing so in a manner that precludes any real assessment of what sort of consequences could occur. The treatment of the Airborne Laser, or ABL, is indicative of this attitude. The draft PEIS says that should the ABL not be able to land at an appropriate location, its fuel and laser chemicals may have to be jettisoned, but this would be at a minimum altitude of 15,000 feet and thus would be diluted in the atmosphere.

And if there was an accidental fire on the ABL, the liquid and solid laser chemicals would be consumed or contained. These laser chemicals include hydrogen peroxide, ammonia, chlorine, helium, and iodine, according to the document. No explanation is given as to what would happen should the ABL jettison its chemicals at a lower altitude than 15,000 feet, nor how exactly the fire would contain all chemicals. The draft PEIS makes these reassuring statements with no solid evidence to back them up.

Finally, the alternatives considered but not carried forward are deliberately chosen to showcase the

BMDS system that the Bush administration has been pushing for in the best light possible. The first one is to cancel development of BMDS capabilities, which is explained as being an alternative that would rely upon diplomatic and military measures to deter missile threats against the U.S. This is exactly what has kept the United States safe from attack to date, and yet it is summarily dismissed out of hand.

The other alternative is to focus on a single- or two-platform BMDS. But, per MDA threat assessments that are not given but merely referred to, it has decided that an effective missile defense should include components based on at least the land, sea, and air, so a more limited missile defense system simply would not do.

This draft PEIS does not fully examine the actual consequences that could very well result from developing and testing a tiered missile defense system. By deliberately rejecting any and all negative effects, it goes against what is legally required of the NEPA process.

Thank you.

MR. BONNER: Thank you.

Theresa Hitchens?

MS. HITCHENS: I'm a lot shorter than her. I'm Theresa Hitchens. I'm also from the Center for Defense

Information, and my comments are related to the treatment by the BMDS PEIS of the potential threats of space debris to objects and people in space, in the air and on the ground presented by the testing of ground-based and especially space-based interceptors.

The overall assumption of the PEIS is that there is a low-level risk from either orbital debris or debris reentering the Earth's atmosphere, and that is not supportable, due in large part to the failure of the MDA to undertake and provide adequate scientific review of the physics involved in debris creation and reentry from the multiple possible scenarios for missile defense intercepts.

Space debris is a major hazard to spacecraft and satellites because of the high impact velocities generated in orbit, meaning that even tiny pieces of debris, which you mention, such as bolts can damage or destroy an on-orbit asset. Reentry of space-based objects, such as the SBIs, can also threaten people or objects on the ground, as not all debris is burned up on its way through the atmosphere.

Major inadequacies in the PEIS treatment of issues related to debris include: Number one: the PEIS severely understates the potential threats to satellites and spacecraft, as well as to people and objects on the ground, from orbital debris caused by ground-based midcourse interceptor tests. The PEIS fails to support its claim that little debris would be created because of lack of adequate modeling of likely debris creation from realistic testing of the ground-based interceptor, which would involve higher speed impacts at higher altitudes than testing so far.

Under realistic testing of GBIs, ground-based interceptors, there is a significant chance that debris could be created that would last for years, not simply the months as asserted by the PEIS.

Further, even short-term debris could be a danger to space objects such as the International Space Station, as the PEIS admits. And while the PEIS states that the ISS could be moved to avoid a collision with any large debris, it fails to recognize that other objects in low Earth orbit that might be threatened are not maneuverable.

Finally, the PEIS asserts that most of the debris created in low Earth orbit would be small and thus not a major hazard to the ISS. Unfortunately, as I said, even tiny pieces of debris could destroy the ISS or other space assets. In actuality, small debris is considered by space operators as a bigger hazard to space objects because it cannot be detected and tracked adequately enough to allow planning for evasive maneuvers by those space objects that can do so. In other words, smaller debris could be a bigger threat to the ISS and other craft than larger pieces on orbit, and the PEIS undertakes no review of this fact of physics.

That said, the PEIS does not provide adequate scientific review to support the assertion that most debris would be small, a term that is undefined in the PEIS, raising the question of the risks from reentry into the atmosphere of both the interceptor and its target after an impact. Not all debris reentering the atmosphere burns up, as the PEIS suggests.

In January 1997, a Delta Two rocket second stage came down over Georgetown, Texas, with large pieces making landfall including a 580-pound stainless-steel fuel tank that landed 50 yards from a house. Another Delta Two second stage reentered the atmosphere over Cape Town, South Africa in April 2000, similarly raining large pieces of debris to the ground. It is important to note that a Delta Two second stage is considerably smaller than the either a ground-based midcourse interceptor or a target ICBM. It also is highly difficult to predict reentry trajectories even from scripted test events because debris can, as the PEIS admits, skip off the atmosphere and land miles away from its original reentry point, and the PEIS provides no evidence that MDA made any significant effort to undertake the complex computer modeling required to predict such possible reentry scenarios.

Number Two: The PEIS fails to support its claim that there would be no significant impact to spacecraft and satellites, and objects and people on the ground, from the testing and deployment of Space-Based Interceptors. Given the inadequate articulation by MDA of the SBI concept itself, it is impossible for the MDA to make any claims about the risks to space objects from SBIs. Debris creation depends on a number of specific factors about individual impacts, such as the mass of the two objects impacting, their relative velocities at impact, the angle of impact, and altitude.

Since the MDA has yet to determine nor to provide in this PEIS critical design parameters of the SBIs themselves--their size, mass, and their speed--and the architecture of an SBI network, how many interceptors on orbit at what altitude--it is simply impossible for the MDA to support the PEIS claim that there is little debris risk, much less to support the PEIS suggestion that a space-based architecture would present less risk to the environment than a solely ground-based one.

Without any specific parameters for an SBI network available, the MDA has no data for undertaking the necessary calculations to support its claims.

Last of all, the PEIS also neglects a critical factor regarding the potential for debris creation from SBIs: that is, the fact that any architecture means large numbers of missiles filled with highly volatile rocket fuel would be orbiting in LEO at altitudes where they themselves will be constantly bombarded by space debris, with an attendant risk of explosion caused by debris impact. The PEIS ignores this risk altogether.

In sum, the PEIS fails to support its conclusions about the risk from the creation of orbital debris and its possible reentry into the atmosphere due to a lack of adequate and complete scientific review. Thus, the PEIS itself is fatally flawed and not legally acceptable.

Thank you.

MR. BONNER: Thank you for your input and comments.

Stephan Young?

MR. YOUNG: My name is Stephan Young. I'm a senior analyst at the Union of Concerned Scientists. I have a number of concerns about this PEIS and the proposed deployment of a missile defense system.

First, it seems clear to me that the NEPA laws are not being fulfilled as required by law.

This study is being done, for large parts of the program, after the fact. As the PEIS says, it, quote, evaluates the potential environmental impacts of activities associated with the development, testing, deployment and planning for decommissioning of the BMDS.

For example, for the ground-based missile defense system, many of those stages are already complete. The silos have been built, the interceptors have been built, many of the tests have been conducted, and the radars have been upgraded. This is also true of the facilities in Colorado Springs, for cable-laying, and so on.

Clearly, the intent of the National Environmental Policy Act is to assess the impact of these actions before they take place. In this case, it's being done after the fact.

Furthermore, the No-Action Alternative described in the PEIS is clearly not a No-Action Alternative. It would merely halt the system-wide integration of the proposed BMDS. All of the components would continue, even to the point of deployment, apparently without the required completion of the appropriate EIS study.

As such, I would support a true No-Action Alternative that would allow testing and development to continue but prohibit deployment of this system or its component parts until such an alternative is considered.

To comply with the law, all current activity should cease until this PEIS process is completed. The current path clearly undermines the intent of the law, and that path should be changed.

Second, the PEIS does not consider the broader environmental impact of the systems deployment. Specifically, the PEIS does not consider how deploying the missile defense system will affect the political and security environment.

It is quite possible, if not likely, that deploying this missile defense system will increase the likelihood of a nuclear weapon being detonated. Obviously, such a detonation would cause an enormous negative environmental impact.

The reason the BMDS makes detonation more likely is quite simple. Both Russia and China will seek to maintain the capability to defeat or overwhelm this missile defense system. In Russia's case, if expansion of the U.S. system proceeds, they could be compelled to maintain a larger arsenal on higher alert, than they otherwise would. Russian President Vladimir Putin has already announced that Russia is developing new missile technologies intended to counter U.S. defenses.

Specifically, Russia is looking at equipping its new Topol missile with multiple warheads and has tested a maneuverable warhead designed to defeat U.S missile defenses and also is planning to maintain its 10-warhead SS-18 ICBM otherwise scheduled for decommissioning.

It is much worse in China's case. With currently a relatively limited arsenal of 20 long-range missiles capable of striking the United States, even the extremely modest system being deployed by the United States will quickly become at least a theoretical threat to the survival of China's nuclear deterrent.

The goal, of course, of U.S. policy, must be to eliminate or at a minimum limit the nuclear threat to the United States. We absolutely do not want China to maintain it's nuclear deterrent, but deploying missile defenses while maintaining our own extremely robust nuclear arsenal ensures that China will hold onto its arsenal and, in all probability, increase it.

In fact, a 2000 National Intelligence Estimate specifically found that China was likely to increase the size of its nuclear arsenal in response to the deployment of U.S. missile defenses. China is already pursuing a vastly upgraded missile arsenal of longer-range, multiple-warhead mobile land- and sea-based missiles with increased accuracy. The key variable is how quickly and how robustly they will pursue these upgrades.

In short, the missile defense system will push China to develop and deploy a larger and more capable nuclear arsenal. Russia will maintain and perhaps upgrade its nuclear arsenal, much of it on high alert. Both those factors contribute to an increase in the likelihood of a nuclear attack, either intentional or accidental, on the United States. There could be no worse outcome for the environment.

The PEIS also considers a space-based weapons alternative. Such an alternative could also have severe negative implications for the overall security environment. Placing weapons in space would provoke a number of other countries to develop responses that would decrease overall US security. These impacts should be considered in the PEIS.

Thank you.

MR. BONNER: Thank you.

Lenny Siegel.

MR. SIEGEL: Good evening. My name is Lenny Siegel with the Center for Public Environmental Oversight. I've reviewed the draft Programmatic Environmental Impact Statement with a focus on the use of solid rocket propellant, and I've found that the document is woefully inadequate and doesn't meet the purposes of NEPA, and I'll explain why.

NEPA is a law, which is designed to evaluate environmental alternatives so you can see what you can do better. You're supposed to do a cradle to grave analysis, someone mentioned this, not just to justify decisions that have already been made but to figure out ways to mitigate the problems, to do things differently to solve the problems.

I don't see that in this document. There's no genuine No-Action Alternative. Now, it may be that once you do your study, you would conclude that the No-Action Alternative doesn't meet the purposes of the program, but it's supposed to be there as a baseline against which to measure the environmental impacts. If there's no solid rocket propellant being used, then, you aren't going to deplete the ozone layer; you aren't going to cause water pollution. That alternative should be there for the study to follow NEPA.

Solid rocket propellant, for those who don't know, just about all of it these days contains aluminum and ammonium perchlorate. When it burns as designed, it generates hydrogen chloride, as the document says. When that's released in the lower atmosphere, it combines with moisture to form acid precipitation. That's something that needs to be mitigated. It causes environmental impacts.

It's important to look at alternative launching technologies to avoid those impacts. I see nothing in the document looking at alternative launching technologies.

If the rocket makes it up to the upper atmosphere, the hydrogen chloride breaks down and depletes the ozone layer, exposing us creatures all around the world to ultraviolet B radiation, which causes cancers and numerous other environmental consequences. At the very least, this document should look at ways that alternative technologies, other launching technologies could eliminate or reduce that impact.

It does not do it. Instead, it compares, and I come up with a higher number, compares the launch-caused ozone depletion to industrial emissions. Those industrial emissions that EPA is calculating every year are actually the emissions caused by the residual release of chemicals that are banned now and are not being produced anymore. And gradually, those are going to be going down because we don't use CFCs anymore around the world. But it looks like the ozone depletion from hydrogen chloride from launching is going to go up unless we look for other ways of launching rockets and missiles.

And finally, I'm from California. We've got a big problem in California and Nevada, Arizona. Twenty million people are drinking water that is contaminated with rocket fuel, perchlorate. It's a growing problem around the country. Perchlorate causes developmental disorders in children. There's no calculation in this document about how much perchlorate needs to be produced to make this system happen, not just for the testing but for the deployed missiles. Presumably--there's no count of how many missiles might be deployed in the system, yet we're going to be manufacturing, disposing of either during manufacturing, during testing or even decommissioning this contaminant.

It is not there. You are not analyzing it. In order to follow NEPA, you have to analyze how much perchlorate might be released into the environment and how you might come up with ways of mitigating that problem or coming up with alternative launch strategies or not doing it at all.

So in order for this document to meet the obligations under the law, there's a need to, one, provide more detailed estimates of perchlorate waste likely to be generated by the system's development, testing and deployment, maintenance and decommissioning and acknowledge emerging regulatory standards for perchlorate exposure; two, consider in detail the management practices, launch protocols, treatment technologies, et cetera, necessary to mitigate the significant environmental impacts, including ozone depletion and the likely release of perchlorate into ground water, surface water and soil; and three, evaluate launch technologies not based upon ammonium perchlorate.

Subsequent studies, site-specific studies, tiered studies doesn't do the job, because there's no way you can do that and look at an alternative to the way it's being done now. You can't substitute for perchlorate five years down the road. It has to be done while the system is testing, or the system that you're testing won't be the system you deploy.

Thank you.

MR. BONNER: Thank you for your comments and input.

At this point, we invite everyone to stay, come back to the poster area, where you can ask clarifying questions of the MDA folks who will be around for the next hour to answer your questions or comments.

Marty?

MR. DUKE: Again, I would just like to thank you for coming and providing your comments. We'll look at those comments and consider those in the draft PEIS. Just one point: the programmatic--you made some very good points, and, you know, we understand there's a lot of issues out there, and a lot of additional tiering environmental analysis will have to be done before any decisions are made in the future. So we're providing a baseline identifying the areas that need further analysis.

Again, thank you very much.

[Whereupon, at 8:22 p.m., the meeting was concluded.]

Exhibit B-14. Sacramento, California Public Hearing Transcripts

MISSILE DEFENSE AGENCY

In Re: MDA Ballistic Missile Defense System Programmatic Environmental Impact Statement Public Hearing)

PUBLIC HEARING

TUESDAY, OCTOBER 19, 2004

6:31 P.M.

Hearing Held At: Sheraton Grand Hotel
1230 J Street
Sacramento, California

Reported by: Desiree C. Tawney, CSR No. 12414

APPEARANCES:

Marty Duke

Colonel Mark Graham

Peter Bonner

Sacramento, California; Tuesday, October 19, 2004
6:31 p.m.

MR. DUKE: First I'd like to welcome --

UNIDENTIFIED SPEAKER: We can't hear you.

MR. DUKE: Can you hear me now?

UNIDENTIFIED SPEAKER: Move it up a little bit.

MR. DUKE: Again, I would like to welcome each and every one of you to tonight's public hearing for the Missile Defense Agency Ballistic Missile Defense System Environmental Impact Statement.

This public hearing is being held in accordance with the NEPA Environmental Policy Act -- excuse me -- the National Environmental Policy Act or NEPA.

My name is Marty Duke. I am the Missile Defense Agency's Program Manager for the development of the Programmatic Environmental Impact Statement.

I would like to introduce Colonel Mark Graham, who is with the Missile Defense Agency's Office of General Counsel. Colonel Graham will talk about the Draft Programmatic Environmental Impact Statement, the NEPA process and the Ballistic Missile Defense capabilities and components.

I also would like to introduce Mr. Peter Bonner, Ms. Deb Shaver in the back, who is with ICF Consulting.

Ms. Shaver is the ICF Consulting Program Manager and the technical lead for PEIS.

Mr. Bonner --

UNIDENTIFIED SPEAKER: What is ICF, please?

MR. DUKE: ICF is -- letters. It does not represent a name. It's ICF Consulting. It is the name of the company they work with.

UNIDENTIFIED SPEAKER: ECF?

MR. DUKE: ICF.

UNIDENTIFIED SPEAKER: UCF?

UNIDENTIFIED SPEAKER: We're going to give you a hard time.

MR. DUKE: That is fine. That is why we're here, to listen to you provide your comments.

With that, I'd like to turn the meeting over to Mr. Bonner, who will go over tonight's agenda and discuss some administrative points on how to provide the public comments on the Programmatic EIS.

MR. BONNER: Good evening. I'd also like to welcome you to the public hearing. We're from DC so we have to have some acronyms for tonight's meeting. We'll refer to the Missile Defense Agency as MDA during this presentation.

We'll review the Ballistic Missile Defense System or BMDS. We'll discuss the Programmatic Environmental Impact

Statement as a PEIS.

Therefore, at tonight's hearing, we'll discuss the development of MDA's draft BMDS PEIS. There is a test at the end.

Next we'll discuss the proposed action, which is the implementation of an integrated BMDS, the activities involved in implementing the BMDS, which have been analyzed for the potential environmental impact. Finally, we'll provide a forum to collect your public comments on the Draft PEIS.

It's our goal to have an open informative process tonight. To ensure MDA has enough time to receive your oral comments, we'll use the following agenda for tonight's meeting: We'll spend -- the first portion is a 30 to 40 minute presentation with information about BMDS, the NEPA process, the National Environmental Policy Act and our analysis.

The presentation will discuss: What is a Programmatic EIS? What is the BMDS? How were potential impacts analyzed? What were the results of the analysis? And how to submit comments on the Draft PEIS.

We'll then take a 15-minute break where you'll get a chance to sign up at the registration table, if you haven't already, to provide some of your oral comments. After the break each speaker will be called in the order they've signed up to come and make their statements.

Following the public statements MDA representatives will be available at the poster area to help clarify any information you might need.

Please note the questions and comments provided in the poster area will not be officially recorded. However, all questions can be formally submitted today to MDA through other available methods.

The most important aspect of tonight's meeting is to hear your comments in the public comments portion. All public statements provided tonight will be recorded in a transcript.

Please remember that the Programmatic -- the PEIS is a draft document. This is your opportunity to provide comments on the document before it's finalized and before a decision is made.

We're going to listen firsthand to your suggestions and concerns. As you give your oral comments, please limit your comments to three minutes. I think we've got 25 or 30 folks who want to make public comments.

The purpose of the meeting is to gather the comments. We'll attempt to answer your questions, clarifying the points we've made in the presentation out in the poster area. Substantive questions recorded tonight will be carefully considered in the Final PEIS.

If you wish to provide written comments, forms are available at the registration table. You may leave the written comments with us at the registration table. You also have options to email, fax or voicemail your comments to us.

To allow time to consider and respond to the comments in the Final PEIS, we need to receive your comments -- your comments must be received by November 17.

Colonel Graham will discuss the BMDS PEIS and the NEPA process.

Thank you.

COLONEL GRAHAM: Thank you, Peter. Can you hear me okay? Good.

NEPA establishes our broad national framework for protecting the environment. NEPA requires Federal agencies to consider the environmental impacts of proposed actions and the reasonable alternatives of those actions early in the decision-making process.

The NEPA process is intended to help public officials make decisions based on the understanding of environmental consequences and take action that protects, restores, and enhances the environment.

In the past, the national approach to the missile defense focused on the development of the individual missile defense elements of programs such as the Patriot, Airborne Laser and ground-based interceptors. These actions were appropriately addressed in separate NEPA analyses that MDA, its predecessor agencies, and executing agents prepared for these systems.

The aim of missile defense has been refocused by the Secretary of Defense to develop an integrated Ballistic Missile Defense System that would be a layered system of components working together, capable of defending against all ranges of threat missiles in all flight phases.

Because the integrated Ballistic Missile Defense System is a large program made up of many projects implemented over time on a worldwide basis, MDA has determined a programmatic NEPA analysis would be appropriate.

Therefore, MDA has prepared a Programmatic EIS to analyze the environmental impact of implementing the proposed program.

The Programmatic EIS or PEIS analyzes the broad environmental consequences in a wide-ranging Federal program like the BMDS. A PEIS looks ahead at overall issues in a proposed program and considers related actions together in order to review the program comprehensively.

A PEIS is appropriate for projects that are broad in scope, are implemented in phases and are widely dispersed geographically. A PEIS creates a comprehensive global analytical framework and supports subsequent analysis of specific activities of specific locations. The Programmatic EIS is thus intended to serve as a tiering document for subsequent specific Ballistic Missile Defense System analyses and includes a roadmap for considering impacts in resource areas and developing future documents.

This roadmap identifies how a specific resource area can be analyzed and includes specifics for considering the significance of environmental impacts on specific resource areas. This means that ranges, installations, and facilities at which specific programs may occur in the future could tier their documents from the PEIS and have some reference point from which to start their site-specific analyses.

The Ballistic Missile Defense System Programmatic EIS analyzes the potential impacts of developing, testing, deploying and planning for decommissioning of the proposed program.

The Programmatic EIS evaluates the proposed Ballistic Missile Defense System's technology components, assets and programs and considers future development and application of new technology.

The proposed action considered in our Programmatic EIS is for MDA to develop, test, deploy and plan for decommissioning activities for an integrated Ballistic Missile Defense System, using existing infrastructures and capabilities, when feasible, as well as emerging and new technologies to meet current and evolving threats.

When feasible, MDA will use existing infrastructure to implement the BMDS and would incorporate new technologies and capabilities as they become available. This would ensure the program could provide defense for both current and future missile threats.

The purpose of the proposed action is to incrementally develop and deploy a Ballistic Missile Defense System, the performance of which could be improved over time, and that layers defenses to intercept ballistic missiles of all ranges in all phases of flight.

The proposed action is needed to protect the United States, its deployed forces, friends and allies from ballistic missile threats.

In this Programmatic EIS, MDA considered two alternative approaches to implementing the Ballistic Missile Defense System in addition to the No Action Alternative. The alternative approach is to address the use of weapons for land, sea, air and space-based platforms.

Alternative 1 is to develop, test, deploy and plan for decommissioning for an integrated Ballistic Missile Defense System that includes land, sea and air-based weapons platforms.

The BMDS envisioned in Alternative 1 would include space-based sensors but would not include space-based defensive weapons.

Alternative 2 is to test, deploy and plan -- develop, test and deploy, and plan for decommissioning an integrated Ballistic Missile Defense System that includes land, sea, air and space-based weapons platform.

Alterative 2 would be identical to Alternative 1, with the addition of the space-based defensive weapons. The Counsel of Environmental Quality Regulations implementing NEPA also requires consideration of the No Action Alternative.

Under the No Action Alternative, the MDA would not develop, test, deploy or plan for decommissioning activities for the integrated Ballistic Missile Defense System.

Please note that under the No Action Alternative MDA would continue existing development and testing of individual elements and stand-alone defensive capabilities. Individual systems would continue to be tested but would not be subjected to system integration testing.

Alternative 1 and 2 provide different weapons platforms through implementing an integrated Ballistic

Missile Defense System, while the No Action Alternative continues the traditional approach to developing individual missile defense elements.

I will now address how MDA characterizes the Ballistic Missile Defense System into relevant components and life cycle activities that could be considered to provide a programmatic overview of the environmental impacts of implementing the proposed action.

As mentioned earlier, MDA's goal is to develop an integrated Ballistic Missile Defense System that will provide layers of defense. The Ballistic Missile Defense System will be capable of destroying threat ballistic missiles in the boost, midcourse and terminal phases and would defend against short, medium, intermediate and long-range threat ballistic missiles.

Finally, the Ballistic Missile Defense System would integrate sensors and weapons through command, control, battle management, and communications or C2BMC network. With this capability the integrated Ballistic Missile Defense System would establish a defense against threat ballistic missiles.

The Ballistic Missile Defense System is a complex system of systems. To be able to perform a meaningful impact analysis, we've considered the Ballistic Missile Defense System in terms of its components; that is, weapons, sensors, C2BMC and support assets.

These components are the building blocks that could be assembled with specific functional capabilities and could be operated together or independently to defeat threat missiles. Testing was considered for each component. However, the integrated Ballistic Missile Defense System needs to be tested at the system level and was analyzed separately using realistic system integration flight test scenarios.

Let's take a look at each of the components. First of all, we have weapons. Ballistic Missile Defense System weapons would provide defense against threat ballistic missiles. They include interceptors and directed energy weapons in the form of high-energy lasers. These weapons would be used to negate threat missiles. These interceptors would use hit-to-kill technology, either through direct impact or directed fragmentation.

Ballistic Missile Defense System weapons are designed to intercept threat ballistic missiles in one or more phases of flight that can be activated from land, sea, air or space-based platforms.

Sensors in the Ballistic Missile Defense System will provide relevant tracking data for threat ballistic missiles. Sensors detect and track threat missiles and assess whether or not the threat missiles have been destroyed. Sensors provide the information needed to locate and track a threat missile to support and coordinate effective decision-making against the threat.

There are four basic categories of sensors considered in the Ballistic Missile Defense System. They are radars, infrared, optical and laser sensors.

Radars send a signal out and detect the same signal after it bounces off an object. Infrared sensors are passive sensors that detect and track heat or infrared radiation from an object. Optical sensors are passive sensors that collect white energy or radiation emitted from an object. Laser sensors use laser energy to illuminate and detect the object's motion. Radars and lasers emit radiation while infrared and optical sensors detect radiation that has been emitted.

The Ballistic Missile Defense System would operate the sensors; that is, would operate from multiple platforms: land, sea, air or space.

The data collected by the Ballistic Missile Defense System sensors would travel through the communication system to command and control centers where battle management decisions on whether to use a defensive weapon could be made.

C2BMC would integrate and coordinate equipment and operators through command and control and integrated fire control centers. C2BMC would enable military commanders to receive and process information, make decisions and communicate those decisions regarding the engagement of the threat missile.

The C2BMC would include fiber optic cable, computer terminals and antennas and would operate from land, sea, air and space-based platforms.

The last category of components is support assets. The support assets would be used to facilitate developing, testing and deployment of the Ballistic Missile Defense System components. Support assets are one of three types: support equipment, infrastructure or test assets.

Support equipment includes general transportation and portable equipment such as automobiles, ships, aircraft, rail and generators. Infrastructure includes docks, ships, yards, launch facilities and airports. Test assets include test range facilities, targets, countermeasure devices, simulants and observation vehicles.

Now that we've discussed the components, Mr. Marty Duke will talk about how they can be integrated into the Ballistic Missile Defense System.

MR. DUKE: This slide depicts the various components of the proposed BMDS as we've just discussed. The use of the multiple defensive weapons and sensors operating from a variety of platforms integrated to a single C2BMC system would created a layered defense allowing several opportunities to intercept and destroy threat missiles.

For example, one weapon could engage a threat missile in the boost stage. And another -- the boost phase being a threat area -- and the other could be used to intercept the missile threat in a later phase after an intercept was unsuccessful.

Components are integrated into the BMDS through the life cycle phase of the system acquisition process. These life cycles phases are development, testing, deployment, and decommissioning. These new components would undergo initial development, testing while existing components will be tested to determine their readiness for use. Work on a given technology would stop if testing failed to demonstrate effectiveness or its functional capabilities needs change.

Components and elements would be deployed as testing demonstrates that they are sufficiently capable of defending against threat ballistic missiles. In most cases, the components would be deployed when testing demonstrated that they are capable of operating within the integrated BMDS and the associated health and safety procedures are developed and adequate. This process concludes with decommissioning, which would occur when and where appropriate.

To determine the environmental impact, this PEIS analyzed the proposed BMDS components by considering the various life cycle activities of each component as well as the operating environment in which the activities are taking place. This slide tries to depict the multi-dimensional complexities involved in considering the impact of implementing the integrated BMDS in terms of its components -- which is the weapons, sensors, C2BMC -- the acquisition life cycle phases and their operating environments.

Because of the complex nature of this project an analysis strategy was developed to effectively, yet efficiently, look at the broad range of environmental impacts for the proposed BMDS.

First, the existing conditions of the affected environment were characterized for the location where various BMDS activities are proposed to occur. Next, MDA determined the resource areas that could potentially be affected by implementing the proposed BMDS.

Finally, impacts of the BMDS are analyzed in four steps. In Step 1, we identified and characterized life cycle phase activity; in Step 2, we identified activities with no potential for impact and dismissed them from further analysis; in Step 3, we identified similar activities across life cycles phases and combined them for the analysis; in Step 4, we conducted the analysis -- the impact analysis for all remaining activities.

The first three steps were used to characterize and reduce the number of unique life cycle activities, thereby reducing the redundancy in preparing the impact analysis.

The affected environment includes all land, air, water, and space environments where proposed BMDS activities are reasonably foreseeable. The affected environment has been considered in terms of broad ocean area, the atmosphere and nine terrestrial biomes.

A biome is a geographic area with similar environments or ecologies. Climate, geography, geology, distribution of vegetation and wildlife determines the distribution of the biomes. The biomes encompass both U.S. and non-U.S. locations where the BMDS could be located or operated.

The resource areas considered in this analysis were those resources which could potentially be affected by implementing the proposed BMDS.

NEPA analyses generally consider resource areas listed on the screen except for orbital debris. Because missile defense development and test activities included launch and intercepting missiles, space-based communications and other satellites and potential for space-based interceptors, MDA also considered orbital debris and its impact on the Earth. This PEIS discusses all resource areas, provides the methodology for analysis and suggests thresholds of significance to provide the reader with a roadmap for performing future site-specific analyses tiering from the PEIS.

These discussions outline the type of information that would be needed to conduct site-specific analyses to identify the steps necessary to ensure the potential impacts are appropriately considered.

The resource areas highlighted on the slide with the red star require site-specific information for analysis. These resource areas are more effectively addressed in subsequent tiered analysis for specific activities.
Once we decided how to consider the affected environment and resource areas of concern, we used the four-step process I mentioned before to conduct the impact analysis. I will discuss each step in more detail.

In Step 1 of the impact analysis, MDA identified and characterized the activity associated with each BMDS component. Each life cycle phase has activities applied to each component. For example, development can include planning, research, system engineering and site preparation and construction. Testing can include manufacturing, site preparation, construction, transportation, activation and launch activities. Deployment can include manufacture, site prep and construction, transportation, activation, launch operation and maintenance upgrades and training. Finally, decommissioning is demilitarization and disposal.

Once life cycle activities were identified it was determined that some of the activities have no potential for impact. The activities such as planning, budgeting, system engineering and tabletop exercises are generally categorically excluded in various Department of Defense NEPA regulations and are therefore not further analyzed in this PEIS.

Other activities for specific components such as transportation, maintenance and sustainment, and manufacturing are not analyzed in this PEIS because they have been evaluated in previous NEPA analyses and were found to have no significant environmental impact.

The remaining activities were then examined to determine which activities had similar environmental impacts. For example, impacts associated with site preparation and construction in the development phase would be similar to or the same as the impacts from site preparation and construction activities in the deployment phase.

Under Step 3, similar activities occurring in different life cycle phases were identified and considered together to reduce redundancy.

The final step was to determine the impact associated with each remaining activity under the proposed action. The significance of the impact is a function of the nature of the receiving environment and the receptors in the environment. For example, an interceptor launch creates the same emission no matter where it's launched. Whether those emissions cause impact, the significance of those impacts depend on the environment in which they are released. The PEIS analyzed these emissions by component for each resource area and life cycle activity where a potential for impact was identified.

Impacts were distinguished based upon the different operating environments: land, sea, air and space. The analysis also considered specific impacts for individual biomes where activities could occur. The impacts of system integration testing was considered separately from the impact of the individual component testing.

Integration testing involved using multiple components in the same test. To deal effectively with integration tests, MDA looked at two generic system integration flight test scenarios which involved a different number of launches and interceptors. The impact analysis for Alternative 1 considers the use of land, sea and air-based platforms for BMDS weapons.

The analysis includes the use of space-based sensors but not space-based weapons. The analysis was specific for each resource area based on the impact from the activities associated with the BMDS components.

The impact analysis for Alternative 2 includes the use of interceptors from land, sea, air, and space-based platforms for BMDS weapons. The impacts associated with the use of interceptors from land, sea and air platforms would be the same as those discussed for Alternative 1. Therefore, the analysis of Alternative 2 focuses on the impact of using interceptors from space-based platforms.

The fundamental difference between Alternative 1 and 2 is that Alternative 2 includes the analysis for space-based platforms for interceptors.

The cumulative impact of implementing the BMDS was also considered. The cumulative impacts are defined as impacts that result from the incremental impacts of the proposed action when added to other past, present, or reasonably foreseeable future actions. Because this proposed action is worldwide in scope and potential application, only activities similar in scope have been considered for cumulative impact.

Under Alternative 1 worldwide launch programs for commercial and government programs were determined to be similar in scope; therefore, the impact of BMDS launches would be considered cumulatively with the impacts from other worldwide government and commercial launches.

Alternative 2 includes placing defensive interceptors in space, which involves adding additional structures in space for an extended period of time. The International Space Station was determine to be an action that is international in scope that has a purpose of placing structures in space for an extended period of time; therefore, the impacts of the use of space-based weapons platforms were considered cumulatively with the impacts of the International Space Station.

The next few slides provide broad summaries of the impact analysis by the BMDS components and Test Integration for Alternatives 1 and 2, a No Action Alternative and the Cumulative impacts for Alternatives 1 and 2. Please note the results are extremely high level, suitable for this presentation. Additional details have been provided in some of the posters in the back room in the hallway. And, also, the impact analysis may be found in the Executive Summary Impact Tables and in Section 4 of the Draft PEIS.

It's important to note that no environmental showstoppers were found in the Programmatic Environmental Impact Analysis. As the next few slides show, there are potential impacts associated with the various activities needed to implement the BMDS; however, they would be appropriately addressed in subsequent tiered NEPA analyses along with the mitigation actions, as required, to ensure less than significant impacts.

This slide shows the summary of the broad potential for environmental impacts associated with the BMDS weapons activities, as examined, for each resource area for Alternatives 1 and 2. Please note, this is a very high-level depiction of the results of the analysis. And additional details of the weapons analysis can be found in the tables of the Executive Summary and the Draft PEIS. However, one can see from this slide the general activities and resource areas that should be considered in subsequent tiered NEPA analyses.

This slide shows the impact summary for the BMDS sensor components. Note the impacts are the same for Alternatives 1 and 2 and include space-based sensor platforms. This summary also shows how MDA characterization of activities helps to simplify the analysis. For example, the activation of the radars would not impact air quality because the only emissions resulting from radars would be from supporting diesel generators, which are addressed under support assets. However, radars generate electromagnetic radiation which could potentially impact biological resources.

Although C2BMC is the glue that enables the integrated BMDS to function effectively as a system, this component creates little potential for environmental impact.

Impacts associated with support assets are mainly those that would be caused by site-preparation and construction of the infrastructure and by using test assets such as countermeasures and simulants during testing.

Test integration overall has the most potential for impact because it includes the use of several components during increasingly realistic test scenarios. Although this programmatic analysis shows the potential for impact, the existing environment of the post-test location of the specific test activities plan would determine the nature and extent of the impact.

The No Action Alternative would continue the development and testing of individuals weapons, sensors, C2BMC and support assets and would not include integration testing of these components. The environmental impact of the No Action Alternative would be the same as the impact resulting from continued development and testing of the individual missile defense elements. The decision not to deploy a fully integrated BMDS could result in the inability to respond to a ballistic missile attack on the U.S. or its deployed forces, allies or friends in a timely and successful manner.

Further, this alternative would not meet the purpose or the need of the proposed action or the specified direction of the President or the United States Congress.

We examined the impact of the worldwide launches for cumulative impacts. Launches can create cumulative impacts by contributing to global warming and ozone depletion. Central launch emissions that could affect global warming include carbon monoxide and carbon dioxide, which is CO2. Unlike C02, carbon monoxide is not a greenhouse gas; it can contribute indirectly to the greenhouse gas effect. Cumulative impact on global warming of emissions from BMDS launches would be insignificant compared to other industrial sources, such as energy generation.

The BMDS launch emission load of C02 and carbon monoxide would only be 5 percent of the emission loads for worldwide launches. In addition, C02 and carbon monoxide in 10 years of BMDS and worldwide launches combined would account for much less than 1 percent of C02 and carbon monoxide emissions from U.S. industrial sources in a single year.

Chlorine is a primary concern with respect to ozone depletion. Launches are one of the man-made sources of chlorine in the stratosphere. The cumulative impacts of stratospheric ozone depletion from launches would be far below the effect caused by natural and man-made sources. The emission loads of chlorine from both BMDS and other launches worldwide occurring between 2004 and 2014 would account for half of 1 percent of the industrial chlorine load from the U.S. in a single year.

The orbital debris produced by BMDS activities would be generally small in size and consist primarily of launch vehicle hardware, old satellites, and bolts and paint chips. It may also be possible for debris from an intercept to become orbital debris. However, orbital debris produced by BMDS activities would occur in low Earth orbit where debris would gradually drop into successively lower orbits and eventually reenter the atmosphere; therefore, orbital debris from BMDS activities would not pose a long-term hazard to the International Space Station or other orbiting structures.

In addition, collision avoidance measures would further reduce the potential for orbiting debris to damage structures in space such as the International Space Station.

I'd like to reiterate that our impact analysis indicated no showstoppers or expected areas of significant impact. However, many resource areas showed potential for impact indicating these areas need to be considered in subsequent analyzed analysis tiered from the PEIS.

Now, I'd like to turn the meeting back over to Peter who will talk about the administrative process and how we're going to take the public comments.

MR. BONNER: Thank you, Marty. Now that we've looked at the proposed BMDS and the potential impacts of implementation, let's discuss the PEIS schedule.

The Notice of Intent was released April 11 of 2003 in the Federal Register. The MDA released the Draft PEIS in September 2004.

The public comment period, which we're in right now, will continue through November 17, 2004. After that time the MDA will consider all comments received and incorporate appropriate changes into the Final PEIS. A release date for the Final PEIS is estimated between December and January 2004 -- 2005.

After release of the Final PEIS, there will be a 30-day waiting period before the MDA can issue the Record of Decision or ROD. I think that is our last acronym.

There are a number of ways in which you can provide comments on the Draft BMDS PEIS. You can provide your comments orally or in writing. Oral and written comments will be given equal consideration in the Final PEIS. If you would like to make a public statement at tonight's meeting, please sign up at the registration table and fill out a speaker's card during the break.

Each speaker will be given five -- or three minutes to make a statement, as mentioned earlier. Public statements by tonight's speakers will be recorded by a court reporter to ensure that we accurately capture your comments on the Draft PEIS. There is also a toll-free telephone number that you can use to submit comments.

Please refer to the handouts you've got for the toll-free telephone number. Another option is to submit your comments in writing. There are four ways to do that. You may leave your written comments with us if you brought them with you. Second, you can use the comment forms available at the registration table to write down your comments and also leave those with us. You can either turn them in tonight or fax them to us. Third, you can email your comments to MDA at the email address listed on the screen. Finally, you can submit your comments through the PEIS website on an electronic form we have.

Again, to ensure your comments are adequately considered in the Final BMDS PEIS, they must be received no later than November 17.

The information on the screen lists the various ways you can submit comments. Information is also listed on the comment forms on the registration table, the MDA PEIS website, and the handouts near the posters. Please visit the BMDS PEIS website for additional information. The website provides the descriptions of the topic areas we touched on this evening, as well as links pertaining to additional information. The materials handed out tonight are posted on the BMDS PEIS website.

We encourage you to sign up for the hard copies of the Executive Summary of the Final PEIS and the CD-ROM containing the entire document when it becomes available. To do this, please fill out the appropriate forms at the registration table. You can also request a copy of the Executive Summary or CD-ROM of the entire document by sending us an email, again, at the address listed on the screen. The Final PEIS will be also be available in pdf format to download from the website and hard copies will be placed in local libraries. A list of these libraries is available on the website.

Marty, final comments?

MR. DUKE: Again, our role here tonight is to provide you the opportunity to address your concerns firsthand so we can consider those in the preparation of the Final PEIS.

Remember, no decisions on this project will be made tonight. But you -- we do want to make sure you have the opportunity to provide us the comments. Again, please provide comments in the various methods that Peter explained. I think there is a handout with all of that information you can pick up and take with you but we need the comments and request they be submitted no later than November 17th(sic).

Now we are going to take about a 10 to 15-minute break to set up for the public statements period. You can sign up at the registration table if you'd like to make a public comment.

After the public comments period we'll be available back at the poster areas to answer any further questions you may have. Okay.

Thank you.

MR. BONNER: Also, if you didn't sign up when you first came in, even if you are not making a public comment, if you could sign up at the front table.

Thank you.

(Brief recess taken from 7:11 p.m. to 7:26 p.m.)

MR. BONNER: Let's come back together and let's get started.

Can you take your seats, please. I have the list of registered speakers and I'll call each person to the microphone to speak.

Again, please limit your remarks to three minutes.

To help you keep track of time, after about two and a half minutes I'll hold up this very professionally done sign and you'll know you need to wrap up.

If you do have a written version of your comments, we ask you provide that to us so we can accurately keep a record of your statements. When providing your public comments, remember to state your name and your affiliation as clearly as possible so we can pick it up as we record the meeting.

If you don't wish to give an oral statement tonight, please take advantage of the many opportunities we've tried to lay out for you to make other comments.

With that, let's start. Alan Stahler. Is it Stahler or Staler(phonetic)?

ALAN STAHLER: Stahler. My name is Alan Stahler. I live in Nevada City, California. The World Trade Center towers were not taken down --

MR. BONNER: One second. Two, three --

ALAN STAHLER: My name is Alan Stahler. I live in Nevada City, California. The World Trade Center towers were not taken down by ballistic missiles. The USS Cole was not attacked by ballistic missiles. The Federal Building in Oklahoma City was not destroyed by ballistic missiles. Any country knows that we know that they know that we know that any launch of a limited ballistic missile attack, as described in the handout we got today, would be suicidal.

They know that we know that they know we know their country would be dust in an hour of any such attack. The handouts says four-fifths of the tests of the system so far were interceptions. I realize that that depends on what your definition of what "interception" is; but in most of the world, almost only applies in horseshoes. I'd like to know what would be the environmental effect, the environmental impact if the system is deployed but does not work?

What are the immediate effects to the environment in which we live? What are the effects of our environment on how we live on diverting financial resources? The handouts didn't say anything about what this would cost now or in the future. What are the effects on our environment of diverting the intellectual resources that could go to better places? What are the environmental effects of diverting skilled work that could be applied to building schools, libraries, roads, bridges, you name it?

MR. BONNER: Thank you. Miles Everett.

MILES EVERETT: Thank you all for this opportunity. My name is Miles Everett. I'm from Healdsburg, California. I'm involved with the Alliance for Democracy and that is what brings me to these particular concerns.

I, too, am concerned about a broader definition of environment. And one of the things that concerns me a great deal about this present project is that the technical environment for making it work does not seem to be up-to-speed. The Union of Concerned Scientists says that the project that is about to be launched has no assurance of working at all. And Thomas Christy, who is the head of one of the testing agencies of the Pentagon, says he has no assurance that the part of the system about to be deployed would even protect Alaska against a missile from North Korea.

I'm also concerned about the financial environment. Apparently, a hundred billion dollars has been spent thus far. 10 billion more is asked for 2005; another 53 billion for 2004 and 2009. The layered project, I would suggest, is a kind of a cover for a blank check, which will keep us paying for these weapon systems until we're all gone.

We have a huge deficit. We have many demands and yet they want to dig that deficit hole much deeper by this particular project. What about the environment for international relations? What is world opinion to make of this situation where the United States charges ahead because it's rich enough to -- to try to build an umbrella which protects it, at the same time it announces its policies of preemptive war.

We already had one comment from an Iranian general who said, "Well, clearly, if you're going to be dealing with the United States in the future, you have to have nukes or you can't even get their attention."

What about American opinion? The idea that somehow we'll be safer under this umbrella, which will be sold -- you can imagine -- the Whitehouse and the Pentagon will sell this idea right off the face of the earth that now we're going to be safe under this umbrella.

I thought that I heard a number of times from this Administration that 911 changed everything. And it ought to have changed this 21-year-old strategy that goes back to the Cold War before we had a great many of the satellite surveillance systems and so forth that cover the entire globe that make it impossible for anybody to set up without us knowing about it and be able to follow the process.

MR. BONNER: You've got about 30 seconds.

MILES EVERETT: It does not do anything, obviously, to address the great multitude of threats that have been so much talked about since 911. It's simply a huge distraction from our real problems of learning how to live on this globe with all of the people on the globe. And the implications -- finally, the implications of destroying missiles, which presumably would be nuclear armed missiles, destroying them in flight and suggesting that is a worthy desirable objective is a -- that is a very dubious proposition.

They will tell you that the nuclear warhead does not necessarily explode. But certainly the technology that can create this mammoth system can also create a system which would cause a nuclear warhead to explode when and if it's intercepted.

So we have warheads going off around the globe wherever we happen to intercept it. That does not create a very attractive environment for human beings.

MR. BONNER: Robert Alpern.

ROBERT ALPERN: Good evening everyone. Thank you for the opportunity to have citizens' comments.

I think we've said that the environment is much broader than what this statement calls for. The environment is a social and cultural environment that we need to take into consideration as we consider building such a new and costly provocative system.

The National Intelligence Estimate of 2001 for the Bush Administration says, and I quote, An attack on U.S. territories is more likely to be -- we are more likely to be attacked by countries or terrorists by using ships, trucks, airplanes or other means, rather than long-range ballistic missiles.

We're still in the era of the Cold War in thinking about these missiles and this program to create this artificial and flawed umbrella for the people of this country. What are the effects on other countries of this provacative system? It is thought likely that China will increase its production of nuclear weapons to overwhelm this system, which is very easily overwhelmed by decoys and numbers. This system, as we now know it, is meant to ideally knock out a very few incoming missiles, not at all the kind of attack that possibly could occur. It is flawed in that respect.

The Pentagon itself in an analysis called the Ballistic Missile Defense System, a Case Study Against Rushing Forward on a Missile System. The Pentagon itself said that. And yet we're -- we have spent a hundred billion dollars. We're planning to spend 83 billion more over the next ten years and we have nothing to show for it except neglected communities, depleted healthcare systems and actual environmental neglect of the real environments that we all daily live in.

This proposal that we're asked to address tonight does not contain a real No Option Alternative not to build the system, to abandon it. That is what I think most of the people in the United States and the world would affirm.

This system's impact on traditional arms control and disarmament efforts would be profound. We've already vitiated the Anti-Ballistic Missile Treaty under this Administration. We're preparing to resume nuclear weapons testing at the Nevada test site. We're building a whole series of new nuclear weapons, the mini nukes and bunker buzzards.

We're prepared to fight preemptive wars and yet this antiquated system that is going to cost you and I and our fellow Americans the treasures of our society that are already depleted by the Iraq war and other weapons spending, we're asked to do this. And I say we must abandon this program and utilize our resources in more constructive ways and practicing the ways of diplomacy negotiations and building alliances, instead of acting unilaterally, which is what this program does.

Thank you.

MR. BONNER: Karen Blomquist.

KAREN BLOMQUIST: Hi. I'm a nurse and I therefore know the difference between preventive care and just treating the symptoms.

Star Wars just treats the symptoms of aggression. And like most efforts to treat the symptoms, while ignoring the real problem, these efforts will make the problem worse. As an example, taking an aspirin for a headache, which is a symptom of an impending stroke, is not going to help the problem.

Star Wars is an aggressive move that will only foster aggressive feelings and eventually aggressive actions from other countries. Continuing to bully other countries around is not going to win us alliances. It does just the opposite. Most countries, if not all, will end up hating us. And as it fosters this aggressive action, Star Wars will clog up the space over our Earth. The consequences of which we do not fully know.

Like food additives that are now found to cause -- or possibly cause mood disorders and ADD, what might clogging up the space surrounding Earth with satellites and debris do? While we shoot more satellites up into air spewing perchlorate into our atmosphere, how much of our ozone will be left to protect all life from destruction of the sun's rays?

If the satellites break and accidentally misfire or fire on their own, how many satellite or accidental misfires will it take before World War III?

Star Wars is an action of those who do not -- do not live in reality but live in some -- but live in some self-centered devil worshipping dream world of control that will ultimately cause the rest of us who live in a nightmare of terror, while destroying the very Earth upon which we live.

MR. BONNER: Thank you, Karen. MacGregor Eddy.

MACGREGOR EDDY: Hi. I came here from Salinas to speak on this. And in Salinas they're proposing closing all of our public libraries. Why? Because they don't have enough money.

Well, where is the money going? I propose that 1.3 trillion dollars for Star Wars is a good example of where the money is going. Closing all of the public libraries completely in a town that is 66 percent Hispanic American, in a town that produces 80 percent of the lettuce you eat.

Let's take a look at what the program is. And I'll address it environmentally. I have copies of my statements if anybody wants it. Here you go. Here. Pass them around.

Statements from MacGregor Eddy. I'm an advisory board member of the Global Network Against Weapons and Nuclear Power in Space regarding the Programmatic Impact Statement of the PEIS Ballistic Missile System presented October 19th, Sacramento, California.

One, the 515 launches which is far more than the 99 commercial launches that are proposed. By the way, I came here expecting a fairly honest presentation of the PEIS and I was shocked at the scummy lies I heard by people I regard as honest people. It's ridiculous that the -- there is 515 launches proposed for Star Wars. That is five times the amount that would be launched under the programs that are non-Star Wars. And you can look this up for yourself. Don't trust me. Check it out.

The second thing is the PEIS is based on the Star Wars program as proposed -- and here we have a statement. Okay. This statement was made by General Henry Tray Obering. He's the head of the Missile Defense Agency. So this is not a statement from some conspiracy website. This is a statement from the head of the MDA. What did he say when he was speaking at a Homeland Security conference on a missile defense panel on October 13th in Colorado Springs, Colorado? He was asked about the THAAD, which is the Theater High Altitude Defense Missiles that are scheduled to go into production in 2005. He was asked about these.

What did General -- General Henry Tray Obering say about the missiles? He said, quote, These missiles are intended to augment, not replace, the current generation of ground-based midcourse interceptors.

That is what we're talking about here tonight, ground-based midcourse interceptors. In fact, there will be a continued spiraling of the capabilities of missile network with more missiles and additional sites added to the current missiles and expansion of the Theater High Altitude Defense Missiles beyond the initial scheduled 25 missiles. Therefore -- hey, listen. Therefore, the program they're talking about includes far more missiles than the ones they're proposing.

The second thing is the PEIS does not evaluate the environmental impact of No Action Alternative; thus, does not comply to the National Environmental Policy Act.

And three, the PEIS does not address the environmental impact of the response to ballistic missile defense systems by other countries. For example, China is planning to increase the number of missiles they have in direct response to our ballistic missile program. And this PE -- this Environmental Impact Report does not address the effect of testing, deployment and decommissioning of these two missiles in China, which is a direct result of our policy. And this is not included in the Environmental Impact Report.

The report -- since No Action Alternative was not considered seriously in the impact report, I say it is not an impact report at all. Therefore, it has not complied with the legal requirements; therefore, it should be stopped.

Thank you.

MR. BONNER: Thank you. Rod Macdonald.

ROD MACDONALD: I'm Rod Macdonald. I'm a professional wetland scientist. I work with identifying wetland ecosystems, their components, soils, water quality, their functionality. I modify them, restore them, recreate them under occasion, so forth. So I know what I'm talking about. I'm a registered wetland scientist, which means, like a structural engineer, Im educated. But I have a reputation to lose, if I don't get the facts right.

I guess what disturbs me is I read Science Magazine. It comes out 52 times a year. It's uncensored. You'd be surprised of the things you'll see in there. Anyway, there is a lot of discussion about missile systems that comes from the point of view of the National Academy of Science. And, of course, there is a broad range of opinions of scientists, like anyone else. It's sort of a scientific engineer-based discussion.

I want to talk about what an Environmental Impact Statement is supposed to be under the NEPA, National Environmental Quality Act. It's supposed to look at a cradle-to-grave analysis of a project. It's supposed to minimize the impact at every state, in every level, every decision within it.

I really think it's a great thing to take a program like this which has a huge cumulative impact and look at it in a systematic cumulative way. That's what it says it does; but, unfortunately, it's not what it does. It provides a false set of figures upon which to compare what the real impacts would be. Instead of trying to look at where we have to go if we want to deploy the system -- I'm not willing to take a stand about whether I agree the system should or shouldn't be built. I think despite all terrorism, the possibility of a missile launched from a disguised container off of the coast is realistic and we'll never know who put it in that container but we'll need to shoot it down.

But my argument isn't with the waste of money, if it may be an overblown system or its provocative nature; but, instead, it really does not address what is going on. And the reason it doesn't is it provides -- I'll look at perchlorates. Perchlorates are important to amphibians. Amphibians are in a worldwide decrease.

If you look at the report, all the report ever says is "hazardous waste will be handled and dispersed in accordance with appropriate regulations; therefore, no significant hazardous materials and hazardous waste impact will be expected."

They go through and they say this for every single thing. The vegetation and so forth won't be or "we'll do a tiered-site analysis and a certain site will be affected" but it won't. But the truth is over the decade life of the program, the global level of perchlorates may rise. Amphibians skin needs to be moist. They're very sensitive to all industrial chemicals. 70 percent of the species are in decline right now, even in habitats that aren't disturbed.

Why would we care about them? The mosquitos are coming out. We don't have hard figures. We don't have real analysis. We're told this is a half a percent. What they're disguising there is most of the chemicals are residual from former manufacturing processes. And even so, the largest contributor -- as a scientist, I'm simply telling you, the largest contributor actually is the manufacturing, testing, open detonation of old rocket motors and the whole thing.

Just to say there would be no impact -- this is a negative deck. We've all seen negative decks. They go through and check off negative deck. Negative deck. Negative deck. This isn't an honest -- this isn't a scientific discussion. I'm aware of what NEIR is. I've dealt with them for 25 years.

Thanks.

MR. BONNER: Thank you. Jimmy Spearow.

JIMMY SPEAROW: Thank you. The -- the --

UNIDENTIFIED SPEAKER: Take a deep breath, Jimmy.

JIMMY SPEAROW: The PEIS underplays many environmental effects of the BMDS. The Ballistic Missile -- I'm sorry. The Ballistic Missile Defense System PEIS does not address several of my scoping comments to start with and does not adequately address several risks, including exposure to increased levels of toxic pollutants from a dramatic increase of missile launches.

As we know, the -- the perchlorates are used in the self-propellants in the formation of a key thyroid hormone which are critical for growth and development of fetuses and children. The PEIS proposes to allow over thirty-fold higher levels of perchlorate at 200 parts per billion than proposed by the State of California, which is six parts per billion. Thus, many rocket launches will inject chemicals including aluminum oxide, hydrogen chloride and hydrochloric acid directly into the upper atmosphere, thereby depleting the ozone.

The PEIS does not address the direct injection of the chemicals high into the atmosphere. Secondly, the BMDS PEIS underestimates the risk of health and safety of BMDS missiles accidentally shooting down civilian and/or friendly military aircraft.

BMDS has failed to mention the U.S. missile systems have a history of accidentally shooting down aircraft.

Consider the U.S. has seen the Pac-3 missiles, which are -- which are in the PEIS, actually shot down several U.S. and allied jets -- two or three in this case of -- I'm sorry -- in two of the cases of the recent invasion of Iraq. There is also Flight TWA 800. And even though several people saw streaks going up toward it, the people that saw it were never allowed to testify.

The -- the point is that the activation of the BMDS risk accidentally shooting down civilian airliners is not even considered in the BMDS. It's a risk to health and safety. While the BMDS states that warning will be provided to enable time to clear the air space, it's highly doubtful that such time would be allowed in such an emergency.

Also, the PEIS underestimates the effects of space to reach from high altitude midcourse missile intercepts in the destruction of satellites, particularly at high altitude.

Furthermore, while the PEIS considers testing the BMDS on targets of opportunity, no mention is of the space debris resulting from U.S. targets of opportunity or other nations' targets of opportunity. The environmental consequences of mini rocket launches needed to deploy and maintain space-based interceptors has not been adequately considered, nor has its environmental consequences of the fuel. They talk about having all of the -- these -- in other words, in Option 2, they have many different interceptors in space that would have a reduced environmental consequence. But there's no consideration you have to launch all of those missiles in the place to get there.

Also, will the space-based satellites use nuclear power sources? Will any BMDS interceptors use nuclear warheads? This was not clearly defined. This is unsatisfactory. The BMDS does not include a real No Action Alternative. Such an alternative does not include further development and testing and deployment of these weapon systems needs to be considered and included in the PEIS. The PEIS does not consider a No Action Alternative at all. In other words, something that would involve rejoining the UN and -- and many other nations of the world in order to enhance security through treaties and arms control, sovereign approaches; i.e., approaches that provided us with long-term security to date.

Also, the PEIS, has not considered any -- has not considered any radioactive follow-up from interceptive missiles. The effects of war are not excluded for the analysis of NEPA. However, the proposed BMDS action is likely to promote a worldwide weapons of mass destruction arms race and force other nations to prepare a massive retaliation against the U.S., should war ensue.

Since the proposed BMDS is very likely to cause a massive arms race, the environmental consequences of a resulting war with nuclear and other weapons of mass destruction should not be ignored.

The PEIS needs to consider the environmental effects that follow up from interceptive weapons of mass destruction, as well as effects of weapons of mass destruction the BMDS fails to intercept. This needs to be considered relative to a true No Action Alternative.

Thank you.

MR. BONNER: Pallo Deftereos.

PALLO DEFTEREOS: I'm Pallo Deftereos, Chairman of the Sacramento Committee for Nuclear Arms Control. I oppose national missile defense, not primarily because it is a near-term threat to our environment but because it threatens human survival.

My concerns are shared by many senior military officers, Nobel Laureate scientists and diplomats. I've been collecting literature on the nuclear weapons issue for over 20 years. Fred Takikowa of my committee will give you an envelope containing a sample of my collected literature. I gave your agency some of the same articles at last year's hearing.

My combined total of employment with the State and

Federal government was almost 40 years. So I know how government works. My differences are not with the MDA representatives who are here tonight. They are instead with Federal decision-makers at a far higher level than these gentlemen.

Thank you.

MR. BONNER: Thank you. Dan Bacher. Do you want to use the hand-held mic, Dan?

DAN BACHER: Does not matter. Where is that? Yeah.

Hi. I'm Dan Bacher, Central American Action Committee member and long-time environmental and peace activist. And I suggest an Alternative Number 4, which means scrap the entire PEIS and the whole program that they are presenting here.

This is a colossal waste of taxpayers money that could be spent on just about anything else other than this and it would be productive. There is a hundred billion dollars that have been spent and another 83 billion that are planned to be spent over the ten years if this Star Wars goes into effect.

The crazy thing about this is there is no imminent threat of weapons of mass destruction or space weapons at least on Earth. I have three questions that I'd like included in the comment period of the document.

Number 1, are we afraid of the zany folks from

Zetaraticuli from launching ballistic missiles at Washington, D.C.? Are we terrified of the peaceful and highly evolved inhabitants of Europa from launching WMD's at New York? Number 3, are we afraid of the wonderful civilization of the third planet from Orion launching a massive terrorist attack here on us in Sacramento? No. I don't think so. Unless the government isn't telling us something about this.

Who are we protecting ourselves against?

Okay. What I think that -- a better thing than calling this all of the acronyms that have been given out here on this wonderful PowerPoint presentation, I think it could be summed up as "Lost in Space."

The people that came up with the Star Wars technologies whole concept are out of their minds. This is the ultimate corporate welfare project.

You know, I -- I'd like to conclude with the fact that we -- we need to get rid of this whole Star Wars project and the PEIS and everything else and get the weapons contractors off welfare.

And when I've been out demonstrating I get this stuff from people, "Why don't you get a job?" Well, I've had a job for years. You know, I've been employed the whole time. What I'd like to say to the people that are proposing Star Wars and the Missile Defense System is to get a job, weapons contractors.

MR. BONNER: Thank you, Dan. Bill Durston.

BILL DURSTON: Dan is a hard act to follow. Anyway, turning some of the comments that have already been made relating back to the Environmental Impact Report, the Environmental Impact Report has to consider the chain reactions. The report on cutting down old growth Redwoods considers the effect it will have on the spotted owl. The Ballistic Missile Defense program will have effect on a lot more than just spotted owls.

It's not only a likelihood, it's a certainty that other countries will react to us developing a Ballistic Missile Defense System, however flawed it might be. And they will react likely by developing more ballistic missiles to overcome the defense system. I've seen nothing in the environmental report on this system that takes into account how other countries will react.

So the effects of the more missile launches, more rocket fuel contaminates going into the water, more depletion of the ozone are not just those of the Ballistic Missile System being described here. All of the effects of the proliferation of ballistic missiles around the world must also be considered in a serious Environmental Impact Report.

Similarly, with the weaponization of space it has been mentioned that other countries are unlikely to be able to afford similar space-based interceptors. Well, the fact is, the U.S. cannot afford this system either. Nevertheless, it wouldn't take much money to send satellites into space to purposely explode and create space debris that would make the space-based interceptors ineffectual and would also make the communication satellites ineffectual and so on and so forth, basically, sabotage space for military and civilian use.

This should be considered quite seriously in an Environmental Impact Report on this system. I don't see any consideration of that. That would be a very simple way another country could stop the whole system.

You know the alternative. This has been alluded to. The alternative has to be considered. The alternative of land, sea, air and space-based defense systems are being considered. The alternative of a diplomacy-based defense system is not considered. In fact, diplomacy seems to be a -- a foreign concept to the current Administration.

But as we now know, UN weapons inspections work quite well to eliminate weapons of mass destruction. And similar systems could be deployed around the world, as was deployed in Iraq, and eliminated all of the weapons of mass destruction. These might not meet the needs of Congress, the President and the likes of Dick Cheney and those with egregious economic conflicts of interest, as Dan alluded; but they would meet the needs of the American people.

Talk about showstoppers. This Ballistic Missile System is a threat to the survival of all living species on Earth. That is a very definite showstopper.

Thank you.

MR. BONNER: Thank you. Mr. Jaskowski.

HELEN JASKOWSKI: I'm not Mr. Jaskowski.

MR. BONNER: Sorry about that.

HELEN JASKOWSKI: My name is Helen Jaskowski and I live in San Pedro. I have to leave in a few minutes because we have to take a bus back to our campground.

I want to -- and Jonathan Paatrey from the Physicians for Social Responsibility will take up whatever time may be left from mine.

I am responding to the first paragraph here, the need for missile defense. In 1973 I was a Fulbright lecturer at a university in Poland. This was the Cold War. I lived behind the Iron Curtain and was sent back there several times more by the government to do teaching.

Would I have felt safer with this kind of system in place at that time with those threats? No, of course not; neither I, nor the people I lived among in Poland, nor the people I came home to here.

This statements says this thing is needed to protect ourselves, our allies and our friends. Does not name who the allies and friends are. We have fewer and fewer of them as every day passes. And this system will destroy any that are remaining.

MR. BONNER: Dorothy Houston.

DOROTHY HOUSTON: My name is Dorothy. I live in Los Angeles. I'm a citizen and taxpayer. Thanks, Mr. Graham, for having us here.

I'm opposed to the BMDS because the system would create a new arms race. Nuclear states will develop faster, smarter weapons and faster, smarter weapons delivery systems. It's only in videogames that the U.S. could protect itself from nuclear conflagration.

I'm opposed to the BMDS because it would undermine any effort at multi-lateral nuclear weapons disarmament and summarily wipe away any U.S. credibility in encouraging non-nuclear states to stay that way.

I'm opposed to the BMDS because it would result in a vast waste of money that could be spent on pursuing real nuclear security, such as supporting the former Soviet Republic in securing, controlling and decommissioning their nuclear materials. Even the money spent giving the Boy Scouts tours of hardware at Vandenberg Air Force Base could be used by Russian scientists and physicists to help protect us all.

Star Wars is a dangerous, destabilized and expensive fantasy. Spend my tax dollars on something that will protect me, my family and amphibians and the Boy Scouts from ultimate environmental issue nuclear holocaust.

MR. BONNER: Jim Lingburg.

JIM LINGBURG: Thank you. Hi. I'm Jim Lingburg. I'm the Legislative Advocate for the Friends Committee on Legislation in California here in Sacramento. Thank you very much for giving me a few minutes to address you all here today. Excuse me.

Rather than extending the arms race into space is we believe that the only way to reduce the threat of war and violence is by addressing the social and material conditions under which we live, reducing those inequities that make war and terrorism attractive options. We spend twice as much on militarization as the rest of the world combined. Can we honestly say that has made us safer?

We were unable to stop 19 men with boxcutters. Since 1983 we've spent a hundred and thirty billion dollars for missile defense. The Administration wants to spend 10 billion dollars this year. We have a letter from 49 retired military generals. If you go to the Center for -- the Center For Arms Control of Non-proliferation, if you go to their website, there is a letter from 49 retired military generals asking President Bush to not spend this money on missile defense, to divert resources to protecting our ports from weapons of mass destruction that could make it into the country.

They also say U.S. technology already deployed can pinpoint the source of a ballistic missile launch. It is therefore highly unlikely any state would dare to attack the U.S. or allow a terrorist to do so from its territory with a missile armed with a weapon of mass destruction, thereby risking annihilation from a devastating U.S. retaliatory strike.

We would note that militarization consumes 50 percent of our Federal tax dollars and our best scientists. Instead of throwing money down a drain or black hole, imagine what we could do if we had a Marshall Plan for the planet. This is the only way to make the planet safer. We need constructive, not destructive, solutions.

Diplomacy, disarmament and multi-lateralism as opposed to unilateralism is the answer.

Thank you.

MR. BONNER: Darien Delu.

DARIEN DELU: I'm Darien Delu. I'm connected with the Women's International League for Peace and Freedom, the United States section. It's an honor to get to speak to this body because of the other speakers who have come before me, who have covered so many of the critical points that have to be addressed in the Environmental Impact Statement.

We have been presented with a document with 700 pages of inadequate information and sidestepping and general ignoring of the real issues involved. Many of these have been raised already tonight and I'll try not to be too redundant.

The -- NEPA provides for consideration of environmental impacts of the MDA proposals. The MDA PEIS finds only limited environmental consequences for the two proposed alternatives. The so-called No Action Alternative creates a straw dog against which to judge the first two alternatives of the MDA.

The focus of my comments will be two-fold. First, I call for a true No Action Alternative, as have others. For example, or specifically, an alternative that goes beyond the failure to integrate anti-ballistic missile system to an alternative that rejects the individual missile defense elements of a BMD System. Secondly, I point out the unaddressed global environmental impact of an accelerated arms race. Such acceleration, as has been repeatedly pointed out this evening, is entirely predictable as a consequence of the U.S. BMD program.

Because of the devastating impacts -- political, environmental, ecological and psychological, as well as merely environmental -- the impacts of a Ballistic Missile Defense Program of any kind, this PEIS must address a true No Action Alternative. The failure of this PEIS to include such a true No Action Alternative violates the requirements of the NEPA process. The absence of a true No Action Alternative allows the PEIS to construct a false comparison with the other alternatives underplaying the different degrees of environmental damage.

According to the PEIS, the proposed action is needed to protect the U.S. from ballistic missile threats. However, the proposal as -- as a BMDS, a Ballistic Missile Defense System in English, will result in an acceleration of the global arms race.

As others have already pointed out, in the case of China, if the U.S. implements a BMDS, other countries will feel called upon to create or increase their missile-based weapons deployment systems as well as their nuclear armament in order to prevent -- in order to present themselves as credible negotiation parties with the U.S. and protect the survivability of their weapons.

As others have already pointed out, the PEIS fails to address the chilling possibilities and associated impacts of an accelerated arms race and its increased missile testing. We're not even talking about the devastation a war would cause.

And what about nuclear proliferation? The PEIS does not address the many environmental impacts of the entire nuclear cycle connected to nuclear proliferation. The PEIS points out NEPA excludes from consideration the environmental impact of a nuclear war or any acts of war. But as human beings, we cannot exclude that in our considerations.

MR. BONNER: Ellen Schwartz.

ELLEN SCHWARTZ: Good evening. I'm Ellen Schwartz. I'm the Co-chair of the Sacramento branch of the Women's International League for Peace and Freedom. And I thank you for the opportunity to speak here.

We know from Gulf War I and the War on Terror and the test results to date for the components of the BMDS that the surgical precision with which U.S. weapons are guided makes them excellent instruments for destroying embassies, wedding parties and a hotels full of journalists. In other words, you honored military gentlemen have trouble hitting your backsides with both hands. If you're -- there, is no way that a kinetic weapon -- is that what you call it? -- hitting a missile with an arrow is going to be able to actually hit any significant number of incoming alleged threatening missiles. You're going to have to use nukes in order to get a broad enough range of destruction to take out any of these alleged incoming threats from Alpha Centauri.

Are you going to test them? Are you going to talk about them in the PEIS? Are you going to talk about the environmental impact of testing nuclear weapons in the atmosphere? Or are you just going to lie in the PEIS and, you know, get it installed and say later, "Oops, we have to have nuclear warheads"?

The display outside the hall finds uniformly no significant impacts from any of the phases of the BMDS. Emissions will be disbursed by the wind. It's unlikely any animals will get in the way. Of course, no satellite has ever fallen out of orbit and no rocket vehicle has ever blown up on launch so there is no danger of anything ever going wrong.

Even on your own terms without considering the environmental impact of forcing China, Korea, Iran and everybody else in the world to build their own systems to protect themselves from ours, even without considering the possibility that any of these countries including us might use these systems, the BMDS is a disaster waiting to happen. Every weapon built, sited, tested or even decommissioned is a potential disaster.

Your three alternatives assume a program that is going to be implemented whether we do whatever we say here. And the PEIS and this hearing is nothing than a legal formality. You have no true No Action Alternative; only build it together or build it a little bit at a time and don't test it together.

I'm a little offended that all you want to hear about is the environmental impact of this system; whereas the presentation talks about how we'll all be not safe if we don't build it. If the safety of our country from our alleged enemies is on the table, then so is the impact of causing a war.

What you should do in your own terms is to consider a true No Action Alternative, which is an analysis of the relative emissions of greenhouse gasses and space debris and toxic chemicals and radiation caused by either (A), blowing things up or (B), pursuing broader implementations of existing treaties, such as the Nuclear Non-proliferation Treaty and the Anti-Ballistic Missile Treaty, which would not produce any greenhouse gasses, any space debris and would not blind any animal or destroy any life on Earth.

Thank you.

MR. BONNER: Thank you. Marjorie Boehm.

MARJORIE BOEHM: I'm another speaker for the Women's International League.

UNIDENTIFIED SPEAKER: The microphone.

MARJORIE BOEHM: I'm another speaker for the Women's International League and I have the honor of reading the statement that was sent to us by our president, Sandra Silver.

The Women's International League is a 90-year-old-non-governmental organization that has worked tirelessly since its inception to put an end to war. We have supported the development of international institutions and international law and non-violent methods of conflict resolution that together could facilitate the coexistence of diverse nations and peoples on this planet. The MDA Draft PEIS seeks to answer to detrimental environmental effects of three alternative development plans.

We have found the answers disturbingly incomplete. We have also considered all three alternatives presented and have concluded that it would be dangerous and indeed disastrous for the future of our nation to proceed with any of them. It's impossible to comment on all of the details but we will be submitting additional comments.

First, we are convinced that Alternative 2, which includes the development of space-based interceptors, is completely unacceptable. We will submit additional comments on both the issue of debris from experiments with space-based weapons and on the development of laser weapons.

I'm skipping a little but -- and we have extra copies of this report. So we'll be glad to share them with you. We believe Alternative 1, which does not include space-based weapons and Alternative 3, which is unclear on this point, are also unacceptable.

Even from a solely environmental viewpoint, we're concerned about the adverse effects in all of the resource areas discussed in the PEIS, including hazardous waste, legal restraint, decommission, destruction of the ozone layer, global warming and rocket fuel solution.

We also wonder why this expensive and almost certainly unachievable missile defense program has been developed in the first place.

It does not answer to probable threat to our national security in the present or in the coming decade. It will do nothing to prevent terrorist attacks. And now there is no hostile country or group with the capability of firing intercontinental ballistic missiles at the United States.

Missile defense seems rather to be preparation for future confrontation with the only two countries really capable of threatening our current military domination or challenging us with nuclear attack. Neither China nor Russia is currently an enemy but this aggressive program may well push them into organizing allies and forces against our own threat of global and planetary domination.

MR. BONNER: Thank you. Ali Hosseinion.

ALI HOSSEINION: I'm Ali Hosseinion. I am an American Iranian -- I'm an American Iranian and I'm really scared in this country. Because this Environmental Impact Report was really just like a third world country Environmental Impact Report. They made it. They approved it. And four locations in the United States are like this, are gathering to say and voice their opinion. That is really a shame. Hundreds of billions of dollars spending and then only handful are here with no budget to look at it and no time to oppose it.

Shame on me. Thank you.

MR. BONNER: Jeanie Keltner.

JEANIE KELTNER: I'm Jeanie Keltner, a Professor Emeritus of English and editor of the progressive paper here in town.

I'm sad to say I'm speaking with a deep sense of futility today calling for a true No Action Alternative. A deep sense of futility because I don't believe this multi-billion dollar system can be stopped even by the passionate, eloquent informed people in this room who have come here on our own dime and our own time and spent many dimes and many hours working for peace and better ways to reconcile differences than the ones we see presented tonight.

Too much money is going to too powerful entities to be stopped by any citizen's group I'm sad to say. But what has really struck me as we speak today is that we're really speaking such different languages. How I wish that we could communicate with each other because the PowerPoint presentation was so far, so different from the words that are being spoken here today in the room.

And how I believe that we are here all working for what we conceive of as the greater good. And it is so tragic that as we face the enormous challenge of global warming and peak oil and ozone depletion that we're going to waste the human capital and the financial capital on this poisonous boondoggle that doesn't even work.

You know, we in Sacramento are surrounded by the toxic mess the Department of Defense and its contractors have left behind. And the U.S. Government has even stopped cleaning up. The corporations long ago stopped cleaning up. The U.S. Government has stopped cleaning up. And I am certain that mothers have sat by the bedside of dying children because of the chemicals those children have ingested, the toxic cocktails. And that is not worth anything.

So I just wish it could be different.

MR. BONNER: Jonathan Paatrey. Jonathan, you've got two extra minutes given by Ms. Jaskowski.

JONATHAN PAATREY: First, I would like to --

MR. BONNER: Can you turn it on?

JONATHAN PAATREY: Is it off? All right. Thank you.

First, I'd like to thank you, Colonel Graham and Mr. Bonner and Ms. Shaver and Mr. Duke for coming out here and -- and presenting your material and then hearing what the public has to share.

My comments are, I hope, going to be very specific and germane to the PEIS. One of the things I want to point out is that the -- our organization I represent is the Physicians for Social Responsibility in Los Angeles. We have about 5,000 members in Southern california. And we have actually worked with Lenny Segal and I believe you've heard his oral testimony as well as written documents regarding the perchlorate and the lack of information that is present in the PEIS.

Most notably, I would like to point out that the timeline of potentially releasing the final document but two weeks after the oral testimony, as well as what anyone else could offer in writing and -- or even six weeks later into -- in the end of January of '05 strikes me that you very well may not take too seriously what we have to say.

I would strongly suggest that you factor a time when you can actually take into account the things that the public are suggesting.

I would like to offer some language for other alternatives which would entail a great deal of work on your part in the MDA office but I think it is absolutely necessary.

You're clearly aware of the political decisions that led to the formation of missile defenses, in general, coming out of a decision politically that deterrents were no longer sufficient. I feel that this Administration in making that determination is mistaken. But in addition to that, we haven't tethered out the differences in this document between strategic defense defenses against long-range missiles and those of an -- in a theater defenses. And all previous administrations had kept these two missile defenses segregated. And this Administration has blended the two. And I think to the detriment because theater defenses have actually a promising future, unlike strategic defenses.

Theater defenses can protect troops in the field. Theater defenses can protect cities from attack, overseas especially. And they have actually enjoyed some limited success both in the field of testing as well as in the battlefield and also enjoys bipartisan support.

There is actually a realistic threat. There are short-range and medium-range missiles that could actually be fired in hostility at American targets or those allies; unlike the strategic long-range missiles which do not really have a basis in reality.

And in addition, theater defenses have a realistic success because the boost phase of a missile is relatively slow and even the descent of a short-range, medium-range missile is much slower than that of the strategic missile, which could be traveling at 10 kilometers per second, which makes it very unlikely to hit.

The alternative, it may be politically impossible for you to do this, but I think you should try to have another alternative which would simply be to keep the -- this is probably the presidential candidate John Kerry's position on these matters -- would be to move ahead on theater defenses but to maintain the strategic weapons that the missile defense is -- against long-range missiles to be held in research and development stage. And -- and that would be my suggestion for a true alternative.

The other thing I want to bring up is in regards to in the PEIS there is some statements in the effect that some of the space-based interceptors would be placed in geosynchronous orbit, which I believe is some 24,000 kilometers from Earth. To actually get a weapon from 24,000 kilometers out to what would be a low-Earth orbit or even a lower trajectory of a missile within 20 minutes or half hour and do so accurately and to hit the missile is fantasy. And therefore I think the PEIS mischaracterizes any weapon that would be placed in geosynchronous orbit as being an anti-missile weapon. It should simply not be listed as a possibility. That would be -- well, you would be deploying an ASAT -- an anti-satellite weapon. And you should go through the process of actually fielding that before the public and have -- and take your hits for that if, indeed, you're doing that.

The same with the Airborne Laser. There is a very good probability that an Airborne Laser would never work in shooting down a missile in the boost phase and all tests indicate that. But it could be highly effective in a directed energy targeting on Earth for terrestrial targets. And you should be honest about what that weapon might also be used for. It would be helpful to actually not mask the true purposes of some of these weapons.

I believe there needs to be more hearings. The PEIS is insufficient in dealing with cumulative effects, especially in Southern California, as so many of our local contractors are working on the weapons systems. We're bearing the brunt of our environmental impacts of the laser weapon development and many of the rocket launches and the rockets that are being assembled for those launches to launch these 515 launches that may take place over the next 10 years.

I also suggest that you get testimony from the National Recognizance Office, if you have not done so. I'm sure there are considerable concerns about military recognizance assets being false -- being harmed by space debris and --

MR. BONNER: Finish up.

JONATHAN PAATREY: Yes. Last but not least, I would also suggest that you conduct a space debris analysis, as you have sited in the PEIS, that there may be intercepts as high a 400 kilometers. That either you do testing at 400 kilometers, which is ill-advised because of the debris problem, but how would you know if the weapons work unless you conduct the tests? Or you should actually assume that the weapons won't work because you cannot conduct the tests at 400 kilometers above.

Thank you very much.

MR. BONNER: Michael Monasky.

MICHAEL MONASKY: So this is a show, as we have showstoppers. I'm confused. Well, actually, I -- I was confused by the glossary. It's five pages long and single spaced. And I haven't started yet.

The New York Times magazine two days ago asked Wlodzimierz Cimoszewicz, Poland's Foreign Minister to the

United States about Polish defense minister, Jerzy Szmajdzinski who recently announced plans to pull all 2500 Polish troops from Iraq next year. Cimoszewicz answered, "It's not true. Our minister of defense mentioned that we would like to end our mission at the end of 2005 but that is not the official position of the government." But when the Times asked Cimoszewics if he had met with the families of the 13 Polish soldiers who died in Iraq, Foreign Minister had replied, "No. I have not." The Polish government was officially represented by the minister of defense.

Which begs the question: Has the defense minister been demoted to coroner/chaplain or how many dead Poles does it take to end the U.S. war in Iraq? Furthermore, Polish Foreign Minister Cimoszewics confirmed the Times figure that 70 percent of Polish people oppose the U.S. war in Iraq.

What are we afraid of? The Polish public opinion? The so-called insurgent Iraqis taking up arms against U.S. corporate mercenaries like Cal F. Brown and Root and Halliburton? Ari Fleischer's so-called Operation Iraqi Liberation? That was the original term for this attack, O-I-L. Serves to liberate the resources under those inconvenient civilians impeding corporate access.

The Cold War is over but this fact does not deter the

Bush crime syndicate from heating things up. There is no peace dividend as it and any surplus saved in the 90's has been spent since the start of the millennium. The world is a decidedly more dangerous place because the Pentagon has run amuck spending half of our income taxes while mortgaging debt so far as our great grandchildren so it can build so-called "kill vehicles."

Meanwhile, the Pentagon mocks our democracy. It plans, tests, builds and imposes terrible weapons of mass destruction. The Pentagon goes through the motions pretending concern about the environment, holding meetings in far away places like Alaska, Hawaii, where 61 people appear; 15 speak forth; and 7 provide written comments representing 280 million U.S. citizens.

Even the congressional "Millionaire Boys Club" does not feign that kind of representative democracy.

The Pentagon does not even care about the speaking and writing concerned citizens. Its Notice of Intent in the Federal Register states the weapons system in question will be used, quote, To defend the forces and territories of the U.S. allies and friends against all classes of ballistic missiles threats in all phases of flights. Which, I suppose, makes the people of the U.S. potential collateral damage.

I imagine the purveyors of the Pentagon portfolio are like the characters in the Beatle’s satirical song entitled, "Piggies": Lying, conniving, consuming everything in sight. They never see their evil behavior inflict pain and suffering upon other beings and upon the world. And to get their attention and change their behavior, what they need is a damn good whacking. Of course, the song is referring to spanking but the Pentagon and spenders can measure its whacking in body counts.

Here in California we analyze public projects and hold them to the test of the California Environmental Quality Act of 1970. When the Pentagon wanted to build a biological nuclear and chemical testing, manufacturing and storage facility at McClellan, UC Davis and Rancho Saco, the community successfully challenged and stopped the bid even before it could be tested by CEQA. The community saw the proverbial writing on the wall. The plan was analyzed. We found it wanting.

MR. BONNER: 30 seconds.

MICHAEL MONASKY: It amazes me -- I have to make a comment, since you've decided to interrupt me here. I speak before city councils and boards of supervisors and they sit -- they sit up until 1:00 in the morning listening to people like me talk who prepare comments. I think it's extremely rude for you to stand there and time us when we've prepared our comments and we've thought this through.

You might have come from Fairfax, Virginia but you know, I'm sorry if I cut into your tee time or anything. So I'm going to finish. I have two more pages. But I'd appreciate it if you would stop interrupting my comments and those others who have worked all day, like I did, and came here.

MR. BONNER: You're cutting in to the time of the others. There are ten other speakers.

MICHAEL MONASKY: No. No. We're cutting into your time. This is not the time of others. This is the others. We are -- are the others. We are the people and we're speaking here, sir. Let me finish without interruption.

Did I get to the spanking?

The body counts. Yes. Thank you. And I talked about the California Environmental Quality Act, of which I think is great -- well, I think it's good to have an Environmental Quality Act. It's weak but nonetheless it's there. Let me pick up where I was at. Here.

Anyway, the community saw the writing on the wall. The plan was analyzed and it was dropped but this -- the same is true of defending BM's. This PEIS reads like a negative declaration.

In case you have not heard, the Cold War is over. This is reason enough for the No Project Alternative CEQA style. It's time for demilitarizing the Pentagon. I'm partial to Helen Caldecott's suggestion that it be converted back to its original design as a hospital.

I recommend we just skip the testing, manufacture and storage steps for these weapons systems that are referred to in this EIS and cut to the quick and decommission them all. Take out their fuses and timers and igniters and hire clever chemists to convert their horrible toxins to safe use.

Further, since adults seem to muck things up in the State Department, we should pay and support a coterie of children as ambassadors of peace and reconciliation to all countries on Earth. No more foreign aide. No more foreign debt. The kids will figure it out from there. The spanking should continue upon Pentagon contractors until they change their behaviors. Meanwhile, rescind all Pentagon weapons contracts. No more bucks for bombs. The reason why the Pentagon thinks it needs these weapons systems is because the United States of America has neither learned how not to over consume the planet's resources or stop exploiting human labor. We must become men and women of conscience who believe in and practice trust and respect for one another.

The No Project Alternative, as in CEQA spares us and our planet's ecology while allowing our energies to be spent on truly productive human endeavors.

No showstoppers, eh? So this is a show. This PEIS is a non-responsive negative declaration.

Thank you very much for your time.

MR. BONNER: Just to clarify, we're willing to stay here as long as you like.

UNIDENTIFIED SPEAKER: We came here on our own time. We payed our own fare to get here. I came from far away. Many came from far away. You are paid to be here. You got your fair pay to be here. You're put up by the government. We are not. Therefore, I think you should listen to us.

MR. BONNER: That is the purpose of this meeting. The reason for setting the time limits is not to restrict comments. The reason for setting the time is to respect your time and the time we have here. We're willing to spend as much time as you want to get your comments out. That is the reason behind the three minutes.

Leonard Fisher.

LEONARD FISHER: I'm Dr. Leonard Fisher, retired faculty member of medicine at UCLA and volunteer physician at the LA Free Clinic and a member of Physicians for Social Responsibility. I'm one of the groups that drove through the rainstorm this morning to get up here so we could express our concerns about what is going on.

I'm going to limit it to the problems related to ground-based interceptors. The most tested but still woefully ill-performing technology to develop to thwart long-range ballistic missile attack is out of the midcourse interceptor. This weapons system is designed to intercept enemy missiles in space from ground platforms in Fort Greely, Alaska, Vandenberg Air Force Base in Southern California. The chemicals used in solid rocket propellant that would be used to launch the intercept missiles, the test missiles and especially the booster rockets that place related detection communication satellites in space would all use ammonium perchlorates as the oxidizing agent in the rocket fuel. The fuel would also contain highly toxic hydrazine compounds and nitrogen oxide.

In the news of late, the developmental toxin perchlorate has been found in many of our nation's drinking water sources. This chemical inhibits thyroid hormone creation and release. In low doses, perchlorate is presumed to decrease the intelligence potential of a developing fetus. In cases of more severe exposure, can cause frank retardation.

Additionally, once combusted and exposed to air moisture, perchlorates create hydrochloric acid, more commonly known as "acid rain." Further, rocket launches deliver hydrochloric acid in the upper atmosphere, which, in turn, chemically interact with the protective ozone layer. It is therefore fair to assume that an increase in rocket launches may correspondingly bring about additional cases of skin cancer.

Rocket fuel needs to be continually replenished. The disposal of solid rocket propellant through washing out, propelling or open burning, open detonation are some of the major sources of perchlorate contamination across the country.

None of these perchlorate-related issues are adequately addressed in the PEIS. I'd like to add one further comment regarding the meetings that have been held. Southern California is bearing a disproportionate impact of missile defense development and its effects on the environment. The midcourse interceptor is being tested and deployed at Vandenberg Air Force Base in Santa Barbara County.

The Airborne Laser is being tested at Edwards Air Force Base in Los Angeles County. The space-based and Airborne Lasers are being developed by Northrop Grumman in the South Bay and San Juan Capistrano. Lockheed Martin, Boeing and Raytheon are deeply involved in developing the midcourse interceptors and other systems.

At a minimum, there should be additional hearings near the areas most effected by missile defense developing. There should also be an environmental health evaluation concerning cumulative impacts for military production, testing and deployment of missile defense systems compounded on top of past military use.

This evaluation should be done with an eye on disproportionate impacts on low-income communities of color.

Thank you.

MR. BONNER: Philip Coyle.

PHILIP COYLE: I'm Philip Coyle. I'm also from Los Angeles. The environmental process --

MR. BONNER: Raise the mic.

PHILIP COYLE: Is this better? I'm Philip Coyle. I'm also from Los Angeles. The environmental process described in this PEIS is not believable or trustworthy because the statement read by Mr. Duke tonight is already not being followed. Mr. Duke said if testing failed to show the system worked, the system would not go forward. But as we know, the system is already being deployed even though it has no demonstrative capability to work under realistic conditions.

To take a different example, the PEIS says and, I quote, The Airborne Laser is currently the only -- emphasize only -- proposed BMDS element with a weapon using an air platform, closed quotes. However, the PEIS does not discuss another proposed BMDS element that would use air platforms; namely, interceptors fired from aircraft.

With respect to the No Action Alternative already mentioned by others, it does not describe a scenario where no action is taken. Rather, it describes a system where the Missile Defense Agency would continue existing development and deployment unabated under the No Action Alternative. And I quote the PEIS here, Individual systems would continue to be tested but would not be subjected to system integration tests, closed quotes.

This is hardly no action and allows for indeterminate missile defense program since -- to go back to quoting the PEIS, There are currently no final fixed architectures and no set operational requirements for the proposed BMDS, closed quotes.

Thus, even if MDA agreed to the No Action Alternative, it would not find its actions constrained for the foreseeable future.

And, finally, with respect to space-based interceptors, the PEIS is silent about the fact that missile defense would, for the first time, weaponize space. While space is certainly militarized, it's not yet weaponized; that is, with attack weapons in space and with the chain reaction of a new arms race in space.

The PEIS does not adequately address the environmental impacts of the consequences of placing strike weapons in space.

Thank you.

MR. BONNER: Lara Morrison.

LARA MORRISON: I'm here from Los Angeles and my background is in bioethics and environmental science. And I feel like the PEIS provides an inadequate assessment of the environmental impacts. It does not allow the reader to compare the magnitude of the potential impacts or the degree of risks involved with the alternatives and with the elements of testing, deployment or not acting.

The proposed system will promote a false sense of security while preempting the use of resources to address real threats, global warming and peak oil.

According to the report on winning the oil end game from the Rocky Mountain Institute and the Pentagon, the U.S. could eliminate our dependance on oil by investing a hundred and eighty billion over ten years.

Dennis Hayes advocates investing 30 billion in implementing solar power over five years as a way of addressing energy problems and reducing the chances of global warming.

These two proposals would greatly improve our security and the health of the planet for less money than is planned for the Ballistic Missile Defense System, which is between 800 and 1200 billion dollars over 15 years.

Also, this impact assessment does not address the potential threats of these weapons falling into the hands of terrorists. And I think that that is really a significant issue. If we don't develop, they cannot fall into the hands of terrorists. If we do develop them, they can. And particularly since the scope of this project is to have different elements deployed throughout the world, and we can't be on top of every local deployment area all of the time, it greatly increases the chance that something like that could happen.

Thank you.

MR. BONNER: Stephen Gonzalez.

STEPHEN GONZALEZ: How you all doing? As you said, my name is Stephen Gonzalez. I'm a resident of planet Earth. I think that is really about all that needs to be said about where I live.

As the subject matter of the defense system covers the whole planet, as is implied by the neat charts and graphs, it does not -- that is kind of a given -- what I find amazing is that the biggest issue is that they've seen the need to integrate a system against a localized threat. Yet the threats to the implementation of the system are not taken holistically; i.e., well, we'll worry about a site-by-site assessment of the environmental impact threat. If you're going to impact the water in one place, it's going to impact the water somewhere else, too. Shouldn't we be tying the threats to the system showstoppers -- which I still don't know what they are? What would -- I -- I'd like to know what would have given these people a red flag to say maybe we shouldn't do this? It's not the depletion of the environment or public health or pissing people off around the world. Those aren't showstoppers. I'm scared to know what the showstoppers are to them. Must be pretty major, like the whole atmosphere lighting on fire. Is that a showstopper?

You know, I mean, laughter is good. You know, I wish I -- it was that funny actually. I have just -- I want to bring to the attention of everyone here that it's good we're here but we need to talk to other people. Someone brought up the issue of communication. We're not talking about the same issues of defense. What is a defense to us? What is a threat to our safety? I'm a lot more concerned right now about dying of asthma than I am of Osama Bin laden. I can feel my lungs collapsing every day. I can smell it in my water. I can't see the mountains. And that was not brought by a terrorist. None of those effects were brought about by terrorists or weapons of mass destruction.

You know, these -- the very process by which we're protecting ourselves are creating the greatest threats to our security. At some point that has to be evaluated. This whole system is really about a very specific threat from a very specific place. This is about choosing a style of conflict, choosing a path of conflict that they've decided is the best way they can win of all of the scenarios of direct conflict engagement or technological engagement. They've decided this is the best way.

You know, I -- I'd like to think there isn't a conflict that is predetermined. I would like to think there is still some hope for diplomacy and such that they've got it planned out we're going to eventually fight somebody. I'll leave you to wonder who.

Don't be afraid to talk to people.

MR. BONNER: Stella Levy.

STELLA LEVY: Thank you to everyone who has spoken so far. I think it's been -- I have learned so much and I feel like I really understand a lot more than I did when I came in. There is not very much really that I can add to a lot of the things that have been said because I don't have the particular expertise.

I'm a local attorney concerned with human rights and peace. And so one thing I thought I might address is something that was alluded to by several of the speakers and that has to do with the process we're involved in here.

As an attorney, that is something we're always concerned about is process. At first when I first heard about the hearing and when I came here and saw all of the nice exhibits you had put up, my first impulse was this is really cool -- you know, this is really nice and how nice we've all been invited. But now I don't think so anymore because I'm noticing that there were only four locations at all where public testimony has been invited: Virginia, Sacramento, California, Hawaii and Alaska. That seems to me to be not nearly enough public input. That point has already been made.

I would like to talk about Exhibit ES-3, which is part of the Executive Summary. If you want to go along with me, that exhibit shows the effected environment. This is about environment that we're talking about here today. I looked at that to see what the affected environment was. All of the environment that can be affected is divided into nine biomes, as well a broad ocean area and the atmosphere. I went through that and I saw the following. I saw that we're talking about the

Arctic regions, North Atlantic Ocean, Pacific Ocean, Alaska, Canada and Greenland. Then some more Arctic regions and also Alaska, deciduous forest and Eastern and North Western U.S. and Europe, Chaparral. That is California Coast, Mediterranean from the Alps to the Sahara Desert, from the Atlantic Ocean to the Caspian Sea. This is a lot of area here. And these are areas that are labeled as "affected areas." Oh, the Grasslands. That is the whole prairie of the Midwest. The desert. Oh, the arid Southwest. New Mexico, Arizona, Utah and the Rocky Mountains, as well as the Alps, Pacific Equatorial Islands, which I don't know. Maybe that is why we're going to be in Hawaii. Northern -- you've got to turn the page. Northern Australia. And then how about the broad ocean area. That has no particular latitudinal range and that's the Pacific, Atlantic and Indian Ocean. And then the really big one, the atmosphere, which is the atmosphere which envelops the entire earth.

That looks to me like a global environmental impact. And it seems to me only fair and some kind of rule that I think is codified in lots of different places that the people that are effected by legislation and -- and programs get to talk about it, get to respond.

Well, that is going to be a lot more than the people in the U.S. Even if you say four hearings is enough in the U.S. --

UNIDENTIFIED SPEAKER: Who said that?

STELLA LEVY: Who said it? Nobody. I did not say it. Even if you do, this is a global environmental impact, this Star Wars Program. And, therefore, I'm not impressed with the hearing anymore. I think four is completely minimal. And so I would like to take the remainder of the time, if you would allow me, to make some suggestions of things that maybe other people might want to add, things that we might be able to do and do a little organizing here; which is, first of all, I think it would be entirely appropriate if you -- anybody who knows anyone and has connections, friends on legislation, which I'm a big supporter, lawsuits -- I think some lawsuits are called for for the reasons that were explained, which is the Environmental Impact Report is really inadequate and does not -- does not meet basic legal requirements.

I think that would be a very good thing to do. You should get ready for that and -- Colonel -- and another thing too is there are a number of people here representing different organizations, Physicians for Social Responsibility, FCL has -- there is also Friends Committee on National Legislation, different groups and so forth. Different groups. I think really we can get the word out through our emails and so forth about this.

And I'm also concerned about contacts in Europe for those like WILPF, for instance, which is an international organization or any international organization, Greenpeace, whatever, that you belong to because I think that people in Europe, Australia and so forth have a right to know about this and to have the same information that we have. And people may have other ideas.

Now, just a little personal note here. My son lives in Southern Switzerland in the Canton of Tacino. He married a woman who is teaching. I'm going to let them know. I saw the Alps are in here. They're in the southern Alps. And I know that when I've gone to visit them, I can tell you those "peace" flags are hanging all over the place. People there really care about peace. They were part of a demonstration in Milan that was humongous. And I think there would be a lot of concern and there should be a lot of concern.

I really think it's unfair to put a Star Wars system into place and not allow people who will be affected to weigh in on that matter.

And I guess my final suggestion would be to vote for change of Administration.

MR. BONNER: Byron Diel.

BYRON DIEL: I'm Byron Diel. I'm a paramedic and music activist. I'm representing Peace Fresno and the band, Superfluid Helium 3. I'm going to address my comments given the possibility, however unlikely, that the system would actually work and that it's not just a big pork barrel corporate welfare project. Let's leave that large probability temporarily aside.

As the Bush doctrine of pre-emptive war required a concrete demonstration -- case-in-point being the invasion of Iraq -- the breaking of the ABM Treaty and the consequential bringing of the real war into the theater of space also requires a concrete example of which I believe Alternative 2 to be the -- the prototype.

And while I'm not generally a betting man, I would speculate that Alternative 2 is a foregone conclusion and that we're currently engaged in a process of a pseudo-imitation democracy and pacification of the public.

Alternative 2, I believe, to be a Trojan horse of sorts, given the facts the openly stated intentions of the authors of the project for the New American Century work and the Vision for 2020 and other similar documents are to create full spectrum dominance; first, by negating the threat of deterrence and increasing the perceived virility of our own nuclear arsenal by illuminating the threats of being shot back at.

Then to move on by actually creating space-based offensive weaponry and then to deny access to space for other nations. The threshold being crossed by Option 2 is a veritable Pandora's Box, moving the militarization of space from the purely informational level to actual weaponization.

And the true environmental impact of such a threshold of crossing, I believe, must be examined on a multi-generational basis, given the dangerous president being set.

That is it.

MR. BONNER: Michael Comer.

MICHAEL COMER: I'd like to use this one if I could. Well, I apologize for what could be considered inappropriate attire. I came straight from work.

My name is Michael Comer. I live in Carmichael. I'm -- in the interest of full disclosure I am a member of the Sacramento Area Peace Action but I'm not here speaking as an official representative of that body.

First of all, I'd like to point out that there is a serious misnaming of this project, as far as it being missile defense. Missile defense is actually the linchpin of an offensive first strike capability.

I find it curious that George Bush has ordered the deployment of this system without comprehensive testing. Perhaps the reason is that the system would not likely pass that testing. I think if you talk about the missile base system, it's really helpful if you have -- what do you call it? -- a transponder or some kind of a beacon in the target you're trying to hit.

So in all likelihood, the missile-based system will fail or at least be considered to be inoperative, which means it would be required to move on to the next phase, which I heard referred to -- basically the character of that next phase would be a satellite network surrounding the Earth. These satellites would be a base for laser weaponry. It has to be considered what would be the power source that could power a laser that could be strong enough to take out a missile or a land-based target. That would be nuclear power.

So if you want to consider environmental impact, we're going to have launches of missiles with nuclear materials aboard. If those missiles fail, we'll have nuclear material raining back on us. If a satellite is successfully launched and it falls out of orbit, it will be bringing back to Earth nuclear materials. I have not heard any of these issues addressed in the Environmental Impact Report.

I actually -- I think I pretty much have no more to say than that.

Thank you very much.

MR. BONNER: Winnie Detwieler.

WINNIE DETWIELER: My name is Winnie Detwieler. I'm here on behalf of Sacramento Area Peace Action and our 4,000 plus supporters, both to comment -- both to comment on the PEIS and to register a complaint with the manner --

MR. BONNER: Let me turn this off. I can get the other one for you.

WINNIE DETWIELER: Okay. I'm here on behalf of Sacramento Area Peace Action and our 4,000 plus supporters here, both to comment on the PEIS and register a complaint in which the manner in which the hearing has been scheduled.

There's been no widespread publicity in California that we're aware of regarding this hearing today in Sacramento. Is this some sort of the stealth strategy to limit public input on such critical issues. The question is: Can the Draft PEIS be legitimate if there is not adequate notice of the document in the hearings on this matter?

What is most disturbing, however, is that the current Administration is forging ahead with components of the first two interceptors for the BMDS, making a mockery of these hearings. It's even more perplexing that the interceptors were just installed and had not been tested in the system. The tests have been continually postponed and the Pentagon's Chief Weapon Evaluator has said the interceptors may only be capable of hitting their target about 20 percent of the time.

Why is our government spending billions of dollars in risking the beginning of a nuclear arms race on a so-called missile shield with such an abysmal record?

The greatest danger we face is not some intercontinental ballistic missile carrying nuclear warheads to our shores; but are reigniting nuclear arms race and motivating countries that fear us to attempt illegal acquisitions of nuclear weapons. They see the technology for our Missile Defense System can also be used offensively against them. Their defense against our military superiority would be to either produce many nuclear ballistic missiles to overwhelm our 20 percent system or to use secret delivery system weapons smuggled into our country or delivered by short-range missiles launched just off shore.

Forging ahead with the missile defense system will create terrible consequences from pollution from rocket launches, space debris and accidents within the system or involving civilians.

Other groups are scheduled to testify more comprehensively on this environmental hazard. But I'm emphasizing here all people on Earth, not just Americans, face grave environmental threats from this drive to dominate the world by dominating space.

The environmental pollution may kill us slowly if we don't do it quickly with a nuclear war. But the greatest environmental impact will be to make the entire planet more dangerous to all forms of life and we Americans more vulnerable and not safer.

Most Americans consider nuclear war unthinkable; but apparently our leaders in Congress do not. It is astounding to see the turn around on proliferation and new nuclear weapons in this Administration.

Will threatening other nations encourage them to cooperate with a non-proliferation treaty? Will the U.S. violations of the treaty persuade other nations to embrace non-proliferation? We think not.

Similarly, the abrogation of the Anti-Ballistic Missile Treaty last year by this Administration in order to pursue this fantasy missile shield will not promote international cooperation on disarmament.

We can only conclude that this rush to further develop and deploy this ill-conceived missile defense shield is driven by ideology and politics and fueled by the greed for profits from this costly boondoggle. That is what it is, a boondoggle.

The leading scientists and Nobel Prize Laureates have condemned this as irrevocable and dangerous to global security. But this Administration rushes headlong into a hasty deployment. The term coined to characterize this drive is a "rush to failure."

In conclusion, we at Sacramento Area Peace Action condemn the Alternatives 1 and 2 with extreme threat proposed on our nation and the world. We would support the No Action Alternative if there had been a legitimate attempt at researching and weighing a true alternative of no action. Such a proposal should have encompassed a suspension of research and development, no testing and no initial deployment. It should have evaluated the cost effectiveness of vigorous pursuit of international cooperation on nuclear disarmament.

As it stands, the No Action Alternative does not meet the requirements of the National Environmental Policy Act. For this reason, we consider the Draft PEIS inadequate and insufficient for proceeding with the BMDS.

MR. BONNER: Is Rick Thomas still here?

RICK THOMAS: Yeah. Good evening, sir. Good evening ma'am. Evening all. I drove up from Fullerton, Southern California through a blizzard coming from Reno. Long story. And I've come to make some comments and I've come to ask a few questions.

I'd like to endorse most of the things I've heard here; not all, but most. I work as an addiction counselor. I'm a Veteran. I don't -- I don't get to work with what you would calling a fun bunch of folks sometimes. But one thing I have found is that when I'm angry or when they're angry, people don't hear. I believe there is a lot of stuff here to be angry about.

One of the things I'd like to say is that one of the things that leads to addiction is family disfunction. And family disfunction often takes place with very good intentions. I'm sure these gentlemen who came here tonight to listen to us have good intentions.

Somebody asked earlier, "Where are the people?" I would guess that a lot of them are either at home unwinding from a ten-hour day, trying to make ends meet. Or they're at work at their second job in order to help the kids gets clothes so they can go to school. Yeah, I'd like to say we need more meetings about this. I'd love to see more people involved in this.

First point, addiction counselors work with overflow emotions. We can laugh or we can cry. Those are the overflow emotions. It is easy, I think, sometimes to laugh at the silliness of some of the stuff. Yeah, if we spend another 250 trillion dollars over the next decade we'll really be safe. How silly is that?

I think we can give checks to every -- everybody in the Middle East and be much safer with that amount of money myself. Everett Dirksen -- Everett Dirksen, he had a line that said, "A million here, a million there. Pretty soon you're talking about real money."

The thing I'd like to say about that is that if this money was used for pure research, that would be fine with me. But what I see happening here is that this money goes towards an in-process research, which we've already heard from a lot a folks more articulate than I -- a Nobel Laureates, scientists, retired people -- saying this isn't going to work in the long run.

I'd also back up a point made earlier about geosynchronous orbit. I was involved throughout the 80's with a thing called High Frontier. Former Princeton professor, Gerard K. O'Neill, he said that if we would use this money that we bandy about so much like we used with NASA, the money that the government put into the NASA program throughout the 60's and 70's, created technologies and investments in the private sector $7 for every $1 invested at the Federal Government level.

I don't see how this program could create this in the private investments. I think if we talked about putting space stations up like Gerard K. O'Neill talked about that would be a much better way to get something going up there.

Lastly, a reporter once asked Mohamed Ghandi what he thought of Western Civilization. His answer was, "I think it's a great idea." And I think it's a great idea, too. And I think if we can maybe reach across the aisle a little bit and get down to some of the more human things we're both looking for, maybe there is a way we can work this stuff out.

Nelson Mandela in his inauguration speech -- and I loved it -- he said, "I'm only running once. That is it." In his -- in his inauguration speech -- I get choked up talking about it -- he said, "After 27 years in prison I firmly believe that it is no longer man's worst that we fear the most. I firmly believe it's man's best that we fear the most."

So what I have here to ask tonight is: Where is our best in this? Where is our best in this? Can't this money be spent better for your kids, for your family? For your kids, for your family? For these people's families? My God, what are we doing? What are we doing?

Thanks for your time.

MR. BONNER: Fawn Hadley.

FAWN HADLEY: Hi. My name is Fawn Hadley. I hadn't intended on speaking tonight but I was inspired so I'm mostly going to read. I'm really glad I got to follow the gentleman I just followed.

My background is in philosophy and I work in a girls' group home. And I see the family disfunction and how it affects those people everyday as well.

I've spent the first half of my life understanding why I self-sabotaged. I've gone to courses that have helped me to learn that I could not fix a problem with the same mind that created it, which is what Einstein said.

We have programs now that have technology that can actually change the way that we think. We have to choose that. It's a choice we have to make. But we can actually change from a victim mentality to a very powerful mentality in taking responsible for our actions. This kind of technology is also available in Israel and practiced on a regular basis all over the world through a program called Landmark Education. There is also a program called the HeartMath that teaches thinking through the heart, as opposed to strictly through the head.

There is a book that was written by a man named Goleman called Emotional Intelligence. And he -- he took his book from a program -- I can't remember if it's Life and Mind or Mind and Life. I think it's Life and Mind Institute, which is the Dalai Lama and the U.S. universities' psychology programs. They come together once a year for a week, I believe, to try to understand how we can become emotionally intelligent.

We have to look at how thinking should be our most powerful resource. We can change how we think. I told you, I'm kind of skipping around a little bit. We have more power in our minds than a ballistic missile. Einstein, Galileo, Max Planck, to give a few examples. Taking responsibility for who we are and what we've done to people is the fastest icebreaker you'll ever find. If someone takes responsibility for something that they've -- that they've done to you, it's really hard to fault them; if they have from the heart taken responsibility. You -- it's a natural communication opener. It just automatically connects your humanness when somebody takes responsibility for doing what they've done. And I don't see that going on in our life very much, in our world very much but it's possible.

If you think I'm in a fantasy world, I'm in the same group as Max Planck and Albert Einstein, only on social issues. Let's vote an emotionally intelligent human into office. There are -- each one of us has an opportunity with every interaction we have with every person to spread that kind of integrity and communication with other people.

The programs I mentioned earlier, Landmark Education and HeartMath both have websites. There is also a man named Gregg Braden, who was first a geologist, I believe. Then he worked in the Defense System. Then he worked for

SYSCO System Computers. And he has -- for the last 12 years he's traveled around to monasteries and such and done research on our human past and what has led us to where we are today. Very interesting man. He also has a website, Gregg Braden. He also has a book called The Isaiah Effect and the last one was the God Code.

Responsibility and communication unites us. I think that is it. Hope I haven't confused anybody.

MR. BONNER: Caroline Schmidt.

CAROLINE SCHMIDT: I wasn't going to speak either but I just wanted to thank all of the people who inspired me: Pallo Deftereos and Winnie Detwieler. They've made me more aware than I ever have in my entire life of what is going on around me. Through those organizations we're going to do another nuclear forum next year, try to get the universities, try to speak to the students who are coming up.

And when I looked at her writing, I thought maybe she was the Sac Bee. Well, the Sac Bee was invited a couple of times. And Mr. Mort Salisman is going to hear from me tomorrow because I do not understand why the Sac Bee would not be here to write to get the people to know what is going on, to gather us together to get forces behind us. It needs to be done.

In a little joke on the refrigerator where a man is standing on stage and he's asked to play a concerto. He says, "Don't make me come down there" to the audience. I'm going to go down there. I don't know how successful I will be. But maybe if everybody who lives in Sacramento will call Mr. Mort Salisman and leave messages on his machine and ask him why nobody was here and why Channel 3 and Channel 10 didn't come either.

I don't know what they're doing but I know -- I don't know. I don't think so because they checked the list. When I hear all of you speak so heartfelt and so glorious about how you feel about this country and what the right thing to do is, I'm in the right neighborhood. And whoever gets in office next time, we have to watch them like a hawk.

Thank you very much.

MR. BONNER: That is the end of the list of folks who signed up to speak. I'd like to offer an open invitation if somebody hasn't spoken and they'd like to take the opportunity.

Please, if you could give us your name and if you have an affiliation, that would be helpful.

HARRY WANG: My name is Harry Wang. And I'm a physician and a member of PSR Sacramento, Physicians for Social Responsibility. I did sign up and I guess my name got overlooked. I know it's getting late.

I believe in the separation of church and State, especially these days. I also believe in the separation of science and State. And I think this has been an issue for our current Administration because I think a lot of our science has gotten politicized in many, many different areas. I also question if the PEIS provides objective scientific information upon which to really base a decision.

I realize that there is a law passed by Congress, a mandate from the government to go ahead with the Ballistic Missile Defense System. But if you're really going to look at the science of the environmental impact, I don't think -- I don't think it's sufficient, this information provided.

I also, you know, agree with many of the comments already made about concerns about toxic pollutants, particularly perchlorate concerns about the debris in space.

But these are just -- these are agonizing times for all of us in the public. It's agonizing because of the decisions that our government is making. It's agonizing seeing how our moneys are being spent. It makes us wonder if the need of our citizens are really being looked at, whether they take priority compared to other agenda items.

For example, this year the government allocated 40 million dollars to try and come up with a new influenza vaccine. As we all know, we have a terrible shortage of influenza vaccine. It's a long process of four, five, six months to develop a vaccine. The government properly allocated funds to come up with a more efficient way to come up with a vaccine. 40 million that was allocated earlier this year before the recent shortage.

On the other hand, Project BioShield passed by Congress just this summer pushed by the Bush Administration allocated 5.6 billion dollars for the next ten years to develop vaccines and medications for anthrax, smallpox and other biological agents.

Once again, we -- the government does have a dilemma of how to deal with bioterrorism, how to deal with missiles and how this drains from other health and environmental priorities is just a highlight. Just looking at the flu vaccine versus Project BioShield, once again, 5.6 billion dollars. This is to develop another smallpox vaccine after the smallpox vaccines that were shipped out by CDC, many have been destroyed because they weren't used.

In this context, we as citizens are going to react to other programs that are -- that we're asked to look at, quote, asked to look at.

Now, in the 1960's, physicians were asked to prepare a response to the possibility that there would need to be a medical response if there were a nuclear war. That was something that PSR really got energized about and led to the origins of Physicians for Social Responsibility. Studies were published based upon data gathered from Hiroshima and Nagasaki. And it was concluded that nuclear war could very well bring on the final epidemic.

So how do you prepare for nuclear war? What would be the environmental impact of such an event? I believe that the BMDS escalates the arms race and will not make us any safer. We need to utilize non-weapon system approaches to try to accomplish the goal, if our goal is really making our world safer.

Thank you.

MR. BONNER: Are there other folks who would like to speak? If you'd like to sit there, that is fine. You can stay there. Just give us your name.

CHARLOTTE DEFTEREOS: I'm Charlotte Deftereos and I agree with everything my husband, Pallo Deftereos, said.

Now that I have a chance to speak, it's going to be, I promise you, real short. This lady here suggested something that I've been thinking a long time and that was the use of the Marshall Plan.

Can you imagine what the chain reaction to the Marshall Plan by a number of countries would be?

That is all I think I've got to say.

MR. BONNER: Thank you.

SHAUNA SMITH: Hi. I'm Shauna Smith. I'm with the Physicians for Social Responsibility and Therapists for Social Responsibility. I want to know if it's possible to get a tape of the comments that have been spoken today?

MR. BONNER: I don't know that we'll have a tape but we'll have a tape of the comments. I believe it will be available -- I believe if you can put a checkmark next to your name or send us an email, we'll get that to you.

Thank you.

UNIDENTIFIED SPEAKER: I have already spoken but I wanted to ask a question. I'll try to be brief. I wanted to address a question to you, sir, and your associates.

Will you pledge to advocate for increasing the number of hearings and public, you know, opportunities for public input on this environmental impact report?

MR. BONNER: Marty, you want to speak to that?

MR. DUKE: I mean, we've looked at --

UNIDENTIFIED SPEAKER: Who is "we"?

MR. DUKE: I say myself. We are trying to publicize this. We have the website and try to make comments because it's really impossible to go to all of the sites we need to go to. And we try to give the avenues for people to have an opportunity through the website, through public forums, through email, faxes to make their case known to the Programmatic EIS.

CAROLINE SCHMIDT: Why Sacramento? Why was Sacramento picked?

KAREN BLOMQUIST: You missed 3,000 miles of country between Arlington and Sacramento.

MR. DUKE: We looked at the states where we have a lot of the MDS program and the Capitol.

KAREN BLOMQUIST: That is not good enough. You'll be hearing from Europe because of it not just of the U.S. It will never be good enough. No matter how you sugarcoat it, it ain't good enough.

MR. BONNER: Any other comments?

ROD MACDONALD: You know, I -- I really find it just stunning that something this national importance -- I heard about it because somebody called in on a local radio show and started talking about it and I -- what? What am I hearing in the midst of traffic? I put it on my calendar. I don't really have time as a scientist to study all of this. I find it just stunning that this much impact or -- you know, your adequate four times we've done it. But what publicity? The Bee isn't here. We know how to turn people out for Staples Stadium. We can sell the world. We can't -- I find it stunning by the lack -- how it's under-publicized.

Now we've done it. We have gone through the formality. Give us an email and website. That is nice. But the organic standards, where they try to ruin organic standards, sewage waste and stuff like that. The government got more feedback than it has ever gotten on a single issue before.

PALLO DEFTEREOS: This is such a tremendous issue. I just don't -- I've been studying it, as I said, for 60 years. I was in World War II. And I studied foreign affairs before the war started. And with an issue of this size, what is the big hurry? I mean, these kinds of hearings should be had -- should be had all over the country. I just don't understand it.

MR. BONNER: Thank you.

SHAUNA SMITH: I just would like to ask, do you actually have any power to make any of these -- I don't think we should actually be harassing you guys. You don't really have the power to make the decisions, do you?

MR. DUKE: Our point is to try to assess the impact of BMDS on the environment, to provide opportunities and very spirited comments, heartfelt comments that you have provided for us on the record and try to address those.

SHAUNA SMITH: But if we wanted more meetings, you couldn't make it happen anyway, right?

MR. DUKE: We'd have to look it --

SHAUNA SMITH: But you, personally --
MR. DUKE: -- or the political impacts --
SHAUNA SMITH: You, personally, could you do anything?
MR. DUKE: I would have to go back, go with the heart of leadership.
SHAUNA SMITH: We'd appreciate it if there was any chance.
MR. DUKE: Again, I appreciate you all coming out. Like you said, a lot of you came out after a hard day's work to provide the comments. And we all know these are very sincere comments. We'll take the comments and go back and look at them and address them in the EIS.
I appreciate you all coming out and providing your comments.
Thank you.
(The proceedings concluded at 9:43 p.m.)

CERTIFICATE

OF

CERTIFIED SHORTHAND REPORTER

The undersigned certified shorthand reporter of the state of California does hereby certify:

That the foregoing deposition was taken before me at the time and place therein set forth, at which time the witness was duly sworn by me;

That the testimony of the witness and all objections made at the time of the deposition were recorded stenographically by me and thereafter transcribed, said transcript being a true copy of my shorthand notes thereof.

In witness whereof, I have subscribed my name this date____.

____

Certificate Number___________

Exhibit B-15. Anchorage, Alaska Public Hearing Transcripts

MISSILE DEFENSE AGENCY'S BALLISTIC

MISSILE DEFENSE SYSTEM DRAFT PROGRAMMATIC

ENVIRONMENTAL IMPACT STATEMENT

October 21, 2004

Sheraton Hotel, Kuskokwim Room
Anchorage, Alaska

RECORDED AND TRANSCRIBED BY:

Computer Matrix Court Reporters, LLC
3522 West 27th Ave., Anchorage, AK 99517
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INDEX

MR. DUKE: Okay, let’s go ahead and get started. I’ve got a little bit after 7:00 o’clock and we’ll go ahead and start the formal presentations.

Tonight, I’d like to welcome you to the public hearing for the Missile Defense Agency’s Ballistic Missile Defense System Draft Programmatic Environmental Impact Statement. This public hearing is being held in accordance with the National Environmental Policy Act, or NEPA. My name is Marty Duke and I am the Missile Defense Program Manager for the development of the Programmatic Environmental Impact Statement.

I would like to introduce Colonel Mark Graham, who is from the Missile Defense Agency’s Office of General Counsel. Colonel Graham will talk about the Draft Programmatic Environmental Impact Statement, the NEPA process, and the BMDS capabilities and components. I also would like to introduce Mr. Peter Bonner and Ms. Deb Shaver, with ICF Consulting. Ms. Shaver was the ICF Consulting Program Manager and technical lead for the PEIS, and Mr. Bonner will facilitate tonight’s meeting.

So I’d like to turn it over to Mr. Bonner who will review tonight’s meeting agenda and discuss some administrative points on how to provide public comments on the Programmatic EIS

MR. BONNER: Hi. I'd also like to welcome you to the public hearing tonight. First, let's define a couple of terms you're going to hear tonight. We'll refer to the Missile Defense Agency as the MDA, we'll review the Ballistic Missile Defense System or BMDS, and discuss the Programmatic Environmental Impact Statement or PEIS.

Therefore, at the hearing we're going to discuss the development of MDA, Draft BMDS PEIS. Everybody have all those acronyms down? We'll then discuss the proposed action, which is the implementation of an integrated BMDS. The activities involved in implementing this BMDS have been analyzed for their potential environmental impact. Finally, we will provide a forum to collect your public comments on the Draft PEIS.

To ensure MDA has sufficient time to receive oral comments this evening, we will use the following agenda that you see up on the screen. We will spend the next 30 to 40 minutes presenting information about the BMDS, the NEPA process, that's the National Environmental Policy Act, as Marty said. And the presentation will discuss the following: What is a programmatic EIS? What is the BMDS? How were potential impacts analyzed? What are the results of the analysis? And how does we submit comments on the Draft PEIS? We'll then take a 15-minute break during which if you would like to sign up at the registration table to make public comment, you can do it then. I see a number of you have already signed up to do that.

After the break, each speaker will be called in the order they signed up to come up and make their statements. Following the public statements MDA representatives will be available in the poster area to clarify the information provided during the presentation. Please note that questions or comments provided informally to MDA representatives in the poster area will not be officially recorded. However all questions can be formally submitted to MDA through one of the other available methods.

The most important aspect of tonight’s meeting is the public comment portion. All public comments and statements provided tonight will be recorded for a transcript. We have a court reporter here doing that. Please remember that the Programmatic EIS is just a draft document. This is your opportunity to provide comments before it is finalized and before a decision is made. We are here to listen firsthand to your suggestions and concerns. Please limit your comments to five minutes to give everyone an opportunity to speak.

The real purpose of this meeting is to gather your comments. Your comments and questions will be recorded tonight and will be carefully considered in the preparation of the Final PEIS. If you wish to provide written comments as an alternative, forms are available at the registration table to do that. You may leave written comments at the registration table with us or you may mail, e-mail or fax those to the MDA using the information provided. To allow time to consider them and respond to comments in the Final PEIS, all comments must be received no later than November 17, 2004.

Colonel Graham will now discuss the BMDS PEIS and the NEPA process. Thank you.

COL. GRAHAM: Thank you, Peter. Good evening everybody.

NEPA establishes our broad national framework for protecting the environment. NEPA requires Federal agencies to consider environmental impacts of proposed actions and reasonable alternatives to those actions early in their decision-making process. The NEPA process is intended to help public officials make decisions based on understanding environmental consequences and take actions that protect, restore, and enhance the environment.

In the past, the national approach to missile defense focused on the development of individual missile defense elements or programs, such as the Patriot, the Airborne Laser, and ground-based interceptors. These actions were appropriately addressed in separate NEPA analysis that MDA, its predecessor agencies, and executing agents prepared for these systems.

The aim of missile defense has been refocused by the Secretary of Defense to develop an integrated Ballistic Missile Defense System that would be a layered system of components working together capable of defending against all classes and ranges of threat ballistic missiles in all phases of flight. Because the integrated Ballistic Missile Defense System is a large program made up of many projects implemented over time on a worldwide basis, MDA has determined that a programmatic NEPA analysis would be appropriate. Therefore, the MDA has prepared a Programmatic EIS to analyze the environmental impacts of implementing the proposed program.

A Programmatic EIS, or PEIS, analyzes the broad environmental consequences in a wide-ranging Federal program like the Ballistic Missile Defense System. A PEIS looks ahead at the overall issues in a proposed program and considers related actions together in order to review the program comprehensively. A PEIS is appropriate for projects that are broad in scope, are implemented in phases and are widely dispersed geographically. A PEIS thus creates a comprehensive, global analytical framework that supports subsequent analysis of specific activities at specific locations.

The Programmatic EIS is intended to serve as a tiering document for subsequent specific Ballistic Missile Defense System analyses and includes a roadmap for considering impacts and resource areas in developing future documents. This roadmap identifies how a specific resource area can be analyzed and also includes thresholds for considering the significance of environmental impacts to specific resource areas. This means that ranges, installations, and facilities at which specific program activities may occur in the future could tier their documents from the PEIS and have some reference point from which to start their site-specific analyses.

The Ballistic Missile Defense System Programmatic EIS analyzes the potential environmental impacts of developing, testing, deploying, and planning for decommissioning for the proposed program. The Programmatic EIS evaluates proposed Ballistic Missile Defense System technology, components, assets, and programs and considers future development and application of new technologies.

The proposed action considered in the BMDS Programmatic EIS is for the MDA to develop, test, deploy, and to plan for decommissioning activities for an integrated Ballistic Missile Defense System using existing infrastructure and capabilities, when feasible, as well as emerging and new technologies to meet current and evolving threats.
When feasible, the MDA would use existing infrastructure to implement the BMDS and would incorporate new technologies and capabilities as they become available. This would ensure that the program could provide defense both for current and future ballistic missile threats.

The purpose of the proposed action is to incrementally develop and deploy a Ballistic Missile Defense

System, the performance of which can be improved over time, and that layers defenses to intercept ballistic missiles of all ranges in all phases of flight. The proposed action is needed to protect the United States, its deployed forces, friends, and allies from ballistic missile threats.

In this Programmatic EIS, MDA considers two alternative approaches to implementing the Ballistic Missile Defense System in addition, of course, to the No Action Alternative. The alternative approach is the use of weapons from land-, sea-, air-, and space-based platforms.

Alternative 1 is to develop, test, deploy, and plan to decommission an integrated Ballistic Missile Defense System that includes land-, sea-, and air-based weapons platforms. The BMDS envisioned in Alternative 1 would include space-based sensors, but would not include space-based defensive weapons.

Alternative 2 is to develop, test, deploy, and plan to decommission an integrated Ballistic Missile Defense System that includes land-, sea-, air-, and space-based weapons platforms. Alternative 2 would be identical to Alternative 1, with the addition of space-based defensive weapons.

The Council on Environmental Quality requires -- the regulations require that when in implementing NEPA, you also require the consideration of the No Action Alternative. Under the No Action Alternative, the MDA would not develop, test, deploy or plan for decommissioning activities for an integrated Ballistic Missile Defense System. Please note that under the No Action Alternative, MDA would continue existing development and testing of individual elements as stand-alone defensive capabilities. Individual systems would continue to be tested but would not be subjected to system integration tests.

Alternatives 1 and 2 provide different weapons platforms options for implementing an integrated Ballistic Missile Defense System while the No Action Alternative continues the traditional approach of developing individual missile defense elements, such as Airborne Laser, Patriot missiles or ground-based interceptors.

I will now address how MDA characterizes the Ballistic Missile Defense System into relevant components and lifecycle activities that could be considered to provide a programmatic review of the environmental impacts of implementing the proposed action.

MDA’s goal is to develop an integrated Ballistic Missile Defense System that will provide a layered defense. The Ballistic Missile Defense System would be capable of destroying threat ballistic missiles in the boost, midcourse and terminal flight phases and would defend against short, medium, intermediate, and long-range threat ballistic missiles. Finally, the Ballistic Missile Defense System would integrate sensors and weapons through a command control, battle management, and communications network, or C2BMC. With this capability the integrated Ballistic Missile Defense System would establish a defense against threat ballistic missiles.

The Ballistic Missile Defense System is a complex system of systems. To be able to perform a meaningful impact analysis, we considered the Ballistic Missile Defense System in terms of its components: weapons, sensors, C2BMC, and support assets. These components are the building blocks that can be assembled with specific functional capabilities and operated together or independently to defeat threat ballistic missiles. Testing was considered for each component; however, the integrated missile system that we would propose needs to be tested at the system level and was analyzed separately using realistic system integration flight test scenarios. Now, let's look at each of these components.

First component is weapons. Weapons would provide defense against threat ballistic missiles. They include interceptors, directed energy weapons in the form of high-energy lasers that would be used to negate threat missiles. Interceptors would use hit-to-kill technology, either through direct impact or directed fragmentation. Ballistic Missile Defense System weapons are designed to intercept threat ballistic missiles in one or more phases of flight and could be activated from land, sea-, air-, or space-based platforms.

Ballistic Missile Defense System sensors would provide the relevant tracking data for threat ballistic missiles. Sensors detect and track threat missiles and assess whether a threat missile has been destroyed. Sensors provide the information needed to locate and track a threat missile to support coordinated and effective decision-making against the threat.

There are four basic categories of sensors considered for the Ballistic Missile Defense System. They are radar, infrared, optical, and laser sensors. Radars send a signal out and detect the same signal as it bounces off an object. Infrared sensors are passive sensors that detect and track heat or infrared radiation from an object. Optical sensors are also passive sensors but they collect light energy or radiation emitted from an object. Laser sensors use laser energy to illuminate and detect an object's motion. Lasers and radars emit radiation while infrared and optical sensors detect radiation that has been emitted. Ballistic Missile Defense System sensors would operate from multiple platforms, such as land, sea, air, or space.

The data collected by the sensors would travel through the communication system to command and control centers where a battle management decision on whether to use a defensive weapon would be made. C2BMC would integrate and coordinate equipment and operators through command and control and integrated fire control centers. C2BMC would enable military commanders to receive and process information, make decisions and communicate those decisions regarding the engagement of threat missiles. The C2BMC would include fiber optic cable, computer terminals, and antennas and would operate from land-, sea-, air-, and space-based platforms.

The last category of support assets. Or, excuse me, the last category of components is support assets. Support assets would be used to facilitate development, testing and deployment of Ballistic Missile Defense System components. Support assets are one of three types: support equipment, infrastructure or test assets. Support equipment includes general transportation and portable equipment such as automobiles, ships, aircraft, rail and generators. Infrastructure includes using docks, shipyards, launch facilities and airports. Test assets include test range facilities, targets, countermeasure devices, stimulants and observation vehicles.

Now that we have discussed the components, Mr. Marty Duke will describe how they can be integrated into the Ballistic Missile Defense System.

MR. DUKE: This slide depicts the integration of the various components of the proposed BMDS that Colonel Graham just discussed. The use of multiple defensive weapons and sensors operating from a variety of platforms integrated through a single C2BMC system would create a layered defense allowing several opportunities to intercept and destroy the threat missile. For example, one weapon could engage a threat missile in its boost phase, represented here in the red, and another could be used to intercept the threat missile in later phases if initial intercept was unsuccessful in the boost phase. So we could intercept in the midcourse or in the terminal phase.

Components are incorporated into the BMDS through the lifecycle phases of the system acquisition process. These lifecycle phases are development, testing, deployment, and decommissioning. New components would undergo initial development testing, while existing components would be tested to determine their readiness for use. Work on a given technology would stop if testing failed to demonstrate effectiveness or if functional capability requirement changed. Components and elements would be deployed as testing demonstrates that they have capabilities of defending against threat ballistic missiles.

In most cases, a component would be deployed when testing demonstrates that it is capable of operating within the integrated BMDS and the associated safety and health procedures are developed and adequate. This process concludes with decommissioning, which would occur when and where appropriate.

To determine environmental impacts, this PEIS analyzed the proposed BMDS components by considering the various lifecycle phase activities of each component, as well as the operating environments in which the activities are taking place. This slide tries to depict the multi-dimensional complexities involved in considering the impacts of implementing an integrated BMDS. In terms of its components, as we have here, the weapon, sensors, C2BMC, supports, against their lifecycle activation activities, against their operating environment.

Because of the complex nature of this project, an analysis strategy was developed to effectively, yet efficiently, consider the broad range of environmental impacts from the proposed BMDS. First, the existing condition of the affected environment was characterized for the locations where various BMDS activities are proposed to occur.

Next, MDA determined the resource areas that could potentially be affected by implementing the proposed BMDS.

Finally, impacts of the BMDS were analyzed in four steps. In Step 1, we identified and characterized life cycle phase activities. In Step 2, we identified activities with no potential for impact and dismissed them from further analysis. In Step 3, we identified similar activities across lifecycle phases and combined them for analysis. And in Step 4, we conducted the impacts analysis for all remaining activities. The first three steps were used to characterize and reduce the number of unique lifecycle activities, thereby reducing the redundancy in preparing the impact analysis.

The affected environment includes all land, air, water, and space environments where proposed BMDS activities are reasonably foreseeable. The affected environment has been considered in terms of the broad ocean area, the atmosphere, and nine terrestrial biomes. A biome is a geographic area with similar environments or ecologies. Climate, geography, geology and distribution of vegetation and wildlife determine the distribution of the biomes. These biomes encompass both U.S. and non-U.S. locations where the BMDS could be located or operated.

The resource areas considered in this analysis are those resources that can potentially be affected by implementing the proposed BMDS. NEPA analyses generally consider the resource areas listed on the screen, except for orbital debris. Because missile defense development and test activities include the launch and intercept of missiles, space-based communications and other satellites, and potential for space-based interceptors, MDA also considered orbital debris and its impacts on the Earth.

This PEIS discusses all resource areas,

provides a methodology for analysis and suggests a thresholds of significance to provide the reader with a roadmap for performing future site-specific analysis tiering from the PEIS. These discussions outline the type of information that would be needed to conduct site-specific analyses and identify the steps necessary to ensure that potential impacts are appropriately considered. The resource areas, highlighted on the slide with a red star, require site-specific information for analyses and are those more effectively addressed in subsequent tiered analyses for specific activities.

Once we decided how to consider the affected environment and the resource areas of concern, we used the four-step process I mentioned earlier. In Step 1 of the impacts analysis, MDA identified and characterized the activities associated with each BMDS component. Each lifecycle phase has activities applied to each component.

For example, development can include planning, research, systems engineering, and site preparation and construction. Testing can include manufacturing, site preparation and construction, transportation, activation, and launch activities. Deployment can include manufacturing, site preparation and construction, transportation, activation, launch, operation and maintenance, upgrades, and training. And finally, decommissioning includes demilitarization and disposal.

Once lifecycle activities were identified, it was determined that some of those activities had no potential for impact. Activities such as planning and budgeting, systems engineering and tabletop exercises are generally categorically excluded in various Department of Defense NEPA regulations and, therefore, not further analyzed in this PEIS. Other activities for specific components, such as transportation, maintenance and sustainment, and manufacturing, were not analyzed in this PEIS because they have been evaluated in previous NEPA analyses or found to have no significant environmental impacts.

The remaining activities were then examined to determine which activities had similar environmental impacts. For example, impacts associated with site preparation and construction in the development phase would be similar to or the same as impacts from site preparation and construction activities in the deployment phase. Under Step 3, similar activities occurring in different lifecycle phases were identified and considered together to reduce redundancy.

The final step was to determine the impact associated with each remaining activity under the proposed action. The significance of an impact is a function of the nature of the receiving environment and the receptors in that environment.

For example, an interceptor launch creates the same emissions no matter where it is launched. Whether those emissions cause impacts and the significance of those impacts depend upon the environment into which they are released. The PEIS analyzes these emissions by component for each resource area and lifecycle activity where a potential for impact was identified. Impacts were distinguished based on the different operating environments, land, sea, air, and space. The analysis also considered specific impacts for individual biomes where activities could occur.

The impacts of system integration tests were considered separately from the impacts of individual component testing because integration testing would involve using multiple components in the same tests. To deal effectively with integration testing MDA looked at two generic systems integration flight test scenarios which involved different numbers of launches and intercepts.

The impacts analysis for Alternative 1 considers the use of land-, sea-, and air-based platforms for BMDS weapons. The analysis includes the use of space-based sensors, but not space-based weapons. The analysis is specific for each resource area based on the impacts from the activities associated with the BMDS component.

The impacts analysis for Alternative 2 includes the use of interceptors from land-, sea-, air- and space-based platforms for BMDS weapons. The impacts associated with the use of interceptors from land, sea, and air platforms would be the same as those discussed for Alternative 1; therefore, the analysis for Alternative 2 focuses on the impacts of using interceptors from space-based platforms. Therefore, the fundamental difference between Alternative 1 and 2 is that Alternative 2 includes the analysis of space-based platforms for interceptors.

The cumulative impacts of implementing the BMDS were also considered. Cumulative impacts are defined as impacts that result from the incremental impacts of the proposed action when added to other past, present, and reasonably foreseeable future actions. Because this proposed action is worldwide in scope and potential application, only activities similar in scope have been considered for cumulative impacts.

Under Alterative 1, worldwide launch programs for commercial and government programs were determined to be activities of similar scopes. Therefore, the impacts of BMDS launches were considered cumulatively with the impacts from other worldwide government and commercial launches.

Alternative 2 includes placing defensive interceptors in space, which involves adding additional structures to space for extended periods of time. The International Space Station was determined to be an action that is international in scope and has a purpose of placing structures in space for extended periods of time. Therefore, the impacts of the use of space-based weapons platforms were considered cumulatively with the impacts of the International Space Station.

The next few slides provide broad summaries of the impacts analysis by BMDS component and Test Integration for Alternatives 1 and 2, the No Action Alternative, and the cumulative impacts for Alternatives 1 and 2. Please note that the results are extremely high level suitable for this presentation. Additional details have been provided in some of the posters that you've seen in the hallway in the back. The impacts analysis may also be found in the Executive Summary Impact tables and in Section 4 of the Draft PEIS.

It is important to note that no environmental showstoppers were found in this programmatic impact analysis. As the next few slides show there are potential impacts associated with the various activities needed to implement the BMDS. However they would be appropriately addressed in subsequent tiered NEPA analyses along with the mitigation actions as required to ensure less than significant impacts.

This slide shows a summary of the broad potential for environmental impacts associated with BMDS weapons activities as examined for each resource area for Alternatives 1 and 2. Please note that this is a very high-level depiction of the results of the analysis and additional details of the weapons analysis may be found in the Executive

Summary of the Draft PEIS. However, one can see from these slides general activities and resource areas that should be considered in subsequent tiered NEPA analyses.

This slide shows the impacts summary for BMDS sensors. Note that the impacts are the same for Alternatives 1 and 2 and include space-based sensor platforms. This summary also shows how MDA's categorization of activities helped to simplify the analysis. For example, the activities of radar would not impact air quality because the only emissions resulting from radars would be from supporting diesel generators, which are addressed under support assets. However, radars generate electromagnetic radiation, which could potentially impact biological resources.

Although C2BMC is the glue that enables the integrated BMDS to function effectively as a system, this component creates little potential for environmental impacts.

Impacts associated with support assets are mainly those that would be caused by site preparation and construction of infrastructure and by using test assets such as countermeasures and stimulants during testing.

Test integration, overall, has the most potential for impacts because it includes the use of several components during increasingly realistic test scenarios. Although this programmatic analysis showed the potential for impacts, the existing environment at the proposed test location and the specific test activities planned will determine the nature and extent of the impacts.

The No Action Alternative would continue the development and testing of individual weapons, sensors, C2BMC, and support assets and would not include integration testing of these components. The environmental impacts of the No Action Alternative would be the same as the impacts resulting from continued development and testing of individual missile defense elements.

The decision not to deploy a fully integrated BMDS could result in the inability to respond to a ballistic missile attack on the U.S. or its deployed forces, allies, or friends in a timely and successful manner. Further, this alternative would not meet the purpose or need of the proposed action or the specified direction of the President and the United States Congress.

We examined the impact of worldwide launches for cumulative impacts. Launches can create cumulative impacts by contributing to global warming and ozone depletion. Potential launch emissions that could affect global warming include carbon monoxide and carbon dioxide, or CO2. Unlike CO2, carbon monoxide is not a greenhouse gas, but it can contribute indirectly to the greenhouse gas effects. The cumulative impact on global warming of emissions from BMDS launches would be insignificant compared to emissions from other industrial sources, such as energy generation. The BMDS launch emissions load of CO_2 and carbon monoxide would only be five percent of the emissions load from worldwide launches. In addition, CO_2 and carbon monoxide from 10 years of BMDS and worldwide launches combined would account for much less than one percent of CO_2 and carbon monoxide emissions from U.S. industrial sources in a single year.

Chlorine is of primary concern with respect to ozone depletion. Launches are one of the man-made sources of chlorine in the stratosphere. The cumulative impacts on stratospheric ozone depletion from launches would be far below the effects caused by other natural and man-made sources. The emission loads of chlorine from both BMDS and other launches worldwide occurring between 2004 and 2014 would account for about half of one percent of the industrial chlorine load from the U.S. in a single year.

The orbital debris produced by BMDS activities would generally be small in size and would consist primarily of launch vehicle hardware, old satellites, bolts and paint chips. It may also be possible for debris from an intercept to become orbital debris. However, orbital debris produced by BMDS activities would occur in low-earth orbit where debris would gradually drop into successively lower orbits and eventually reenter the atmosphere. Therefore, orbital debris from BMDS activities would not pose a long-term hazard to the

International Space Station or other orbiting structures. In addition, collision avoidance measures would further reduce the potential for orbital debris to damage orbiting structures, such as the International Space Station.

I would like to reiterate that our impacts analysis indicated no expected areas of significant impacts on the environment. However, many resource areas showed potential for impacts indicating that these areas need to be considered in any subsequent analyses tiered from this PEIS.

Okay, this is the conclusion of the summary of our findings. Now, I'd like to turn to Peter Bonner who will discuss some of the administrative comments -- points on making the public comments.

Peter.

MR. BONNER: Thank you, Marty. Now that we've reviewed the proposed BMDS and the potential impacts from its implementation, let's discuss the PEIS schedule. The PEIS development process started with the Notice of Intent, or NOI, which was published in the Federal Register on April 11th, 2003. MDA released the Draft PEIS in September. The public comment period for the Draft PEIS, currently underway, will continue through November 17th, 2004. After that time, the MDA will consider all comments received and incorporate appropriate changes in the Final PEIS. A release date for the Final PEIS is estimated for December 2004 or January 2005. After the release of the Final PEIS there will be a 30-day waiting period before the MDA can issue the Record of Decision, or ROD, one more acronym.

There are a number of ways in which you can provide comments on the Draft BMDS PEIS. You may provide your comments orally or in writing. Oral and written comments will be given equal consideration in preparing the PEIS -- the Final PEIS.

If you would like to make a public statement at Tonight’s meeting, we encourage you to sign up at the registration table and fill out a speaker’s card. Each speaker will be given five minutes to make a statement. The five minutes are your time. If you need significantly more time than the five minutes, I'd ask that you yield to another speaker and then come back at the end after the final speaker has finished to continue your input.

As mentioned earlier, public statements by Tonight’s speakers will be recorded by the court reporter to ensure that we accurately capture your comments on the Draft PEIS. There is also a toll-free telephone number on which you might submit comments. Please refer to your handouts for the toll-free phone number. Another option is to submit your comments in writing. There are four ways to do this. First, you may leave written comments that you brought with you tonight with the person at the registration table. Second, you can use the comment forms that are available at the registration table to write down your comments. You may either turn those in tonight or you may fax or mail them to MDA using the addresses and toll-free tax number -- toll-free fax number, not tax number, that appear on the comment forms. You may also e-mail your comments to MDA using the addresses listed in the handouts and on the MDA BMDS PEIS web site.

Finally, you may submit comments through the PEIS web site using an electronic comment form. To ensure that your comments are adequately considered in the Final BMDS PEIS, they must be received no later than November 17th.

The information on the screen lists the various ways you could submit your comments. This information is also listed on the comment forms at the registration table and handouts available near the posters.

Please visit the BMDS PEIS web site for additional information. The web site provides descriptions of topic areas that we touched on this evening, as well as links for obtaining additional information. The materials handed out tonight are also posted on the BMDS PEIS web site.

We encourage you to sign up to receive a hardcopy of the Executive Summary of the Final PEIS and a CD-ROM containing the entire document when it becomes available. To do this, please fill out the appropriate form at the registration table. You can also request a copy of the

Executive Summary or CD-ROM of the entire document by sending an e-mail to us, to the address listed in the handout materials and on the screen. The Final PEIS will also be available in .pdf format to download from the BMDS PEIS web site and hardcopies will be placed in local libraries. A list of these libraries is available on the BMDS PEIS web site.

If you haven't signed up to receive these materials, please do so during the break out in the registration area.

Marty.

MR. DUKE: Okay. Our purpose of being here tonight is really to listen to you, to hear your comments on our Draft PEIS. No decisions will be made on the PEIS tonight. We'll take your comments, all the comments we have received during the comment period of oral, written, faxed and consider those in the Final PEIS. But, again, as Peter mentioned we need all comments in by November 17th.

So let's go ahead and take about a 10- or 15-minute break and then we'll come back. It allows us to set up for the public statement period. After the public statement period we'll be available to answer additional questions you may have out at the poster area, okay?

Thank you.

(Off record)

(On record)

MR. BONNER: Let's get started again. I have the list of registered speakers and I'll call each person to the front of the room to the microphones provided to make their comment. Please limit your remarks to five minutes. As we said, if you have additional comments to make after the five minutes, if you could wait until the last speaker speaks and then we'll bring you back up again.

To help you keep track of the time, after about four minutes I will hold up my very expensive and fancy sign here that says you've got a minute left. This should help you find a comfortable place to wrap up your comments. If you have a written version of your comments, we ask you provide it to us to facilitate keeping an accurate record of them. When providing your public statement, please remember to state your name and, if you have an affiliation, give us that too. And if you speak clearly for the meeting recorder that would be helpful.

Okay. If you do not wish to give an oral statement here tonight, please consider providing comments to using one of the available methods we talked about earlier. We tried to develop a lot of avenues for you to give us your comments. Thanks again for your participation in this process.

Have Jean Bodeau come up.

MS. BODEAU: Hello, my name is Jean Bodeau and I have no affiliation with an organization. I'm a professional geologist and engineer and I've worked as an environment consultant in Alaska for almost 20 years. I now work in health care. Some of the work I've done as a consultant is I've managed several million dollars worth of military contracts, mostly for the Air Force.

I oppose the entire program on both philosophical and concrete grounds, with specific points as follows:

First, it doesn't address the real threat, i.e., terrorist with low tech devices that could come over borders, by sea, suicide bombers. I understand the Iraqi insurgents now are trying to get more weapons of mass destruction. This project, to me, seems totally divorced from the realities that we're facing as a country and takes funds away from the real threats.

Two, the sequencing on the whole program seems backward. The EIS is late and the project is premature. Furthermore, the technology doesn't appear to work, yet it is already being deployed.

Three, NEPA does not seem, to me, to be a big enough vehicle to evaluate the program. It should include international input because the implications of this project are global. And I noticed on your map out there Antarctica is not included on the map. I'm sure you looked at it but.....

Fourth, the PEIS, with all due respect, I know a lot of work went into it, is -- in my opinion it's crap. I've worked on these things quite a bit and I know that you can manipulate your data, manipulate your analyses to come out with exactly the results you desire. And I think that's what's been done here. It ignores or glosses over potential concerns and it put many other assessments off to future assessment to the site-specific assessments, the tiered impact -- or the tiered assessments that you mentioned.

I noticed on the summary and in the documents, I've looked through those. I got them in the mail and I appreciate those being sent out in advance. There are a huge number no significant impacts listed. And I think that this issue is a big enough and hugely important issue that it deserves more than a cursory analysis of the environment impacts.

I have some more specific concerns, things that the PEIS does not adequately address. Number one, exposure to increased levels of toxic pollutants from a dramatic increase in missile launches. Liquid propellants containing hydrazine, nitrogen tetroxides and other compounds that are highly toxic. In addition, ammonium perchlorate, which is used in solid propellants, it blocks the formation of key thyroid elements that are critical for growth and development, especially in fetuses and children, and this was not considered.

Another concern is that the risk to health and safety of DMD missile accidentally shooting down civilian and friendly military aircraft was not considered.

Third, it neglected to look at space debris from high altitude midcourse missile intercepts or destruction of satellites, and it really glossed over potential impacts of debris falling to earth. It just wrote them off as being burned up in the atmosphere.

Another concern is that it didn't really look at the many rocket launches that are needed to test and deploy and maintain the space interceptors.

Five of the specific points, the program could contribute to the proliferation to the weapons of mass destruction and an arms race in space. The response of other nations to the BMDS has not been considered.

Six, radioactive fallout from intercepted missiles has not been considered. The effects of war are normally excluded from analysis by NEPA; however, this proposed BMDS action is very likely to provoke a worldwide WMD arms race and force other nations to prepare to launch a massive retaliation against the U.S. should war ensue. And I believe that radioactive fallout needs to be looked at and not written off as a no significant impact.

Seven, also missing is an assessment of impacts to the environment, human health and welfare and future generations, which would result from the monstrous financial burden of this program and taking resources away from other critical aspects of our nation.

And, last, the BMDS PEIS does not really include a No Action Alternative. Your No Action Alternative does not include the option of not deploying any of these, there's just dropping the program right now. And I think that we need to have a true No Action Alternative considered as part of this.

I am going to submit additional written comments. Thank you for the opportunity.

MR. BONNER: Thank you. Have Steve Cleary come up.

MR. CLEARY: Hi. Thanks for having me. My name is Steve Cleary, I'm the Executive Director for the Alaska Public Interest Research Group, my acronym is AKPIRG. That's another acronym for everybody tonight.

I, like Jean, am in favor of the No Action Alternative, but would also like a real No Action Alternative, which would save us tens to hundreds of billions of dollars if we didn't deploy the system.

I remember from last time, part of about the radar, somebody from Valdez was worried about that it was going to set off airbags in cars, set off fire extinguishers, some kind of weird effects of the radar, but I didn't see any mention of that in there and I didn't get a chance to read the whole thing. I just read the executive summary. So I would like to hear more about that.

But I think a lot of us are concerned about the integration of all these systems when all the systems aren't here. We hear about the sea-based radar that's going to be swung around and come on up and be sitting outside by Shemya, but we have five missiles in the ground, maybe six by now, and we're going to start deploying that by September, but yet this isn't due until -- you know, the Record of Decision isn't going to be until February, so the integration of the system doesn't seem to have happened, yet it all seems to be going forward and this Programmatic EIS doesn't seem to have a whole lot of effect on that.

So, again, I am here tonight to speak in favor of the No Action Alternative. I do also believe that deployment of the missile defense would spur a global arms race and cause nations to devote resources, simply because we are, to this weaponization of space.

I'm also concerned that we'll be exporting it to non-U.S.A. locations, Canada, United Kingdom and other places who might see us as a world superpower and want to, you know, receive our favors and so they would acquiesce to this system.

Specific to Alaska, I have a lot of questions about the Kodiak Launch Complex. I'm really concerned about the aborted launch that happened at Kodiak, I believe it was two years ago November and Kodiak itself is a significant enough population center to be concerned about it, but if we start launching missiles from Fort Greeley, which is near Fairbanks, near Delta Junction, that have to be aborted, there's significant population centers there, not to mention the TransAlaska Pipeline.

Something that was mentioned in the presentation and in the PEIS, it talks about a robust testing program. It mentioned in the PEIS that the test are going to dictate which further things happen. We haven't seen a realistic test yet and that concerns us here in Alaska, particularly when, you know, like I said, an aborted launch could have such a disaster effect on our state.

It's unclear from the PEIS, and I'm looking at Section 2.242, whether or not the Kodiak Launch Complex is going to be a launch test and defensive operational asset or if it's going to launch things into orbit, or if it's just a test center. So it's confusing for the folks on Kodiak and for us here in Alaska what is actually going to happen out on the island.

It talks about a safety zone that would be established around the laser during activation. This is also in the PEIS, Pages 250 to 254. There's a lot of small plane traffic and a lot of small boat traffic around Kodiak and other places in Alaska. It has us concerned about the laser and its effects on our economy and on the human resources, or humans, I should say, of Alaska.

The hydrazines that Jean mentioned were the same things that I believe came from when the space shuttle crashed and landed in Texas and there was a very large mobilization to get people not to touch those things. And if that's the same chemical that's going up with each of these launches and potentially coming back down, then those will be grave consequences indeed.

A lot of the missile defense system has been sold up here in Alaska for the economic benefits. And I know the Programmatic EIS also takes in social and economic benefits and I could think of a lot better ways for us to spend these hundreds of billions of dollars that will eventually be spent on this system that isn't going to work and is also addressing the least likely threat.

So I thank you for the opportunity to speak in favor of the No Action Alternative. Thanks.

MR. BONNER: Thank you. Can I have Greg Garcia come up? Greg.

MR. GARCIA: Yes, hello. My name is Greg Garcia, I'm a member of Alaskans for Peace and Justice, as well as No Nukes North. There's just a few brief things I'd like to say about this. I mostly want to comment on it as a policy issue. I realize that, you know, the purpose of this is to take testimony about the actual environmental impact of this and I'm not really all that knowledgeable. I've looked at a lot of the materials about it, about the environmental aspects and, frankly, you know, I'm not probably qualified to interpret a lot of the things that are said there.

However, I do definitely oppose the space-based weapons platform that are mentioned in Alternative 2. Certainly, you know, be opposed to putting weapons in space. I'd like to see something quite a bit less than the No Action Alternative, I'd really like to see something rolled back in a way and dismantling and using these resources, the financial resources that were wasted on this on much more pressing needs in this country.

As many people have mentioned, it does protect us from what's the least likely attack scenario. There's way too many other things going on that are threats where the resources that are being expended here could be used. For example, roughly four percent of the cargo containers coming into the United States from foreign countries are inspected in any way, and that's mostly just inspecting the paperwork, not even actually doing an actual physical inspection. And we could certainly create a lot of jobs that way, as well as by building this system. So it doesn't seem like a very good cost benefit there.

I feel that this system makes us less safe. In one way by leading to an increased arms race as we have pulled out of the 1972 ABM treaty. I think that was a mistake. By pulling out of that treaty I think we've stimulated China to increase its production of intercontinental ballistic missiles and possibly the spin off there is that India and Pakistan may be increasing their weapons as well in order to have a defense against China.

The idea to dominate space seems to be at the heart of this, that's fairly, clearly spelled out in United Space Command documents and this seems to be kind of a component of that. And it would seem to me that the desire to dominate space is just a new era of colonialism.

In conclusion, I feel that this entire system is based on corporate welfare, that the legislative process that takes place in Washington, D.C. seems to be dominated by huge multinational corporations that want to build the system and so they have managed to lobby and provide the funding for the campaigns for the Congress people, Senators and Representatives who have approved for this program to take place, so that they get to become even more fabulously wealthy than they are now by building a system that, frankly, doesn't work.

Thank you.

MR. BONNER: Thank you. Have Christine

Reichman come up.

MS. REICHMAN: Hello, I'm Christine Reichman. Just here on my own. I'm an amateur church musician and a mother. I'd like to go on record opposing the construction of these new weapons. I prefer the No Action Alternative, bad as it is, given only three choices. I oppose the new weapons system being discussed because it is destabilizing ecologically with space debris radioactive material and other pollutants. Because it's destabilizing economically using resources that we should be using for helpful things for our civilization. Because it's destabilizing politically, because it encourages aggression by us and towards us. It's not just the physical environment that is endangered, though it certainly is, it is also our cultural environment. New weapons increase distrust among people, create new enemies, reinforce old prejudices against peaceful needs. We can refuse to be each other's enemies.

Thank you.

MR. BONNER: Thank you. Have Tom Macchia come up.

MR. MACCHIA: Thanks for the opportunity to make a few comments.

I guess my first question about this is I'm really kind of concerned and troubled that we're talking about an Environmental Impact Statement for a program that's already begun -- that's already started to deploy. I thought that standard procedure was to make decisions about environmental impact, then decide whether we were going to employ [sic]. So that was one question.

I work in heath care and used to work as a researcher, so all of you who are doing work on this have my sympathy. I understand that when you're given a job you try to do the best you can with it, and you try to get some sort of an answer. In a lot of cases to make your bosses happy. And given that we have an administration that 5,000 scientists have accused of elevating junk science, and totally ignoring real science, and given that the Union of Concerned Scientists have said that this whole idea is rather preposterous and will never work. I'm also a member of -- I work in health care, I'm a member of physicians for social responsibility and they done some very excellent critiques of both the environmental impacts of this and of the whole idea. And so rather than try and duplicate their science, which I am not qualified to do, I'll just say they speak very well for me as well as far as science goes.

If this were free, at best it would be foolish. Given the fact that it's costing us so many valuable dollars, and continues to grow exponentially in terms of its budget, it's a dangerous farce, and I certainly support the No Action option.

MR. BONNER: Thank you for your comments. Have Myrna Hammond come up.

(No response)

MR. BONNER: Is Myrna here? She had to leave? Okay.

Would anyone else like to come up and speak and provide input or feedback?

MR. SOLLENBERGER: I'll come up.

MR. BONNER: Okay.

MR. SOLLENBERGER: I wrote something that I was going to (indiscernible - away from microphone)

MR. BONNER: Could you give us your name?

MR. SOLLENBERGER: Bruce Sollenberger.

MR. BONNER: Bruce. What was the last name again?

MR. SOLLENBERGER: Sollenberger is the last.

MR. BONNER: Sollenberger, thank you.

MR. SOLLENBERGER: What I wrote is any activity can be subjected to one basic question; will it work and are there alternative activities that are better use of resources? It may be possible at the cost of 500 million to a billion dollars to develop a system that can detect some missile and intercept them. Given the complexity of the system, it will be vulnerable at a number of levels. These include jamming of the ionospheric layer used to detect missiles using multiple warhead systems, several missiles launched at once.

Implementation will undoubtedly trigger an arms race and force neighbors, such as the former Soviet Union, to adopt countermeasures. It is my view that a far better use of resources is met by a policy of mutual disarmament combined with treaties involved with not attacking and mutual aid and respect. Ultimately the question must be asked, is a protection-based program the best we can do? Or is a program of reduction of antagonism between nations not more cost effective? A billion dollars can buy a lot of aid. North Korea, for example, is starving at present. Their reaction to such a system may be to sell their nuclear weapons to a terrorist source. I believe this is a former likely way that the U.S. may be threatened. This system does nothing to address such a treat.

My thesis is that escalation of an arms race benefits no one. Rather we must deescalate the world's weaponry. We cannot live with it any longer. Sooner or later an accident will set it off and bring it down upon us.

Thank you.

MR. BONNER: Thank you. Okay. Any other comments from those who haven't spoken or others from those who have?

(No audible responses)

MR. BONNER: Marty.

MR. DUKE: Well, I would like to again thank each and every one of you for taking your time and your effort to review the document and providing the comments for us tonight. We have your comments, we'll go back and look at each comment that you gave and consider it. And if we need to include more information in the Final PEIS, expand the areas that you're concerned about, then we'll do that.

Again, I appreciate you coming out, we take your comments seriously and thank you for your participation.

MR. BONNER: If you have any further questions, feel free to stay.

MR. DUKE: Yeah, we're going to be outside, if you have any more questions.

(Off record)

C E R T I F I C A T E

UNITED STATES OF AMERICA)
)ss.
STATE OF ALASKA)

I, Joseph P. Kolasinski, Notary Public in and for the state of Alaska, and reporter for Computer Matrix Court Reporters, LLC, do hereby certify:

THAT the foregoing MEETING FOR DRAFT PEIS was transcribed by under my direction and reduced to print to the best of our knowledge and ability;

THAT the meeting was recorded electronically by myself on October 21, 2004;

I further certify that I am not a relative, nor employee, nor attorney, nor of counsel of any of the parties to the foregoing matter, nor in any way interested in the outcome of the matter therein named.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my seal this 28th day of October 2004.

Joseph P. Kolasinski
Notary Public in and for Alaska
My Commission Expires: 3/12/2008

MISSILE DEFENSE AGENCY

BALLISTIC MISSILE DEFENSE SYSTEM

(BMDS)

DRAFT

PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT

(PEIS)

PUBLIC HEARING

taken on behalf of the Missile Defense Agency at the Best Western Hotel, 3253 North Nimitz Highway, Honolulu, Hawaii, 96819, commencing at 6:34 p.m., on Tuesday, October 26, 2004, pursuant to Public Notice.

Reported by: Julie A. Peterson, CSR #361, CRR, RMR
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I N D E X

PUBLIC COMMENTS

MR. DUKE: Okay, I have a little bit after 6:30 so let's go ahead and get started with the formal presentation.

I'd like to welcome everyone this evening to the public hearing for the Missile Defense Agency's Ballistic Missile Defense System Draft Programmatic Environmental Impact Statement.

This public hearing is being held in accordance with the National Environmental Policy Act or NEPA. My name is Marty Duke and I'm the Missile Defense Agency's Program Manager for the development of the Programmatic Environmental Impact Statement.

I'd also like to introduce Colonel Mark Graham who is with the Missile Defense Agency's Office of General Counsel. Colonel Graham will talk about the Draft Programmatic Environmental Impact Statement, the NEPA process, and the BMDS capabilities and components.

Also I would like to introduce Mr. Peter Bonner and Ms. Deb Shaver in the back who are with ICF Consulting. Ms. Shaver is the ICF Consulting Program Manager and the technical lead for the PEIS, and Mr. Bonner will facilitate tonight's meeting.

Again, I'd like to welcome you. Now I'd like to turn the meeting over to Peter who will go over tonight's meeting agenda and make some administrative points on providing public comments on the Programmatic Environmental Impact Statement.

Peter?

MR. BONNER: Thanks, Marty. Good evening. I'd also like to welcome you to tonight's hearing. First I'd like to dispense with a couple of the acronyms we're going to use tonight.

As we move through the presentation, we refer to the Missile Defense Agency as MDA.

We'll review the Ballistic Missile Defense System, or BMDS, and discuss the Programmatic Environmental Impact Statement, or PEIS.

There will be a test at the end of the evening.

Therefore, at the hearing, we'll discuss the development of MDA's Draft BMDS PEIS. We will discuss the proposed action, which is the implementation of an integrated BMDS. The activities involved in implementing the BMDS have been analyzed for their potential environmental impact.

Finally, we'll provide a forum to collect public comments on the Draft PEIS.

To ensure MDA has enough time to receive your oral comments, we'll use the following agenda you see up on the screen. We'll spend the next thirty to forty minutes presenting information about the BMDS, the NEPA process, and our analysis.

The presentation will discuss what is a Programmatic EIS, what is the BMDS, how were potential impacts analyzed in the BMDS PEIS, what are the results of this analysis, and how does one submit comments on the Draft PEIS.

After the presentation portion, we'll then have a fifteen-minute break when any of you wishing to provide oral comments can sign up at the registration table in the back.

After the break, each speaker will be called in the order in which they signed up, and come up and make their statements.

Following the public statements, MDA representatives will be available in the poster area to clarify any information we've given during the presentation.

Please note that questions or comments provided informally to MDA in the poster area will not be officially recorded. We are officially recording tonight's session and we have a court reporter here tonight to do that.

However, all your questions can be

submitted to MDA through one of a number of available methods.

The most important part of tonight's meeting is the public comment portion. All public statements provided tonight will be recorded for a transcript.

Please remember that the Programmatic EIS is a draft document. This is your opportunity to provide comments on that draft before it's finalized and the decision is made.

We're here to listen firsthand to your suggestions and concerns. Please limit your comments to five minutes to give everyone an opportunity to speak.

Your comments and questions will be recorded tonight and be carefully considered in the final PEIS.

If you wish to provide written comments, forms are available at the registration table in the back. You may leave your written comments with us at the registration table, you can mail them to us, e-mail them to us, fax them to us using MDA information provided.

To allow time to consider and respond to comments in the final PEIS, all comments must be received no later than November 17.

Colonel Graham will now discuss the BMDS PEIS and the NEPA process. Thank you.

COLONEL GRAHAM: Good evening everyone. NEPA establishes our broad national framework for protecting the environment. NEPA requires federal agencies to consider the environmental impacts of their proposed actions and reasonable alternatives to those actions early in the decision-making process.

The NEPA process is intended to help public officials make decisions based on understanding environmental consequences, and take actions that protect, restore, and enhance the environment.

In the past, the national approach to missile defense focused on the development of individual missile defense programs or elements, such as the Patriot, the Airborne Laser, and ground-based interceptors. These actions were appropriately addressed in separate NEPA analyses that MDA, its predecessor agencies, and executing agents prepared for these systems.

The aim of missile defense has been refocused by the Secretary of Defense to develop an integrated Ballistic Missile Defense System that would be a layered system of components working together capable of defending against all classes and ranges of threat ballistic missiles in all flight phases. Because the integrated Ballistic Missile Defense System is a large program made up of many projects implemented over time on a worldwide basis, MDA has determined that a programmatic NEPA analysis would be appropriate. Therefore, the MDA has prepared a Programmatic EIS to analyze the environmental impacts of implementing the proposed program.

The Programmatic EIS, or PEIS, analyzes the broad environmental consequences in a wide-ranging federal program like the Ballistic Missile Defense System.

The PEIS looks ahead at the overall issues in a proposed program and considers related actions together in order to review the program comprehensively.

The PEIS is appropriate for projects that are broad in scope, are implemented in phases, and are dispersed widely geographically.

A PEIS creates a comprehensive, global, analytical framework that supports subsequent analysis of specific activities at specific locations.

The Programmatic EIS is intended to serve as a tiering document for subsequent specific

Ballistic Missile Defense System analysis and includes a roadmap for considering impacts and resource areas in developing future documents.

This roadmap identifies how a specific resource area can be analyzed and also includes thresholds for considering the significance of environmental impacts to specific resource areas.

This means that installations, ranges, and facilities at which specific program activities may occur in the future could tier their documents from the PEIS and have some reference point from which to start their site-specific analysis.

The Ballistic Missile Defense System Programmatic EIS analyzes the potential environmental impacts of developing, testing, deploying, and planning for decommissioning for the proposed program.

The Programmatic EIS evaluates the proposed Ballistic Missile Defense System technology, components, assets, and programs, and considers future development and application of new technologies.

The proposed action considered in the BMDS Programmatic EIS is for the MDA to develop, test, deploy, and plan for decommissioning activities for an integrated Ballistic Missile Defense System using existing infrastructure and capabilities, when feasible, as well as emerging and new technologies to meet current and evolving threats.

When feasible, the MDA would use existing infrastructure to implement the BMDS and would incorporate new technologies and capabilities as they become available. This would ensure that the program could provide defense for both current and future ballistic missile threats.

The purpose of the proposed action is to incrementally develop and deploy a Ballistic Missile Defense System, the performance of which can be improved over time, and that layers defenses to intercept ballistic missiles of all ranges in all phases of flight.

The proposed action is needed to protect the United States, its deployed forces, friends and allies, from ballistic missile threats.

In this Programmatic EIS, the MDA considered two alternative approaches to implementing the Ballistic Missile Defense System. We also considered a No Action Alternative. The alternative approaches address the use of methods from land-, sea-, air-, and space-based platforms.

Alternative 1 is to develop, test, deploy, and plan to decommission an integrated Ballistic

Missile Defense System that includes land-, sea-, and air-based weapons platforms.

The BMDS envisioned in Alternative 1 would include space-based sensors, but would not include space-based defensive weapons.

Alternative 2 is to develop, test, deploy, and plan to decommission an integrated Ballistic Missile Defense System that includes land-, sea-, air-, and space-based weapons platforms.

Alternative 2 would be identical to 1, with the addition of space-based defensive weapons.

The Council on Environmental Quality regulations implementing NEPA also require consideration of the No Action Alternative. Under the No Action Alternative, the MDA would not develop, test, deploy or plan for decommissioning activities for an integrated Ballistic Missile Defense System.

Please note that under the No Action Alternative, MDA would continue existing development and testing of individual elements as stand-alone defensive capabilities. Individual systems would continue to be tested but would not be subjected to system integration tests.

Alternatives 1 and 2 provide different weapons platforms options for implementing an integrated Ballistic Missile Defense System, while the No Action Alternative continues the traditional approach of developing individual missile defense elements such as the Airborne Laser, Patriot, or ground-based interceptors.

I will now address how MDA categorized the Ballistic Missile Defense System into relevant components and life cycle activities that could be considered to provide a programmatic overview of the environmental impacts of implementing the proposed action.

MDA's goal is to develop an integrated Ballistic Missile Defense System that will provide a layered defense. The Ballistic Missile Defense System would be capable of destroying threat missiles in the boost, midcourse, and terminal phases of flight and would defend against short, medium, intermediate, and long-range threat ballistic missiles.

Finally, the Ballistic Missile Defense System would integrate sensors and weapons through a command control, battle management, and communications network, or C2BMC.

With this capability, the integrated Ballistic Missile Defense System would establish a defense against threat ballistic missiles.

The Ballistic Missile Defense System is a complex system of systems. To be able to perform a meaningful impact analysis, we considered the Ballistic Missile Defense System in terms of its components: weapons, sensors, C2BMC, and support assets.

These components are the building blocks that can be assembled with specific functional capabilities and can be operated either together or independently to defeat threat ballistic missiles.

Testing was considered for each component; however, the integrated Ballistic Missile Defense System needs to be tested at the system level, and thus was analyzed using realistic system integration flight test scenarios.

Let's look at each of the components.

The Ballistic Missile Defense System weapons would provide defense against threat ballistic missiles. They include interceptors and directed energy weapons in the form of high-energy lasers that would be used to negate threat missiles.

Interceptors would use hit-to-kill technology, either through direct impact or directed fragmentation. Ballistic Missile Defense System weapons are designed to intercept threat ballistic missiles in one or more phases of flight and could be activated from land-, sea-, air-, or space-based platforms.

The Ballistic Missile Defense System sensors would provide the relevant tracking data for threat ballistic missiles. Sensors detect and track threat missiles and assess whether a threat missile has been destroyed. Sensors provide the information needed to locate and track a threat missile to support coordinated and effective decision-making against the threat.

There are four basic categories of sensors considered for the Ballistic Missile Defense System. They are radars, infrared, optical, and laser sensors.

Radars send out a signal and detect the same signal as it bounces off an object.

Infrared sensors are passive sensors that detect and track heat or infrared radiation from an object.

Optical sensors are passive sensors that collect light energy or radiation emitted from an object.

Laser sensors use laser energy to illuminate and detect the object's motion.

Radars and lasers, thus, emit radiation, while infrared and optical sensors detect radiation that has been emitted.

The Ballistic Missile Defense System sensors would operate from multiple platforms, such as land, sea, air or space.

The data collected by the sensors would travel through a communication system to command and control centers where a battle management decision on whether to use a defensive weapon would be made.

C2BMC would integrate and coordinate equipment and operations throughout command and control and integrated fire control centers.

C2BMC would enable military commanders to receive and process information, make decisions, and communicate those decisions regarding the engaging of the threat missiles.

The C2BMC would include fiber optic cable, computer terminals, and antennas, and would operate from land-, sea-, air- and space-based platforms.

The last category of components is support assets.

Support assets would be used to facilitate development, testing, and deployment of the Ballistic Missile Defense System components.

Support assets are one of three types:

support equipment, infrastructure, or test assets.

Support equipment includes general transportation and portable equipment such as automobiles, ships, aircraft, rail, and generators.

Infrastructure includes docks, shipyards, launch facilities, and airports.

Test assets include test range facilities, targets, countermeasure devices, simulants, and observation vehicles.

Now that we have discussed the components, Mr. Marty Duke will continue and describe how they can be integrated into a Ballistic Missile Defense System.

MR. DUKE: This slide depicts the integration of the various components of the proposed BMDS that Colonel Graham just discussed.

The use of multiple defensive weapons and sensors operating from a variety of platforms integrated through a single C2BMC system would create a layered defense allowing several opportunities to intercept and destroy the threat missile.

For example, one weapon could engage a threat missile in its boost phase, which is represented in the red here, and another could be used to intercept the threat missile in a later phase if the initial intercept attempts were unsuccessful either in the mid or in the terminal phase here.

Components are incorporated into the BMDS through the life cycle phases of the system acquisition process.

These life cycle phases are development, testing, deployment, and decommissioning.

New components would undergo initial development testing, while existing components would be tested to determine their readiness for use.

Work on a given technology would stop if testing failed to demonstrate effectiveness or if the functional capability needs changed.

Components and elements would be deployed as testing demonstrates that they have capabilities of defending against threat ballistic missiles. In most cases, that component would be deployed when testing demonstrates that it's capable of operating within the integrated BMDS and the associated safety and health procedures are developed and adequate.

This process concludes with decommissioning, which would occur when and where appropriate.

To determine the environmental impacts, this PEIS analyzes the proposed BMDS components by considering the various life cycle phase activities of each component as well as the operating environments in which the activities take place.

This slide tries to depict the multi-dimensional complexities involved in considering the impacts of implementing an integrated BMDS in terms of its components, which we represent here - the weapon sensors, C2BMC, support assets - across each of their life cycle phase - development, test, deploy, decommissioning - in the different operating environments.

Because of the complex nature of this project, an analysis strategy was developed to effectively yet efficiently consider the broad range of environmental impacts from the proposed BMDS.

First, the existing conditions of the effective environments were characterized for the location where various BMDS activities are proposed to occur.

Next, MDA determined the resource areas that could potentially be affected by implementing the BMDS.

Finally, impacts of the BMDS were analyzed in four steps.

In Step 1 we identified and characterized life cycle phase activities.

In Step 2 we identified activities with no potential for impact and dismissed them from further analysis.

In Step 3 we identified similar activities across life cycle phases and combined them for the analysis.

And, finally, in Step 4 we conducted the impact analysis for all remaining activities.

The first three steps were used to characterize and reduce the number of unique life cycle activities, thereby reducing the redundancy in preparing the impact analysis.

The affected environment includes all land, air, water, and space environments where proposed BMDS activities are reasonably foreseeable.

The affected environments have been considered in terms of broad ocean area, the atmosphere, the nine terrestrial biomes.

A biome is a geographic area with similar environments or ecologies.

Climate, geography, geology, and the distribution of vegetation and wildlife determined the distribution of these biomes.

These biomes encompass both the U.S. and non-U.S. locations where the BMDS could be located or operated.

The resource areas considered in this analysis are those resources that can potentially be affected by implementing the proposed BMDS.

NEPA analysis generally considers the resource areas listed on the screen, except for orbital debris. Because missile defense development and test activities include the launch and the intercept of missiles, space-based communications and other satellites, and potential for space-based interceptors, MDA also considered orbital debris and its impact on the Earth.

This PEIS discusses all resource areas, provides a methodology for analysis, and suggests thresholds of significance to provide the reader with a roadmap for performing future site-specific analyses tiering from this PEIS.

These discussions outline the type of information that would be needed to conduct site-specific analyses and identifies the steps necessary to ensure potential impacts are appropriately considered.

The resource areas, highlighted with the red star, require site-specific information for analysis, and these resource areas are more effectively addressed in subsequent tiered analyses for specific activities.

Once we decided how to consider the effective environment and resource areas of concern, we used the four-step process I just mentioned earlier. I will discuss each step with more detail.

In Step 1 of the impacts analysis, MDA identified and characterized the activities associated with each BMDS component.

Each life cycle phase has activities applied to each component. For example, development can include planning, research, systems engineering, site preparation and construction.

Testing can include manufacturing, site preparation and construction, transportation, activation, and launch activities.

Deployment can include manufacturing, site preparation and construction, transportation, activation, launch, operation and maintenance, upgrades, and training.

And, finally, decommissioning includes demilitarization and disposal.

Once life cycle activities were identified, it was determined that some of these activities had no potential for impact. Activities such as planning and budgeting, systems engineering, and tabletop exercises, are generally categorically excluded in various Department of Defense NEPA regulations and therefore were not further analyzed in this PEIS.

Other activities for specific components, such as transportation, maintenance and sustainment, and manufacturing, were not analyzed in this PEIS because they've been evaluated in previous NEPA analyses and have been found to have no significant environmental impacts.

The remaining activities were then examined to determine which activities had similar environmental impacts. For example, impacts associated with site preparation and construction in the development phase would be similar to or the same as the impacts for site preparation and construction activities in the deployment phase.

Under Step 3, similar activities occurring in different life cycle phases were identified and considered together to reduce redundancy.

The final step was to determine the impacts associated with each remaining activity under the proposed action.

The significance of an impact is a

function of the nature of the receiving environment and the receptors in that environment. For example, an interceptor launch creates the same emission no matter where it's launched. Whether those emissions cause impacts and the significance of those impacts depends upon the environment into which they are released.

The PEIS analyzes these emissions by components for each resource area and life cycle activity where potentials for impacts were identified.

Impacts were distinguished based upon the different operating environments: land, sea, air and space.

The analysis also considered specific impacts for individual biomes where activities could occur.

The impacts of system integration testing were considered separately from the impacts of individual component testing because integration testing would involve using multiple components in the same test.

To deal effectively with integration testing, MDA looked at two generic system integration flight test scenarios which involved different numbers of launches and intercepts.

The impacts analysis for Alternative 1 considers the use of land-, sea-, and air-based platforms for BMDS weapons. The analysis includes the use of space-based sensors, but not space-based weapons. The analysis is specific for each resource area based on the impacts from the activities associated with the BMDS component.

The impacts analysis for Alternative 2 includes the use of interceptors from land-, sea-, air-, and space-based platforms for BMDS weapons.

The impacts associated with the use of interceptors from land, sea, and air platforms would be the same as those discussed under Alternative 1; therefore, the analysis for Alternative 2 focuses on the impact of using interceptors from space-based platforms.

Therefore, the fundamental difference between Alternative 1 and 2 is that Alternative 2 includes the analysis of space-based platforms for interceptors.

The cumulative impacts of implementing the BMDS were also considered. Cumulative impacts are defined as impacts that result from the incremental impacts of the proposed action when added to other past, present, and reasonably foreseeable future actions.

Because this proposed action is worldwide in scope and potential application, only activities similar in scope have been considered for cumulative impacts.

Under Alternative 1, worldwide launch programs for commercial and government programs were determined to be similar activities and similar in scope; therefore, the impacts of BMDS launches were consider cumulatively with the impacts from other worldwide government and commercial launches.

Alternative 2 includes placing defensive interceptors in space, which involves adding additional structures to space for extended periods of time.

The International Space Station was determined to be an action that is international in scope and has a purpose of placing structures in space for extended periods of time; therefore, the impacts of the use of space-based weapons platforms were considered cumulatively with the impacts of the International Space Station.

The next few slides provide broad summaries of the impacts analysis with the BMDS components and Test Integration for Alternatives 1 and

2, the No Action Alternative, and the Cumulative impacts for Alternative 1 and 2.

Please note that these results are extremely high level suitable for this presentation. Additional details have been provided in some of the posters in the back of the room. The impact analysis may also be found in the Executive Summary Impact tables in Section 4 of the Draft PEIS.

And we also have the Executive Summary available in the back of the room.

It is important to note that no environmental showstoppers were found in this programmatic impact analysis.

As the next few slides show, there are potential impacts associated with the various activities needed to implement the BMDS; however, they would be appropriately addressed in subsequent tiered NEPA analyses, along with the mitigation actions required to ensure less than significant impacts.

This slide shows a summary of the broad potential for environmental impacts associated with the BMDS weapon activities as examined for each resource area for Alternatives 1 and 2.

Please note again that this is a very high-level depiction of the results of the analysis, and additional details of the weapons analysis may be found in the table in the Executive Summary.

However, one can see from this slide the general activities and resource areas that would be considered in subsequent tiered NEPA analyses.

This slide shows the impacts summary for the BMDS sensors. Note that the impacts are the same for Alternative 1 and 2 and include space-based sensor platforms. This summary also shows how MDA's categorization of activities helped to simplify the analysis.

For example, the activation of radars would not impact air quality because the only emissions resulting from radars would be from the supporting diesel generators, which are addressed under the support assets. However, radars do generate electromagnetic radiation and could potentially impact biological resources.

Although C2BMC is the glue that enables the integrated BMDS to function effectively as a system, this component creates little potential for environmental impact.

Impacts associated with Support Assets are mainly those that would be caused by site preparation and construction of infrastructure and by using test assets such as countermeasures and simulants during testing.

Test Integration overall has the potential for impacts because it includes the use of several components during increasingly realistic test scenarios. Although this programmatic analysis shows the potential for impacts, the existing environment at the proposed test location and the specific test activity planned will determine the nature and the extent of these impacts.

The No Action Alternative would continue the development and testing of individual weapons, sensors, C2BMC, and support assets, and would not include integration testing of these components.

The environmental impacts of the No Action Alternative would be the same as the impact resulting from continued development and testing of the individual missile defense elements.

The decision not to deploy a fully integrated BMDS could result in the inability to respond to a ballistic missile attack on the U.S. or its deployed forces overseas, our allies or friends, in a timely and successful manner.

Further, this alternative would not meet the purpose or the need of the proposed action or the specified direction of the President and the United States Congress.

We examined the impact of the worldwide launches on the cumulative impacts. Launches can create cumulative impacts by contributing to global warming and ozone depletion. Potential launching emissions that could affect global warming include carbon monoxide and carbon dioxide or CO_2. Unlike CO_2, carbon monoxide is not a greenhouse gas, but it can contribute indirectly to the greenhouse gas effect.

The cumulative impact on global warming of emissions from BMDS launches would be insignificant compared to the emissions from other industrial sources, such as energy generation.

The BMDS launch emissions load of CO_2 and carbon monoxide would only be five percent of the emissions load from worldwide launches. In addition, CO_2 and carbon monoxide from ten years of BMDS worldwide launches combined would account for much less than one percent of the CO_2 and carbon monoxide emissions from U.S. industrial sources in a single year.

Chlorine is of primary concern with respect to ozone depletion. Launches are one of the manmade sources of chlorine in the stratosphere. The cumulative impacts on stratospheric ozone depletion from launches would be far below the effects caused by other natural and manmade sources.

The emission loads of chlorine from both BMDS and other launches worldwide occurring between 2004 and 2014 would account for only about half of one percent of the industry chlorine load from the U.S. in a single year.

The orbital debris produced by BMDS activities would generally be small in size and would consist primarily of launch vehicle hardware, old satellites, bolts, and paint chips.

It may also be possible for debris from an intercept to become orbital debris. However, orbital debris produced by BMDS activities would occur in low-earth orbit where debris would gradually drop into lower orbits and reenter the atmosphere; therefore, orbital debris from BMDS activities would not pose a long-term hazard to the International Space Station or other orbiting structures.

In addition, collision avoidance measures would further reduce the potential for orbital debris to damage structures in space, such as the International Space Station.

I would like to reiterate that our impacts analysis indicated no expected areas of significant impacts on the environment. However, many resource areas show potential for impact, indicating that these areas need to be considered in any subsequent analyses tiered from this PEIS at a site-specific location.

At this time I'd like to turn the meeting back over to Peter who will discuss some more about how we're going to do the administrative comments later on into the meeting.

MR. BONNER: Now that we've looked at the proposed BMDS and the potential impacts from implementation, let's discuss the PEIS schedule for a minute.

The PEIS development process began with the Notice of Intent, or NOI, which was published on April 11th, 2003.

The MDA released the Draft PEIS in September of 2004. The public comment period, that we're in right now, will continue through November 17th, 2004. At that time, the MDA will consider all the comments received and incorporate appropriate changes into the Final PEIS.

A release date for the Final PEIS is estimated for December 2004 or January 2005.

After the release of the Final PEIS, there will be a 30-day waiting period before MDA can issue its Record of Decision, or ROD.

There are a number of ways you can submit comments and provide comments on the Draft BMDS PEIS. You can provide your comments either orally or in writing. Both oral and written comments will be given equal consideration in the final PEIS.

If you'd like to make a statement at tonight's meeting, please sign up at the registration table and fill out a speaker's card. Each speaker will have an initial five minutes to make a statement. This five minutes is your time. If you need significantly more time than five minutes, I'd ask that you yield to the other speakers and then come back after the final speaker has spoken and provide additional input.

As mentioned earlier, public statements by tonight's speakers will be recorded by the court reporter to ensure that we can accurately capture your comments. There's also a toll-free telephone number that you may use to submit comments, and please refer to your handouts for that.

The information on the screen lists the various ways you can submit your comments to us. The information is also listed in the comment form at the registration table, the MDA website, and handouts available in the poster area.

Another option to submit your comments is in writing. There are four ways to do that. First, you may leave your written comments you brought with you tonight with us at the registration table. Second, you can use the comment forms that we have available at the registration table, and you can either turn them in to us or fax or e-mail them to us.

You may also e-mail your comments using the MDA address listed in the handouts and on the website. Finally, you can submit your comments through the website on an electronic form there.

Again, to ensure that your comments are adequately considered, please get them to us by November 17th.

Please visit the BMDS PEIS website for additional information. The website provides fuller descriptions of the topic areas that we touched on this evening, as well as links for obtaining additional information.

The material handed out tonight are also posted on the BMDS PEIS website.

We encourage you to sign up to receive a hard copy of the Executive Summary of the Final PEIS and a CD-ROM of the whole document when it becomes available. To do this, please fill out the appropriate form at the registration table.

You can also request the Executive Summary or CD-ROM of the entire document by sending an e-mail to the address listed in the handout materials.

The final PEIS will be available in PDF format to download from the website, and hard copies will be placed in local libraries. A list of these libraries, again, is available on the website.

Please remember that no decision on the project will be made tonight. Our role is to listen to your concerns and issues firsthand and ensure that they're considered in the Final PEIS.

To ensure that all comments are addressed in the Final PEIS, again, we'd like them submitted no later than November 17th.

At this point we'd like to take a fifteen-minute break to set up for public statements. Please use this time to sign up at the registration table if you're interested in providing a public comment. Please also note that the MDA staff will be available to answer questions immediately following the conclusion.

TERRI KEKOOLANI: I have a question.

MR. BONNER: Yes?

TERRI KEKOOLANI: Who present here is going to be your Hawaiian language translator?

MR. BONNER: I don't think we've provided for one, unfortunately.

MR. DUKE: Has there been a request?

TERRI KEKOOLANI: Please note that you don't have one.

MR. BONNER: Thank you. Let's take our fifteen-minute break where you can sign up for public comment.

KYLE KAJIHIRO: I also have questions about the process. That was one of my questions. The other one had to do with the schedule of hearings. There's only one hearing on Oahu and we had requested at the scoping meeting that there be meetings on Kauai and Maui, because those are islands that are also affected. It's very expensive to fly over here, and you haven't scheduled those, so I'd like to know why not, you know, and because the reason is you're actually discriminating against native Hawaiians in doing so.

As William Eiler has said in other testimony, Hawaiian culture is an old tradition, so to be able to testify in person, orally, is very important, and if you don't provide that opportunity, you've effectively discriminated against a whole segment of the community. So can you answer that, please?

MR. BONNER: I think that was considered as part of the schedule in moving forward and it was considered by MDA and the folks who had made the decisions on where to schedule these, that these locations would be sufficient.

Marty, would you like to comment on that any further?

MR. DUKE: We take everything considered. Since this is a very programmatic document, it's not site-specific on particular ranges, it's just BMDS in general, the integration of BMDS, we looked at the states that had most of our activities and we decided to meet in the Capitols of those states.

Now, comments can be made through the various means. And written comments, e-mail comments, hold the same weight as public comments.

TERRI KEKOOLANI: I’m sorry, I have to interrupt. Isn't this going to be based on Kauai? When you say the Capitol of the state, they can't drive here, so when you --

MR. DUKE: We have other means to make the

comments through --
        TERRI KEKOOLANI: How are they seeing your
presentation?
        MR. DUKE: Well, I guess they are not seeing our presentation, but we have the information out on our website and other means.
        TERRI KEKOOLANI: So the people who are directly impacted by this particular program are not actually seeing your presentation?
        MR. DUKE: No, they are not seeing our presentation.
        KYLE KAJIHIRO: You're missing the point I'm making, which is that for many in the native Hawaiian community, they're an oral tradition, so to deny the opportunity for direct oral comments is to basically cut them out of the process completely.
        MR. DUKE: When we published --
        KYLE KAJIHIRO: That's a serious flaw in this entire thing.
        MR. DUKE: Well, since we drafted and published the Draft PEIS from your previous comments, we've had no other requests from anyone from the islands requesting we have a different location.
        KYLE KAJIHIRO: There were only three of us who actually found out about this scoping meeting. It was

at a very hard-to-find location, and I think that that's been the pattern with these hearings related to the missile defense program is that they have been very hard to get to, very inaccessible, and that really discriminates against the communities that are most affected. And that's a concern that I have, that I think it questions and undermines the integrity of the whole process.

My name is Kyle Kajihiro.

MR. BONNER: Let me make a suggestion, that comments about process are certainly well within and appropriate for the public comment period. Let's move to the public comment period and get your comments about the process or about the PEIS or comments about the BMDS during that process, okay?

Please sign up at the registration table if you'd like to. Thank you.

So we're going to take fifteen minutes. Give you an opportunity to sign up, come back and make the public comments.

(Recess at 7:18 p.m. until 7:33 p.m.)

MR. BONNER: I have the list of speakers who have registered. I'll call each person to the front of the room to the microphone to speak. Again, please limit your initial comments to five minutes. If you'd like to extend those comments later on, if you could wait until the final speaker has finished and then come back and provide additional input, that would help us.

At the end of about four minutes I'm going to hold up a sign that says "one minute" on it to give you a chance to wrap up. If you have a written version of your comments, we ask that you provide it to us to facilitate an accurate record.

When providing your public statement, please remember to state your name, if you have an affiliation with an organization, we'd like that too, and speak as clearly as you can for the meeting recorder.

If you don't wish to make an oral statement here tonight, please consider providing your comments in writing to us through the avenues we talked about.

Again, thanks for your participation in the process.

Could I have Seiji Yamada come up?

DR. SEIJI YAMADA: My name is Seiji Yamada and I'm a physician, a public health worker, and an educator. I would like to submit comments on the effects that the testing of the Ballistic Missile

System has had on the society and health of the people of the Marshall Islands.

Kwajalein Atoll in the Marshall Islands is the site of the Ronald Reagan Ballistic Missile Defense Test Site. The RTS is equipped to track ICBMs launched from California and to launch the interceptor missiles being testing for the BMDS. I speak from my observations on a number of medical visits to Kwajalein Atoll.

The current testing of the BMDS follows upon the use of the Marshall Islands for nuclear weapons testing. From 1946 to 1957, the U.S. tested 67 nuclear weapons in the Marshall Islands. The 15 megaton Bravo blast of 1954 was America's largest. It rendered Bikini uninhabitable and exposed the people of Rongelap and Utrik to nuclear fallout. Many suffered from acute radiation sickness, and Marshallese have high rates of thyroid cancer.

Displaced by weapons testing, the people of Enewetak, Rongelap, and Bikini have been forced into nomadic lives.

Depending on the level of activity on the base, two to 4,000 non-Marshallese live on Kwajalein Island, the largest and nicest island in Kwajalein Atoll. Most of the residents are employees of U.S.

contractors.

Kwajalein has wide-open spaces and streets shaded with trees. The stores are well-stocked and the grocery store carries fresh fruit and vegetables. The grounds are kept up by Marshallese men, and linens on the beds are changed by Marshallese women.

Marshallese workers on Kwajalein arrive on the ferry from nearby Ebeye Island in the morning, and must return there within three hours of completing their shifts.

Ebeye Island, where the Marshallese people live, is three miles and a twenty minute ferry ride from Kwajalein Island. Its 66 acres are home to 10,000 people. Some people are from Enewetak, Rongelap, and Bikini, displaced by nuclear testing. Some were residents of the central corridor of islands within Kwajalein Atoll, displaced by missile testing. Jobs at the RTS have brought people to Ebeye from all over.

On Ebeye, many of the private houses are made of corrugated tin and plywood. There's little greenery on the island. There's no space for crops. During the rains, the sewage backs up. The electricity goes out occasionally for extended periods. So people subsist on imported white rice and canned meats with little access to fresh vegetables or fruits. The result is undernutrition in children, malnutrition, Vitamin A deficiency. The crude prevalence of diabetes in adults over 30 years of age is 20 percent.

The hospital often lacks basic medical supplies, and until 2001 did not have running water. Also until 2001 boys and young men met the ferry with containers to carry water from Kwajalein to Ebeye. Such difficult water conditions led to a cholera epidemic on Ebeye in December 2000. There were over 400 cases and six people died.

The racism inherit in the apartheid-like Kwajalein-Ebeye setup is palpable for the Marshallese people. Indeed, racism was inherit in the decision to conduct nuclear and ballistic missile testing in the Marshall Islands in the first place. After all, who would willingly volunteer their home to be a target for missiles shot from another continent?

Finally, I would like to note that the Ballistic Missile Defense System is only one component of the militarization of space. The goal is the absolute military superiority of the U.S., allowing it to act with impunity around the globe. Missile defense is about preserving America's ability to wield power abroad. It is not about defense. It is about offense.

As noted in Vision 2020, a document produced by the U.S. Space Command, the goal is full-spectrum dominance, including precision-strike capability.

While space-based strike weapons are not yet a reality, cruise missiles are. Some 800 Tomahawk cruise missiles were utilized at the start of the assault on the people of Iraq in March 2003 in a strategy called Shock and Awe.

This is more than was used during the entire First Gulf War. Strategist at the National Defense University, Harlan Ullman, touted Shock and Awe on CBS TV prior to the assault. He said we want them to quit. We want them not to fight. This will have the desired simultaneous effect, rather like the nuclear weapons at Hiroshima, not taking days or weeks but in minutes.

I'm from Hiroshima, and it's hard for me to comprehend Hiroshima being cited in a positive manner.

MR. BONNER: You've got about a minute left for your five minutes.

DR. SEIJI YAMADA: Between 5,000 and 10,000

Iraqi civilians and between 4,000 and 7,000 Iraqi military personnel were killed during the period of the initial assault. This is the suffering caused by such weapons. We cannot continue to let this happen.

Thank you.

(Applause.)

MR. BONNER: Thank you.

Will Michael Jones come up?

MICHAEL JONES: I have a few comments to make about deficiencies in this, and some of these were deficiencies in previous analyses.

There's no examination of treaty restriction on target launches in this EIS, no quantitative information on the reliabilities of rocket boosters. There's some inconsistencies and confusion about cumulative impacts. This EIS estimates 515 launches in a ten-year period, the previous 2003 ground-based missile defense extended test range EIS estimated only 100 in a ten-year period.

There's an egregious error in Exhibit 4-11 on page 4-102. First of all, there's an addition error in the table. The more serious error is that total emissions for the interceptor are given as 115 kilograms, whereas the 2003 EIS for the ground-based interceptor gave the first stage emissions as 15,000 kilograms. So what's given in this EIS is a factor of 100 too small.

Probably the most serious problem is that this document is largely irrelevant.

As the summary in Section 1.2 indicates, environmental analyses have been done for most of the components already. Notable exceptions are sea-based midcourse defense and space weapons, which to my knowledge have not been analyzed.

R&D and testing of most of the components is well underway and decisions have mostly been made about these systems, including even decisions about the initial deployment of the ground-based midcourse defense and the sea-based midcourse defense.

The No Action Alternative is not seriously considered. It is claimed not to be at the direction of Congress, presumably the 1999 Missile Defense Act. This Act states U.S. policy is to deploy as soon as is technologically possible an effective NMD system, but the EIS has no discussion about NMD effectiveness and whether that criteria is satisfied.

Finally, the spiral development approach seems to preclude any meaningful assessment. The PEIS could make an useful contribution by analyzing how to judge the effectiveness of the missile defense with no specified architecture and no operational requirements.

Thank you.

(Applause.)

MR. BONNER: Elayne Pool?

ELAYNE POOL: I have a letter that's been signed by 36 people and myself and I would like to read that to you, please.

We support a real No Action Alternative to the deployment of a missiles defense system. This means no further testing, development or deployment.

Deployment of such a system threatens a new nuclear arms race, puts the global environment at risk, and does not improve the security of the United States.

Deployment of a missile defense system will increase the likelihood of a nuclear catastrophe. It impels Russia to maintain a larger nuclear arsenal on high alert than it otherwise would.

Deployment also drives China to deploy a larger arsenal. The impact of a nuclear war, whether accidental or intentional, would dwarf any other environmental nightmare one can envision.

Moreover, the system does not improve our security. So far it has yet to be tested in realistic conditions and would be ineffective against an attack.

While in the future the capabilities of this system can be expanded at great expense, these developments are likely to be made useless by the newly improved weapons and countermeasures of potential adversaries.

Finally, the $10 billion a year being spent on missile defense should be spent on measures that are more effective and environmentally sound. One example is the program to secure stockpiles of nuclear weapons material in the former Soviet Union and other countries.

The testing, development, and deployment of the missile defense system should be halted, given that the system leads to environmental harm and potentially to environmental devastation and does so without improving the security of the United States.

Finally, I'd like to read a statement, and I wonder if you know who said it. These words certainly apply to this costly system that is untested and will endanger mankind further.

"Every gun that is made, every warship launched, every rocket fired, signifies in the final sense, a theft from those who hunger and are not fed, those who are cold and are not clothed.

"The world in arms is not spending money alone. It is spending the sweat of its laborers, the genius of its scientists, the hopes of its children.

"This is not a way of life at all, in any true sense. Under the cloud of threatening war, it is humanity hanging from a cross of iron."

That was said by Dwight Eisenhower, Five Star General of the U.S. Army and the United States President.

(Applause.)

MR. BONNER: Thank you.

Kyle Kajihiro?

KYLE KAJIHIRO: Aloha. I am Kyle Kajihiro. Thank you for this opportunity to testify. I am representing the American Friends Service Committee this evening, Hawaii area program, and we're opposed to the Ballistic Missile Defense System completely.

I think that you have inadequate alternatives. You only have three alternatives and there ought to be a fourth one which includes not deploying, developing the Ballistic Missile Defense System, and actually reducing the scope of existing programs.

That should be considered as a real alternative for considering what is really in the interest of the United States and the world in terms of building a real security environment.

I want to first just go back to the question of the process being flawed so it can get on the record.

Again, I think that these processes have typically discouraged public participation. Whether that's by design or just by negligence, I think that it needs to be noted that there haven't been adequate efforts to reach out to the public, to provide accessible venues and opportunities for people to testify.

As I said earlier, as Terri Kekoolani said earlier, Hawaiian translation is essential, the native Hawaiian language, Olelo Hawaii, is one of the official languages of Hawaii, and that should be honored in these proceedings so that when Hawaiian words are expressed, they are captured correctly and not noted as inaudible or unintelligible, which is often the case.

Second, the question of native Hawaiian culture being an oral tradition, it's very important that you provide opportunities for people to give live testimony where they can look you in the eye and express what they are feeling.

When you say that often written testimony or e-mail testimony is adequate, you effectively discriminate against a whole group of people who are actually one of the groups that are disadvantaged and should be considered as part of the environmental justice analysis of your Environmental Impact Statement.

The missile defense program we believe violates international treaties and is destabilizing in this global environment. As others have said, it will increase the likelihood of nuclear catastrophe by creating nuclear rivalries and forcing other countries to build up their arsenal.

In July 2001 the Russian foreign ministry spokesperson, Alexander Yakovenko reacted very angrily to the U.S. missile defense tests over the Pacific. He warned that the missile defense contributes to a situation which "threatens all international treaties in the sphere of nuclear disarmament and nonproliferation which are based on the 1972 Anti-Ballistic Missile Treaty."

On June 13, 2002, George W. Bush unilaterally and without the vote of Congress withdrew the United States from the ABM Treaty.

So I think that if the United States is

going to be a leader of the world in terms of establishing policy for peace and democracy, it needs to demonstrate that by its own actions, and instead it's only demonstrated a policy of aggression.

The nuclear posture is now to consider the possible use of limited nuclear strikes. That's a very dangerous step from past nuclear doctrine, and combined with the missile defense system is seen as a threat to many countries around the world.

So I don't think you can separate the missile defense system from the rest of the nuclear doctrine. It has to be considered together. And in that light, missile defense is an offensive weapon, as others have said, to establish U.S. full-spectrum dominance.

So the Programmatic EIS fails to analyze how the proposed BMDS system will affect the international security environment, how will it impact international laws and treaties such as prohibitions on the weaponization of space. And that's one of the explicit options for the Ballistic Missile Defense System. So that goes against established agreements to keep space for peace.

I want to also speak about the opportunity costs. As someone testified earlier, what we spend on missile defense and other military spending is stealing from the dreams of our children, the potentials of our community.

I want to give you an example of how this would affect us here in the Hawaii, according to the National Priorities Project. Taxpayers in Hawaii will pay 33.1 million for ballistic missile defense in fiscal year 2005.

For the same amount of money, the following could be provided: 11,269 people receiving health care, or 4,426 Head Start places for children, or 17,466 children receiving health care, or 150 affordable housing units, or four new elementary schools, or 9,556 scholarships for university students, or 571 music and arts teachers.

So I say that that needs to be considered. The opportunity costs of ballistic missile defense is one of the impacts that we have to deal with and our children have to deal with, and it needs to be considered in your Environmental Impact Statement, and I didn't see it listed there.

The cumulative impacts analysis I think was very flawed. You said earlier that you would only consider similar types of global actions in comparing what the cumulative impacts would be, but I think that's a way of effectively ignoring the combined effects of many, many local impacts that occur when you have these programs in many forms around the world. So I think you need to consider all those analyses, the local studies that are being done, that have been done, past, present and future.

And this also includes historical impacts related to colonialism. As others have expressed about the Marshall Islands, the U.S. program there has been devastating for that community. The same is true here in Hawaii for native Hawaiians; the 111 years that the U.S. military has invaded and destroyed Hawaiian land, culture, or denied people the ability to practice. Those also have to be considered as part of the cumulative impacts.

And this gets to the environment justice analysis, which is also flawed and inadequate.

There is an adverse and significant impact on native peoples here in Hawaii, in Greenland, Enewetak in the Marshall Islands, and in other places, Alaska and so forth, and you did not look at how this program has a disparate effect on those peoples, their culture, their resources, and actually their survival. So please consider those.

And, in closing, I urge you to scrap the program. We oppose the ballistic missile defense, it's dangerous, it's wasteful, and the world will be much better off without it. Thank you.

(Applause.)

To add a little levity here to this program: It's been documented that the program is -- the missile defense system is easily fooled by decoys which resemble these mylar balloons in space, and because there's been so much, I think, misinformation or incorrect information about what the program actually is, we wanted to present you with this testimony that sort of documents some of the effects.

(Mylar balloons tendered.)

(Applause.)

MR. BONNER: Thank you.

We call Elma Coleman to come up and speak, please.

Let me make one short note before you start talking. If someone would like to give testimony in Hawaiian, we are taping this and while we don't have a live translator, we will provide the translation of that for the record, okay? Thank you.

ELMA COLEMAN: Does that mean I can give my testimony in Marshallese?

MR. BONNER: Yes.

ELMA COLEMAN: I'm from the Marshall Islands.

(Applause.)

MR. BONNER: Yes, absolutely.

ELMA COLEMAN: (*Speaking Marshallese - Hi everybody. My name is Elma Coleman and I am from the Marshall Islands. I am sitting and listening to the words you have said and I am very frustrated because there were so many scientific words used in your talking which are strange to me and I was not able to understand most of them, only a few were clear. I came here to talk and get some information in regard to some of the issues being discussed and the ones that I think are related to the Marshall Islands case that took place some fifty-one(51) years passed.*)

51 years since the nuclear Bravo exposed the people of Marshall Islands to nuclear fallout.

(*Speaking Marshallese - It's been 51 years passed. The people of Utrik and Rongelap did not know what to do when the nuclear testing was taking place at that time.*)

The people did not know what was happening. They didn't know how to deal with the nuclear fallout.

(*Speaking Marshallese - I, myself, would like to ask a question. What would you do if there were an accident affecting the lives of the Marshallese people by the nuclear testing?*)

Are they aware of what would they do if there's any accident with the missile testing?

(*Speaking Marshallese - Were there any studies ever made by you (Americans) about the nuclear testing in the Marshall Islands? If an island or and atoll is damaged by the testing, the problem won't affect the island only, but it will also affect the people of the whole Marshall Islands and the other Pacific Islanders as well. I am hearing all the words you are saying now, and I think it would be a better idea if you (Americans) could go there again and conduct more studies or do more research regarding the nuclear testing.*)

Conduct one hearing in the Marshall Islands. After all, that's where the missile testing is taking place.

(Applause.)

How come I'm reading here that the request was given to have the hearing posed or made on Kauai, Maui, and the Marshall Islands, and it was refused? These are the most affected places that are going to be most impacted.

(*Speaking Marshallese - The people have left their homes and made it easier for the Americans to do their testing on their islands. Is there anything the Americans could do now to return the people?*)

I don't think that's fair.

(*Speaking Marshallese - Is it safe for them to return?*)

Or at least reassure the people that there's not going to be any accident happening. But we cannot say that there's not going to be any accident. There's no guaranty. No matter what, there's no guaranty. And if something happens, what are the people going to do?

(*Speaking Marshallese - If you're using the missiles?*)

You know, I'm not sure what kind of chemical you use or you put in a missile testing or in the warhead when you intercept it in space, but all over the years that you have been doing the testing between Kwajalein and Vandenberg, has there been any environmental study of all the debris that has fallen down into the ocean to find out how contaminated the area is and how far spread the contamination is? Has there been anything done like that? And have the people been aware of what has been done or has not been done?

(Applause.)

MR. BONNER: Thank you.

Can we have Marti Townsend come up?

MARTI TOWNSEND: Aloha kakou. My name is Marti. I have a few points to make. The first are mostly legal, because I hope to God this EIS is put through litigation.

First, notice and public hearing were inadequate. Although it's true that NEPA doesn't require them to hold a public hearing, it does require that the notice be on par with the extent of the program. And as they've clearly shown on their beautiful screen, this is supposed to have worldwide effect, yet we're only having, what, thirty of us here? I mean, this is affecting not only all of Hawaii, but all of the pacific and all of the entire world, and where was this hearing noticed in? Was it noticed on TV? Where did you guys hear about it? Word of mouth. I don't think notice was sufficient in this case, especially given the extent of this project.

In addition, as everyone has stated, there should be more hearings held. The three on the continent and the one here are just not sufficient.

In addition, the alternatives analysis is also inadequate. NEPA requires the alternatives to be considered, including the No Action Alternative, as has already been stated. That is sorely inadequate. But, in addition, you'll notice from reading the two alternatives, they're simply variations on a theme, they're one and the same thing.

And the reason for this, the reason why this is justified is because they're getting off on a technicality, because they stated that the purpose of this program or this project is to implement a Ballistic Missile Defense System. It's misleading, because really what this project is supposed to do, like the overriding principle, is to provide for the defense of the United States.

If you're going to provide for the defense of the United States, you need to talk about what are some real practical things that we should do or that Americans should do to protect themselves, and that includes, you know, not going over to other countries and blowing them up. We're actually talking about real diplomacy.

Unfortunately, this EIS doesn't do that, so, therefore, it's inadequate. I'm hoping that through litigation the technicality, like, can really narrowly define the purpose so that you don't have to do an extensive alternatives analysis, will end with this PEIS.

Also, the cumulative impact analysis is also inadequate. NEPA requires that past, present, and future activities that may incrementally add up to a cumulative impact on an area be assessed, but this

PEIS is flawed for several reasons. First, it doesn't really consider past projects in the cumulative impact analysis. It says something to the effect of, well, there are things that had gone through NEPA assessment before and so we're not considering those now.

This is obviously logically flawed. I mean, the EISs that we've gone through before, had any of them ever dreamed that there would be a missile defense thing shot from space? I mean, let's look at the Striker IS. We're all familiar with that. Does that mention at all anywhere ballistic missiles? No.

Okay. So clearly relying on a NEPA document published before this day is not going to give us an adequate analysis of whether it's a cumulative impact. In fact, there's a heck of a lot going on here caused by the military that never went through NEPA analysis.

Let's talk about use of Agent Orange on Oahu, okay? There's lots that needs to be assessed here, and to just cop out and say, well, there was once a NEPA document done, when we never even dreamed of shooting missiles from space, that's just not going to cut it.

In addition, they also put this really interesting limitation on it that I've never seen before in an EIS, and I've read quite a few myself. It says, well, because this has a national and international nature to the impact of the ballistic missiles, they were only going to consider national/ international cumulative impacts. That means only something that affects the entire continent, only if it affects the entire world. So we're not going to look at the unique situation of Hawaii. And what we are having to go through is the increasing militarization of Hawaii, and that's not sufficient.

I mean, to really consider the cumulative impacts of this PEIS, we need to talk about things that are in the areas that are likely to be affected and likely to be caused harm.

In addition, the PEIS -- I guess I covered that point. Okay.

So the two main points are that past analysis is needed, we need to look at previous things that have been done in Hawaii and across the country or across the United States that have caused impacts, and then also the effect of not just national/ international impacts, but also of local impacts.

The rest of what I have to say is really like a wake-up call for people. Like I said, there's only what, thirty of us, maybe forty? This thing is huge. We need to not let them take advantage of our trust, take advantage of our naivety. We need to get out there and talk to every person you know about this. This is huge. The only way that we're going to counteract this is not through these public hearings -- they are a great way to educate ourselves and connect with each other -- but what we need to do is talk to your Congress people, talk to your neighbors, vote, demonstrate, write letters to the editor, educate people about what they want to do.

Crap is going to fall from the sky. It's going to set on fire and it's going to land on the ground. They're going to be shooting hazardous materials from space. And CERCLA is mentioned once in the EIS. CERCLA is the hazardous waste law. Want to know where it's mentioned? In the table of contents, that's it. It's only mentioned in that list where they say, these are what all the abbreviations are. It's not anywhere else in the document.

So we need to organize. They really are playing on our trust and our ignorance about this process. They say stuff like, well, there's no unavoidable adverse impacts. I think Marty said something to the effect there's no, like, showstopper environmental impacts. Well, that's because they are relying on a thing called best management practices.

Best management practices says that given whatever project you're involved in, you use the industry standard to make sure that you are abiding by whatever everybody else is doing. So if you're running a power plant, you look at what other power plants are doing and make sure you are doing the best thing environmentally for that.

Well, let's see. Who else is shooting missiles from space? Don't know. There's only one. Okay. So best management practices is whatever they want them to be.

So there are going to be unavoidable adverse impacts. We can't let them string us along like that. They use these words and these technical terms and people don't know what they mean. This stuff is just filled with technical jargon and we're forced to read 500 pages and make an informed decision about something.

They are using this process to sort of tell people who don't think we have the time to get involved because we're too busy being employed and trying to raise a family, they use this process to cover up the fact that we aren't really making an informed decision, that people are being taken advantage of, and the law is being tweaked and used to their advantage to disempower us.

So although they may meet technical requirements of NEPA, we need to make people aware of the fact that they are not meeting the real requirements of NEPA and we aren't making an informed decision. Thank you.

(Applause.)

MR. BONNER: Thank you.

Will Julia Estrella come up?

JULIA ESTRELLA: Good evening. My name is Julia Estrella and I serve on the National Committee of the United Church of Christ, which deals with justice for Micronesians. It is with that hat on that I testify before your committee tonight.

As a member of the Micronesian Pronouncement Implementation Committee of the United Church of Christ, I have become aware of how the United States tested 67 nuclear bombs in the Marshall Islands from 1946 to 1958.

Now the United States' missile plan includes missile launches from Vandenberg Air Force Base in California to the lagoons of the Marshall Islands.

I am not a scientist, although my husband was a physicist, and therefore I do not understand all the scientific terminology that they use in the EIS. In fact, as I was listening to all three of you make your presentation, I felt like I was an alien from another planet, as though -- I mean, we were totally in a different stratosphere as far as I was concerned. I felt pretty overwhelmed by your presentation and, actually, I began to feel like how the Marshallese folk must have felt when the military approached them and asked them to give up Bikini. I felt like you were saying this is good for mankind, trust us, we know what we're doing, and feeling overwhelmed. You know, I felt like I was being fooled. I felt like the decisions were already being made. How can you say no when probably the decisions are already made to move in this direction?

Anyway, I feel that I was glad to hear the previous speakers all talk about cumulative effects, because I think that is one of the weakest areas of your EIS. The cumulative effects on the Marshallese people, for example, who have already been exposed to so much nuclear poison and now you want to add more toxic waste into their lagoons. And the cumulation, the additive factors, I think you have not even touched on how this is going to impact a group of people that have already suffered enough for us

Americans.

So I think that if we're going to shoot at all, we should be shooting these missiles on the coast of Washington, D.C. I think that would be more fair in terms of cumulative effects on a group of people who have already taken too much of our nuclear and our toxic waste into the lagoons.

Also, I feel that instead of spending billions on an expanded missile defense program, I, like Kyle from AFSC, feel we should spend those billions on the needs of the people.

I work with people who live in public housing, as an organizer, and I see the people on a day-to-day basis who don't have enough food to eat, enough supplies for schools, who are on a survival basis. And here we're speaking about spending all these billions of dollars for what? You know, to me it's such a big waste of money, a big boondoggle. And who is benefitting from it? All the big defense contractors like Raytheon and all these multinational corporations. These are big bucks for the military contractors.

It's not fair, it's not just, and I think we need to realize that. Even in the EIS, we need to state something more clearly about the social impacts and what it does to ordinary people who do not benefit from these kinds of programs. The rich are already getting richer. Why put more money into the pockets of these defense contractors?

Then, finally, I wanted to say that in your EIS I think you're misleading all of us by putting No Action as a third alternative. I think you need to be more honest and state specifically that No Action means to keep on testing as is without the integration.

I think that some of the people here felt like No Action meant that you were going to start dismantling the missile defense system, which, of course, should have been stated as another alternative, which you didn't even give us a chance to put down.

At first I was going to put No Action, and then I read where it says continue testing as is. And so please do not mislead us. Please state what you're really meaning when you say that's a third alternative. And please give us another alternative which says stop Star Wars, dismantle the missile defense system, start helping the people who really need the help, and let's bring peace instead of more destruction. Because as you were talking, you talked about destroy this and intervene here, and we don't need more destruction. So in the EIS please focus on other than destruction.

Thank you.

(Applause.)

MR. BONNER: Thank you.

Ron Fujiyoshi?

RON FUJIYOSHI: My name is Ronald Susumo Fujiyoshi. I come here as a member of U.S. Japan Committee for Racial Justice. I also served as a missionary of the United Church of Christ for 29 years. Twenty of the years were in Asia. And after that, part of the time was in the pacific.

A friend of mine, Dr. Kosuki Koyama wrote a book called "Water Buffalo Theology," and one of the chapters of the book was called "Gun and Ointment." He said that western imperialism has gone and colonized the world, and in many cases the missionaries were the ointment that went along with the gun. And since I was a missionary, I wanted to state very clearly that we need to cut the ties of the missionaries, the ointment that goes with the gun, and to state very clearly that we oppose any gun.

So that's part of the reason why I am here today. I think the EIS or the Draft EIS that I read is just a shibai. "Shibai" in Japanese is something like a show, just a show or a play or a deception. You know, all of the nice PR stuff that is written and says there's no impact, we know there's an impact because we know Marshallese people are dying of cancer. We know that the Department of Energy is cutting back the funds that are monitoring the Marshallese from the atolls of Rongelap and Utrik because of the expense and the war in Iraq.

These are the ones who were used as guinea pigs in the 67 nuclear and atomic tests. The cumulative effect of the 67 nuclear and atomic tests were 7,000 times the impact of the Hiroshima A bomb. You can't imagine what 7,000 times Hiroshima is.

Seiji talked about coming from Hiroshima, so he has seen firsthand the effect of just one A bomb on Hiroshima, and so it's beyond the scope of us to imagine what 7,000 times that would be.

I went to the Marshall Islands maybe about five times when I spent time there, and the last time I went was on March 1st of last year, which was the 50th anniversary of the Bravo test, and we were there with the survivors and heard their stories of that one Bravo test, which was the first U.S. hydrogen bomb tested. And so we heard the stories of what happened in the tests. And to me it's very hard for the Marshallese people to believe the U.S. military, especially in cases like the EIS, because, as Elma explained, if you looked at the video called "Half Life," you would see that there was a U.S. Commodore Wyett who went and spoke to the Bikini Marshall Islanders after they came out of church on Sunday and he made a statement that you can see for yourself in here that they're going to harness this destructive nuclear force for the good of mankind, and he asked them, will you give permission to move off the island so we can do this for the sake of all mankind. And their response was something like, well, if it is the will of God, we will do it. And so he made the statement, and I can't forget his statement, well, if it is the will of God, it must be good.

You know, and that kind of a shibai or deception has gone down through the ages.

Many of you know that in 1972 Secretary of State Henry Kissinger confirmed U.S. thinking that American military interests must prevail over the self-determination of the Micronesian people when he casually remarked: "There are only 9,000 people there. Who gives a damn?" This was quoted by former Secretary of Interior Hickel.

So I think if you are Marshallese, are you going to believe an EIS statement that says no impact? I think it's very hard to convince them that there is.

I think those of us who are from Asian or Pacific background, we have a theology that all life is related. What is related is a harmony of life, so that what you do to one thing, affects everything else. But it's only a western kind of thinking that compartmentalizes everything and says, this spot will have no impact, this spot will have no impact, this spot will have no significant impact, this spot won't have, and then they go around the whole thing and say, therefore, there's no significant impact. Well, we know that's erroneous, because the whole understanding of how everything is interrelated is different from that. And I think we need to point that out to the people here.

We had JoAnn Wypijewski of the PST (phonetic) who was the managing editor of the Nation Magazine, went over to the Marshalls and did an in-depth story. And she went to Roi-Namur where some of the top U.S. military scientists are stationed. It's way in a secluded area and many of them are brilliant people because they are tracking the missiles. And they said that this is like a bullet striking a bullet. It's impossible to do. It's impossible to do.

And so what they do actually is they put homing devices in the missiles so that they can have a chance of hitting the missiles. If they didn't have that, there would be no way they're going to do this. So here they're spending billions of dollars on Star Wars when the chances of success are so minute that it's wasting of money.

I think we should be using the money not to make war, but to build friends. And I think what it has to do with, places like the Marshall Islands, is to care for those who are affected by the 67 nuclear and atomic tests, and that's how you keep from having war. I think you build friends.

MR. BONNER: Could you finish up, Mr. Fujiyoshi, or come back?

RON FUJIYOSHI: Okay. I think what is happening is there's no transparency. So much of the things are done in secret that we don't know what is really going on.

I was arrested twice on Kauai, PMRF, when we tried to oppose the missiles being fired from Kauai to Kwajalein. Why? Because pacific people are now firing on Pacific people. And so it's being fired from a burial site on Kauai. And one of the things we found out in one of the times we got arrested is that foreign, other countries, are using missiles to test their own missiles, too. And what do they use in the payload, that was secret. We couldn't find out what was it.

So all of the things that we're doing, we're trying to guess, because we don't know. They're asking us to believe them when there's no transparency. And we need to find out what is really going on.

For example, I read all of the material out there. I don't even see the word "depleted uranium." And depleted uranium is so crucial even right now, what is happening in Iraq or elsewhere, you know, people, even our own soldiers that went in Iraq in the first war, you know, were affected by that. I went to Vieques, and we know the effect of depleted uranium upon the people there.

So if they're not even mentioning depleted uranium in the material on here, then what else are they keeping from us? I think we have a hard time believing that what is being done is on good faith.

Finally, I think if it's true that the Missile Defense Agency refused to have public meetings on Kauai where PMRF is and in the Marshall Islands, to me that's a very deep flaw. That's something that needs to be corrected. So I support stopping of Star Wars. Thank you.

(Applause.)

MR. BONNER: Thank you.

Terri Kekoolani?

TERRI KEKOOLANI: Aloha kakou. Kala mai ia'u. I'm going to turn my back to you folks. I want to talk to these guys.

I just want to make a few comments. First of all, the first comment I want to make has to do with the process. It is very deeply flawed. If what you are planning goes through, then obviously all islands will be impacted. Therefore, to properly inform our people here in Hawaii, you must have all people from all islands being fully informed, which would include the Big Island, Maui, Molokai, Lanai, Ni'ihau, and Kauai.

And it's amazing to me that you don't have a meeting scheduled in Kauai with almost half of an island impacted by the missile range facility there.

Also, just alone coming on Oahu, you're having a meeting in a very small hotel, in a small room. The capacity of the room is sixty people. And so what it looks like is that you're kind of hiding, and that you are not looking for a way to actually get a lot of people to participate in this process.

So what you're doing is actually minimizing the input of people, but you sure are maximizing the hardware that's going into this plan of yours. So I think this is a very, very, big flaw.

Also I would like to say that I just returned from a visit on the island of Ka-ho'olawe and I mentioned to people who have been visiting from Kauai on the island that this hearing was taking place here on Oahu, and they didn't know about it. I don't know if you guys know how much it costs to get from Kauai to Oahu, but it takes some money, and our people don't have that kind of money. So it says something about you. It says something about how you folks think, that you don't have our people included in this process.

The second thing that I would like to talk about is five minutes. How long did it take you to put this study together? You all only give us five minutes to comment. I don't understand that.

The other thing is, that's not island style. It takes us maybe kind of like a couple of hours just to say hello, just to get to know you.

Like who are you, where you from, why are you here, what's on your mind, what do you want to do? What is going to happen with the plans that you are going to do to us? How is it going to impact us? That takes a long time. I mean, come on.

The other thing is, and people have already commented that you don't have any person here that can translate our language. And I'm glad Ms. Coleman spoke to you in Marshallese. You need to do your homework. Before you come to the islands, you should know what the people speak.

Then I just want to continue with just a few more comments. My name is Terri Kekoolani. I'm a member of Ohana Koa, a Nuclear Free and Independent Pacific. So on behalf of Ohana Koa I would like to say that we are absolutely against Star Wars, and that means that we would like to see the ending of all testing, development, and deployment of a Ballistic Missile Defense System.

Deployment of the Star Wars program threatens a new nuclear arms race, puts the global environment at risk, and undermines the security of the United States as well, and undermines the security of all people.

Also, Star Wars fuels the nuclear arms

race. Deployment will increase the likelihood of a nuclear catastrophe. BMDS greatly increases tensions between the world's nuclear powers.

On June 13th, 2002, George W. Bush unilaterally and without a vote of Congress withdrew the United States from the Anti-Ballistic Missile Treaty, once a cornerstone of arms control. We denounced that unilateral action.

Also, Ohana Koa believes that Star Wars will have a significant adverse impact on native Hawaiians, our Marshall Island brothers and sisters, the Enewetaks, and other indigenous peoples; and that the Programmatic Environmental Impact Statement fails to consider these impacts.

Hawaiian burials and sacred sites are desecrated by the missile launches and Star Wars facilities, while cultural practices and subsistence access rights are denied due to base security measures.

That is already taking place right now on Kauai. You folks have missile launching pads over there on top of an ancient burial ground. It's called Nohili. It is a crime. It's a crime.

And also there are now people being denied access to beachfronts that have traditionally always been accessible by our people.

So, anyway, on behalf of Ohana Koa, a Nuclear Free and Independent Pacific, we are totally against the Star Wars and want to make that very clear. Mahalo.

(Applause.)

MR. BONNER: Thank you.

Marion Ano.

MARION ANO: Aloha kakou everybody. My name is Marion Ano and I say no to Star Wars. I'm representing my kupuna, my fellow kanaka, keiki o ka 'aina.

You know, when our kupuna arrived here, there was peace, there was always enough water, food and 'aina, land. My personal EIS is Hawaii, and the world is simple. Malama 'aina, malama ai kupuna, malama our fellow men, women, children, and all living organisms.

I'm a being of peace and build world peace through nonviolent ways and aloha. Mahalo.

(Applause.)

MR. BONNER: Thank you.

Kanoa Nelson?

KANOA NELSON: (*Speaking in Hawaiian - Eie no… E hele mai ʻo Kanaloa ʻoli /This is a chant in which places and gods are named including Kanaloa, the god of the seas*).

I'm a practitioner of native Hawaiian

crafts and tradition. And I believe Hawaii is the center for Ho'oponopono (*fixing and making right*), for healing, for healing the people not only that live here, but the center for gathering of the world as people come to visit here. They learn aloha spirit. And something that we still have to teach people is kuleana (*right and responsibility*), and kuleana is that we are deeply connected to this 'aina. Our genealogy goes back to Papa and Waikea, earth mother and sky father. And every Hawaiian's genealogy goes back to that. And we have a deeply rooted sense of connection to whatever happens to the 'aina (*land*). We feel it inside of our body when the earth is damaged. So there's something that we will feel, the 'eha (*pain*) of this 'aina as it's damaged. No matter where it is, even on Kauai, we on Oahu, I will feel that inside of me. So I want everybody to remember us Hawaiians as deeply connected. Aloha.

(Applause.)

MR. BONNER: Thank you.

Corrine Goldstick.

CORRINE GOLDSTICK: I am against the Star Wars. I'm Corrine Goldstick. I'm affiliated with American Friends Service Committee. Since I've been here tonight, I've been thinking, well, I know you people can't do anything about stopping this, and so I started thinking about the politics of it and the law of this whole thing being dumped in our laps, and it seems to me that there could be a point made, maybe by a good attorney, that it's illegal to begin with, because Bush in cancelling our participation in the Missile Treaty acted illegally. Of course, he was not stopped by our Senate as should have happened. Bush then instructed his Department of Defense Secretary Donald Rumsfeld to proceed with this program, if you can call it that, and the steps have been taken to start.

And I just wanted to maybe ask, although you probably don't want to speak: What if a new administration comes in in November and a better Congress, certainly a better Senate that would proceed to challenge him, challenge Bush and Rumsfeld and the pentagon, you know, where would this leave Star Wars? I hope it would leave it in the mud. Thank you.

(Applause.)

MR. BONNER: Thank you.

Keli'i Collier?

KELI'I COLLIER: (*Speaking in Hawaiian - He kanaka maoli wau. ʻO kena koʻu a ../inaudible/ Hewa ke kaua ʻAmelika. Makemake wau e haʻalele i ka pae ʻaina o Hawaiʻi. /I am a native Hawaiian. That I have … The American war [star wars] is wrong. I wish for it to leave the Hawaiian islands*).

My first point, I want to address the process. And I'm not sure what his name was, but you're talking about written, e-mail submission of comments, right?

Native Hawaiians rank amongst the largest statistics for disease, social issues, drug abuse, domestic violence, and whatnot. How many Hawaiians do you think on Kauai or Maui, Hawaii island, Molokai, Ni'ihau, Ka-ho'olawe have access to internet? Take a guess.

MR. DUKE: I really don't know.

KELI'I COLLIER: Okay. Not much. So when you say that you weigh the written testimony as heavy as the oral testimony, that premise alone is a fault of yours, it's a fault of your thinking, it's a fault of your understanding of where you are, this context of Hawaii.

These people can barely feed themselves half the time. They can barely send their kids to school with slippers. So that's something you got to wake up to fast.

My second point is, this, what is it, BMDS, it's just another component of America's imperialistic forces going around the world and taking land and natural resources and basically slave labor to extract natural resources to gain military strategy over other countries so they can go in and take their natural resources; aka oil, right?

We've been colonized, land, ocean, water, and now you want to take the skies and the heavens. I can't fathom how you guys can sit here and think that this thing is going to be beneficial, because it's not.

As far as the environmental impacts, I was reading some of your poster boards. Spilled fuel, soil disturbance, and whatnot, no impact.

When you go hiking and you walk on a trail, there's an impact from my 220 pound body. What is a missile going to do when it's blasting off from the ground going up into space and trying to intercept each other and they miss and go and they land someplace else? Is that in your impact statement?

What if I went to John Muir Redwood Forest and decided to build a spam fast-food restaurant, drive-through, and I did an EIS for all the cars that would be coming through the redwood forest and go, you know what, no impact. Cutting down the trees, these thousand-year-old trees, no impact.

My final point is the cultural impact. As Auntie Terri said earlier about Nohili, it's a graveyard, how about if I took my spam fast-food restaurant and franchised it and put it in Arlington

Cemetery? How would you feel then? And I start digging up bones and you guys tell me there's bones, and I say, oh, yeah, yeah, take your bones, I got to build my restaurant here.

(Applause.)

MR. BONNER: Thank you.

Would anybody else like to come up and make a comment?

Go ahead.

EMMA GLOVER: I'm Emma Glover. Fear is the most destabilizing force in the world, whether we're talking about fear between individuals or fear between countries. It can result in actions which in the long term are seen as very regrettable and very ill-advised.

This whole program assumes fear. I suggest, in addition to the alternative number 4 that's already been suggested, an alternative number 5, which came to me as I was reading your information.

This BMDS assumes that there are potentially threatening areas in the world. I would suggest employing (inaudible) and analysis, and many of the same scientists could do this that have been working already on this, so they wouldn't lose their jobs. They can analyze the problems which are currently being encountered by residents of the areas of the world that are viewed as potentially threatening.

They could figure out what are the fears in the people that live there. Are they afraid of starving to death? Are they afraid of catching a disease from polluted water? Is the soil not sufficiently productive because it lacks certain nutrients? Is there lack of education on how to build a sustainable future for them and their children and their children?

If we spend the same amount of money doing some of this analysis as a fifth alternative, I have a hunch that we won't even need any ballistic missiles.

(Applause.)

MR. BONNER: Thank you.

Danny Li?

DANNY LI: Good evening. My name is Danny Li. Good evening. I'm with Nadi Nao-ying (phonetic), a group that's opposed to the people who commit violence on the world.

The best behavior, best predictor of future behavior of anyone is the history of past behavior. I think ever since the advent of the missile age, if I can recall, I could be wrong, some sixty years ago, I don't think there was ever a missile or rocket that has been fired against the United States. Not a single one.

In that same period there have been lots of missiles and rockets fired all over the world, every continent, by armed forces of the United States. And I'm not even talking about now. In every single continent.

So there is an example of, you know, what words mean, and yet these are all done under the name of Department of Defense.

It's more properly called Department of Offense if you look at the history. So that's part of the problem.

(Applause.)

So just as you do not trust, you do not trust a convicted serial rapist to run a child safety program, you cannot ask the same kind of people to run a so-called missile defense. So get rid of it. We're opposed to it. The people of the world are getting wise to that, and they're all opposed to this. Mahalo.

(Applause.)

MR. BONNER: Ikaika Hussey.

IKAIKA HUSSEY: Aloha kakou.

(*Speaking in Hawaiian - Aloha kakou. ʻO wau ʻo Ikaika Hussey. No ka ʻaina o kaʻewu au. ʻO koʻu ʻōhana no Kohala, Hawaiʻi makou. Honokohau. Mai ka mua loa, mai ka wa kahiko mai a i keia la. He Hawaiʻi, he ʻōhana Hawaiʻi koʻu ma ka ʻaina o Kauaʻi. A ma laila no, ma laila no hoʻi ka makemake, ka ʻiʻini o ʻAmelika no hoʻi ma ko lakou ʻaina no laia (unintelligible) Polihale. No laila, eia wau no ke kuʻe, e kuʻewa, e kupaʻa no hoʻi, i keia ke kaua aʻo kou halawai.*
/Greetings to all. I am Ikaika Hussey. My family is from Kohala, Hawaiʻi. Honokohau (?). From the past, from ancient times until today. Hawaiian. I have Hawaiian family on the land of Kauaʻi. It is there, there indeed, where America wishes and desires their land, thus /unintelligible/ at Polihale. Therefore I am here to oppose and resist firmly this war [star wars] at your meeting.)

In addition to my own opposition to the proposed ballistic defense system, I come here with words from people who were not offered the opportunity to testify this evening because there was no hearing on the island where they reside and where the impacts will take place.

I'd like to begin with offering the testimony of Mr. Jumble (phonetic) Kalaniole Fu who is a fisherman, commercial fisherman, in a family-owned business on the island of Kauai. He experiences on a regular basis the militarization of his island. He witnesses the missiles leaving Pole Hale. He witnesses the missiles flying up out of the ocean.

He is told that he can't fish in certain areas because of military work that's being done.

He's also very concerned because he's seen it for so long. He talks about 18 years of the people of Kauai constantly being told and being exposed to the Star Wars program to the point where they have become desensitized to it.

He's concerned about the effects that it has on his family. He's spoken to me about the fact that there is no research being conducted to ascertain health effects on the people of Kauai, about the propellants and all those things.

He is also very concerned simply because of the very dangerous things that we're talking about here. We're talking about missiles. A missile has no function but to be a weapon, unless you put a person into it and they're going to explore outer space. Even in that case there's a probability that there's imperial notions at hand. But what we're talking about here are very dangerous things, and he is concerned about the possible dangers that might come upon him and his family and his people on Kauai.

He has seen missiles that misfired or missed their target and destroyed or -- apparently a missile hit another boat, another American vessel. And he doesn't want to see that happen either to the American military or to his own family. So that was his concern.

I also would like to relate the testimony of Mr. Wilfred who e-mailed me from Canada, and obviously there's no hearing in Canada, but he is very concerned because he knows that the proposed American military expansion, the full-spectrum dominance that we're talking about here, he is concerned about the effects that will have on him and his people in Canada.

He is concerned that it will spark a new arms race. He also mentioned to me that 70 percent of the people in Canada, of people polled in Canada, opposed the Ballistic Missile Defense System, so if that's an indication.

Since 1893, and actually before then, America and the greed of America and also the greed of other European countries, we've experienced that greed through military incursion consistently. American businessmen, European businessmen who wanted to set up shop in Hawaii and sell sandalwood and do whaling, and sell sugar and pineapples, the way that they were able to fulfill their avarice was by calling on the military of their countries to come and support them in their desire for Hawaiian land.

All the way through 1848 to the Mahele and then past the Mahele to 1893 we've had constant military invasions from the outside, people wanting our land for their purposes.

Since 1893 American military has only procreated in Hawaii. It's ironic, I know. And the guns that were pointed at the palace have multiplied, and now we're talking about missiles. And I can't bear the thought of my family and my family's land being part of anyone's desire for empire.

I have no desire for empire personally. I have no desire for dominating anyone. So I can't even fathom the idea of full-spectrum dominance. It seems absolutely inhumane, and I don't think that it is something that you folks or the people of America, people of the United States of America have innate to them. I don't believe that there's something that's genetic about Americans that says that they will try to promulgate empire. So I can only hope for the emergence of humanity in the United States, and the toppling of a regime that will only promote dominance of other peoples.

(Applause.)

Finally, I would like also to present the testimony of 1,330 people who signed petitions opposing the expansion of military in Hawaii. And these people need to be included in the process. They need to be notified of the Record of Decision. Thank you.

(Applause.)

(Document tendered.)

MR. BONNER: Thank you.

Jacina Fernandez. Is she still here?

Fred Dodge?

DR. FRED DODGE: Aloha kakou.

AUDIENCE: Aloha.

DR. FRED DODGE: My name is Fred Dodge and I'm a physician, a family practitioner. I'm happy to see two other family practitioners testifying today. We take seriously our role in trying to use preventive medicine in treating communities. I'm also a member of PSR, Physicians for Social Responsibility, and IPPNW stands for International Physicians for the Prevention of Nuclear War, and I also am a member of other organizations. I'm not here representing any of them officially. I speak for myself.

I want to add my voice to those who said that the process is flawed. You really need to hold hearings on Kauai, other places also, but especially Kauai where the Pacific Missile Range Facility is located, who are really greatly impacted by this. And I, too, have friends on Kauai who didn't know about it and want the opportunity to testify.

The Ballistic Missile Defense System, let's just call it Star Wars, everybody seems to know it by Star Wars, is really a part of our warfare state. A lot of people criticize the welfare state mentality, but we really have more of a warfare state mentality now more than ever.

(Applause.)

I think to those who have examined this whole system, it really has -- I mean, it's put forth as a defensive system, but it really has a great deal of offensive capabilities, and is certainly seen that way by other nuclear powers, especially Russia and China.

I believe it to be dangerous to humans and other living things, and, therefore, I'm certainly against it.

I also question the conclusions of the PEIS in that alternatives that have been mentioned in the past aren't included. I won't go into that except I support those. The lack of detail on cumulative effects is a major defect. And I think the lack of environmental and racial justice needs to be addressed more fully certainly.

And after saying all this, believing it, I agree with Ron Fujiyoshi that it's shibai, this whole thing is something you just sort of go through, because it's going to get approved. But yet we must speak out.

Ghandi has said you have to speak truth to power, and certainly you guys have the power or you represent the government with the power, but we must speak out.

It seems to me that instead of threats from missiles, there's a lot more threats from the suitcase A bombs the U.S. had and then Russia developed the backpack. These are portable A bombs. The horrific thing about it is that the sources that I have read and listened to and so on say that a lot of these are not accounted for in Russia during the changeover, they're missing. Where are they? I mean, they're the things that can be brought into the U.S.

I don't know how many people are aware of the fact that about a month after 9/11 the U.S. received reports that one of these portable A bombs was somewhere in New York City.

Fortunately it turned out that this was not an accurate report, like many of our intelligence, it was not correct, but it's interesting to note that Mayor Guilliano was not notified of this at the time and was extremely angry when he found out that this had happened. And apparently there was no way, if that were to happen, to find it. That's a real threat, much more so.

The other thing that I want to mention is that all the information that I've read, mostly from independent scientists, says that the Star Wars project is very likely to fail. Originally the PSR, the Physicians for Social Responsibility, had taken up on that there was - originally they said there would be six percent chance that a missile could get through, especially the multiple warhead type, and so they gave every member of Congress an umbrella with holes in the umbrella amounting to 6 percent of the umbrella surface. It won't keep you dry.

It's also extremely wasteful, and I think that's been addressed here today. It's bound to escalate the arms race.

I had a letter from the late Patsy Mink, representative from Hawaii, and I'll quote what she told me at the time. This is already three years ago. But she said: The National Missile Defense System has the potential to destabilize our relationship with other nuclear powers and will violate the Anti-Ballistic Missile Treaty, which was then in effect. And, as people have stated, our present president has withdrawn us. And certainly we question whether that withdrawal by the president, without congressional support, is legal.

She goes on to say: We should not deploy a system if we don't know whether it will work, which violates our treaty obligations and escalates deployment of nuclear weapons by potential adversaries. In other words, they see it as offense and they're going to be building up. And other people have stated the same thing.

So where are we at? In my opinion, we don't need it. The world certainly doesn't need it. The project should be abandoned. We could save billions. We could even use it for some human needs, such as 45 million people who don't have health insurance in the United States, for instance. This is where I come from.

I also was going to quote President Eisenhower, but that's been so eloquently quoted earlier.

I'll just say that if there's any way possible to do some of those other alternatives, at least put this on hold, if not scrap it, I think that would be the way to go. Thank you very much.

(Applause.)

MR. BONNER: Thank you.

Let me make a last call for anyone else who would like to make comments.

KAREN MURRAY: Hi. My name is Karen Murray, M-u-r-r-a-y.

MR. BONNER: Thank you.

KAREN MURRAY: I was born here in 1955, four years before this was declared a state. I wasn't born a citizen, as most people here were not. A lot of the statehood and a lot of the things that declare us citizens, we understand that it's an illusion. The wrong questions were asked, people were not invited to be citizens that were declared citizens. There are so many layers of illusion that, in Hawaii, you can see very clearly, because it's a small microcosm.

When they talk about Saddam Hussein ignoring U.N. resolutions and international requests, here in Hawaii we look around and we see that the United States has done this to such a greater degree. We know that in the Hague we were recognized, the Kingdom, the Nation State of Hawaii was recognized, and the illegality of the United States in Hawaii was recognized.

We had the Apology Bill, we had all kinds of things that lift the veils from our eyes, that make it so that we can see through the illusions.

So when we look at Star Wars and we look at the effects on Kauai - my mother is from Kauai, her family is on Kauai - when we look and we're told and we look around and we look at where this hearing is held and how it's held, we know that Star Wars is just another illusion, because it's just another part of the play that has George Bush under a banner saying mission accomplished. It's another part of the play that says we have something to fear and so you need us to protect you.

Everywhere I've traveled I've met beautiful, wonderful people. I've been warned people are, people in New York even, I've been warned against people in almost every part of this country, but everywhere I went there were beautiful people, and I imagine that so everywhere in the world.

We can live from fear or we can use fear as an advisor and live from beauty and truth, and what the earth really is. We can lift the veils from our eyes and see what the world really is.

And your participation - I came up here because I want you to understand your participation in enforcing this illusion that we need Star Wars, that some of the world needs Star Wars, that the world needs more propagation of the idea of fearing each other, more than being cooperative and friendly and living together.

When you have Nobel prize winning scientists getting up and saying we have to turn this planet around, we have to turn our idea about how to run this planet around or else the environmental impacts will be irreparable, that was said, what, fifteen, sixteen years ago? And they gave it about twenty years.

We don't have very long. We don't have very long for people in your positions to wake up and turn us around so that we can all survive on the earth together. And that's what we need from you. Thank you.

(Applause.)

MR. BONNER: Thank you.

Anyone else?

SEBASTIAN BLANCO: Hello. My name is Sebastian Blanco and I wasn't sure if I was going to say anything tonight, but I've been watching the three of you and I've been feeling a little bad for you. No one all night long has spoken in favor of Star Wars, so I thought I would do that. I thought I would come here and talk about what Star Wars is. It just came out on DVD, great movies.

And the message of those movies is that no matter how evil you are, even if you are Darth Vader and control the Death Star, control the empire, you can do good. You can turn on the emperor in the end and throw him down the shaft of the Death Star.

(Applause.)

And you guys are going to go home tonight or later, and you have a choice to make. You've heard from the rebellion tonight. There's things you can do to help stop this program. It doesn't help people. It kills people. It kills things. It is evil.

We are doing what we can do tonight, but Luke couldn't do what he needed to do on his own. He needed Darth Vader to turn around. And that's kind of, I think, one of the messages that we have for you tonight. As individuals, you can make decisions to speak out against this thing, to make it less wrong.

So that's why I am speaking in favor of Star Wars, but not your Star Wars. Thank you.

(Applause.)

MR. BONNER: Thank you. Marty, final comment?

MR. DUKE: Well, thanks for the comments there. Liven it up a bit.

Again I want to thank each and every one of you for coming out. We were here as part of the NEPA process, and that process is to hear from the public and to get your comments and to go back and analyze those comments.

And, as you know, frankly, some of the comments are political and maybe outside the NEPA process. It's an opportunity that you can make your comments, and we recorded those, and we'll go back and analyze those. And comments that, you know, we need more public forums to hear about the NEPA process and what our Programmatic EIS is, we'll take those comments back and we'll analyze those and discuss those with our leadership and determine what to do.

Again, I appreciate you coming out and I respect all your comments, all your views, and thank you again.

(Hearing adjourned at 9:11 p.m.)

STATE OF HAWAII)
) ss.
CITY AND COUNTY OF HONOLULU)

I, Julie A. Peterson, Notary Public, State of Hawaii, do hereby certify:

That on October 26, 2004, commencing at 6:34 p.m., the above PUBLIC HEARING was taken in machine shorthand by me and thereafter reduced to typewriting under my supervision; that the foregoing represents, to the best of my ability, a true and correct transcript of the proceedings had in the foregoing matter.

I further certify that I am in no way interested in the aforementioned proceedings.

Dated at Honolulu, Hawaii, this ______ day of November, 2003.

____
NOTARY PUBLIC, STATE OF HAWAII

My Commission Expires:
September 1, 2006

APPENDIX C
RELATED DOCUMENTATION

RELATED DOCUMENTATION

The documentation identified below has been incorporated by reference in the BMDS PEIS. The information and analyses contained in these documents were used in the development of this PEIS and have been summarized as appropriate. These environmental assessments (EAs) and environmental impact statements (EISs) have previously been prepared to support the development of the specific technologies that may be used as part of the BMDS and the locations where these technologies may be used.

- Ballistic Missile Defense Organization, Space and Missile Systems Center, 2001. *Space-Based Laser Integrated Flight Experiment Ground Testing Environmental Assessment,* January.

- Ballistic Missile Defense Organization, 2000. *Ballistic Missile Defense Organization Cooperative-Engagement-Capability/PATRIOT (CEC/PATRIOT) Interoperability Test Environmental Assessment,* July.

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

- Cortez III Environmental, 1996. *Lance Missile Target Environmental Assessment.*

- Federal Aviation Administration, 1996. *Environmental Assessment of the Kodiak Launch Complex, Kodiak Island, Alaska,* June.

- Missile Defense Agency (MDA), 2003. *Ground-Based Midcourse Defense Initial Defensive Operations Capability at Vandenberg AFB Environmental Assessment,* July.

- MDA, 2003. *Airborne Laser Program Supplemental Environmental Impact Statement,* June.

- Strategic Defense Initiative Organization, 1992. *Midcourse Space Experiment Environmental Assessment,* September.

- U.S. Army Space and Missile Defense Command, 2003. *Ground-Based Midcourse Defense Extended Test Range Environmental Impact Statement,* July.

- U.S. Army Space and Missile Defense Command, 2002. *Theater High Altitude Air Defense Pacific Test Flights Environmental Assessment,* 20 December.

- U.S. Army Space and Missile Defense Command, 2002. *White Sands Missile Range, New Mexico, Liquid Propellant Targets Environmental Assessment,* 23 May.
- U.S. Army Space and Missile Defense Command, 2002. *Ground-Based Midcourse Defense Validation of Operational Concept Environmental Assessment,* 15 March.
- U.S. Army Space and Missile Defense Command, 2000. *National Missile Defense Deployment Environmental Impact Statement,* July.
- U.S. Army Space and Strategic Defense Command, 1998. *Theater Missile Defense Extended Test Range Supplemental Environmental Impact Statement,* June.
- U.S. Army Space and Strategic Defense Command, 1998. *Tactical High Energy Laser Advanced Concept Technology Demonstration Environmental Assessment,* 17 April.
- U.S. Army Space and Strategic Defense Command, 1995. *U.S. Army Kwajalein Atoll Temporary Extended Test Range Environmental Assessment,* 19 October.
- U.S. Army Space and Strategic Defense Command, 1994. *Theater Missile Defense Extended Test Range Environmental Impact Statement,* November.
- U.S. Army Space and Strategic Defense Command, 1994. *Theater Missile Defense Ground Based Radar Testing Program at Fort Devens, Massachusetts Environmental Assessment,* 22 June.
- U.S. Army Space and Strategic Defense Command, 1994. *Theater High Altitude Area Defense Initial Development Program Environmental Assessment*, March.
- U.S. Army Space and Strategic Defense Command, 1993. *Theater Missile Defense Programmatic Life Cycle Environmental Impact Statement,* September.
- U.S. Army Space and Strategic Defense Command, 1993. *Ground Based Radar Family of Strategic and Theater Radars Environmental Assessment*, June.
- U.S. Army White Sands Missile Range, 1998. *White Sands Missile Range, Range-wide Environmental Impact Statement,* January.
- U.S. Department of the Air Force, 2002. *Early Warning Radar Service Life Extension Program, Cape Cod Air Force Station Environmental Assessment, Massachusetts,* September.

- U.S. Department of the Air Force, 2000. *Evolved Expendable Launch Vehicle Program Supplemental Environmental Impact Statement,* March.

- U.S. Department of the Air Force, 1998. *Evolved Expendable Launch Vehicle Program Environmental Impact Statement,* April.

- U.S. Department of the Air Force, 1997. *U.S. Air Force atmospheric interceptor technology Program Environmental Assessment,* November.

- U.S. Department of the Air Force, 1997. *Environmental Impact Statement for the Program Definition and Risk Reduction Phase of the Airborne Laser Program,* April.

- U.S. Department of the Air Force, 1990. *Starlab Program Environmental Assessment,* 17 August.

- U.S. Department of the Navy, 2002. *Point Mugu Environmental Impact Statement/Overseas Environmental Impact Statement,* March.

- U.S. Army Space and Missile Defense Command, 2003. *Arrow System Improvement Program Draft Final Environmental Assessment,* August.

- U.S. Department of the Navy, 1998. *Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement,* December.

APPENDIX D
DESCRIPTIONS OF PROPOSED BMDS ELEMENTS

DESCRIPTIONS OF PROPOSED BMDS ELEMENTS

D.1 Airborne Laser

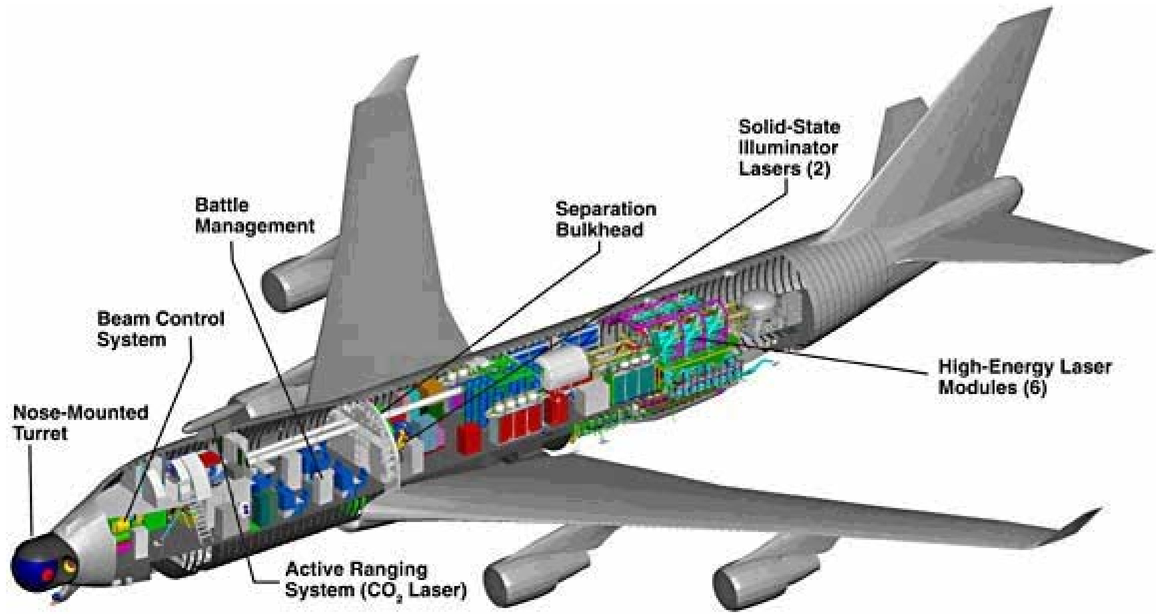
Introduction

The Airborne Laser (ABL) is a part of the Boost Phase Defense Segment of the BMDS. The ABL is a rapidly deployable airborne platform equipped with a long-range laser weapon capable of acquiring, tracking, and negating threat ballistic missiles in the boost phase of their flight (i.e., powered flight, prior to booster burn-out). ABL is designed to operate autonomously as well as in concert with other BMDS elements.

The ABL aircraft is a Boeing 747-400F modified to accommodate the laser weapon system, laser fuel storage tanks, onboard sensors, battle management command, control, communications, computers, and intelligence (BMC4I), and a beam control/fire control (BC/FC) system (see Exhibit D-1). The ABL aircraft would fly at altitudes above 10,668 meters (35,000 feet) and would detect and track launches of enemy ballistic missiles using its onboard sensors. Directed energy from the laser weapon would heat the threat missile body canister. Ground support assets of the ABL element include chemical storage, mixing, and handling facilities; chemical transport and loading/unloading; optics handling and maintenance; and aircraft support and maintenance facilities.

The ABL consists of several coordinated sensor and laser systems. The BMC4I infrared search and track (IRST) and Active Ranging System (ARS) suite would detect and track the target ballistic missiles. The ARS laser is a lower-power carbon dioxide (CO_2) laser that would acquire and assess the range to the target. The Track Illuminator Laser (TILL) is a lower power, solid-state laser. Designed to track the intended target, reflected light from the TILL returned to sensors onboard the ABL aircraft provides information about the target's speed, elevation, and vector. The Beacon Illuminator Laser (BILL) is a lower-power, solid-state laser that serves as part of a laser-beam control system designed to focus the laser weapon beam on the target and to correct for any atmospheric distortion. All of the ABL lasers firing off of the aircraft are American National Standard Institute (ANSI) Classification 4 lasers. The Surrogate High Energy Laser (SHEL) is tens of watts, the ARS hundreds of watts, the BILL and TILL are KW class, and the High Energy Laser (HEL) is MW class. Only the HEL, a Chemical Oxygen Iodine Laser (COIL), is designed to destroy the target missile.

Exhibit D-1. Airborne Laser



During operations, the ABL BMC4I system would prioritize IRSTand ARS track files and nominate targets, forwarding this information to both the BC/FC system and the communications suite, which maintains inter-theater connectivity with other BMDS elements. BC/FC would then establish precision tracking, stabilized pointing, and atmospheric compensation. After BC/FC has determined an accurate track on the nose of the missile, selected an aim point, and determined the atmospheric compensation required to propagate a laser with high beam quality to the target, a fire command would be passed to the laser segment. The laser beam would be directed through a beam tube to the forward optical bench, where it would be controlled, compensated, and focused through a nose-mounted turret to the boosting missile target. The ABL then would identify and report target negation.

ABL would be integrated into the BMDS battle management architecture. Using its surveillance sensors, ABL would provide highly accurate ballistic missile launch point, impact zone, and state vector data to the BMDS via a near real-time data exchange network (i.e., Tactical Digital Information Link network). The network would provide the ABL connectivity to other BMDS elements and airborne assets such as the Airborne Warning and Control System and Joint Surveillance and Target Attack Radar System. Once intelligence and other off-board track data are received by the ABL, the battle management system would correlate the data with onboard sensor data and databases to provide the crew with the best information. This information would maintain the rapid-reaction situation awareness required to execute the boost phase intercept mission in the most effective manner. The information on friendly and enemy assets would also provide necessary information to prevent ABL from shooting down friendly missiles or aircraft and to enhance self-defense. The ABL has an Identification Friend or Foe transponder capability that identifies ABL when interrogated by friendly assets.

Development

The U.S. Air Force (USAF) began to develop the concept of aerial battleships armed with one or more high-power lasers that could be used to blast enemy aircraft or ground-to-air missiles in the 1970s. Initially a KC-135A was chosen to be the platform for a CO_2 gas dynamic laser. Christened the ABL Laboratory, the specially modified aircraft shot down its first target – a towed drone – over the White Sands Missile Range (WSMR) in New Mexico on May 2, 1981. The event marked the first time a high-energy laser beam had ever been fired from an airborne aircraft. On July 26, 1983, the Air Force announced that the ABL Laboratory had been used to shoot down five Sidewinder air-to-air missiles.

In 1992, following the Persian Gulf War, interest was revived in developing laser weapons systems to counter ballistic missiles. In 1993, the USAF began development of ABL as part of Strategic Defense Initiative (SDI) since one of SDI's goals was to study ways that directed energy could be used in a weapons system. On November 12, 1996, the USAF awarded a $1.1 billion contract to three defense contractors to begin working on a prototype ABL that would detect, track, and destroy theater ballistic missiles during their boost phase.

Present development efforts are focused on completing the first ABL aircraft at Edwards Air Force Base (AFB), California. The Boeing 747 aircraft was purchased and flown to Wichita, Kansas where the nose was removed and several modifications were made, including attaching a mock turret. The aircraft was then flown to Edwards AFB for integration of the weapon components, sensors, BMC4I, and BC/FC.

Also located at Edwards AFB is the Systems Integration Laboratory (SIL). The SIL contains a Boeing 747 body that is being used to test the integration of the various ABL components prior to placing them in the actual first ABL aircraft. The development of the first ABL would involve completion of ground testing of ABL components including a flight worthy, six module, weapon class laser and ground and flight testing of the BC/FC system. It would focus integration and ground testing of the laser, BC/FC, and battle management. This effort would culminate in a shoot down of a threat missile target not earlier than 2008.

Follow on efforts would continue to perform ground and flight tests of the first ABL weapons system. Program emphasis would be on continuing ABL-specific technology maturation for integration and testing on subsequent blocks. Technology maturation includes improvements in domestic capabilities to produce advanced optics for high-energy laser systems. Ground support enhancements would focus on redesigning the laser fluid management system for air transportability and rapid deployment to enable the

ABL to move to and operate from a forward operating location. Specific locations for these potential forward operating locations have not been determined.

Future efforts would include maturation and development of a second ABL aircraft to include new technologies, enhanced lethality, and additional operational suitability. The second aircraft would be similar to the first aircraft (i.e., a Boeing 747-400 outfitted with COIL technology and tracking and ranging lasers) but would be further optimized to obtain increased performance. New laser module designs and advances in optics and control systems would be tested in the SIL then integrated onto future aircraft. The second aircraft would support the BMDS test bed and potential ABL production decisions. The USAF is planning an operational fleet of ABL aircraft to conduct dual-orbit operations in a major regional conflict. Details of the development schedule and full operations for the ABL Program are under development.

Testing - First ABL

The ABL test program is intended to build on the technology and risk reduction accomplishments of testing activities to date. The testing would initially focus on testing and verifying independent components of the ABL system. The individual components would then be integrated and tested in the SIL and then on the aircraft, leading up to a lethal shoot down. This testing involves both ground and flight-testing. Extensive ground testing includes segment level testing at a variety of contractor and government facilities and system level testing of the lower-power laser systems (i.e., ARS, BILL, TILL, and a SHEL) at Edwards AFB. The SHEL is a lower-power laser designed to simulate the operating characteristics and wavelength of the HEL during testing activities.

Flight-testing consists of airworthiness testing of the ABL aircraft itself as well as testing of individual segments after they are integrated into the weapon system and after laser testing in the SIL. Test flights at WSMR, Edwards AFB, and Vandenberg AFB would be used to test the lower-power lasers and the HEL. The tests would include acquisition and tracking of missiles as well as high-energy tests. The tests would be conducted against instrumented, diagnostic target boards carried by missiles or aircraft, including the Missile Alternative Range Target Instrument (MARTI); the Lance, Black Brant IX, Hera, and/or Two-Stage Terrier missiles, and the Proteus Aircraft (i.e., manned aircraft with target board attached). Flight-testing would culminate with the shoot down of a ballistic missile target. The specific testing areas currently planned include

- **BC/FC Ground Test.** This test would be conducted at contractor facilities in Sunnyvale, California and would involve positioning the turret in the correct relationship to the illuminator bench of the laser weapon component to ensure proper alignment. Testing would also demonstrate the TILL and BILL operation through the

BC/FC system. The objective is to demonstrate the performance of the beam-control segment at low power.

- **SIL Laser Ground Tests.** This test would be conducted at Edwards AFB and would involve a step-by-step buildup of laser operation. The objective is to verify successful integration of all HEL modules in the SIL. The major milestones for the SIL ground tests include chemical flow, first light, and full duration lase.

- **Integration of the BC/FC with BMC4I.** This test would demonstrate the ability to operate the BC/FC on the aircraft in preparation for flight tests.

- **System Demonstration.** This test would involve the shoot down of a threat representative ballistic missile target. The test missile would be launched from Vandenberg AFB with engagement and negation occurring over the Western Range. Up to three target missiles could be used, with the goal of one successful negation.

Ground-testing activities of the lower-power laser systems (i.e., ARS, BILL, TILL, and SHEL) would be conducted from an aircraft parking pad or the end of a runway at Edwards AFB, 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. Ground testing of the HEL would be conducted at Edwards AFB, within Building 151 or in the SIL, using a ground-based simulator or an enclosed test cell. No open-range testing of the HEL would be conducted at Edwards AFB. These activities would involve testing the laser components (first and second ABL configurations and upgrades of new technologies) on the ground in the SIL and after they are integrated into the first 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. Up to 500 rotoplane (Ferris wheel-like rotating target) and 500 ground target board tests would be conducted for the first aircraft. Similar tests would be conducted for the follow-on aircraft. The HEL weapon system would be connected to a Ground Pressure Recovery Assembly to test the laser on the ground. On the ground, the Ground Pressure Recovery Assembly would simulate the atmospheric pressure that occurs naturally when the laser device is operating in the aircraft at altitudes of 10,388 meters (35,000 feet) or higher.

Flight-testing activities would occur at WSMR, Edwards AFB, and Vandenberg AFB to test the ARS, BILL, TILL, and SHEL, and the high-power HEL. Up to 15 MARTI Drop tests would be conducted at each of Vandenberg AFB and WSMR to test the ARS, BILL, TILL, and SHEL. Half of the MARTI tests at each location would also incorporate testing of the HEL. Up to 50 Proteus Aircraft tests would be conducted at each of Edwards AFB, Vandenberg AFB, and WSMR. The Proteus tests would involve only testing the ARS, BILL, TILL, and SHEL systems. Flights may also include onboard 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.

Additional flight tests with the BQM-34 (a remote-controlled [drone] vehicle) would be flown to test the ARS, BILL, TILL and HEL systems. The BQM-34 drones would be used at WSMR, China Lake NAWC, or Point Mugu as outlined in the *Program Definition and Risk Reduction Phase of the Airborne Laser Program Environmental Impact Statement (1997).*

Up to 35 missile flight tests utilizing solid or liquid propellant missiles would occur at WSMR using WSMR restricted airspace, Federal Aviation Administration (FAA) controlled airspace, and airspace utilized by Fort Bliss. Missiles would be launched from existing approved launch areas. Approximately ten of these flight tests would involve testing the ARS, BILL, TILL, and SHEL systems. The remaining 25 tests would also incorporate the HEL. Lasing activities during flight tests at WSMR would involve the ABL aircraft flying outside of restricted airspace and firing the lasers at targets within WSMR restricted airspace.

Up to 25 missile flight tests would occur at the Western Range used by Vandenberg AFB. Missiles would be launched from Vandenberg AFB from launch areas analyzed in the *Theater Ballistic Missile Targets Final Programmatic Environmental Assessment (EA) (1997)* to test the ARS, BILL, TILL, and HEL systems.

Interwoven with the proposed standard flight tests, additional activities would be done to use the ABL detection, tracking, and communications capability. The ABL could be used to track other targets of opportunity. Targets of opportunity come in two forms. The first is a simple infrared signal given off by a moving military article (aircraft, missile, or similar vehicle) that can be passively observed with the 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.

Testing - Technology Improvements

The primary focus of this testing would be verifying the effectiveness and suitability of the upgraded laser fluid management system (ground testing), deployable support equipment, flight testing of capabilities deferred from the first ABL, and participation in BMDS System Integration Tests. Additional efforts may focus on weapon system effectiveness at negating extended range ballistic missiles if targets are available.

Testing - Second ABL

The second ABL testing would be similar in scope and concept to the first ABL testing. With the modification of a new aircraft into the upgraded configuration, the same complete weapon system verifications would have to be accomplished. In future testing, the SIL would be transitioned to a permanently based hardware-in-the-loop "Iron Bird" facility (i.e., a laser module and beam control test facility and lethality cell). Future testing would also include testing on the Iron Bird. These system-level ground tests would complement the flight test efforts from the technology improvement tests to assure system readiness for integration onto the second aircraft. The Iron Bird would also be used for continuing design and component upgrade testing. The second ABL testing would continue building on the lethality demonstrations from prior Blocks to arrive at a measure of the ABL's lethality. After completion of weapon system validation, the second ABL would also be used in the BMDS System Integration Tests. This additional testing is expected to take approximately 24 months.

Deployment

Following flight testing, this aircraft would be capable of providing, if directed, an emergency operational capability that offers limited rudimentary protection against ballistic missile threats in a regional crisis situation. Subsequent activity would involve enhancing ABL software and hardware on the first aircraft and would add deployable ground support equipment, including chemical production and storage facilities to produce the required laser fuel, to allow for forward deployment of the ABL as a weapon.

Decommissioning

Decommissioning of ABL facilities and equipment would involve demilitarizing or disposing of the aircraft and aircraft support facilities, the laser weapon components, chemical production and storage facilities, sensors, and BMC4I assets as required by the appropriate regulations.

National Environmental Policy Act (NEPA) Analysis

The following NEPA analyses support the majority of ABL test and development efforts.

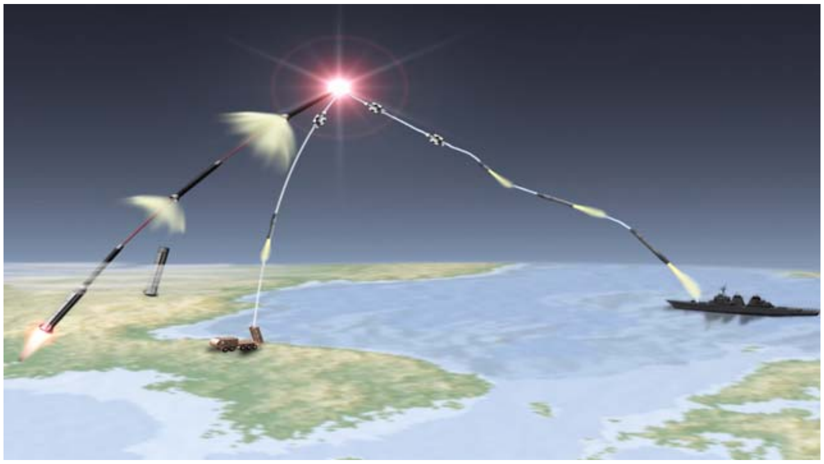
- *Airborne Laser Program Final Supplemental Environmental Impact Statement* (June 2003)
- *Point Mugu Sea Range Final Environmental Impact Statement/Overseas Environmental Impact Statement* (Department of the Navy, March 2002)
- *Program Definition and Risk Reduction Phase of the Airborne Laser Program Final Environmental Impact Statement* (April 1997)
- *Theater Ballistic Missile Targets Final Programmatic Environmental Assessment* (U.S. Air Force, December 1997)
- *Programmatic Environmental Assessment, Theater Missile Defense Lethality Program* (U.S. Army Space and Strategic Defense Command, April 1993)

D.2 Kinetic Energy Interceptor

Introduction

One MDA goal for Block 12 is to add a kinetic energy boost layer to the BMDS. There are two major efforts to achieve this goal. Development and Test (D&T) of a mobile, land-based boost ascent interceptor element and the Near-Field Infrared Experiment (NFIRE) risk reduction activity. MDA will complete development of a land-based, boost/ascent element in Block 12 (see Exhibit D-2 for an artistic depiction of terrestrial and sea-based concepts).

Exhibit D-2. Kinetic Energy Interceptor Terrestrial and Sea-Based Concepts



Development

In Fiscal Year (FY) 03 MDA awarded two contracts to design a mobile, boost/ascent element and propose a detailed plan to achieve this capability. Block 12 program priorities in rank order are mission assurance, schedule, performance and cost. These priorities resulted in the contractors proposing existing hardware, software and proven technologies in their design concept. During the Concept Design phase initial hardware-in-the loop testing of a kill vehicle seeker was completed, a full-scale prototype launcher was built and tested, the second-stage rocket motor with trapped-ball thrust vector control was static fired, real-time C2BMC/Fire Control experiments with Overhead Non-Imaging Infrared sensors were conducted, and a high-fidelity simulation of entire Kinetic Energy Interceptor (KEI) element concept was built and exercised. In December 2003, MDA awarded a contract for the KEI D&T Program to a defense contractor team.

The KEI land-based element design is based on mature technologies proven in ground and flight test at the component level. The KEI kill vehicle combines the Standard

Missile (SM)-3 seeker/avionics with an Exoatmospheric Kill Vehicle (EKV) liquid divert and attitude control system to achieve a high performance boost/ascent interceptor with inherent midcourse defense capability. The KEI third stage is a production SM-3 third stage rocket motor with a new attitude and control subsystem derived from Ground-based Midcourse Defense (GMD). The first and second stage motors utilize advanced solid axial stage technologies we have been developing and testing incrementally over the last decade. The C2BMC component builds upon an extensive suite of concept design phase algorithms and the contractor's substantial investments as lead developer of the GMD C2BMC capability. The mobile launcher is a modification of military-off-the-shelf equipment.

The KEI D&T program is structured much differently than predecessor missile defense programs. The D&T integrated master plan/integrated master schedule features an unprecedented mix of program content during the early years of execution. This content is driven by newly defined MDA engineering and manufacturing, software, and operational readiness level criteria. The MDA has defined the new readiness levels as exit criteria (knowledge points) for design reviews and the Block 12 capability milestone. MDA's objective is to focus early development work on manufacturing, producibility, quality, affordability, and operational suitability in addition to the traditional upfront emphasis on technical performance. The FYs 04 to 08 D&T program content includes: 1) mitigation of key risks through early build and test of full scale prototypes based on mature technologies, 2) complete definition of all requirements and interfaces by Design Review-1, 3) design of the interceptor, C2BMC, and launcher production lines, 4) establishment of machines and tooling in a laboratory environment for selected items, 5) development of engineering models as flight test unit pathfinders, 6) initiating builds of all integration labs and activating test facilities, 7) initiate procurement of flight test targets, and 8) extensive involvement of the User (STRATCOM, NORTHCOM) in KEI capability design and operations concept definition. Work will be conducted across multiple geographic centers where the integrated product teams are based.

Mobility of the interceptor is an essential characteristic enhancing its military utility. The KEI contractor is developing a canisterized interceptor, which is completely common to both land and sea basing and compatible with land and sea environments. These attributes will provide both flexibility and robustness to the test program, and ease the transition to a fully integrated sea based capability.

The collection of the near field infrared measurements of boosting targets will be from an on-orbit satellite. Currently, MDA is building the NFIRE satellite. The major objective of this effort is to collect near field long, medium and short wave infrared measurements of the rocket plume and body in the boost phase of flight to anchor our understanding of the plume phenomenology and plume to rocket body discrimination. MDA will also use this data to validate the models and simulations that are fundamental to developing the navigation, guidance and control and endgame homing algorithms for the KEI D&T program.

Testing – Block 2012

Land-based Kinetic Energy Interceptor

Developing a realistic, robust test program for the BMDS Interceptor element is paramount to the BMDS. Beginning in FY 08 the interceptor will be tested from both land-based ranges and a sea-based platform. Launching the interceptor from a sea-based platform is critical to providing realistic coverage of the operational envelope and intercept geometries. Based on results of a Military Sealift Command market survey, the agency, through Military Sealift Command, will acquire a containership to support the BMDS interceptor testing. While serving to enhance the flexibility of the BMDS test bed, the containership may be deployed in case of a national emergency.

MDA will execute a series of two flight tests (Element Characterization Flight and Ship-launched Risk Reduction Flight) and five Integrated Flight Tests (1-5) against targets during the D&T. These flight tests will be preceded by a robust series of ground testing including multiple static fire tests of all three rocket motor stages and integrated Kill Vehicle hover testing as well as a Booster Flight test, a Partial Full Scale flight test and a Control Test Vehicle flight test. Numerous integrated GTs of the Element C2BMC with the BMDS and the Element C2BMC with the launcher will also be conducted. All five Integrated Flight Test missions will have the objective of intercepting the target. Beginning with Integrated Flight Test-3, the element will be tested using production hardware and software with Integrated Flight Test-5 mission conducted by the user. To support this strategy MDA will procure nine targets (including two spares).

Block 12 testing focuses on boost/ascent phase intercept. Technical and operational issues resolved during land-based development and testing mitigate risks for future evolutions of this mobile and highly effective capability.

MDA continues to conduct a disciplined approach to collecting data to better understand the physics and phenomenology of boosting flight. This measurements test program exploits existing targets of opportunity flights such as intercontinental ballistic missile and space launches through the use of ground, aircraft-borne and space based sensors. The importance of these data products enables improvements to be made to guidance algorithms, scene generation fidelity levels, and modeling and simulation results that are used to analyze interceptor performance capabilities against various threat type characteristics to include plume to hard body discrimination under different scenarios. MDA intends to conduct additional target of opportunity flights, varying the geometries of the flight test scenarios and instrument set-ups to improve the fidelity of data sets to include near field data needs throughout boost.

Two payloads will be integrated onto the NFIRE satellite to execute four missions. The first mission set tracks ground targets such as forest fires, volcanoes, and static tests of rocket engines. This mission will verify, on-orbit, the pointing accuracy of the gimbaled system and calibrate the tracking sensors. The second mission set tracks targets of opportunity worldwide that take place regardless of the NFIRE experiment. These might include aircraft flights, space launches and operational missile tests. The two primary missions require the spacecraft to maneuver to view a boosting intercontinental ballistic missile closing on the spacecraft. During the second of these two missions, the spacecraft releases the kill vehicle for a fly-by of the burning missile.

Deployment

The KEI program office will develop deployment plans in the event the DoD makes a positive deployment decision. MDA plans to deploy KEI only to the BMDS test bed.

Decommissioning

The program office will develop decommissioning plans in the event the DoD makes a positive deployment decision.

NEPA Analysis

Planning for NEPA analysis is underway for range, facility, and early test events.

D.3 AEGIS Ballistic Missile Defense

Introduction

The Aegis Ballistic Missile Defense (BMD) is a sea-based element designed to negate ballistic missiles in the midcourse flight phase and provide surveillance and tracking support to the BMDS against ballistic missiles of all ranges. Aegis BMD uses hit-to-kill technology to intercept and destroy short- to medium-range ballistic missiles. Future development would expand to use hit-to-kill technology to counter intermediate-range ballistic missiles. Currently, the focus of Aegis BMD is to counter ballistic missile threats in the midcourse phase. Future flight tests would address the element's ability to intercept ballistic missile lower in the exoatmosphere.

Aegis BMD components consist of a select number of Aegis Guided Missile Cruisers and Destroyers employing the AN/SPY-1 Radar with SM–3 missiles. Designated Aegis destroyers are being equipped ships would be modified to provide Long Range Surveillance and Tracking and will eventually be modified to support engagement with SM-3 missiles. Designated Aegis cruisers are being modified to support engagement.

Interceptors

The Aegis BMD midcourse defense element of the BMDS integrates the SM-3 with the existing Aegis Weapons System aboard Navy cruisers to provide protection against short- to medium-range ballistic missiles. The SM-3 is based on the SM-2 Block IV airframe and propulsion stack, but incorporates a third stage rocket motor, a Global Positioning System/Inertial Navigation System guidance section, and the SM-3 kinetic warhead. The SM-3 is a solid propellant-fueled, tail-controlled, surface-to-exoatmosphere missile.

The SM-3 is an evolution of the Lightweight Exoatmospheric Projectile developed in the mid-1980s to demonstrate hit-to-kill technology. The Aegis Weapons System's SPY-1 Radar detects and tracks a ballistic missile and passes that information to the SM-3. The SM-3 is launched from the vertical launch system and controlled by the Aegis Weapon System up to the kinetic warhead ejection from the third stage rocket motor. The Global Positioning System/Inertial Navigation System guides the missile on an intercept trajectory. The kinetic warhead is equipped with propulsion, a long wave infrared seeker, and a guidance and control system enabling it to acquire, track, discriminate, divert and intercept a ballistic missile target above the Earth's atmosphere.

Aegis Cruisers and Destroyers

The Aegis BMD element builds upon the existing Aegis weapons system and the SM infrastructure currently deployed on both Ticonderoga class cruisers (see Exhibit D-3) and Arleigh Burke class destroyers.

Exhibit D-3. Aegis Cruiser USS LAKE ERIE

AN/SPY-1 Radar

The AN/SPY-1 radar, S-band multi-function phased array radar is the primary sensor for the Aegis BMD. The radar is capable of search; automatic detection; transition to track; tracking of ballistic missiles, air and surface targets; and missile engagement support.

The AN/SPY-1 radar is computer-controlled, four-faced, phased array radar that rapidly transitions detections into tracks and passes them to the ship's Command and Decision system element for engagement decisions and further processing. The four fixed arrays of the radar send out beams in all directions, continuously providing a search and tracking capability for multiple targets at the same time. All targets tracked by the AN/SPY-1 radar are monitored by the ship's Command and Decision system. The Aegis BMD system development and testing has been integrated with the BMDS Test Bed and architecture to support MDA's capability-based block acquisition strategy.

Development

The Aegis BMD development began with the TERRIER Lightweight Exoatmospheric Projectile Program, which included four flight tests between 1992 and 1995, and demonstrated that Lightweight Exoatmospheric Projectile could be integrated into a sea-based tactical missile for BMD based on exoatmospheric intercepts.

The next step in program development was the Aegis Lightweight Exoatmospheric Projectile Intercept project that built upon the lessons learned from the TERRIER-Lightweight Exoatmospheric Projectile program and emerging technologies. The purpose of the Aegis Lightweight Exoatmospheric Projectile Intercept was to demonstrate technologies required to hit a ballistic missile target in the exoatmosphere from a ship at sea. The project test requirements were satisfied with two successful intercepts from the USS LAKE ERIE: Flight Mission (FM)-2 and FM-3 in January 2002 and June 2002, respectively. FM-2 accomplished a direct hit of a ballistic missile target and successfully demonstrated kinetic warhead guidance, navigation, and control operations against a live target. FM-3 successfully repeated the intercept of a live ballistic missile target. With the successful completion of FM-3, the Navy considers the exit criteria of the Aegis Lightweight Exoatmospheric Projectile Intercept project to have been met.

Current developmental efforts for Aegis BMD Block 2004 are focused on defeating short- and medium-range ballistic missiles while providing surveillance support to the BMDS. Block 2004 delivers the Aegis BMD capability to provide long-range surveillance and tracking against intermediate range and intercontinental ballistic missiles to other components of the BMDS. Aegis BMD flight-testing includes a series of test FMs that demonstrate increasingly complex capability against ballistic missiles such as testing against unitary targets, separating targets, separating targets in clear environments and separating targets that include countermeasures.

The operational objective of the Aegis BMD Block 2004 Test Bed capability is to act synergistically with other BMDS boost, midcourse, and terminal elements to maximize BMD capability.

The Japan Cooperative Research project consists of joint research conducted by Japan and the U.S. to enhance the capabilities of the SM-3 for BMD. This program is part of the U.S. security alliance with U.S. allies to complement the incremental capability approach. The focus of research is on four components of the SM-3 guided missile - sensor, advanced kinetic warhead, second stage propulsion, and lightweight nosecone. Initial flight-testing will test advanced nosecone functionality, which may be integrated into the Aegis BMD Block 2006 capability.

Testing – Block 2004

The Aegis BMD program test strategy consists of coordinated ground and flight-testing to verify the expanding capabilities of the system's evolutionary block development. The Block 2004 flight test program is designed to demonstrate capability against an increasingly complex range of ballistic missile targets. These flight tests provide the opportunity to demonstrate both midcourse ascent and descent phase intercept capability and to flight test the divert-and-attitude control system kinetic warhead. Block 2004 FMs will demonstrate the capability to tactically engage unitary ballistic missile targets including one in the low exoatmosphere as well as demonstrate an initial capability against simple separating ballistic missile targets.

Aegis BMD has developed the capability to deliver long-range surveillance and tracking support to the BMDS and GMD. As part of this development, Aegis BMD Blocks 04 and beyond participates in all GMD Integration Flight Test missions and System Integration Flight Test (SIFT) missions to provide a long-range surveillance and tracking capability to GMD. At some point in Aegis BMD development, future blocks may participate in Integrated Flight Tests as an engagement asset (Block 08 or later). In the near term, Aegis BMD will be demonstrating connectivity between an Aegis ship in the Western Pacific and the BMDS.

Testing - Block 2006

The Block 2006 flight test program will demonstrate system capability improvements to defeat short range, medium range, and intermediate range ballistic missiles, enhanced discrimination, and will provide capability against countermeasures. The flight test program will include Launch on Boost in addition to Launch on Remote. Other plans for system improvements are under development including the Aegis BMD signal processor. Additionally, Japan Cooperative Research Project flight tests will be conducted to demonstrate the SM-3 lightweight nosecone.

Testing - Block 2008

Aegis BMD Block 2008 will provide fully integrated radar discrimination and other enhancements against Long Range Ballistic Missiles and countermeasures as well as continued upgrades for BMDS C2BMC. It will include multiple simultaneous engagement capability. Further details are being developed within MDA.

Testing - Block 2010

The Block 2010 flight test program will demonstrate a weapon system upgrade that will permit the incorporation of Aegis BMD into the Navy developed Aegis Weapon System open architecture, thereby fully integrating BMD into the Aegis multi-mission capability. Additional performance in countermeasure environments will also be demonstrated.

Deployment

Deployment includes production, manufacture and fielding of the Aegis BMD elements and any test-related assets. At the conclusion of Block 2004, three Aegis BMD cruisers and 15 Aegis BMD destroyers will be modified. Deployment locations have not yet been determined.

Decommissioning

The U.S. Navy would decommission the Aegis cruisers or destroyers at the end of their useful life. Decommissioned ships may be overhauled and returned to service, sold to an Allied Navy through foreign military sales, or the ship may be sold for scrap metal. The disposition of all weapons and sensors would be in accordance with applicable DoD and U.S. Navy policy.

NEPA Analysis

The following NEPA analyses support the majority of Aegis BMD test and development efforts.

- *Rim of the Pacific Programmatic Environmental Assessment* (June 2002)
- *Point Mugu Sea Range Final Environmental Impact Statement/Overseas Environmental Impact Statement* (Department of the Navy, March 2002)
- *Pacific Missile Range Facility Enhanced Capability Final Environmental Impact Statement* (December 1998)
- *Lightweight Exoatmospheric Projectile Test Program Environmental Assessment* (June 1991)

D.4 Ground-Based Midcourse Defense

Introduction

The GMD segment of the BMDS is comprised of ground-based interceptor missiles, radars and other sensors, and GMD Fire Control (GFC) Node and is designed to neutralize a threat ballistic missile during the midcourse phase of its flight. The midcourse phase is best defined as the ballistic portion of a missile's flight after it leaves the atmosphere and before it reenters the atmosphere. An operational GMD within the proposed BMDS includes the following key components

- Ground-Based Interceptors (GBIs),
- Sea-Based X-Band Radar (SBX),
- Ground-Based Midcourse Defense Fire Control/Communications (GFC/C) facilities and links, and
- Upgraded Early Warning Radars (UEWRs).

Sensors

Sensors proposed for the GMD include the SBX, UEWR (e.g., COBRA DANE on Eareckson Air Station, UEWRs at Beale AFB, Royal Air Force Fylingdales, and Thule Air Base), AN/SPY-1 Radar, BMDS Radar (Forward Based X-band Transportable[FBX-T]), AN/FPQ-14 Radar, and space-based sensors. The GMD program also uses sensors from other elements of the BMDS. See Appendix E for a detailed description of the BMDS sensors.

Interceptors

The GBI is designed to intercept incoming ballistic missile warheads outside the Earth's atmosphere and destroy them through force of impact. The GBI consists of a multi-stage solid propellant booster and an EKV. Each interceptor booster contains up to approximately 20,500 kilograms (45,000 pounds) of solid propellant.

During flight, the GBI receives information from the GFC/C to update the location of the incoming ballistic target, enabling the EKV's onboard sensor system to identify and home in on the threat re entry vehicle. Each EKV contains approximately 7.5 liters (2 gallons) of liquid monomethyl hydrazine fuel and 7.5 liters (2 gallons) of liquid nitrogen tetroxide oxidizer. The liquid fuel and liquid oxidizer tanks arrive at GMD test and operational sites fully fueled. Interceptors are assembled on site.

The components associated with a typical GBI launch site include the Launch Control Center, range sensors, and In-Flight Interceptor Communications System Data Terminal

(IDT). The Launch Control Center is linked to the GBI silo via fiber optic cable and contains computer terminals and the flight control center. Range sensors and telemetry equipment are used to monitor all missile flights. The IDT provides an in flight tactical or communications link between the GFC/C and the interceptor during flight. Each GMD site uses commercial power with electrical generators for backup power.

Interceptor missile boosters, payloads, and support equipment will be transported by air, ship, or over-the-road common carrier from U.S. Government storage depots or contractor facilities to the test range. Shipping is conducted in accordance with Department of Transportation (DOT) regulations. The interceptor will be placed in existing or newly constructed facilities for assembly and launch preparation. Applicable safety regulations are followed in the transport, receipt, storage, and handling of hazardous materials. An appropriate explosive safety quantity distance (ESQD), as approved by the DoD Explosives Safety Board, surrounds facilities where interceptors and ordnance are stored or handled.

Ground-Based Fire Control/Communications

The GFC/C facilities and links are presented below in two categories: 1) GFC command nodes, and GFC communications links, which include the Ground Based Communications Network, and 2) the IDTs.

GFC Command Nodes

The existing and proposed GFC command nodes with their related facilities and hardware exist or are under construction at identified locations for either test or operational purposes.

The command level GFC/C sites are located at the Joint National Integration Center and Fort Greely. GFC/C sites will be operational 24 hours a day.

Execution level GFC/C nodes are located at GMD GBI sites and use electric power from the base or GBI site. The operational concept is for GFC/C to consist mostly of battle management functions and to act as the centralized point for readiness, monitoring, and maintenance. GFC/C provides the user with system status displays, threat displays, predictive planning displays, and weapons control data to support both GMD and BMDS level command and control decision-making and execution.

The sensor level site communications node is co-located with the sensor or, in the case of spaced-based sensors, at the appropriate satellite control center to communicate sensor data to the GFC/C network.

GFC/C system sites may include

- Peterson AFB, Colorado (Command Level Node),
- Schriever AFB, Colorado (Command Level Node),
- Cheyenne Mountain Complex, Colorado (Command Level Node),
- Beale AFB, California (Sensor Level Site Communications Node),
- Eareckson Air Station, Alaska (Sensor Level Site Communications Node),
- Fort Greely, Alaska (Execution Level Node),
- Vandenberg AFB, California (Execution Level Node),
- Thule Air Base, Greenland (Sensor Site Communications Node), and
- Royal Air Force Fylingdales, England (Sensor Site Communications Node).

These GFC/C nodes use existing facilities where available. These existing facilities usually only require minor modifications, hardware and software upgrades, and connections to existing communications lines. However, some sites require new facility construction, such as satellite earth terminals or new utility or communications lines.

GMD Communications Network

The GMD Communications Network is that portion of the GFC/C component that provides voice and data communications through a network of transmission equipment and circuits, cryptographic equipment, and local and wide area networks necessary to provide a dedicated, reliable, and secure GMD communication capability. Components of the network provide connectivity to all components of the test bed and for limited defensive capability (LDC), providing functional connectivity to the IDTs, the GBI and target launch facilities, radars, and the GFC/C system. Communications occur over a combination of existing and new communication cables (either fiber optic or copper), Military Satellite Communications (MILSATCOM) and Commercial Satellite Communications (COMSATCOM) terminals.

Satellite Communications

The primary power for MILSATCOM and COMSATCOM Earth Terminals (see Exhibit D-4) is commercial, with backup power provided by generator. Communication cables between the terminal and the launch control complex are required. Equipment can be housed in a military van, a small building, or an existing facility if an adequate structure is available. The site requirements include a concrete base for the Earth Terminal, an all-weather road to the site, a prepared surface and fencing around the site.

Exhibit D-4. COMSATCOM Earth Terminal

Communications Cable

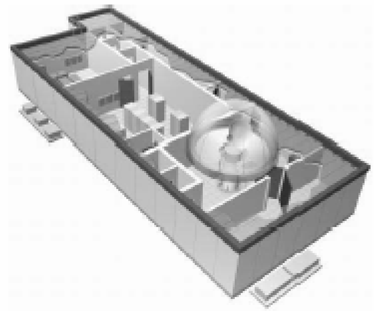
For communication among the components on the same installation, the test bed maximizes available communications assets, including existing cable. If communication cable is not available, new cable will be installed. New cable uses existing conduit, if available. If existing conduit is not available, new conduit is laid using existing rights-of-way, where possible to avoid environmental concerns. Where new conduit is necessary, it requires a trench approximately one meter (three feet) wide and one meter (three feet) deep.

In-Flight Interceptor Communication System Data Terminals

The IDT provides communications links between a GBI missile in flight and GFC/C systems. IDTs are located close to GBI launch sites and at remote locations. See Exhibit D-5 for conceptual examples of these alternative IDT configurations. GMD may employ more than one of these IDT configurations to meet testing or future deployment requirements.

The IDT is a radio transmitter and receiver that functions only during GMD and BMDS exercises, test events and missions. It is a super high frequency transceiver that provides communications uplink and downlink between the GFC/C nodes and the in-flight GBI.

Exhibit D-5. In-Flight Data Terminals



Development

As one of the more mature elements of the BMDS, GMD has been under development for a number of years. Currently, GMD is in the LDC phase of development at Fort Greely, Alaska, Vandenberg AFB, California, and at several other locations.

Testing

GMD testing involves increasingly robust interceptor flight tests with participation of additional BMDS components to achieve more realistic testing. Enhanced flight testing requires the extension of existing Pacific Region test range areas that currently support BMDS test activities. The Extended Test Range (ETR) provides increased realism for GMD/BMDS testing by allowing multiple missile engagement scenarios, trajectories, geometries, distances, and target speeds that more closely resemble those an operational BMDS is likely to encounter. Most tests include launching a target missile; tracking by range and other land-based, sea-based, airborne, and space-based sensors; launching a GBI; and missile intercepts at high altitudes over the Pacific Ocean. Some test events include multiple target and interceptor missile flights to validate BMDS performance, as well as testing from existing test or operational sites in compliance with Federal, state and local regulations.

Target missiles could be launched from Ronald Reagan Ballistic Missile Defense Test Site (RTS) at U.S. Army Kwajalein Atoll (USAKA) in the Marshall Islands; Vandenberg AFB, California; Pacific Missile Range Facility (PMRF) on Kauai, Hawaii; and/or from mobile platforms situated in the Pacific Ocean. GMD's existing deployed sites also may be involved in test firing and other test activities to assess system performance. Exhibit D-6 shows these and other test and test support locations. Interceptor missiles may be launched from RTS, Kodiak Launch Complex (KLC), Alaska, and/or Vandenberg AFB, California. Dual target and interceptor missile launches may occur in some scenarios. Existing, modified, and new infrastructure support launch activities at the various locations.

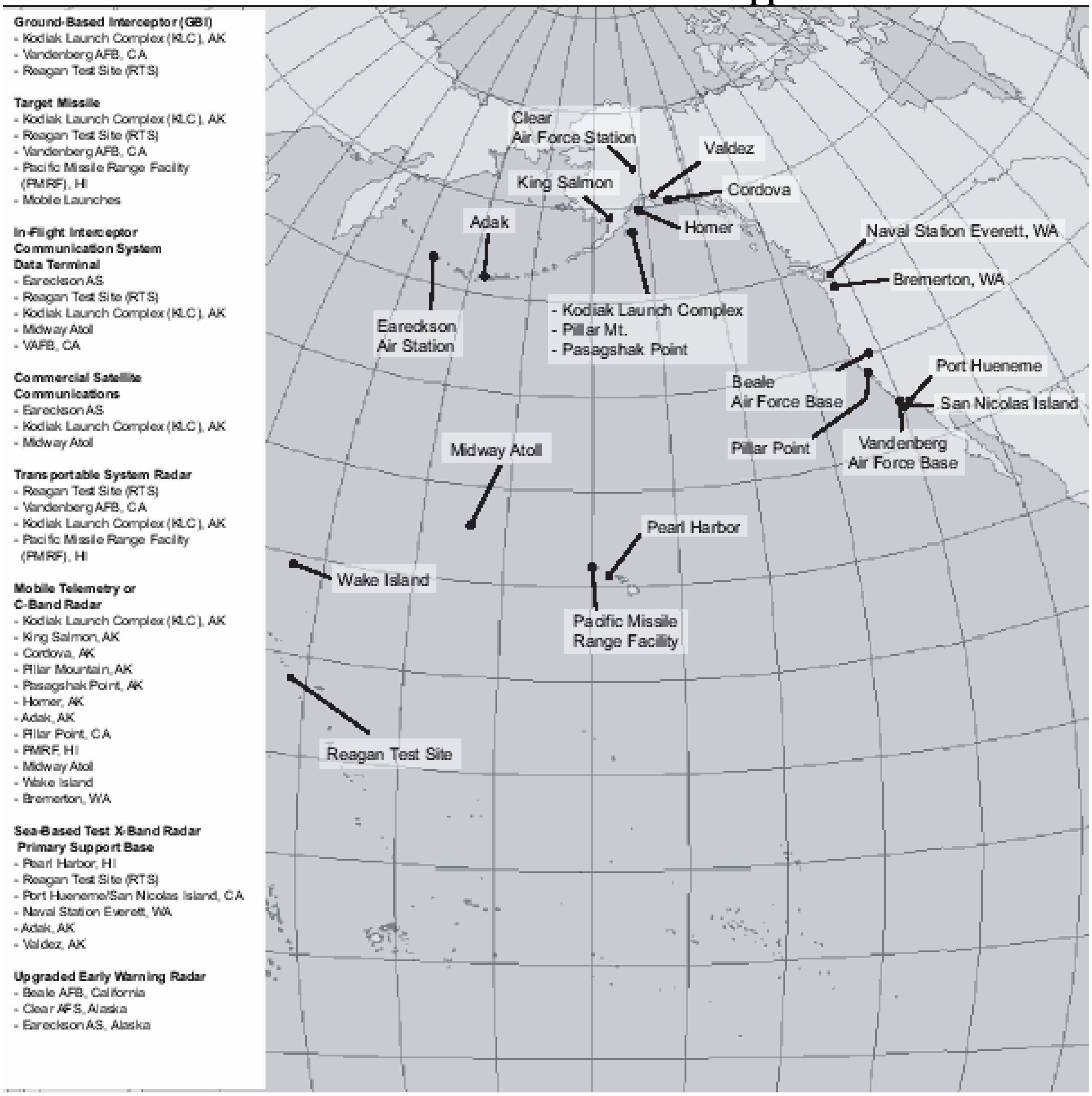
Target missile acquisition and tracking would be provided by sea-based sensors (e.g., Aegis cruisers and destroyers, SBX) and land-based sensors in the Pacific Region; a transportable test X-band radar (TPS-X) or the forward deployed radar (FDR) positioned at test ranges such as Vandenberg AFB, KLC, RTS, or PMRF; the existing prototype X-band Ground Based Radar (GBR-P) at RTS; and existing/upgraded radars at Beale AFB, California, Clear Air Force Station, Alaska, and Eareckson Air Station, Alaska (see Exhibit D-6).

IDTs may be located at GBI launch sites. Satellite communications terminals will be constructed at launch sites that do not have fiber optic communication links and at other locations.

GMD test plans include a number of missile launches (interceptors and/or targets) from each launch facility per year. The total per year will vary to meet the needs of the program.

The GMD flight test program consists of various Integrated Flight Tests in which an intercept is attempted, and Radar Characterization Flights in which only a target vehicle is flown and observed by radars.

Exhibit D-6. MDA GMD ETR Test and Test Support Locations[3,4]



Source: GMD ETR EIS (July 2003)

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[3] At the time this graphic was originally published, the MDA was considering six sites for the location of the SBX Primary Support Base (i.e., Pearl Harbor, HI; Reagan Test Site; Port Hueneme/San Nicolas Island, California; Naval Station Everett, Washington; Adak, Alaska; and Valdez, Alaska). MDA has decided to establish the Primary Support Base at Adak, Alaska. (Record of Decision [ROD] To Establish a GMD ETR, August 26, 2003).

[4] At the time this graphic was originally published, the MDA was evaluating the potential impacts of launching interceptor missiles from the KLC; however, in a Record of Decision issued on December 9, 2003, the MDA determined that the activities proposed for the KLC would consist of dual target launches and no interceptor launches.

Testing - Block 2004

Block 2004 GMD element proposed actions include introduction of the SBX into the BMDS Test Bed to increase test capability and realism against more stressful long-range targets and countermeasures suites.[5]

Testing - Block 2006

Block 2006 GMD proposed actions include prototype hardware and software maturation for all GMD interceptor, sensor, and GFC/C components; ground and flight-testing to demonstrate added performance, and interfaces with external sensors; and the upgrade of theearly warning radar (EWR) at Thule Air Base, Greenland.[6]

Testing - Block 2008

Block 2008 GMD proposed actions include demonstrating advanced engineering and pre-planned equipment improvements for boosters, interceptors, early warning and fire control radars, and GFC/C software builds; and demonstrating improved performance based on overall enhancements to BMDS integration, including KEI and space-based sensors.[7]

Testing - Block 2010

Block 2010 GMD-proposed actions include continued flight-testing of improved weapon and sensor components, and design, engineering and integration of an advanced KEI.[8]

Deployment

In light of the new security environment and advances made to date in missile defense development, the President directed the DoD to field limited defensive capabilities by the end of 2004 to meet growing ballistic missile threats.

The initial set of GMD capabilities planned for 2004-2005 included as many as 16 GBIs at Fort Greely, Alaska and two interceptors at Vandenberg AFB, California. Additionally, the GMD element of the BMDS will take advantage of land-, sea-, and space-based sensors, including existing early warning satellites and an upgraded radar located at Eareckson Air Station, Alaska, and the SBX. MDA also plans to upgrade EWRs at Cape Cod and in the United Kingdom and the Kingdom of Denmark.[9]

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[5] MDA FY 2004/2005 Budget Estimate Submission Press Release (page 11)
[6] Ibid. (page 13)
[7] Ibid. (page 16)
[8] Ibid. (page 17)
[9] DoD Press Release, December 2002

The exact nature of future GMD deployment activities (i.e., additional interceptors, land-based radars, and the construction of necessary support facilities) has yet to be determined. Any decision to deploy additional interceptors would be addressed in additional NEPA analysis or the appropriate analysis under Executive Order (EO) 12114, if appropriate. Currently, the Initial Defensive Operations (IDO) capabilities Record of Decision (ROD) dated April 18, 2003, supports deployment of as many as 40 interceptors at Fort Greely, Alaska.[10]

Decommissioning

Decommissioning of all or part of the GMD element is dependent on many variables. The exact timing of decommissioning activities has not been determined. The decommissioning of GBI missiles and the demolition of GMD element facilities (e.g., silos, radar buildings, etc.) will be in accordance with the applicable environmental regulations and standard practices. The decommissioning effort will seek to reuse and recycle materials to the maximum extent possible.

NEPA Analysis

The following NEPA analyses support the majority of GMD test and development efforts including establishment of the IDO capability.

- *Ground-Based Midcourse Defense Extended Test Range Final Environmental Impact Statement* (July 2003)
- *National Missile Defense Deployment Final Environmental Impact Statement* (July 2000)
- *Ground-Based Midcourse Defense Initial Defensive Operations Capability at Vandenberg AFB Environmental Assessment* (August 2003)
- *Alternate Boost Vehicle Verification Tests Environmental Assessment* (August 2002)
- *Ground-Based Midcourse Defense Validation of Operational Concept Environmental Assessment* (March 2002)
- *Ground-Based Midcourse Defense Supplemental Validation of Operational Concept Environmental Assessment* (December 2002)
- *Exoatmospheric Kill Vehicle Final Assembly and Checkout Operations at Redstone Arsenal, Alabama Environmental Assessment* (March 2000)
- *Integration, Assembly, Test, and Checkout of National Missile Defense Components at Redstone Arsenal, Alabama Environmental Assessment* (February 1999)
- *Additional Facilities at the National Missile Defense Ground-Based Interceptor Development and Integration Laboratory, Huntsville, Alabama Environmental Assessment* (March 1999)

[10] MDA, DoD. ROD to Establish GMD IDO Capability at Fort Greely, Alaska, April 18, 2003.

- *Booster Verification Tests Environmental Assessment, Vandenberg AFB* (March 1999)

Related Environmental Documentation

- *North Pacific Targets Program Environmental Assessment* (April 2001)
- *Theater Ballistic Missile Targets Programmatic Environmental Assessment* (December 1997)
- *Kodiak Launch Complex Environmental Assessment (May 1996)*

D.5 Patriot Advanced Capability-3

Introduction

PATRIOT is a mobile and transportable ground-based missile defense element that would be part of the terminal defense segment of the BMDS. PATRIOT is capable of multiple simultaneous engagements of the full range of short- and medium-range threats, including theater and tactical ballistic missiles, cruise missiles, tactical air-to-surface missiles including anti-radiation missiles, and lower radar cross-section aircraft flying in clutter and/or intense electronic countermeasure environments. PATRIOT defends deployed forces, strategic assets, and population centers in military operations. PATRIOT is designed to be able to communicate and operate with other elements, such as Terminal High Altitude Area Defense (THAAD) and Arrow, and the BMDS.

The PATRIOT uses PAC-3 and PAC-2 Guidance Enhanced Missiles as interceptors. The PAC-3 interceptor is a hit-to-kill guided missile with an onboard radar seeker and an explosive lethality enhancer. The PAC-2 Guidance Enhanced Missile interceptor is a guided missile with upgraded software to improve guidance of the missile and an onboard radar seeker and an explosive fragmentation warhead that detonates in close proximity to the target.

PAC-3 Missile

The PAC-3 missile (see Exhibit D-7) uses a solid rocket motor, aerodynamic controls, and a guidance system to navigate to an intercept point specified by the Fire Solution Computer prior to launch. Shortly before reaching the intercept point, the onboard radar acquires the target and the missile maneuvers to intercept the target. The control necessary for these maneuvers is provided by an Attitude Control Section. A lethality enhancer may be deployed near intercept to further increase the probability of destroying air-breathing targets.

Exhibit D-7. PAC-3 Launch

The PAC-3 missile consists of the seeker assembly, Attitude Control Section, Mid Section Assembly, solid rocket motor Section, and the Aft Section Assembly.

The seeker assembly is mounted at the forward end of the PAC-3 missile. It consists of a protective ceramic cover called a radome, active Ka Band Radar that acquires the target, an aluminum and graphite composite assembly and housing, the onboard radar, and associated electronics.

The Attitude Control Section contains a number of small, short duration, solid propellant (aluminum and ammonium perchlorate and hydroxyl-terminated polybutadiene) rocket motors (side thrusters) that enable the PAC-3 missile to maneuver to achieve an intercept of a target in response to the instructions provided by the onboard guidance processor. The Attitude Control Section housing and assembly is a composite material made of aluminum and graphite. The Attitude Control Section also contains one lithium thermal battery.

The mid section assembly contains various guidance, control, and communications electronics and antennas mounted in aluminum and graphite composite housing and assembly. The mid section assembly also contains a lethality enhancer to further increase the kill probability at intercept. The lethality enhancer contains various standard explosives, standard explosive detonators, two lithium thermal batteries, and a number of steel fragments. The main explosive charge is a low explosive that has been fully qualified for production and operational use. The lethality enhancer also serves as the Missile Destruct System for the PAC-3 missile. In the event that the PAC-3 missile diverges from a safe trajectory, the missile operator in the Engagement Control Station can command the lethality enhancer to detonate, breaking up the airframe of the missile, terminating thrust of the solid rocket motor, and causing it to terminate its flight and fall as debris.

The solid rocket motor Section includes the single stage solid rocket motor, fixed fins, pyrotechnic motor initiators, and a graphite composite case. The fixed fins are titanium and are secured to the rocket motor casing by titanium attachments. The solid rocket motor contains approximately 160 kilograms (350 pounds) of solid propellant (aluminum and ammonium perchlorate and hydroxyl-terminated polybutadiene).

PAC-2 Missile

The PAC-2 missile is equipped with four clipped-delta movable control surfaces mounted on the tail. The missile propulsion is furnished by a single-grain solid propellant rocket motor. A high explosive warhead provides target-kill. The PAC-2 missile would consist of the radome, guidance section, warhead section, propulsion section, and the control actuator section.

The radome provides an aerodynamic shape for the missile and microwave window and thermal protection for the Track-via-Missile seeker and electronic components. The guidance section consists of a Modular Digital Airborne Guidance System and is comprised of two parts. The Modular Midcourse Package, which is located in the forward portion of the warhead section, consists of the navigational electronics and a Missile Borne Computer which computes the guidance and autopilot algorithms and provides steering commands in accordance with a resident computer program. The Terminal Guidance section is the Track-via-Missile seeker, which consists of an antenna mounted on an inertial platform, antenna control electronics, a receiver, and a transmitter.

The propulsion section is comprised of the rocket motor, external heat shield, and two external conduits and contains a conventional, case-bonded solid propellant.

The control actuator section is located at the aft end of the missile. It receives commands via the missile autopilot and positions the fins to steer and stabilize missile flight. The fin servo system consists of hydraulic actuators and valves and an electrohydraulic power supply consisting of battery, motor-pump, oil reservoir, gas pressure bottle, and accumulator.

Development

The U.S. Army first introduced the PATRIOT air defense system in 1983, and the PATRIOT system was fielded in Europe in the mid 1980's. Continuous improvements and upgrades have been made to enhance its ability to counter evolving threats. The PATRIOT system was used to defend against Iraqi scud missiles in 1991 during Operation Desert Shield and Operation Desert Storm. The PATRIOT system was again utilized to defend against Iraqi missile threats in 2003 during Operation Iraqi Freedom.

By the end of Block 2004 the PATRIOT force will include 735 PAC-2 Guidance Enhanced Missiles and 364 PAC-3 Missiles, 30 PATRIOT AN/MPQ-53 Radars and 43 PATRIOT AN/MPQ-65 Radars, and PATRIOT Battle Management/Command and Control (BMC2) (Information and Coordination Central Control Units/Engagement Control Stations) to provide defense against short range and medium range threats.

The PAC-3 program was formally transferred to the U.S. Army in FY 03. The Army became responsible for the development, testing, budgeting, operations, fielding, and sustaining functions for the PAC-3 program. MDA remains involved from the BMDS perspective including BMDS performance, integration, and system testing.

Testing

Testing falls into one of four test categories, pre-production test, ground test, flight test, and lethality/survivability test.

Pre-Production Test

The pre-production test includes production qualification tests and production conformation tests. These two types of tests involve subjecting the upgraded components to a standard battery of natural environment, induced environment, supportability, transportability, mobility, performance, and other sub-tests. Production conformation tests demonstrate that deficiencies discovered during production qualification tests are fixed and operating properly. Upon completion of production qualification tests, the upgraded components would be integrated into the system and the system would undergo system level ground tests.

Ground Test

Ground testing would include simulations and performance tests. Simulations would be used to predict and verify system performance. Performance tests would include Developmental Testing and Evaluation, Information Assurance, Search Track, Ground-to-Ground and Ground-to-Air, and Operational Demonstration. Developmental Testing and Evaluation would ensure that hardware and software upgrades to the system have been successfully integrated and are ready for operational testing. Information Assurance would evaluate the vulnerability of the software and information systems. Search Track testing consists of a series of integrated hardware and software tests using simulated and real targets, electronic countermeasures, and penetration aids. Ground-to-ground and ground-to-air tests allowed checkout of missile guidance functions against simulated and real targets prior to flight tests. An Operational Demonstration was performed to demonstrate the technical merits of the hardware and software when tested in an operationally realistic environment. Interoperability testing will assess upgrades that allow the PATRIOT system to interoperate and trade data with other BMDS Command, Control, Communications, and Intelligence platforms.

Flight Test Programs

The Counter Anti-Radiation Missile program will involve one flight test that would demonstrate that the PAC-3 element could detect, track, engage, and successfully intercept an Anti-Radiation Missile flying a threat representative trajectory. This flight test is planned to occur at WSMR, New Mexico.

The PATRIOT Service Life Extension Program would modernize and repackage the PATRIOT system to meet the requirement that the PATRIOT be transportable by C-130 aircraft. A flight test would demonstrate that the modifications can support system functionality to detect, track, threat process, engage, and intercept a threat representative target. The flight test would occur at WSMR during Block 2006 testing.

The Light Antenna Mast Group would be an improved, scaled-down version of the existing tactical PATRIOT Antenna Mast Group and is a sub-program of the Service Life Extension Program. A flight test would demonstrate that the Light Antenna Mast Group could support system functionality to detect, track, threat process, engage, and intercept a threat representative aerial target. The flight test would occur at WSMR during Block 2004 testing.

The Evolutionary Development Program would be a continuing process that results in Block Upgrades to the PATRIOT system. Initially there are 16 tasks foreseen, and three are still being evaluated. The Evolutional Development Program would test computer software and processing, sensors, communications, Command and Control/Battle Management, (C2BM) ability to counter evolving threats, and upgrades to the PAC-3 missile. Several flight tests are scheduled to occur at WSMR under this program during Blocks 2004 and 2006.

Ripple Fire testing to assess the ability of the two PAC-3 missiles fired successively to intercept two tactical ballistic missile targets was successfully accomplished in November 2004.

Lethality/Survivability Test

Requirements for lethality testing are still being addressed. Survivability testing would involve nuclear, biological, and chemical contamination survivability.

BMDS Testing

The PAC-3 element would play a role in SIFT 2-1 and SIFT 3. Information from other SIFTs could be used to construct overlay scenarios for the PAC-3 element. In SIFT 2-1, a launch would be detected by the Defense Support Program (DSP), which would notify C2BMC of the launch. C2BMC would pass cueing information to PAC-3. PAC-3 would place the incoming ballistic missile under track and engage from WSMR. Following the intercept PATRIOT would perform a hit assessment and inform C2BMC of the results.

Deployment

PAC-3 units are fielded, operated, and sustained within the U.S. Army and U.S. National Guard throughout the U.S. Up to four surveillance rounds will be fired per year during operation and fielding phases. PAC-3 operators and maintainers would receive initial and follow-up training. The PAC-3 units would be upgrades of existing PAC-2 units, resulting in minimal training impacts.

Routine field training in tactics, techniques, and procedures for PAC-3 fielded units would provide the PAC-3 operators the opportunity to realistically train against systems similar to those likely to be encountered in a hostile environment. Field training activities occur at least on a weekly basis. Simulation training and live fire training will be conducted throughout the service life of the PAC-3 missile and system. Live fire training occurs at regular intervals, at qualified test ranges.

Decommissioning

The PAC-3 system is anticipated to be in the U.S. Army inventory for approximately 30 years. Upon reaching the conclusion of its U.S. Army effective service life, the system would be withdrawn from military service, decommissioned, and disposed. Some components could be evaluated for continued use by other U.S. Government agencies or as candidates for Foreign Military Sales. Various adaptive reuses could be analyzed and implemented if appropriate. If no appropriate requirements were identified, the PAC-3 units would be demilitarized and disposed of. Demilitarization is the act of destroying a system's offensive and defensive capabilities to prevent the equipment from being used for its intended military purpose. Disposal is the process of redistributing, transferring, donating, selling, abandoning, destroying, or any other disposition of the property.

Key items to be demilitarized include explosives; propellants and propellant fillers; toxic materials; incendiary or smoke content; other military design features; and any features determined to be hazardous to the general public. Items to be demilitarized include the entire missile or vehicle. To ensure freedom from explosive, toxic, incendiary, smoke, or design hazards, the process would be undertaken as economically as practicable and in accordance with existing environmental standards and safety and operational regulations.

PAC-3 system disposal would involve establishing disposal facility availability and shipping hardware to disposal site. Disposal of material would then conform to DoD directives, Joint Service Regulations, and comply with all Federal and state laws.

Each individual piece of equipment has disposition instructions that have been prepared by its development contractor or project office. These instructions identify the hazardous materials contained in the item of equipment. A copy of the disposition instructions would be provided to the depot or contractor performing the demilitarization and disposal. Disposal would be conducted according to the supplied disposition instructions in accordance with all federal, state, and local laws. Transportation of PAC-3 system components to demilitarization and disposal locations from military units, training, and maintenance locations would be by commercial ground transportation in accordance with DOT, state and local transportation and safety regulations and procedures.

NEPA Analysis

The following NEPA analyses support the majority of PATRIOT test and development efforts.

- *PATRIOT Advanced Capability-3 (PAC-3) Life Cycle Final Supplemental Environmental Assessment* (U.S Army Space and Missile Defense Command, January 2002)
- *PATRIOT Advanced Capability-3 (PAC-3) Life Cycle Environmental Assessment* (U.S. Army Space and Strategic Defense Command, May 1997)
- *PATRIOT Missile System, White Sands Missile Range, New Mexico Environmental Assessment* (U.S. Army, June 1995)
- *Theater Missile Defense Flight Test Supplemental Environmental Assessment* (U.S. Army Space and Strategic Defense Command, November 1995)

D.6 Terminal High Altitude Area Defense

Introduction

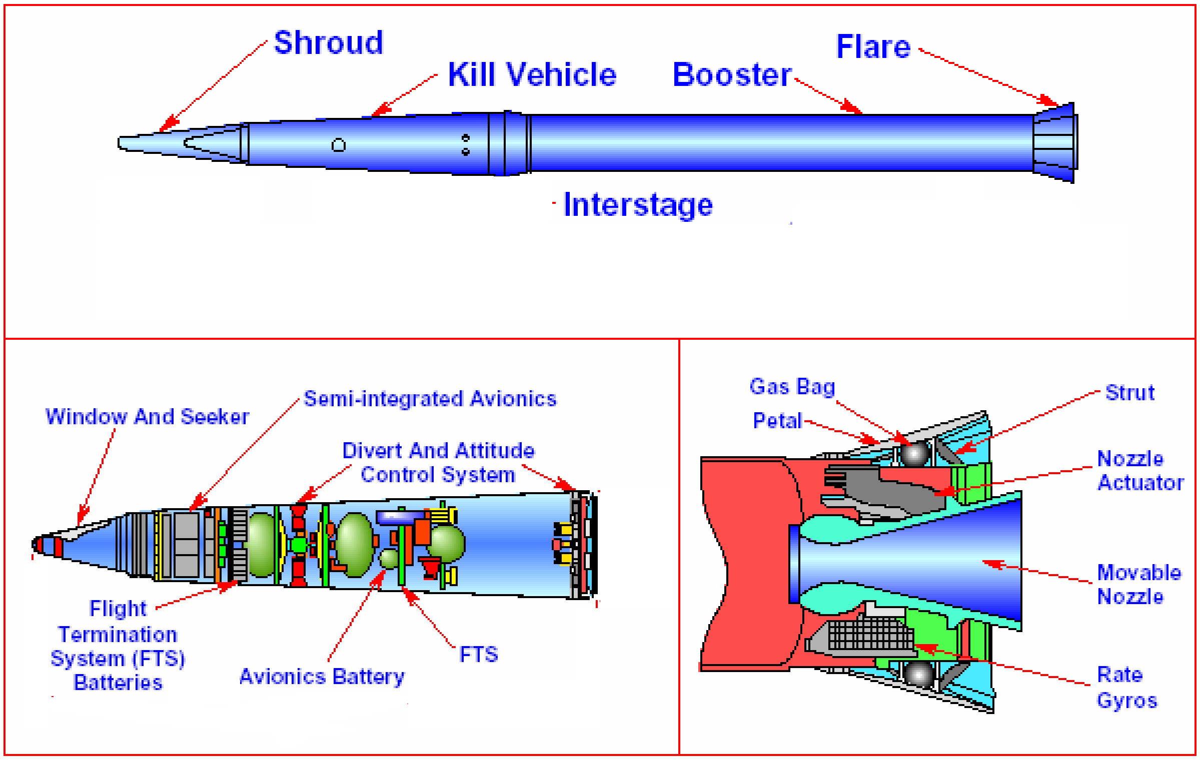
The THAAD weapons system is a mobile, land-based missile system designed to intercept and destroy short and medium range ballistic missiles in the endo- and exoatmosphere and to provide surveillance support to the BMDS against ballistic missiles of all ranges. The BMDS is envisioned as a system of layered, yet independent, defenses that use complementary interceptors, sensors and C2BMC to intercept ballistic missiles of all ranges in all phases of flight. The THAAD element would be integrated as part of the BMDS to provide protection against incoming ballistic missiles in the terminal phase of their flight. Complete with its own radar, launcher and C2BMC, the THAAD missile could operate independently as a BMDS or could be deployed as a sensor to provide surveillance and tracking of target missiles and to communicate data to other elements in the BMDS.

The THAAD missile system consists of four principle components: interceptor missiles, truck-mounted launchers, the THAAD radar system, and the THAAD C2BMC. All components of the THAAD missile system, with the exception of certain radar components, can be transported by a C-130 aircraft for deployment by sea, rail, and/or road.

Interceptor Missiles

The THAAD missile is intended to intercept and destroy incoming ballistic missiles with ranges of up to 3,000 kilometers (1,860 miles). The missile rounds are comprised of a single-stage booster attached to a kill vehicle. The THAAD kill vehicle includes an infrared seeker that detects and homes in on the target missile to destroy the target by high-speed collision. This hit-to-kill technology uses kinetic energy to eliminate the enemy missile. The kill vehicle consists of a shroud, fore-cone, seeker, divert and attitude control system, and guidance and control electronics. The kill vehicle has an uncooled sapphire window with an infrared seeker mounted on a two-axis stabilized platform. See Exhibit D-8 for an example configuration of a THAAD missile.

Exhibit D-8. Example THAAD Missile Configuration



The missile uses liquid hypergolic propellants for divert and attitude control. The booster is a single-stage solid propellant rocket motor with a flare. The flare consists of overlapping petals that lock into position after deployment. An inter-stage provides a physical interface linking the kill vehicle to the booster. The booster solid propellant is a hydroxyl-terminated polybutadiene composition that is rated as a Class 1.3 explosive. This booster rating includes the additional high-explosive energy associated with the flight termination system (FTS). The FTS is designed to terminate thrust if unsafe conditions develop during powered flight.

Mobile Launcher

The THAAD mobile launcher transports the interceptors in addition to providing a structure from which to fire them. The launcher consists of an easily reloadable missile round pallet. The pallet is an eight-round container with two tiers of four launch tubes. The launcher uses a modified M-1120 U.S. Army Heavy Expanded Mobility Tactical Truck-Load Handling System Truck to perform the functional requirements of the transporter on both improved and unimproved roads. The pallet can be quickly loaded onto or removed from the transporter using the truck.

THAAD Radar

The THAAD prototype radar is a wide-band, X-band, single faced, phased array radar system of modular design. The transmit/receive module has been upgraded to higher power outputs and improved reception levels. It performs surveillance, tracks the target, and controls firing functions. The radar communicates with the interceptor while it is in flight.

The THAAD radar consists of four units: Antenna Equipment Unit, Electronic Equipment Unit, Cooling Equipment Unit, and Prime Power Unit. The Antenna Equipment Unit includes all transmitter and beam steering components as well as power and cooling distribution systems. The Electronic Equipment Unit houses the signal and data processing equipment, operator workstations, and communications equipment. The Cooling Equipment Unit contains the fluid (ethylene glycol)-to-air heat exchangers, pumping system to cool the antenna array and power supplies. The Prime Power Unit, used to power the THAAD radar system, is a self-contained trailer in a noise-dampening shroud that contains a diesel generator, governor and associated controls, a diesel fuel tank, and air-cooled radiators. Each individual unit is housed on a separate trailer interconnected with power and signal cabling, as required. Operation of the Prime Power Unit would require refueling operations. The fuel tank of the Unit would be filled from a fuel truck as necessary.

C2BMC System

The basic C2BMC unit, the Tactical Support Group, consists of two tactical shelters mounted on XM-113 HMMVs; the Tactical Operations Station; and the Launcher Communications Station. There are also two HMMV cables and support equipment and towed tactical generators. The C2BMC system manages and integrates all THAAD components by providing instructions, processing sensor data, and communication with the radar and launcher. The C2BMC system also links the THAAD to other missile and air defense systems in the BMDS via the system-wide C2BMC. The C2BMC is connected internally and externally to allow the exchange of data and commands among the various components of the THAAD element. It uses a netted, distributed, and replicated flow of information to ensure uninterrupted execution of engagement operations. Key engagement operations include surveillance, threat evaluation, weapon assignment, engagement control, target engagement, and kill assessment. Missile launch procedures are controlled from separate C2BMC shelters mounted on XM-1113 High Mobility Multipurpose Wheeled Vehicles. Launch commands to the M-1120 Heavy Expanded Mobility Tactical Truck - Load Handling System Launcher are transmitted via fiber-optic cables.

Development

The THAAD element has been under development since the early 1990's. THAAD was formerly part of Theater Defense and is now an element of the Terminal Defense Segment. By the middle of FY 2000, THAAD had completed the Demonstration/Validation phase of its development. It is currently in the Systems Development phase.

THAAD has implemented a block approach. During Block 2004 THAAD program development will include the design and development of a significant, fundamental THAAD capability against short- and medium-range ballistic missiles. Development during Block 2004 aimed to reduce risk and to characterize component and element capabilities. Development activities include contractor conducted testing and modeling and simulations. The development program seeks to identify and correct failures at the lowest level possible and implement corrective actions early to support early design maturation, reduce risk, and control cost. For example, the THAAD prototype radar has been upgraded and has already undergone assembly, integration, and initial testing at WSMR. Verifying element capabilities supports THAAD integration into BMDS Block 2004 architecture.

Development plans for Block 2006 would include conducting THAAD system integration laboratory hardware-in-the-loop activities of hardware and software in preparation of flight-testing. Ongoing upgrades to the THAAD missile, radar, launcher and C2BM software would continue. Training programs would be conducted for staff planners and other Military Occupational Specialties.

Testing

Demonstration of the THAAD's capabilities during the 1990's was performed at WSMR, New Mexico where eleven flight tests were conducted in the Program Definition and Risk Reduction (PDRR) Phase. Upon successful completion of the PDRR, the THAAD program began planning a comprehensive test program to validate the performance capability and overall effectiveness of the THAAD element, to include flights tests, and intercepts of target missile launches over more realistic distances [50 to 3,000 kilometers (31 to 1,860 miles)] prior to its procurement and deployment. These distances are not available at WSMR; therefore, current testing plans for THAAD include missile launches and radar operation from PMRF on Kauai, Hawaii and from islands in the Republic of Marshall Islands. These ranges include short- (less than 482 kilometers), medium- (482 to 1,609 kilometers) and long-range (more than 1,609 kilometers) testing. Up to 50 THAAD interceptor missiles and up to 50 target missiles could be launched over a four-year period. This action was analyzed in the *Theater High Altitude Area Defense Pacific Test Flights Environmental Assessment* (U.S. Army Space and Missile Defense Command, 2002) and some of the activities proposed are summarized below. The

THAAD Development flight test program would consist of 17 contractor and government conducted flight tests and two radar data collection missions. These tests would be conducted in biannual blocks: Block 2004, Block 2006, and Block 2008.

Target missiles would be used to test the tracking and intercept ability of the THAAD components against realistic ballistic missile threats. Target missiles may carry payloads with biological or chemical simulants to test the effectiveness, or lethality, of the THAAD interceptor. These simulants are chemically and biologically neutral substances that mimic the significant qualities, such as dispersion, weight, and viscosity, of a toxic or hazardous substance that threat missiles could be armed with.

Testing - Block 2004

During Block 2004, testing would verify THAAD's capability against short- and medium-range ballistic missiles and would demonstrate its exoatmospheric and high endoatmospheric capability against unitary and separating targets in limited battle space. The Block 2004 flight test program would consist of four flight tests: one interceptor controls flight test; one system flight test employing a virtual target; one seeker characterization test; and one intercept flight test. The interceptor controls flight test would be conducted to confirm proper flight control operations in the high endo/exoatmospheric intercept regime. The seeker characterization flight test would ensure proper functioning of the interceptor's seeker in a live intercept environment. The remaining flight test would focus on demonstrating and characterization exoatmospheric performance capability, ultimately with soldier operation of the element. Demonstration activities at PMRF would begin in late FY 2006 and continue through FY 2010.

The Block 2004 THAAD element consists of an interceptor missile with range safety package (test missile), launcher, radar, and C2BMC. One or more THAAD missiles would be loaded in the missile round pallet. The remaining tubes would be filled with dummy missiles, which serve to balance the load across the breadth of the pallet. Operating radar and back up radar would be required. Some construction would be required at the selected radar site for a re-radiation tower that would verify the X-band communication link (transmit and receive) between the THAAD radar and the THAAD launch site. To operate the C2BMC, a Data Analysis Team would consist of 45 persons in two trailers. A Simulation Over Live Driver would generate simulated targets to add to live targets during flight tests. As of the publication date of the *Theater High Altitude Area Pacific Test Flights Environmental Assessment* (December 2002), specific support sensors and radars for each test had not been determined.

Solid propellant target missiles would be used to provide realistic threat scenarios. Target missiles would consist of a single reentry vehicle, a guidance and control unit, solid fuel boosters, and an aft skirt assembly. Solid rocket motors that could be used include the SR-19, GEM-40, Castor IV, Orbus-1, Polaris A3 and A3R, and the M-57A-1.

Testing - Block 2006

The Block 2006 flight test program would be conducted to demonstrate the endoatmospheric and exoatmospheric engagement capability. Block 2006 would consist of two radar data collection missions and 7 flight tests: an interceptor controls flight test, a seeker characterization flight test and 10 interceptor flight tests. The radar data collection missions would be non-interceptor (i.e., target only) flights using separating target missiles to gather data to support the development of radar software required later in the Block 2006 flight test program. The interceptor controls flight test would be conducted to confirm proper flight control operations in the endoatmospheric intercept regime. The seeker characterization flight test would ensure proper functioning of the interceptor's seeker in an endoatmospheric intercept environment.

Flight Test (FTT-06-5) would consist of two THAAD interceptors launched against a single target. All other Block 2006 flight tests would be single intercept missions (single interceptor, single target). Block 2006 flight-testing would resolve critical technical issues and critical operational suitability and effectiveness issues associated with the THAAD element design using the production representative missile configuration, C2BMC, and radar software upgrades.

Testing - Block 2008

Block 2008 flight testing will consist of six intercept missions. FTT-08-03 (14^{th} flight) will be a multiple, simultaneous engagement mission (two intercepts against two trailers). FTT-06-5 and FTT-08-6 would demonstrate expanded capability for THAAD to acquire and intercept threat-representative targets at higher velocities and longer ranges. The Block 2008 element will contain hardware and software improvements necessary to demonstrate launch on remote, remote launchers, and reporting of non-trajectory ballistic missiles. Future program upgrades would define deployability and survivability enhancements and expand THAAD element capabilities against faster and longer-range threats.

Testing - Block 2010

The technical details of Block 2010 are less defined than near-term block efforts. Block 2010 would focus on improving THAAD missile, radar, C2BMC and communications to better assimilate the element into the over all BMDS.

Some flight-testing that is scheduled to occur as part of the THAAD element development and demonstration also would be used to evaluate the overall interoperability of the BMDS.

Deployment

Deployment would include production, manufacture, and fielding of the THAAD element and any test-related assets. The THAAD element is designed to be a highly mobile interceptor weapon; therefore, fielding of the THAAD would include the transportation of the element components to designated locations and installation of component and support equipment. These locations have not yet been determined. Deployment would also include training of personnel to operate and perform ongoing operations and maintenance activities on the THAAD. MDA plans to deliver two THAAD Fire Units for operation by the Army in mid-FY 09 and mid-FY 11 timeframe. These two fire units will be stationed in existing THAAD motor pool facilities at Fort Bliss, Texas. Additional fire units and/or missile quantities for deployment will be determined based on Combatant Commander and Army requirements determination. Responsibility for operating and maintaining the THAAD will transition from MDA to the U.S. Army.

Decommissioning

Final ownership and disposition of permanent facilities constructed in support of THAAD testing would be determined by an inter-service agreement between the MDA and the host installation. Decommissioning would include the disposal of rocket propellant used in the THAAD booster. The THAAD's Class 1.3 propellant has a 20-year shelf life. Excess propellant would be recycled, burned or sold for re-use. A THAAD demilitarization plan will be developed for all THAAD components and will focus on re-use of equipment to the maximum extent possible.

NEPA Analysis

The following NEPA analyses support the majority of THAAD test and development efforts.

- *Ground-Based Radar Family of Radars Environmental Assessment*. June 1993. Analyzed TMD Ground Based Radars, which included the early versions of the THAAD radar.
- *Theater Missile Defense (TMD) Programmatic Life-Cycle Environmental Impact Statement*. September 1993. Provided conceptual coverage for all TMD activities.
- *Theater High Altitude Area Defense (THAAD) Initial Development Program Environmental Analysis*. March 1994. Analyzed the production of the THAAD missile at various plants in the United States, and the initial test flights at White Sands Missile Range (WSMR).
- *Environmental Assessment for Theater Missile Defense Ground-Based Radar Testing at Fort Devens, Massachusetts*. June 1994. Covered initial operational testing of THAAD Radar at Fort Devens, near the Raytheon Production Plant in Massachusetts.

- *Theater Missile Defense (TMD) Extended Test Range Environmental Impact Statement*. November 1994. Covered Th1D intercept launches from WSMR and target launches from Fort Wingate and Green River Launch Sites.
- *Theater Missile Defense (TMD) Flight Test Environmental Assessment*. April 1995. Covered test launches and intercepts at WSMR.
- *Theater Missile Defense (TMD) Flight Test Supplemental Environmental Assessment*. November 1995. Expanded the original number of launches and launch points that were covered in the TMD Flight Test EA.
- *THAAD Pacific Flight Test Environmental Assessment*. March 2003. Analyzed the launch of target missiles and THAAD intercepts at RTS, USAKA and PMRF.

D.7 Arrow Weapon System

Introduction

The Arrow Weapon System (AWS) is a ground-based missile defense system that is capable of tracking and destroying multiple targets during the terminal phase of their flight path. Development of the AWS is a cooperative effort between the U.S. and the Government of Israel to develop a missile defense system for the State of Israel. The AWS would defend Israel and U.S. and Allied forces deployed in the region from the evolving threats in the Middle East Region. The presence of a BMDS in Israel helps ensure U.S. freedom of action in future contingencies and would serve as a deterrent to aggression and proliferation of weapons in the Middle East.

The AWS consists of the Arrow II interceptor, the mobile launcher, the Fire Control Radar, the Fire Control Center, and the Launcher Control Center. The AWS is mobile and transportable.

The Arrow II interceptor missile is a two-staged vehicle launched from a six-pack mobile launcher. The missile contains solid rocket propellant with a hazard classification of 1.3 in the booster. The interceptor contains a focused blast fragmentation warhead to eliminate incoming missiles. The Arrow II interceptor is not hit-to-kill. It is controlled through aerodynamic and thrust vector control and contains a FTS. The Arrow II interceptor is capable of intercepting and destroying short- and medium-range ballistic missiles in the mid and high endo-atmosphere.

The fire control radar is L-Band phased array radar with search, acquisition, track, and fire control function configured in four vehicles (power, cooling, electronics, and antenna). The fire control radar is towable, using range-supplied vehicles on improved roads.

The fire control center is a mobile shelter in which all the battle management, command and control, communications, and intelligence functions are performed. It connects through multiple high-capacity communications interfaces to support communications with the fire control radar and other fire control centers.

The launcher control center is a mobile shelter that provides a communication interface between the fire control center and the Arrow Launcher. Its primary function is to enable monitoring of launcher and missile status and it also provides missile maintenance and diagnostic capabilities. The launcher control center can support operations at remote distances from the fire control center.

Diesel generators supply power to the AWS, with several smaller miscellaneous generators used for various support equipment. Nitrogen (N_2) tanks are kept at the launch control area, and N_2 gas is used to cool the onboard electro-optical sensor of the missile.

Development

The Arrow program was initiated in 1988. The first two phases were primarily focused on the development of the Arrow interceptor and launcher. In the third phase, integration and testing of other system components (launcher control center, fire control radar and fire control center) were accomplished. The latest phase of the Arrow program is the Arrow System Improvement Program (ASIP).

The purpose of the ASIP is to enhance the operational capabilities of the AWS to defeat emerging ballistic missile threats, including longer-range missiles and countermeasures. In addition, ASIP would enhance the capability of the AWS to interoperate with deployed U.S. missile defense systems. Technology development and data collection resulting from the ASIP would benefit both U.S. and Israeli missile defense efforts. As part of the ASIP, the current (baseline) AWS and the improved AWS would be tested in a series of flight tests in both the U.S. and Israel.

The ASIP consists of three phases. During the initial phase of the ASIP, technologies for insertion into the AWS were identified. The second phase of the ASIP consists of system development, in which the required component improvements would be designed, fabricated, tested and integrated into the total system. In addition, flight tests of the baseline AWS would be conducted in both the U.S. and Israel. The third phase of the program would focus on the testing and evaluation of the improvements implemented during the second phase.

Testing

All testing of the AWS before the ASIP was conducted in Israel. Because of the limited geography and airspace of the Israeli test range, the ASIP would include tests of the AWS in the U.S. to test the capability of the AWS to engage longer-range threats.

Flight tests of the AWS in the U.S. would consist of intercept flight tests at the Naval Air Warfare Center Weapons Division Point Mugu Sea Range against various short- and long-range threat representative target missiles launched from the surrounding test range open ocean area. Currently two series, or caravans, of tests are planned in the U.S. over a period of five years.

Caravan 1, completed in FY 2004, consisted of two flight tests necessary to the baseline AWS, including performance of critical subsystem and element level components, against current threat-representative target missiles at realistic ranges. The primary objectives of Caravan 1 are to

- Perform baseline flight tests against current threats at full range, and
- Provide data to evaluate critical performance parameters.

Caravan 2 would consist of two flight tests of the enhanced AWS at Point Mugu against a threat-representative target at approximately full range. To the extent they are available, U.S. theater missile defense (TMD) elements or components would be used in interoperability testing and in data collection. The first flight test is planned to be an engagement of a Long Range Air-Launched Target configuration. The second flight test is planned to be a simultaneous engagement of an LRALT configuration and a Hera-based configuration at the maximum possible range allowed by test range constraints.

Deployment

The AWS system will be deployed in Israel and operated by the Israeli Air Force.

Decommissioning

The decommissioning of all or parts of the AWS element are dependent on many variables and the exact timing of any decommissioning activities has not been determined at this time. The decommissioning of AWS missiles and the demolition of element facilities (e.g., silos, radar buildings, etc.) would be in accordance with the applicable U.S. and Israeli environmental regulations and standard practices. The decommissioning effort would seek reuse and recycle materials to the maximum extent possible.

NEPA Analysis

The ASIP Environmental Aassessment (EA)/Finding of No Significant Impact was signed in November 2003. The ASIP EA analyzed the potential environmental consequences of the flight tests that are part of the ASIP that are scheduled to occur at a U.S. test range. The ASIP test program will include four missile intercept tests divided between two series, or caravans, of two tests each. The ASIP EA did not consider efforts being implemented in the State of Israel.

Other relevant NEPA analyses include

- *Development and Demonstration of the Long Range Air Launch Target System Environmental Assessment* (October 2002)
- *Point Mugu Sea Range Final Environmental Impact Statement /Overseas Environmental Impact Statement* (March 2002)

- *Theater Missile Defense Extended Test Range Supplemental Environmental Impact Statement– Eglin Gulf Test Range* (June 1998)
- *Air Drop Target System Program Programmatic Environmental Assessment* (May 1998)
- *Theater Ballistic Missile Targets Final Programmatic Environmental Assessment* (December 1997) *Theater Missile Defense Extended Test Range Environmental Impact Statement* (November 1994)

D.8 Medium Extended Air Defense System

Introduction

The Medium Extended Air Defense System (MEADS) program is an international cooperative development effort between the U.S., Germany, and Italy to develop a surface-to-air missile defense system that is strategically transportable and tactically mobile. MEADS will improve the limited area defense of vital assets, population centers, and deployed troops and will provide capability to move with and protect forces as they maneuver in combat. It will be capable of intercepting short- and medium-range threats including ballistic missiles in the terminal phase of their flight path and air breathing threats such as aircraft, unmanned aerial vehicles, and cruise missiles in the terminal phase of their flight path.

MEADS will incorporate the PAC-3 interceptor into a smaller, more self-sufficient missile defense system. Ground-based operations communicate with the missile before and during flight to guide the missile to the target. The PAC-3 interceptor is a hit-to-kill missile that uses active homing seeker to track and directly hit the target. A solid rocket motor propels the missile, and aerodynamic controls and an Attitude Control Section allow for the precision necessary for a direct hit. A lethality enhancer consisting of standard explosives can increase the probability of destroying the ballistic threat.

MEADS will be more tactically mobile than the PATRIOT element and therefore will be more capable of participating in combat maneuvers. MEADS will reduce strategic airlift requirements and therefore would be more easily transportable and readily deployable than the PATRIOT element. MEADS will have greater firepower and require less manpower than its predecessors. MEADS will also have greater lethality and improved capability against evolving threats in more stressing combat scenarios and is eventually expected to replace the PATRIOT system.

The components of MEADS will be linked by a flexible communications network with netted and distributed architecture enabling the MEADS units to be organized according to military strategy and expected threats. Within this network, battle management stations can hand over command and control of launchers and missiles to neighboring battle management units. The MEADS battle management units will share information from MEADS sensors and will have access to a broad range of sensors from other systems and services. The multiple paths of communication result in the system being very robust against jamming and also allow the units to be dispersed over a wide area. MEADS will be able to operate with the overall BMDS and other Army, joint, and allied systems. The international nature of MEADS increases the potential for the program to promote interoperability of U.S. and allied forces and to aid transatlantic defense cooperation. The missile launchers can be located well away from the ground radar and the battle management units. This reduces the risk of detection of the launchers.

The MEADS Fire Unit will consist of six launchers and three reloaders, two Tactical Operations Centers, one Surveillance Radar, two Multi-Function Fire Control Radars, two armored security vehicles, and PAC-3 missiles. The MEADS fire unit will be mobile and C-130 roll-on/roll-off and C-160 transportable. The MEADS fire unit will also be CH-47 and CH-53 transportable.

The tactical operations center will perform the BMC4I functions of the MEADS Fire Unit. It will provide a single shelter for Engagement Operations/Force Operations and sensor and launcher control. A battle monitor will provide real-time link between engagement operations and force operations. The tactical operations center will have workspace for three operators. Each tactical operations center will be capable of serving as the battalion tactical operations center as well as the Fire Unit tactical operations center in a "multi-echelon configurability" approach.

The surveillance radar will employ Ultra-High Frequency Pulse Doppler Phased Array radar. It will be mounted on a truck and will provide 360-degree coverage. An onboard generator and transformer will provide power to each surveillance radar unit. The multi-function fire control radars will employ X-band Pulse Doppler Phased Array radar and will also provide 360-degree coverage. It will include a generator and transformer to provide power and will missile uplink/downlink software.

Development

The MEADS project will pass through three development phases, product definition/validation, design and development, and production. The participating countries will negotiate a Memorandum of Understanding for each of these phases.

MEADS is currently in the second stage, design and development.

The responsibility for MEADS was transferred from MDA to the U.S. Army at the same time as transfer of the PAC-3 element to the U.S. Army, in early 2003. The Army is responsible for the development, testing, budgeting, operations, fielding, and sustaining functions for MEADS. MDA remains involved from the BMDS perspective including BMDS performance, integration, and system testing.

Testing

Developmental testing will place emphasis on performance; integrated logistics support; reliability, availability, and maintainability; manpower and personnel integration; safety verification; environment; survivability; interoperability; and live fire test – survivability and lethality

The U.S. proposed developmental testing will include 10 missions, 22 missiles, and 15 targets. Developmental testing will certify that the system is prepared for operational testing. The U.S. proposed operational testing will include three missions, 14 missiles, and seven targets.

Developmental Testing

Engineering development tests will be conducted during system development and demonstration to provide data on performance; safety; nuclear, biological, and chemical survivability; achievability of a system's critical technical parameters; refinement of hardware configurations; and determination of technical risks.

Operational Testing

Operational testing will consist of ground-to-ground testing, ground-to-air testing, FM simulation, digital simulations, and large search and track exercises.

Ground-to-ground testing will confirm proper functioning of ground equipment interfaces prior to conducting ground-to-air testing and flight tests. Ground-to-ground testing will use a Fire Unit along with a ground-to-ground test set to simulate the pre-launch communication activities and to "engage" a software-simulated target. The objectives of ground-to-ground testing include confirming the system baseline; verifying system software and hardware; and verifying radar and communication systems. Simulated faults will be inserted at various points in the launch sequence to test system contingency logic.

Ground-to-air testing will verify the integrated system and confirm missile and ground equipment interfaces prior to conducting flight tests. Ground-to-air testing will employ a Fire Unit to use an actual missile to engage an actual aircraft target (e.g., F-16 or MQM-107 Drone) or a simulated missile to engage a simulated Air-Breathing Threat. The objectives of ground-to-air testing include verifying radar and communications systems, verifying system hardware and software, verifying missile seeker target acquisition and target tracking functionality, and verifying system target handover and missile cueing.

FM Simulation will test the ability of the system to acquire, track, discriminate, and classify a threat target. The simulation will employ system sensors and computers in real-time scenarios. This simulation will evaluate the ability of the system to perform multiple simultaneous engagements. The simulation will assess the techniques, procedures, and tactics of the system. Large Search and Track Exercises will test sensors in comprehensive and varied environments, including electronic countermeasures, low/high altitude, clutter, multi-path, and benign conditions.

Deployment

Full MEADS capability could reach the field as early as 2015.

Decommissioning

The decommissioning of all or parts of the MEADS element are dependent on many variables and the exact timing of any decommissioning activities has not been determined at this time. The decommissioning of MEADS missiles and the demolition of MEADS element facilities (e.g., silos, radar buildings, etc.) will be in accordance with the applicable environmental regulations and standard practices. The decommissioning effort would seek reuse and recycle materials to the maximum extent possible.

NEPA Analysis

Because the MEADS concept and technology are still in development, existing environmental analyses are limited.

- *Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement* (December 1998)
- *PATRIOT Advanced Capability-3 (PAC-3) Life Cycle Environmental Assessment* (U.S. Army Space and Strategic Defense Command, May 1997)

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APPENDIX E
DESCRIPTIONS OF PROPOSED BMDS SENSORS

DESCRIPTIONS OF PROPOSED BMDS SENSORS

BMDS sensors comprise four sensor technologies (radar, infrared, optical, and laser) based on the frequency or electromagnetic (EM) energy spectrum involved. Sensors can be found on land, sea, air or space-based operating environments. Sensors planned for deployment as part of the proposed BMDS architecture have surveillance and tracking missions and may be stand-alone or part of individual weapons components. These sensors would be included in testing of the BMDS. However, some existing sensors are used solely for testing purposes and would not be used in a deployed BMDS.

There are two types of land-based radar that are currently components of the proposed BMDS: EWR and fire control radar. The EWRs are existing, fixed, land-based radars, which include the Position and Velocity Extraction Phased Array Warning System (PAVE PAWS), Ballistic Missile Early Warning System (BMEWS), COBRA DANE, and Advanced Research Project Agency Lincoln C-Band Observable Radar (ALCOR). Each of these radars already has a DoD mission to detect and track inter-continental ballistic missiles (ICBMs), submarine launched ballistic missiles, and satellite objects.

Fire control radar is used to provide target information inputs, such as providing continuous positional data to a weapon fire control system to support firing the weapon and guiding it to the target. Some fire control radars are multi-function and have early warning capabilities such as the PAC-3 radar. Land-based fire control radars may be fixed, located in or on a building, such as the GBR-P. Alternatively, they may be mobile, located on a vehicle or trailer, such as the PAC-3 radar.

The sea-based radars that are components of the proposed BMDS include the Aegis SPY-1 radar, the SBX, and mobile sensors placed on sea-based platforms.

Land-based infrared sensors would provide threat identification and location data to the proposed BMDS using the short and long wave infrared energy from the threat. Air-based infrared coverage for the proposed BMDS would be provided by the ABL. Space-based Infrared Sensors (SBIRs) include the DSP, SBIRS-High, and the planned Space Tracking and Surveillance System (STSS). These three systems are independent yet would complement each other by providing global infrared coverage. These systems support four mission areas: Missile Warning, Missile Defense, Technical Intelligence, and Battle Space Characterization.

Other BMDS sensors would operate in the visible light spectrum. Using data obtained from optical wavebands, the sensors would acquire and track threat ballistic missiles during all phases of flight. Laser sensors also would be used to track a target and focus a laser weapon on the target missile.

Sensor Descriptions

- **ABL -** The ABL has infrared and laser sensors mounted onboard an aircraft (a modified Boeing 747). These sensors include the ARS, TILL, and BILL. These are ANSI Classification 4 lasers; the BILL and TILL have a power output in the kilowatt range and the ARS is in the hundred watt range.

- **ARS -** The ARS laser operates at altitudes of greater than 10,668 meters (35,000 feet). It is a low power CO_2 laser that performs target acquisition and ranging for the ABL. The ABL ARS would be deployed as part of the BMDS architecture.

- **TILL -** The TILL is a lower power solid-state laser that uses a crystal as its lasing medium. The TILL is part of the laser beam control system and is designed to provide information on the target's speed, elevation, and vector. The TILL would be deployed as part of the BMDS architecture.

- **BILL -** The BILL is a lower power solid-state laser that uses a crystal as its lasing medium. The BILL is also part of the laser beam control system and is designed to focus the ABL weapon or HEL on the target and to correct for any atmospheric distortion.

- **IRST -** The IRST uses six infrared sensors to detect and track targets for the ABL. The IRST would be deployed as part of the BMDS architecture.

- **ALCOR -** ALCOR is a fixed, land-based system with wide-band radar that functions in the C-band. The ALCOR conducts long-range, high-power tracking. It would be deployed as part of the BMDS architecture.

- **Aegis SPY-1 Radar -** The U.S. Navy Aegis Weapons System is a multi-mission weapon system used on both Ticonderoga (CG-47)-class guided missile cruisers and on Arleigh Burke (DDG-51)-class guided missile destroyers. It is S-band multi-function phased array radar and is the primary air and surface sensor for the Aegis BMD. The SPY-1 replaces several conventional ship sensors, including long range search and fire control quality tracking radars. The SPY-1 radar has been modified to perform ballistic missile detection and tracking as part of its new capability as part of the BMDS. The SPY-1 radar is capable of collecting ballistic missile track data and would be integrated into the proposed BMDS through the C2BMC. The SPY-1 radar has four antenna arrays that send out beams of EM energy in all directions simultaneously. The SPY-1 radar can track many targets simultaneously. The SPY-1 radar would be deployed as part of the BMDS architecture.

- **Air Force Research Laboratory (AFRL) Ka-Band Radar -** The Air Force Cloud Profiling Radar system is Ka-band radar specifically designed for cloud microphysical measurements. The system has the capability to provide characterizations of clouds and large atmospheric aerosols in terms of internal structure, geometric thickness, particle asymmetry, orientation, and relative motion. This radar would provide test data for the MDA Measurements Program.

- **AFRL Mobile Atmospheric Pollutant Mapper CO_2 Lidar -** The AFRL Space Vehicles Directorate's Mobile Atmospheric Pollutant Mapper CO_2 Light Detection and Ranging (Lidar) is a mobile trailer-based system. It employs a precision full hemispherical scanner. The Lidar's operating wavelength and transmitted beam size make it eye-safe at the exit aperture. This Lidar requires a 100-amp power supply and N_2, helium and CO_2 gases, approximately 60 liters (16 gallons) of liquid N_2, and approximately 76 liters (20 gallons) of distilled water.

- **AFRL Mobile Light Detection and Ranging Trailer -** This AFRL Lidar system is based in a Mobile Lidar Trailer which houses a steerable Lidar. The Lidar operates at three wavelengths making it highly sensitive. One of the signals can be used to spot the aerosol layers and direct other ground-based and airborne sensors when the plume is no longer visible. This mobile Lidar trailer requires a 30-amp power supply and is operated by the Battlespace Environment Division in the AFRL, Space Vehicles Directorate.

- **AN/FPS-16 -** AN/FPS-16 is a fixed, land-based system that functions in the C-band. It conducts close-range, high-precision tracking. The AN/FPS-16 would only be a test sensor.

- **AN/TPQ-18 -** AN/TPQ-18 is a fixed, land-based system that functions in the C-band. It conducts long-range, small-target tracking. The AN/TPQ-18 would only be a test sensor.

- **AN/MPS-36 -** AN/MPS-36 is a mobile, land-based system that functions in the C-band. It conducts close-range, high-precision tracking. The AN/MPS-36 would only be a test sensor.

- **AN/MPS-39 -** AN/MPS-39 is phased array radar that functions in the C-band. It is a multiple object tracking radar. The AN/MPS-39 would only be a test sensor.

- **ATR-500C -** Information is not available for this test sensor.

- **AN/FPQ-6 -** AN/FPQ-6 is a fixed, land-based system that functions in the C-band. It conducts long-range, small-target tracking. The AN/FPQ-6 would only be a test sensor.

- **Arrow Fire Control Radar -** The Arrow Fire Control Radar is part of the AWS. Specifically, the Arrow Fire Control Radar is L-band, mobile phased array radar with search, acquisition, track and fire control functions contained in four vehicles (power, cooling, electronics and antenna). This radar can be towed over the road. The Arrow Fire Control Radar is currently used by the nation of Israel and testing in the U.S. is proposed for the near future. It would be deployed as part of the BMDS architecture.

- **BMDS FDR -** The FDR is relocatable wide-band, phased array radar that operates in a portion of X-band spectrum. The radar uses the hardware/software design of the THAAD radar with addition of algorithms to support forward basing and software modules to enhance its ability to identify and track boost phase threats. This forward deployed radar will assemble data for tracking the threats and hand-over the threat tracks to the BMDS C2BMC element for control of intercept. (See Appendix D, THAAD and in this Appendix, TPS-X.) BMDS radar has the Antenna Equipment Unit, Electronic Equipment Unit, and Cooling Equipment Unit design from THAAD. The BMDS radar uses commercial power with a backup generator or a diesel generator(s), typical of those used for back-up power to industrial facilities, which requires routine refueling. The radar has an intrinsic capability to transition to a THAAD radar mission with the addition of the THAAD BMC2 and interceptor launchers. With the commonality of design and use, the NEPA analysis developed for THAAD radar is applicable to the BMDS radar. The TPS-X radar, also X-band, is an earlier demonstration design (hardware and software) of the THAAD radar and is a test bed for development and risk reduction of the FDR radar software and C2BMC connectivity.

- **BMEWS -** The BMEWS consists of Solid-State Phased-Array Radar System radars, which operate in the Ultra High Frequency range and would have the same mission as the PAVE PAWS in the proposed BMDS. The BMEWS radar network includes three sites; Clear Air Force Station, Alaska, Thule Air Base in Greenland; and Royal Air Force Air Base, Fylingdales, United Kingdom. The Clear and Thule BMEWS are two faced phased array radars, and the Fylingdales BMEWS is three-faced phased array radar. BMEWS tracks intercontinental ballistic missiles, short-range ballistic missiles, and earth orbiting satellites. The BMEWS would be part of the EWR system and would be deployed as part of the BMDS architecture.

- **COBRA DANE AN/FPS-108 -** The large L-band, computer-controlled, phased array radar system with local wide- and narrow-band communication systems, and an operations and test complex is located at Eareckson Air Station, Shemya, Alaska. It has historically fulfilled three concurrent missions: intelligence data collection of strategic missile systems; treaty verification; and early warning of ballistic missile attack against the continental U.S. and southern Canada. The system provides coverage that spans the eastern Russian peninsula and northern Pacific Ocean. It would provide warning and target track information to the proposed BMDS. The COBRA DANE would be deployed as part of the BMDS architecture.

- **COBRA GEMINI -** COBRA GEMINI is a ship-based system that functions in the S-band and X-band. It performs detection, acquisition, tracking, and data collection on threat missiles and testing activities. COBRA GEMINI would be part of the BMDS and would be used during testing.

- **DSP -** The DSP is a system of satellites operated by the Air Force Space Command (AFSPC) that is a key part of North America's early warning systems and would be part of the proposed BMDS. In their more than 35,406 kilometer (22,000 mile) Geosynchronous Earth Orbits (GEO), DSP satellites help protect the U.S. and its allies by detecting missile launches, space launches and nuclear detonations. DSP satellites use an infrared sensor to detect heat from missile and booster plumes against the Earth's background. In 1995, technological advancements were made to ground processing systems, enhancing detection capability of smaller missiles to provide improved warning of attack by short-range missiles against U.S. and allied forces overseas.

  The USAF has units that report warning information, via communications links, to the North American Aerospace Defense Command and U.S. Space Command early warning centers. These centers immediately forward data to various agencies and areas of operations around the world.

  Typically, DSP satellites are launched into GEO on a Titan IV booster. However, one DSP satellite was launched using the space shuttle on mission STS-44 (November 24, 1991).

  For more than 30 years, the DSP has provided integrated tactical warning attack assessment to the President and Secretary of Defense. For nearly 10 years DSP has provided theater commanders with similar missile warning notifications, first through the Attack Launch and Early Reporting to Theater system and most recently via the SBIRS Mission Control Station. Additionally, DSP host sensors provide nuclear detonation detection. Twenty-three DSP satellites have been built and all but two have been launched. The remaining inventory of satellites is scheduled for launch by 2005.

  A step toward a more robust infrared capability in space was taken with the declaration of the Mission Control Station at Buckley AFB, Colorado as operationally capable on December 18, 2001. The Mission Control Station consolidates command and control and data processing elements from dispersed legacy systems into a single modern peacetime facility. The Mission Control Station is also designed to accommodate the new capability up through the SBIRS High constellation. The DSP would be deployed as part of the BMDS architecture.

- **GBR-P -** GBR-P is an X-band phased array radar located at RTS. The GBR-P phased array antenna face is mounted on a rotating assembly. It currently provides real-time operations as the GFC radar. GBR-P provides precision tracking, target discrimination, target-object-mapping and the kill assessment for the GMD and would be used similarly for the proposed BMDS. The radar system design leverages technology developed for the THAAD radar. Prior to commitment of interceptors, the GBR-P performs surveillance autonomously or as cued by other sensors, and will acquire, track, classify/identify and estimate trajectory parameters for target(s). In post-commit (after interceptor launch), the radar will discriminate and track the target(s), and provide an In-Flight Target Update and a Target Object Map to the GMD interceptor(s) (the in-flight EKV) via the In-Flight Interceptor Communications System. The GBR-P would be deployed as part of the BMDS architecture.

- **Homing All-the-Way-Killer X-Band Doppler Radar -** This radar was developed in the late 1950s as an anti-aircraft missile system. Among the original components was Doppler surveillance radar that operated in the X-band. The Homing All-the-Way Killer radar has been operated at WSMR to support the Aerial Dispersion Experiment tests (the release of 25 to 50 metal experiment objects). Power for the radar is supplied by a self-contained generator.

- **High Accuracy Instrumentation Radar (HAIR) -** The HAIR is a fixed, land-based system that operates in the C-band. It conducts long-range, small-target tracking. The HAIR would be a test sensor only.

- **High Altitude Observatory (HALO) -** The HALO-I is an airborne system housed in a modified Gulfstream IIB. It is an infrared imaging system with high-speed visible and infrared photodocumentation. The HALO-II is an airborne system housed in a modified Gulfstream IIB that operates at altitudes up to 13,716 meters (45,000 feet). It has visible and infrared photodocumentation and ultra high frequency satellite communication. It performs target acquisition and tracking. The HALO System would be test sensors only.

- **Innovative Science and Technology Experimentation Facility (ISTEF) -** The ISTEF is a research and development site that has designed a suite of transportable tracking mounts with variable range optics. The ISTEF mobile sensors use optics, passive sensors, and active (lasers) sensors to track missiles in the boost, midcourse and terminal flight segments. The ISTEF would be deployed as part of the BMDS architecture.

- **Infrared Sensor Simulator -** The Infrared Sensor Simulator is a Joint Installed System Test Facility sponsored by the Central Test and Evaluation Investment Program. The Navy is the lead for development of this system, which would be used to stimulate installed infrared and ultraviolet Electro-Optic sensors undergoing integrated developmental and operational testing. The simulator is a family of integrated software applications and hardware that would support all phases of the infrared simulation and test process. The Infrared Sensor Simulator would be specifically designed to support the design, development, integration, and testing of infrared electro-optic sensor systems. It would support testing of a sensor's installed/integrated functional performance and a sensor's performance characterization. The simulator would generate radiometrically correct scenes in real-time for reactive installed sensor-in-the-loop testing of a variety of infrared sensor systems. The generated scenes would provide a realistic portrayal of the infrared scene radiance as viewed by the unit under test in operational scenarios, and would be used for the direct (projected) and/or injected stimulation of the sensor.

- **Long Range Tracking and Instrumentation -** Long Range Tracking and Instrumentation is a fixed, land-based system that operates in the X-band. It is used for detecting, tracking, and imaging targets and interceptors. Long Range Tracking and Instrumentation would be a test sensor only.

- **Maui Space Surveillance System (MSSS) -** The MSSS is located on the summit of 3,048-meter (10,000-foot) Mount Haleakala on the island of Maui, Hawaii. The MSSS is a space surveillance and Research and Development site. The Air Force Maui Optical and Supercomputing (AMOS) detachment of the AFRL operates the MSSS, a national resource providing measurement support to various government agencies and the scientific community. One of the objectives of the AMOS program is to serve as a test bed for newly developed, evolving electro-optical sensors. The Maui Space Surveillance Complex consists of two facilities, the MSSS and the Ground-based Electro-Optical Deep Space Surveillance system. The MSSS is a state-of-the-art electro-optical facility that provides primary space surveillance coverage and high accuracy trajectory information. The MSSS has two telescopes with infrared sensors, the long-wave infrared sensor on the 3.6-meter (12-foot) telescope and the GEMINI sensor on the 1.6-meter (5-foot) telescope. The MSSS would be used in the proposed BMDS as a test and development support sensor. Specifically, the telescopes would observe MDA test activities and provide images for post-test analysis. The infrared sensors would be used for operations and research on tracking and imaging space objects for the proposed BMDS. The suite of passive and active sensors at MSSS AMOS would conduct mid-course target tracking and satellite tracking and would be deployed as part of the BMDS architecture.

- **MEADS Surveillance Radar -** The MEADS radar is being developed as mobile, land-based radar that will be a part of the MEADS system. It will function in the

X-band ultra high frequency with rotating, Pulse Doppler phased array radar. It will perform surveillance, tracking and fire control. The MEADS radar would be deployed as part of the BMDS architecture.

- **Midcourse Space Experiment (MSX) -** The MSX is a space-based system that uses eleven optical sensors functioning in the low wavelength infrared to ultraviolet range to detect, track and discriminate targets. The MSX would be used during testing only.

- **Millimeter Wave Radar -** The Millimeter Wave radar is a fixed, land-based system that functions in the Ku-band and W-band. It performs imaging and tracking of targets and interceptors. This radar would be used during testing only.

- **Naval Surface Warfare Center -** The Naval Surface Warfare Center has a suite of fixed and mobile infrared and optical sensors with air-, land-, and sea-based capabilities. The Naval Surface Warfare Center sensors would perform target tracking during testing only.

- **PATRIOT Radar (AN/MPQ-53 [AN/MPQ-65 upgrade]) -** The PATRIOT radar is a mobile system consisting of AN/MPQ-53 C-band multifunction phased array radar mounted on a semi-trailer towed by a Heavy Expanded Mobility Tactical Truck. The PATRIOT radar is the primary mission sensor for the PATRIOT system and performs surveillance, target tracking and controls firing functions. It is a single faced, non-rotating, phased array radar that provides targeting and tracking information to the Engagement Control Station (i.e., the PATRIOT Battle Management/Command, Control and Communications [BMC3]) throughout PATRIOT defensive operations, and particularly during PATRIOT missile flight and intercept. The AN/MPQ-65 is an upgrade to the AN/MPQ-53 (both will be part of the Block 2004 IDO Capability). An Electrical Power Plant powers the Radar Station. The Radar Station has a personnel exclusion area established 120 meters (395 feet) to the front, and extending 60 degrees to each side of the center of the radar during radar operations. The PATRIOT radar is currently used at various military installations worldwide. The radar would be deployed as part of the BMDS architecture.

- **PAVE PAWS -** PAVE PAWS is a solid-state phased array radar system, designated AN/FPS-115. Each of the PAVE PAWS radars is housed in a 32-meter (105-foot) high building with three sides. Two sides of the building house the flat phased array antenna faces, each containing approximately 1,800 individual active radiating antenna elements that transmit and receive radiofrequency signals generated by the radar. Besides detecting and tracking inter-continental and submarine launched ballistic missiles, the system also has a secondary mission to detect and track Earth-orbiting satellites. Information received from the PAVE PAWS radar systems is forwarded to the U.S. Space Command's Missile Warning and Space Control Centers at Cheyenne Mountain AFB, Colorado. Data are also sent to the National Military

Command Center and the U.S. Strategic Command. Currently the PAVE PAWS network includes two solid-state phased array radar systems located at Cape Cod Air Force Station, Massachusetts and Beale AFB, California. The PAVE PAWS would be deployed as part of the BMDS architecture.

- **SBX -**The SBX would consist of a sea-based platform or commercial oil-drilling platform modified to support XBR. The platform would be an existing, commercial column-stabilized semi-submersible platform with two pontoons and six stabilizing columns supporting the upper hull. Communication systems and an IDT would be mounted on opposite sides of the platform. The XBR, which would be mounted on top of the platform, is multifunction radar that would perform tracking, discrimination, and kill assessments of over flying target missiles. The XBR would use high frequency and advanced radar signal processing technology to improve target resolution, which permits the radar to discriminate against various threats. The XBR would provide data from the midcourse phase of a target/threat missile's trajectory and real-time in-flight tracking data. The data would be transmitted using radio and military satellite communications and potentially though a connection to a fiber optic transmission line. The initial operations for the SBX are planned for the Pacific Ocean region and the Primary Support Base for the SBX is Adak, Alaska. The SBX would be deployed as part of the BMDS architecture.

- **STSS -** The STSS was previously called the SBIRS Low program. Through its spiral development process, STSS would provide space-based infrared capability to acquire, track and discriminate ballistic missiles and supply over-the-horizon fire control to BMDS weapon systems extending their effective range. The near term emphasis for STSS is on tracking performance, followed by improvements in the sensor's discrimination capability. Using the advantage of a lower operational altitude, the STSS would track tactical and strategic ballistic missiles. The satellite's sensors would operate in Low Earth Orbit (LEO) across long and short wave infrared frequencies to acquire and track missiles in the boost phase of flight. By combining information collected by infrared and optical sensors, STSS satellites would substantially improve the performance of BMDs for the boost and midcourse phases of flight. The STSS is expected to launch its first satellites in 2007. The STSS would be deployed as part of the BMDS architecture.

- **SBIRS High -** SBIRS High features a mix of four GEO satellites, two highly elliptical Earth orbit payloads, and associated ground hardware and software. These satellites would use infrared sensors to detect heat from missile and booster plumes. SBIRS High would have both improved sensor flexibility and sensitivity. Sensors would cover short-wave IR, expanded mid-wave IR and see-to-the-ground bands allowing it to perform a broader set of missions as compared to DSP. SBIRS High is a USAF program that would eventually replace the DSP. The SBIRS High would be deployed as part of the BMDS architecture.

- **THAAD Radar -** The THAAD radar is part of the THAAD system. It is a mobile, land-based system with a wideband, X-band, single faced, phased array radar. The radar performs detection, target discrimination, tracking, and kill assessment. The THAAD radar would be deployed as part of the BMDS architecture.

- **TPS-X -** The TPS-X radar is a relocatable wide-band, X-band phased array radar system of modular design. The TPS-X is the User Operational Evaluation System THAAD radar now being used as the test bed for the BMDS FDR. As single faced, non-rotating, phased array radar it performs surveillance, tracks the target and will transmit data used by C2BMC for controlling firing functions. TPS-X consists of three units: Antenna Equipment Unit, Electronic Equipment Unit, and Cooling Equipment Unit. The Antenna Equipment Unit includes all transmitter and beam steering components as well as power and cooling distribution systems. The Electronic Equipment Unit houses the signal and data processing equipment, operator workstations and communications equipment. The Cooling Equipment Unit contains the fluid-to-air heat exchangers and pumping system to cool the antenna array and power supplies. The power can be provided by either a commercial line or by a diesel generator(s), typical of those used for back-up power to industrial facilities and requires routine refueling. Each individual unit is housed on a separate trailer interconnected with power and signal cabling, as required. The fuel tank of the generator would be filled from a fuel truck as necessary.

- **Tracking and Discrimination Experiment Radar -** This radar is a fixed, land-based system that functions in the S-band with L-band capabilities. It performs target tracking and discrimination. The tracking and discrimination experiment radar would only be a test sensor.

- **Transportable Telemetry System (TTS) -** The TTS is a long-range, high data rate telemetry collection, processing, and data transmission system. Its primary mission area is midcourse and terminal phase telemetry coverage. The TTS is a standalone system capable of supporting flight tests from remote areas with minimal or no test infrastructure. The TTS can receive and record multiple telemetry streams with redundancy in the S- and L-bands. The TTS would have the capability to process multiple streams in real-time. Over-the-horizon voice and data communications would be provided through a built-in satellite communications system. Each TTS would have a satellite uplink/downlink terminal. The system configuration would consist of two primary telemetry shelters, two 7-meter (23-foot) antennas, two power shelters, and a SATCOM antenna and shelter. The TTS would be powered by two 100 kilowatt generators, or via a shore power from fixed power lines. Approximately 625 square meters (25 by 25 meters) would be required to set up the mobile TTS. The transportation of the TTS would require either four tractor-trailers or two C-130 or similar aircraft.

- **U.S. Naval System (USNS) Observation Island -** The USNS Observation Island is a ship-based, phased array radar system. The USNS Observation Island radar systems are a national system for technical verification of foreign ballistic missile reentry systems. The instrumentation consists of the world's largest ship-borne phased array radar, parabolic dish-type radar, and a telemetry system. The USNS Observation Island includes S-band and XBRs, which would be used to verify treaty compliance and provide support to missile development tests by the MDA. The radars would also be used for research and development work in areas not accessible to ground-based sensors. The Military Sealift Command is responsible for operating the mobile platform, while the USAF is responsible for operating the radar systems and administrative support. USNS Observation Island would be deployed as part of the BMDS architecture.

- **W-Band Tornado Radar -** The W-band Tornado radar is a polarmetric, pulsed Doppler radar. It has a dish antenna and is mobile. The antenna is mounted on a crew-cab pickup truck. For power this radar uses a 3,500-watt generator, mounted on the tail hitch of the truck. The radar runs on 110-volt alternating current and has a 15-amp maximum current. The radar is jointly operated by the Universities of Massachusetts and Oklahoma.

- **Widebody Airborne Sensor Platform (WASP) -** The WASP is an airborne system housed in a modified DC-10. It has ultra high frequency satellite communication and performs target acquisition and tracking. The WASP would be only a test sensor.

APPENDIX F
ADVANCED SYSTEMS

ADVANCED SYSTEMS

Introduction

The MDA Advanced Systems program develops and transitions science and technology hardware and software programs into BMDS elements. New concepts are inserted by MDA and external participants, including industry, research facilities, and foreign governments. New concepts and technologies undergo an initial review that includes

- Assessment of BMDS utility,
- Assessment of technology maturity - expected technology development progress, defined utilizing Technology Readiness Levels, and
- Assignment of transition targets - users of the technology are identified and liaison takes place to develop a transition plan to the appropriate elements.

Upon completion of this initial review, the concepts and developing technologies enter a continuous process that evaluates the technology's development process, BMDS utility, and transition prospects. Advanced Systems monitors the technology maturation and assesses the technology at regular intervals. Promising and mature technologies are transferred to one or more BMDS elements. The sections below summarize current Advances Systems programs.

Project Hercules

The objective of Project Hercules is to develop algorithms that increase BMDS capability to counter the full spectrum of potential threats. Project Hercules is developing a communications structure that would pass data during flight tests. Project Hercules works with BMDS Elements, Prime Contractors, and System Engineers to identify potential algorithmic areas of improvement. Project Hercules also looks for long-term promising algorithm methodologies.

Advanced Concepts Analysis Group

The Advanced Concepts Analysis Group conducts short- and long-term studies of promising concepts and technologies for future block upgrades.

Small Business Innovation Research Program

The Small Business Innovation Research Program works to stimulate technological innovation, meet research and development needs of the MDA, foster opportunities for small businesses, and support commercialization of technology.

Terminal Missile Defense

Long Range Atmospheric Defense (LRAD)

The goal of LRAD is to develop a long-range, high endoatmospheric interceptor that can engage intercontinental ballistic missile threats in the terminal phase of flight. LRAD would provide a backstop for midcourse tier leakage and would hedge against technological surprise in adversaries' countermeasure capability elements including any attempt to fly under existing defense architectures. LRAD would enhance the effectiveness of the multi-tier system and provide total United States terminal defense coverage with a small number of defense units.

LRAD is currently in the Concept Definition Phase and is based on using atmospheric interaction with the threat cloud as the key metric for discrimination of the lethal object(s). A number of revolutionary technology advancements have been evaluated indicating the most promising set for development including an approved development plan. Execution of this LRAD development plan will yield component demonstration and concept down select for an eventual proof-of-principle prototype integrated flight test of the LRAD interceptor. The goal is to provide a new LRAD element fully integrated into the BMDS 2015 - 2020 architecture.

Midcourse Missile Defense

Discriminating Seeker

A Discriminating Seeker would be developed that is able to accurately discriminate emerging countermeasures, decoys, and re-entry vehicles. The technologies under development are multi-spectral infrared focal plane arrays, ultra compact laser radar (ladar), high-speed miniature processors, and data fusion algorithms. These components would be integrated into a lightweight Track-Via-Missile seeker after development and demonstration.

At greater distances (400 to 800 kilometers [249 to 497 miles]), the focal plan arrays would acquire the target cluster and perform simple discriminations. At shorter distances (less than 400 kilometers [249 miles]) the focal plan arrays and ladar would work together to accurately discriminate and track the target. The multi-spectral infrared focal plane arrays can accurately measure thermal characteristics of non-gray-body re-entry vehicles and decoys. Ladar actively illuminate the target with a laser and measures back-scattered Doppler-shifted radiation to calculate target range, velocity, and angular rates. Ladar does not rely on external illumination or emitted radiation from the target. Ladar substantially increases the number of target features measurable and significantly improves discrimination and aim point selection. Ladar could be applied to early deployment phase to track threat cloud dispersal. Ladar would assist in boost phase functions of hard body/plume discrimination and final aim-point selection.

After development and testing of the individual technology components of the seeker, the components would be integrated into a lightweight Track-Via-Missile seeker.

Advanced Discrimination Initiative

The Advanced Discrimination Initiative would investigate and develop interceptor payloads that move beyond the current hit-to-kill Kill Vehicle payloads. The Advanced Discrimination Initiative would validate these advanced interceptor payload concepts and understand how they would generate into the BMDS block plans. This initiative is a cross-Agency effort to modify BMDS weapons and sensors to defeat adversary countermeasures.

Multiple Kill Vehicles

The Multiple Kill Vehicles program aims to develop small, lightweight, and lethal kill vehicles dispensed from a single booster. The integrated payload would be designed to fit on existing and future interceptor boosters. One or more Multiple Kill Vehicles can be assigned to intercept all credible targets within a threat cluster when discrimination is challenging. Multiple Kill Vehicles have the potential to solve many of the most difficult countermeasure challenges.

The Multiple Kill Vehicles program will demonstrate the feasibility and lethality of Multiple Kill Vehicles through conceptual designs, analyses, simulations, and flight testing and critical hardware demonstrations. Existing and emerging miniaturization technology would be evaluated and subsequently integrated into a functional system.

Boost Missile Defense

Early Launch Detection and Tracking

The Early Launch Detection and Tracking program would develop and demonstrate all-weather surveillance techniques that detect, track, and classify ballistic missile threats as soon as possible after liftoff with very high confidence and low false alarm rates. The program is analyzing, developing, integrating, and testing several sensor technologies that may provide detection of boosting threats significantly earlier than currently available sensors. Both active and passive sensors using optical and radio frequency band concepts are being evaluated.

Pumped Propulsion

The Pumped Propulsion program aims to develop a lightweight, high mass fraction kill vehicle divert and attitude control system utilizing non-toxic propellants. Boost phase interceptors must have the ability to quickly accelerate and catch the target. A low mass, high mass-fraction, kill vehicle divert and attitude control system would enhance boost phase interceptor capability. Pumped propulsion has traditionally been used in large launch vehicles; however, several challenges exist in applying pumped propulsion to light weight boost interceptors.

Global Defense

Space-Based Passive Surveillance

The goal of the Space-Based Passive Surveillance program is to extend the wavelength response into the very-long wavelength of electro-optical component technologies, in order to enable the detection and tracking of distant exoatmospheric targets, thereby improving exo-intercept capability. Space-based Passive Surveillance technology development efforts would include advanced Focal Plane Arrays, optical elements, cryocoolers and radiation-hardened electronics – technologies that can be used by the STSS system.

High Altitude Airship (HAA)

The HAA would be a mobile, unmanned and untethered airship that can be deployed worldwide as a stable, geo-stationary communications, sensors, and weapons platform. The HAA would be able to operate autonomously in long-endurance operations of more than one year. The HAA would operate at 21,336 meters (70,000 feet) above mean sea level (MSL) where wind conditions are minimal and the HAA would have a large field of view. The HAA would be used in homeland defense and theater operations for missile defense and military communications. The HAA would help overcome the challenge of detecting and countering low-flying and maritime threats, especially cruise missiles. The HAA would be able to broadcast and relay communications. Command and control of the airship would be from a fixed ground location in Colorado Springs. Compared to satellites, a fleet of HAAs would have lower costs and simplified battle management with reduced timelines. Currently, a fleet of 12 HAAs is envisioned to enhance national security and improve missile defense capabilities.

The HAA would contain helium to make it a "lighter-than-air" technology, thereby saving energy and reducing emissions. The HAA would be built from strong, lightweight, and durable materials. The HAA vehicle would be 152 meters (500 feet) long and 46 meters (150 feet) wide. Photovoltaic cells and fuel cells would power the HAA. Electric-powered propeller technology would be used to propel the HAA and maintain geo-stationary location. The HAA would be able to carry a minimum payload of approximately 1,800 kilograms (4,000 pounds) and would be able to deliver at least 75 kilowatts to the payload.

The airship vehicle and subsystems, along with system integration interfaces and control systems, would be sufficiently developed, tested, and integrated to meet mission requirements. Strong, durable materials, lightweight renewable energy sources, and propeller technologies would have to be developed and improved to make the HAA technically feasible. Components and subsystems would be tested prior to integration, and the integrated system would undergo ground testing and flight-testing.

The HAA Advanced Concept Technology Demonstration is to develop a prototype HAA in order to demonstrate the feasibility and utility of the HAA concept. The prototype HAA would be an unmanned, untethered airship that would operate autonomously for one month at a geo-stationary location 18,288 to 21,336 meters (60,000 to 70,000 feet) above MSL with a payload of 1,814 kilograms (4,000 pounds). The prototype HAA would be able to deliver 15 kilowatts (kW) of power. The demonstration would test the technical readiness of all necessary technologies, materials, aerodynamics, flight control, and internal environment management. It would also test the launch, flight, and recovery capabilities. Based on the demonstration results, the operational concepts would be validated and refined.

Enabling Technology

Radar Technology

Emerging component technologies would allow for radar systems that have increased sensitivity and longer ranges, lower elevation angles, and increased discrimination capability. The technologies would allow radar systems to be more effective against enemy countermeasures. The radar systems would have increased transportability and reduced costs.

Laser Technology Program

The objective of the Laser Technology Program is to pursue laser technologies on a broad front across multiple functions of boost, midcourse, and terminal phase defense tiers. This program will select laser projects that significantly support BMDS block upgrades or lead to entirely new defense system capabilities while generally excluding laser communications, processors, and basic research projects.

The Laser Technology Program is designed to support significant improvements to execute BMD functions and to add new capabilities to BMDS components. Low power solid-state laser technology supports improvements in optical sensor angle and range resolution and precision tracking, target discrimination, and kinetic energy weapon guidance. Low- and medium-power lasers can provide improved target imaging and long-range acquisition and tracking, while medium and high-power lasers can contribute to advanced discrimination and kill assessment. Improvements in high power chemical lasers can significantly enhance the potential effectiveness of future laser weapon systems. The Laser Technology Program includes the following projects: Strategic Illuminator Laser, Advanced Inertial Reference Unit, Advanced Detectors for Ladar, and Small Laser Amplifier for Ladar.

Multi-Application Focal Plane Arrays

Development of focal plane arrays technology, including simultaneous, high sensitivity dual-band (Medium Wavelength Infrared and Long Wavelength Infrared) focal plane arrays would allow for increased range and sensitivity for detecting targets. Development would emphasize continuous tracking over boost to post-boost phases. Increased sensitivity would enable detection by miniature interceptors of targets in the boost or in post boost phases. Higher frame rates would enable acquisition and tracking of targets at high approach speeds. Higher frame rates would also allow for tracking of error signals. Focal plane arrays would be inserted into a camera system and tested to characterize performance. Testing would include data collection in the laboratory and acquisition and tracking of target launch and flight in boost and post-boost phases. Focal plane arrays would enhance ABL and KEI capabilities.

Spectral Imaging

Spectral Imaging may be utilized in BMDS sensors because it provides a broader and more comprehensive view of material properties, availability of more regions to target for improved discrimination, and can be tailored to a variety of applications. Spectral Imaging may be used to track and discriminate target objects within all phases of missile flight and kill assessment by providing characteristic infrared spectral fingerprints for all objects in a scene of interest. The Spectral Imaging program would identify useful spectral signatures that are characteristic of targets and countermeasures. Spectral Imaging provides more accurate temperature estimation than current sensors. Advances in miniature spectral sensors with lower cost and reduced mass and volume increase the utility of spectral sensors to the BMDS. Spectral Imaging is in an advanced stage of development as a stand-alone measurement tool, however, spectral sensors must be adapted to specific BMDS elements and platforms, and supporting algorithms must be customized to specific signatures.

Joint Industry Programs for Technology

The Joint Industries Programs for Technology includes three programs

- Technology Applications Program,
- Commercial Technology Exploitation Initiative, and
- Joint Technology Development with Industry Program.

The Technology Applications Program seeks to identify commercial applications for technology developed by MDA. The objectives of this program are to reduce final product cost through economies of scale and to assure maturation of the technology. The Commercial Technology Exploitation Initiative seeks to identify non-defense commercial technologies that are either currently available or in the final stages of development and can potentially contribute to MDA systems. Commercial technologies may satisfy the needs of BMDS elements with lower costs, increased performance, and shorter development timelines. The Joint Technology Development with Industry creates a team effort between MDA, the program elements, and industry to understand common development needs, maximize technology development resources, and reduce development costs through shared efforts.

Innovative Science and Technology

The Innovative Science and Technology (ISTEF) program invests seed money in selected applied and exploratory research and development high-risk technologies relevant to missile defense. The ISTEF program interacts with Universities and the research community, identifies research and development breakthroughs as they arise, and works with researchers to develop novel technologies for the BMDS.

The program is currently pursuing several research and development efforts. The Optical Target Characterization ISTEF aims to further the understanding of target observables and associated sensing instrumentation, procedures, and signal processing. The Dual-Mode Experimentation on Bowshock Interaction Flight Experiment would further the understanding of chemistry associated with hypersonic flight in hit-to-kill applications within the Earth's atmosphere. The ISTEF program would develop and demonstrate stability of holographic glass with the capability to enhance high power laser beams and optical sensors. The ISTEF program would develop polymeric photonic devises and demonstrate their utility for discrimination and identification during boost and midcourse phase, and for assisting track-via-missile seekers during the discrimination process. The ISTEF program would also develop and demonstrate polymer-based modulators for novel control schemes of phased array radars.

International

The MDA International Program aims to identify technologies being developed in other countries that surpass, complement, or represent a viable alternative to those available through United States supplies. The program fosters and cultivates relationships with friends and allies and their scientific communities. MDA exchanges ideas and perspectives on missile defense and promotes international support.

The MDA cooperates with officials and scientists of the United Kingdom and Germany to investigate, test, and develop technologies that are of mutual interest and can contribute to missile defense. The MDA funds researchers in Israel to research and improve missile guidance against maneuvering targets. The MDA funds researchers in the Czech Republic to develop focal plane arrays for infrared detector technology. The MDA funds researchers in Hungary to investigate the use of cellular nonlinear network image processing to perform target detection and classification and sensor fusion. The MDA funds researchers in Russia to investigate the synthesis of high energy materials for propulsion and explosives. MDA awards research grants to foreign research facilities and sponsors travel to the U.S. as a means to facilitate exchange of technical information among scientists.

Other

Tactical HEL

A Tactical HEL could be used to counter short-range missiles, rockets, and other air threats. The U.S. is assisting Israel in developing a mobile, tactical-sized laser to defend Israel's northern cities from short-range threats. Testing of a laser demonstrator began in 2000.

Satellite-Based Laser Communications

Satellite-Based Laser Communications would allow for more efficient and rapid transmission of large amounts of information.

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APPENDIX G
APPLICABLE LEGAL REQUIREMENTS

APPLICABLE LEGAL REQUIREMENTS

This appendix provides an overview of the applicable federal statutes enacted by Congress; corresponding regulations promulgated by the Federal agency charged with implementing the statute; EOs signed by the President of the U.S. and directed to Federal agencies; internal orders, directives[11], and policies implemented by the Federal agencies; and international treaties and convention to which the U.S. is a party. This overview is not exhaustive, as it does not include all possibly applicable legal requirements, further, all of the listed requirements may not be relevant to every activity associated with the proposed BMDS. Therefore, site-specific environmental documentation may require a more thorough investigation into the specific Federal and international legal requirements. Likewise, local laws and regulations are excluded and should be addressed in site-specific environmental documentation. With the exception of requirements that apply generally to the MDA or to the BMDS PEIS, and those that apply to orbital debris, the legal requirements in this appendix are organized by Resource Area. Where appropriate, applicable Federal and international requirements are specified by Resource Area.

Generally Applicable

Missile Defense Act (Public Law 92-190), enacted as part of the National Defense Authorization Act of 1992, establishes goals for theater and national missile defenses (NMDs). It directs the DoD to develop a TMD system for possible deployment at an initial Anti-Ballistic Missile Treaty-compliant site by 1996 or as soon as appropriate technology would allow. In July 1992, Secretary of Defense Cheney outlined a plan for the development and deployment of theater and national missile defenses. In passing the National Defense Authorization Act (Public Law 92-484) of 1993, Congress deleted the dates contained in the Act and in the conference report accompanying this Act. Congress endorsed a plan to deploy a limited national missile defense system by 2002.

NMD Act of 1999 (Public Law 106-38), states that "[i]t is the policy of the United States to deploy as soon as is technologically possible an effective NMD system..."

The Treaty between the United States of America and the Union of Soviet Socialist Republics on the Reduction and Limitation of Strategic Offensive Arms Treaty (START) is a treaty that provides for reductions in U.S. and Soviet strategic offensive nuclear forces. START I is a protocol between the U.S. and Russia, Belarus, Kazakhstan, and Ukraine and is recognized for its complexity and comprehensive approach. START II was signed by the U.S. and Russia after the demise of the Soviet Union and calls for

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[11] DoD Services may have their own policies that apply to various resource areas. For example, the U.S. Army recently developed Army Regulation 200-4: Cultural Resources Management (AR 200-4), which is an official policy for management, care and preservation of cultural resources. Policies specific to DoD services are not addressed in this PEIS and should be considered as part of site-specific environmental analyses.

further reductions in nuclear arsenals (by approximately two-thirds) and prohibits the use of ICBMs.

NEPA of 1969, as amended (42 United States Code [U.S.C.] 4321), requires federal agencies, early in the agency's planning process, to assess the potential environmental impacts of implementing major federal actions so that this information can be used in the decision-making process. The Act requires analysis of effects from the full range of project alternatives, along with public comment and review. NEPA specifies several levels of environmental review, ranging from Categorical Exclusion for categories of actions that have been determined to not have a substantial effect on the environment, to EISs for major, unprecedented, or controversial actions having potentially significant environmental impacts. NEPA is implemented through CEQ regulations at 40 CFR Parts 1500-1508.

Regulations developed by the CEQ (40 CFR Part 1500) define the procedures for completing the environmental review and analysis called for in NEPA. The regulations outline the principles to be followed in the environmental impact analysis process, including incorporating environmental review early in project planning, preparing an action-forcing environmental document to assist in project decisions rather than one that documents decisions previously made, and ensuring public involvement throughout the process. The regulations also include guidelines for determining what level of environmental review is required; the contents of environmental documents; procedures for comments by the public and federal agencies; and schedules.

In accordance with the CEQ regulations for implementing NEPA (40 CFR 1507.3(b)), the DoD and the military services have developed regulations that further implement NEPA within the Department. These regulations establish categorical exclusions for those actions, which do not individually or cumulatively have a significant effect on the human environment (see Exhibit G-1). Where appropriate, the DoD and the military services have established categorical exclusions for such activities. For example, infrequent, temporary (less than 30 days) increases in air operations up to 50 percent of the typical installation aircraft operation rate are categorically excluded.

Exhibit G-1. Location of Categorical Exclusions in Agency or Service NEPA Implementing Regulations

DoD Entity	NEPA Implementing Regulations
Department of Defense (DoD)	32 CFR, Part 188
Department of the Army	32 CFR, Parts 650, and 651
Department of the Navy	32 CFR, Part 775
Department of the Air Force	32 CFR, Part 989
Department of the Army, U.S. Army Corps of Engineers	33 CFR, Part 230

EO 13148, Greening the Government Through Leadership in Environmental Management (65 FR 24595 (2000)), requires Federal agencies to develop a plan to phase out the procurement of Class I ozone-depleting substances for all nonexcepted uses by December 31, 2010. Plans should target cost effective reduction of environmental risk by phasing out Class I ozone depleting substance applications as the equipment using those substances reaches its expected service life.

International Framework

Some MDA activities may occur outside the continental U.S. (OCONUS), its territories and possessions. Because NEPA and other environmental laws do not generally apply to OCONUS activities, various EOs and DoD directions have been implemented. This section describes the framework within which MDA activities must comply regarding these international activities.

- **Overseas Environmental Planning Issues**. Because the NEPA does not apply to overseas actions, EO 12114, Environmental Effects Abroad of Major Federal Actions (44 FR 1957 (1979)), represents the U.S. exclusive and complete requirement for taking into account considerations with respect to actions that do significant harm to the environment of places outside the U.S. The DoD Directive 6050.7 (Environmental Effects Abroad of Major DoD Actions) provides policy and procedures to enable DoD officials to be informed of and take account of those issues. This directive establishes procedures for considering major federal actions with significant effects that take place in the global commons (Enclosure 1) and in a foreign country (Enclosure 2).

- **Overseas Environmental Compliance Issues**. Compliance with other environmental requirements is generally achieved by treaty or agreement, or by U.S. statutes having extraterritorial application. In addition, DoD Instruction 4715.5 (Management of Environmental Compliance at Overseas Installations) establishes environmental compliance standards for protection of human health and the environment at DoD installations in foreign countries. Under this authority, the DoD has established an Overseas Environmental Baseline Guidance Document, which is a set of standards designed to protect human health and the environment. The Overseas Environmental Baseline Guidance Document and applicable international agreements constitute compliance requirements for DoD activities outside the U.S.

To further this process, the DoD designates an Environmental Executive Agent where the level of DoD presence justifies such a designation. The Environmental Executive Agent establishes Final Governing Standards, which are a comprehensive set of country-specific substantive provisions (i.e. effluent limitations, specific management practices), by comparing the Overseas Environmental Baseline Guidance Document with applicable host-national or international standards. The Environmental Executive Agent typically uses the more protective standard in establishing Final Governing Standards. Once established, the Final Governing Standards for a country constitute the environmental compliance requirements for military activities overseas in that country.

Air Quality

United States

The Clean Air Act (42 U.S.C. 7401) requires the adoption of primary and secondary National Ambient Air Quality Standards (NAAQS) to protect the public health, safety, and welfare from known or anticipated effects of the identified criteria air pollutants. The primary standards were established to protect public health with an adequate margin of safety, while the secondary standards were intended to protect the public welfare from any known or anticipated adverse effects of a pollutant (e.g., plant life, cultural monuments, and wildlife). These threshold levels were determined based on years of research on the health effects of various concentrations of pollutants on biological organisms. Exhibit G-2 summarizes the primary and secondary NAAQS.

The Clean Air Act gives state and local authorities the responsibility to ensure regional attainment of the standards. To further define local and regional air quality, the EPA designates areas with air quality better than the NAAQS as attainment areas, and areas with worse air quality as non-attainment areas. These classifications generally are based on air quality monitoring data collected at certain sites in the state. The criteria for non-attainment designation vary by pollutant. An area is in non-attainment for ozone if its NAAQS has been exceeded more than three discontinuous times in three years at a single monitoring station. An area is in non-attainment for any other pollutant if its NAAQS has been exceeded more than once per year. Some areas are unclassified because insufficient data exist to characterize the area;

Exhibit G-2. National Ambient Air Quality Standards

Standards[a]			
Pollutant	**Averaging Time**	**Concentration Primary[b,c]**	**Concentration Secondary[b,d]**
Ozone	1 hour	0.12 ppm[e] (235 μg/m^3)[f]	Same as primary
	8 hour	0.08 ppm (157 μg/m^3)	Same as primary
Carbon monoxide (CO)	8 hour	9.0 ppm (10 mg/m^3)[g]	---
	1 hour	35 ppm (40 mg/m^3)	---
Nitrogen dioxide (NO_2)	Annual arithmetic mean	0.053 ppm (100 μg/m^3)	Same as primary
Sulfur dioxide (SO_2)	1 hour	---	---
	3 hours	---	0.5 ppm (1,300 μg/m^3)
	24 hour	0.14 ppm (365μg/m^3)	---
	Annual (arithmetic mean)	0.03 ppm (80 μg/m^3)	---
Particulate matter as PM_{10}	24 hour	150 μ/m^3	Same as primary
	Annual (arithmetic mean)	50 μg/m^3	Same as primary
Particulate matter as $PM_{2.5}$	24 hour	65 μg/m^3	Same as primary
	Annual (arithmetic mean)	15 μg/m^3	Same as primary
Lead	Quarterly average	1.5 μg/m^3	Same as primary
	30-day average	---	---

Source: EPA, 2003f

[a] These standards, other than for ozone, PM, and those based on annual averages, must not be exceeded more than once per year. The eight-hour ozone standard is attained when the fourth highest eight-hour concentration in a year, averaged over three years, is equal to or less than the standard. For PM_{10}, the 24-hour standard is attained when the expected number of days per calendar year with a 24-hour average concentration above the standard is equal to or less than one. For $PM_{2.5}$, the 24-hour standard is attained when 98 percent of the daily concentrations, averaged over three years, are equal to or less than the standard.

[b] Concentration is expressed first in units in which it was adopted and is based on a reference temperature of 25°Celsius (°C) (77 °Fahrenheit [°F]) and a reference pressure of 760 millimeters (1,013.2 millibars) of mercury. All measurements of air quality must be corrected to a reference temperature of 25°C (77 °F) and a reference pressure of 760 millimeters (1,013.2 millibars) of mercury. Parts per million (ppm) in this exhibit refers to parts per million by volume or micromoles of pollutant per mole of gas.

[c] National primary standards are the levels of air quality necessary, with an adequate margin of safety, to protect the public health.

[d] National secondary standards are the levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

[e] Parts per million by volume or micromoles per mole of gas

[f] Micrograms per cubic meter

[g] Milligrams per cubic meter (mg/cm^3)

other areas are deemed maintenance areas. Maintenance areas are regions where NAAQS were exceeded in the past, and are subject to restrictions specified in a State Implementation Plan (SIP)-approved maintenance plan to preserve and maintain the newly regained attainment status.

The Clean Air Act requires the preparation of a SIP that describes how the state will meet or attain the NAAQS. The SIP contains emission limitations as well as record keeping and reporting requirements for affected sources. As a result of the Clean Air Act Amendments, the requirements and compliance dates for reaching attainment are based on the severity of the air quality standard violation.

Section 176(c)(1) of the Clean Air Act mandates the general conformity rule. This requirement is further implemented in 40 CFR parts 51 and 93. The general conformity rule prohibits the Federal government from conducting, supporting or approving any actions that do not conform to an approved Clean Air Act SIP. Federal agencies are required to perform a conformity review for federal actions taking place in a region designated non-attainment for a particular pollutant, or in a maintenance area. The U.S. Federal government is exempt from the requirement to perform a conformity analysis if two conditions are met.

1. The ongoing activities do not produce emissions above the *de minimis* levels specified in the rule. Exhibit G-3 shows the *de minimis* threshold levels of various non-attainment areas.

2. The Federal action is not considered a regionally significant action. A Federal action is considered regionally significant when the total emissions from the action equal or exceed ten percent of the air quality control area's emissions inventory for any criteria pollutant.

The EPA considers emissions at or below 914 meters (3,000 feet) to evaluate ambient air quality and calculate *de minimis* levels. Air quality modeling is used to determine the effects of air emission sources on the ambient air concentrations. The types and amounts of pollutants, the topography of the air basin, and the prevailing meteorological parameters that most often affect pollutant dispersions are wind speed, wind direction, atmospheric stability, mixing height, and temperature.

Exhibit G-3. *De Minimis* Thresholds in Non-Attainment Areas

Pollutant	Degree of Non-Attainment	*De Minimis* Level (metric tons/year [tons/year])
Ozone (Volatile Organic Compounds [VOCs] and Nitrogen Oxides [NO_X])	Serious	45 (50)
	Severe	23 (25)
	Extreme	9 (10)
	Marginal/Moderate (outside ozone transport region)	45 (50 VOC)
	Marginal/Moderate (inside ozone transport region)	91 (100 NO_X)
CO	All	91 (100)
PM	Moderate	91 (100)
	Serious	64 (70)
SO_2 or NO_2	All	91 (100)
Lead	All	23 (25)

Source: 40 CFR 93.153(b)

Section 169A of the Clean Air Act established visibility protection for Class I Federal areas (such as national parks and wilderness areas). In 1999, the EPA promulgated Regional Haze regulations (64 FR 35714 (July 1, 1999)) that require states to develop SIPs to address visibility at designated mandatory Class I areas, including 156 designated national parks, wilderness areas, and wildlife refuges. General features of the regional haze regulations are that all states are required to prepare an emissions inventory of all haze related pollutants from all sources in all constituent counties. Most states will develop their regional haze SIP in conjunction with their $PM_{2.5}$ SIP over the next several years.

International

Since its adoption in 1979, the Convention on Long Range Transboundary Air Pollution has addressed some of the major environmental problems of the United Nations Economic Commission for Europe through a process of international scientific collaboration and policy negotiation. The Convention aims to protect human health and the environment against air pollution by limiting, gradually reducing, and preventing air pollution, including long-range transboundary air pollution. The objectives of the Convention Protocols are to reverse freshwater and soil acidification, forest dieback, eutrophication, exposure to excess ozone, degradation of cultural monuments and historic buildings, and accumulation of heavy metals and persistent organic pollutants in the soil, water, vegetation, and other living organisms.

The 1985 Convention for the Protection of the Ozone Layer (Vienna Convention) aims to protect human health and the environment against adverse effects resulting from modifications of the ozone layer, especially from increased ultraviolet solar radiation. It requires that states reduce their reliance on ozone-depleting substances and conduct collaborative research to find alternatives to harmful substances such as chlorofluorocarbons and halons.

The Montreal Protocol on Substances that Deplete the Ozone Layer was developed under the guidance of the United Nations Environmental Program in September 1987 and based on the recommendations of the Vienna Convention. The Montreal Protocol identifies the main ozone-depleting substances and specifies a timetable for phasing out the consumption and production of ozone depleting substances. Title VI of the Clean Air Act Amendments of 1990 establishes phase out requirements for ozone depleting substances consistent with the Montreal Protocol.

The United Nations Framework Convention on Climate Change, an international agreement for addressing climate change, was adopted at the United Nations Conference on Environment and Development (Earth Summit) in Rio de Janeiro, Brazil, in 1992. The framework aims to regulate levels of greenhouse gas concentrations in the atmosphere.

Airspace

United States

Airspace management and use in the U.S. are governed by the Federal Aviation Act of 1958 (Public Law 85-725) and its implementing regulations set forth by the FAA. FAA Order 7490, "Policies and Procedures for Air Traffic Environmental Actions," includes procedures and guidance for coordination between FAA and DoD on environmental issues regarding special use airspace. FAA Order 7610.4H, "Special Military Operations," specifies procedures for air traffic control planning, coordination, and services during defense activities, and special military operations conducted in airspace controlled by or under the jurisdiction of the FAA.

The U.S. airspace is divided into 21 zones (centers), and each zone is divided into sectors. Also within each zone are portions of airspace, about 81 kilometers (50 miles) in diameter, called Terminal Radar Approach Control airspaces. Multiple airports exist within each of these airspaces, and each airport has its own airspace with an eight-kilometer (five-mile) radius.

International

For international airspace, the procedures of the International Civil Aviation Organization (ICAO) are followed. These procedures are outlined in ICAO Document 444, "Rules of the Air and Air Traffic Services." The ICAO ensures the safe, efficient, and orderly evolution of international civil aviation through the establishment of international standards and recommended practices.

Biological Resources

United States

The Endangered Species Act of 1973 (16 U.S.C. 1531), as amended, requires all Federal agencies to seek to conserve endangered and threatened species. The Secretary of the Interior was directed to create lists of endangered and threatened species. Endangered species listing is given to any plant or animal species that is in danger of extinction throughout all or a significant portion of its range. The Act defines a threatened species as any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Critical habitat for a threatened or endangered species is defined as specific areas, within the geographical area occupied by the species at the time it is listed, which contain the physical or biological features essential to conservation of the species and may require special management considerations or protection. Critical habitat also includes specific areas, outside the geographic area occupied by the species at the time it is listed, which are essential to conservation of the species. The National Defense Authorization Act for FY 2004 (Public Law 108-136, Section 318) amended the Endangered Species Act to allow the Secretary of the Interior to exempt DoD sites from critical habitat designations if an integrated natural resources management plan is determined to be of benefit to the species.

A key provision of the Endangered Species Act for Federal activities is Section 7, Consultation. Under Section 7 of the Act, every Federal agency must consult with the Secretary of the Interior, USFWS, to ensure that an agency action is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of habitat of such species. Under the Act, if a threatened or endangered species may be affected, a biological assessment is required to determine the impact.

The Fish and Wildlife Coordination Act of 1958 (16 U.S.C. 661) requires Federal agencies to consult with the USFWS and state wildlife agencies where any water body or wetlands under U.S. Army Corps of Engineers jurisdiction is proposed to be modified by a Federal agency.

The Migratory Bird Treaty Act of 1918 (16 U.S.C. 703-712) protects migratory waterfowl and all seabirds. Specifically, the Act prohibits the pursuit, hunting, taking, capture, possession, or killing of such species or their nests and eggs. The USFWS Division of Migratory Bird Management develops migratory bird permit policy. The regulations governing migratory bird permits can be found in General Permit Procedures (50 CFR 13) and Migratory Bird Permits (50 CFR 21). Most states require a state permit for activities involving migratory birds (USFWS, 2002). Taking of migratory birds by Federal agencies is governed by EO 13186, Responsibilities of Federal Agencies To Protect Migratory Birds (66 FR 3853 (January 17, 2001)), which requires Federal agencies taking actions that have, or are likely to have, a measurable negative effect on migratory bird populations to develop and implement a Memorandum of Understanding with the USFWS that promotes the conservation of migratory bird populations.

The Marine Mammal Protection Act of 1972 (16 U.S.C. 1361) outlines prohibitions for the taking of marine mammals. The Act gives the USFWS and NOAA Fisheries Service co-authority to protect the resource. The Marine Mammal Commission, which was established under the Act, reviews laws and international conventions, studies worldwide populations, and makes recommendations to Federal officials concerning marine mammals. The National Defense Authorization Act for FY 2004 amended the Marine Mammal Protection Act to redefine harassment as activities that “injure, disturb or are likely to disturb” marine mammals. This new standard applies to DoD actions and research done by or for the Federal government. In addition, the amendments grant the DoD an exemption from the Marine Mammal Protection Act for actions “necessary for national defense” as determined by the Secretary of Defense.

The Marine Protection, Research, and Sanctuaries Act (33 U.S.C. 1401) regulates the disposal of all materials into the ocean to prevent adverse effects to human welfare, the marine environment, ecological systems, or the economy. It provides the EPA with the authority to issue permits for ocean dumping.

The Bald and Golden Eagle Protection Act (16 U.S.C. 668) establishes penalties for the unauthorized taking, possession, selling, purchase, or transportation of bald or golden eagles, their nests, or their eggs. If a Federal activity might disturb eagles or a nest is found in areas where activities for the proposed BMDS may occur, consultation with the USFWS for appropriate mitigation is required.

The National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd-668ee) consolidates the categories of lands that are administered by the Secretary of the Interior for the conservation of fish and wildlife, including species that are threatened with extinction. Provisions of the Act relating to determinations of the compatibility of a use shall not apply to overflights above a refuge or activities authorized, funded, or conducted by a Federal agency (other than USFWS) that has primary jurisdiction over a refuge or a portion of a refuge, if the management of those activities is in accordance with a memorandum of understanding between the Secretary/Director and the head of the Federal agency with primary jurisdiction over the refuge governing the use of the refuge.

The Magnuson–Stevens Fishery Conservation and Management Act (16 U.S.C. 1801) requires Federal agencies to consult with NOAA Fisheries on activities that could harm Essential Fish Habitat areas. Essential Fish Habitat refers to "those waters and substrate (sediment, hard bottom) necessary to fish for spawning, breeding, feeding, or growth to maturity."

The Fish and Wildlife Conservation Act of 1980 (16 U.S.C. 2901-2912) provides for financial and technical assistance to states to develop conservation plans, subject to approval by the Department of Interior, and implement state programs for fish and wildlife resources. The Act also encourages all Federal departments and agencies to utilize their statutory and administrative authority to conserve and promote conservation of non-game fish and wildlife and their habitats.

The Sikes Act (Conservation Programs on Military Installations) (16 U.S.C. 670) requires the Secretary of each military department to carry out a program for the conservation, restoration, and management of ecosystem, wildlife, and fishery resources on military reservations. Federal and state fish and wildlife agencies are given priority for managing these resources and a cooperative plan must be implemented to sell or lease land or forest products. The National Defense Authorization Act for FY 2004 amendments authorize the Secretary of the Interior to exempt DoD land from critical habitat designation where the Secretary finds that the natural resources plan prepared pursuant to the Sikes Act provides a benefit to the species for which the critical habitat designation is proposed.

EO 8646, Establishing the San Andres National Wildlife Refuge, New Mexico (6 FR 592 (1941)), creates the San Andres National Wildlife Refuge, an area that provides habitat for a variety of sensitive species, for the conservation and development of natural wildlife resources.

EO 11990, Protection of Wetlands (42 FR 26961 (1977)), requires Federal agencies to provide leadership and work to minimize the destruction, loss, and degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands while carrying out the agency's responsibility for acquiring, managing, using, and disposing of Federal lands. The National Defense Authorization Act for FY 2004 authorizes the Federal government to participate in mitigation banks for wetlands. The mitigation banks allow developers to fill wetlands in one area in exchange for a payment to create wetlands in another area.

EO 13061, Federal Support of Community Efforts Along American Heritage Rivers (62 FR 48445, 1997), requires Federal agencies to preserve, protect, and restore rivers designated American Heritage Rivers, including their natural resources and associated historical, cultural, and economic resources.

EO 13089, Coral Reef Protection (63 FR 32701 (1998)), requires all Federal agencies to "identify their actions that may affect U.S. coral reef ecosystems; utilize their programs and authorities to protect and enhance the conditions of such ecosystems; and to the extent permitted by law, ensure that any actions they authorize, fund, or carry out will not degrade the conditions of such ecosystems."

EO 13112, Invasive Species (64 FR 6183 (1999)), directs the prevention of invasive species introduction and provides means for their control to minimize economic, ecological, and human health impacts they may cause.

EO 13178, Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve (65 FR 76903 (2000)), establishes the Northwestern Hawaiian Island Coral Reef Ecosystem Reserve, which lies to the northwest of the main islands of the Hawaiian chain, to "ensure the comprehensive, strong, and lasting protection of the coral reef ecosystem and related marine resources and species (resources) of the Northwestern Hawaiian Islands."

The Natural Resources Management Program (DoD Directive 4700.4) instructs DoD to show active concern for natural resource value in all its efforts to achieve military missions. Under this directive, DoD must inform key decision-makers of potential conflicts between military and conservation actions.

The DoD Memorandum of Understanding to Follow the Ecosystem Approach (1995) asserts that Federal agencies should provide a leadership role in working with landowners and communities to sustain and restore the health, productivity, and biodiversity of ecosystems. The ecosystem approach should be integrated with social and economic goals in a way that improves the overall quality of life.

International

The Convention on Wetlands of International Importance Especially as Waterfowl Habitat, or Ramsar Convention, has been in force since 1975 and aims to stem the progressive encroachment on and loss of wetlands, now and in the future. It requires its Parties to designate at least one national wetland of international importance; establish wetlands nature reserves and cooperate in information exchange for wetlands management; assess the impacts of any changes in use on identified wetland sites; and take responsibility for conservation, management, and wise use of migratory stocks of waterfowl.

The 1986 Convention for the Protection of the Natural Resources and Environment of the South Pacific Region is a comprehensive, umbrella agreement for the protection, management, and development of the marine and coastal environment of the South Pacific Region. Sources of pollution that require control under SPREP are ships, dumping, land-based sources, seabed exploration and exploitation, atmospheric discharges, storage of toxic and hazardous wastes, testing of nuclear devices, mining, and coastal erosion.

Cultural Resources

Numerous laws and regulations require that possible effects on cultural resources be considered during the planning and execution of Federal undertakings. These laws and regulations stipulate a process of compliance, define the responsibilities of the Federal agency proposing the action, and prescribe the relationship among other involved agencies (e.g., State Historic Preservation Officer, the Advisory Council on Historic Preservation).

The National Historic Preservation Act (16 U.S.C. 470f and 470h-2(a)) establishes a national policy to preserve, restore, and maintain cultural resources. The Act establishes the National Register of Historic Places as the mechanism to designate public or privately owned properties deserving protection. Federal agencies must take into account the effect of a project on any property included in or eligible for inclusion in the National Register.

The Native American Graves Protection and Repatriation Act (25 U.S.C. 3001) is triggered by the possession of human remains or cultural items by a federally funded repository or by the discovery of human remains or cultural items on Federal or tribal lands. It provides for the inventory, protection, and return of cultural items to affiliated Native American groups. Permits are required for intentional excavation and removal of Native American cultural items from Federal or tribal lands. The Act includes provisions that, upon inadvertent discovery of remains, the action will cease in the area where the remains were discovered, and the responsible official will protect the materials and notify the appropriate lands management agency.

The Archaeological Resources and Protection Act (16 U.S.C. 470aa - 470mm) ensures the protection of archaeological sites on Federal land. It requires Federal permits to be obtained before cultural resource investigations begin at sites on Federal land and investigators to consult with the appropriate Native American groups prior to initiating archaeological studies on sites of Native American origin.

The American Indian Religious Freedom Act (42 U.S.C. 1996) states that it is the policy of the U.S. to protect and preserve for American Indians their inherent right of freedom to believe, express, and exercise the traditional religions including but not limited to access to sites, use and possession of sacred objects, and the freedom to worship through ceremonial and traditional rites.

The Antiquities Act of 1906 (16 U.S.C. 431) was the first piece of historic preservation legislation, and it protects sites and objects of antiquity, including historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest that are situated upon lands owned or controlled by the U.S. The Act prohibits excavation or destruction of such antiquities unless a permit is obtained. Antiquity permits issued under this law are still in effect, though new permits are now being issued under the Archaeological Resources Protection Act of 1979 (16 U.S.C. § 470aa-mm) and its implementing regulations (43 CFR 7). These regulations enable Federal land managers to protect archaeological resources, taking into consideration provisions of the American Indian Religious Freedom Act (42 U.S.C. 1996), through permits authorizing excavation and/or removal of archaeological resources, through civil penalties for unauthorized excavation and/or removal, through provisions for the preservation of archaeological resource collections and data, and through provisions for ensuring confidentiality of information about archaeological resources when disclosure would threaten the archaeological resources.

EO 13007, Indian Sacred Sites (61 FR 26771 (1996)), requires each executive branch that manages Federal lands, whenever practicable and permitted by law, to accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and to avoid adversely affecting the physical integrity of such sacred sites.

EO 13287, Preserving America (68 FR 10635 (2003)) establishes Federal policy to provide leadership in preserving America's heritage by actively advancing the protection, enhancement, and contemporary use of the historic properties owned by the Federal Government, and by promoting intergovernmental cooperation and partnerships for the preservation and use of historic properties.

Environmental Justice

EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (56 FR 7629 (1994)) requires each Federal agency to identify and address, as appropriate, "disproportionately high and adverse human health and environmental effects on minority and low-income populations." The demographics of the affected area should be examined to determine whether minority populations or low-income populations are present in the area impacted by the proposed action. If so, a determination must be made whether the implementation of the proposed action may cause disproportionately high and adverse human health or environmental effects on those populations.

Geology and Soils

Although there are no Federal regulations pertaining specifically to geology and soils in areas where activities for the proposed BMDS may occur, some water quality regulations are indirectly related with respect to erosion and resultant turbidity (mixing) in surface waters (Clean Water Act sections 402 and 405 National Pollutant Discharge Elimination System (NPDES) permitting program, codified at 40 U.S.C. 1342 and 1345, respectively), avoidance of development in floodplains (EO 11988, Floodplain Management), and spill response plans to ensure that ground water is not adversely impacted. (U.S. Army Space and Missile Defense Command, 2003)

Several states and counties have regulations or ordinances in place to protect and mitigate impacts to soils. Such regulations and procedures include best management practices, which typically are outlined in sediment and erosion control handbooks (e.g. Virginia Erosion and Sediment Control Handbook). The Best Management Practices outlined in the state and local handbooks are designed to address the storm water run-off and water quality criteria specified in the Clean Water Act. (See discussion under Water Resources.)

Hazardous Materials and Hazardous Waste

United States

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), or Superfund, (42 U.S.C. 9601) creates authority and procedures for conducting emergency responses, removal, and remediation actions at sites requiring a cleanup of releases of hazardous substances. The Act specifies standards of liability and provides procedures for determining compensation, reportable quantities of releases of hazardous substances, penalties, employee protection, claims procedures, and cleanup standards.

The Superfund Amendment and Reauthorization Act of 1986 revised and extended CERCLA in 1986. SARA Title III, the Emergency Planning and Community Right To Know Act, provides for emergency planning and preparedness, community right-to-know reporting, and toxic chemical release reporting. The Act requires information about hazardous materials be provided to state and local authorities, including material safety data sheets, emergency and hazardous chemical inventory forms, and toxic chemical release reports.

Resource Conservation and Recovery Act (RCRA), or Solid Waste Disposal Act, (42 U.S.C. 6901) authorizes the EPA to regulate the generation, storage, and disposal of hazardous wastes. RCRA also applies to underground storage tanks and establishes a “cradle-to-grave” or life cycle system of requirements for managing hazardous waste, from generation to eventual disposal.

The Pollution Prevention Act of 1990 (42 U.S.C. 13101) defines pollution prevention as source reduction and other practices that reduce or eliminate the creation of pollutants. It requires the EPA to develop standards for measuring waste reduction, serve as an information clearinghouse, and provide matching grants to state agencies to promote pollution prevention. Facilities with more than ten employees that manufacture, import, process, or otherwise use any chemical listed in and meeting threshold requirements of the Emergency Planning and Community Right To Know Act must file a toxic chemical source reduction and recycling report.

The Hazardous Materials Transportation Act of 1975 (49 U.S.C. 1801) gives the DOT authority to regulate shipments of hazardous substances by air, highway, or rail. These regulations may govern any safety aspect of transporting hazardous materials, including packing, repacking, handling, labeling, marking, placarding, and routing (other than with respect to pipelines).

The Ocean Dumping Act (33 U.S.C. 1401) imposes restrictions on what items and substances may be dumped into the open ocean. To protect the marine environment, the Act restricts dumping to designated locations and strictly prohibits dumping of materials such as biological warfare substances. The U.S. Coast Guard conducts surveillance as a regulatory enforcement measure.

The Oil Pollution Act of 1990 (33 U.S.C. 2701) requires oil storage facilities and vessels to submit to the Federal government plans detailing how they will respond to large discharges. The Oil Pollution Act requires the Federal government to “ensure effective and immediate removal of a discharge, and mitigation or prevention of a substantial threat of a discharge, of oil or a hazardous substance” into the navigable waters of the U.S., adjoining shorelines, and the exclusive economic zone. The Act requires the development of Area Contingency Plans to prepare and plan for oil spill response on a regional scale.

The Toxic Substances Control Act of 1976 (15 U.S.C. 2601) gives the EPA authority to require testing of new and existing chemical substances entering the environment and the authority to regulate these substances. Section 6 of the Act specifically addresses, among others, polychlorinated biphenyls and asbestos.

EO 12856, Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements (58 FR 41981 (1993)), requires the head of each Federal agency to develop and implement a written pollution prevention strategy that aims to minimize release of toxic chemicals to the environment and report in a public manner toxic chemicals entering the waste stream of the agency. This order relates to compliance with the

Emergency Planning and Community Right To Know Act and the Pollution Prevention Act.

International

The Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, generally known as the London Dumping Convention, was adopted in 1972. Its objective is to control pollution of the sea caused by dumping and to encourage regional agreements supplementary to the Convention. It prohibits the dumping of certain hazardous materials, requires a prior special permit for the dumping of a number of other identified materials, and requires a prior general permit for other wastes or matter.

"Dumping" has been defined as the deliberate disposal at sea of wastes or other matter from vessels, aircraft, platforms or other man-made structures, as well as the deliberate disposal of these vessels or platforms themselves. Discharges of spent stages from missiles and of residual propellants are part of the normal operation of launch vehicles, and therefore are not covered by the London Dumping Convention or other related agreements.

The U.S. is party to the Protocol of 1978 Relating to the International Convention for the Prevention of Pollution from Ships of 1973 as Amended (MARPOL) and Annexes I, II, III, and IV to MARPOL. Normal debris released by missiles after launch is not covered by MARPOL, as this agreement applies to ships. After lift-off from the launch pad, vehicles and their payloads are not ships within the meaning of MARPOL.

The 1989 Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (Basel Convention) aims to establish obligations for State Parties with the objective of reducing transboundary movements of wastes subject to the Basel Convention to a minimum consistent with the environmentally sound and efficient management of such wastes; minimizing the amount and toxicity of hazardous wastes generated and ensuring their environmentally sound management (including disposal and recovery operations) as close as possible to the source of generation; and assisting developing countries in environmentally sound management of the hazardous and other wastes they generate. Hazardous wastes shall be exported only if the state of export does not have the technical capacity and facilities to dispose of them in environmentally sound management.

Health and Safety

Regulatory requirements related to the Occupational Safety and Health Act of 1970 (29 U.S.C. 651 et seq.) have been codified in the General Industry Standards (29 CFR 1910) and Construction Industry Standards (29 CFR 1926). The regulations specify equipment, performance, and administrative requirements necessary for compliance with Federal occupational safety and health standards, and apply to all occupational (workplace) situations in the U.S. The requirements are monitored and enforced by the Occupational Safety and Health Administration, which is a part of the U.S. Department of Labor.

The Occupational Safety and Health Standards (OSHA) regulations (29 CFR 1910) address electrical and mechanical safety and work procedures, sanitation requirements, life safety requirements (such as fire and evacuation safety and emergency preparedness), design requirements for certain types of facility equipment (such as ladders and stair lifting devices), mandated training programs (such as employee Hazard Communication training and use of powered industrial equipment), and record-keeping and program documentation requirements. For any construction or construction-related activities, additional requirements specified in the Safety and Health Regulations for Construction (29 CFR 1926) also apply.

The Safe Drinking Water Act provides the EPA with the authority to set standards for drinking water quality and oversee states, localities, and water suppliers who implement those standards. Additional information on the Safe Drinking Water Act can be found in Section 3.1.15, Water Resources.

RCRA gave the EPA the authority to control hazardous waste from "cradle-to-grave." This includes generation, transportation, treatment, storage, and disposal of hazardous waste. Additional information on RCRA can be found in Section 3.1.7, Hazardous Materials and Hazardous Waste.

The Federal Water Pollution Control Act, as amended by the Clean Water Act of 1977 (33 U.S.C. 1251) has special enforcement provisions for oil and hazardous substances. For example, the Spill Prevention Control and Countermeasure (SPCC) Plan covers the release of hazardous substances, as identified by EPA, which could reasonably be expected to discharge into the waters of the U.S. Additional information on the Clean Water Act can be found in Section 3.1.15, Water Resources.

Requirements pertaining to the safe shipping and transport handling of hazardous materials, which can include hazardous chemical materials and explosives, are found in the DOT Hazardous Materials Regulations and Motor Carrier Safety Regulations (49 CFR parts 107, 171-180 and 390-397). These regulations specify all requirements that must be observed for shipment of hazardous materials over highways or by air. Requirements include those for specific packaging, material compatibility issues, permissible vehicle/shipment types, vehicle marking, driver training and certification, and notification.

Safety and Health Regulations for Marine Terminals (29 CFR 1917) apply to employment within a marine terminal including the loading, unloading, movement or other handling of cargo, ship's stores, or gear within the terminal or into or out of any land carrier, holding or consolidation area, and any other activity within and associated with the overall operation and functions of the terminal, such as the use and routine maintenance of facilities and equipment. Cargo transfers accomplished with the use of shore-based material handling devices also are regulated.

Safety and Health Regulations for Longshoring (29 CFR 1918) applies to longshoring operations and related employments aboard marine vessels.

EO 13045, Protection of Children from Environmental Health Risks and Safety Risks (62 FR 19885 (1997)), as amended by EO 13229 (66 FR 52013 (2001)) and EO 13296 (68 FR 19931 (2003)), provides for the consideration of potential environmental effects from federal actions on health and safety risks that may disproportionately affect children.

Defense Directive 3200.11, Major Range and Test Facility Base, provides the framework under which the national ranges operate and provide services to range users.

Range Commanders Council (RCC) Standard 321-02, Common Risk Criteria for National Test Ranges, sets requirements for minimally acceptable risk criteria to occupational and non-occupational personnel, test facilities, and non-military assets during range operations. Methodologies for determining risk also are set forth.

RCC 319-92, FTS Commonality Standards, specifies performance requirements for flight termination systems used on various flying weapons systems.

DoD 6055.9-STD, DoD Ammunition and Explosives Safety Standards describes appropriate safety measures to be followed during loading of missiles and propellants as required by DoD.

Land Use

United States

The Coastal Zone Management Act (16 U.S.C. 1451) seeks to preserve, protect, and restore coastal areas. Coastal areas include wetlands, floodplains, estuaries, beaches, dunes, barrier islands, coral reefs, and fish and wildlife and their habitat. All Federal agencies must assess whether their activities will affect a coastal zone and ensure, to the maximum extent possible, that the activities are consistent with approved state Coastal Zone Management Plans.

The Farmland Protection Act of 1981 (7 U.S.C. 4201) is designed to require Federal agencies to consider alternatives to projects that would convert farmlands to nonagricultural use. The Act is limited to procedures to assure that the actions of Federal agencies do not cause U.S. farmland to be irreversibly converted to nonagricultural uses in cases in which other national interests do not override the importance of the protection of farmland nor otherwise outweigh the benefits of maintaining farmland resources.

The Wilderness Act of 1964 (16 U.S.C. 1131-1136) provides Congressional protection of several named wilderness areas and establishes a National Wilderness Preservation System for inclusion of lands within national forests, national parks, and national wilderness refuges.

The Federal Land Policy and Management Act of 1976 (43 U.S.C. 1701) repeated a number of public land statutes and instituted a number of new programs including review of all lands managed by the Bureau of Land Management for possible designation by Congress as "wilderness," including a stipulation that the Federal agency must manage the public lands so as not to impair their wilderness potential.

International

The Convention on Environmental Impact Assessment in a Transboundary Context of 1991 aims to promote environmentally sound and sustainable economic development through the application of environmental impact assessment, especially as a preventive measure against transboundary environmental degradation. It stipulates the obligations of Parties to assess the environmental impact of certain activities at an early stage of planning. It also requires states to notify and consult each other on all major projects under consideration that are likely to have a significant adverse environmental impact across boundaries.

Noise

Federal and state governments have established noise regulations and guidelines for the purpose of protecting citizens from potential hearing damage and various other adverse physiological, psychological, and social effects associated with noise. The Federal government preempts the state on control of noise emissions from aircraft, helicopters, railroads, and interstate highways.

The Noise Control Act (42 U.S.C. 4901) directs all Federal agencies, to the fullest extent within their authority, to carry out programs in a manner that promotes an environment that is free from noise. The act requires a Federal department or agency engaged in any activity resulting in the emission of noise to comply with Federal, state, interstate, and local requirements respecting control and abatement of environmental noise.

OSHA regulations (29 CFR 1910.95) establish a maximum noise level of 90 A-weighted decibel (dBA) for a continuous eight-hour exposure during a workday and higher sound levels for a shorter time of exposure in the workplace. When information indicates that an employee's exposure may equal or exceed an eight-hour time-weighted average of 85 dB, the employer shall develop and implement a monitoring program.

The DoD Noise–Land Use Compatibility Guidelines state that sensitive land use areas, such as residential areas, are incompatible with annual day/night average sound level (L_{dn}) greater than 65 dBA.

Socioeconomics

The CEQ implementing regulations for NEPA provide no specific thresholds of significance for socioeconomic impact assessment. Significance varies depending on the setting of the proposed action (40 CFR 1508.27(a)). However, 40 CFR 1508.8 states that indirect effects may include those that are growth inducing and others related to induced changes in the pattern of land use, population density, or growth rate.

Transportation and Infrastructure

Regulations pertaining to transportation are implemented by the DOT and are located in Title 49 of the CFR. Title 49 includes regulations applicable to railroads (49 CFR 200-299), highways (49 CFR 300-399; 49 CFR 500-599), coastal transportation (49 CFR 400-499), transportation safety (49 CFR 800-899), and surface transportation generally (49 CFR 1000-1199). In addition, the DOT oversees air transportation and the applicable regulations are located at Title 14 of the CFR.

Utilities

There are significant numbers of legal requirements that exist for utilities; however, these are most appropriately considered in action- and site-specific environmental analyses. Therefore they will not be included in this PEIS. Subsequent site-specific environmental analyses will examine the applicable legal requirements for utilities, including Federal, state, and local regulations.

Visual and Aesthetic Resources

There are no Federal aesthetics permits or regulations for visual resources applicable to the proposed action and alternatives. Local planning guidelines may be included in city and county general plans to preserve and enhance the visual quality and aesthetic resources within the plan's jurisdiction. Protection of visual resources typically results from local zoning and building ordnances.

Water Resources

The Clean Water Act (33 U.S.C. 1251) establishes water pollution control standards and programs with the objective of restoring and maintaining the chemical, physical, and biological integrity of U.S. water resources. The Act provides for the elimination of the discharge of pollutants into navigable waters and for water quality goals to protect fish and wildlife. The Act specifies (1) that actions must comply with Federal and state water quality criteria; (2) regulations for issuing permits under the NPDES for storm water discharge be established by the EPA; and (3) states assess non-point source water pollution problems and develop pollution management plans.

Water quality and the consumption and diversion of water are regulated by a number of Federal and state agencies in the U.S. The EPA has the primary authority for implementing and enforcing the Clean Water Act. (33 U.S.C. 1251) The EPA, along with state agencies to which the EPA has delegated some of its authority, issues permits under the Clean Water Act to maintain and restore the quality of U.S. water resources. The Clean Water Act requires permits for activities that result in the discharge of pollutants to water resources or the placement of fill material in waters of the U.S.

Storm Water Pollution Prevention Plans are typically prepared and permitted under the NPDES to ensure construction activities do not lead to unacceptable levels of erosion and water pollution. The Safe Drinking Water Act of 1974 (42 U.S.C. 300f) provides the EPA with the authority to regulate the quality of U.S. drinking water supplies, including surface water and ground water sources. The EPA has delegated some of its authority for enforcement to all of the states, with the exception of Wyoming and the District of Columbia. The appropriation of water, including diversions, consumption of potable water, and other uses usually is regulated by the same state agencies that regulate water quality.

EO 11988, Floodplain Management (42 FR 26951 (1977)), requires Federal agencies to provide leadership and work to minimize the impacts of floods on property loss and human health and safety and simultaneously preserving the natural and beneficial values served by floodplains while carrying out the agency’s responsibility for acquiring, managing, using, and disposing of Federal lands.

Orbital Debris

The President authorized a new national space policy on August 31, 2006 that establishes overarching national policy that governs the conduct of U.S. space activities. The directive states:

"Orbital debris poses a risk to continued reliable use of space-based services and operations and to the safety of persons and property in space and on Earth. The United States shall seek to minimize the creation of orbital debris by government and non-government operations in space in order to preserve the space environment for future generations. Toward that end:

- Departments and agencies shall continue to follow the United States Government Orbital Debris Mitigation Standard Practices, consistent with mission requirements and cost effectiveness, in the procurement and operation of spacecraft, launch services, and the operation of tests and experiments in space;

- The Secretaries of Commerce and Transportation, in coordination with the Chairman of the Federal Communications Commission, shall continue to address orbital debris issues through their respective licensing procedures; and

- The United States shall take a leadership role in international fora to encourage foreign nations and international organizations to adopt policies and practices aimed at debris minimization and shall cooperate in the exchange of information on debris research and the identification of improved debris mitigation practices."

APPENDIX H
BIOME DESCRIPTIONS

BIOME DESCRIPTIONS

This Appendix provides detailed descriptions for each of the nine terrestrial biomes and the Broad Ocean Area (BOA) and the Atmosphere as discussed in Section 3, Affected Environment.

H.1 Arctic Tundra Biome

The Arctic Tundra Biome[12] discussion encompasses the arctic coastal regions that border the North Atlantic Ocean and Arctic Ocean. This biome includes coastal portions of Alaska in the U.S., Canada, and Greenland (administered by Denmark).

The majority of the Arctic Tundra Biome is located north of the latitudinal tree line and consists of the northern continental fringes of North America from approximately the Arctic Circle northward. For example, Thule AFB, Greenland, which is located approximately 1,100 kilometers (700 miles) north of the Arctic Circle, is the northernmost installation where MDA activities for the proposed BMDS may occur. The Arctic Tundra Biome includes other coastal locations that may be situated south of the Arctic Circle but have a climate and ecosystem similar to that of inland Arctic Tundra. These sites are located on the islands of the Aleutian chain and include Eareckson Air Station, Shemya Island, Alaska, and Adak, Alaska.

H.1.1 Air Quality

Climate

The Arctic Tundra Biome has very short, cool summers and long, severe winters. No more than 188 days per year, and sometimes as few as 55, have a mean temperature higher than 0°Celsius (°C) (32°Fahrenheit [°F]). On average, the frost-free period ranges from 40 to 60 days. The average annual temperature is -28°C (-18°F). Nights can last for weeks when the sun barely rises during winter months, and the temperature can drop to -70°C (-94°F). During the summer, the sun shines almost 24 hours per day and average summer temperatures range from 3°C to 16°C (37°F to 60°F).

The climate of the Arctic Tundra Biome is characterized as polar maritime with persistent overcast skies, high winds, frequent and often violent storms, and a narrow range of temperature fluctuation throughout the year. Weather at these coastal sites tends to be localized. (U.S. Army Space and Missile Defense Command, 2003) Parts of the Arctic Tundra may be classified as desert due to low precipitation. Annual precipitation is light, often less than 200 millimeters (eight inches). Most precipitation falls as snow in

[12] Exhibit H-12 shows the global location of the Arctic Tundra ecosystem. However, based on reasonably foreseeable locations for activities for the proposed BMDS to occur, the affected environment highlights the coastal portions of this ecosystem.

October through November. However, because potential evaporation also is very low, the climate tends to be humid. The Arctic Tundra also is characterized by high winds, which can blow from 48 to 97 kilometers (30 to 60 miles) per hour.

The Aleutian Islands are a representative example of locations where activities for the proposed BMDS may occur, and persistent cloudy weather, fog, mist, drizzle, and rain borne on powerful driving winds characterize the climate of the Aleutian Islands. Cold ocean currents keep land temperatures consistently cool, even during the warmest summer weather. The mean daily temperature in the Aleutian Islands of 3.9°C (39°F) has an annual range of only ± 9.4°C (49°F). (U.S. Geologic Survey [USGS], 1999) The Aleutian Islands typically receive some form of precipitation every day of the year, which averages approximately 76 to 137 centimeters (30 to 54 inches) annually, usually in the form of rain. Local shifts and rapid changes in velocity characterize the wind conditions of sites located on the Aleutian Islands.

Regional Air Quality

Air quality in the Arctic Tundra Biome is considered good, however, some areas in and around urban centers are in non-attainment for CO. Mixing heights in the Arctic Tundra Biome adversely affect regional air quality and vary greatly depending on atmospheric conditions. The mixing height is highest during afternoon hours and lowest during the evening and early morning. Temperature inversions, which occur most often in the winter, may cause extended periods of low mixing heights. Low mixing heights adversely affect regional air quality. During episodes of cold winter weather, atmospheric inversions may trap contaminants and cause exceedances of U.S. NAAQS or regional standards.

The Aleutian Islands are located in an attainment area for ambient concentrations of air pollutants. Although there is little actual ambient air quality monitoring in the Aleutians, the climate of the islands is conducive to good air quality, except during times of very high winds and dry weather, when blowing, natural dust can occur. The wet conditions of these coastal regions help to reduce windblown dust. (U.S. Army Space and Missile Defense Command, 2003)

Existing Emission Sources

Major emissions sources associated with proposed BMDS activities in the Arctic Tundra Biome include boilers, engines, hush houses, gas stations, fuel handling, chemicals, generators, storage tanks, miscellaneous equipment, and prescribed burning/firefighter training. Title V Air permits are maintained or applications have been submitted for some sites where proposed BMDS activities may occur. Existing natural emissions surrounding the Aleutian Islands stem primarily from regional volcanic activity.

The Arctic Tundra region absorbs more CO_2 than it releases. During the short summer, tundra plants absorb CO_2 through photosynthesis and release CO_2 through decomposition. However, due to the short, cool summer and freezing winter temperatures, plants cannot decompose. Remains of plants thousands of years old have been found in the tundra permafrost. In this way, the tundra traps the CO_2 and removes it from the atmosphere. However, every year an area of tundra permafrost melts and is lost due to rising global temperatures. As the tundra permafrost melts, the plant mass decomposes and returns CO_2 to the atmosphere.

H.1.2 Airspace

Controlled and Uncontrolled Airspace

Airspace above U.S. military airfields in the Arctic Tundra Biome includes controlled airspace and operates under Instrument Flight Rules (IFR). Alaskan airspace is located within the Anchorage Oceanic Control Area/Flight Information Region and within the U.S. Alaskan Air Defense Identification Zone. The Anchorage Air Route Traffic Control Centers (ARTCC) controls Alaskan airspace. Communication and radar products are sent and received at the Anchorage Center via satellite, ground, and microwave transmitters and receivers. Due to the mountainous terrain, many areas have marginal to no communications and may lack radar coverage. The publication, *Flight Tips for Pilots in Alaska*, provides information to pilots flying to and within Alaska. It should be used in addition to the current Alaska Supplement, Sectional Aeronautical Charts, World Aeronautical Charts, Airmen's Information Manual, current Notices to Airmen (NOTAMs), and current weather briefings.

The Arctic Tundra Biome also includes regions that are located in international airspace and therefore, the procedures of the ICAO are followed. Flight plans, notifications, and itineraries are mandatory for all operations over Canadian terrain. Current NOTAMs should be obtained, as well as the Canadian Flight Supplement, which updates the aeronautical charts every 56 days and lists facility frequencies. In sparsely settled areas, Air Navigation Orders require aircraft to be equipped with certain radio and emergency equipment. In addition, the Transport Canada Aviation Group has designated a mandatory frequency for use at selected aerodromes or aerodromes that are uncontrolled during certain hours.

The Danish Civil Aviation Administration is the authority in Greenland, where Thule AFB is located. Controlled airspace includes the Sondrestrom Flight Information Region for operations outside the shoreline of Greenland. Much of the airspace in Greenland is uncontrolled. With the exception of control zones and terminal control areas at Sondrestrom Airport and Thule AFB, the Sondrestrom Flight Information Region is uncontrolled airspace below Flight Level (FL) 195.

Special Use Airspace

Alaska has some of the largest Military Operations Areas (MOAs) in the world. Much of Alaska's aviation activity takes place within existing MOAs, through a shared-use agreement, with information provided by the Special Use Airspace Information Service, which is a system operated by the USAF under agreement with the FAA Alaskan Region to assist pilots with flight planning and situational awareness while operating in or around MOAs or Restricted Areas in interior Alaska. The service provides a means for civil and USAF pilots to obtain information regarding activity of aircraft so that pilots can fly safely in those areas. Pilots must be aware of the hazards associated with sharing special use airspace with aircraft of vastly different capabilities, as civilian aircraft are considerably slower and less maneuverable than their military counterparts.

In Canada, the Air Navigation Services and Airspace Services of Transport Canada are responsible for issues involved with airspace utilization and classification, levels of service for Air Navigation Service facilities, and services, including weather, navigation, radar, and communication services. Transport Canada issues NOTAMs regarding special use airspace and closures in Canada.

In Greenland, the Danish Civil Aviation Administration issues NOTAMs regarding restricted airspace. Special use airspace typically involves military ranges.

Airports/Airfields

Civilian, military, and private airports exist in the Arctic Tundra Biome. There are five major civilian airports, over 650 other airports registered with the FAA, and more than 3,000 airstrips in Alaska, most of which are designed for small aircraft, such as single engine planes and helicopters. Most of the airports are owned and operated by the State of Alaska and certified by the FAA. However, many airports are private and not maintained on a regular basis. As a result, runway conditions may not be favorable at some airport locations. Existing military airfields, which have runways that are paved and in good condition, would be used to support activities for the proposed BMDS.
The National Airports System of Canada is comprised of a core network of 26 airports that currently handles over 90 percent of all scheduled passenger and cargo traffic in Canada. These airports are the points of origin and destination for almost all inter-provincial and international air service in Canada. Locations of these airports include national, provincial, and territorial capitals, as well as airports that handle at least 200,000 passengers each year. Canada also has regional, local, military, and remote airports.
Greenland has both civilian and military airports, many of which are located in remote areas and have unpaved runways. Three airports in Greenland handle international flights, while the rest are used for air transportation between towns where ground transportation is not available.

En Route Airways and Jet Routes

Civilian aircraft generally fly along established flight corridors that operate under Visual Flight Rules (VFR). Numerous Minimum En route Altitudes are present in Alaska. Minimum En route Altitudes from 2,400 to 4,000 meters (8,000 to 13,000 feet) are common throughout the state, and in some areas they can be as high as 7,000 meters (23,000 feet).

The Transport Canada Aviation Group and Danish Civil Aviation Administration establish Minimum En route Altitudes and other routes for Canada and Greenland, respectively.

H.1.3 Biological Resources

Vegetation

Much of the Arctic Tundra Biome lies beyond the latitudinal tree line. As a result, vegetation on the Arctic Tundra consists of grasses, sedges, lichens, and willow shrubs. Tundra is characterized by treeless areas, which consist of dwarfed shrubs and miniature wildflowers adapted to a short growing season. At southern latitudes of the Arctic Tundra the vegetation changes into birch-lichen woodland and then into needleleaf forest. In some places, a distinct tree line separates forest from tundra. In the Arctic Tundra, the ground remains frozen beneath the top layer of soil, preventing trees from sending their roots down. Willows are able to grow on some parts of the Arctic Tundra, but only as low carpets about eight centimeters (three inches) high. Most plants grow in a dense mat of roots that has developed over thousands of years.

Vegetation common to the Arctic Tundra region includes arctic moss (*Calliergon giganteum*), arctic willow (*Salix arctica*), bearberry (*Arctostaphylos Uva-Ursi*), caribou moss (*Cladonia rangifernia*), diamond-leaf willow (*Salix pulcha*), labrador tea (*Ledum latifolium*), pasque flower (*Pulsatilla vulgaris*), and tufted saxifrage (*Saxifraga caespitosa*). Wet meadows are extensive throughout the Arctic Tundra region. Despite low annual precipitation, lakes and ponds are abundant, and their margins in certain seasons are red with Arctic pendantgrass (*Arctophila fulva)*. Wet meadows are dominated by pure and mixed stands of water sedge (*Carex aquatilis*), cottongrass (*Eriophorum*), and tundra grass (*Dupontia fisheri*). Exposed lake bottoms offer bare soil for colonization by plants.

Outside the reach of the modifying effects of the ocean, rises in temperature and changes in plants are significant. Tussock tundra is absent near the coast of the Arctic Ocean but is the dominant vegetation type inland and in the arctic foothills. Only prostrate (low-lying, horizontal) shrubs occur near the coast, but the abundance of willows increases inland, especially in riparian settings. Dwarf birch (*Betula nana*) forms thickets on the southern uplands. Balsam poplar (*Populus balsamifera*) persists well north of the tree line in the headwaters of several arctic rivers where gravels, through which ground water passes, are sheltered by benches and bluffs. (USGS, 1999)

Vegetation in the Aleutian Islands differs from that of mainland Arctic Tundra. For example, on Shemya Island, the predominant vegetative associations consist of beach grass (*Ammophila breviligulata*) that tends to colonize disturbed areas, and remnants of crowberry (*Empetrum* sp.) tundra. Beach grass dominates the shorelines within bays, inlets, and coves of the island. Other plants inhabiting this area are beach pea (*Lathyrus japonicus*), seabeach sandwort (*Honkenya peploides*), cow parsnip (*Heracleum maximum*), cinquefoil (*Potentilla sp.*), and species of sedge. The Aleutian tundra is composed mainly of grasses, sedges, heath, and composite families with an almost continuous mat of mosses and lichens. Dwarf shrubs such as crowberry, cloudberry (*Rubus chamaemorus*), lapland cornel (*Cornus suecica*), and blueberry (*Vaccinium* sp.) are located at higher elevations with better drainage. Forbs such as bistort (*Polygonum bistorta*), buttercup (*Ranunculaceae*), lousewort (*Pedicularis)*, monkshood (*Aconitum species)*, and violet (*Viola odorata*) are scattered throughout Shemya Island. There are no large native trees. Eelgrass (*Zostera marina*) beds are confined to lagoons and estuaries and are an important food source for waterfowl and invertebrates and provide food and rearing habitat for juvenile groundfish and salmon. Pondweed (*Potamogeton sp.*), water milfoil (*Myriophyllum spicatum*), and mare's tail (*Hippuris vulgaris L.*) are the primary freshwater vegetation. Large mosses and leafy liverworts are located in freshwater Aleutian streams. (U.S. Army Space and Missile Defense Command, 2000)

Although plant cover in the Aleutian Islands is sparse, the mountainous backbone of the islands and the fell-fields on the exposed slopes and ridge crests (even near sea level) provide habitats for some plants that are endemic to the Aleutians. These include Aleutian draba (*Draba aleutica)*, Aleutian chickweed (*Cerastium beringinanum* variety *aleuticum)*, Aleutian wormwood (*Artemisia aleutica)*, Aleutian shield-fern (*Polystichum aleuticum)*, and Aleutian saxifrage (*Saxifraga aleutica)*. Aleutian wormwood is known from only two islands, and the Aleutian shield fern is known only from Adak and is federally listed as an endangered species. Personnel at the Alaska Maritime National Wildlife Refuge, which administers the area, are attempting to find additional Aleutian shield fern populations and to protect the species from damage by introduced caribou. (USGS, 1999)

On numerous sites where activities for the proposed BMDS may occur, native vegetation has been removed, and the land is landscaped and maintained by mowing and brush control measures. Isolated pockets of vegetation may remain on sites where activities for the proposed BMDS may occur, however, vegetation on off-site areas is widespread and may be undisturbed.

Wildlife

Species of land mammals found on the Arctic Tundra consist of slightly modified shrews, hares, rodents, wolves, foxes, bears and deer. Large herds of caribou, or reindeer, which feed on lichens and plants, are present in North America. There are also smaller herds of musk oxen (*Ovibos Moschatus*). Wolves, wolverines (*Gulo gulo*), arctic foxes *(Alopex Lagopus)*, and polar bears (*Ursus maritimus*) are the predators of the Arctic Tundra. Smaller mammals include snowshoe rabbits (*Lepus Americanus*) and lemmings. Insect species are limited in the tundra, but black flies (*Simuliidae)*, deer flies (*Chrysops spp.*), mosquitoes (*Diptera – order*) and "no-see-ums" (tiny biting midges [*Culicoides furens*]) appear during the summer. Migratory birds such as the harlequin duck (*Histrionicus histrionicus*), sandpipers, and plovers have been sighted in marshy areas of the tundra.

Several lakes in the Arctic Tundra region support a small, unique assemblage of freshwater fishes, including Arctic grayling (*Thymallus Arcticus*), lake trout (*namaycush*), and burbot (*Lota lota*). However, many lakes and streams in the region, especially in mountainous areas, freeze severely in winter, often to the bottom. Consequently, habitat becomes extremely limited in winter, and fish may become concentrated in small areas of rivers and at the bottom of lake basins. In the Aleutian waters, freshwater fish species most used by humans are the Dolly Varden (*Salvelinus malma Walbaum*) and sockeye (*Oncorhynchus nerka*), pink (*Oncorhynchus gorbuscha*), coho (*Oncorhynchus kisutch*), and chum salmon (*Oncorhynchus keta*). (USGS, 1999)

Arctic mountain lakes support small numbers of breeding waterfowl, primarily ducks, during the summer. Golden eagles (*Aquila chrysaetos*) and merlins (*Falco columbarius*) commonly breed in mountainous regions of the Arctic Tundra, and gyrfalcons (*Falco rusticolus*) and peregrine falcons (*Falco peregrinus*) may nest where suitable cliff-nesting habitats are available. The Aleutian Islands provide nesting habitat for about ten million seabirds, which all feed heavily on fishes in the marine environment and may eat locally spawned young salmon. (USGS, 1999)

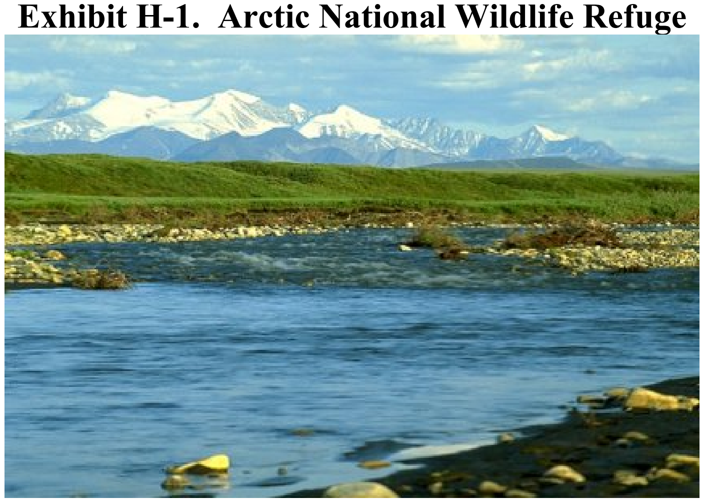
Marine mammals with Federal or state threatened or endangered status that may occur in the Aleutian Islands include the Steller sea lion (*Eumetopias jubatus*), northern sea otter (*Enhydra lutris)*, blue whale (*Balaenoptera musculus*), bowhead whale (*Balaena mysticetus*), fin whale (*Balaenoptera physalus*), humpback whale (*Megaptera novaeangliae*), northern right whale (*Eubalaena glacialis*), sperm whale (*Physeter macrocephalus*), and short-tailed albatross (*Phoebastria albatrus*). (U.S. Army Space and Missile Defense Command, 2002d) The recently delisted Aleutian Canada goose (*Branta canadensis leucopareia*) can occur in the area during migration. Several bird species that nest on Aleutian Islands include the mallard (*Anas platyrhynchos*), pelagic (*Phalacrocorax pelagicus*) and red-faced cormorant (*Phalacrocorax urile*), common eider (*Somateria mollissima*), bald eagle (*Haliaeetus leucocephalus*), Arctic (*Sterna paradisaea*) and Aleutian tern (*Sterna aleutica*), marbled murrelet (*Brachyramphus* *marmoratus*), and tufted puffin (*Fratercula cirrhata*). (U.S. Army Space and Missile Defense Command, 2003)

Environmentally Sensitive Habitat

Wetlands are typical of the Arctic Tundra. Lack of oxygen in the waterlogged soil of wetlands and cold ground temperatures delay the decomposition of plant and animal matter and limit productivity. Poor drainage of the underlying permafrost soils results in a build-up of organic materials, such as peat and humic substances, which tend to color the water brown. The amount of water in the ground also influences what will grow in a particular wetland. There are five basic types of wetlands found in the Arctic Tundra: bogs, fens, swamps, marshes, and shallow open water. Bogs and fens are the most common in this region.

Ecological reserves and wildlife refuges are found throughout the Arctic Tundra region. For example, the Arctic National Wildlife Refuge is the largest wild land unit in the U.S. National Wildlife Refuge System. The refuge consists of an intact, naturally functioning community of arctic and sub-arctic ecosystems. Such a broad spectrum of diverse habitats occurring within a single protected unit is unparalleled in the circumpolar north. The refuge also is an important part of a larger international network of protected arctic and sub-arctic areas. Exhibit H-1 shows the landscape of the refuge.

Exhibit H-1. Arctic National Wildlife Refuge



Source: USFWS, 2000

Two Aleutian sites and their waters (including submerged lands), Shemya Island and Adak Island, are part of the Alaska Maritime National Wildlife Refuge. Shemya Island also is part of the National Wildlife Refuge System. In addition, the USFWS has indicated that the Upper, Middle, and Lower Lake system of Shemya is of interest for its ability to support migratory birds and provide a resting place. Asian birds, not observed elsewhere in the U.S., are often blown off course during migration by storms and appear to be attracted by the airfield lights located in the vicinity of the lakes at Eareckson Air Station. (U.S. Army Space and Missile Defense Command, 2002d)

Protection of wildlife and natural resources is a concern throughout the Arctic Tundra, including international territories. The Conservation of Arctic Flora and Fauna, a working group of the Arctic Council, aims to conserve arctic biodiversity and to ensure that the use of arctic living resources is sustainable. The purpose of the Arctic Council, which consists of eight arctic countries, namely Canada, Denmark (which administers Greenland), Finland, Iceland, Norway, Sweden, the U.S., and the Russian Federation, is to provide a policy forum for discussion of environmental and sustainable development issues of common concern to the arctic-rim countries. The Conservation of Arctic Flora and Fauna advises the arctic governments on conservation matters and sustainable use issues of international significance and common concern.

Disturbance caused by boats or aircraft usually is controlled by distance or altitude regulations in protected areas and advisory restrictions elsewhere. Sometimes boat activities, such as the use of horns, are restricted. Exhibit H-2 provides examples of distance/altitude restrictions currently in place in some Arctic countries. Canada, Greenland, and the U.S. restrict the distance boats can approach breeding seabirds, but restrictions apply only to specific protected areas. Distance restrictions range from 15 meters (49 feet) for unmotorized boats in some reserves within Newfoundland, Canada to 1,600 meters (5,250 feet) in reserves in the U.S.

Arctic countries restrict the altitude below which aircraft cannot fly over a seabird colony. In general, minimum altitudes are in the range of 300-500 meters (984-1,640 feet) but are higher over some reserves in the U.S. (700 meters [2,300 feet]). Canadian flight manuals advise a minimum altitude of over 600 meters (2,000 feet) when flying over bird concentrations. In Greenland, advisory rules are in place restricting disturbance to wildlife caused by mineral resource exploration and extraction (directed mainly at helicopters).

Exhibit H-2. Regulation of Activities Near Seabird Colonies in Arctic Regions

Country	Closest Approach Distance by Boat	Boat Speed (maximum)	Aircraft Altitude (minimum)	Use of Boat Siren
	20 meters (66 feet) – motorized[1] 15 meters (49 feet) – non-motorized 100 meters (328 feet) or 50 meters (164 feet) off murre colonies	--	300 meters (984 feet) April 1 – September 1 in Newfoundland province reserves, most large colonies are marked on aeronautical charts	Not explicitly restricted but not allowed if disturbance to colony occurs
Greenland	500 meters (1,640 feet) for some protected colonies	18 kilometers per hour (11 miles per hour) [2]	500 meters (1,640 feet)	--
U.S.	100 – 1,600 meters (328 – 5,249 feet)	--	500 – 700 meters (1,640 – 2,297 feet)	--

Source: Modified from Chardine and Mendenhall, 2003
[1]Provincial regulation; Gull Island, Witless Bay- mixed Atlantic Puffin, Black-legged Kittiwake, Common Murre colony. Boat tour operators presently exempt
[2]Restriction in place for mineral exploration activities only

H.1.4 Geology and Soils

Geology

Geomorphic processes are distinctive in the Arctic Tundra, resulting in a variety of landforms. Under a protective layer of sod, water in the soil melts in summer to produce a thick mud that sometimes flows downslope to create bulges, terraces, and lobes on hillsides. The freeze and thaw of water in the soil sorts out coarse particles, giving rise to such patterns in the ground as rings, polygons, and stripes made of stones. The coastal plains have numerous lakes of thermokarst origin, formed by melting ground water. In some areas, a distinct tree line separates forest from the tundra. (Bailey, 1995)

Soils

Soil particles in the Arctic Tundra derive almost entirely from mechanical breakup of rock, with little or no chemical alteration. Continual freezing and thawing of the soil have disintegrated its particles. In the Arctic Tundra, the soil is very low in nutrients and minerals, except where animal droppings fertilize the soil. (Bailey, 1995) A matted accumulation of tundra peat is the predominant surficial soil on the Aleutian Islands.

This highly saturated material is typical of tundra regions. (U.S. Army Space and Missile Defense Command, 2002d)

Below the soil is the tundra's permafrost, a permanently frozen layer of earth. The majority of the Arctic Tundra Biome resides on a layer of permafrost. In the central and southern portions of the Arctic Tundra region, permafrost is discontinuous, absent on most southern exposures, and irregularly present adjacent to rivers and lakes. In more northern areas, the permafrost level may be two to four meters (six to 12 feet) deep. In the lowlands of the broad interior valleys, permafrost restricts drainage and accounts for the presence of extensive wetlands that form a complex of marshes, shrub thickets, small ponds, and forested islands.

During the short summers, the top layer of soil may thaw just long enough to allow plants to grow and reproduce. Water from melting permafrost and snow forms lakes and marshes each summer because the saturated ground cannot absorb any more water beneath its surface.

Geologic Hazards

Geologic hazards in the Arctic Tundra Biome include earthquakes, forest fires, volcanic activity, avalanches, and flooding. Volcanic eruptions in Alaska average one to two per year and significantly affect air transportation every three to four years.

Earthquake epicenters are scattered throughout the Arctic Tundra Biome, especially throughout the Aleutian Islands. The Aleutians extend nearly 1,900 kilometers (1,180 miles) from the tip of the eastern Alaskan Peninsula to the western tip of Attu Island. The island arc is the product of the convergence of the Earth's crustal plates, formed when the massive Pacific plate was forced downward beneath the Bering Sea plate. This rupturing of the Earth's crust is characterized by extreme tectonic activity, frequent earthquakes, and extensive volcanism. Of the 76 volcanoes throughout the Aleutians, about 40 have been active in the last 250 years. (USGS, 1999)

For example, Shemya Island falls within seismic zone 4, which reflects the highest hazard potential for earthquakes and severe ground shaking. Eareckson Air Station also is susceptible to tsunamis (tidal waves) resulting from earthquake ground displacements and earthquake triggered submarine landslides. (U.S. Army Space and Missile Defense Command, 2002d)

H.1.5 Hazardous Materials and Hazardous Waste

Hazardous Materials

Installations where MDA activities for the proposed BMDS may occur may store and use large quantities of hazardous materials, including a variety of flammable and combustible liquids. Hazardous materials stored at these installations may include fuels, antifreeze, paints, paint thinners and removers, adhesives, lead-acid batteries, nickel-cadmium batteries, plating solution, epoxy primer, lubricants, solvents, pesticides, and sodium dichromate. Materials used for boat, vehicle, and aviation repair; power and heat generation; wastewater treatment; photo processing; and building maintenance also are common. Fuels may include aviation gasoline, motor gasoline, and diesel fuel. Fuels can be transported to the sites via pipeline, truck, rail, or aircraft.

Procedures for managing hazardous materials are developed to establish standard operating procedures for the correct management and storage of hazardous materials at installations. Hazardous material inventories are regularly reviewed and updated as needed. Due to the extreme climate, special measures may be necessary for storage and handling of hazardous materials in arctic areas.

Hazardous Waste

Hazardous wastes generated at MDA installations where activities for the proposed BMDS may occur typically are associated with equipment maintenance. Wastes generated by the facility include oils, fuels, antifreeze, paint, paint thinner and remover, photo chemicals, pesticides, aerosol canisters, batteries, used acetone, sulfuric acid, and sewage sludge. Procedures are developed for managing hazardous wastes at sites where activities for the proposed BMDS may occur. The procedures include details necessary for maintaining compliance with U.S. and international regulations when handling hazardous waste.

Aboveground storage tanks with a range of capacities may be present at specific sites. The tanks and any supporting equipment are periodically inspected using visual inspection, hydrostatic inspection, or a system of nondestructive shell thickness testing. Protection of the contents of aboveground storage tanks from the extreme climate of the Arctic Tundra Biome is necessary. Sites where activities for the proposed BMDS may occur also may have underground storage tanks with a range of capacities. However, underground storage tanks are not likely to be found in areas where permafrost occurs.

H.1.6 Health and Safety

All activities associated with the proposed BMDS would comply with Federal, state, and local laws and regulations applicable to worker and environmental health and safety. All sites where activities for the proposed BMDS may occur have established safety plans for various operations and accident scenarios, including the range; region; ordnance management; ocean area; fire and crash; rocket propellant and motor exhaust constituents; electromagnetic radiation (EMR); communications-electronics frequency; ESQD arcs; and sea range concerns. These safety plans are coordinated with the appropriate local governments.

The MDA would take every reasonable precaution during the planning and execution of the operations, training exercises, and test and development activities to prevent injury to human life or property. Potential hazards from explosive devices, physical impact, EM hazards, chemical contamination, ionizing and non-ionizing radiation, and lasers are considered in the safety plans. (U.S. Department of the Navy, 1998)

Where applicable, warning areas are established in international airspace and waters to contain activity that may be hazardous, and to alert pilots and captains of nonparticipating vessels to the potential danger. NOTAMs and Notices to Mariners (NOTMARs) are published and circulated in accordance with established procedures to provide warning to pilots and mariners (including recreational users of the space) that outline any potential impact areas that should be avoided.

Launch complexes and impact areas are generally located in remote areas often on military installations or ranges. Launches generally do not overfly areas where the majority of site personnel are located. Mission-essential personnel are instructed in safety procedures and equipped with necessary safety devices such as hearing protection. A launch can proceed only after all required safety evacuations have been accomplished to ensure that no unauthorized personnel are present in hazardous areas. Flight safety procedures include determining the dimensions of the safety zone surrounding the launch and impact area; identifying areas of the site that are evacuated for each mission; and activation of the FTS in the event of missile failure. Areas that are exposed to debris should be evacuated even though risk may be considered minimal.

Health and safety procedures should be available in site-specific operating documents.

H.1.7 Noise

Eareckson Air Station is a representative location where activities for the proposed BMDS may occur in the sparsely populated Arctic Tundra Biome. Eareckson Air Station is located on Shemya Island, which has no population other than personnel associated with the air station, and would be expected to have a background noise level of day/night average sound level (L_{dn}) less than or equal to 55 dBA. Shemya Island is quiet due to the prevailing winds, and aircraft noise is heard only when standing next to the airfield. The closest civilian community is approximately 604 kilometers (375 miles) from Shemya Island. (U.S. Army Space and Missile Defense Command, 2000)

The principal sources of noise from missile defense operations are vehicular traffic and military activities, including aircraft operations, rocket testing, and rocket launches. Frequency and duration of noise from military activities vary as a factor of the irregular training schedules, and noise levels vary with the type of activities at these facilities. Sonic booms are experienced near some of these facilities. Facilities that generate high outdoor noise levels have established programs with the goal of ensuring compatibility with land uses in the vicinity of these facilities. Examples of these programs are the Air Installation Compatible Use Zone program for DoD air installations and the Installation Compatible Use Zone program for Army installations and facilities. (BMDO, 1994)

Noise from missile defense activities, while intermittent, can be fairly loud. For example, noise from weapons testing typically ranges from 112 to 190 dBA. The noise levels on the ground from a helicopter at 460 meters (1,500 feet) and 76 meters (250 feet) of altitude are 79 dBA and 95 dBA, respectively. Maintenance equipment, such as the tracked vehicles used for trail maintenance, can generate noise levels up to 105 dBA. Aircraft noise occurs during aircraft engine warm-up, maintenance and testing, taxiing, takeoffs, approaches, and landings.

Generally, sites where activities for the proposed BMDS may occur are located far from towns and population centers and are surrounded by open space.

Ambient noise levels have the potential to impact wildlife resources. Because there are no absolute standards of short-term noise impacts to potentially noise-sensitive species, a short-term maximum noise exposure of 92 dB has been suggested as a significance cut-off for impacts. (U.S. Army Space and Missile Defense Command, 2002c) Measurements of ambient sound levels should be analyzed in site-specific environmental documents.

H.1.8 Transportation

Ground Transportation

Roadway travel in the Arctic Tundra Biome is generally limited due to the vast, undeveloped terrain. Highways decrease as one moves northward. Especially in the Arctic Tundra, roads between towns may be nonexistent. The quality of roads also varies greatly. Many roads in developed areas are two lanes and paved, however, some roads in remote areas may be unpaved and covered with dirt or gravel.

Due to the limited number of roadways, the traffic volume in sparsely populated areas tends to be greater than the volume experienced in urban areas. The summer months experience the highest amount of traffic, due to tourism and good weather.

Ground transportation also includes railway systems. The Arctic Tundra Biome includes systems that provide freight, passenger, and intermodal transportation across North

America, as well as regional and local service railways. Some rail lines, especially those located in northern regions of this biome, pass through scenic areas such as fjords, national parks and forests, mountains, and historic rivers.

Given the vast area of the Arctic Tundra Biome and the limited road network, aircraft provide an alternate means of transportation. Private and military aircraft comprise a large portion of air traffic in this region. Helicopters serve many domestic routes; especially where towns lack airstrips and ground transportation is not available. Chartered airplanes often are used for passenger service.

Air Transportation

Given the vast area of the Sub-Arctic Taiga Biome and the limited road network, aircraft provide an alternate means of transportation. Private and military aircraft comprise a large portion of air traffic in this region. Helicopters serve many domestic routes; especially where towns lack airstrips and ground transportation is not available. Chartered airplanes often are used for passenger service.

Marine Transportation

Marine travel tends to be limited in the Arctic Tundra Biome due to glacial patches found throughout many waterways. Transit operations in the arctic ice have proven hazardous to many large vessels in the past, especially cargo and merchant ships. The use of air transportation for cargo has alleviated the need for sea transportation in the Arctic. However, both local residents and tourists visiting this northern environment commonly rely on marine transportation. Small commercial vessels are used primarily for ferry passenger service and fishing activities and often are limited to designated waterways.

H.1.9 Water Resources

Surface Water and Ground Water Resources

In the Arctic Tundra, alluvial deposits are the principal aquifers for ground water, which is greatly restricted by permafrost. When under pressure from frost, ground water may burst to the surface in places, forming conical hills of mud and debris called pingos.

The Arctic Tundra Biome is characterized by permafrost, or ground that is permanently frozen. Because the permafrost has no cracks or pores, water is unable to penetrate it. There is little to no surface water in winter. During the summer, the surface layer above the permafrost, known as the active layer, thaws. The thickness of the active layer depends on its location in the tundra; the active layer becomes thinner in more northerly locations. As a result, during the summer, the Arctic Tundra is characterized by large quantities of surface water. When snow melts, the water percolates through the active layer but is unable to penetrate the permafrost. Pools of water form on the surface, and the active layer becomes saturated. The thawing permafrost creates wetland conditions, dotting the landscape with countless lakes, bogs, streams, and meadows. Surface waters in the Arctic Tundra tend to be acidic and rich in organic material. In addition, glaciers are present throughout the Arctic Tundra region.

Different types of streams may be found throughout the Arctic Tundra. Glacier streams are fed from glacier melt water. While glacier-fed streams have moderate nutrient levels, which are supplied by subsurface runoff of the melt water, they also have very high sediment loads. The sediment is made up of fine rock particulates called glacial "flour." This suspended sediment blocks light and scours the stream bottom. Glacier-fed streams also have highly variable discharge and water temperature on a diurnal cycle and are high gradient streams with unstable substrate. These factors inhibit the colonization of substantial amounts of algae and insects, leading to low biodiversity.

Tundra streams have clear water that is often stained light brown with organic matter from the tundra. Many nutrients are locked within the permafrost, although there may be pulses of high nutrient levels during the spring runoff. The low gradient and generally stable flows of most tundra streams allow for the colonization of benthic algae and insects. However, a short growing season and the lack of phosphorus limit substantial algal accumulation.

Water Quality

Surface water and ground water quality is generally good in the Arctic Tundra Biome except in isolated areas of known contamination.

Although soils in the Arctic Tundra Biome are strongly acidic, pH of regional surface waters in North America is around 7, ranging from 6.8 to 7.5 in streams and 7.1 to 7.3 in lakes. The relatively high pH and capacity of streams and lakes to buffer acid inputs from natural and man-made sources are presumed to be the result of ions (e.g., calcium and magnesium) that have been carried into the atmosphere with sea spray and subsequently returned in rainfall. This is a common occurrence in coastal maritime regions. (Wetzel 1975, as referenced in FAA, 1996)

H.2 Sub-Arctic Taiga Biome

The Sub-Arctic Taiga Biome discussion focuses on the sub-arctic regions of North America, including portions of Alaska. This biome is generally located between latitudes 50 and 60 degrees north (see Figure 3-12). The sub-arctic climate zone coincides with a great belt of needleleaf forest, often referred to as boreal forest, and with the open lichen woodland known as taiga. Existing inland sites found in Alaska in the Sub-Arctic Taiga

Biome include Fort Greely (which includes Delta Junction), Clear Air Force Station, Eielson AFB, and Poker Flat Research Range.

Coastal sites also are located in the Sub-Arctic Taiga Biome, including portions of southwestern and western Alaska. Coastal sites are influenced by the cool climate generated by the cold waters of the North Atlantic Ocean and share maritime characteristics. Existing coastal sites where proposed BMDS activities may occur are found in Alaska in the Sub-Arctic Taiga Biome and include the KLC and Port of Valdez.

H.2.1 Air Quality

Climate

The climate of the Sub-Arctic Taiga Biome shows great seasonal range in temperature and rapid seasonal changes. Winters are severe and the cold, snowy forest climate remains moist all year, with cool, short summers. The average temperature is below freezing for six months out of the year. Winter is the dominant season and the temperature range is -54°C to -1°C (-65°F to 30°F). All moisture in the soil and subsoil freezes solidly to significant depths because average monthly temperatures remain subfreezing for six to seven consecutive months. Summers are mostly warm, rainy, and humid, and temperatures range from –7°C to 21°C (20°F to 70°F). Summer warmth is insufficient to thaw more than the surface, so permafrost prevails under large areas. Seasonal thaw penetrates from 0.6 to four meters (two to 14 feet), depending on latitude, aspect, and kind of ground. Altitude strongly influences the presence and extent of permafrost.

The total precipitation in a year is 30 to 85 centimeters (12 to 33 inches), which may fall as rain or snow or accumulate as dew. Most of the precipitation in the taiga falls as rain in the summer. Fire is a natural feature of the ecology of this biome. Early summer is often dry with an increased risk of fires, which are caused primarily by lightning.

Coastal locations in the Sub-Arctic Taiga Biome have a marine phase of the tundra climate, which is characterized by long, cold winters and short, cool summers. Maritime tundra dominates throughout southwestern and western Alaska and is the product of the cool climate generated by North Atlantic Ocean waters. The Arctic Ocean, which receives relatively warm north-flowing currents from the Atlantic and Pacific, acts as a moderating influence on the climate of the maritime tundra. Annual temperature ranges are much smaller in the marine phase than other sub-arctic regions. Winters are milder, and annual precipitation is greater. The average January temperature is about 16°C (3°F), and average temperatures in July are below 10°C (50°F). Fairly heavy snowfall occurs in winter and heavy concentrations of rain occur in summer. Average annual precipitation is about 46 centimeters (18 inches), and average annual snowfall ranges from 100 to 200 centimeters (39 to 78 inches).

Surface winds along the coast are much stronger and more persistent than at inland areas. For example, on Kodiak Island, while winds tend to be from the northwest at about 19 kilometers (12 miles) per hour, high winds occur throughout the year. Peak gusts range from 56 kilometers (35 miles) per hour in June to 134 kilometers (83 miles) per hour in December. Typically one day of heavy fog occurs per month, with visibility of 0.4 kilometer (0.25 mile) or less. The largest monthly snowfall occurs during December and January, with the maximum snowfalls ranging from 100 to 110 centimeters (40 to 45 inches) per month. (U.S. Army Space and Missile Defense Command, 2003)

Regional Air Quality

Air quality in the Sub-Arctic Taiga Biome generally is considered favorable; however, some areas in and around urban centers, such as Anchorage and Fairbanks are in non-attainment for CO concentrations, as designated by the U.S.

The primary pollutant of concern from mobile sources in Alaska is CO. According to Fairbanks North Star Borough studies, approximately 90 percent of all CO produced within the borough is from vehicles. (U.S. Army Space and Missile Defense Command, 2002d) During episodes of cold winter weather, atmospheric inversions may trap contaminants and cause exceedances of the NAAQS or state standards. Vehicle "cold starts" during moderately cold weather, prolonged idling periods, and low-level temperature inversions contribute to pronounced air quality impacts from motor vehicle emissions in cold climates. For example, up to 80 percent of CO emissions contributing to exceedances of the NAAQS in Fairbanks have been attributed to mobile sources. Other pollutants from mobile sources include hydrocarbons, NO_X, and particle emissions. (U.S. Army Space and Missile Defense Command, 2002d)

Mixing heights (altitudes at which pollutants and atmospheric gases are thoroughly combined) in the Sub-Arctic Taiga Biome adversely affect regional air quality and vary greatly depending on atmospheric conditions. The mixing height is generally highest during afternoon hours and lowest during the evening and early morning. However, temperature inversions, which occur most often in the winter, may cause extended periods of low mixing heights. Low mixing heights adversely affect regional air quality. For example, mixing heights in the taiga may range from 198 meters (650 feet) on winter mornings to 604 meters (1980 feet) on summer afternoons.

Existing Emission Sources

Emissions from activities for the proposed BMDS include CO, NO_x, SO_x, VOCs, hazardous air pollutants (HAPs), and particulate matter (PM). In coastal areas, wind-blown volcanic dust is the primary air contaminant. Major emissions sources associated with activities for the proposed BMDS in the Sub-Arctic Taiga Biome would include boilers, engines, hush houses, gas stations, fuel handling, chemicals, generators, storage tanks, miscellaneous equipment, and prescribed burning/firefighter training. Most sites where activities for the proposed BMDS may occur would be classified as a major emissions source. Sites where activities for the proposed BMDS may occur maintain, or have submitted an application for, Title V Air Permits. For example, Clear Air Force Station operates under a Title V Air Permit. (U.S. Army Space and Missile Defense Command, 2002d)

H.2.2 Airspace

Controlled and Uncontrolled Airspace

Airspace above U.S. military airfields in the Sub-Arctic Taiga Biome generally includes controlled airspace and operates under IFR. In positive controlled areas, aircraft separation and safety advisories are provided by air traffic control centers. In general controlled airspace, operations may be either under IFR or VFR, and traffic advisories may be provided to aircraft operating under VFR. In uncontrolled airspace, operations may be under VFR or IFR, but no air traffic control is provided.

Alaskan airspace is located within the Anchorage Oceanic Control Area/Flight Information Region and within the U.S. Alaskan Air Defense Identification Zone. The Anchorage Air ARTCC controls Alaskan airspace. Communication and radar products are sent and received at the Anchorage Center via satellite, ground, and microwave transmitters and receivers. Due to the mountainous terrain, many areas have marginal to no communications and may lack radar coverage. The publication *Flight Tips for Pilots in Alaska* provides information to pilots flying to and within Alaska. It should be used in addition to the current Alaska Supplement, Sectional Aeronautical Charts, World Aeronautical Charts, Airmen's Information Manual, current NOTAMs, and current weather briefings.

Special Use Airspace

Alaska has some of the largest MOAs in the world. Much of Alaska's aviation activity takes place within existing MOAs, through a shared-use agreement, with information provided by the Special Use Airspace Information Service, which is a system operated by the USAF under agreement with the FAA Alaskan Region to assist pilots with flight planning and situational awareness while operating in or around MOAs or Restricted Areas in interior Alaska. Special use airspace designations typically are coordinated with airspace users through existing protocols for the site where activities for the proposed BMDS may occur, commercial aircraft carriers, and military aircraft. In addition, military facilities may have missile-firing ranges, drop zones, air-to-ground training weapons ranges, ammunition storage areas, and restricted areas. Pilots are advised to avoid overflight of such areas.

Airports/Airfields

There are over 650 civilian, military, and private airports registered with the FAA and more than 3,000 airstrips in Alaska. Most of the airports are owned and operated by the State of Alaska and certified by the FAA. However, many airports are private and not maintained on a regular basis. As a result, runway conditions may not be favorable at some airport locations. Existing military airfields, which have runways that are paved and in good condition, would be used to support activities for the proposed BMDS.

En Route Airways and Jet Routes

Civilian aircrafts generally fly along established flight corridors that operate under VFR. Numerous Minimum En route Altitudes are present in Alaska. Minimum En route Altitudes from 2,400 to 4,000 meters (8,000 to 13,000 feet) are common throughout the state, and in some areas they can be as high as 7,000 meters (23,000 feet).

H.2.3 Biological Resources

Vegetation

The vegetation of the Sub-Arctic Taiga Biome is primarily boreal forest, which is a complex array of plant communities shaped by fire, soil temperature, drainage, and exposure. Forest types are mixed and species composition is determined by steepness of slopes, aspects (the cardinal direction a slope faces), and fire histories. Natural wildfires, which are a critical component of the boreal forest biome, occur about every 50 to 70 years. Vegetation at and near sites where activities for the proposed BMDS may occur located in interior Alaska is typical of boreal forest regions.

The boreal forest is a transition zone of scattered coniferous or evergreen trees and shrubs, which are mixed with tundra vegetation. The most common trees are balsam fir, spruce, and larch. The conifers of the boreal forest are white spruce (*picea glauca*), which are found on well-drained floodplain soils, uplands, and south-facing slopes where seasonal thaw is deep. Black spruce (*Picea mariana*) grows in lowlands and on north-facing slopes where the annual thaw is shallow and permafrost is close to the surface. A broad-leaved deciduous forest of quaking aspen (*Populus tremuloides*), balsam poplar (*Populus balsamife*ra), and Alaska paper birch (*Betula neoalaskana*) is prominent on well-drained uplands, whereas floodplain forests are composed of balsam poplar, white spruce, paper birch mixed with mountain alder (*alnus tenuifolia*) and several species of willow. White birch, (*Betula papyrifera*) one of the few deciduous trees able to withstand the cold climate, also is found in this region. There is little precipitation and a short growing season. The stunted and slow-growing trees often are of little use to humans.

Rocky areas in the central part of the boreal forest region contain small trees but little other vegetation. The rest of this region is covered mainly with lakes and swamps called muskegs. Dense growths of spruce and tamarack (*Larix laricina*) are found around the edges of muskegs while many shrubs and cranberries (*Vaccinium oxycoccus*) grow near the center.

In coastal regions, plant life is transitional between the Arctic Tundra and Sub-Arctic Taiga regions. Lava fields of recent origin provide unusual sites for plants. Groves of balsam poplar and other boreal forbs and ferns, which are common in the boreal forest but unusual here, occur in the immediate vicinity of hot springs, presumably because soils are suffused with warm mineral waters. Clusters of pingos and thermokarst lakes (sites of erosion and subsidence by thawing of permafrost) occur in the interior lowlands, which were formed by large rivers, and also may occur in association with isolated groves of balsam poplar where other trees are absent. In the sedge-graminoid meadows where flooding occurs, important taxa include the Ramenski sedge (*Carex ramenski*), loose-flowered alpine sedge, Lyngby sedge (*Carex Lyngbyei*), reedgrass, forbs silverweed cinquefoil, and low chickweed (*stellaria media*).

Sandy beaches are common in the maritime areas, some of which are associated with dune fields. Mudflats support open communities of halophytic plants that are adapted to a saline environment and include grasses, sedges, and forbs such as creeping alkaligrass *(Puccinellia phryganodes),* Hoppner sedge *(Carex subspathacea),* sea-beach sandwort *(Honkenya peploides),* and oysterleaf *(Mertensia maritime).* The sandy beaches are dominated by beach ryegrass *(Elymus arenarius)* and forbs such as beach pea and seaside ragwort *(Senecio resedifolius).* In places where dunes formed, strong floristic differences exist between plants on prominences and those in depressions, and between plants on dunes and those on backslopes.

On numerous sites where activities for the proposed BMDS may occur, native vegetation has been removed, and the land is landscaped and maintained by mowing and brush control measures. Isolated pockets of vegetation may remain on sites where activities for the proposed BMDS may occur, however, vegetation on off-site areas is widespread and may be undisturbed.

Wildlife

The interior areas of the Sub-Arctic Taiga Biome are populated with unique animals that have techniques for preserving warmth and staying dry. Animals of the taiga tend to be predators such as the lynx and members of the weasel family such as wolverines, bobcats (*Lynx rufus*), minks (*Mustela vison*), and ermine (*Mustela erminea*), which hunt herbivores such as snowshoe rabbits, red squirrels (*Tamiasciurus hudsonicus*), and voles. Red deer (*Cervus elaphus*), elk (*Cervus Canadensis*), and moose (*Alces alces*) can be found in regions of the taiga where more deciduous trees grow. Many insect-eating birds come to the boreal forest to breed and leave at the end of the breeding season. Seed-eating birds, such as finches and sparrows, and omnivorous birds, such as crows, are present year-round. The wildlife at sites where activities for the proposed BMDS may occur in interior Alaska is typical of the fairly undisturbed nature of the surrounding taiga.

Fish species that occur in the freshwaters of the taiga include chinook (*Oncorhynchus tshawytscha*), chum, and coho salmon; rainbow trout (*Salmo gairdneri*); sheefish (*Stenodus leucichthys*); humpback (*Coregonus clupeaformis*) and round whitefish (*Propopium cylindraceum*); least cisco (*Coregonus sardinella*); Arctic grayling (*Thymallus arcticus*); lake trout; northern pike (*Esox lucius)*; and burbot. Adaptations of fish species to different systems or to different parts of the same system have sometimes caused complex migrations to overwintering, spawning, and feeding sites. Large numbers of breeding waterfowl summer on wetlands of the boreal forest, and thousands more pass through this region during migration. The region is important for trumpeter swans (*Cygnus buccinator*) and tundra swans (*Cygnus colombianus*), canvasbacks (*Aythya valisineria*), and greater white-fronted geese (*Anser albifrons*). Bald eagles (*Haliaeetus leucocephalus*) that breed along major river systems have maintained relatively stable populations. The recently delisted American peregrine falcon (*Falco peregrinus anatum*) and arctic peregrine falcon (*Falco peregrinus tundrius*) migrate through the area during the spring and fall migration periods. Four other species are of special concern because of declining population trends throughout North America: the olive-sided flycatcher (*Contopus borealis*), gray-cheeked thrush (*Catharus minimus*), Townsend's warbler (*Dendroica townsendi*), and blackpoll warbler (*Dendroica striata*). (USGS, 1999)

In coastal areas of the Sub-Arctic Taiga Biome, the freshwaters include fish species such as the sheefish, whitefishes, Arctic grayling, Arctic char (*Salvenlinus alpinus*), Dolly Varden (*Salvelinus malma Walbaum*), rainbow trout, northern pike, Alaska blackfish (*Orcinus orca*), and five salmon species (sockeye, coho, chinook, chum, and pink). In some coastal areas, freshwaters are subject to severe freezing in winter, making springs important to the overwinter survival of freshwater fishes. The region's spawning (anadromous) and freshwater resident fishes and their eggs provide food for a diversity of mammals, birds, and other fishes.

All estuarine and marine areas out to the Exclusive Economic Zone of the U.S. used by Alaskan Pacific salmon are designated as Essential Fish Habitat for salmon fisheries. Salmon occur in the Prince William Sound mainly from June through September as they return from the ocean to spawn. Essential Fish Habitat also has been designated for scallops and Gulf of Alaska ground fish in the Port of Valdez. (U.S. Army Space and Missile Defense Command, 2003)

The coastal sub-arctic region supports large populations of brant *(Branta bernicla),* cackling Canada geese *(Branta canadensis minima),* emperor geese *(Anser canagicus),* and greater white-fronted geese *(Anser albifrons).* Birds of prey are relatively rare in this area, although the pealei subspecies of peregrine falcons *(Falco peregrinus pealei)* is common around seabird colonies. The large numbers of shorebirds that breed on coastal maritime tundra in western Alaska include the world's population of black turnstones *(Arenaria melanocephala)* and most of the world's population of bristle-thighed curlews *(Numenius tahitiensis).*

The mammalian fauna of this region is composed of shared elements from the boreal forest (muskrat [*Ondatra zibethicus*], northern red-backed vole [*Clethrionomys rutilus*], tundra vole [*Microtus oeconomus*], and red fox [*Vulpes vulpes*]) and from the Arctic Tundra (Greenland collared lemming [*Dicrostonyx groenlandicus*], Arctic ground squirrel [*Spermophilus parryii*], and Arctic fox [*Alopex lagopus*]). Species that have been absent from much of the area in the recent past include the moose, caribou, snowshoe hare (*Lepus Americanus*), lynx (*Felis lynx*), beaver (*Castor Canadensis*), coyote (*Canis latrans clepticus*), and gray wolf (*Canis lupus*), however, many of these species have begun to return to the maritime tundra region. (USGS, 1999)

Marine mammals with Federal or state status that may occur in the coastal areas of the Sub-Arctic Taiga Biome include the Steller sea lion, humpback whale *(Megaptera novaeangliae)*, Northern right whale, Sei whale *(Balaenoptera borealis),* blue whale *(Balaenoptera musculus),* fin whale, sperm whale, short-tailed albatross, and Steller's eider. For example, consistent and extensive use of the Kodiak area by the Steller's eider has been observed. Although critical habitat has not been designated in the Kodiak Archipelago, the area still contains important habitat for Steller's eiders and protection afforded by the Endangered Species Act still applies. Critical habitat for the Steller sea lion includes a special aquatic foraging area in the Shelikof Strait area consisting in part of an area between the Alaskan Peninsula and the western side of Kodiak Island. (U.S. Army Space and Missile Defense Command, 2002d)

Environmentally Sensitive Habitat

Wetlands in the U.S. support vegetation, provide habitat for fish and wildlife, and contribute to flood control and sediment retention. Palustrine, emergent, persistent, seasonally flooded and palustrine scrub/shrub, broad-leaved deciduous, saturated wetlands are located throughout the Sub-Arctic Taiga Biome. Most wetlands in the Sub-Arctic Taiga generally are classified as palustrine (non-flowing) or riverine, which occur alongside rivers and streams. The most common type of vegetated wetland is black spruce (*Picea mariana*) wetlands. On most wetlands in the sub-arctic region, wet soils result from poor drainage caused by permafrost.

Extensive deposits of sand and sand dunes were formed over some present-day boreal forest areas in the late glacial time. Forest cover stabilized many of these deposits, but others remain exposed along riverbanks and deltas. For example, the exceptional, extensive, active dune fields of the Great Kobuk Sand Dunes occur on the middle Kobuk River, where the wildflower Kobuk locoweed (*Oxytropis kobukensis*) is endemic, and on the Nogahabara Sand Dunes of the Koyukuk River, which is the sole Alaskan locality of the Baikal Sedge (*Carex sabulosa*), a sedge of desert-steppe landscapes in Asia. This species is known from North America only from similar habitats in a few localities in the southwestern Yukon Territory, Canada. These unique landscapes and their plant complexes are protected because they are located in national parks or national wildlife refuges. (USGS, 1999)

Steppe vegetation can be located and defined by its south-facing topographic aspect. The steepest portions of slopes are generally treeless, presumably because of drought and geomorphic instability. Each steppe site can be thought of as a small island in a sea of forest. The steppe bluffs are characterized by rare plant taxa. The vascular plants of these steppe bluffs, for example, the disjunct species American alyssum (*Alyssum obovatum*) and the wormwood *Artemisia laciniatiformis*, occur only in the sub-arctic interior of Alaska and in the adjacent Canadian Yukon Territory. Researchers are exploring how these isolated plant communities became established on these bluffs and why they remain so restricted. (USGS, 1999)

Coastal areas of the Sub-Arctic Taiga support unique populations of freshwater fishes. These populations are considered to have intrinsic ecological values that reach beyond this region because they have not been genetically altered by releases of fishes from hatcheries and represent some of the only truly wild populations left in the world. (USGS, 1999)

H.2.4 Geology and Soils

Geology

High mountains, broad lowlands, diverse streams and lakes, and complex rock formations characterize the geology of the Sub-Arctic Taiga Biome. High mountains in inland areas shelter the interior from the moist maritime air that occurs in the south and the cold arctic air characteristic of the north. The uplift of foothills, advance and retreat of glaciers, and subsequent erosion by major drainages originating in the Alaska Range and foothills have provided the source for major sedimentary deposition throughout the Sub-Arctic Taiga Biome. Beaches, lagoons, and sandy sediments also characterize coastal areas.

Soils

The boreal forest grows on poorly developed soils with pockets of wet, organic histosols. These light gray soils are wet, strongly leached, and acidic; they form a highly distinct layer beneath a topsoil layer of organic matter. Agricultural potential is poor due to the natural infertility of soils and the prevalence of swamps and lakes left by departing ice sheets. In some places, ice has scoured rock surfaces bare. Elsewhere, rock basins have been formed and stream courses dammed, creating countless lakes. (Bailey, 1995)

Permafrost is mostly continuous in the northern portion of the boreal forest region, except in riverbeds, beneath lakes, and on steep, south-facing bluffs. Permafrost is permanently frozen soil, subsoil, or other deposit and is characteristic of arctic and some sub-arctic regions. Permafrost is a thermal condition in which the ground remains at a temperature below freezing, year-round. In permafrost regions, summers are only long and warm enough to thaw the surface of the ground, known as the active layer. In coastal areas, permafrost is generally absent or discontinuous.

Soils in the coastal areas are typically rocky, organic, or volcanic. These soils support tall brush, grass, and some moist tundra at higher elevations and coastal spruce on lower slopes. Limitations on types of vegetation are due not only to soil types but also to land slopes. Soils in the maritime region are formed in ash deposits of various thicknesses and are underlain by glacial gravel or silty sediments. Coastal plain soils are formed in gravels, cinders, or weathered rock blanketed by thick sedge peat. Permafrost is sporadic or absent. The maritime taiga is characterized by poor drainage of surface water.

Geologic Hazards

Geologic hazards in the Sub-Arctic Taiga Biome include earthquakes, forest fires, volcanic activity, avalanches, and flooding. Volcanic eruptions in Alaska average one to two per year and significantly affect air transportation every three to four years. The coastal regions of the taiga are subject to ash falls from active volcanoes in the Aleutian chain. Over 40 volcanoes are active in the Aleutian arc.

Earthquake epicenters are scattered throughout the interior Sub-Arctic Taiga Biome. For example, portions of Alaska are located in Seismic Zone 3, a northeast-trending band of seismic activity, where major earthquake damage has a ten percent probability of occurring at least once in 50 years. An average of five or six earthquakes a year is actually felt in this zone. In June 1967, a series of three earthquakes of about magnitude six had epicenters in this seismic zone. In November 2002, the Denali Fault earthquake occurred on the Denali-Totschunda fault system with a magnitude of 7.9.

H.2.5 Hazardous Materials and Hazardous Waste

Hazardous Materials

Installations where activities for the proposed BMDS may occur may store and utilize large quantities of hazardous materials, including a variety of flammable and combustible liquids. Hazardous materials stored at these installations in the Sub-Arctic Taiga Biome may include fuels, antifreeze, paints, paint thinners and removers, adhesives, lead-acid batteries, nickel-cadmium batteries, plating solution, epoxy primer, lubricants, solvents, pesticides, and sodium dichromate. Materials used for boat, vehicle, and aviation repair; power and heat generation; wastewater treatment; photo processing; and building maintenance also are common. Fuels may include aviation gasoline, motor gasoline, and diesel fuel. Fuels can be transported to the sites via pipeline, truck, rail, or aircraft.

Procedures for managing hazardous materials are developed to establish standard operating procedures for the correct management and storage of hazardous materials at installations where activities for the proposed BMDS may occur. Hazardous material inventories are regularly reviewed and updated as needed.

Above- and underground tanks with a range of capacities may be present at specific sites. The tanks and any supporting equipment are periodically inspected using visual inspection, hydrostatic inspection, or a system of nondestructive shell thickness testing. Currently, Fort Greely has 49 aboveground storage tanks with capacities ranging from 946 to 2,384,809 liters (250 to 630,000 gallons). There are 23 underground storage tanks at Fort Greely with capacities ranging from 1,136 to 189,270 liters (300 to 50,000 gallons). (U.S. Army Space and Missile Defense Command, 2002d)

The Port of Valdez, a coastal site in the Sub-Arctic Taiga Biome, serves as the southern terminal of the Trans-Alaska Pipeline System. This terminal occupies approximately 404.7 hectares (1,000 acres) of land owned by the Alyeska Pipeline Service Company. The terminal serves to store and load crude oil and houses the Operations Control Center for the Trans-Alaskan Pipeline System. The most prevalent hazardous material at the terminal is diesel fuel, with approximately 30 million liters (eight million gallons) nominally being stored at any given time. Other common materials include gasoline for equipment and vehicles, propane, organic solvents, heat transfer fluids, glycol-based coolants, refrigerants, protective coatings, fire suppression chemicals, and cleaning agents. (U.S. Army Space and Missile Defense Command, 2003)

Hazardous Waste

Hazardous wastes generated at specific installations where activities for the proposed BMDS may occur typically are associated with equipment maintenance. Wastes generated by the facility include oils, fuels, antifreeze, paint, paint thinner and remover, photo chemicals, pesticides, aerosol canisters, batteries, used acetone, sulfuric acid, and sewage sludge. Procedures typically are developed for managing hazardous wastes at sites where activities for the proposed BMDS may occur. Installations may recycle non-hazardous waste that includes paper, cardboard, plastics, glass, and aluminum; however, recycling capabilities in Alaska are limited.

For example, the Valdez Marine Terminal is considered a large quantity generator. Hazardous waste would be generated from various routine and preventative maintenance and repair activities at the terminal. These wastes include spent thinners, cleaning solvents, flammable paints and coatings, corrosive acids, flammable adhesives, used oils containing chlorinated compounds, spent coolants, spent aerosol cans and crushed fluorescent lights. Sludge and residues removed from equipment and sumps also may be characterized as hazardous. The largest quantity of potentially hazardous waste would be from tank bottoms and "materials in process" that are periodically removed from equipment and storage tanks. Some spill debris and containment media also may be characterized as hazardous. (U.S. Army Space and Missile Defense Command, 2003)

H.2.6 Health and Safety

Health and Safety attributes of the Sub-Arctic Taiga Biome are similar to those discussed in Section H.1.6.

H.2.7 Noise

The Sub-Arctic Taiga Biome generally is sparsely populated and most of the region is expected to have a background noise level of L_{dn} less than or equal to 55 dBA. The KLC is representative of noise levels for sites where activities for the proposed BMDS may occur in the Sub-Arctic Coastal Biome. Ambient noise levels range from 70 dBA to 95 dBA. (DOT, 2001) Noise sources associated with the proposed BMDS are described in Section H.1.7.

H.2.8 Transportation

Ground Transportation

Roadway travel in the Sub-Arctic Taiga Biome is generally limited due to the vast, undeveloped terrain. Highways are found throughout the region and decrease as one moves northward. Roads between towns may be nonexistent. The quality of roads also varies greatly. Many roads in developed areas are two-lanes and paved, however, some roads may be unpaved in remote areas and covered with dirt or gravel.

Due to the limited number of roadways, the traffic volume in sparsely populated areas tends to be greater than experienced in urban areas. The summer months experience the highest amount of traffic due to tourism and good weather.

Ground transportation also includes railway systems. The Sub-Arctic Taiga Biome includes systems that provide freight, passenger, and intermodal transportation across North America, as well as regional and local service railways. Some rail lines, especially those located in northern regions of this biome, pass through scenic areas such as fjords, national parks and forests, mountains, and historic rivers.

Air Transportation

Given the vast area of the Sub-Arctic Taiga Biome and the limited road network, aircraft provide an alternate means of transportation. Private and military aircraft comprise a large portion of air traffic in this region. Helicopters serve many domestic routes, especially where towns lack airstrips and ground transportation is not available. Chartered airplanes often are used for passenger service. Kodiak Island, for example, currently supports C-130 aircraft and H-60 helicopters. Personnel and most types of equipment can be transported to Kodiak Island on daily flights offered by Alaska Airlines and ERA Aviation. (U.S. Army Space and Missile Defense Command, 2003)

Marine Transportation

Marine travel tends to be limited in the Sub-Arctic Taiga Biome due to glacial patches found throughout many waterways. Transit operations in the arctic ice have proven hazardous to many large vessels in the past, especially cargo and merchant ships. The use of air transportation for cargo has alleviated the need for sea transportation in the Arctic. However, both local residents and tourists visiting this northern environment commonly rely on marine transportation. Small commercial vessels are used primarily for ferry passenger service and fishing activities and often are limited to designated waterways.

For example, Kodiak Island offers a full range of dockage and marine services for commercial fishing, cargo, passenger, and recreational vessels. Large vessels, including the state ferry, cruise ships, and cargo vessels are moored at three deepwater piers. In the Prince William Sound area, marine transportation plays an important role, including its role in shipping petroleum products from the Valdez Marine Terminal. The Port of Valdez is equipped with the highest level of marine infrastructure, accommodating interstate and international cargo receipt and shipment. The Port of Valdez is an ice-free port with access to Interior Alaska, the U.S. Pacific Northwest, Northern Canada, and the Pacific Rim trade routes. (U.S. Army Space and Missile Defense Command, 2003)

H.2.9 Water Resources

Surface Water and Ground Water Resources

Ground water is supplied by nearby rivers, precipitation, and melt water in the Sub-Arctic Taiga Biome. The depth and amount of ground water fluctuates in response to changes in the seasons and weather. Ground water levels are highest in the late summer, when snow and ice melt is augmented by rainfall. The lowest levels generally occur in the fall, and a slow rise in winter levels is normal. Local variations in flow directions occur near surface water bodies and sources of ground water, such as melting snow.

Characteristic of the taiga are innumerable water bodies, including bogs, fens, marshes, shallow lakes, rivers and wetlands, which are intermixed among the forest and hold vast amounts of water. Creeks and ponds also are common throughout this biome. Many rivers in the boreal forest region are glacier-fed and silt-laden. The peak flow of these rivers is reached in late summer, when snow and ice melt is augmented by rainfall. Minimum flow occurs in winter when precipitation occurs as snow. Many bodies of water remain frozen during the winter. Permafrost is present only in patches, and during the summer, the unfrozen layer is generally thick. The water is often acidic and rich in organic material from the surrounding landscape. Because the ground has a limited ability to store water, the spring flood can be violent, undercutting the riverbank and causing extensive erosion along its path. Rainstorms also may cause high flows and floods, especially on small streams. The effects of floods and storms can be much less severe on rivers with large drainage basins.

Spring streams in the sub-arctic region derive water from underground sources. As a result, springs are rich in cations (positively charged particles that aid in uptake by plants) and nutrients, flow year-round, and have stable water temperatures. This provides a stable, enriched habitat for primary and secondary producers leading to high biomass and diversity of algae, moss, and insects.

In coastal areas, ground water is found primarily in river basins and recharged by infiltration of melt water from precipitation and glaciers. Ground water typically is derived from unconfined aquifers composed of sand and gravel. The coastal region generally consists of wet, saturated organic materials spread across flat lands, extensive areas of peatlands, swamps, streams, small lakes, and wetlands. Kettle lakes and lakes formed by glacial erosion are found in upland areas. Sea ice occasionally occurs in water formations. During high tides, marshes and lagoons that feed into the coastline may be subject to saltwater inundation.

Water Quality

Water quality for sites where activities for the proposed BMDS may occur in interior Alaska, such as Fort Greely and Clear Air Force Station, typically meets state drinking water standards. Water quality is subject to seasonal variations, but remains within established EPA drinking water standards. However, at Eielson AFB, background ground water quality analyses have shown that the average iron and manganese concentrations typically exceed the secondary maximum contaminant levels for drinking water. Arsenic has been identified as a constituent of concern at Eielson AFB, and one background sample exceeded the primary drinking water standard of 50 micrograms per liter. (U.S. Army Space and Missile Defense Command, 2002d) Water quality in the coastal areas of the Sub-Arctic Taiga Biome is generally good.

H.3 Deciduous Forest Biome

As shown in Exhibit 3-13, the Deciduous Forest Biome includes the deciduous forest regions of North America, which include most of the eastern portion of the U.S. and parts of central Europe and East Asia. The description in this section of the U.S. deciduous forest is representative of this biome throughout the world.

Existing inland sites in the Deciduous Forest Biome include Redstone Arsenal, Alabama; Fort Devens, Massachusetts; and Aberdeen Proving Ground, Maryland.

Coastal sites also are located in the Deciduous Forest Biome. These sites share maritime characteristics. Existing coastal sites include Naval Air Station Patuxent River, Maryland; Wallops Island, Virginia; Cape Canaveral Air Force Station, Florida; Cape Cod Air Force Station, Massachusetts; and Eglin AFB, Florida.

H.3.1 Air Quality

Climate

The average annual temperature in a deciduous forest is 10°C (50°F). The average rainfall is 76 to 152 centimeters (30 to 60 inches) a year, with nearly 36 centimeters (14 inches) of rain in the winter and more than 46 centimeters (18 inches) of rain in the summer. Humidity in these forests is high, ranging from 60 to 80 percent. Because of its location, air masses from both the cold polar region and the warm tropical region contribute to the climate changes in this biome.

Most deciduous forests have mild summers with temperatures averaging about 21°C (70°F). Winter temperatures are cool with an average temperature slightly below 0°C (32°F). The humid subtropical climate, marked by high humidity, especially in summer, and the absence of cold winters, prevails in the Southern Atlantic and Gulf Coast states.

Most deciduous forests are located near oceans. The ocean and wind are two key factors that determine the variability in temperature and climate changes in this ecological system. In the northern part of the deciduous forest, the frost-free or growing season lasts for three to six months.

In the coastal regions of the Deciduous Forest Biome, climate is influenced by three main air masses, the Continental Arctic, the Continental Polar, and the Maritime Tropical. The Continental Arctic air masses usually originate north of the Arctic Circle and plunge across Canada and the U.S. during winter. The Continental Arctic air masses have extremely cold temperatures and very little moisture. Continental Polar air masses form farther south and often dominate the weather in the U.S. during winter. During the summer, the Continental Polar air masses bring clear weather to the northeastern U.S. Continental Polar air masses have cold and dry air, but not as cold as Arctic air masses. Maritime Tropical air masses originate over the warm waters of the southern Atlantic Ocean and the Gulf of Mexico and can form year-round. Maritime Tropical air masses have warm temperatures with copious moisture and are responsible for the hot, humid summer across the South and the East.

The climate along the U.S. coast differs according to latitudinal location. Differences in climate in this region are characterized according to the Northern Atlantic states and the Southern Atlantic and Gulf Coast states. The coastal region is considered moist and rainfall decreases with distance from the ocean. Located squarely between the source regions of Continental Polar air masses to the north and Maritime or Continental Tropical air masses to the south, coastal areas of the northern states are subject to strong seasonal contrasts in temperature as these air masses push back and forth across the continent. (Bailey, 1995)

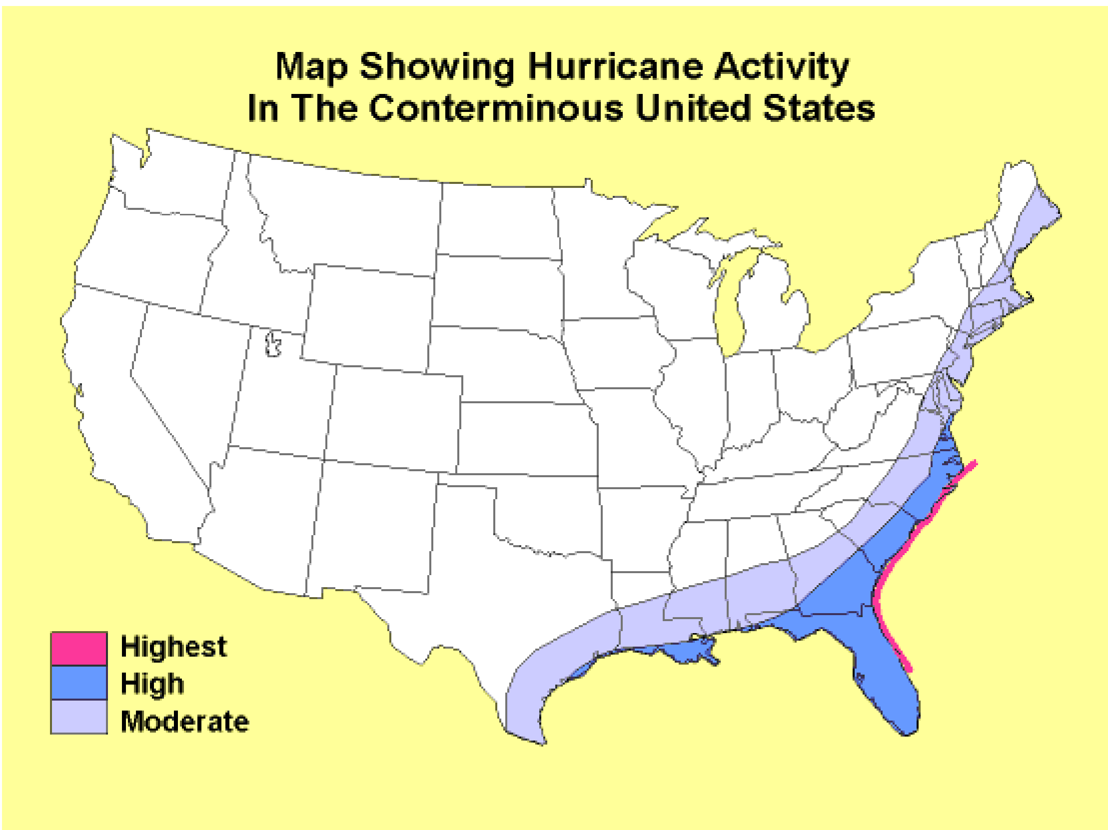
The humid subtropical climate, marked by high humidity, especially in summer, and the absence of cold winters, prevails in the Southern Atlantic and Gulf Coast states. The climate is temperate and rainy with hot summers. The climate has no dry season, and even the driest summer month receives at least 30 millimeters (1.2 inches) of rain. The average temperature of the warmest summer month is above 22 °C (72 °F). Precipitation is ample all year but is greatest during summer.

Winter precipitation, some in the form of snow, is of the frontal type. Temperatures are moderately wide in range and comparable to those in tropical deserts, but without the extreme heat of a desert summer. (Bailey, 1995)

Thunderstorms are frequent, especially in the summer, and may be thermal, squall line, or cold front in origin. Tropical cyclones or hurricanes strike the southern U.S. Atlantic coastal area occasionally, bringing heavy rains. Hurricanes form in the Atlantic basin to the east of the continental U.S. in the Atlantic Ocean, Gulf of Mexico, and Caribbean Sea. In the Atlantic coast region, hurricanes form anywhere from the tropical central

Atlantic to the Gulf of Mexico. Those that form in the central Atlantic and Caribbean region usually start off moving westward, then may curve towards and strike the North American mainland. Some storms that begin in the Gulf of Mexico may move pole-ward and eastward from their inception. Along the U.S. Atlantic and Gulf coasts, the Gulf Stream provides a source of warm waters (greater than 26.5°C [80°F]) to help maintain hurricane activity. Exhibit H-3 shows that the Deciduous Forest Biome in the U.S. is subject to significant hurricane activity.

Exhibit H-3. Hurricane Activity in the U.S.



Source: USGS, 2002e

The areas shown in Exhibit H-3 reflect the number of hurricanes per 100 years expected to pass within 159 kilometers (75 nautical miles) of any point in the shaded regions. The highest-risk area (the southern and Mid-Atlantic coast) shows where 60 hurricanes per 100 years skim up the east coast. The high-risk area would see 40-60 hurricanes per 100 years, and the moderate-risk area would see 20-40 hurricanes per 100 years. The period of observation was 1888 to 1988.

Regional Air Quality

Many metropolitan regions on the U.S. Atlantic Coast are in non-attainment for EPA's NAAQS for ozone, the primary constituent of urban smog. The EPA recently conducted a national-scale assessment of 33 air pollutants (a subset of 32 HAPs plus diesel PM), including sources, ambient concentrations, and human health risk (cancer and noncancer). Many of the highest-ranking 20 percent of counties in terms of risk are located in the Atlantic and Gulf coastal areas in Texas, Louisiana, Alabama, and coastal areas from northern Virginia to Maine. (EPA, 1996) For example, Cape Cod Air Force Station is situated within the Southeastern Massachusetts Air Quality Control Region, which is classified as serious non-attainment for ozone and attainment or unclassified for all other NAAQS. (U.S. Department of the Air Force, 2002)

The southern Atlantic coast from Virginia through Florida is in attainment for all criteria air pollutants. However, the entire coastal area from northern Virginia through Maine is in non-attainment for ozone (ranging from moderate to severe), and small areas in Connecticut are in moderate non-attainment for PM_{10}.

The air in the eastern Gulf of Mexico has very low concentrations of air pollutants. There are few emissions sources (air traffic, drilling platforms, surface vessel exhaust, transport phenomena), and while each of these sources individually has limited localized effects on air quality, their cumulative impact on overall Gulf of Mexico air quality has not been documented. (U.S. Department of the Air Force, 2002)

Air pollutants occasionally reach relatively high levels when strong ground-based temperature inversions trap pollutants near the ground. Many coastal areas experience inversions during the night. Although these inversions normally break during the morning due to surface heating, sometimes they persist for more than one day. In the Gulf region, on average there are five to seven days each winter during which the inversion does not break. Most often this is due to a deep layer of sea fog reducing the amount of surface heating. (U.S. Department of the Air Force, 2002)

For example, the atmosphere of the Eglin AFB area has a limited tolerance to high pollution because of the regular occurrence of inversions. It is, however, more capable of dispersing air pollutants than adjacent areas to the north but not so much that winter air pollution episodes could not occur. Low-velocity winds and inversion conditions contribute to short-duration, low-level concentrations of air pollution, especially in areas with high traffic concentrations. (U.S. Department of the Air Force, 1998a)

The meteorology and climatology of the Gulf Coast region are dominated by the western Gulf with extremes in humidity, precipitation, and coastal air mass movements. The Gulf Coast has an unusual mix of large industrial emission sources, extensive transportation emission sources, significant biogenic emissions, and a complex coastal meteorology.

These sources and the meteorology interact to produce high levels of ozone, HAPs, and fine PM. Ozone concentrations in areas of the region are among the highest in the nation.

Air quality throughout East Asia varies markedly. The region includes highly industrialized cities, such as Tokyo and Kyoto in Japan, with comparatively low air quality. Of Asian countries, Japan's average annual SO_2 emissions are the highest, at 0.26 milligrams per cubic meter (mg/m^3). By way of comparison, the average annual SO_2 emissions in China and the U.S. are 0.06 mg/m^3. There are many largely unpopulated rural areas in remote coastal areas of East Asia that are far less polluted. (World Bank, 2003a)

Existing Emission Sources

Sites where activities for the proposed BMDS may occur maintain, or have submitted an application for, Title V Air Permits. Many activities for the proposed BMDS would be located at existing facilities with emissions generated by automobile and other vehicular exhaust, airplane and rocket exhaust, and diesel-powered generator emissions. Some manufacturing facilities could be located in existing major manufacturing areas that are likely to be in non-attainment for one or more pollutants. Emissions from activities for the proposed BMDS include CO, NO_X, SO_X, VOCs, HAPs, and PM.

Major emissions sources associated with activities for the proposed BMDS in the Deciduous Forest Biome would include boilers, engines, hush houses, gas stations, fuel handling, chemicals, generators, storage tanks, miscellaneous equipment, and prescribed burning/firefighter training. Most sites where activities for the proposed BMDS may occur would be classified as a major emissions source. For example, at Wallops Flight Facility, an example of a coastal site in the biome, sources of air pollution include operation of the central boiler plant, rocket launches, disposal of rocket motors by open burning, aircraft emissions and auto emissions. (U.S. Department of the Navy, 1991)

Existing emissions sources in the coastal areas of the Deciduous Forest Biome are primarily the same as those in the inland areas. Industry and manufacturing sources historically are located in coastal urban areas because of access to marine transportation, so emissions levels from those sources would be greater on the coast than inland. Furthermore, because most of the existing sites in the Deciduous Forest Biome are on the coast, many of the activities for the proposed BMDS would occur in this biome.

The East Asian continental rim region is characterized by anthropogenic emissions that are already high in many localities and are increasing throughout the region more rapidly than in most other parts of the world. Within two decades, emissions from East Asia could account for roughly half of the sulfur and N_2 and a third of the carbon emitted from all anthropogenic sources worldwide. (IGAC, 2000) Air pollution in urban areas along the East Asian Coast (with a drastically expanding transportation sector) originates predominately from traffic, power generation, home cooking, and biomass burning. (World Bank, 2003b) In addition, widespread transport of Asian-originated emissions is a growing concern. Aeolian dusts and gaseous and particulate pollutants from the Asian continent, including NO_x and polycyclic aromatic hydrocarbons, are transported eastward over the Pacific, especially in the spring, towards the western U.S.

H.3.2 Airspace

Controlled and Uncontrolled Airspace

The Deciduous Forest Biome in the U.S. contains all FAA classifications for airspace, as described in Section 3.1.2. Airspace at Santa Rosa Island on Eglin AFB is described as representative of airspace for this biome. Approximately 85 kilometers (53 miles) to the west and 107 kilometers (66 miles) to the east of the Santa Rosa Island launch site, is controlled airspace. This airspace is composed of Class A airspace from 5,486 meters (18,000 feet) above MSL up to and including FL 600, including the airspace overlying the waters within 22.2 kilometers (12 nautical miles) of the coast, and Class E airspace below 5,486.4 meters (18.000 feet) above MSL. Class C and D airspace surrounds Pensacola and Pensacola Regional airports to the west of the special use airspace. No Class B airspace, which usually surrounds the nation's busiest airports, or Class G (uncontrolled) airspace is found in the vicinity. (U.S. Army Space and Strategic Defense Command, 1994a)

The airspace beneath R-2915C is Class G uncontrolled airspace. However, there is Special Air Traffic Rule Part 93 Airspace at Eglin AFB. Part 93 Airspace is established to cover certain special situations of air traffic where normal rules do not apply. The Part 93 Airspace underlies R-2915C and extends eastward underneath R-2919B. It requires pilots to obtain an Air Traffic Control clearance/advisory prior to entering or operating in the Eglin/Valparaiso terminal area. (U.S. Army Space and Strategic Defense Command, 1994a)

The deciduous forest parts of East Asia are located in international airspace and therefore, the procedures of the ICAO are followed. The Honolulu ARTCC would manage airspace in this region.

Special Use Airspace

The special use airspace for Santa Rosa Island on Eglin AFB consists of the following areas: R-2915C restricted area, which lies immediately above Sites A-15 and A-10 on Santa Rosa Island; the western portion of the overlying Eglin E MOA; the Santa Rosa CFA; and the W-l55A and W-151A warning areas offshore. The R-2915A restricted area is part of the special use airspace complex over Eglin AFB, which includes several restricted areas, the Eglin E and Eglin F MOAs, and two Special Air Traffic Rule Corridors. (U.S. Army Space and Strategic Defense Command, 1994a)

W-151 is a large volume of airspace extending south and east of Eglin AFB to Cape San Blas and approximately 190 kilometers (118 miles) over the Gulf of Mexico. The large warning area is divided into smaller units for airspace management purposes. The W-151 Test Area is scheduled for more than 27,000 hours per year and is used by approximately 15,000 sorties per year. Training accounts for 80 percent of the total hours scheduled for W-151. Test activities account for most of the rest, with exercises taking less than one percent. W-470 is adjacent to and east of W-151. The W-470 Test Area is scheduled for more than 13,000 hours per year and is used by approximately 20,000 sorties per year. W-155 Test Area is scheduled primarily by the U.S. Navy for more than 3,300 hours per year. The Navy conducts surface to air and surface-to-surface missile testing using Eglin restricted airspace, W-151, and the Eglin Water Test Area several times a year. (U.S. Army Space and Strategic Defense Command, 1994a)

An east-west corridor underlies the R-2915C restricted area over and just south of Santa Rosa Island. The purpose of the Special Air Traffic Rule Corridors is to alert aircraft that they must contact the appropriate air traffic control function prior to flight entry or operation in these terminal areas to obtain routing and altitude clearance. The east-west corridor extends from the surface to 2,591 meters (8,500 feet) above MSL, commencing at the eastern boundary of R-29148, continuing between and below the northern and southern boundaries of R-29148 and R-2919B, and west below R-2915C. (U.S. Army Space and Strategic Defense Command, 1994a)

Unless otherwise authorized by the Eglin Radar Control Facility, aircraft cannot operate within the corridor without two-way radio communication with the Eglin Radar Control Facility or an appropriate FAA facility. The east-west corridor allows non-participating aircraft access to airports in the Eglin AFB-Fort Walton Beach area. Low-altitude/low speed private and commercial aircraft also use this corridor. (U.S. Army Space and Strategic Defense Command, 1994a)

Facilities would be required to request NOTMARS and NOTAMs prior to each test. Missile and target drone flight paths and intercepts may take place over the Gulf of Mexico within the confines of warning areas W-151 and W-470. Jacksonville ARTCC controls this airspace, which extends from sea level to an unlimited altitude and currently is in use only intermittently. W-151 and W-470 are not crossed by any low-altitude airways or any high-altitude jet routes, although Gulf Route 26 (low altitude) and J58-86 (high altitude) pass just to the south. (U.S. Army Space and Strategic Defense Command, 1994a)

Airports/Airfields

Civilian, military, and private airports exist in the Deciduous Forest Biome to serve different aircraft. Considerable civil and commercial flying activities take place in this biome. For example, approximately five civil airports located near Eglin AFB would be affected by closure of Eglin's Part 93 Airspace. General aviation aircraft may fly unrestricted in VFR conditions up to 5,486 meters (18,000 feet) above MSL. (U.S. Army Space and Strategic Defense Command, 1998a)

En Route Airways and Jet Routes

Numerous airways and jet routes that traverse international airspace are found in this biome. The airway and jet route segments located near Eglin AFB lie within airspace managed by Jacksonville, Miami, and Houston ARTCCs, and Houston Oceanic Control. ARTCCs exercise control of air traffic within sectors, usually dividing the airspace both vertically and horizontally. The vertical divisions, Low, High, and Ultra-High, are further divided into several horizontal sectors. Both ARTCCs and Oceanic Control activate and deactivate the various sectors as traffic loads warrant, and no set times are used. (U.S. Army Space and Strategic Defense Command, 1998a)

Jacksonville ARTCC manages traffic in Sector 30, which extends from the surface. It covers the area south of the Florida panhandle from the Florida Coast on the east to Mobile, Alabama, on the west and south to the boundary with Miami ARTCC. Miami ARTCC manages Sectors five, six, and eight south of Jacksonville's airspace past the southern tip of Florida and west to the 100-degree latitude, where it abuts Houston-managed airspace. Houston ARTCC manages traffic in Sector 24, which extends from the surface. It covers the area south of the New Orleans area, from Mobile, Alabama, on the east to Baton Rouge on the west, and south to the boundary with Houston Oceanic. Houston Oceanic manages Sector 29 south of Houston ARTCC to the northern edge of Merida (Mexico) Upper Control Area, from Miami Oceanic on the east to Monterrey (Mexico) Upper Control Area on the west. (U.S. Army Space and Strategic Defense Command, 1998a)

H.3.3 Biological Resources

Vegetation

On numerous sites where activities for the proposed BMDS may occur, native vegetation has been removed, and the land is landscaped and maintained by mowing and brush control measures. Isolated pockets of vegetation may remain on sites where activities for the proposed BMDS may occur, however, vegetation on off-site areas is widespread and may be undisturbed.

Although evergreens are found in this region, the Deciduous Forest Biome is characterized by an abundance of deciduous trees. In deciduous forests there are five different zones. The first zone is the tree stratum zone, which contains such trees as oak, beech, maple, chestnut hickory, elm, basswood, linden (*Tilia platyphylla*), walnut, and sweet gum (*Liquidambar styraciflua*) and has height ranges between 18 and 30 meters (60 and 100 feet). The small tree and sapling zone, the second zone, has young and short trees. The third zone, the shrub zone, includes such shrubs as rhododendrons (*R. Fragrantissimum*), azaleas, mountain laurel, and huckleberries. The Herb zone is the fourth zone, which contains short plants such as herbal plants. The final zone is the Ground zone, which contains lichen, club mosses, and true mosses.

At Redstone Arsenal, Alabama, an existing site in this biome, vegetation consists largely of forests, shrublands, cultivated land and pastures, and mowed, grassy areas. Approximately 20 percent of the installation is covered by wetlands. The Wheeler National Wildlife Refuge is located along the southern boundary of Redstone Arsenal; 1,620 hectares (4,000 acres) of the refuge are located within Redstone Arsenal.

The vegetation along the U.S. Atlantic coast is widely varied. The Everglades region is dominated by two principal natural communities adapted to moist conditions, an extensive treeless savanna (the Everglades) on the eastern side of the area and forested woodlands (the Big Cypress Swamp) on the western side. The Everglades region consists of a shallow, broad (95 kilometers [60 miles]) river with freshwater flowing southward from Lake Okeechobee to the Gulf of Mexico. Vegetation here varies by duration of inundation and amount of salt content and includes grasses in permanently submerged freshwater habitats, trees in dry to intermittently flooded freshwater habitats, and shrubs to small trees in saltwater estuary habitats. Coastal areas influenced by saltwater tidal zones are occupied by successive zones of vegetation from freshwater to saltwater environments and include button mangroves, black mangroves, and red mangroves.

For example, on Cape San Blas, an existing site located in Florida, the vegetation is typical of Atlantic or Gulf barrier island vegetation associations. Salt tolerance is an important factor in the tidal communities along the beaches. Fresh or brackish water communities are found behind the primary dune system and are scrubby or forested marshes and swamps. Cape San Blas also has upland habitat, including flatwoods, shrubs, xeric and old scrub dunes, and a variety of disturbed areas in various stages of recovery. Several stands of large pines occur at Cape San Blas.

In the Outer Coastal Plain, gum and cypress trees dominate the extensive coastal marshes and interior swamps. The American Chaffseed (*Schwalbea americana*) is an example of a threatened or endangered species in the Outer Coastal Plain.

Further north in the deciduous forest, predominant vegetation includes northern hardwood-hemlock-white pine, central hardwoods, transition hardwoods, coastal pitch pine, maritime oak and maritime red cedar. Albany sand plains support pitch pine-scrub oak communities. There are also cedar bogs with transition pine forests and deciduous swamps, and pine plains and grassy savannas, especially in the pine barrens area.

Predominant vegetation types in the northeast include montane red spruce-balsam fir, lowland spruce-fir, northern hardwood-conifer, lowland red spruce-balsam fir, coastal spruce-fir, coastal raised peatlands, and coastal plateau peat lands. The central coast of Maine is described as a transitional zone. From west to east the forest transition ranges from northern Appalachian oak, pine, and mixed hardwoods typical of the southern New England coastal plain to northern coastal spruce-fir and spruce-fir-northern hardwood communities. From south to north, coastal communities grade to more montane spruce-fir and northern hardwood communities. Coastal pitch pine communities are represented on sand dunes and outcrops in the coastal zone.

Wildlife

The Deciduous Forest Biome provides habitat for a wide variety of animals. The black bear (*Ursus americanus*) and the endangered Florida panther are found in small numbers in isolated areas, and the whitetail deer is one of the only large indigenous mammals. Common small mammals include raccoons (*Procyon lotor*), opossums, flying squirrels, rabbits, red fox and numerous species of ground-dwelling rodents. Bobwhite and wild turkey are the principal game birds. Migratory non-game bird species are numerous, as are migratory waterfowl. Ducks, geese, rails, herons, shore birds, beaver, mink, and muskrats are found in inland ponds, marshes, and swamps. Winter birds are diverse and numerous. The endangered red-cockaded woodpecker (*Picoides borealis*), bald eagle, and the Atlantic piping plover (*Charadrius melodus*) inhabit the lower coastal plains and flatlands of the middle portion of this biome. Further north, threatened and endangered species include the gray wolf, mountain lion, lynx, peregrine falcon, and bald eagle.

Fort Devens, Massachusetts, is an existing inland site in this biome. Undeveloped lands of this installation are known to support migratory birds including waterfowl, wading birds, raptors, shorebirds, and passerrines (perching birds). Other species found on site include resident mammals, reptiles and amphibians, and invertebrates. The installation lands support breeding areas for at least 12 state-listed animal species and provide migration, feeding, and resting habitat for two federally listed endangered species.

The neighboring Oxbow National Wildlife Refuge is a migratory bird refuge on the Atlantic Flyway. Swamp and floodplains surround the oxbows of the Nashua River. On the upland edge a few pine-covered knolls, marshes, swamps and open water areas exist. The Oxbow refuge is also a good birding area where pheasant, woodcock, grouse, snipe, bittern, herons, sandpipers, passerines and woodland birds are likely to be found. Ducks and geese can be present, especially during migration periods. It is assumed that birds found on the refuge also will fly over or utilize the Fort Devens area. Raptors that are expected to use the base area during the breeding season include the American kestrel (*Falco sparverius*), red-tailed hawk (*Buteo jamaicensis*), screech (*Otus asio*), barred (*Strix varia*) and great horned owls (*Bubo virginianus*), plus the forest dwelling sharp-shinned (*Accipiter striatus*), coopers (*Accipiter cooperii*) and goshawks (*Accipiter gentiles*), and the red-shouldered (*Buteo lineatus*) and broad-winged (*Buteo platypterus*) hawks. Many additional species have been identified during migration. (U.S. Army Space and Strategic Defense Command, 1994b)

Oxbow National Wildlife Refuge and Fort Devens are also home to several mammalian species. Those likely to be observed are woodchucks (*Marmota monax*), snowshoe hares (*Lepus Americanus*), red (*Tamiasciurus hudsonicus*) and gray squirrels and cottontail rabbits. Those less likely to be observed are raccoons, skunks, opossum, river otters (*Lutra Canadensis*), red foxes, muskrats, and white-tailed deer (*Odocoileus virginianus*). (U.S. Army Space and Strategic Defense Command, 1994b)

Wetlands and open water habitats are known to support populations of mink (*Mustela vison*), river otter, muskrat, and beaver. There are eighteen species of reptiles and thirteen species of amphibians known to utilize the upland and wetland habitats at Fort Devens. The reptile species include various turtles and snakes, and amphibian species include mole salamanders, newts, lungless salamanders, toads, tree frogs, and true frogs. (U.S. Army Space and Strategic Defense Command, 1994b)

The Federally listed species near Fort Devens are the peregrine falcon and the bald eagle, and the candidate species is the Northern Goshawk. No other federally listed threatened or endangered species occur in the area. Exhibit H-4 shows examples of threatened and endangered wildlife species in the Deciduous Forest Biome.

Exhibit H-4. Examples of Threatened and Endangered Wildlife Species in the Deciduous Forest Biome

Common Name (*Scientific Name*)	**Threatened (T) or Endangered (E)**
Indiana bat *(Myotis sodalist)*	E
Eastern cougar *(Puma (Felis) concolor couguar)*	E
Bat, Virginia big-eared *(Corynorhinus (Plecotus) townsendii virginianus)*	E
Heather, mountain golden *(Hudsonia montana)*	T

Source: USFWS, 2003

Along the coast, the Everglades region contains both freshwater and saltwater habitats, and both habitats contain a wide variety of species. The freshwater habitats are occupied by woodstork (*Mycteria Americana*), bluegill (*Lepomis macrochirus*), crayfish, Florida gar (*Lepisosteus platyrhincus*), largemouth bass (*Micropterus salmoides*), purple gallinule (*Porphyrula martinica*), alligator, ibis (*Plegadis falcinellus*), zebra butterfly (*Heliconius charitonius*), Everglades kite (*Rostrhamus sociabilis*), and apple snail (*Pomacea bridgesii*). Characteristic fauna of the hammocks are various species of tree snails, barred owl, white-tailed deer, and Florida panther (*Puma concolor coryi*). In saltwater habitats, typical fauna include great white heron (*Ardea herodias occidentalis*), American crocodile (*Crocodylus acutus*), loggerhead turtle (*Caretta caretta*), West Indian manatee (*Trichechus senegalensis*), pink shrimp, mangrove snapper (*Lutjanus griseus*), blue crab (*Calinectes sapidus*), coon oyster (*Crassostrea m, lntertldal*), brown pelican (*Pelecanus occidentalis*), osprey (*Pandion haliaetus*), roseate spoonbill (*Ajaia ajaja*), and southern bald eagle (*Haliaeetus leucocephalus*). Exhibit H-5 contains examples of the threatened and endangered species of the Everglades.

Exhibit H-5. Examples of Threatened and Endangered Species of the Everglades

Type of Species	Common Name (*Scientific Name*)	Threatened (T) or Endangered (E)
Reptiles and Amphibians	Atlantic Ridley Turtle (*Lepidochelys kempi*)	E
	American Crocodile (*Crocodylus acutus*)	E
Birds	Southern Bald Eagle (*Haliaeetus leucocephalus leucocephalus*)	T
Mammals	Florida Panther (*Puma concolor coryi*)	E
	West Indian Manatee (*Trichechus manatus*)	E
Insects	Schaus Swallowtail Butterfly (*Heraclides aristodemus*)	E

Source: USFWS, 2003

Gulf of Mexico estuaries provide critical feeding, spawning, and nursery habitats for a rich assemblage of fish, wildlife, and plant species. Hundreds of species of birds, recreational and commercial fish and shellfish species, native cypress and mangroves, and threatened and endangered species such as sea turtles, Gulf sturgeon (*Acipenser oxyrhynchus desotoi*), beach mice, and manatees can be found in Gulf estuary habitats.

Along the northeastern coast, the northern spring salamander (*Gyrinophilus porphyriticus*), four-toed salamander (*Hemidactylium scutatum*), grey tree frog (*Hyla versicolor*), mink frog (*Rana septentrionalis*), American toad (*Bufo americanus*), eastern box turtle (*Terrapene carolina Carolina*) northern brown snake (*Storeria dekayi*)., and eastern milk snake (*Lampropeltis triangulum*) characterize rich reptile and amphibian populations. Peregrine falcons are returning to coastal areas to nest. The storm petrel (*Hydrobates pelagicus*), razorbill (*Alca tord*), roseate tern (*Sterna dougallii*), laughing gull (*Larus atricilla*), Atlantic puffin (*Fraterculus arctica*), black guillemot (*Cepphus grylle*), and sharp-tailed sparrow (*Ammospiza caudacuta*) occur in a variety of coastal habitats. Historically, Atlantic salmon was found in the major rivers (Penobscot and Kennebec) of this area. Restoration of Atlantic salmon to the Penobscot is underway. Numerous whales, dolphins, and seals seasonally migrate through the Gulf of Maine, as do several marine turtle species such as the leatherback (*Dermochelys coriacea*), loggerhead (*Caretta caretta*), and Atlantic Ridley turtle (*Lepidochelys kempi*). No Federally listed threatened and endangered species are unique to this area.

The canopy in the East Asian tropical and subtropical moist broadleaf forests is home to many of the forest's animals, including apes and monkeys. Below the canopy, the lower understory contains snakes and big cats. The forest floor, relatively clear of undergrowth due to the thick canopy above, is home to animals such as gorillas and deer. Wildlife specific to this biome in East Asia include the Calamian deer (*Axis calamianesis*), Chinese pangolin (*Manis pentadactyla*), Sunda tree squirrel (*Sundasciurus juvencus*), and gray imperial-pigeon (*Ducula pickeringii*). Characteristic wildlife of the temperate broadleaf and mixed forest are either mast-eaters (nut and acorn feeders) or omnivores. Mammals show adaptations to an arboreal life and a few hibernate during the winter months. Wildlife specific to this biome in Asia include the Japanese otter (*Lutra Iatra whiteleyi*), Japanese serow (*Capricornis crispus*), Shika deer (*Cervis nippon*), Blakeston's fish owl and Tokyo Salamander (*Hynobius tokyoensis*). The Okinawa Woodpecker is an example of a threatened species that occurs in the Southeast Asia portion of the Deciduous Forest Biome.

Environmentally Sensitive Habitat

The Florida Keys have been designated a National Marine Sanctuary, Outstanding Florida Waters, and an Area of Critical State Concern. In addition, the Nature Conservancy has designated the Keys one of the ten most significant ecological communities in the world. (U.S. Army Space and Strategic Defense Command, 1998a)

For example, Cape San Blas, Florida encompasses habitat that is of unique and critical importance, perhaps the most conspicuous of which is the coastal beach and primary dune system. A variety of micro-habitats exist within the three miles of beach front at Cape San Blas, including overwash sites, mud flats, and sandbars. Cape San Blas is within a migratory bird route and is heavily used by a wide variety of migratory shorebirds throughout the year. Cape San Blas also is a known shorebird wintering and nesting area. Of special concern are sea turtles, which nest along the Cape San Blas shoreline, particularly the Atlantic loggerhead. Cape San Blas has the highest sea turtle nesting density in northwest Florida with approximately ten nests per kilometer (15 nests per mile). (U.S. Army Space and Strategic Defense Command, 1998a)

H.3.4 Geology and Soils

Geology

The geology of the Deciduous Forest inland is varied. The Appalachian Mountains run the length of this region. They are low mountains of crystalline rocks with valleys underlain by folded strong and weak strata. Some dissected plateaus with mountainous topography are also present. The relief is high (up to 900 meters [3,000 feet]). Elevations range from 90 to 1,800 meters (300 to 6,000 feet) and are higher to the south, reaching 2,037 meters (6,684 feet) at Mount Mitchell, North Carolina. West of the Appalachian Mountains are the Appalachian Plateaus. The sedimentary formations there are nearly horizontal, a typical plateau structure, but they are so elevated and dissected that the landforms are mostly hilly and mountainous. Altitudes range from about 300 meters (1,000 feet) along their western edge to somewhat more than 900 meters (3,000 feet) on the eastern edge. East of the mountains is the Piedmont Plateau and coastal plain, where altitudes range from sea level to about 300 meters (1,000 feet).
Most of New England is comprised of glacial features such as small to large delta plains, lake basins, isolated mounds and extended ridges of unstratified rocks. The area gradually descends in a series of broad, hilly plateaus to the coastal zone. Elevation ranges from sea level to 450 meters (1,500 feet), with some high hills in lower New England (monadnocks) at 600 meters (2,000 feet). Most of the Upper Atlantic Coastal Plain has elevations of less than 50 meters (150 feet). In the northernmost part of Lower New England, coastal lowlands are covered by glacial marine sediments (mostly clay). Inland, the bedrock is covered by a thin layer of glacial sediments deposited by rivers and in lakes. In the Upper Atlantic Coastal Plain, a series of terraces is composed of progressively younger sediment layers that range from poorly defined to unconsolidated and include interbedded mud, silt, sand, and gravel.

The Coastal Plain is predominantly flat and is covered with terrestrial sediments. Elevation ranges from 0 to 25 meters (0 to 80 feet) in the Middle Atlantic Coastal Plain, Atlantic Coastal Flatlands, and along the West Florida Coastal Lowlands, and from 0 to 50 meters (0 to 160 feet) along the Louisiana Coastal Prairies and Marshes. Elevation ranges from 25 to 200 meters (80 to 660 feet) along the Lower Coastal Plains and Flatwoods and in the Western Gulf Coastal Plains and Flatlands. The majority of the mid Atlantic coastal area is characterized by low ridges surrounded by poorly drained and relatively flat terrain. Lakeshore and river erosion, transport, and deposition are the primary processes shaping the landscape. Elevation ranges from 25 to 300 meters (80 to 1,000 feet). Most of this province has low relief, but rolling hills occur in many places. Lakes, poorly drained depressions, morainic hills (those created by an accumulation of earth and stones carried and deposited by a glacier), drumlins (oval hills made by glacial drift), eskers (long narrow ridges or mounds of sand, gravel, and boulders deposited by a stream flowing on, within, or beneath a stagnant glacier), outwash plains, and other glacial features are typical of the area, which was entirely covered by glaciers during parts of the Pleistocene era. Elevations range from sea level to 730 meters (2,400 feet). The coastal lowlands are covered by Pleistocene marine sediments (mostly clay). Stratified drift overlay the rest of the bedrock.

The Everglades, in the coastal area of this biome, are predominantly a flat plain. The sediments covering the plain are of marine origin. Elevation ranges from sea level to 25 meters (85 feet). Poorly defined broad streams, canals, and ditches drain into the ocean. Much of south Florida is underlain by a fossiliferous limestone, a rock composed primarily of calcium carbonate. The calcium carbonate is subject to dissolution when exposed to acidic water, such as acid rain.

Soils

Deciduous trees shed their leaves each fall, and as the leaves decompose, the soil absorbs the nutrients contained in the leaves. For this reason, the soils of this ecological system tend to be fertile due to high amounts of decaying organic matter. There are two types of soil found in deciduous forests in the U.S. Fertile soils with high organic content occupy roughly 14 percent of the U.S. land area. These soils are rich in nutrients and have well-developed layers of clay. The second type, the “red clay” soil occupies roughly nine percent of the U.S. and is found mainly in the southeast. These “red clay” soils are found in humid temperate and tropical areas of the world, typically on older, stable landscapes. While the clay layer is well developed, many of the nutrients have been washed or leached out of the soil over time. Because of the favorable climate regime, these soils can support productive forests, but are poorly suited for continuous agriculture without the use of fertilizer and lime.

For example, Fort Belvoir, Virginia has uplands that are underlain by sands, silts, and clays of riverine origin. Uplands underlain by sands and silts tend to be more stable than those underlain by clays. Uplands that are underlain by clayey soils form undulating and rolling hills, and the dominant geomorphic process in these areas is mass wasting that includes downhill creep, landslides, slumping, and rock falls. Lowlands and valley bottoms are typically underlain with alluvium. The dominant geomorphic process is active riverine erosion and deposition during overbank flooding. Surface drainage is commonly poor due to the shallow water table. Drainage usually occurs as surface runoff, with runoff greatest on the steeper slopes and increasing with construction activity and the removal of vegetation, which greatly increases the rate of erosion and the probability of creep and slumping.

In coastal areas of this biome, soils are predominantly deep and adequately drained. However, those soils found in the Western Florida Coastal Lowlands and part of the

Louisiana Coastal Prairies and Marshes are poorly drained. Soils in the Everglades are composed mainly of organic materials and have varying degrees of stratification. Most soils inland from the Florida coasts are poorly drained, shallow, and moderately textured. Some coastal soils are deep sands that are well drained or excessively drained. These soils are topographically situated in low-lying areas and are subject to tidal flooding.

Geological Hazards

Because limited seismic activity occurs along the Atlantic continental shelf, the risk of an earthquake in the Deciduous Forest Biome is low. For example, there are no known areas of volcanic activity within Alabama, where the existing Redstone Arsenal is located. According to the Uniform Building Code, this installation is located in seismic zone 1. Within this seismic zone there is a low probability of earthquakes. No unique geologic landforms have been identified in the area.

Volcanic activity generally is not observed along the U.S. Atlantic and Gulf Coasts, however, cracks present in the Eastern Seaboard have the potential to cause the seabed to crumble and create a tsunami that would push huge masses of seawater toward the coast.

Landslides are a significant geologic hazard throughout the Deciduous Forest Biome.

The U.S. Atlantic and Gulf Coasts are susceptible to coastal land loss. The physical factors that have the greatest influence on coastal land loss are reductions in sediment supply, relative sea level rise, and frequent storms, including hurricanes, whereas the most important human activities are sediment excavation, river modification, and coastal construction. As a result of these agents and activities, coastal land loss is manifested most commonly as beach or bluff erosion and coastal submergence.

H.3.5 Hazardous Materials and Hazardous Waste

Hazardous Materials

At the Stennis Space Center in Mississippi, an existing site in the Deciduous Forest Biome, numerous types of hazardous materials are used to support its various missions, research, operations, and general maintenance. These materials include common building paints, industrial solvents, and certain chemicals used in the scientific and photographic labs. Propellant and oxidizer are used to test rocket engine components. Hazardous materials also are used by on-station contractors to support station construction and operations. Hazardous materials such as solvents and paints, chlorine, sulfuric acid, oils, sodium hydroxide, and sulfide solutions are used in maintenance activities. (BMDO, 2001)

Under CERCLA, the resident agencies at the Stennis Space Center, NASA, and contractors are responsible for reporting releases of reportable quantities to the National Response Center within 24 hours. The Stennis Space Center implements this program through NASA Management Instruction 1040.1C, which provides a comprehensive emergency plan. Routine and accidental releases, as well as quantities of listed chemicals stored on site, are reported annually in accordance with the Emergency Planning and Community Right To Know Act. The Stennis Space Center Fire Department is trained to handle hazardous materials. (BMDO, 2001)

Federal Oil Pollution Prevention regulations require the preparation of an SPCC Plan for aboveground petroleum storage tanks with a capacity greater than 2,500 liters (660 gallons) or 5,000 liters (1,320 gallons) in aggregate. The Stennis Space Center has a limited number of tanks to which this requirement applies. The Stennis Space Center maintains an SPCC Plan as part of the contingency plan (SPG 4l30.3C). (BMDO, 2001)

Hazardous materials commonly utilized at Cape Cod Air Force Station, Massachusetts, an existing site in the coastal section of this biome, include adhesives; batteries; biocides; corrosives; ethylene glycol (antifreeze); diesel fuel; gasoline; paint; petroleum, oil, and lubricants; solvents; biocides; and household products. (U.S. Department of the Air Force, 2002) In addition, the main mission computers generate a large amount of heat and are mechanically cooled using approximately 45 kilograms (100 pounds) of the hydrochlorofluorocarbon refrigerant R-401a. R-401a is an ozone-depleting substance, but it is not listed as a Class I or Class II ozone-depleting substance due to its low ozone-depleting potential. The installation does not vent R-401a to the atmosphere; it is reclaimed. The Tech Facility Chiller utilizes approximately 1,900 kilograms (4,200 pounds) of R-134a, which is not an ozone-depleting substance.

Hazardous Waste

Hazardous materials and hazardous waste are stored and managed in accordance with applicable laws and regulations. At Redstone Arsenal, Alabama, hazardous waste is stored prior to disposal in igloos in restricted areas. Each igloo is designated for one type of waste and is inspected on a regular basis. At some installations, it is the responsibility of each contractor to manage and dispose of all hazardous waste generated from its operations in accordance with all local, state, and Federal regulations. (U.S. Department of the Air Force, 2000) For example, at the Stennis Space Center, Mississippi, all individuals or organizations are responsible for administering the applicable regulations and plans regarding hazardous waste and for complying with applicable regulations regarding the temporary accumulation of waste at the process site. Individual contractors and organizations maintain hazardous waste satellite accumulation points and 90-day hazardous waste accumulation areas in accordance with 40 CFR 262.34. All hazardous wastes placed in the accumulation areas must be shipped off-site for treatment, storage, and disposal within 90 days of the start of accumulation.

At other installations, DoD contracts out waste management responsibilities to local private companies. For example, Cape Cod Air Force Station is considered a small quantity generator of hazardous waste. The installation generates less than 1,000 kilograms of hazardous waste per month and can accumulate up to 6,000 kilograms (13,000 pounds) of hazardous waste on site at any one time. As a small quantity generator, Cape Cod Air Force Station can store hazardous waste on site for up to 180 days (only if the amount stored is less than 6,000 kilograms (13,000 pounds)) before shipping the waste to an off-site disposal location. The Defense Reutilization and Marketing Office (DRMO) in Groton, Connecticut, or Portsmouth, New Hampshire, acts as the principal agent for the procurement of an environmental services disposal company to transport and dispose of hazardous waste generated at Cape Cod Air Force Station. (U.S. Department of the Air Force, 2002)

Underground storage tanks (USTs) are subject to Federal regulations within RCRA, 42 United States Code (U.S.C.) 6991, and EPA regulations, Title 40 CFR 265. Aboveground storage tanks are subject to regulation under the Clean Water Act (33 U.S.C. 1251-1578) and oil pollution provisions (40 CFR 112). For example, the Mississippi Department of Environmental Quality has adopted the Federal UST program and is the administering agency for USTs at the Stennis Space Center, Mississippi. Currently, Stennis Space Center contains three USTs and twenty-four ASTs that are subject to Federal regulations. (BMDO, 2001)

H.3.6 Health and Safety

Health and Safety attributes of the Deciduous Forest Biome are similar to those discussed in Section H.1.6.

H.3.7 Noise

The Eastern Range is a representative example of noise levels for sites where activities for the proposed BMDS may occur in the Deciduous Forest Biome. Ambient noise levels based on daytime monitoring, range from 60 dBA to 80 dBA. (DOT, 2001) Noise sources associated with the proposed BMDS are similar to those described in Section H.1.7.

H.3.8 Transportation

Coastal environments sustain widespread infrastructure, including marine ports and docks that are supported by traffic circulation systems such as highways and byways, unpaved roads, non-maintained roads, trails, railroad lines, municipal, private, and military airports and any other system involved in mass transportation.

Ground Transportation

For example, at Cape Canaveral Air Force Station, Florida, on-site roadways provide access to launch complexes, support facilities, and industrial areas. During peak hours, traffic flow remains steady, and significant delays seldom occur. Several off-site roads and major highways provide access to the installation. Railways transport both cargo and passengers in the region. (U.S. Army Space and Missile Defense Command, 1999a)

Air Transportation

There are numerous commercial, private, and military airports within the Deciduous Forest Biome. They vary in size from major international airports such as Hartsfield-Jackson Atlanta International Airport in Georgia that supports 80 million passengers each year to small, rural airstrips that support single engine planes.

Marine Transportation

The top ports in U.S. foreign trade are deep draft (with drafts of at least 12 meters [40 feet]). Twenty-five U.S. ports, located within the Deciduous Forest Biome, received 73 percent of total vessel calls, including Portland, Maine; New York, New York; Baltimore, Maryland; Hampton Roads, Virginia; Charleston, South Carolina; Savannah, Georgia; Jacksonville, Florida; Miami, Florida; Port Everglades, Florida; Mobile, Alabama; Lake Charles, Louisiana; LOOP Terminal, Louisiana; Beaumont, Texas; Corpus Christi, Texas; Freeport, Texas; and Texas City, Texas. Of vessels over 1,000 gross tons, tankers and containerships called at U.S. ports more often in 2000 than did other types of vessels. (DOT Bureau of Transportation Statistics (BTS), 2001)

H.3.9 Water Resources

Surface Water and Ground Water Resources

Ground water provides about 40 percent of the U.S. public water supply. Freshwater aquifers along the Atlantic coastal zone are among the most productive in the U.S., supplying drinking water to an estimated 30 million people from Maine to Florida. (USGS, 2000) More than 40 million people, including most of the rural population, supply their own drinking water from domestic wells. Ground water is also the source of much of the water used for irrigation. It is the principal reserve of fresh water and represents much of the potential future water supply. Ground water is a major contributor to flow in many streams and rivers and has a strong influence on river and wetland habitats for plants and animals.

In the Northern U.S. coastal areas, nearly all rural, domestic, and small-community water systems obtain water from ground water wells. Where water demand is great, sophisticated reservoir, pipeline, and purification systems are needed to meet demands. In the Mid-Atlantic, rivers are important sources of water supply for many cities, but populations living on the Coastal Plain depend on ground water for supply. For example, at Cape San Blas, Florida, the Floridian aquifer is the primary potable water source, although the surficial aquifer may be used as a potable water source in rural areas.

Ground water resources along the Atlantic Coast are vulnerable to saltwater intrusion and nutrient contamination. Saltwater intrusion, the movement of saline water into freshwater aquifers, is most often caused by ground water pumping near the coast. Nutrient contamination results from many human activities and has caused widespread increases of nitrate in shallow ground water. (USGS, 2000)

Sole Source Aquifer designations under the Safe Drinking Water Act protect drinking water supplies in areas with few or no alternative sources to the ground water resource, or where, if contamination occurred, using an alternative source would be extremely expensive. The designation protects an area's ground water resource by requiring EPA review of any proposed projects within the designated area that are receiving Federal financial assistance. Many sole-source aquifers have been designated in coastal areas, especially on near shore islands. For example, there are 15 designated Sole Source Aquifers in New England, most of which are in coastal areas. (EPA, 2003a)

The Coastal Plain of the Atlantic Coast has a moderate density of small to medium size perennial streams and a low density of associated rivers, most with moderate volume of water flowing at very low velocity. In the Mid-Atlantic Coastal Flatlands and Lowlands and Louisiana Prairies and Marshes, the water table is high in many areas, resulting in poor natural drainage and abundance of wetlands. In the Lower Coastal Plains, few natural lakes occur, except in central Florida where they are abundant. Large, freshwater springs are common in central Florida, especially in areas of limestone rock formations.

In the Upper Atlantic Coastal Plain streams flow relatively slowly to the Atlantic Ocean or the Delaware Bay. Natural lakes are rare to non-existent. Small water impoundments are common along the upper reaches of streams. Bogs, swamps, and salt marshes exist along the Atlantic Coast. Bogs tend to be very acidic. Rates of stream flow near the Delaware Bay and the coast fluctuate daily in response to tides. Tests show that salt content is sufficiently low that tidewater from streams may be used for irrigation without adverse effects on soils and vegetation. Currently, there is ample water for farm, urban, and industrial uses. However, urban development increasingly affects the hydrology of the area, including infiltration, underground water storage, and runoff.

The source of most surface water in the Everglades, other than precipitation, is Lake Okeechobee, about 1,940 square kilometers (750 square miles) in area, immediately north of this area. Most waterways are canals that were built to carry a moderate to high volume of water at very low velocity. The water table is high in many areas, resulting in poor natural drainage and abundance of wetlands. A poorly defined drainage pattern has developed on this landscape, which is relatively young and weakly dissected.

Water Quality

The quality of the ocean along the east coast of the U.S. is highly impacted by human activity. A great percentage of our population lives within 50 miles of the coast and much of the land along the coast has been developed. Water testing shows that the ocean of the Mid-Atlantic is highly affected by the flow into the ocean from the Hudson River, the Delaware River, and the Chesapeake Bay. Water that falls on land can make its way to streams and rivers that empty into the ocean, carrying pollutants, such as fertilizers and pesticides from farms and homes. Pollution of coastal waters also comes from rainfall that can carry particulates and other pollutants; sewage treatment plants; combined sewer overflows; and storm drains that discharge liquid waste directly into the ocean through pipelines, dumping of materials dredged from the bottoms of rivers and harbors, and waste from fish processing plants, legal and illegal dumping of wastes from ships and ground water from coastal areas.

Along the east coast, some indicators of water quality show improvement, while others indicate worsening conditions. Overall, the long-term trend is for increasing loads of contaminants in the ocean caused by an ever-increasing population impacting the coastal area. (EPA, 2003e)

The majority of estuaries assessed in the Gulf of Mexico were in good ecological condition, meaning that neither environmental stressors (nutrients, contaminants, etc.) nor aquatic life communities showed any signs of degradation. However, some estuaries showed indications of poor aquatic life conditions, and some were impaired for human uses.

These estuaries support submerged aquatic vegetation communities that stabilize shorelines from erosion, reduce non-point source loadings, improve water clarity, and provide habitat. Water clarity in Gulf Coast estuaries is fair. Water clarity was estimated by light penetration through the water column. For approximately 22 percent of the waters in Gulf of Mexico estuaries, less than ten percent of surface light penetrated to a depth of one meter (three feet). Dissolved oxygen conditions in Gulf Coast estuaries are generally good, except in a few highly eutrophic, or nutrient rich regions. Estimates for Gulf of Mexico estuaries show that about four percent of the bottom waters in the Gulf estuaries have hypoxic conditions characterized by low dissolved oxygen (less than 2 parts per million) on a continuing basis in late summer. These areas are largely associated with Chandeleur and Breton Sounds in Louisiana, some shoreline regions of Lake Pontchartrain, northern Florida Bay, and small estuaries associated with Galveston Bay, Mobile Bay, Mississippi Sound, and the Florida panhandle. While hypoxia resulting from human activities is a relatively local occurrence in Gulf of Mexico estuaries, accounting for less than five percent of the estuarine bottom waters, the occurrence of hypoxia in the Gulf's shelf waters is much more significant. The Gulf of Mexico hypoxic zone is the largest zone of anthropogenic, or human-caused, coastal hypoxia in the Western Hemisphere. (NOAA, 2000) Since 1993, midsummer bottom water hypoxia in the northern Gulf of Mexico has been larger than 10,000 square kilometers (3,861 square miles), and in 1999, it reached 20,000 square kilometers (7,722 square miles). (NOAA, 2000)

Over half of the N_2 load comes from non-point sources north of the confluence of the Ohio and Mississippi Rivers, with much of the loading coming from the drainage of agricultural lands. (NOAA, 2000) Gulf of Mexico ecosystems and fisheries are affected by the widespread hypoxia. Mobile organisms leave the hypoxic zone for more oxygen-rich waters, and those that cannot leave die as a result of hypoxia.

The condition of Gulf Coast estuaries as measured by eutrophic (high nutrient) conditions is poor. Expression of eutrophic condition was high in 38 percent of the area in Gulf estuaries. The symptoms of eutrophic condition are expected to increase in over half of Gulf of Mexico estuaries by 2020. High expressions of chlorophyll were determined for about 30 percent of the estuarine area of the Gulf of Mexico. The areas with high chlorophyll were largely in Louisiana, Laguna Madre, Texas, Tampa Bay, Florida, and Charlotte Harbor, Florida. (EPA, 2003e)

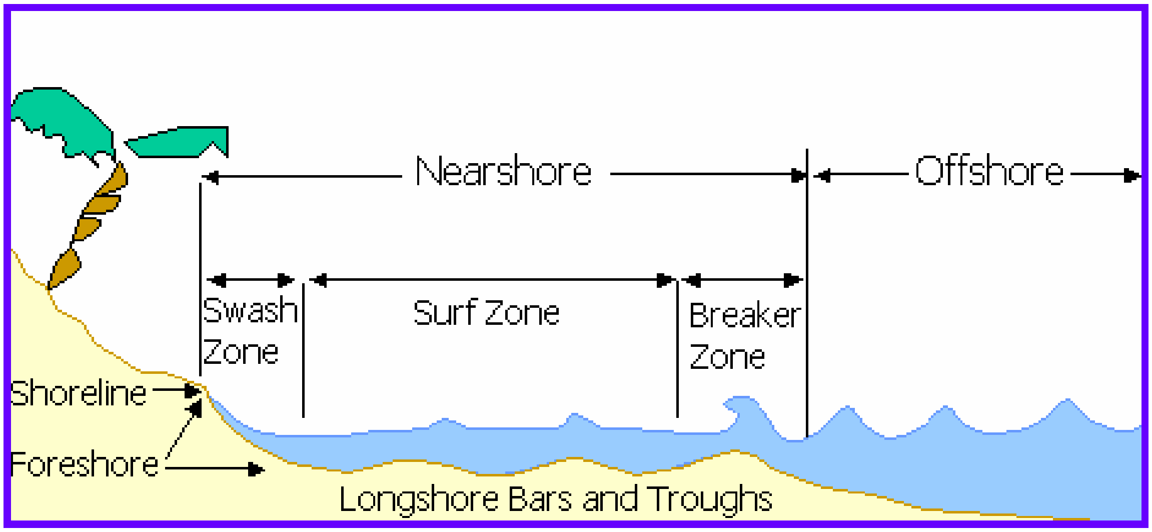
The coastal wetlands indicator for the Gulf of Mexico receives a score of poor. Wetland losses along the Gulf of Mexico from the 1780s to 1980s are among the highest in the nation. Losses over the 200-year time span were 50 percent throughout the Gulf and ranged from 46 percent declines in Florida and Louisiana (although the absolute losses in these states were the highest) to a 59 percent decline in Mississippi. During the 1970s to 1980s, the Gulf lost five percent of its wetlands, with the largest declines seen in Texas. Not all of the wetland losses in the Gulf of Mexico are due to coastal development. Sea-level rise, coastal subsidence, and interference with normal erosion and depositional processes also contribute to wetland loss.

H.4 Chaparral Biome

The Chaparral Biome includes regions corresponding to those shown in Exhibit 3-14, but focuses on a portion of the California Coast and the coastal region of the Mediterranean from the Alps to the Sahara Desert and from the Atlantic Ocean to the Caspian Sea. Representative sites where activities for the proposed BMDS may occur are part of the Western Range, including Vandenberg AFB and the Point Mugu Sea Range.

Coastal areas consist of land areas that are affected by proximity to the sea, and sea areas that are affected by proximity to the land. As noted above, the coastal area consists of the Exclusive Economic Zone, which is 322 kilometers (200 miles) offshore and incorporates the 19.3-kilometer (12-mile) designation often used by the Navy to define coastal areas. The coastal zone also extends one kilometer (.6 mile) inland of the coastal shoreline, tidal wetlands, coastal wetlands, and coastal estuaries. Sea-based activities may occur in near shore areas of the Chaparral Biome. The near shore is an indefinite zone extending seaward from the shoreline beyond the breaker zone (see Figure H-6). This typically includes water depths less than 20 meters (65 feet). (Discover the Outdoors, 2002)

Exhibit H-6. Near Shore Waters



Not to scale
Source: Texas A&M University, Division of Nearshore Research, 2003

H.4.1 Air Quality

Climate

Chaparral Biomes, also known as Mediterranean Biomes, occur along the California coast, Europe, Africa, Asia Minor, North America, and South America. Chaparrals exist between 30 and 40 degrees north and south latitude on the west coasts of continents. The climatic conditions that produce this biome include shore areas with nearby cold ocean currents. The California Chaparral Biome extends from northeastern Baja California, Mexico, northward along the Pacific into southern California in the U.S. The biome is bounded in the east by the Colorado-Sonora Desert and continues south as far as Punta Baja, Mexico and includes the Channel Islands (U.S.) and Cedros and Guadalupe Islands (Mexico). The Mediterranean Chaparral biome is localized in the coastal areas surrounding the Mediterranean Sea including parts of Europe, North Africa, and Asia Minor. (National Geographic, 2003a)

Chaparral climate is characterized by rugged coastal mountain ranges parallel to the coastline, which influence and modify climatic patterns, forming rain shadows and microclimates. (Atmosphere, Climate and Environment Programme, 2003) The

Chaparral climate consists of hot summer drought and winter rain in the mid-latitudes, north of the subtropical climate zone. The climate in this area is unique with the wet season occurring in winter and annual rainfall of only 38 to 102 centimeters (15 to 40 inches). Cold ocean currents and fog affect temperatures, which limit the growing season. The high-pressure belts of the subtropics drift northwards in the Northern Hemisphere from May to August and they coincide with substantially higher temperatures and little rainfall. During the winter, weather becomes dominated by the rain-bearing low-pressure depressions. While usually mild, such areas can experience cold snaps when exposed to the icy winds of the large continental interiors, where temperatures can drop to -40°C (-40^{o}F) in the extreme continental climates. (Atmosphere, Climate and Environment Programme, 2003)

Regional Air Quality

The primary sources of air pollutants in coastal areas include stationary sources, area sources, mobile sources, and biogenic sources such as forest fires. Many VOCs react with sunlight in the atmosphere to produce ozone (i.e., smog). In some areas, background levels of air pollutants are relatively high due to air currents depositing pollution from sources outside of the coastal area.

The EPA recently conducted a national-scale assessment of 33 air pollutants (a subset of 32 HAPs plus diesel PM), including sources, ambient concentrations, and human health risk (cancer and noncancer). Many of the highest-ranking 20 percent of counties in terms of risk are located in the Pacific coastal areas in central and southern California. (EPA, 1996)

There is a large area along the Pacific coast, particularly in southern California that is in non-attainment for ozone (ranging from severe to extreme). Non-attainment for ozone is found within all of the air basins along the southern California coast. Los Angeles and Orange counties are in extreme non-attainment for ozone. Ventura and San Diego counties are in serious and severe non-attainment for ozone, respectively, and Santa Barbara County is in moderate non-attainment. Several factors contribute to this including

- Increases in industrial and automotive activity associated with population growth,
- Stagnant air movement,
- Strong inversions during warm weather, and
- Pollutants migrating from neighboring areas.

There are also many areas along the Pacific coast that are in non-attainment for PM_{10}. A large area in southern California is in severe non-attainment for PM_{10}, while smaller areas are in moderate non-attainment in coastal Oregon and Washington. (EPA, 2003f)

The EPA has designated the near shore areas of southern California as unclassified/attainment areas. Due to the lack of major emissions sources in the area and the presence of strong northeast winds, the likelihood of pollutants remaining in the ambient air is low.

The European Union eight-hour air quality standard for ozone (53 nmol/mol) is exceeded throughout the summer in the entire Mediterranean region. Typical ozone mixing ratios in summer are 55 to 70 nmol/mol, and the diurnal variability is small (approximately 10 percent). In addition, the concentrations of aerosols are high. The fine aerosol fraction (less than1micrometer) is composed mainly of sulfate (35 to 40 percent), organics (30 to 35 percent), ammonium (10 to 15 percent) and black carbon (five to 10 percent) and is produced mostly by fossil fuel and biomass combustion. The persistent northerly winds in summer carry large pollution loads from Europe to the Mediterranean Sea, affecting water quality and contributing to eutrophication.

Aerosols further influence the Mediterranean atmospheric energy budget by scattering and absorbing solar radiation. They reduce solar radiation absorption by the sea by about ten percent and they alter the heating profile of the lower troposphere. As a result, evaporation and moisture transport, in particular to North Africa and the Middle East, are suppressed. Furthermore, aerosols interfere with the cloud microstructure and convection, which may lead to decreased precipitation.

There is a remarkably high level of air pollution from the surface to the top of the troposphere (up to 15 kilometers [nine miles] altitude). The strongest anthropogenic influence was observed in the lower four kilometers (two miles), originating from both West and East Europe transported by the northerly flow. Major sources of air pollution along the Mediterranean coast include industrial activity, traffic, forest fires, and agricultural and domestic burning. Because the Mediterranean region has very few clouds in summer, solar radiation levels are high so that noxious reaction products such as ozone and peroxyacetyl nitrate are formed in photochemical smog.

At higher altitudes, above four kilometers (two miles), significant contributions from long-distance pollution transport from North America and Asia are present. About half of the mid-tropospheric CO over the Mediterranean originates from Asia and 25 to 30 percent from North America. These transports follow the prevailing westerly winds that are typical of the extra-tropics. These layers are affected substantially by ozone that is mixed from the stratosphere. The middle troposphere, in particular, is influenced in summer by stratosphere-troposphere exchange, leading to a stratospheric contribution to column ozone in the troposphere up to 25 to 30 percent. Transport of anthropogenic ozone and its precursor gases from the U.S. exert a significant influence in the free troposphere.

A distinct layer that is associated with high levels of reactive species such as formaldehyde is found in the upper troposphere (above eight kilometers [five miles] altitude). This layer of pollution is caused by anthropogenic emissions transported from South Asia, following convective lifting into the upper troposphere by thunderstorms in the Indian monsoon. Subsequently these air parcels follow the easterly tropical jet and turn north over the eastern Mediterranean in a large upper level anticyclone. The chemical "fingerprint" of biomass burning (e.g., enhanced acetonitrile, methyl chloride, acetylene), in particular by biofuel use in India as observed during the Indian Ocean Experiment, is evident. From the upper troposphere over the eastern Mediterranean these substances can penetrate the lowermost stratosphere. It appears that the Mediterranean region is a preferred location for cross-tropopause exchanges, partly related to direct convective penetration of the lower stratosphere over southern Europe. (Lelieveld, 2002)

Existing Emission Sources

The southern U.S. Pacific coast has intensely populated areas with heavy urban development. Heavy industrial activities, high automobile traffic, and energy generation are the main sources of air pollutants in this area. The South Coast Air Basin includes a population that accounts for 40 percent of the traveled vehicle miles and creates one-third of the air pollution in California. The main emission source in this area is automobiles. However, continued construction and development is causing increased fugitive dust levels resulting in growing PM_{10} concentrations.

Emission sources in the south central coastal area include power plants, oil extraction and refining activities, transportation, and agriculture. Ozone concentrations in this district are improving, but the area still struggles with high PM_{10} levels.

Existing air emissions in the near shore environment include emissions from aircraft operations, missile/target operations, and marine vessel operations.

Power plants and transportation provide the greatest sources of global warming gases emissions in Europe, including the southern regions of the Mediterranean Biome. Electricity demand continues to rise in the European Union, securing the presence of CO_2 as a growing emission, with emission levels possibly rising to 23 percent over their 1995 levels by 2020. Emissions of polyaromatic hydrocarbons are another pollutant of concern, deriving primarily from combustion processes in the region, especially in small boilers with often poor combustion. Road traffic is another contributor.

The European Union also pays special attention to hydrofluorocarbons, perfluorocarbons and sulfur hexafluoride as global warming contributors. They are primarily emitted from refrigeration practices, air conditioning (including in cars), and industry. Emissions of each of these three gases have been on the rise lately due to their substitution for ozone depleting substances banned by the Montreal Protocol. (Acid News, 2003)

While most Mediterranean countries studied are not big polluters, the Mediterranean region is a crossroads area for pollution carrying air currents from Europe, Asia, and North America. (Lelieveld, 2002) In fact, studies show that trans-Atlantic pollution transport from North America exerts the greatest influence over the Mediterranean region. (Bey and Schultz, 2003)

The main sources of atmospheric pollution in Northern Africa are bush fires, vehicle emissions, manufacturing, mining, and industry. Major industrial sources include thermal power stations, copper smelters, ferro-alloy works, steel works, foundries, fertilizer plants, and pulp and paper mills. The use of leaded fuel in vehicles also greatly contributes to emissions, which are worsening due to the ageing of the region's vehicles, most of which are more than 15 years old. These older vehicles also are said to emit five times more hydrocarbons and CO, and four times more NO_X, than new vehicles. (United Nations Environment Programme [UNEP], 2000)

H.4.2 Airspace

Controlled and Uncontrolled Airspace

The Chaparral Biome in the U.S. contains all FAA classifications for airspace, as described in Section 3.1.2. Airspace in coastal regions of North America contains "North American Coastal Routes," which are numerically coded routes preplanned over existing airways and route systems to and from specific coastal fixes. See Section 3.1.2 for a description of North American Routes.

Portions of the Chaparral Biome are located in international airspace. Therefore, the procedures of ICAO (outlined in ICAO Document 444, Rules of the Air and Air Traffic Services) are followed. The ICAO is a specialized agency of the United Nations whose objective is to develop the principles and techniques of international air navigation and to foster planning and development of international civil air transport. The FAA acts as the U.S. agent for aeronautical information to the ICAO, and the Los Angeles ARTCC manages air traffic in the California portion of the Chaparral Biome.

In December of 2002, the European Union adopted the "single sky" directive, which will create a single European airspace by 2004. The single sky proposal will eliminate many of the national boundaries that currently divide Europe's airspace to create several "functional blocks of airspace" that will be regulated as a single entity. European Union airspace above 8,687 meters (28,500 feet) will be under unified control.

Special Use Airspace

There are numerous restricted areas in the near shore environment associated with the Western Range. These include restricted areas R-235A and R-2535B, and eight warning areas (W-289, W-289N, W-290, W-412, W-532, W-537, W-60, W-61). The airspace in each warning area extends from the surface (sea level) to an unlimited altitude. The FAA Los Angeles ARTCC controls civil aircraft operating under IFR clearances and transiting areas associated with the Western Range along the U.S. Pacific Coast. Aircraft operating under VFR conditions are not precluded from operating in the Warning Area airspace; however, during hazardous operations every effort is made to ensure that non-participating aircraft are clear of potential hazard areas.

The procedures for scheduling each portion of airspace are performed in accordance with letters of agreement with the controlling FAA facility, Los Angeles ARTCC. Schedules are provided to the FAA facility as agreed between the agencies involved. Aircraft transiting the open ocean portion of the region of influence that could be affected by tests events would be notified, and any necessary rerouting would be accommodated before departing their originating airport. This may require affected aircraft to take on additional fuel before take-off.

Airports/Airfields

Numerous airports and airfields exist within the Chaparral Biome. For example, the area that encompasses the Vandenberg AFB includes the Santa Barbara Municipal, Santa Ynez, Lompoc, and Santa Maria Public airports. Vandenberg AFB also maintains its own runway, which is capable of handling large aircraft (U.S. Army Space and Missile Defense Command, 2002b).

En Route Airways and Jet Routes

Numerous jet routes that cross the Pacific pass through the U.S. Chaparral Biome, including A331, A332, A450, R463, R465, R584, Corridor V506 and Corridor G10.

H.4.3 Biological Resources

Vegetation

Chaparral Biome occurs in mild temperate climate zones with moderate winter precipitation and long, hot, dry summers or where there is moderate precipitation, but the sandy soils have low water-holding capacities. The Chaparral supports a broad variety of xeric (requiring little water) woodlands from piñon-juniper woodlands to pine barrens to sandhill pine woodlands, sandpine scrub, and pine flatwoods. The vegetation of the Chaparral is characterized by the presence of Sclerophyllous (hard, tough, evergreen) leaves and low, shrubby appearance. Many plants are specially adapted to areas of nearly toxic, magnesium-rich soil (known as serpentine).

Due to the summer drought, many plants that thrive in other European areas are unable to thrive on the Mediterranean Coast. Shrubs and low-growing vegetation are the main components of the region. However, some areas exhibit growth that extends to larger trees and hard-leaf forests, as well as aromatic plants. The vegetation is hardy and drought-resistant and includes evergreens, cacti, olive and fruit trees, and cork oak. Plants with small hard needles or small leathery leafs thrive in this region. Plants have adapted by storing water through thick bark or waxy coverings, and by growing thorns to prevent animals from eating them. Adaptations also include regeneration after fire. Aromatic plants and herbs grow well in this region. These aromatics contain highly flammable oils that sometimes contribute to forest fires.

Wildlife

Several bird species nest and hunt for insects in the Chaparral Biome, including the endangered California gnatcatcher and Costa's hummingbird. Birds of the Chaparral include the endangered California gnatcatcher (*Polioptila californica*), California thrasher (*Toxostoma redivivum*), western scrub jay (*Aphelocoma californica*), and cactus wren (*Campylorhynchus brunneicapillus*).

The near shore and coastal area of the Chaparral Biome may support several Federally listed threatened or endangered species. Exhibit H-7 contains examples of listed threatened or endangered species within the Chaparral Biome.

Exhibit H-7. Federally Listed Threatened or Endangered Species within the Chaparral Biome

Common Name	Scientific Name	Federal Status
Western snowy plover	*Charandrinus nivosus*	Threatened
California brown pelican	*Pelecanus occidentalis californicus*	Endangered
California least tern	*Sterna antillarum broni*	Endangered
Green sea turtle	*Chelonia mydas*	Threatened
Loggerhead sea turtle	*Caretta caretta*	Threatened
Leatherback sea turtle	*Dermochelys coriacea*	Endangered
Olive ridley sea turtle	*Lepidochelys oliveacea*	Threatened
Southern sea otter	*Enhydra lutris nereis*	Threatened
Guadalupe fur seal	*Arctocephalus townsendi*	Threatened

Modified from U.S. Army Space and Missile Defense Command, 2003

The Western snowy plover (*Charandrinus nivosus*) is federally listed as threatened and breeds along the Pacific coast from southern Washington State to southern Baja California, Mexico. The plover nests and forages year round on the beaches and intertidal zone of San Nicolas Island which has been designated as critical habitat for the plover. Twenty-eight locations along the California coast have been designated as critical habitat for the plover. Threats to the plover include shoreline modification, recreational activities such as off-road vehicles and beach combing, and loss of nesting habitat. (Sacramento Fish and Wildlife Service, 2003)

The California brown pelican (*Pelecanus occidentalis californicus*) is federally and state listed as endangered and breeds in nesting colonies on islands that are free from mammal predators. The nesting colonies range from Baja California to West Anacapa and Santa Barbara Islands. The breeding season is from March to August. Brown pelicans may roost along the Pacific coast from the Gulf of California to Washington State and southern British Columbia. Threats to the California brown pelican include a decline in the food supply because of over-fishing, entanglement with hooks and fishing lines, disturbances at roosting sites, disease, and climate changes. (Sacramento Fish and Wildlife Service, 2003)

The California least tern (*Sterna antillarum browni*) is federally and state listed as endangered and is a highly migratory species that is present in California from April to September. It migrates further south during the winter. The least tern nests on sandy beaches close to lagoons and forages in the near shore waters. Threats to the California least tern include habitat loss, human disturbance, predation, and climatic events. (Sacramento Fish and Wildlife Service, 2003)

The Green sea turtle (*Chelonia mydas*) is a federally threatened sea turtle found in the eastern North Pacific from Baja California to southern Alaska. Green sea turtles forage in the kelp beds off western San Nicolas Island but there are no known nesting locations on the island. The sea turtles are sighted year round in the Western Range generally in waters less than 50 meters (164 feet) deep. Populations appear to be highest from July to September. Threats to the Green sea turtle include over-harvesting by humans, habitat loss, fishing net entanglement, boat collisions, and disease. (Sacramento Fish and Wildlife Service, 2003)

The Loggerhead sea turtle (*Caretta caretta*) is a federally threatened sea turtle similar to the Green sea turtle. It has been observed in the Range at depths up to 1,000 meters (3,280 feet). Juvenile Loggerhead sea turtles are spotted frequently in the Western Range particularly from July to September but adult Loggerheads are rarely seen in the Western Range. Threats to Loggerhead sea turtles include exploitation, loss of habitat, fishing practices, and pollution.

The Leatherback sea turtle (*Dermochelys coriacea*) is a federally listed endangered species. The Leatherback sea turtle is a highly migratory species and is more pelagic (using deep ocean waters) than other sea turtle species. They may forage in the kelp beds off western San Nicolas Island, but there are no known nesting beaches on the island. They have been observed in the Western Range at depths of up to 1,000 meters (3,280 feet). They are most common from July to September. Threats to the Leatherback sea turtle include exploitation, loss of habitat, fishing practices, and pollution.

The Olive ridley sea turtle (*Lepidochelys oliveacea*) is a federally listed threatened species. (NOAA, 2003a) The Olive ridley is primarily tropical, nesting from southern Sonora, Mexico to Colombia. These turtles are rarely seen in the waters off the southwestern U.S. They have been observed in the Western Range in waters less than 50 meters (164 feet) but are rarely encountered.

The Southern sea otter (*Enhydra lutris nereis*) is federally listed as threatened. The sea otter lives in shallow water along the shores of the North Pacific. Sea otters inhabit intertidal and shallow, subtidal zones often in kelp beds. Sea otters can be found throughout the year in the kelp beds at the west end of San Nicolas Island and in smaller numbers off the north end of the island. Threats to the sea otters include shootings, boat strikes, capture and relocation, oil spills, and exposure to other toxic contaminants.

The Guadalupe fur seal (*Arctocephalus townsendi*) is federally listed as threatened. Individuals have been observed in the southern Channel Islands, including San Nicolas Island. The decline in the species appears to have been due to historic commercial hunting.

Environmentally Sensitive Habitat

The Chaparral Biome around the world supports 20 percent of all plants, but these areas are all relatively small and highly threatened. For example, the California Chaparral is one of only five Chaparral shrublands and woodlands of its kind and is the only one in North America. The biggest problem for this habitat is agricultural and urban expansion, which destroys and fragments remaining patches of Chaparral. Smaller patches also experience higher impacts from introduced plants and animals. Small patches also lose species that require larger areas of habitat for survival. In addition, fire suppression causes fuels to build up and can trigger very hot, devastating fires.

In 1980, a 4,294-square kilometers (1,252-square nautical miles) portion of the Santa Barbara Channel was designated as the Channel Islands National Marine Sanctuary. The sanctuary is an area of national significance that encompasses the waters that surround Anacapa, Santa Cruz, Santa Rosa, San Miguel and Santa Barbara Islands and extends from mean high tide to 11 kilometers (six nautical miles) offshore around each of the five islands. The sanctuary's primary goal is the protection of natural resources contained within its boundaries. The NOAA plans to expand the Channel Islands National Marine Sanctuary off the coast of Vandenberg AFB. The study area for this expansion includes an area off the coast of California from south of Point Mugu to north of Point Sal. (NOAA, 2003a)

Essential Fish Habitat includes those waters and sediment that are necessary to complete the life cycle for fish from spawning to maturity. The two Essential Fish Habitat zones in this region are for coastal pelagic and groundfish species. The coastal pelagic species include Pacific sardine (*Sardinops sagax*) Pacific mackerel (*Scomber japonicus*), northern anchovy (*Engraulis mordax*), jack mackerel (*Trachurus symmetricus*), and squid. The groundfish species include rockfish, shark, and cod. Migratory fish species in the area include tunas, marlin, and swordfish (*Xiphias gladius*). The east-west boundary for the Essential Fish Habitat zone includes all marine and estuary waters from the coast of California to the limits of the Exclusive Economic Zone (322 kilometers [200 miles]) where the U.S. has authority over the management of fisheries.

H.4.4 Geology and Soils

Geology

The California Chaparral Biome consists of narrow ranges with wide plains in between, as well as alluviated lowlands and coastal terraces. Elevation ranges from zero to 2,280 meters (zero to 7,500 feet).

In the Mediterranean region, the African plate pushes northward, causing the plate to move beneath, or subduct, European countries along the north coast of the Mediterranean. Many of these countries are known for their mountains and volcanoes, a result of this continuing process. There are many points of convergence and subduction throughout the Mediterranean, making it a distinctly geologically active region. Tectonics explains the size of the mountains around the Mediterranean Basin. Recent, high mountains with rough-hewn shapes rise either on the sea or a few kilometers inland. The main mountain ranges are the Atlas, the Betic chain, the Pyrenees, the Alps, the Apennines, the Dinaric massif, the Pinde mountains, the Taurus, and Mount Lebanon. In the northern part of the Mediterranean Basin, large plains are infrequent. However, in the southern part, along the thousands of kilometers of coastline, mountains are replaced by usually flat stretches where the desert often runs to the sea. (UNEP, 2003)

Soils

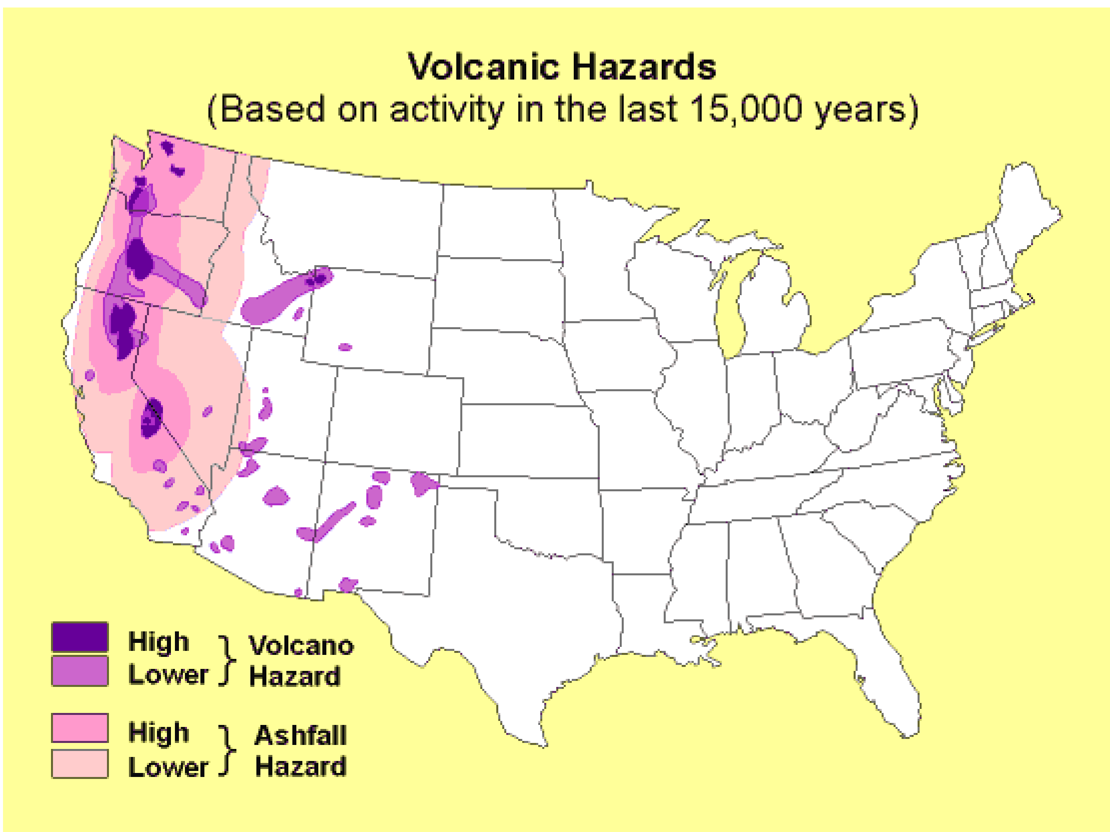
The soils of the Chaparral Biome may be classified into four categories, coastal beach sands, tidal flats, loamy sands, and silty clay. The erosion hazard of these soils depends on slope and vegetation cover.

In addition, the soils of the north Mediterranean Basin, where the climate is more humid, contain plant matter, which breaks down faster into soils rich in organic matter. In the southern Mediterranean Basin, because of extreme temperatures and lack of water, soils become depleted in organics, leaving behind a higher concentration of minerals. In addition, organics are removed by encroaching seawater along the coast that can cause salinization of soils. These soils, which are sensitive to desertification, become shallow and have a low water-holding capacity. (UNEP, 2003) Mediterranean soils are subject to intense erosion due to irregular and often violent precipitation such as monsoons, wind, the steep topography, and reduction in plant cover caused by the severe climate and man-made activities. (UNEP, 2003)

Geological Hazards

The California Chaparral Biome is noted for its intense seismic activity due to the right lateral motion of the Pacific and North Atlantic Plate boundary. Fault activity can cause damage in a variety of ways, and hazards include landsliding, ground shaking, surface displacement and rupture, and the triggering of tsunamis. In general, the type of damage sustained at a particular location depends on the proximity to the active faults, the frequency and severity of the disturbance, the potential for surface rupture, the composition of the surface and subsurface materials, and topography. Exhibit H-8 shows the geological hazards found in the U.S. Chaparral Biome.

Exhibit H-8. Volcanic Hazards (based on activity in the last 15,000 years)



Source: USGS, 2002c

Darker shaded areas show regions at greater or lesser risk of local volcanic activity, including lava flows, ashfalls, lahars (volcanic mudflows) and debris avalanches, based on the record of the last 15,000 years, as compiled by Mullineaux (1976). Lighter shaded areas show regions at risk of receiving five centimeters (two inches) or more of ashfall from large or very large explosive eruptions, originating at the volcanic centers. These projected ashfall extents are based on observed ashfall distributions from an eruption (large) of Mt. St. Helens that took place 3,400 years ago, and the eruption of Mt. Mazama (very large) that formed Crater Lake, Oregon, 6,800 years ago.

H.4.5 Hazardous Materials and Hazardous Waste

Hazardous Materials

Hazardous materials use within the Chaparral Biome must conform to applicable Federal, state and local laws and regulations. Existing ranges located within the U.S. Chaparral Biome have established procedures for obtaining hazardous materials from off-base suppliers. Hazardous materials are tracked using Environmental Management System software. These procedures are in accordance with the Hazardous Materials Management Plan. Spills of hazardous materials are covered under the Hazardous Materials Emergency Response Plan. This plan ensures that adequate and appropriate guidance, policies, and protocols regarding hazardous material incidents and associated emergency response are available to all installation personnel.

Hazardous Waste

Hazardous waste would be handled through established procedures, which describe procedures for packaging, handling, transporting, and disposing of hazardous waste. Hazardous wastes are typically collected at the point of generation and, if not reused or recycled, transported to a collection-accumulation point. Following initial containerization, waste may remain at the collection-accumulation point for up to 90 days, at which point all hazardous waste must be transported to the off-site Treatment, Storage, and Disposal Facility (U.S. Army Space and Missile Defense Command, 2001).

H.4.6 Health and Safety

Health and Safety attributes of the Chaparral Biome are similar to those discussed in Section H.1.6.

H.4.7 Noise

Vandenberg AFB is a representative example of noise levels for sites where activities for the proposed BMDS may occur in the Chaparral Biome. Ambient noise levels at Vandenberg AFB range from 48 to 67 dBA. (DOT, 2001) Noise sources associated with the proposed BMDS are described in Section H.1.7.

H.4.8 Transportation

Coastal areas sustain widespread infrastructure, including marine ports and docks that are supported by traffic circulation systems such as highways and byways, unpaved roads, non-maintained roads, trails, railroad lines, municipal, private, and military airports and any other system involved in mass transportation.

Ground Transportation

For example, at Vandenberg AFB, California, on-site roadways provide access to launch complexes, support facilities, and industrial areas, and significant delays seldom occur. Several off-site roads and major highways provide access to the installation. Railways transport both cargo and passengers in the region.

Air Transportation

There are numerous commercial, private, and military airports within the Chaparral Biome. They vary in size from major international airports such as Los Angeles International Airport in Los Angeles, California that supports 55 million passengers each year to small, rural airstrips that support single engine planes.

Marine Transportation

The top ports in U.S. foreign trade are deep draft (with drafts of at least 12 meters [40 feet]). Two major U.S. ports are located within the Chaparral Biome, including San Diego and Los Angeles, California. Once a shipping vessel leaves the navigation lanes leading to sea, there are no regulations or directions obliging commercial vessels to use specific cross-ocean shipping lanes. NOTMARs can be issued to warn vessels of testing events occurring in this area.

H.4.9 Water Resources

Surface Water and Ground Water Resources

Very few perennial streams occur in the Southern California coastal area. Perennial and intermittent streams occur in alluvial and weak bedrock channels that flow directly to the Pacific Ocean. High velocity and quantity flows periodically occur in the numerous intermittent drainages.

There is relative scarcity, on a per capita basis, of freshwater supplies in Mediterranean regions, where agriculture competes for freshwater with growing tourism and industrial use. (UNEP Plan Bleu, 2000) In coastal and marine areas, urban and industrial development and tourism have resulted in growing pressures on already hard-pressed areas. Parts of the Mediterranean Sea are affected by high nutrient inputs, coastal degradation, over-fishing, and the disposal of plastics. (UNEP, 1999)

Drinking water production represents only a small part of the total quantity of water mobilized and used in the Mediterranean region (15 to 20 percent in the developed countries to the North; less than ten percent in countries with a high demand for irrigation water). For example more than 80 percent of the population in Mediterranean Countries has access to drinking water. (Margat and Vallée, 1999)

Water Quality

Major water nutrients in the near shore environment include dissolved nitrogen, phosphates, and silicates. Dissolved inorganic nitrogen occurs as nitrates, nitrites, and ammonia, with nitrates being most common. The nitrate concentration of water in the near shore environment varies annually from 0.1 to 10.0 micrograms per liter with the lowest concentrations occurring in the summer months. At a depth of 10 meters (33 feet), concentrations of phosphate and silicate in the near shore environment range from 0.25 to 1.25 micrograms per liter, respectively.

The Clean Water Act prevents the release of hazardous substances into or upon U.S waters out to 370 kilometers (200 nautical miles) from the shore. Shipboard waste handling procedures for commercial and U.S. Navy vessels govern the discharge of non-hazardous waste.

H.5 Grasslands Biome

As shown in Exhibit 3-15, the Grasslands Biome includes the grasslands biomes of North and South America, Eurasia, and Australia (see Exhibit 3-15). The description in this section is representative of this biome throughout the world. Currently there are no active sites in the Grasslands Biome where proposed activities for the BMDS might occur; however, past military installations within this biome make it reasonably foreseeable that future activity for the proposed BMDS could occur here. There are no coastal sites located in the Grasslands Biome.

H.5.1 Air Quality

Climate

Grasslands can be found in the middle latitudes, spanning from 55 degrees north to 30 degrees south within the interiors of continents. Grasslands in North America are known as Prairies, and those in Eurasia are called Steppes.

In the Grasslands Biome, approximately 25 to 76 centimeters (ten to 30 inches) of precipitation falls annually, while in May, June, and August, some regions may receive up to ten to 12 centimeters (four to five inches) of precipitation per month. Northern grasslands often receive large quantities of snowfall. The temperature varies due to the vast latitudinal span of the grasslands, with annual temperatures ranging from -20°C to 43°C (-4°F to 104°F). The average annual temperature across the Grasslands Biome is 24°C (43°F).

The low humidity of the Grasslands Biome arises because mountain barriers block warm, moist air from oceans. For example, in the U.S, the Rocky Mountains block moistures from the Pacific Ocean, which dry grassland areas in the interior of the country where summers are hot and dry and winters are very cold. The mean temperatures for the U.S. prairies are -7ºC and 21ºC (20ºF and 70ºF) for January and July, respectively. In Eurasia, warm, moist air from the Indian Ocean is blocked by the Himalayas creating dry grassland areas in the Eurasian steppes. There are, however no barriers to block arctic winds in the Eurasian steppes, therefore, winters are extremely cold and windy. Winter temperatures in this region can reach as low as -40°C (-40°F), while summer temperatures may reach 21°C (70°F). A lack of natural barriers, such as trees, results in constant, often violent, winds throughout the Grasslands Biome. Erratic precipitation and hot summer temperatures cause drought and fire, which prevent the growth of large forests.

Regional Air Quality

Air quality over the plains of the U.S. is regulated by EPA Regions 5, 6, 7, and 8. The locations of non-attainment areas within the U.S. Grasslands Biome are indicated in Exhibit 3-2. The European Union monitors ambient air quality through its 1996 Framework Directive 96/62/EC. This directive sets limits and/or threshold values for the above pollutants as a concentration of the pollutant by mass per volume of air, as well as provides guidance for ambient air quality assessment and management.

Air pollution issues of special concern to the Grasslands Biome are emissions from open burning and fugitive dust. Open burning frequently occurs in rural areas to eliminate noxious weeds or crop-damaging pests/insects in agricultural fields and to dispose of household waste. Further, because dry grasslands may experience periods of drought and high winds, fugitive dust, such as dust from mining or construction activity, gravel roads or wind erosion from agricultural fields, may be kicked up and circulated in the atmosphere, and may travel long distances due to the lack of natural barriers. (South Dakota Department of Environment and Natural Resources, 2003)

Existing Emission Sources

Due to the low population density of most grassland areas, biogenic (naturally occurring) activities are the predominant sources of air pollution emissions in this biome.

Agriculture produces a variety of non-methane VOCs from livestock and crop sources that contribute to the production of secondary pollutants, such as ozone, which in turn damages crops and natural fauna. N_2 also is produced from aerobic vegetative processes, anaerobic soil activity, and through animal excretion. Ammonia emissions are likewise attributed to livestock wastes. Ruminant animals (e.g., cows) exhale dimethyl sulfide, which oxidizes to sulfuric acid that contributes to the formation of acid rain.

Anthropogenic sources of emissions in the Grasslands Biome may include industrial activity, electricity generation and transmission, and traffic in metropolitan areas.

H.5.2 Airspace

Controlled and Uncontrolled Airspace

The Grasslands Biome in the U.S. contains all FAA classifications for airspace, as described in Section 3.1.2. The appropriate ARTCC would control civil aircraft operating under IFR clearances within the biome.

In December of 2002, the European Union adopted the "single sky" directive, which will create a single European airspace by 2004. The single sky proposal will eliminate many of the national boundaries that currently divide Europe's airspace to create several "functional blocks of airspace" that will be regulated as a single entity. European Union airspace above 8,687 meters (28,500 feet) will be under unified control.

Special Use Airspace

For restricted airspace or established Warning Areas, aircraft operating under VFR conditions are not precluded from operating in these areas; however, during hazardous operations every effort is made to ensure that non-participating aircraft are clear of potential hazard areas. Examples of restricted airspace occurring within the Grasslands Biome include the R-5401 Restricted Area southeast of Devils Lake in the Devils Lake East MOA, the Tiger North and Tiger South MOA, and the Devils Lake East and Devils Lake West MOA in the U.S. IFR Military Training Routes occurring in the Grasslands Biome are designated such that the military assumes responsibility for separation of aircraft operations established by coordinated scheduling. (U.S. Army Space and Missile Defense Command, 2000)

Airports/Airfields

Civilian, military, and private airports exist in the Grasslands Biome.

En Route Airways and Jet Routes

Civilian aircraft generally fly along established flight corridors that operate under VFR. Numerous Minimum En route Altitudes are present in the Grasslands Biomes. The airway and jet route segments in this Biome lie within airspace managed by the Minneapolis ARTCC.

H.5.3 Biological Resources

Vegetation

Latitude, soil, and local climates determine what kinds of plants grow in particular grasslands. Short grasses, which are predominant throughout the Grasslands Biome, have adapted physiological responses to widespread drought and fire. Grasses can survive fires because they grow underground storage structures for holding vital nutrients and because they grow from the bottom, slightly below ground surface, rather than from the top. Therefore, their stems can grow again after being burned off.

Wildlife

Wildlife in the Grasslands Biome varies from amphibians and reptiles to a variety of small mammals (field mice, voles, prairie dogs) to a host of avian species, including migratory species. Some of resident and migratory species rely on ephemeral prairie potholes that exist in the Grasslands Biome. Many endangered or threatened animals are found in the Grasslands Biome. In the U.S., the Whooping crane (*Grus americana*) is endangered, and the Piping plover (*Charadrius melodus*) is threatened. Naturally occuring grasslands are becoming harder to find due to human encroachment that can be attributed to increasing population pressures, desire for farmland, and oil exploration, among others.

Environmentally Sensitive Habitat

Critical habitat for the Whooping Crane has been designated in the states of Colorado, Idaho, Kansas, Nebraska, New Mexico, Oklahoma, and Texas. Critical habitat is designated for wintering grounds for the Piping Plover, including units in Texas. The USFWS has proposed areas for critical habitat designation throughout other plains states, yet no final rule has been promulgated.

Kelly's Slough Wildlife Management Area is located approximately three kilometers (two miles) east of Grand Forks AFB, a former installation located in this biome. This 656-hectare (1,620-acre) wetland area, managed by the USFWS, is a stopover for migratory waterfowl. Wetlands occur in drainage-ways, low-lying areas, and potholes. Approximately 10 hectares (24 acres) of wetlands were identified within the boundary of

Grand Forks AFB. An additional 73 hectares (180 acres) are located east of the main base and are associated with four sewage lagoons. Several small prairie potholes on Grand Forks AFB support non-forested wetlands. (U.S. Army Space and Missile Defense Command, 2000)

H.5.4 Geology and Soils

Geology

The majority of the Grasslands Biome in the U.S. is part of the North American craton, which is an area that has been tectonically stable throughout most of geologic time. The area includes crystalline Precambrian rocks that underlie Paleozoic and younger sedimentary rocks, which in some areas are covered by glacial sediments. Precambrian rocks are exposed only in the St. Francois Mountains of southeastern Missouri, where they are locally more than 1,000 feet above sea level; these rocks are buried to depths of as much as 6,000 feet below sea level in southwestern Kansas on the northern flank of the Anadarko Basin. (USGS, 1997)

Post-depositional erosion of the Paleozoic sedimentary-rock sequence from eastern Missouri to central Kansas and eastern Nebraska has beveled off some of the rocks. As a consequence, progressively younger rocks are exposed to the west and northwest of the Precambrian core of the St. Francois Mountains in southeastern Missouri. The glacial sediments cover portions of the bedrock strata in eastern Nebraska, northeastern Kansas, and northern Missouri, and stream-valley deposits are prevalent along the major streams and some secondary streams. The widespread areas of Tertiary and Quaternary sediments in western Kansas and Nebraska are not related to erosion or beveling of rocks away from the St. Francois Mountains and the Ozark Uplift. These Tertiary and Quaternary sediments are mostly alluvium that was derived from erosion of the Rocky Mountains to the west of the segment. (USGS, 1997)

The Tertiary and Quaternary deposits are the most widespread geologic unit in the Grassland Biome and are especially prominent in Kansas and Nebraska. They are characterized mainly by unconsolidated sand and gravel, but locally include beds of sandstone, siltstone, silt, and clay. Various other geologic formations present in the Grasslands Biome include Cambrian rocks (sandstones and dolomite), Ordovician rocks (dolomite and limestone interbedded with minor sandstone and shale), Silurian rocks (a thin sequence of dolomite and limestone), Devonian rocks (limestone interbedded with minor sandstone and chert) Mississippian rocks (limestone (commonly cherty) but include some beds of sandstone and shale), and Pennsylvanian strata crop (shale, sandstone, limestone, and some coal beds). Other geologic formations that are present in the biome, but to a lesser extent include Permian rocks (shale and sandstone but also contain beds of halite (rock salt), gypsum, anhydrite, and minor limestone), and Triassic and Jurassic rocks (shale, siltstone, and dolomite), Cretaceous rocks (consist largely of shale, with some widespread sandstones). (USGS, 1997)

Soils

Grasslands typically consist of flat to rolling terrain with open fields and meadows carpeted by deep-rooted grasses and sparse trees. The soil of most grasslands is too thin and dry for trees to survive. Grasses with deep root systems keep the soil from blowing away. The predominant soil type found throughout the Grasslands Biome is characterized by a thick, dark surface horizon resulting from the long-term addition of organic matter derived from plant roots. This type of soil occupies roughly 21 percent of the U.S. land area and is some of the most productive agricultural soil in the world. However, where the grasslands are more arid, the soil is characteristically dry most of the year. The soil has accumulated clays, calcium carbonate, silica, and salts. This type of soil occupies roughly eight percent of the U.S. land area and is used mainly for range, wildlife, and recreation. Because of the dry climate in which they are found, they are not used for agricultural production unless irrigation water is available.

Geological Hazards

There are no significant widespread geological hazards within the Grasslands Biome.

H.5.5 Hazardous Materials and Hazardous Waste

Hazardous Materials

Hazardous materials use at ranges within the Grasslands Biome include diesel fuel, gasoline, lubricating oil, thinners, kerosene, solvents, and sulfuric acid. All areas that contain hazardous materials have appropriate Material Safety Data Sheets that provide workers and emergency personnel with the proper procedures for handling or working with a particular substance. (U.S. Army Space and Missile Defense Command, 2000)

Typically, all personnel working with hazardous materials have initial and updated training in Hazard Communication that enables them to identify the hazards of the material. Material Safety Data Sheets are provided with materials or they can be obtained from the Bioenvironmental Engineering Services office or a Pharmacy, a type of facility that would dispense hazardous materials to users.

Hazardous Waste

Missile facilities generate batteries, battery acid, paint and solvent wastes, and sodium chromate solution and rags. When a hazardous material is spilled, spent, or contaminated to the extent that it is not able to be used for its original purpose, or cannot be converted to a usable product, it becomes a hazardous waste. Hazardous wastes can be generated on a continual basis or generated if a spill of a hazardous material occurs. Hazardous wastes also are generated at deployment area facilities. For example, spent sodium chromate solution, rags used to handle the solution, and rags or gloves used to handle sodium chromate are wastes generated during daily routine operations and maintenance of the missile system.

H.5.6 Health and Safety

Health and Safety attributes of the Grasslands Biome are similar to those discussed in Section H.1.6.

H.5.7 Noise

Noise sources associated with the proposed BMDS are similar to those described in Section H.1.7.

H.5.8 Transportation

The plains states of the U.S. have, within the last decade, become a major transportation corridor for the transport of goods between Mexico, the U.S., and Canada, as the North American Free Trade Agreement opened up the conjoining international borders to free trade. Thus, most transportation through the plains is for commercial purposes.

Ground Transportation

Railroads and motor carriage (i.e., trucking) are the backbone of the freight transportation system in the Grassland region. Railroads in the Grasslands region of the U.S. compete with barges for business. The highway system in the prairies consists largely of rural roads, many of which are local roads that are maintained by county and township governments.

Air Transportation

There are numerous commercial, private, and military airports within the Deciduous Forest Biome. They vary in size from major international airports such as Kansas City International that handles around 11 million passengers each year to small, rural airstrips that support single engine planes.

Marine Transportation

In the U.S. Grasslands Biome, the transportation of grains and other agricultural commodities is of utmost importance. Barges haul over half of all U.S. grain shipments to export ports, predominately via the Upper Mississippi River towards the Gulf of Mexico. The Upper Mississippi River is the dominant river for originating barge grain traffic for export, and it originates almost as much grain for exports as all the regional railroads combined. As there are no coastal sites located in the Grasslands Biome, there are no major coastal ports associated with this Biome.

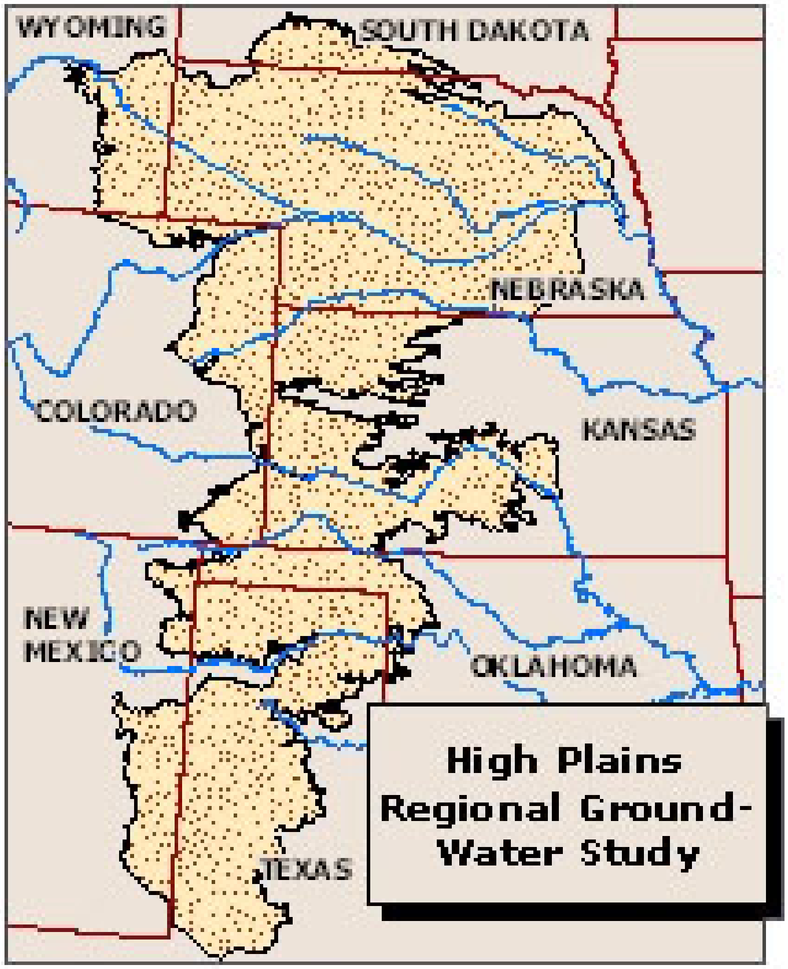
H.5.9 Water Resources

Surface Water and Ground Water Resources

The prairies of the U.S. typically exhibit an arid climate. Therefore, water is an important natural resource. Sources of water in the Grasslands Biome include precipitation, ground water in aquifers, and surface water in rivers, streams, lakes, and wetlands. The High Plains aquifer system, also referred to as the Ogallala Aquifer, underlies 362,102 square kilometers (225,000 square miles) in parts of eight states, as shown in the Exhibit H-9 below. Competing uses for ground water include agriculture, domestic and commercial consumption, recreation, natural ecosystems, and industrial uses (such as cooling water for energy generation and to keep dust down at mining sites, etc.). Agriculture (e.g., irrigation and livestock) is the largest consumptive use category of water in almost all prairie states, accounting for 40 percent of the total water used in most states.

Due to the heavy dependence on underground water systems for irrigation of the plains' extensive farmland (and to a lesser extent for municipal water systems and industrial development), the depletion of the Grassland Biome's aquifers is of special concern. Withdrawal of this ground water has greatly surpassed the aquifer's rate of natural recharge, resulting in a drawdown of the water table. Some areas overlying the aquifer have already exhausted their underground supply as a source of irrigation. States in the South Plains are more affected by the depletion than are the northern states. (Glantz, 1989) Not only does aquifer depletion result in a loss of available water resources, but the overlying land also may subside, disrupting surface drainage, reducing aquifer storage, causing earth fissures, and damaging wells, buildings, roads, and utility infrastructure. (Cyberwest Magazine, 2003)

Exhibit H-9. High Plains Aquifer System



Source: USGS, 2003

Prairie potholes tend to be seasonal water bodies closely associated with wetlands. Prairie potholes are typically filled following the spring snowmelt, although many potholes are situated within a surficial aquifer and retain water throughout the year. Prairie potholes are prime waterfowl production areas that also provide habitat for waterfowl and other species during migratory seasons. (U.S. Army Space and Missile Defense Command, 2000)

Europe abstracts a relatively small portion of its total renewable water resources each year. Total water abstraction in the region is about seven percent of the total freshwater resource. Resources are unevenly distributed across the region, and even if a country has sufficient resources at the national level there may be problems at regional or local levels. Agriculture and cooling for electricity production are the dominant uses of ground and surface water in Europe.

Water Quality

The quality of water in the High Plains aquifer generally is suitable for irrigation use, but in many places, the water does not meet EPA drinking water standards with respect to several dissolved constituents: dissolved solids/salinity, fluoride, chloride, and sulfate. (USGS, 2003) The primary sources of water contamination in the U.S. prairies are agricultural practices (especially non-point source runoff from crop inputs and animal wastes), oil and gas extraction, and industry. Natural conditions, such as low flows, also contribute to violations of standards. (U.S. Army Space and Missile Defense Command, 2000)

The European Union monitors surface water quality and drinking water quality via the 1976 Council Directive 76/160/EEC on Bathing Water Quality and the 1998 Council Directive 98/83/EC on the Quality of Water Intended for Human Consumption, respectively. Due to the outdated content of the former directive, the European Commission adopted a proposal for a revised directive (COM(2002)581) in October of 2002. Though this revision uses only two bacteriological indicators, Intestinal Enterococci and Escherischia coli, it sets a higher health standard than the existing directive.

In the 1970s and 1980s, freshwater, surface water and ground water sources throughout Europe suffered eutrophication when they became flooded with organic matter, nitrogen from fertilizer, and phosphorus from industrial and residential wastewater. In recent decades, however, water quality improvements have been made across Europe. In Central and Eastern Europe, 30 percent to 40 percent of households were not yet connected to sewer systems as of 1990, and water treatment in this area was still inadequate. (UNEP, 2002) (European Union, 1998)

H.6 Desert Biome

The Desert Biome includes the desert regions of North America, which include the western arid environment of the southwestern U.S. (see Exhibit 3-16, Volume 1). The description in this section of the U.S. desert is representative of this biome throughout the world. Existing inland sites in the Desert Biome include WSMR, New Mexico; Fort Bliss, Texas; Edwards AFB, California; and the Nevada Test Site, Nevada. There are no coastal sites located in the Desert Biome.

H.6.1 Air Quality

Climate

Deserts cover about one-third of the Earth. Although deserts may be predominantly hot or cold, all deserts are dry. The two main distinguishing characteristics between different desert types are temperature and degree of aridity. In cold desert regions, temperatures range from 2ºC to 4ºC (36ºF to 39ºF) in the winter and from 21ºC to 26ºC (70ºF to 79ºF) in the summer. These regions usually have larger amounts of precipitation in the winter and spring, followed by a dry season. Total annual precipitation averages 15 to 26 centimeters (six to ten inches). In contrast, hot desert regions have average monthly temperatures above 18ºC (64ºF), with typical temperatures ranging from 20ºC to 25ºC (68ºF to 77ºF). The extreme maximum temperature for hot desert biomes ranges from 44ºC to 49ºC (111ºF to 120ºF). Hot desert regions usually have very little precipitation annually and/or concentrated precipitation in short periods, totaling less than 15 centimeters (six inches) a year.

Existing sites where activities for the proposed BMDS may occur reside within the hot desert biome. Hot desert regions span the equatorial belt from 15 to 28 degrees north and south of the equator, with most of these deserts lying near the Tropic of Cancer or the Tropic of Capricorn. While the characteristics of the desert biome are similar throughout the world, this discussion focuses on the deserts of the western U.S., including parts of California, Utah, Nevada, Arizona, New Mexico, and Texas.

Deserts are characterized by high-pressure zones in which cold air descends. The descending air then becomes warm, but instead of releasing rain, the heat from the ground evaporates the water. Because deserts are dry, they have large daily temperature variations. Temperatures are high during the day because there is very little moisture in the air to block the sun's rays from reaching Earth. As the sun sets, the heat absorbed during the day quickly escapes back into space, resulting in cold nightly temperatures.

Regional Air Quality

A unique pollutant of concern in desert regions is dust, i.e., PM, which contributes to desertification, the process of creating deserts. Activities that expose and disrupt topsoil, such as grazing and agricultural cultivation common throughout the western U.S., can increase the amount of dust released into the air. Dust and other particles in the air cause water droplets in clouds to be smaller. The size of the water droplets in a cloud determines whether gravity will force the droplets towards the earth’s surface, instead of remaining suspended in the air. Therefore, the more dust and other particulates that are suspended in the air, the less rain falls to the earth, thereby enhancing drought conditions and contributing to further desertification. (NASA, 2001)

Regional air quality at WSMR is described as representative of the Desert Biome. Otero County is in attainment for state and Federal standards. Doha Ana County is currently considered to be in attainment with the NAAQS. However, the Air Quality Bureau has recorded exceedances of the standard for PM_{10} in the county. (U.S. Army Space and Missile Defense Command, 2002d)

Existing Emission Sources

As discussed above, the predominant source of air pollution in the Desert Biome is agriculture, which disturbs the surface layer soil and emits dust into the air. Animal excrements are also a source of N_2, ammonia, and non-methane VOCs, which may contribute to the formation of ozone and particulates in the atmosphere. Reduced air quality also can be attributed to natural and man-made fires, as well as to industrial activity.

H.6.2 Airspace

Controlled and Uncontrolled Airspace

The U.S. Desert Biome contains all FAA classifications for airspace, as described in Section 3.1.2. Ranges in the Desert Biome, such as WSMR in New Mexico, may include airspace that may be recalled for purposes such as conducting testing operations. This airspace is controlled by the Holloman AFB radar approach control facility, by agreement with the FAA through the Albuquerque ARTCC. The radar approach control airspace has been divided into five areas for recall purposes when conducting testing operations.

Depending on the airspace and safety requirements of a particular WSMR mission, one or more of these areas can be recalled by WSMR for a specified period of time. WSMR recalls portions of the radar approach control areas for research and development missions, which has the effect of limiting instrument approaches to Holloman from the north, limiting departures to the north directly into WSMR airspace, modifying VFR arrivals from the north, and tightening IFR departures to the southwest. (U.S. Army Space and Missile Defense Command, 2002d)

Special Use Airspace

Ranges within the Desert Biome may contain special-use airspace, which enables the airspace to be utilized for military purposes without interference. For example, the R-5107 complex of special-use airspace covering WSMR was especially chartered to protect non-participating aviation from potentially hazardous military operations, including missile testing. WSMR controls a complex of 19 restricted areas. Any aircraft that have not been authorized and scheduled by the controlling agency are prohibited from entering active restricted airspace. During part of the day, WSMR may return some of the restricted airspace to FAA control for use by aircraft under a shared-use agreement between WSMR and the FAA. All areas are joint-use except R-5107B, which is in continuous use by WSMR and is not released back to the FAA. Many of the restricted areas are used extensively by Holloman AFB for advanced training missions. (BMDO, 1994)

Airports/Airfields

Civilian, military, and private airports exist in the U.S. Desert Biome to serve different aircraft. General aviation airports are located in Las Cruces and Alamogordo, New Mexico, and El Paso, Texas. The Las Cruces International Airport is used primarily for general and some commercial aviation. The Alamogordo/White Sands Regional Airport is used mainly for general and some commercial aviation. The El Paso International Airport is used primarily for commercial and general aviation. (U.S. Army WSMR, 1998)

En Route Airways and Jet Routes

The airway and jet route segments in the flight corridor at WSMR lie within airspace managed by the Albuquerque ARTCC. This office exercises control of its Class A and B airspace traffic within sectors, dividing the airspace both vertically and horizontally. Some military low-level routes and refueling routes are within the region. (U.S. Army Space and Strategic Defense Command, 1997)

H.6.3 Biological Resources

Vegetation

From a biogeographic perspective, the Desert Biome encompasses three major vegetation types. In order of dominance, these are semi-desert grassland, plains-mesa sand scrub, and desert scrub. In species composition, these three vegetation types correspond to the desert scrub biotic community and the semi-desert grassland biotic community. Grassland habitat merges with desert scrub, creating a complex landscape mosaic. Major vegetation in the desert scrub area includes a combination of woody and herbaceous shrubs such as the Creosote Bush (*Larrea tridentata*), Shadscale (*Atriplex confertifolia*), Winterfat (*Ceratoides lanata*), and White Bursage (*Ambrosia dumosa*). Plains-mesa sand scrub separates semi-desert grassland and desert scrub vegetation. The desert scrub vegetation is divided into broadleaf evergreen and broadleaf deciduous types. There are no wetland types in this biome; however, springs may support wetland type vegetation, such as Cattail (*Typha latifolia*), sedges (*Carex spp.),* and rushes (*Juncus spp.*).

Plants in the Desert Biome have adapted to the harsh climatic conditions of intense heat with little shade and precipitation. Plants, such as cacti, have adapted to the biome by altering their physical structure and usually have special means of storing and conserving water. Other plants have acclimated to arid environments by growing extremely long roots, allowing them to acquire moisture at or near the water table. Still other desert plants have adjusted their behavior so that they grow and reproduce during the seasons of greatest moisture and/or coolest temperatures and remain dormant during the harshest (i.e., hottest and driest) months.

In the U.S., the Holmgren Milk Vetch (*Astragalus homgreniorum*) is endangered, and Welsh's Milkweed (*Asclepias welshii*) is threatened.

Wildlife

Desert animals include small nocturnal carnivores, insects, arachnids, reptiles, and birds. Desert animals are even more susceptible to the extremes of the desert climate than are plants. In response to extremely high temperatures and large diurnal temperature variations, many desert animals have evolved behavioral and/or physiological mechanisms to cope with the heat and aridity of the desert. Desert animals may adjust their behavior by breeding in the desert during the relatively cool spring and then migrating to cooler habitat for the remainder of the year, or they may be active only at dusk and dawn and retreat to the shade or burrow underground during the heat of the day. Some animals are completely nocturnal for this same reason. Some animals estivate (the opposite of hibernate), sleeping during the hottest and driest summer months. To increase their water intake, many desert animals rely on succulent plants, such as cacti, that store water in their tissue

The bald eagle could occur as a transient species in Desert biomes and it may fly over desert sites. Baird's sparrow and McCown's longspur are attracted to playas and grasslands that are also common in Desert biomes. Peregrine falcons have been reported from Lake Holloman, and potential feeding and nesting areas occur in other areas of the desert. These raptors may fly over the site.

The Desert Tortoise (*Gopherus agassizii*) and Chiricahua Leopard Frog (*Rana chiricahuensis*) are threatened under the Endangered Species Act in the U.S., and the Alamosa Springsnail (*Tryonia alamosae*) is endangered. (U.S. Army Space and Strategic Defense Command, 1997) The White Sands pupfish (*Cyprinodon tularosa)*, which is the only fish known to occur naturally on WSMR, is listed as endangered by the State of New Mexico and is endemic to Salt Creek, Malpais, and Mound Springs drainage basins.

Environmentally Sensitive Habitat

The USFWS designated habitat critical to the survival and recovery of the Mojave Desert populations of the Desert Tortoise in 1994. Critical Habitat Units in the map in Exhibit H-10 below were designated in California, Nevada, Utah, and in Arizona north and west of the Grand Canyon. This area includes Joshua Tree National Park.

Exhibit H-10. Critical Desert Tortoise Habitat

Source: California Turtle and Tortoise Club, 2003

Sensitive wildlife habitats occurring within the Desert Biome include White Sands pupfish habitat, raptor nesting areas, wetlands and riparian habitats, and other regionally valuable habitats such as grama grasslands and pinyon-juniper woodland, which are located within or adjacent to WSMR. Only 0.4 percent of WSMR has been mapped as jurisdictional wetlands, which are dispersed throughout the range. Limited water resources render most aquatic habitats critical as habitat for wildlife including the pupfish, particularly Salt Creek and its tributaries, Malpais and Mound Springs, Lost River, and Malone Draw. The San Andres National Wildlife Refuge, an area that provides habitat for a variety of sensitive species, was established in 1941 by EO 8646 for the conservation and development of natural wildlife resources. The refuge supports a population of state-endangered desert bighorn sheep (*Ovis canadensis*), as well as mule deer (*Odocoileus hemionus*), mountain lions (*Puma concolor*), golden eagles (*Aquila chrysaetos*), and gray vireos. Any activities related to the proposed BMDS with the potential to impact protected wildlife within the refuge are subject to review by the USFWS Refuge Manager. (U.S. Army Space and Missile Defense Command, 2002d)

H.6.4 Geology and Soils

Geology

Sand covers only about 20 percent of the Earth's deserts, with most of the sand in sand sheets and sand seas, vast regions of undulating dunes resembling ocean waves. Nearly 50 percent of desert surfaces are plains where the removal of fine-grained material by wind has exposed loose gravels consisting predominantly of pebbles and occasional cobbles, forming "desert pavement." Deflation basins, called "blowouts," are hollows formed by the removal of particles by wind. Blowouts are generally small, but may be up to several kilometers in diameter.

The remaining surfaces of the Desert Biome are composed of exposed bedrock outcrops, desert soils, and fluvial deposits, including alluvial fans (a cone-shaped deposit of sediments), playas (dry lake beds), desert lakes, and oases. Bedrock outcrops commonly occur as small mountains surrounded by extensive erosional plains. Wind-driven grains abrade landforms, creating grooves or small depressions in rock. Sculpted landforms have been streamlined by desert winds and can be up to tens of meters high and kilometers long.

Soils

The desert soil is mostly sandy and is similar to the arid grassland soil described in the Section H.5.4. Desert soils are predominately mineral soils with low organic content. The repeated accumulation and subsequent evaporation of water in some soils causes distinct salt layers to form. Thus, poorly drained areas may develop saline soils and dry lakebeds may be covered with salt deposits. Desert soils tend to be low in humus and high in calcium carbonate. Calcium carbonate may cement sand and gravel into hard layers called “calcrete” that form layers up to 50 meters (164 feet) thick.

Biological soil crusts are often commonly found in arid environments, such as the Desert Biome, where vegetative cover is sparse. These crusts are formed by living organisms and their by-products, creating a crust of soil particles bound together by organic materials. Aboveground crust thickness can reach up to ten centimeters (four inches); however, crusts usually are concentrated in the top one to four millimeters (.04 to .16 inches) of soil. Due to their presence near the top surface layers of the soil, crusts primarily affect processes that occur at the land surface or soil-air interface, including soil stability and erosion, atmospheric N_2 fixation, nutrient contributions to plants, soil-plant-water relations, infiltration (of water), seedling germination, and plant growth.

Geological Hazards

Exhibits 3-5, 3-6, and H-7 show the geographic distribution for earthquakes, landslides, and volcanoes in the continental U.S. These geological hazards are concentrated in the western U.S., including areas where deserts lie.

H.6.5 Hazardous Materials and Hazardous Waste

Hazardous Materials

WSMR and Holloman AFB are existing sites where activities for the proposed BMDS may occur. The types of hazardous materials and hazardous waste produced at WSMR and Holloman AFB are representative of those that may be generated at other such sites within the Desert Biome, and they display appropriate management techniques.

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. Department of the Air Force, 1997b)

Hazardous Waste

When a hazardous material is spilled, spent, or contaminated to the extent that it is not able to be used for its original purpose, or cannot be converted to a usable product, it becomes a hazardous waste. Hazardous wastes can be generated on a continual basis or generated if a spill of a hazardous material occurs. 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 EPA SPCC requirements; Emergency Planning and Community Right-to-Know Act; and Occupational Safety and Health Act 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.

H.6.6 Health and Safety

Health and Safety attributes of the Desert Biome are similar to those discussed in Section H.1.6.

H.6.7 Noise

Ambient noise levels for remote desert environments range from 22 to 38 dBA, whereas, ambient noise levels at a representative sites where activities for the proposed BMDS may occur within the Desert Biome range from 65 to 85 dBA at Edwards AFB and from 45 dBA to 65 dBA at WSMR. (DOT, 2001) Noise sources associated with the proposed BMDS are described in Section H.1.7.

H.6.8 Transportation

In the Desert Biome of the western U.S., transportation is one of the primary environmental concerns with regard to air quality, water quality, habitat protection, land use, hazardous waste transportation, and noise pollution. Because the population density is so low and dispersed throughout most of the region, transportation infrastructure is concentrated near metropolitan centers, such as Phoenix, Arizona, and Los Angeles, California. Metropolitan areas are characterized by urban transit, a complex mix of heavy, light, and commuter rail; buses and demand responsive vehicles; ferries; and other less prevalent types such as inclined planes, trolley buses, and automated guide ways.

Ground Transportation

An extensive network of interstate highways and by-ways, spanning the vast distances between city centers transverse the western U.S. Desert Biome. The railroad system is also well developed throughout this region.

The road system at WSMR is described as representative of other installations located in the Desert Biome. WSMR's road network is extensive, but in relatively poor condition. There are three classifications of the road types on WSMR: major roads, secondary roads, and trails. The major roads are two lane roads that are paved, graded, and maintained as funding permits. All the major roads on WSMR have the capacity to support 1,200 cars per hour for each lane. Approximately 966 kilometers (600 miles) of secondary roads serve the WSMR network. Secondary roads on WSMR are unpaved roads that are graded and maintained as funding permits. The WSMR road network has approximately 2,414 kilometers (1,500 miles) of bladed trails. These unpaved trails are bladed but not maintained on a regular basis. (U.S. Army Space and Missile Defense Command, 2002d)

A network of Federal and state highways serves WSMR and the immediate area. The Federal or U.S. highway system in the area is a network of six major routes that serve most of WSMR and the immediate area. The state highway system in the area provides access to local markets and urban areas. (U.S. Army WSMR, 1998)

Air Transportation

The major commercial airports serving the U.S. Desert region are Los Angeles International Airport, McCarran International Airport (Las Vegas, Nevada), Phoenix Sky Harbor International Airport, and Albuquerque International Airport all of which move millions of passengers each year.

Marine Transportation

There are no major U.S. ports associated with the Desert Biome because it does not extend to any coastal areas. There may be some ports associated with the international portions of this biome (e.g., Ensenada Port, Mexico).

H.6.9 Water Resources

Surface Water and Ground Water Resources

In the Desert Biome, droughts and aquifer supply issues are of particular concern. Increasing population pressures and need for irrigation water are quickly draining the limited underground reserves of water for the western U.S., making adequate water resources a contentious topic of scholarly and political debate.

For example, at WSMR, water supply sources are a critical concern in many areas. Freshwater aquifers are in a state of overdraft resulting in declining water tables and degraded water quality. The volume of ground water pumped in the Main Post area decreased from approximately 3.5 million cubic meters (925 million gallons) in 1967 to 3.3 million cubic meters (872 million gallons) in 1992. Water use in other areas varies from year to year according to missions in operation. (U.S. Army Space and Missile Defense Command, 2002d)

Water Quality

The leading causes of impairment of rivers and streams include pathogens (bacteria), siltation (sedimentation), and habitat alterations, and the leading sources for these include agriculture, hydraulic modifications, and habitat modifications. The leading causes of impairment of lakes, ponds, and reservoirs include nutrients, metals (primarily mercury), and siltation (sedimentation), and the leading sources for these are agriculture, hydraulic modifications, and urban runoff/storm sewers. The leading causes of impairment of estuaries include metals (primarily mercury), pesticides, and oxygen-depleting substances, and the leading sources for these include municipal point sources, urban runoff/storm sewers, and industrial discharges. (EPA, 2002)

The water quality of the freshwater aquifers at both WSMR and Fort Bliss is very good. Total dissolved solids at WSMR range from 200 to 420 milligrams per liter (parts per million). Hueco Bolson aquifers have total dissolved solids of approximately 600 milligrams per liter (parts per million). However, the quality of many of the freshwater aquifers in this region is decreasing due to increasing salinity.

Because irrigation is commonly practiced in arid desert biomes, drainage water from irrigated fields is a water body of concern. In 1982, dying waterfowl and waterfowl with birth defects and reproductive failures were discovered by the USFWS at the Kesterson Reservoir, National Wildlife Refuge, California. The cause of the problem was high levels of selenium in the irrigation drain water discharged into the reservoir. Since then, there has been significant media and congressional interest concerning the potential for similar toxic impacts from irrigation drain water at other locations across the western U.S. (Department of the Interior, 2003)

H.7 Tropical Biome

The Tropical Biome encompasses areas within the Pacific and Atlantic Oceans. For the purposes of this Programmatic Environmental Impact Statement (PEIS), the coastal zone is defined as the Exclusive Economic Zone, which is 322 kilometers (200 miles) off shore. The coastal zone also stretches 1,000 meters (3,281 feet) inland of the coastal shoreline, tidal wetlands, coastal wetlands, and coastal estuaries. (CPC of Australia, 2003) Because many of the islands within the Pacific and Atlantic Oceans are relatively small, the entire island may be considered within this affected environment section.

The Pacific Tropical Biome would include islands found within the equatorial region. The Pacific contains approximately 25,000 islands, the majority of which are found south of the equator. (Wikipedia, 2003) Current Ranges within this biome where activities of the proposed BMDS may occur include PMRF, USAKA, Wake Island, and Midway.

The majority of islands in the Atlantic Tropical Biome are in the Caribbean between the Caribbean Sea and the North Atlantic Ocean.

H.7.1 Air Quality

Climate

The climate for the Tropical Biome is tropical marine to semi-tropical marine, characterized by relatively high annual rainfall and warm to hot, humid weather throughout the year. The months of December to February tend to be cool, windy and wet, while May through October tend to be warm and sunny. Steadily blowing trade winds allow for relatively constant temperatures of 21°C to 27°C (70°F to 81°F) throughout the year. For islands lying South of the equator in the Pacific, such as American Somoa, the driest months are June to September and the wettest months are December to March.

Pacific

The annual rainfall in the Pacific Tropical Biome is approximately 127 to 1,016 centimeters (50 to 400 inches). In the Pacific, tropical storms and typhoons are common between May and December but can occur in any month. Regional trade winds from the eastern portion of the Pacific push equatorial surface water in to a mound in the west-equatorial Pacific Ocean, which affects atmospheric conditions. The trade winds occasionally weaken, causing a reverse flow of warm surface waters to the east, which then mound against South America. The additional pressure of warm water in the east-equatorial Pacific Ocean inhibits and slows the upwelling of the more dense, cold, and nutrient-rich deep ocean water (DOT, 2001b) in a phenomenon known as the El Nino/Southern Oscillation. The El Nino effect includes an extreme decline in ecological productivity along the coast of South America, and great fluctuations in heat transfer and molecular exchange between the ocean and the atmosphere throughout the Pacific region. (DOT, 2001b)

Atlantic

The Atlantic Tropical Biome typically experiences hurricanes that form close to the coast of West Africa and move westwards to the Caribbean. The hurricane season falls between June and November. However, most hurricanes tend to form during the month of September. The number of hurricanes varies annually from as few as two to as many as twelve. Hurricane weather is variable ranging from very low to heavy rainfall. Hurricane wind speeds tend to be severe, often traveling at more than 100 kilometers per hour (62 miles per hour). Hurricane tracks typically move across the Caribbean towards the southeastern U.S. and Mexico. (Caribbean, 2003)

Regional Air Quality

Pacific

Ambient air quality monitoring data is not readily available for islands in the Pacific. There is a sampling station on the island of Kauai, which monitors for PM_{10}. The area around the sampling station is classified as being in attainment for both National and State Ambient Air Quality Standards. However, the sampling station is located in the city of Lihue, which is located 42 kilometers (26 miles) from PMRF and is on the southeast side of the island; thus, air quality measurements there may not be representative of air quality at PMRF. Strong winds in the tropical Pacific region tend to disperse local emissions. Therefore there are no major air pollution problems.

Atlantic

In the Caribbean, increasing urbanization and rampant forest destruction have led to considerable air quality degradation. Rapid urbanization, population growth, industrialization, and a growing number of motor vehicles are the main causes of air pollution. The growth of industry, agriculture, and the transportation sector over the past 30 years has been accompanied by a steady increase in CO_2 emissions. Industrial pollutants originate mostly from fuel combustion processes in the power generation sector, although emissions of heavy metals, such as lead and mercury, also are important. Air quality at the local and regional level is affected by other sources of air pollution, such as pesticide use in agriculture and airborne particles resulting from soil erosion and biomass combustion.

Existing Emission Sources

Pacific

Primary pollution sources in the Pacific Tropical Biome include power plants, diesel-fuel powered generators, fuel storage tanks, solid waste incinerators, aircraft operations, and vehicles. Existing rocket launches in the area are typical of smaller sources of emissions. The primary toxic air contaminant emitted from solid rocket launches is hydrochloric acid. The Clean Air Act Amendments allow regulation of rocket engine test firing by the manufacturer and do not regulate the launch by an operational user.

Because of the relatively small numbers and types of air pollution sources, dispersion caused by trade winds, and lack of topographic features at most locations, air quality in the equatorial region is considered good (i.e., well below the maximum pollution levels established for air quality in the U.S.). (U.S. Army Space and Missile Defense Command, 2003)

Atlantic

The main contributors to poor air quality in the Atlantic Tropical Biome include inadequate vehicle emissions controls, exacerbated by recent influxes of foreign used vehicles with inadequate emission devices; industrial activity; inefficient energy use; high-density settlements and urban areas; pesticide residues from spraying in rural agricultural communities; and particulates from soil erosion and sugar cane burning.

Regulations and infrastructure for ambient air quality monitoring in the Caribbean are limited. Counties with dependence on the U.S. have well-established ambient air monitoring programs for PM, SO_2, and CO. Routine monitoring in other islands is limited to stations near industrial sources.

H.7.2 Airspace

Controlled and Uncontrolled Airspace

Pacific

The majority of islands in the Pacific Tropical Biome are located in international airspace and therefore, the procedures of the ICAO are followed. ICAO Document 4444 is the equivalent air traffic control manual to the FAA Handbook 7110.65, *Air Traffic Control*. The ICAO is not an active air traffic control agency and has no authority to allow aircraft into a particular sovereign nation's Flight Information Region or Air Defense Identification Zone and does not set international boundaries for air traffic control purposes. The ICAO is a specialized agency of the United Nations whose objective is to develop the principles and techniques of international air navigation and to foster planning and development of international civil air transport. The FAA acts as the U.S. agent for aeronautical information to the ICAO. Airspace in this region would be managed by the Honolulu and Oakland ARTCCs.

Atlantic

The Atlantic Tropical Biome consists of both U.S. and international airspace. U.S. territorial possessions in the Caribbean are defined as Puerto Rico, which includes Puerto Rico, Vieques, Culebra, Caja de Muertos, Desecheo Island, and Mona Island, and the U.S. Virgin Islands, which include Saint Croix, Saint John, and Saint Thomas. On November 28, 2001, the FAA authorized aircraft registered in the U.S., Canada, Mexico, the Bahamas, Bermuda, Cayman Islands, and British Virgin Islands to operate VFR/IFR in the sovereign airspace of the U.S. and its territorial possessions. International airspace in the Caribbean is subject to the operating rules of the ICAO. The airspace of all states and territories of the Eastern Caribbean Islands including adjacent international waters comprise the Piarco Flight Information Region.

Special Use Airspace

Pacific

The procedures for scheduling each portion of airspace are performed in accordance with letters of agreement with the controlling FAA facility. Schedules are provided to the FAA facility as agreed between the agencies involved. The special use airspace at the PMRF consists of Restricted Areas R-3101, which lies immediately above PMRF/Main Base and to the west of Kauai, and R-3107, which lies over Kaula, a small uninhabited rocky islet 35 kilometers (19 nautical miles) southwest of Niihau. The special use airspace also includes Warning Area W-188 north of Kauai, and Warning Area W-186 southwest of Kauai, all controlled by PMRF. Warning Areas W-189 and W-190 north of Oahu and W-187 surrounding Kaula are scheduled through the Fleet Area Control and Surveillance Facility. Exhibit H-11 lists the affected Restricted Areas and Warning Areas and their effective altitudes and times used. The controlling agency for the Restricted Areas and Warning Areas is the Honolulu Combined Center Radar Approach Center.

Exhibit H-11. Special Use Airspace in the PMRF/Main Base Airspace Use Region of Influence

Number	Location	Altitude	Time of Use	
			Day	Hours
R-3101	PMRFAC FOUR	To Unlimited	Monday - Friday	0600-1800
R-3107	Kaula	To FL 180 (5,500 meters [18,000 feet] above MSL)	Monday - Friday	0700-2200
W-186	Hawaii	To 9,000	Continuous	Continuous
W-187	Hawaii	To 18,000	Monday - Friday Saturday - Sunday	0700-2200 0800-1600
W-188	Hawaii	To Unlimited	Continuous	Continuous
W-189	Hawaii	To Unlimited	Monday - Friday Saturday - Sunday	0700-2200 0800-1600
W-190	Hawaii	To Unlimited	Monday - Friday Saturday - Sunday	0700-2200 0800-1600

Source: U.S. Department of the Navy, 1998

Airports/Airfields

Pacific

There are numerous Range-affiliated airports and airfields located within the Pacific Tropical Biome, including Wake Island, USAKA, PMRF, and Midway. Many of these airfields are engaged in activities similar to those of the proposed activities. Future test events would act in accordance with existing activities at the airfields.

Atlantic

The majority of local airports within the Atlantic Tropical Biome handle smaller, private aircraft, which are uncontrolled.

En Route Airways and Jet Routes

Pacific

High-altitude overseas jet routes cross the Pacific Tropical Biome via nine Control Area Extension corridors off the California coast. These corridors and associated jet routes continue northwest to Alaska and then southwest to the Orient. These corridors can be opened or closed at the request of a user in coordination with the FAA. A Memorandum of Agreement exists between users and the FAA to stipulate the conditions under which the Control Area Extensions can be closed to civil traffic. Under most circumstances, at least one Control Area Extension must remain available for use by general aviation and commercial air carriers.

H.7.3 Biological Resources

Vegetation

Pacific

Many plant species have been introduced to the islands in the Pacific Tropical Biome since the arrival of permanent residents. The most common of these include ironwood, golden crown-beard (*Verbesina encelioides*), wild poinsettia (*Euphorbia heterophylla*), Haole koa (*Leucaena leucocephala*), sweet alyssum (*Lobularia maritima*), buffalo grass (*Buchloe dactuloides*), peppergrass (*Lepidium lasiocarpum*), and Bermuda grass (*Cynodon dactylon*). Some examples of indigenous vegetation on the islands include beach naupaka (*sericea Vahl*), tree heliotrope (*Tournefortia argentea*), beach morning glory (*Ipomoea imperati*), lovegrass, sickle grass (*Pholiurus incurvus*), ihi (*Portulaca molokiniensis*), alena (*Boerhavia repens*), puncture vine (nohu) (*Tribulus citadoides*), and ‘ena’ena (*Pseudognaphalium* [=*Gnaphalium*] *sandwicensium var. molokaiense*). Some islands also include ruderal vegetation, which is vegetation that grows where the natural vegetational cover is disturbed by human activities in addition to the naturally occurring kiawe (*Prosopis pallida*)/koa haole (*Leucaena leucocephala*) scrub.

Atlantic

The Atlantic Tropical Biome habitat includes seagrass meadows, which occur in the protected waters landward of coral reefs. The two main seagrass species, the turtle grass (*Thalassia testudinum*) and the manatee grass (*Syringodium filiforme*), occur either in mixed or in monospecific beds. Mangroves are found along the coasts of tropical and subtropical regions. The term mangrove refers to both the forest and the tree. Mangroves protect coasts against erosion by breaking storm waves and dampening tidal currents.

Wildlife

Pacific

The Laysan albatross (*Diomedea immutabilis*), a migratory bird protected under the Migratory Bird Treaty Act, uses ruderal vegetation areas in some islands in the Pacific Tropical biome for courtship and nesting. The Laysan albatross is being discouraged from nesting at existing Ranges to prevent interaction between the species and aircraft using the runway. This action is being accomplished under USFWS permits. Other species of birds found in this region include red-tailed tropicbirds (*Phaethon rubricauda*), black noddies (*Anous minutus*), Pacific golden plover (*Pluvialis fulva*), ruddy turnstone (*Arenaria interpres*), white terns (*Chlidonias leucopterus*), short-tailedand black-footed albatross (*Phoebastria nigripes*), shearwaters, brown (*Sula leucogaster*), masked (*Sula dactylatra*), and red-footed booby (*Sula sula rubripes*).

There are five species of giant clams found in areas of the Western Pacific Tropical Biome. The largest species (*Tridacna gigas*) was observed during a 1998 inventory (Army, 2001). The species has been significantly reduced in numbers. All species of mollusks in the family *Tridacnidae* are listed as protected under the Convention for the International Trade on Endangered Species (USFWS, 2002).

Atlantic

Grazers, such as green sea turtles (*Chelonia mydas*), fish, and sea urchins feed directly on seagrasses. Seagrass beds also serve as nursery grounds for the juveniles of many commercially important species, such as snappers, grunts, lobsters and conchs. Mangroves serve as nursery grounds for the juveniles of many commercially important fisheries species and provide habitat for a variety of small fish, crabs, and birds. Sea turtles use many beaches in the Caribbean to dig their nests and deposit their eggs. The beach also provides habitat for burrowing species, such as crabs, clams, and other invertebrates.

Hawaiian monk seals (*Monachus schauinslandi*) are found throughout the region. Eastern and Spit islands are the main pupping areas. The monk seal is endemic to the Hawaiian archipelago and is found almost exclusively in the Northwestern Hawaiian Islands.

The Hawaiian (American) coot (*Fulica americana alai*), Hawaiian black-necked stilt (*Himantopus mexicanus knudseni*), Hawaiian common moorhen (*Gallinula chloropus sandvicensis*), and Hawaiian duck (*Anas wyvilliana*) are Federal and State endangered species that have been observed in the drainage ditches and ponds on PMRF/Main Base.

The Hawaiian Gallinule *(Gallinula chloropus sandvicensis)* is a Federally listed endangered subspecies of the common North American moorhen. Newell's shearwater (*Puffinus auricularis newelli*) and the dark-rumped petrel (*Pterodrome phaeopygia sandwicense*) are listed as federally endangered species. The Hawaiian duck (*Anas wyvilliana)* is a federally listed endangered species of duck, which has been observed in the wetlands of PMRF and the ditches of Mana.

The Green sea turtle (*Chelonia mydas*) is a federally threatened sea turtle found in the eastern North Pacific from Baja California to southern Alaska. The sea turtles are sighted year round in eastern portions of the Pacific Ocean, generally in waters less than 50 meters (164 feet) deep. Populations appear to be highest from July to September. Threats to the green sea turtle include over harvesting by humans, habitat loss, fishing net entanglement, boat collisions, and disease. (Sacramento Fish and Wildlife Office, 2003)

The Loggerhead sea turtle (*Caretta caretta*) is a federally threatened sea turtle similar to the green sea turtle. It has been observed at depths up to 1,000 meters (3,280 feet). Threats to loggerhead sea turtles include exploitation, loss of habitat, fishing practices, and pollution.

The Leatherback sea turtle (*Dermochelys coriacea*) is a federally listed endangered species. The Leatherback is a highly migratory species and is more pelagic than other sea turtles, meaning they tend to stay in the open ocean rather than in areas closer to the coast. They are sighted most often during July to September. Threats to the sea turtles include exploitation, loss of habitat, fishing practices, and pollution.

The Olive ridley sea turtle (*Lepidochelys oliveacea*) is a federally listed threatened species. (NOAA, 2003b) The Olive ridley is primarily tropical nesting from southern Sonora, Mexico to Colombia. Individuals are seen rarely in the waters off the southwestern U.S. They have been observed in the eastern Pacific Ocean in waters less than 50 meters (164 feet), but are rarely encountered.

Marine mammals that may reside in the ocean area and that are listed under the Endangered Species Act include several species of cetaceans (i.e., the blue whale [*Balaenoptera musculus*], finback whale [*Balaenoptera physalus*], humpback whale [*Megaptera noveangliae*], and sperm whale [*Physter catodon*]). These are open-water, widely distributed species.

Non-native species, such as feral dogs (*Canis familiaris*) and cats (*Felis catus*) occur in the region and prey on native and introduced species of birds. Rodents including the Polynesian black rat (*Rattus exulans*), Norway or brown rat (*Rattus norwegicus*), and the house mouse (*Mus musculus domesticus*) also are known to inhabit the region. (U.S. Army Space and Strategic Defense Command, 1993a)

Environmentally Sensitive Habitat

Pacific

A submerged barrier reef that is roughly 13 kilometers (eight miles) long and composed of fossil coral (*Porites compressa*) lies offshore of the island of Kauai. The reef has an irregular appearance resulting from numerous ledges, walls, slumped limestone blocks, and mounds. Coral and fish diversity is low within the exercise area as a result of deep water, low coral density, and seasonal sand scouring. Fishes associated with the low vertical relief habitat include the bluestripe snapper (*Lutjanus kasmira*) and several species of burrowing blennies. Pelagic (open ocean) fishes associated with the exercise area include jacks, amberjack (*Seriola dumerili*), and flying fishes.

The Hawaiian Islands Humpback Whale National Marine Sanctuary was designated by Congress in 1992. Humpback whales (*Megaptera novaeangliae*) are endangered marine mammals and are therefore protected under provisions of the Endangered Species Act and the Marine Mammal Protection Act wherever they are found. Humpbacks are present in the winter months in the shallow waters surrounding the Hawaiian Islands, where they congregate to mate and calve. By agreement with the Governor of the State of Hawaii in 1997, NOAA's Sanctuaries and Reserves Division modified the Congressionally defined boundary of the Hawaiian Islands Humpback Whale National Marine Sanctuary so that it includes certain portions of the shallow water along northern Kauai. Regulations implementing designation of the sanctuary specifically recognize that all existing military activities outlined or external to the sanctuary are authorized, as are new military activities following consultation with the NOAA Fisheries Service. (62 FR 14816, 15 CFR §922.183)

All of Midway Atoll, except for Sand Island and its harbor, has been designated as critical habitat for the Hawaiian monk seal. A small (less than 0.2 hectares [0.5 acres]), emergent wetland area has been identified on Sand Island. It is located west of Decatur

Avenue, north of the cemetery, and south of Halsey Drive. (U.S. Department of the Navy, 1998)

The Coral Reef Ecosystem Fishery Management Plan for the western Pacific has established Marine Protected Areas. No-take Marine Protected Areas are at 0 to 10 fathom (0 to 18 meter [0 to 60 foot]) depths. No-take Marine Protected Areas also are located from ten to 50 fathoms (18 to 91 meters [59 to 299 feet]) at French Frigate Shoals, Laysan, and the northern half of Midway. The southern half of Midway is for recreational catch and release only. (Western Pacific Fisheries Management Council, 2003)

H.7.4 Geology and Soils

Geology

Pacific

Geomorphically, islands within the Pacific Tropical Biome are exceedingly varied and therefore difficult to generalize. The islands range from atolls with small, low inlets and extensive lagoons, to raised limestone islands, to volcanic high islands with substantial topographic and internal climatic diversity. About half of the Caroline Islands and 80 percent of the Marshall Islands are atolls, some of which peak at only a few feet above present sea level. Volcanic islands, on the other hand, can reach heights of more than 3,962 meters (13,000 feet), as does the snow-capped peak of Mauna Kea on the island of Hawaii. (East-West Center, 2001)

Coral reefs have developed upon the eroded platforms around some of the islands. Wave action has eroded the coral surface in many areas, creating a primary source for beach sand, which is actively being deposited and reworked along the shorelines of some islands. Some of the reefs and islands consist entirely of the remains of coral reef rock and sediments to a thickness of several thousand feet atop submarine volcanoes, which formed 70 to 80 million years ago. As the volcanoes became extinct and began to subside, living coral reefs grew and formed atolls. The reef rock is formed entirely from the remains of marine organisms that secrete external skeletons of calcium and magnesium carbonates. (East-West Center, 2001)

High volcanic islands, which tend to have larger surface areas, generally have more fresh water, better soils, and more diverse resource bases. Low-lying atolls, on the other hand, are prone to drought and erosion, and generally (at least on land) have limited natural resources. (East-West Center, 2001)

Windward oceanic reef flats generally are composed of hard rock that extends downward for 0.6 to 1.2 meters (two to four feet), with softer or unconsolidated rock below that level. (U.S. Army Space and Strategic Defense Command, 1993a) Lagoon reef flats are typically narrower than the ocean reef flats and are composed of softer rock.

Atlantic

Islands within the Atlantic Tropical Biome are composed of two distinctive chains of islands, the Lesser and Greater Antilles. The Lesser Antilles are a line of mainly volcanic islands sweeping northward from the island of Trinidad, while the Greater Antilles consist of four large islands that are part of a submerged mountain range jutting westward into the Caribbean for over a thousand miles. The islands are characterized by a range of geological formations, from volcanic and sedimentary strata to coral limestone and alluvium. The majority of the islands lack rivers or streams due to the porous nature of mountainous rock and the absence of hills or valleys. The lack of water and sediment runoff into the sea contributes to the clarity of surrounding waters. Numerous cracks and fissures may be found within the rock formations.

Soils

Pacific

The soils on smaller atolls in the Pacific Tropical Biome have poor fertility and are deficient in N_2, potash, and phosphorus. This low fertility is due to alkalinity, which inhibits the absorption of iron, manganese, zinc, boron, and aluminum; and course soil particles and low organic matter content, which both impair the soils water-holding capacity. All of these factors severely inhibit plant growth. Poor soil fertility on some islands also is due to human activities (e.g., forest cutting, slash and burn, copra plantations, war). High volcanic islands tend to have larger surface areas, and have better soils. In many places, the surface layers are dark brown as a result of accumulated organic matter and alluvium. The silt is neutral to moderately alkaline through its profile. The soils are permeable, and infiltration is rapid. Wind erosion is severe when vegetation has been removed.

Atlantic

The islands within the Atlantic Tropical Biome include a wide range of soils, which may be derived from limestone, serpentine, dolomite, basalt, granite, diorite, gabbro, sandstone, or slate. The humid tropical environment and mountainous terrain of many islands are conducive to high rates of sedimentation. Washed from the hill slopes and construction sites, sediments settle out in the calm waters of the reservoirs, thus reducing the storage capacity of the reservoirs. Major floods associated with hurricanes and tropical disturbances may cause extensive land erosion and sediment transport that rapidly deplete the storage capacity of reservoirs.

Geological Hazards

Pacific

Volcanic islands within the Pacific Tropical Biome have been built of successive lava flows. Volcano eruptions occur relatively frequently on the islands. Eruptions typically start with lava issuing vertically from a central vent or fissure in a rhythmic jet-like eruption, called a lava fountain. (NOAA, 2003b)

Atlantic

Many earthquakes and tsunamis have occurred in the northeastern Caribbean, where the movements of the Earth's surface plates are rapid and complicated. The Caribbean is one of the smaller surface plates of the Earth. The approximately rectangular plate extends from Central America on the west to the Lesser Antilles on the east, and from just south of Cuba on the north to South America on the south. Earthquakes occur all around its periphery. Tsunami waves form when large pieces of the sea floor undergo abrupt vertical movement due to fault rupture, landslides, or volcanism. (USGS, 2001)

Volcanoes erupt on the eastern and western sides of the Caribbean plate. There are active volcanoes in the southern Caribbean islands, most recently on the island of Montserrat. Current eruptions of the Soufriere Hills Volcano, which is located at the south end of Montserrat Island in the Lesser Antilles, began on July 18, 1995. The summit area consists primarily of a series of east/southeast-trending lava domes. The volcano is 915 meters (3,010 feet) high and monitored by the Montserrat Volcano Observatory. (USGS, 2002a)

H.7.5 Hazardous Materials and Hazardous Waste

Hazardous Materials

Pacific

Test event sponsors would be responsible for safe storage and handling of the materials that they obtain and must adhere to all DOT hazardous materials transportation regulations. Hazardous materials used in support of test event activities would include propellants, various cleaning solvents, paints, cleaning fluids, fuels, coolants, and other materials. Releases of materials in excess of reportable quantities specified by CERCLA would be reported to the EPA. Material and Safety Data Sheets would be available at the use and storage locations of each material.

The use of hazardous materials at the ranges is limited primarily to materials used in facility infrastructure support and flight operations, with some additional quantities of hazardous materials used by various test operations at the range. The use of these materials must conform to Federal, DoD, and Army hazardous materials management requirements. Hazardous materials used in base infrastructure support activities include various cleaning solvents, paints, cleaning fluids, pesticides, motor fuels and other petroleum products, freons, and other materials. Aircraft and helicopter flights use various grade of jet propellant, which are refined petroleum products.

All shipping would be conducted in accordance with DOT-approved procedures and routing, as well as OSHA requirements, U.S. Army safety regulations, and USAF regulations. Appropriate safety measures would be followed during transportation of the propellants as required by the DOT and as described in 49 CFR 171-180, *Hazardous Materials Regulations of the Department of Transportation*.

For ship or barge transportation, U.S. Coast Guard and/or applicable U.S. Army transportation safety regulations also would be followed. Appropriate safety measures would be followed during loading of missiles and propellants as required by DoD and as described in DoD 6055.9-STD, *DoD Ammunition and Explosives Safety Standards.*

Atlantic

The transport of potentially hazardous substances, such as oil, fertilizers and insecticides is always a hazardous activity, and there have been several oil spills within the Caribbean region. While the local impact is immediate and obvious, there is little information and few quantified studies on the long-term effects of oil in the coastal zone. Corals do not die from oil remaining on the surface of the water. However, gas exchange between the water and the atmosphere is decreased, with the possible result of oxygen depletion in enclosed bays where surface wave action is minimal. Coral death does result from smothering when submerged oil directly adheres to coral surfaces, and oil slicks affect sea birds and other marine animals. Tar accumulation on beaches reduces tourism potential of coastal areas. With increased shipping activity in the Caribbean, the dumping of garbage and washing of bilges at sea have become serious problems. Garbage dumped in international waters are driven by wind and currents to the shorelines of the Caribbean, causing persistent pollution, which threatens both the tourism and fishing industries, as well as the health of coastal communities.

Hazardous Waste

Pacific

Test event sponsors would be responsible for tracking hazardous waste; for proper hazardous waste identification, storage, transportation, and disposal; and for implementing strategies to reduce the volume and toxicity of the hazardous waste generated.

Federal Ranges located within the Pacific Tropical Biome manage hazardous materials through the Navy's Consolidated Hazardous Materials Reutilization and Inventory Management Program. This program mandates procedures to control, track, and reduce the variety and quantities of hazardous materials use at facilities. Individual Ranges may have additional management and disposal procedures for used oils and fuels and management plans for pollution prevention, installation restoration, storage tanks, pesticides, radon, ordnance, polychlorinated biphenyls, medical and biohazard wastes, lead-based paints, and asbestos.

Atlantic

Hazardous waste generated within the Atlantic region of the Tropical Biome that require disposal is disposed of in accordance with Federal safety and environmental regulations.

H.7.6 Health and Safety

Health and Safety attributes of the Tropical Biome are similar to those discussed in Section H.1.6.

H.7.7 Noise

Natural background sound levels in the Tropical Biome are relatively high due to wind and surf.

Sources of noise in the Tropical Biome are similar to principle sources of noise associated with sites where activities for the proposed BMDS may occur, as described in the Section H.1.7.

H.7.8 Transportation

The Tropical Biome includes transportation that could be affected by the Proposed Action. The smaller islands may require marine transport vessels to transport passengers and supplies between islands.

The isolated locations of the equatorial environments make transportation vital to many of the locations. Many of the islands or atolls are chains of multiple islands that may require transportation of workers, visitors, and cargo between outside locations and the islands. Also, there are many islands that serve as refueling stops for military and nonmilitary flights in the Pacific Ocean. Small DeHaviland-7 aircraft or helicopters may be used for intra-island transportation.

Ground Transportation

Ground transportation facilities consist of roadways and pathways used by motor vehicles, bicycles, and pedestrians. For many of the islands, distances traveled are short, and people travel mostly on bicycle or on foot, or by using scheduled shuttle buses. Private automobiles are banned on some islands such as USAKA.

Air Transportation

Air transportation is an integral method used to transport goods to and from the island locations in this biome, due to the fact that are not linked to U.S. mainland ground transportation networks. Airports range in size from small airfields, supporting single engine planes, to larger international airports such as Luis Munoz Marin International Airport in Puerto Rico, which is the 37th most active passenger airport in the U.S.

Marine Transportation

Ships and smaller craft carry ocean cargo and fuel to the Equatorial Islands and deliver workers and cargo, including fuel, between islands. Many of the islands associated with this biome have major working ports, such as San Juan Harbor, Puerto Rico, which is in the top 17 ports of the world for container movement.

H.7.9 Water Resources

Surface Water and Ground Water Resources

Pacific

On some of the islands, seasonal infiltration of rainwater recharges the aquifer, and potable water is provided by rainwater catchments. Coral atolls typically lack surface water bodies or defined drainage channels due to extreme porosity and permeability of the soils. Rainwater typically drains rapidly into the ground.

Seasonal rainfall is the primary source of freshwater for most small atolls. Catchments are used to capture rainfall for potable use. Raw water is stored in aboveground storage tanks. On the Kwajalein atoll in particular, water is shipped from Kwajalein to the other islands that do not have catchments and to ships that visit.

Ground water on the smaller atolls typically occurs as a lens of fresh to brackish water floating on deeper marine waters in the subsurface rock strata of larger and wider islands. Seasonal infiltration of rainwater recharges the aquifer. The size and salinity of the lens are affected by many factors, including the distribution and composition of the rock, tidal fluctuations, gravitational forces, salt spray, mineral dissolution, and the rate of ground water pumping.

Atlantic

Coastal areas of the Caribbean near major watersheds often contain large lagoons of fresh or brackish water. Estuaries, coastal lagoons, and other inshore marine waters are very fertile and productive ecosystems, because they serve as important sources of organic material and nutrients and provide feeding, nesting, and nursery areas for various birds and fish. These ecosystems act as sinks of terrestrial runoff, trapping sediments and toxins, which may damage the fragile coral reefs.

Salinas, or shallow ponds or lakes with limited water circulation and tidal contact, are found on many dry Caribbean islands. They function as sediment traps, protecting coral reefs from excessive sediment loading.

Water Quality

The coastal zone is the ultimate depository of most pollutants originating from land or sea. Of the land-based sources of pollution, eutrophication, or nutrient enrichment, from human sewage disposal is a growing problem in the Caribbean, particularly in the vicinity of large coastal cities and harbors. Increased nutrient loading from sewage stimulates algal growth and degrades coral reefs and seagrasses. Activities outside of the coastal zone also may have a direct impact on the health of the coastal areas, for example when sedimentation and pollution from forestry and agriculture enter coastal areas via rivers and other waterways. Agricultural pesticides and fertilizers result in changes in the reef and seagrass communities, and in high concentrations, may cause fish kills in areas of poor water circulation. Sedimentation from land clearance results in increased water turbidity, which in turn decreases the productivity of coral reefs and seagrasses. With high levels of sedimentation, physical smothering of corals and benthic organisms by sediments and fine silt may take place.

Pacific

The prevailing trade winds cause strong currents to enter the lagoon water in the Pacific Atolls. The currents are a major source of seawater exchanging with lagoon water, and they help to keep the lagoons in the Pacific relatively well mixed. Water quality in the near shore and lagoon waters is generally of very high quality, with high dissolved oxygen and pH at levels typical of mid-oceanic conditions.

Open sea waters are typically alkaline, and have a pH of greater than 8.0, which allows the buffering of acidic rocket emissions without significant long-term change to water chemistry. Water quality in the open ocean is described as having high water clarity, low concentrations of suspended matter, dissolved oxygen concentrations at or near saturation, and low concentrations of contaminants such as trace metals and hydrocarbons.

Atlantic

Problems with freshwater ecosystems are a major environmental issue in the Caribbean. Water pollution, siltation of reservoirs, and excessive withdrawals of fresh water from rivers are problems associated with the growing human populations of the islands. (USGS, 1999)

H.8 Savanna Biome

The Savanna Biome includes the transitional zone between the tropical forest and the semi-desert scrub vegetation types and typically occupies latitudes between 5º and 20º North and South of the equator (see Exhibit 3-18, Volume 1). Savannas cover extensive areas in the tropics and subtropics of Central and South America, Central and South Africa, and northern Australia in both inland and coastal areas. The description in this section is representative of this biome throughout the world.

H.8.1 Air Quality

Climate

The climate of the Savanna Biome is typically semi-humid tropical, with a six- to eight-month hot, rainy summer season and a cooler, drier winter season.[13] A marked temperature and rainfall gradient is shown across the latitudinal range. Towards the equator, annual rainfall is typically higher relative to the more poleward edges of the Savanna belt, and total annual precipitation may be as high as 250 centimeters (98 inches). On the Savanna edges nearest the tropics (towards the poles), annual rainfall totals may be as little as 50 centimeters (20 inches). In Australian Savanna Biomes, coastal areas receive twice as much rainfall as inland savannas.

Annual temperatures in the Savanna Biome are relatively constant, averaging roughly 24ºC to 27ºC (75ºF to 80ºF). When the temperature fluctuates (ranging between 20ºC to 30ºC [68ºF to 86ºF]), it is a gradual change; the Savanna Biome does not experience drastic temperature swings. The average temperature during the wet summer season is 29ºC (85ºF) and can reach 49ºC (120ºF) in locations away from the moderating effects of the coastal waters. The temperature during the dry winter season averages around 21ºC (70ºF).

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[13] Summer/winter references are in terms of Southern hemisphere concepts of seasons. The wet season would occur during the Northern hemisphere winter, and the dry season would be in the Northern hemisphere summer.

The wet season may experience periods of flooding due to the poorly drained soils, especially at the start of the season when the ground is particularly parched. The dry season is marked by months of drought and fire, which are essential to the maintenance of savannas and which require adaptive mechanisms for plants and animals to survive.

Regional Air Quality

The Savanna Biome faces similar air quality concerns as those found in the Grassland Biome, namely emissions from open burning, natural drought-driven fires, and other fugitive dust. Open burning frequently occurs in more rural areas to eliminate noxious weeds or crop-damaging pests in agricultural fields and to dispose of household waste. Because savannas may experience periods of drought during the dry season, fugitive dust may be kicked up and circulated in the atmosphere, enabling it to travel long distances due to the lack of natural barriers. Savanna fires represent the dominant source of carbon released to the atmosphere from global annual biomass burning, contributing one to 1.6 giga-tons of carbon. Additionally, large quantities of NO_X have been observed in plumes of savanna fires. (Committee on Earth Observation Satellites, 2000)

Dust can be blamed for the trans-regional transport of air toxics and other pollutants that "hitch a ride" on airborne dust particles. Therefore, pollution that arises in the Savanna Biome or nearby areas can degrade global air quality.

Existing Emission Sources

Due to the rural nature, and therefore low population density, of most Savanna Biomes, biogenic, or naturally occurring, activities are the predominant sources of air pollution emissions in this biome. Fire is a predominant emission source, while anthropogenic activities, such as agriculture and mining also contribute. Overgrazing of ranch lands increases fugitive dust emissions. Agriculture produces a variety of non-methane VOCs from livestock and crop sources that contribute to the production of secondary pollutants, such as ozone, which in turn damages crops and natural fauna. N_2 also is produced from aerobic vegetative processes, anaerobic soil activity, and through animal excretion. Ammonia emissions are likewise attributed to livestock wastes. It also has been established that ruminant animals (e.g., cows) exhale dimethyl sulfide, which oxidizes to sulfuric acid and contributes to the formation of acid rain.

H.8.2 Airspace

Controlled and Uncontrolled Airspace

The Savanna Biome is located in international airspace; and therefore, the procedures of the ICAO are followed. ICAO Document 4444 is the equivalent air traffic control manual to the FAA Handbook 7110.65, *Air Traffic Control*. The ICAO is not an active air traffic control agency and has no authority to allow aircraft into a particular sovereign nation's Flight Information Region or Air Defense Identification Zone and does not set international boundaries for air traffic control purposes. The ICAO is a specialized agency of the United Nations whose objective is to develop the principles and techniques of international air navigation and to foster planning and development of international civil air transport. The FAA acts as the U.S. agent for aeronautical information to the ICAO.

Special Use Airspace

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.

Airports/Airfields

Civilian, military, and private airports exist in the Savanna Biome.

En Route Airways and Jet Routes

There are no domestic jet routes in the Savanna Biome. Site-specific analysis would be conducted to ensure that international and foreign government airspace requirements are met.

H.8.3 Biological Resources

Vegetation

Savannas are characterized by a continuous cover of perennial grasses, often one to two meters (three to six feet) tall at maturity. They also may have an open canopy of drought- or fire-resistant trees or an open shrub layer. The Savanna Biome is a transitional biome between those dominated by forest and those dominated by grasses. Most savanna grass is coarse and grows in tufts with intervening patches of bare ground. Trees may be scattered individually or grow in small intermittent groves. The presence of trees is limited by the low annual level of rainfall and intense sunlight, as well as seasonal fires that burn back forests and stimulate the growth of grasses, similar to those occurring in the Grasslands Biome.

The type of vegetation found in the Savanna Biome varies geographically based on soil and rainfall characteristics between the three continents where savannas are predominantly found – Central and South America, Central and South Africa, and northern Australia. Annual rainfall is higher in the Central and South America savannas and therefore, cypress (*Cupressus sempervirens*) and nance (*Byrsonima crassifolia*) trees thrive in this region. Fire tolerant tree species, such as Caranday palm (*Copernicia alba*) and tusequi (*Machaerium hirtum*), exist in drier areas. Sedges and grasses, such as Mexican papyrus (*Cyperus giganteus*), annual spikerush (*Eleocharis geniculata*), and brook crowngrass (*Paspalum acuminatum*), among others, dominate the more flood-prone areas. Wetlands also may be found in these savannas due to seasonal flooding. Cactii may be present on termite mounds that commonly are found in the Savanna Biome.

In African savannas, acacia (*Acacia spp.*) and baobab trees (*Adansonia Digitata*) dominate the savanna overstory. Other hardy plants that constitute the grassy-shrub understory include the boscia (*Boscia angustifolia*) and sporobolu (*Sporobolus indicus*); Combretum (*Combretum molle*) and Terminalia (*Terminalia arjuna*) shrub and tree species; and tall grasses, such as elephant grass (*Pennisetum purpureum*), Sorghum (*Sorghum bicolor*), and Eriachne (*Eriachne spp.*).

Australian savannas are marked by eucalypt woodland with a grassy understory. Dominant tree species in the coastal lowland savannas are Darwin woolybutt (*Eucalyptus miniata*) and Darwin stringybark (*Eucalyptus tetradonta*). Lancewood (*Acacia shirleyi*) and bullwaddy (*Macropteranthes keckwickii*) display characteristics of rainforests and are found in wetter savannas. Mulgas, small acacia trees or shrubs, are highly drought-resistant and therefore, survive in drier Australian savannas. Tall grasses similar to those found in African savannas are common in Australia.

Vegetation in the Savanna Biome has developed adaptive mechanisms to tolerate the dry season and periodic fires. Some trees (e.g., the baobab tree) produce leaves only during the wet season and these leaves are small to limit water loss via evapotranspiration. The baobab tree also stores water in its large trunk to maintain reserves during periods of drought. Other adaptive mechanisms include developing long taproots that reach to deep ground water sources. Mulga trees use this approach with a two-layered root system – a surface layer to collect light rainfall and another layer deep below the surface to obtain deep-water sources. Additionally, the mulga's crown and branches are shaped to collect and direct rainfall efficiently. Many grasses and trees of the Savanna Biome are fire-resistant and flourish during the wet season and then enter a state of dormancy during periods of drought.

Wildlife

Geographic differences also determine the animal species present in the Savanna Biome. Typical South and Central American savanna wildlife include pumas (*Puma concolor*), jaguars (*Panthera onca*), giant anteaters (*Myrmecophaga tridactyla*), giant armadillos (*Priodontes maximus*), tapirs (*Tapirus spp.*), rodents (*Akodon dayi*, *Kunsia tomentosus*, *Oxymyceterus inca*), opossums (*Monodelphis kunsi*, *Marmosops dorothea*, *Lutreolina crassicaudata*), and bats (*Vampyrum spectrum*, *Phyllostomus hastatus*, *Micronycteris behnii*). Common bird species are the jabiru (*Jabiru mycteria*), the great tinamou

(*Tinamus major*), and the savanna hawk (*Heterospizias meridionalis*). The blue-throated macaw (*Ara glaucogularis*) is a threatened bird species in this region.

African animal species include wildebeest (*Connochaetes taurinus*), warthog (*Phacochoerus aethiopicus*), zebra (*Equus burchelli*), rhinoceros (*Diceros bicornis* [black], *Ceratotherium simum* [white]), giraffe (*Giraffa camelopardalis*), gazelle (*Gazella spp.*), hyena (*Crocuta crocuta*), ostrich (*Struthio camelus*), mousebird (*Colius spp.*), starling (*Sturnus spp.*), and weaver (*Ploceus spp.*). Threatened species include the African elephant (*Loxodonta Africana*), wild dog (*Lycaon pictus*), cheetah (*Acinonyx jubatus*), leopard (*Panthera pardus*), and lion (*Panthera leo*).

Animal species found in Australian savannas are largely endemic to this region. Mammal fauna include numerous species of wallaby (spectacled hare-wallaby [*Lagorchestes conspicillatus*], northern nailtail wallaby [*Onychogalea unguifera*], bridled nailtail wallaby [*Onychogalea fraenata*]), red (*Macropus rufus*) and gray (*Macropus giganteus*) kangaroos, dingos (*Canis lupus dingo*), fawn antechinus (*Antechinus bellus*), antilopine wallaroo (*Macropus antilopinus*), and several species of skinks (*Mabuya spp.*). Reptiles may include copper or brown mulga snake (*Pseudechis australis*), Oenpelli python (*Nyctophilopython oenpelliensis*), Ord Curl Snake (*Suta ordensis*), Kings' goanna (*Varanus kingorum*), and the agamid lizard (*Cryptagama aurita*). Common bird species are the Australian bustard (*Ardeotis australis*), grey falcon (*Falco Hypoleucos*), pigeons (chestnut-quilled rock pigeon [*Petrophassa rufipennis*], pied imperial pigeon [*Ducula bicolor*], orioles (*Oriolus spp.*), cuckoos (*Cuculus spp.*), lorikeets (*Charmosyna spp.*), and the Australasian shoveler (*Anas rhynchotis*). Black-striped wallaby (*Macropus dorsalis*), yellow-footed rock wallaby (*Petrogale xanthopus*), purple-crowned fairy-wren (*Malurus coronatus*), and wingless dung beetle (*Onthophagus apterus*) are examples of threatened animal species in Australian savannas.

Animal species must also be adaptive to the seasonal drought and fires of the Savanna Biome. Many of the large mammals and most birds migrate during the dry season in search of water. While elephants are migratory, they have a unique physical strength and anatomy that enables them to tear open the large trunks of acacia trees that contain water. Burrowing animals remain dormant during times of drought. The ability to fly or to run fast enables most birds and large mammals to escape from fire, while burrowing animals survive by digging underground and waiting for the flames to pass them by. Termites and ants often build mounds throughout the Savanna Biome in all continental regions.

Environmentally Sensitive Habitat

The pressure of expanding human settlement and the resulting loss of critical habitat threaten many of the species found in the Savanna Biome. The preservation of land as National Parks, Wildlife Refuges, and Game Reserves forms the cornerstone of regional conservation strategies to protect biodiversity. (Margules and Pressey 2000) Threatened and endangered vegetative and wildlife species of the Savanna Biome can be found in approximately fifty parks and reserves in eleven countries throughout Africa. (ThinkQuest 1998) Thirty-four National Parks protect environmentally sensitive savanna habitat in the Northern Territory and Queensland, Australia. (Australian Tourism Net 2005) Critical habitat in the Savanna Biome also benefits from the conservation efforts of non-profits organizations and academic research institutions. Those actively working in this area include Conservation International, Earthwatch, the Smithsonian Institution and the National Zoo, the Neotropical Grassland Conservancy, the Tropical Savannas Cooperative Research Center, and the World Conservation Union.

H.8.4 Geology and Soils

Geology

Savannas are similar to grasslands in geologic and topographic features, predominantly characterized by flat terrain and may be marked with escarpments and other plateau-like features of sandstone or limestone composition.

Soils

Savannas typically have porous (often sandy) soil, with only a thin covering of nutrient-rich humus and an overall low concentration of nutrients. Some soils have a hard crust that is subject to cracking, which allows trees to send their roots down to water held deep beneath the surface. Termite and ant mounds are common throughout savanna plains, and their inhabitants are important for soil formation. Coastal soils tend to be better drained relative to inland soils.

Geological Hazards

There are no significant widespread geological hazards throughout the Savanna Biome.

H.8.5 Hazardous Materials and Hazardous Waste

Missile facilities generate batteries, battery acid, paint and solvent wastes, and sodium chromate solution and rags. Hazardous wastes also are generated at deployment area facilities. For example, spent sodium chromate solution, rags used to handle the solution, and rags or gloves used to handle sodium chromate are wastes generated during daily routine operations and maintenance of the missile system.

Hazardous Materials

There are no existing facilities proposed for use in the BMDS in the Savanna Biome. However, future sites would use hazardous materials similar to those in use at existing sites discussed in this chapter and would produce similar hazardous wastes.

Hazardous Waste

Any future facilities that may be used as part of the proposed BMDS would adhere to all applicable legal requirements for hazardous materials and hazardous waste management as described in Section 3.1.7.

H.8.6 Health and Safety

Health and Safety attributes of the Savanna Biome are similar to those discussed in Section H.1.6.

H.8.7 Noise

Sources of noise in the Savanna Biome are similar to principle sources of noise associated with sites where activities for the proposed BMDS may occur, as described in the Section H.1.7.

H.8.8 Transportation

Transportation in the Savanna Biome is typically limited due to the frequently remote and rural nature of savannas. However, there are some cities located in the Savanna Biome such as Miami, Florida, and New Orleans, Louisiana.

Ground Transportation

Highways, if present, are typically unpaved and may not be regularly maintained due to the low volume of traffic carried and remote locations. Railways are not a dominant form of transportation in the Savanna Biome. Airports with paved runaways are scarce in the Savanna Biome.

Air Transportation

Airport facilities in this biome are likely to small in size, and support single engine planes. However, there are a few locations with major airports such as Miami International Airport, which handles more than 33 million passengers a year.

Marine Transportation

Navigable waterways are present in some wetter savannas and may be used to transport goods to ports along coastal savannas. Some major ports exist along the coastal regions of this biome, such as the Port of Miami that moved nearly 4 million passengers and over 9 million tons of cargo through the port in 2003.

H.8.9 Water Resources

Surface Water and Ground Water Resources

Riparian zones, although covering a small percentage of the total land area of the Savanna Biome, are vital to biodiversity, stream channel morphology, water quality, and the local economy. Within watersheds, savanna grasslands absorb rainfall, recharge aquifers, stabilize soils, and moderate run-off. However, savanna water resources are highly vulnerable to the effects of weed invasion, feral animals, overgrazing, and fire. Water resources are further strained by heavy water use in riparian areas for agriculture and tourism. (Douglas and Lukacs, 2004) For example, irrigated agriculture accounts for more than 70 percent of Australia's water use, and this water is increasingly extracted from ground water reserves. (Hutley, Eamus, and O'Grady, 1999)

During the wet season, rainfall is absorbed by the soil or becomes surface run-off. In wetter savanna regions during periods of heavy precipitation, the soil's absorptive capacity is quickly exceeded, and water drains from the soil, recharging shallow ground water aquifers or flowing into nearby streams. During the dry season, surface water resources are readily depleted, forcing plants to rely on deeper ground water supplies and animals to migrate to areas of more plentiful water. (Hutley, Eamus, and O'Grady, 1999)

Water Quality

Water quality problems most commonly are caused by livestock and feral animals during the dry season. During the wet season, large volumes of rain elicit surface water flow. Additionally, cattle tend to be dispersed away from waterholes during the wet season. However, as the dry season progresses, water levels fall, surface flow ceases, and pressure from grazing cattle increases. Cattle and feral animals stir up bottom sediments in surface streams, which reduces water clarity, thereby limiting the penetration of sunlight and in turn, the growth of aquatic plants. (Cooperative Research Centre for Tropical Savannas Management, 2003)

H.9 Mountain Biome

As shown in Exhibit 3-19, Volume 1, the Mountain Biome includes the mountainous regions of North America and Europe, which include the Rocky Mountains in the western

U.S. and the Alps in central Europe. The description in this section is representative of this biome throughout the world. Mountain biomes are found at high altitudes and lie just below and above the snow line of a mountain. Existing inland sites in the Mountain Biome include Buckley AFB, Cheyenne Mountain AFB and Fort Carson Military Reserve, Colorado; and F.E. Warren AFB, Wyoming. It is not reasonably foreseeable that activities for the proposed BMDS will occur on coastal locations within the Mountain Biome.

H.9.1 Air Quality

Climate

The Mountain Biome, often referred to as the Alpine biome, Tundra biome, or Alpine Tundra biome, encompasses the high mountain regions of the world and accounts for approximately one-fifth of the world's landscape. This biome occurs at high altitudes and lies just below and above the snow line of a mountain. Given its high altitude, the Mountain Biome is characteristically cold with heavy snowfall and frequently bitter winds. Temperatures remain below freezing for at least seven months of the year, and in the summer, average temperatures range from 10°C to 15°C (50°F to 59°F). Nighttime temperatures are almost always below freezing (0°C [32°F]). The average precipitation across mountain biomes is 30 centimeters (11.8 inches) a year. The seaward sides of mountain ranges receive rain or snow from moist oceanic air masses, whereas the interior sides are typically arid.

The Rocky Mountains in western North America are representative of the Mountain Biome as a whole, and the majority of sites where activities for the proposed BMDS may occur are located within this mountain range. The Rocky Mountain range lies at 35 degrees north to 60 degrees north latitude and 115 degrees east to 165 degrees east longitude. The Rocky Mountains experience unpredictable weather, which can change rapidly. As with other mountain climates, the climate changes with increasing altitude. In general, the Rockies have mild summers, cold winters, and large amounts of precipitation. The seasons differ drastically from one another. In the winter, deep snow, high winds, and sudden blizzards are common, whereas spring is characterized by unpredictable weather and may be wet or dry, cold or warm. In the summer, there are sunny mornings, afternoon thunderstorms, and clear nights. The fall has cool days, wind, and decreasing precipitation.

The average annual temperature in the Rocky Mountains is 6°C (43°F), with a winter average temperature of –2°C (28°F) and a summer average temperature range of 10°C to 15°C (50°F to 59°F). In the spring, the temperature averages 4°C (40°F), and the fall average temperature is 6°C (44°F). The highest temperature is 28°C (82°F) in July, while the lowest temperature is -14°C (7°F) in January.

The average precipitation per year is 36 centimeters (14 inches). The average winter precipitation is 3.6 centimeters (1.4 inches), and the summer receives 15 centimeters (5.9 inches) of precipitation on average. In the spring, an average of 10.7 centimeters (4.2 inches) of precipitation falls across the Rocky Mountains, and the fall averages 6.6 centimeters (2.6 inches) of precipitation.

Regional Air Quality

Mountain Biomes exhibit particular sensitivity to air pollution via deposition of both wet and dry pollutants, principally in snowpacks, which can in turn result in reduced surface water quality. Regional air pollutants of concern to mountainous areas include visibility-reducing PM, deposition of nitrogen and sulfur compounds, ozone, greenhouse gases that contribute to localized warming, and air toxics such as mercury and persistent organic pollutants. An emerging air quality concern is the issue of the effects of CO_2 and other toxics released from prescribed burns meant to actively manage the forested regions lying below the Mountain Biome. (Tonnessen, 2003) Another air quality issue unique to the Mountain Biome is increasing UV-B radiation, which affects human and ecological health. (Welch, 2002)

Existing Emission Sources

Typical sources of air pollutants in the Mountain Biome include population centers, energy development and power plants, and agricultural. Global emissions of air pollutants such as mercury, dioxin, pesticides, and polychlorinated biphenyls result in deposition to high elevation areas due to the "cold condensation" effect, which permits pollutants to partition out of air and into water as air masses cool as they rise in elevation. (Tonnessen, 2002)

H.9.2 Airspace

Controlled and Uncontrolled Airspace

The U.S. Mountain Biome contains all FAA classifications for airspace, as described in Section 3.1.2. The Denver ARTCC, located within the U.S. Mountain Biome, has the responsibility for maintaining separation between aircraft, which operate on IFR within this geographical area. The Center's area is divided into sectors. Low altitude sectors control from the ground to FL 260 (7,925 meters [26,000 feet]); high altitude sectors control FL 270 (8,230 meters [27,000 feet]) and above. From one to three controllers may work a sector, depending upon the traffic density. Controllers have direct communication with pilots, with surrounding sectors and Centers, plus the Towers and Flight Service Stations under their jurisdiction.

Special Use Airspace

The Denver ARTCC designates special use and restricted airspace for the Rocky Mountain region. Potential sites in the Mountain Biome where BMDS activities could occur would coordinate test events with the ARTCC to ensure that appropriate NOTAMs are issued.

Airports/Airfields

Civilian, military, and private airports exist in the Mountain Biome.

En Route Airways and Jet Routes

Civilian aircraft generally fly along established flight corridors that operate under VFR. Numerous Minimum En route Altitudes are present in the Grasslands Biomes. The airway and jet route segments in this Biome lie within airspace managed by the Denver ARTCC.

H.9.3 Biological Resources

Vegetation

Mountain Biomes are located at elevations too high to support the growth of trees; however, about 200 species of mountain plants are able to withstand the harsh climatic conditions of the Mountain Biome. The Mountain Biome is typically covered with a single dense layer of vegetation, usually only a few centimeters or decimeters in height. At high altitudes, there is very little CO_2, which plants need to perform photosynthesis. Because of the cold and wind, most species are slow-growing perennials (lasting for three growing seasons or more, as opposed to annuals that die and grow back year after year) and plants that have been forced to adapt to such an extreme environment. Plants protect themselves from the cold and wind by "hugging" the ground. Some plants have waxy coatings or hairs for minimal loss of heat and water to the wind.

Dominant plants tend to be dwarf perennial shrubs, sedges, grasses, mosses, and lichens. Alpine Phacelia (*Phacelia sericea*), Bear Grass (*Xerophyllum tenax*), Moss Campion (*Silen acaulis*), and Pygmy Bitterroot (*Lewisia pygmaea*) are all commonly found throughout the Mountain Biome. Despite their generally low productivity during most of the year, mountain plants exhibit bursts of productivity during the short growing season, lasting up to 180 days.

Wildlife

Mountain animals have to tolerate cold temperatures and intense ultraviolet radiation. Due to the high altitude, the atmosphere is thinner in the Mountain Biome, allowing more UV wavelengths to penetrate to the ground surface. Because of the year-round cold, only warm-blooded animals can survive in the Mountain Biome, although insects also exist.

Some lakes in the Mountain Biome support a small but unique assemblage of freshwater fishes, including Arctic Grayling (*Thymallus arcticus*), Lake Trout (*Salvelinus namaycush*), and Burbot (*Lota lota*). Many lakes and streams in the interior mountains freeze severely in winter, often to the bottom. Consequently, habitat becomes extremely limited in winter, and fish may become concentrated in small areas of rivers and at the bottoms of lake basins. Mountain lakes also support small numbers of breeding waterfowl, primarily ducks, during the summer. Golden Eagles (*Aquila chrysaetos*) and Merlins (*Falco columbarius*) commonly breed in the Mountain Biome, and Gyrfalcons (*Falco tinnunculus*) and Peregrine Falcons (*Falco peregrinus*) may nest where suitable cliff-nesting habitats are available.

Mountain animals adapt to the cold by hibernating, migrating to lower, warmer areas, or insulating their bodies with layers of fat. They also tend to have shorter appendages, including legs, tails, and ears, than their relatives in warmer environments to reduce heat loss. In addition, mountain animals have larger lungs, more blood cells, and more hemoglobin to combat the increased atmospheric pressure and lack of oxygen found in higher altitudes.

Two endangered animal species that may be found in the Mountain Biome are the Black-footed ferret (*Mustela nigripes*) and the Least tern (*Sterna antillarum*). A full list of endangered species under the Endangered Species Act may be found at the USFWS website (http://endangered.fws.gov). The web site allows the user to search for threatened and endangered species by geographic location and species name.

Environmentally Sensitive Habitat

Several mammals of the Mountain Biome, including the Dall Sheep (*Ovis dalli dalli*), Collared Pika (*Ochotona collaris*), Arctic Ground Squirrel (*Spermophilus parryii*), and Singing Vole (*Microtus montanus*), occur only in the state of Alaska and northwest Canada. These species survived the last glaciations in this region and are adapted to the short summers and long winters of their mountain habitats. These mammals are considered sensitive species and may warrant special conservation measures.

H.9.4 Geology and Soils

Geology

The Mountain Biome is a complex network of mountain ranges characterized by extreme physiographic variability. Wide differences in elevation, slope steepness, and exposure exist locally and between major mountain masses. The Mountain Biome occurs at high altitudes and lies just below and above the snow line of a mountain.

Soils

Much of the Mountain Biome appears as barren rock or a cover of thin soils. Soils in the biome are relatively fragile and are subject to erosion when disturbed. The cold weather of the Mountain biome delays decomposition of plant material therefore, mountainous soils typically do not contain many nutrients. Soils on steep or rocky slopes have had less time to develop. These younger soils occupy roughly 12 percent of the U.S. land area. Soils with similar characteristics to the arid grassland soil can also be found in mountainous areas, where the soil has accumulated clays, calcium carbonate, silica, and salts. This type of soil occupies roughly eight percent of the U.S. land area and is used mainly for range, wildlife, and recreation. Because of the dry climate in which they are found, they are not used for agricultural production unless irrigation water is available.

Geological Hazards

Mountain Biomes are subject to numerous geological hazards, including earthquakes, landslides, and volcanoes. Exhibits 3-5, 3-6 and H-7 show the geographic distribution for such hazards in the continental U.S.

H.9.5 Hazardous Materials and Hazardous Waste

Hazardous Materials

Maintenance support and flight support operations at Ranges or installations within the Mountain Biome use products containing hazardous materials, which include solvents, oils, lubricants, batteries, fuels, surface coatings, and cleaning compounds. These products are used and stored at locations throughout the base, but are found primarily in the industrial and maintenance facilities. Procedures are developed for hazardous material management.

Hazardous Waste

Hazardous waste generated at specific BMDS installations typically is associated with equipment maintenance. Wastes generated by the facility include oils, fuels, antifreeze, paint, paint thinner and remover, photo chemicals, pesticides, aerosol canisters, batteries, used acetone, sulfuric acid, and sewage sludge. Procedures are developed for managing hazardous wastes at sites where activities for the proposed BMDS may occur. Due to the extreme climate of this biome, special measures may be necessary for storage and handling of hazardous materials and hazardous wastes in mountain areas.

H.9.6 Health and Safety

Health and Safety attributes of the Mountain Biome are similar to those discussed in Section H.1.6.

H.9.7 Noise

Sources of noise in the Mountain Biome are similar to principle sources of noise associated with sites where activities for the proposed BMDS may occur, as described in Section H.1.7.

H.9.8 Transportation

Mountain areas in central Europe sustain widespread infrastructure, including traffic circulation systems such as highways and byways, unpaved roads, non-maintained roads, trails, railroad lines, municipal, private, and military airports and any other system involved in mass transportation.

Ground Transportation

The sites where activities for the proposed BMDS may occur in the Mountain Biome are concentrated in Colorado, predominantly in the Colorado Springs area (Fort Carson Military Reserve, Peterson AFB, Schriever AFB). U.S. Interstates 70 and 25 are major arteries serving this region, as are U.S. Highway 24 and (Colorado) State Highways 94 and 115.

I-25, a four-lane freeway that meets most of the Federal standards established for the interstate system, connects Colorado Springs with urban centers to the north (Denver) and south (Pueblo). I-25 is currently undergoing a major modernization effort, called the I-25 Corridor Improvements Project, to upgrade an outdated, aging interstate facility through the construction of improved interchanges and roadways.

The east-west I-70 Mountain Corridor is a 225-kilometer (140-mile) stretch of rural, mountainous roadway that serves as a major intra- and inter-state highway. A PEIS is currently being prepared to address needed mobility improvements and congestion-reducing measures along the roadway. (Colorado DOT, 2003)

Air Transportation

Due to the extreme cold and heavy snowfall characteristic of the Mountain Biome, airports within this region require the ability to provide landing access under zero visibility conditions such as blizzards and de-icing capability.

Marine Transportation

Given the location of the Mountain Biome away from the coast, marine transportation is not a major source of transportation in this biome.

H.9.9 Water Resources

Surface Water and Ground Water Resources

Surface water resources in the Mountain Biome include glacial lakes, streams, and rivers fed by rainfall and melting snow or that originate from ground water sources. The water in mountain regions usually is clear with moderate amounts of nutrients provided from rain and melting snow runoff.

The Rocky Mountains of the western U.S. are characteristic of the water supply and uses found throughout the Mountain Biome. The Rocky Mountain region is arid to semi-arid with limited water resources. The watershed of the Rocky Mountains is known as the Great Basin. While agriculture is the biggest consumer of area water supply, draining approximately 80 percent of the total available water, urban, industrial, recreational, and historic Native American rights are intensifying competition for water. All available water is already allocated to some designated use; therefore, the watershed cannot readily support any extra demand on the region's water supply.

About 85 percent of the water used by the population of the Great Basin is derived from surface water, namely streams. Approximately three-fourths of the region's stream flow originates from melt and runoff of the yearly snowpacks found in the higher elevations of the Rockies. These snowpacks are the sources of many of the U.S.'s rivers, including the Missouri, Yellowstone, Platte, Arkansas, Rio Grande, Colorado, and Snake. Rocky Mountain waters flow into the Mississippi and Columbia River systems, and subsequently into the Pacific Ocean, the Gulf of Mexico, and the Gulf of California. Thus, the Great Basin contributes to the water needs of municipalities outside the region, including Los Angeles and San Diego, California; Phoenix, Arizona; and Albuquerque, New Mexico. Most of the Great Basin is an interior drainage basin. Therefore, its streams typically do not reach the oceans, largely draining internally into the Great Salt Lake and numerous playas (seasonally dry lakebeds). (USGCRP, 2003)

Europe abstracts a relatively small portion of its total renewable water resources each year. Total water abstraction in the region is about seven percent of the total freshwater resource. Resources are unevenly distributed across the region, and even if a country has sufficient resources at the national level there may be problems at regional or local levels. Agriculture accounts for 50 to 70 percent of total water abstraction in southwestern Europe, while cooling for electricity production is the dominant use in central Europe.

Water Quality

The National Water Quality Inventory summarizes the water quality assessments performed by state, local and Tribal governments. (EPA, 2000a) Water quality standards consist of three elements: (1) designated uses assigned to a water body (e.g., drinking, swimming, and fishing); (2) criteria to protect the designated use (e.g., chemical specific threshold limits); and (3) antidegradation policy to prevent deterioration of current water quality.

In the Mountain Biome, elevated levels of contaminants accumulate in snowpacks, negatively impacting local flora and fauna. Upon melting, the concentrated pollutants are dispersed throughout the area watershed, deteriorating the quality of downstream surface and ground water systems. U.S. Geological Survey studies indicate that concentrations of ammonium, nitrate, and sulfate (contaminants of particular concern for their tendency to form acid precipitation) are higher in heavily developed areas. The highest concentrations of nitrate and sulfate in the Rocky Mountain region are found in snowpacks that lie adjacent to both the highly developed Denver metropolitan area to the east and coal-fired power plants to the west. Ammonium concentrations are highest in northwestern Wyoming and southern Montana. (USGS, 2003)

Mining and agriculture are two other activities common in the Rockies that can degrade water quality. Concentrations of cadmium and zinc in streambed sediment are generally orders of magnitude higher than background concentrations. These elevated concentrations in turn degrade fish communities and habitat conditions. Agricultural areas often exhibit higher concentrations of nutrients and selenium than background levels. (USGS, 1999)

The European Union monitors surface water quality and drinking water quality via the 1976 Council Directive 76/160/EEC on Bathing Water Quality and the 1998 Council Directive 98/83/EC on the Quality of Water Intended for Human Consumption, respectively. Due to the outdated content of the former directive, the European Commission adopted a proposal for a revised directive (COM(2002)581) in October of 2002. Though this revision uses only two bacteriological indicators, Intestinal Enterococci and Escherischia coli, it sets a higher health standard than the existing directive. The directive uses these bacteriological indicators to provide bathing water quality goals and maximum bacterial concentrations, and pH to measure bathing water acidity, in a quantitative manner. The remaining parameters (phytoplankton blooms or micro-algae proliferation, mineral oils, tarry residues and floating materials) offer a qualitative measure of the minimal allowable bathing water quality.

Water quality is a serious environmental issue across Europe. While water pollution is a particularly critical issue in Central and Eastern Europe, water abstraction (extraction) for public use is a primary concern in Western Europe.

In the 1970s and 1980s, freshwater surface water and ground water sources throughout Europe suffered eutrophication when they became flooded with organic matter, nitrogen from fertilizer, and phosphorous from industrial and residential wastewater. In recent decades, however, water quality improvements have been made across Europe. In Western Europe, phosphorous discharge from urban wastewater treatment plants has decreased by 50 to 80 percent since the 1980s. In Central and Eastern Europe, 30 percent to 40 percent of households were not yet connected to sewer systems as of 1990, and water treatment in this area was still inadequate. Improved efficiency for domestic and industrial water use in Western Europe decreased water abstraction for public water supply by eight to ten percent from 1985 through 1995. (UNEP, 2002)

H.10 Broad Ocean Area

For the purposes of this PEIS, the BOA encompasses the Pacific Ocean, the Atlantic Ocean, and the Indian Ocean.

Proposed activities in the BOA would take place at a distance of several hundred kilometers from any land mass. The BOA is subject to EO 12114, *Environmental Effects Abroad of Major Federal Actions,* which requires consideration of Federal actions abroad with the potential for impacts to the environment. The EO specifically defines environment as “the natural and physical environment, and excludes social, economic, and other environment.” Therefore, potential impacts to environments other than the natural and physical area not analyzed in this document.

The Pacific Ocean is comprised of approximately 155.6 million square kilometers (60.1 million square miles) and includes the Bali Sea, Bering Sea, Bering Strait, Coral Sea, East China Sea, Flores Sea, Gulf of Alaska, Gulf of Tonkin, Java Sea, Philippine Sea, Savu Sea, Sea of Japan, Sea of Okhotsk, South China Sea, Tasman Sea, Timor Sea, and other tributary water bodies. Its maximum length is 14,500 kilometers (9,000 miles) and its greatest width is 17,700 kilometers (11,000 miles), which lies between the Isthmus of Panama and the Malay Peninsula. (Encyclopedia.com, 2003)

The Atlantic Ocean is comprised of 76.8 million square kilometers (29.6 million square miles) and includes the Baltic Sea, Black Sea, Caribbean Sea, Davis Strait, Denmark Strait, part of the Drake Passage, Gulf of Mexico, Mediterranean Sea, North Sea, Norwegian Sea, almost all of the Scotia Sea, and other tributary water bodies. The Atlantic Ocean extends from the North Pole southward for 16,093 kilometers (10,000 miles) to the Antarctic continent. The width of the Atlantic varies from about 2,850 kilometers (1,770 miles) between Brazil and Liberia to approximately 4,830 kilometers (3,000 miles) between Norfolk, VA, and Gibraltar. The average depth is 3,660 meters (12,000 feet) and the greatest depth is approximately 8,650 meters (28,400 feet) in the Puerto Rico Trench. (Oceans of the World, 2003)

The Indian Ocean is comprised of approximately 68 million square kilometers (26 million square miles) and includes the Andaman Sea, Arabian Sea, Bay of Bengal, Great Australian Bight, Gulf of Aden, Gulf of Oman, Mozambique Channel, Persian Gulf, Red Sea, Strait of Malacca, and other tributary water bodies. It is triangular and bordered by Africa, Asia, Australia, and the Southern Ocean. Its maximum width is about 10,000 kilometers (6,200 miles) between the southernmost portions of Africa and Australia, and its average depth is about 3,900 meters (12,750 feet). The greatest depth occurs in the Java Trench at 7,300 meters (23,800 feet) below sea level. (Oceans of the World, 2003)

H.10.1 Air Quality

Two kinds of circulation create the currents in the ocean, wind-driven circulation and Thermohaline circulation. Wind-driven circulation results from the wind setting the surface waters into motion as currents. The currents generally flow horizontally or parallel to the earth’s surface. The wind mainly affects only the upper 100 to 200 meters (328 to 656 feet) of water; however, the flow of wind-driven currents may extend to depths of 1,000 meters (3,280 feet) or more. (University of Washington, Department of Atmospheric Sciences, 2003) Thermohaline circulation produces great vertical currents that flow from the surface to the ocean bottom and back. The currents largely result from differences in water temperature and salinity. The currents move sluggishly from the polar regions, along the sea floor, and back to the surface.

Climate

Because oceans have great capacity for retaining heat, maritime climates are moderate and free from extreme seasonal variations. The oceans are the major source of the atmospheric moisture that is obtained through evaporation. Climatic zones vary with latitude and the warmest climatic zones stretch across the Atlantic, north of the equator. Ocean currents contribute to climatic control by transporting warm and cold waters to other regions. Adjacent land areas are affected by the winds that are cooled or warmed when blowing over these currents.

Pacific Ocean

The atmosphere and ocean continually interact in physical and chemical cycles in the eastern portion of the Pacific. Ocean surface temperatures play a large role in atmospheric conditions. A daily cycle of solar heat drives convective mixing, which occurs as a result of changes in water stability. In this case, the surface water sinks and the subsurface water rises to the surface, thus creating a mixing effect. Regional trade winds from the east push equatorial surface water into a mound in the west-equatorial Pacific Ocean that affects atmospheric conditions. The trade winds occasionally weaken, causing a reverse flow of warm surface waters to the east, which then mound against South America. The additional pressure of warm water in the east-equatorial Pacific Ocean inhibits and slows the upwelling of the more dense, cold, and nutrient-rich deep ocean water (DOT, 2001b) in a phenomenon known as the El Nino/Southern Oscillation. The El Nino effect includes an extreme decline in ecosystem productivity along the coast of South America and great fluctuations in heat transfer and molecular exchange between the ocean and the atmosphere throughout the Pacific region. (DOT, 2001b)

Winds and currents in the Pacific flow predominantly from East to West. Above the equator Pacific Ocean trade winds blow from the northeast, while below the equator, they blow from the southeast. Across the equatorial Pacific, prevailing trade winds push warm surface waters westward from Ecuador toward Indonesia. Deep, cold waters off the coast of South America rise, creating an east-west temperature contrast. That, in turn, lowers air pressure in the west, which draws in winds from the east.

Tropical cyclones (hurricanes) may form south of Mexico from June to October and affect Mexico and Central America. (Oceans of the World, 2003) Weather patterns in the north Pacific Ocean can be influenced by landmasses. The western Pacific tends to be monsoonal; a rainy season occurs during the summer months, when moisture-laden winds blow from the ocean over the land; and a dry season occurs during the winter months, when dry winds blow from the Asian landmass back to the ocean. Tropical cyclones (typhoons) may strike southeast and east Asia from May to December. (Oceans of the World, 2003)

Atlantic Ocean

The temperatures of the surface waters, water currents, and winds influence the climate of the Atlantic Ocean and adjacent land areas. The Gulf Stream, for example, warms the atmosphere of the British Isles and northwestern Europe, and the cold water currents contribute to heavy fog off the coast of northeastern Canada and the northwestern coast of Africa. In general, winds tend to transport moisture and warm or cool air over land areas.

Precipitation over the Atlantic BOA varies between ten centimeters (four inches) per year in the subtropics, with minimum amounts occurring near St. Helena and the Cape Verde Islands, and more than 200 centimeters (79 inches) per year occurring in the tropics. The region of highest rainfall follows the Intertropical Convergence Zone in a narrow band along five degrees north. A second band of high rainfall, with values of 100 to 150 centimeters (39 to 59 inches) per year, follows the path of storm systems in the Westerlies of the North Atlantic from Florida (28 to 38 degrees north) to Ireland, Scotland, and Norway (50 to 70 degrees north). No significant decrease in annual mean precipitation is observed from west to east; however, rainfall is not uniform across the band through the year. Most of the rain near Florida falls during summer, whereas closer to Europe it rains mainly in winter. (Tomczak and Godfrey, 2001)

The Atlantic BOA demonstrates a large seasonal variation of northern hemisphere winds. Important seasonal changes in wind direction occur along the east coast of North America, which experiences offshore winds during most of the year but warm, alongshore winds in summer. As part of the North Atlantic circulation, warm surface water from the equatorial Atlantic in the Gulf of Mexico travels north-westward as the Gulf Stream into the North Atlantic before cooling and sinking. The sinking water, called the North Atlantic deep water, acts as a pulling force and maintains the strength of the Gulf Stream. The presence of the warm Gulf Stream influences the climate of Western Europe, keeping winter temperature many degrees warmer than they would be otherwise. The North Atlantic Westerlies enter the ocean from the northwest and bring cold, dry air out over the Gulf Stream. The Atlantic northeast trade winds blow surface waters toward the equator and are somewhat stronger in winter than in summer. Seasonal wind reversals, characteristic of monsoons, are of minor importance and limited to the Florida-Bermuda area in the Atlantic BOA. (Tomczak and Godfrey, 2001)

Tropical cyclones, or hurricanes, develop off the coast of Africa near Cape Verde and move westward into the Caribbean Sea. Hurricanes can occur from May to December, but are most frequently observed from August to November. Storms are common in the North Atlantic Ocean during northern winters, making ocean crossings more difficult and dangerous. From October to May, ships may be subject to superstructure icing in extreme northern areas.

Indian Ocean

The climate of the Indian Ocean is marked by seasonal monsoons, which are seasonally shifting winds that produce either heavy precipitation or dry conditions, depending on the direction of the winds. (Virtual Domain Application Data Center, 2004) Low atmospheric pressure over Southwest Asia from rising hot summer air results in the southwest monsoon, which brings heavy rainfall from June to October. Cold, falling winter air builds high-pressure systems over northern Asia that contributes to the dry northeast monsoon from December to April. (CIA, 2003) Differential heating between the land and ocean and the storage and subsequent release of energy that occurs as water changes from liquid to vapor and back (latent heat) intensifies the effects of the Indian Ocean Monsoon more than any other place in the world. (Virtual Domain Application Data Center, 2004)

Similar to the El Nino effect in the Pacific Ocean, the Indian Ocean experiences an El Nino event, as well. A warm pool in the Indian Ocean moves eastward along the equator in a cycle of three to seven years. The warm pool migrates to the central Indian Ocean, where the warmest sea surface temperatures form, and then continues eastward to Indonesia and southward into the Timor Sea, north of Australia. The warm pool in the Indian Ocean propagates eastward along the equator more slowly than it does in the Pacific Ocean. (Columbia University Record, 1994)

Tropical cyclones occur during May and June and October and November in the northern Indian Ocean and during January and February in the southern Indian Ocean. (CIA, 2003) Cyclones also may occur in the Arabian Sea and the Bay of Bengal when monsoon winds change. (Wikipedia, 2003)

Regional Air Quality

No sources of ambient air quality monitoring data are known to exist for the BOA. Air quality over the Pacific Ocean is expected to be good because there are no major sources of air pollution, and the nearly constant trade winds in the area serve to disperse any pollutants from transient sources, such as passing seagoing vessels or low-flying aircraft. In the Atlantic Ocean, there is potential for large, thick plumes of aerosols blowing eastward over the North Atlantic. The aerosol plume is the regional haze produced by the industrial northeastern U.S. and typically occurs during the summer months. The haze is composed of sulfates and organics that originate from power plants and automotive sources. (NASA, 2003)

Air quality over the Indian Ocean is seasonally poor due to anthropogenic emissions from growing South and Southeast Asian countries, particularly India. During the dry monsoon season (northern hemisphere winter), air pollutants in South and Southeast Asia are transported long distances to the Indian Ocean by persistent northeasterly monsoon winds. A dense, brown haze covers an area greater than ten million square kilometers (3.9 million square miles) over most of the northern Indian Ocean (Max Planck Society, 2001), including the Arabian Sea, much of the Bay of Bengal, and part of the equatorial Indian Ocean to about five degrees south of the equator. (Environmental News Network, 1999) The haze extends from the ocean surface up to three kilometers (1.9 miles). Comprised primarily of soot, sulfates, nitrates, organic particles, fly ash, and mineral dust, the airborne particles can reduce visibility over the BOA to less than 10 kilometers (6.3 miles) and reduce the solar heating of the ocean by about 15 percent. The haze also contains relatively high concentrations of gases, including CO, SO_2, and other organic compounds. (Environmental News Network, 1999)

Existing Emission Sources

There are no known existing emission sources in the Pacific Ocean. Ozone and other pollutants found in the Atlantic Ocean are primarily the result of anthropogenic sources. Agricultural, urban, and industrial production that occurs on continental landmasses surrounding the Atlantic Ocean may impact emission levels, as well as marine life. A monitoring station in the Maldives Islands records air quality in the Indian Ocean. (Environmental News Network, 1999) The aerosol cloud covering much of the northern Indian Ocean originates primarily (at least 85 percent) from anthropogenic sources (Max Planck Society, 2001), namely agricultural and other biomass burning, the use of biofuels, and fossil fuel combustion, in South and Southeast Asia. (Lelieveld et al., 2001) Model calculations indicate that, in contrast to European and North American pollution, anthropogenic emissions from South and East Asia reduce the concentration of hydroxyl (OH) radicals. Because OH is a powerful oxidant and acts as an atmospheric cleansing agent, the Asian pollution decreases the oxidizing power of the atmosphere, contributing to greater pollution problems over the Indian Ocean. (Max Planck Society, 2001)

H.10.2 Airspace

Controlled and Uncontrolled Airspace

Because the airspace in the BOA is beyond the territorial limit and is in international airspace, the procedures of the ICAO, outlined in ICAO Document 444, *Rules of the Air and Air Traffic Services* are followed. The FAA acts as the U.S. agent for aeronautical information to the ICAO. The Honolulu or Oakland ARTCC manages air traffic in the Pacific region of influence and the New York ARTCC manages the air traffic in the Atlantic region of influence. The Oakland Oceanic Flight Information Region is the world's largest, covering approximately 48.4 million square kilometers (18.7 million square miles) and handling over 560 flights per day.

Special Use Airspace

Domestic 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. Special use airspace is established at PMRF, Warning Area W-188 north of Kauai, and Warning Areas W-189 and W-190 north of Oahu. There are numerous warning areas along the U.S. Pacific coastline.

Airports and Airfields

There are no airports or airfields located in the BOA.

En Route Airways and Jet Routes

Before conducting a missile launch, NOTAMs would be sent in accordance with the conditions of the directive specified in Operations Naval Instruction 3721.20. In addition, the responsible commander would obtain approval from the FAA Administrator, through the appropriate U.S. Navy airspace representative. Hazardous operations would be suspended when it is known that any non-participating aircraft has entered any part of the danger zone until the non-participating entrant has left the area or a thorough check of the suspected area has been performed.

High-altitude overseas jet routes cross the Pacific BOA via nine control area extension corridors off the California coast. These corridors and associated jet routes continue northwest to Alaska and then southwest to the Orient. These corridors can be opened or closed at the request of a user in coordination with the FAA. A Memorandum of Agreement exists between users and the FAA to stipulate the conditions under which the control area extensions can be closed to civil traffic. Under most circumstances, at least one control area extension must remain available for use by general aviation and commercial air carriers.

The FAA is gradually permitting aircraft to select their own routes as an alternative to flying above 8,830 meters (29,000 feet) following the published jet routes through a Free Flight program. The program is designed to enhance the safety and efficiency of the National Airspace System (NAS). The concept moves the NAS 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. (ICF Kaiser for Beal Aerospace, 1998)

The Free Flight program would become fully implemented once procedures are modified, and technologies become available and are acquired by users and service providers. Advanced satellite voice and data communications would be 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. (ICF Kaiser for Beal Aerospace, 1998) With full implementation of this program, the amount of airspace in the region 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 jet routes.

H.10.3 Biological Resources

Marine biology of the open ocean consists of the animal and plant life that lives in and just above the surface waters of the sea and its fringes; physical and chemical properties of the ocean; biological diversity; and the characteristics of its different ecosystems or communities.

The general composition of the ocean includes water, sodium chloride, dissolved gases, minerals, and nutrients. These characteristics determine and direct the interactions between the seawater and its inhabitants. The most important physical and chemical properties are salinity, density, temperature, pH, and dissolved gases. For oceanic waters, the salinity is approximately 35 parts of salt per 1,000 parts of sea water. Most organisms have a distinct range of temperatures in which they thrive. A greater number of species live within the moderate temperature zones, with fewer species tolerant of extremes in temperature. Most areas maintain a temperature of 4°C (39.2°F).

Surface sea water often has a pH between 8.1 and 8.3 (slightly basic), but generally is stable with a neutral pH. The amount of oxygen present in sea water will vary with the rate of production by plants, consumption by animals and plants, bacterial decomposition, and surface interactions with the atmosphere. CO_2 is a gas required by plants for photosynthetic production of new organic matter and is 60 times more concentrated in seawater than it is in the atmosphere.

Vegetation

Organisms inhabiting the open ocean typically do not come near land, continental shelves, or the seabed (DOT, 2001b). Marine plants and plant-like organisms can live only in the sunlit surface waters of the ocean, known as the photic zone, which extends to only about 101 meters (330 feet) below the surface. Beyond the photic zone, the light is insufficient to support plants and plant-like organisms. Animals, however, live throughout the ocean from the surface to the greatest depths. The organisms living in the open ocean communities may be drifters (plankton) or swimmers (nekton). These organisms make up approximately two percent of marine species populations. Plankton consists of plant-like organisms and animals that drift with the ocean currents, with little ability to move through the water on their own. Benthic, or sea floor, communities are made up of marine organisms, such as kelp, sea grass, clams, and other species that live on or near the sea floor.

Regulation of marine wildlife in the BOA is diverse and may involve Federal, state, local, or international agencies and organizations. A report by NOAA’s National Marine Fisheries Service, Our Living Oceans (1999) covers the majority of living marine resources that are of interest for commercial, recreational, subsistence, and aesthetic or intrinsic reasons to the U.S.

Wildlife

Organisms inhabiting the open ocean typically do not come near land, continental shelves, or the seabed (DOT, 2001b). The organisms living in the open ocean communities may be drifters (plankton) or swimmers (nekton). These organisms make up approximately two percent of marine species populations. Nekton consists of animals that can swim freely in the ocean, such as fish, squids, and marine mammals. Benthic, or sea floor, communities are made up of marine organisms, such as kelp, sea grass, clams, and other species that live on or near the sea floor. The deep-sea benthic community, which lives a thousand to several thousand meters beneath open ocean waters, has been stable over long periods of geologic time and has allowed for the evolution of numerous highly specialized species. (DOT, 2001b) Less than one percent of benthic species live in the deep ocean below 2,000 meters (6,562 feet).

Regulation of marine wildlife in the BOA is diverse and may involve Federal, state, local, or international agencies and organizations. A report by NOAA's National Marine Fisheries Service, Our Living Oceans (1999) covers the majority of living marine resources that are of interest for commercial, recreational, subsistence, and aesthetic or intrinsic reasons to the U.S.

Sea turtles are highly migratory and widely distributed throughout the world's oceans. Six species of seas turtles are found in the U.S. and all are listed as endangered or threatened. The loggerhead (*Caretta caretta*), Kemp's ridley (*Lepidochelys kempi*), green (*Chelonia mydeas*), Olive ridley (*Lepidochelys olivacea),* green (*Chelonia mydeas)*, hawksbill (*Eretmochelys imbricate*), and leatherback (*Dermochelys coriacea*) commonly are found in BOA waters. The Kemp's ridley, hawksbill, and leatherback are listed as endangered throughout their ranges, while the loggerhead and green turtle are listed as threatened. The National Marine Fisheries Service report noted that ingestion of marine debris could be a serious threat to sea turtles. When feeding, sea turtles can mistake debris for natural food items. Plans are underway to prioritize actions that are necessary to conserve and recover the species. (NMFS, 1999)

Federally listed endangered species that exist within the BOA include the Sei Whale (*Balaenoptera borealis*), the Blue whale (*Balaenoptera musculus*), the Fin Whale (*Balaenoptera physalus*), the Humpback whale (*Megaptera novaengliae*), and the Sperm whale (*Physeter macrocephalus*). Threats to these species include commercial whalers, historic whaling practices, offshore drift gillnet fishing, and ship strikes.

Environmentally Sensitive Habitat

EO 13178 established the Northwestern Hawaiian Island Coral Reef Ecosystem Reserve, which lies to the northwest of the main islands of the Hawaiian chain, to "ensure the comprehensive, strong, and lasting protection of the coral reef ecosystem and related marine resources and species of the Northwestern Hawaiian Islands." The Reserve includes submerged lands and waters of the Northwestern Hawaiian Islands, extending approximately 2,220 kilometers (1,200 nautical miles) long and 185 kilometers (100 nautical miles) wide. The Reserve also includes the Hawaiian Islands National Wildlife Refuge to the extent that it expands beyond the seaward boundaries of Hawaii. The seaward boundary of the Reserve is 93 kilometers (50 nautical miles) from the approximate geographical centerline of Nihoa, Necker, French Frigate Shoals, Gardner Pinnacles, Maro Reef, Laysan, Lisianski, Pearl and Hermes Reef, Midway Atoll, and Kure.

Congress created the Hawaiian Islands Humpback Whale National Marine Sanctuary in 1992. Humpback whales (*Megaptera novaeangliae*) are endangered marine mammals and are protected under provisions of the Endangered Species Act and the Marine Mammal Protection Act wherever they are found. In the winter months, Humpbacks are typically seen in the shallow waters surrounding the Hawaiian Islands, where they congregate to mate and calve. Regulations implementing designation of the sanctuary specifically recognize that all existing military activities external to the sanctuary are authorized, as are new military activities following consultation with the NOAA Fisheries Service. (62 FR 14816, 15 CFR 922.183)

H.10.4 Geology and Soils

Geology

Pacific Ocean

The Pacific Ocean floor of the central Pacific basin is relatively uniform, with a mean depth of about 4,270 meters (14,000 feet). The western part of the floor consists of mountain arcs that rise above the sea as island groups, such as the Solomon Islands and New Zealand, and deep trenches, such as the Marianas Trench, the Philippine Trench, and the Tonga Trench. Most of the deep trenches lie adjacent to the outer margins of the wide western Pacific continental shelf. (Encyclopedia.com, 2003) The Pacific Ocean floor is characterized by the Central Pacific Trough. This feature extends from the Aleutian Islands southward to Antarctica and from Japan to the west coast of North America. Along with a number of deep ocean trenches, the Pacific has many flat-topped seamounts called guyots. (Oceans of the World, 2003)

The approximately 20,000 islands in the Pacific Ocean are concentrated in the south and west. Most of the larger islands are structurally part of the continent and rise from the continental shelf; these include the Japanese island arc, the Malay Archipelago, and the islands of northwest North America and southwest South America. Scattered around the Pacific and rising from the ocean floor are high volcanic islands. Along the eastern margin of the Pacific basin is the East Pacific Rise, which is a part of the worldwide mid-oceanic ridge. About 3,000 kilometers (1,800 miles) across, the rise stands about three kilometers (two miles) above the adjacent ocean floor. Because a relatively small land area drains into the Pacific, and because of the ocean's immense size, most sediments are authigenic (minerals that grow in place with a rock) or pelagic in origin. Pelagic deposits, which contain the remains of organisms that sink to the ocean floor, include red clays and Globigerina, pteropod, and siliceous oozes. Covering most of the ocean floor and ranging in thickness from 60 meters (200 feet) to 3,300 meters (10,900 feet), pelagic deposits are thickest in the convergence belts and in the zones of upwelling. Authigenic deposits, which are materials that grow in place with a rock, rather than having been transported and deposited, consist of such materials as manganese nodules and occur in locations where sedimentation proceeds slowly or currents sort the deposits. (Wikipedia, 2003)

The Earth's crust in the equatorial Pacific region is broken into roughly two-dozen plates, which create various features on the ocean floor, such as ridges, trenches, and volcanoes. (DOT, 2001b) The floor of the Pacific Ocean, which has an average depth of 4,300 meters (14,000 feet), is largely a deep-sea plain. The greatest known depth is the Challenger Deep in the Marianas Trench, which is 10,911.5 meters (35,798.6 feet) deep. (Encyclopedia.com, 2003)

Atlantic Ocean

The principal feature of the bottom topography of the Atlantic BOA is a great submarine mountain range called the Mid-Atlantic Ridge. It extends from Iceland in the north to approximately 58 degrees south latitude, reaching a maximum width of about 1,600 kilometers (1,000 miles). A great rift valley also extends along the Mid-Atlantic Ridge over most of its length. The depth of water over the ridge is less than 2,700 meters (8,900 feet) in most places, and several mountain peaks rise above the water, forming islands.

The Mid-Atlantic Ridge separates the Atlantic BOA into two large troughs with depths averaging between 3,660 and 5,485 meters (12,000 and 18,000 feet). (Oceans of the World, 2003)

The deep ocean floor of the Atlantic is thought to be fairly flat, although numerous seamounts and some guyots exist. Several deeps or trenches also are found on the ocean floor. The deepest elevation point is the Milwaukee Deep in the Puerto Rico Trench. The shelves along the margins of the continents constitute about 11 percent of the bottom topography. In addition, a number of deep channels cut across the continental rise.

Indian Ocean

The Mid-Ocean Ridge, a broad submarine mountain range extending from Asia to Antarctica, dominates the terrain of the Indian Ocean floor and divides the Indian BOA into three major sections – the African, Antardis, and Australasian. The ridge rises to an average height of approximately 3,000 meters (10,000 feet), and a few peaks emerge as islands. A large rift, an extension of the Great Rift Valley that runs through the Gulf of Aden, extends along most of the ridge's length.

The Indian Ocean is subdivided into a series of deep sea basins (abyssal plains) by the Southeast Indian Ocean Ridge, Southwest Indian Ocean Ridge, and Ninetyeast Ridge (CIA, 2003). The floor of the Indian Ocean has an average depth of approximately 3,886 meters (12,750 feet). The greatest depth occurs in the Java Trench at 7,258 meters (23,812 feet) below sea level. (Oceans of the World, 2003) Glacial outwash dominates the extreme southern latitudes. (Wikipedia, 2003)

Soils (Sediment)

Ocean sediments are composed of terrestrial, pelagic, and authigenic material. Terrestrial deposits consist of sand, mud, and rock particles formed by erosion, weathering, and volcanic activity on land and then washed to sea. These materials are largely found on the continental shelves and are thickest off the mouths of large rivers or desert coasts. Pelagic deposits, which contain the remains of organisms that sink to the ocean floor, include red clays and Globigerina, pteropod, and siliceous oozes. Covering most of the ocean floor and ranging in thickness from 60 meters (200 feet) to 3,300 meters (10,900 feet), pelagic deposits are thickest in the convergence belts and in the zones of upwelling. Authigenic deposits, which are materials that grow in place with a rock, rather than having been transported and deposited, consist of such materials as manganese nodules and occur in locations where sedimentation proceeds slowly or currents sort the deposits. (Wikipedia, 2003)

Geologic Hazards

The Pacific Ocean is surrounded by a zone of violent volcanic and earthquake activity sometimes referred to as the "Pacific Ring of Fire." Icebergs are common in the Davis Strait, Denmark Strait, and the northwestern Atlantic Ocean from February to August and have been spotted as far south as Bermuda and the Madeira Islands. (Oceans of the World, 2003) Occasional icebergs occur in the southern reaches of the Indian Ocean. (CIA, 2003)

H.10.5 Hazardous Materials and Hazardous Waste

Hazardous Materials

Test event sponsors would be responsible for safe storage and handling of the materials that they obtain and must adhere to all DOT hazardous materials transportation regulations. Hazardous materials used in support of test event activities would include propellants, various cleaning solvents, paints, cleaning fluids, fuels, coolants, and other materials. Releases of materials in excess of reportable quantities specified by CERCLA would be reported to the EPA. Material and Safety Data Sheets would be available at the use and storage locations of each material.

For test events using sea-based platforms, hazardous materials would be conducted in accordance with all applicable state and Federal regulations as well as Range-specific and U.S. Navy standard operating procedures.

The transport, receipt, storage, and handling of hazardous materials will adhere to the Army TM 38-410, Navy NAVSUP PUB 505, Air Force AFR 69-9, Marine Corps MCO 4450-12 or Defense Logistics Agency DLAM 4145.11, Storage and Handling and Implementing Regulations Governing Storage and Handling of Hazardous Materials.

Hazardous Waste

The Clean Water Act prohibits the discharge of hazardous substances into or upon U.S. waters out to 370 kilometers (200 nautical miles). Also shipboard waste handling procedures for commercial and U.S. Navy vessels govern the discharge of hazardous wastes as well as non-hazardous waste streams. These categories include “blackwater” (sewage); “greywater” (leftover cleaning water); oily wastes; garbage (plastics, non-plastics, and food-contamination); hazardous wastes; and medical wastes. (U.S. Department of the Navy, 2002b)

Under the regulations implementing the Act to Prevent Pollution from Ships, as amended, and the Marine Plastics Pollution Research and Control Act, the discharge of plastics, including synthetic ropes, fishing nets, plastic bags, and biodegradable plastics, into water is prohibited. A slurry of sea water, paper, cardboard, or food waste capable of passing through a screen with opening no larger than 12 millimeters (0.4 inch) in diameter may not be discharged within 5.6 kilometers (three nautical miles) of land. Discharge of floating dunnage, lining, and packing materials is prohibited in navigable waters and in offshore areas less than 46.3 kilometers (25 nautical miles) from the nearest land.

Test event sponsors would be responsible for tracking hazardous wastes; for proper hazardous waste identification, storage, transportation, and disposal; and for implementing strategies to reduce the volume and toxicity of the hazardous waste generated. For test events using a sea-based platform, hazardous materials and hazardous waste management would be conducted in accordance with all applicable state and Federal regulations as well as Range-specific and U.S. Navy standard operating procedures.

The transport, receipt, storage, and handling of hazardous materials would comply with Army TM 38-410, Navy NAVSUP PUB 505, Air Force AFR 69-9, Marine Corps MCO 4450-12 or Defense Logistics Agency DLAM 4145.11, Storage and Handling and Implementing Regulations Governing Storage and Handling of Hazardous Materials.

H.10.6 Health and Safety

The region of influence for health and safety in the BOA would be limited to work crews located on sea-based platforms. If noise exposures equal or exceed an 8-hour time-weighted average of 85 dB, personnel on the sea-based platform would be required to wear appropriate hearing protection equipment.

The WorldWide Navigational Warning Service is a worldwide radio and satellite broadcast system for the dissemination of Maritime Safety Information to U.S. Navy and merchant ships. The WorldWide Navigational Warning Service provides timely and accurate long range and coastal warning messages promoting the safety of life and property at sea and Special Warnings that inform mariners of potential political or military hazards that may affect safety of U.S. shipping. The world is divided into 16 Navigational Areas for global dissemination of Maritime Safety Information. National Imagery and Mapping Agency is the coordinator of Navigational Areas.

The International Maritime Organization is a specialized agency of the United Nations, whose objective is to develop and facilitate the general adoption of the highest practicable standards in matters of ship safety, training, operation, construction, and certification, efficiency of navigation, and pollution prevention and control. The Maritime Safety Committee is the organization’s senior technical body on safety-related matters. The International Maritime Organization also has developed and adopted international collision regulations and global standards for seafarers, as well as international conventions and codes relating to search and rescue, the facilitation of international maritime traffic, load lines, the carriage of dangerous goods, pollution and tonnage measurement.

H.10.7 Noise

Baseline or ambient noise levels on the ocean surface are a function of local and regional wind speeds. Studies of ambient noise of the ocean have found that the sea surface is the predominant source of noise, and that the source is associated with the breaking of waves. (Knudsen, et al., 1948, as referenced in DOT, 2001a) Wave breaking is further correlated to wind speed, resulting in a relationship between noise level and wind speed. (Cato, et al., 1994 as referenced in DOT, 2001) Seasonal changes in winds usually do not include changes in wind speed but rather wind direction. (NIMA, 1998, as referenced in DOT, 2001a) Storms and other weather events, however, would increase localized wind speed, and therefore would increase the noise level for the duration of that weather event.

Common sources of background noise for large bodies of water are tidal currents and waves; wind and rain over the water surface; water turbulence and infrasonic noise; biological sources (e.g., marine mammals); and human-made sounds (e.g., ships, boats, low-flying aircraft). The ambient noise levels from natural sources are expected to vary according to numerous factors including wind and sea conditions, seasonal biological cycles, and other physical conditions. Noise levels from natural sources can be as loud as 120 dB in major storms. (U.S. Army Space and Strategic Defense Command, 1994a)

The primary human-made noise source within the BOA is associated with ship and vessel traffic, including transiting commercial tankers and container ships, commercial fishing boats, and military surface vessels and aircraft. Noise sources also would include launch or other activities from sea-based platforms.

H.10.8 Transportation

The potential transportation issue related to the BOA is marine shipping.

Ground Transportation

Given the nature of the BOA, no ground transportation exists in this biome.

Air Transportation

Because no airfields are located in the BOA, air transportation is not associated with this biome. Several national and international commercial air traffic routes pass over the BOA.

Marine Transportation

Marine shipping refers to the conveyance of freight, commodities, and passengers via mercantile vessels. There are no regulations or directions obliging commercial vessels to comply with specific cross-ocean lanes. Once a commercial vessel has left the navigation lanes leading out to the open sea, the majority of shipping will follow the course of least distance between two ports.

As of January 1, 1999, the domestic fleet includes

- Domestic coastal and oceangoing vessels including 55 container ships, 104 tankers, 982 dry cargo barges, and 456 tank barges;
- An inland-barge fleet consisting of 22,279 dry cargo barges and 2,791 tank barges;
- A tug and towing system consisting of 5,424 vessels that move coastal and inland barges and provide ship docking, vessel escort, lightering, and other services;
- A Great Lakes system consisting of a fleet of 56 dry bulk carriers, eight cement carriers, three tankers, and an additional 101 dry cargo barges and 41 tank barges; and
- Hundreds of passenger vessels that serve as ferries, excursion vessels, and gaming vessels.

The Pacific and Atlantic oceans are important commercial seaways, carrying a substantial portion of the U.S. trade in raw materials and finished products. For example, in 1996, about 21 percent of all commercial vessels importing and exporting goods to and from the U.S. top 30 ports departed from, or were bound for, ports on the U.S. Pacific seaboard. (DOT, 1999)

The Indian Ocean provides major sea routes connecting the Middle East, Africa, and East Asia with Europe and the Americas. It carries a particularly heavy traffic of petroleum and petroleum products from the oilfields of the Persian Gulf and Indonesia. (CIA, 2003)

H.10.9 Water Resources

The two main factors that define ocean water are the temperature and the salinity of the water. Ocean water gets denser when either the temperature decreases or the salinity increases. (UCAR, 2001b)

Surface water temperatures vary with latitude, current systems, and seasons and reflect the latitudinal distribution of solar energy. Temperatures range from less than 2°C to 29°C (28°F to 84°F). Maximum temperatures occur north of the equator, and minimum values are found in the Polar Regions. In the middle latitudes, which is the area of maximum temperature variations, values may vary by 7°C to 8°C (13°F to 14°F). Surface seawater often has a pH between 8.1 and 8.3 (slightly basic), but generally is very stable with a neutral pH. The amount of oxygen present in seawater will vary with the rate of products by plants, consumption by animals and plants, bacterial decomposition, and surface interactions with the atmosphere.

Pacific Ocean

Water temperatures in the Pacific vary from freezing in the poleward areas to about 29°C (84°F) near the equator. Water near the equator is less salty than that found in the mid-latitudes because of abundant equatorial precipitation throughout the year. Poleward of the temperate latitudes salinity is also low, because little evaporation of seawater takes place in these areas. The surface of the Pacific Ocean generally circulates clockwise in the Northern Hemisphere and counterclockwise in the Southern Hemisphere. (Wikipedia, 2003)

Atlantic Ocean

The salinity of the surface waters in the open ocean ranges from 33 to 37 parts per thousand and varies with latitude and season. Although the minimum salinity values are found just north of the equator, in general the lowest values are in the high latitudes and along coasts where large rivers flow into the ocean. Maximum salinity values occur at about 25 degrees north latitude. Surface salinity values are influenced by evaporation, precipitation, river inflow, and melting of sea ice. For example, poleward of the Westerlies, sea surface salinity decreases further as a result of freshwater supply from glaciers and icebergs. In subtropical areas, water with high salinity flows westward with the North Equatorial Current, and continuous evaporation further increases surface salinity. (Tomczak and Godfrey, 2001)

Effects on sea surface salinity are somewhat alleviated by the large land drainage area of the Atlantic BOA, which includes the American continent north of the equator, Europe, large parts of northern Africa, and northern Asia (Siberia). Many of the world's largest rivers, including the Mississippi and Rhine Rivers, empty into the Atlantic BOA, while others, such as the Nile and Kolyma Rivers, empty into its Mediterranean seas. In these adjacent seas, river runoff plays an important role in the salinity balance and consequently influences their circulation. Overall, however, the contribution from rivers to the freshwater flux of the Atlantic BOA cannot compensate for the low level of rainfall over the sea surface. (Tomczak and Godfrey, 2001)

Indian Ocean

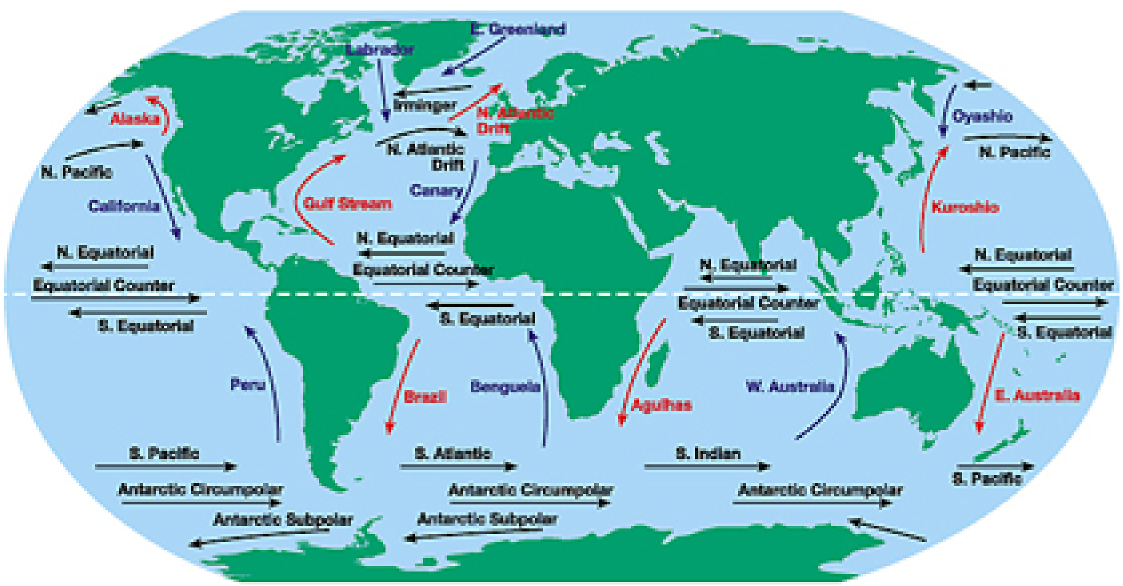
Surface water temperatures in the Indian Ocean vary with the seasons and distance from the equator, but the ocean’s mostly tropical waters do not exhibit the same temperature extremes found in the Atlantic and Pacific oceans. The surface waters are generally warm, with a minimum temperature of 22ºC (72ºF) north of 20 degrees south latitude. Surface water temperature may exceed 28ºC (82ºF) to the east. South of 40 degrees south latitude, temperatures drop quickly. Pack ice and icebergs are found year-round south of approximately 65 degrees south latitude; the average northern limit for icebergs is 45 degrees south latitude. (Wikipedia, 2003)

Surface water salinity ranges from 32 to 37 parts per thousand, the highest occurring in the Arabian Sea and in a belt between southern Africa and southwestern Australia. (Wikipedia, 2003) Rainfall anomalies and winds associated with monsoons and El Nino events affect surface salinity in the Indian Ocean. (Perigaud, McCreary, and Zhang, 2003)

The Indian Ocean has two water circulation systems – a regular counterclockwise system in the southern hemisphere, including the South Equatorial Current, Mozambique Current, West Wind Drift, and West Australian Current, and a northern system, the Monsoon Drift, whose currents are directly related to the seasonal shift of monsoon winds. (Encylopedia.com, 2003) The southwest monsoon in the summer results in southwest-to-northeast winds and currents, and the northeast monsoon results in the opposite direction of wind and currents (CIA, 2003). Deepwater circulation is controlled primarily by inflows from the Atlantic Ocean, the Red Sea, and Antarctic currents. (Wikipedia, 2003)

Due to the Coriolis force, water in the North Atlantic Ocean circulates in a clockwise direction. In latitudes above 40 degrees north, some east-west oscillation occurs. The surface water currents in the open ocean influence the temperature of the water and the types of species that live in the region. Exhibit H-12 shows the surface currents in the world's oceans.

Exhibit H-12. Surface Currents of the World's Oceans



Source: UCAR, 2001a

Water Quality

Water quality in the open ocean is considered excellent, with high water clarity, low concentrations of suspended matter, dissolved oxygen concentrations at or near saturation, and low concentrations of contaminants such as trace metals and hydrocarbons.

H.11 Atmosphere

The Atmosphere envelops all areas of the Earth and consists of the four principal layers of the Earth's atmosphere: troposphere, stratosphere, mesosphere, and ionosphere or thermosphere.[14] These layers are characterized by altitude, temperature, structure, density, composition, and degree of ionization – the positive or negative electric charge associated with each layer. Altitude ranges for atmospheric layers are shown in Exhibit 3-20.

Troposphere

The troposphere extends from the Earth's surface to approximately ten kilometers (6.2 miles). It is the turbulent and weather region containing 75 percent of the total mass of the Earth's atmosphere. It is characterized by decreasing temperature with increasing altitude. The major components of the troposphere are N_2 (76.9 percent) and oxygen (20.7 percent). Other components of lesser concentration include water vapor (1.4 percent in the lower atmosphere), argon, CO_2, nitrous oxide, hydrogen (H_2), xenon, and ozone.

The troposphere is composed of two sub-layers: the atmospheric boundary layer (lower troposphere) and the free troposphere. The altitude of the atmospheric boundary layer is a function of surface roughness and temperature gradient and extends from the surface of the Earth to approximately two kilometers (1.2 miles). The altitude of the free troposphere is a function of time and location, and ranges from approximately two to 10 kilometers (1.2 to 6.2 miles) above the Earth's surface. Clouds and gases in the free troposphere regulate incoming and outgoing radiation, which affects the thermal heat balance of the Earth's surface.

Air pollutants frequently move through the atmospheric boundary layer and into the free troposphere, where they are subject to photochemical oxidation and chemical reactions within cloud droplets and return through precipitation to the atmospheric boundary layer or the Earth's surface.

Certain emissions or toxic contaminants, from both human and natural activities, can cause acute health exposure, degrade ambient air quality, can form acid rain that is deposited on Earth, or can travel to the upper atmosphere to contribute to global warming and ozone depletion. Approximately ten percent of the Earth's ozone is in the troposphere. Ozone at the Earth's surface is of great concern because it can directly damage life, including crop production, forest growth, and human health. Ozone is also a key ingredient for smog production.

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[14] Most resource areas do not apply to the Atmosphere. Therefore, the affected environment discussion includes only Air Quality, Airspace, Biological Resources, and Transportation.

Stratosphere

The stratosphere is located approximately 10 to 50 kilometers (6.2 to 31 miles) above the Earth's surface. Unlike the troposphere, the stratosphere is characterized by higher temperatures at the higher altitudes. It is the main region of ozone production in the atmosphere. Stratospheric ozone absorbs ultraviolet solar radiation, which is known to increase rates of skin cancer in humans and can be harmful to plant and animal life. Most atmospheric ozone (90 percent) is found in the stratosphere. The highest ozone concentrations are found in the lower stratosphere.

The concentration of ozone results from a dynamic balance between the ozone transported by stratospheric circulation and ozone destruction and production by chemical means. The dynamic nature of this balance means that ozone can vary on many timescales. Variations on timescales of up to 11 years have been observed, correlating with the solar cycle. Annual variations in the total ozone column can be as much as one percent, while day-to-day changes can be greater than ten percent. Causes of temporal ozone variations include changes in ozone transport, changes in ozone chemistry, or a coupling of these processes. Although the tropical latitudes have fairly constant year-round ozone levels, temperate altitudes exhibit strong seasonal ozone variations with a maximum peaking in March/April and a minimum in October/November in the northern hemisphere, and the reverse variation in the southern hemisphere. Variations in ozone concentrations may be solar-related or caused by other natural or man-induced variations in the chemistry of the stratosphere.

Ozone is continually created and destroyed by naturally occurring photochemical processes, and its concentration fluctuates seasonally (25 percent) and annually (one to two percent). Ozone is made up of three oxygen atoms and is generated by the action of sunlight to combine an oxygen molecule with an atom of oxygen. Atomic oxygen is produced by photolysis, or the use of radiant energy to produce chemical changes, of molecules of oxygen, NO_2, or ozone. Ozone can be depleted by compounds that contain various elements, most notably chlorine, fluorine, H_2, and N_2. Aluminum oxide (Al_2O_3) (particulates) and soot also may provide a reaction surface for the destruction of ozone. NO_2 is also important in the stratosphere; it functions as a major catalyst for ozone destruction at those altitudes.

The capability for stratospheric ozone depletion by a particular organo-chlorine compound is basically a consequence of its ability to deliver chlorine to the stratosphere and is primarily a function of its number of chlorine atoms, atmospheric lifetime, and stratospheric reactivity. Ozone depletion potentials have been developed for organo-chlorine compounds. They represent the relative amount of ozone depletion calculated in atmospheric models in comparison to the losses from an equivalent tonnage of CFC-11 set as 1.0.

Concerns about the ozone layer, and in particular the effect of man-made chlorine, led to the Montreal Protocol of 1987. Under the Montreal Protocol, more than 90 nations, including the U.S., agreed to limit future production of ozone-depleting compounds. There are two classes of ozone-depleting compounds. Class I substances include chlorofluorocarbons, carbon tetrachloride, halons, methyl bromide, and methyl chloroform. Class II substances consist of hydrochlorofluorocarbons. In the U.S., the 1990 Clean Air Act Amendments established phase-out schedules that surpassed those established during the Montreal Protocol and subsequent international meetings. The term "phase-out" refers to discontinuation of both production and consumption. Production of Class I substances was phased out by January 1, 1996, with the exception of halons, production of which was phased out on January 1, 1994. Class II substances have a more gradual phase-out schedule, which began in 2000 and extends to approximately 2020. The EPA can issue exceptions to the ban on use of some of these substances for medical, aviation safety, national security, and fire-extinguishing purposes.

EO 13148, Greening the Government Through Leadership in Environmental Management (65 FR 24595, 2000) requires Federal agencies to develop "a plan to phase out the procurement of Class I ozone-depleting substances for all nonexcepted uses by December 31, 2010. Plans should target cost effective reduction of environmental risk by phasing out Class I ozone-depleting substance applications as the equipment using those substances reaches its expected service life. DoD contracts may not include a specification that requires the use of a Class 1 ozone-depleting substance, unless a waiver is granted. An agency may request a waiver, and waiver requests must provide: (1) an explanation of the mission critical use of the chemical; (2) an explanation of the nature of the need for the chemical to protect human health; (3) a description of efforts to identify a less harmful substitute chemical or alternative processes to reduce the release and transfer of the chemical in question; and (4) a description of the off-site transfers of toxic chemicals for treatment directly associated with environmental restoration activities."

The stratospheric ozone discussed above can be characterized as beneficial to the human environment. This is contrasted to the ozone produced near the surface of the earth formed through chemical reactions between precursor emissions of VOCs and NO_x in the presence of sunlight. High concentrations of ozone at ground level are a major health and environmental concern.

Mesosphere

The mesosphere extends from 50 to 80 kilometers (31 to 53 miles) above the Earth's surface. The upper boundary of the ozone layer occurs at the base of the mesosphere. The temperature in the mesosphere decreases with altitude and distance from radiation adsorbing ozone molecules. Varied wind speeds and directions also characterize the mesosphere.

Ionosphere/Thermosphere

The ionosphere is the lowest part of the Earth's upper atmosphere and roughly extends from 80 to 1,000 kilometers (50 to 620 miles). In the ionosphere, the temperature rises with altitude due to the molecular adsorption of high-energy solar radiation. The ionosphere is further characterized by its high ion and electron density and is composed of several layers, each with different properties.

The E layer is the lowest layer, occurring between 80 and 140 kilometers (50 and 87 miles), and the dominant ion in the E layer is the NO+ ion. The F1 and F2 layers occur between 140 and 1,000 kilometers (621 miles), and the dominant ion in these layers is O+. The F2 layer always is present, and the highest electron concentration occurs within this layer at about 300 kilometers (186 miles). Above 300 kilometers (186 miles), the electron concentration decreases to a distance equivalent to several Earth radii. At this point, the Earth's magnetic field and the protonosphere (the outermost portion of the ionosphere) become indistinct from the solar wind or space.

The major neutral (non-charged) constituents of the ionosphere are atomic oxygen, N_2 and oxygen, and minor constituents are NO, atomic nitrogen, helium, argon, and CO_2. These neutral constituents are influenced strongly by the motions of plasma, or ionized gas. Though this layer has properties similar to a vacuum (by comparison to the Earth's surface), orbiting satellites still encounter drag forces within it.

The different layers of the ionosphere are important to low frequency radio communications. Radiation from the visible spectrum (e.g., aurora) originates in this region. The ionosphere is influenced by solar radiation, variations in the Earth's magnetic field and the motion of the upper atmosphere. Because of these interactions, the systematic properties of the ionosphere vary greatly with geographic latitude and time (diurnally, seasonally, and over the approximately 11-year solar cycle).

H.11.1 Air Quality

Radiation Balance/Global Climate Change

During the past 150 years, combustion of fossil fuels has resulted in increasing concentrations of atmospheric gases that are believed to influence global climate. Some of the activities associated with the BMDS could involve launches that use rocket fuels derived from fossil fuels. The partial products of combustion (burning) of the rocket fuel (which consists of hydrocarbons) are CO_2 and water. Both liquid and solid fuel propulsion systems emit water vapor and CO_2, either directly from the nozzle or as a result of afterburning in the exhaust fumes.

The temperature of the earth's atmosphere is determined by three factors: the sunlight it receives, the sunlight it reflects, and the infrared radiation absorbed by the atmosphere. The principal absorbers include CO_2, water vapor, nitrous oxide, CFCs, and methane. In general, higher concentrations of these gases produce increased absorption of infrared radiation and warmer temperatures. This phenomenon is commonly referred to as the "greenhouse effect."

H.11.2 Airspace

Exhibit H-13 illustrates the relationship between airspace classifications and atmospheric layers.

Exhibit H-13. Relationship between Airspace Classifications and Atmospheric Layers

Type of Airspace	Altitude (from MSL)	Atmospheric Layer(s)
Controlled	> 5.5 kilometers (3.4 miles)	Troposphere, Stratosphere
Uncontrolled	< 4.4 kilometers (2.7 miles)	Troposphere

H.11.3 Biological Resources

While the atmosphere generally is not considered to contain biological resources, atmospheric conditions have a direct impact on climate, which affects the location and health of biological resources.

H.11.4 Orbital Debris

Orbital debris for the purposes of this PEIS is defined as abandoned man-made objects or components of these objects that are orbiting the Earth in space. The space environment may be defined as any location outside the Earth's atmosphere and is generally considered to begin at an altitude approximately 120 kilometers (76 miles) above the Earth's surface, where the aerodynamic forces of the atmosphere are so thin that the various control surfaces of an aircraft (e.g., rudder, aileron, elevator) no longer function effectively. Space is characterized by a vacuum-like quality, devoid of the evenly distributed gases that make up the Earth's atmosphere. This PEIS analyzes proposed BMDS activities that may take place in space with regard to their potential to impact the human environment. The NEPA definition of the human environment does not, based on its characteristics, include the space environment. However, unlike natural debris like meteoroids that is part of the space environment and sweep through Earth orbital space at an average speed of 20 kilometers per second (12 miles per second), orbital debris remains in Earth orbit creating potential acute and cumulative impacts on satellites and other space objects. This analysis includes the impacts of orbital debris that pose a potential collision hazard to man-made objects such as satellites and spacecraft in orbit. Eventually these orbiting objects lose energy and drop into consecutively lower orbits until they reenter Earth's atmosphere. Orbital debris has no impact on the human environment unless and until the debris enters the Earth's atmosphere. De-orbiting debris (i.e., debris reentering the atmosphere from orbit) is a potential concern as a course of deposition of small particles into the stratosphere, and as a possible contributor to stratospheric ozone depletion by providing particulate reaction sites.

Orbital debris generally can be classified into four source categories. Operational debris are composed of inactive payloads and objects released during satellite delivery or satellite operations, including lens caps, separation and packing devices, spin-up mechanisms, empty propellant tanks, spent and intact vehicle bodies, payload shrouds, and a few objects thrown away or dropped during manned activities. Fragmentation debris results from either collisions or explosions. Deterioration debris is very small debris particles created by the gradual disintegration of spacecraft surface as a result of exposure to the space environment, including paint flaking and plastic and metal erosion. Solid rocket motor ejecta results from the ejection of thousands of kilograms of Al_2O_3 dust from solid rocket motors into the orbital environment. (DOT, 2001b)

Orbital debris particles can be characterized by size as

- Small – debris particles smaller than 1.02 centimeters (0.4 inch) in diameter,
- Medium – debris particles between 1.02 and 10.2 centimeters (0.4 and four inches) in diameter, and
- Large – debris particles larger than 10.2 centimeters (four inches) in diameter.

Large particles represent five percent of the total population of debris particles. Particles of this size can be tracked and catalogued by the Space Surveillance Network. (U.S. Department of the Air Force, 2000) The major source of orbital debris is explosion/collision-induced satellite breakups. Although the exact cause of most breakups is unknown, it is generally thought to result primarily from inadvertent mixing of hypergolic fuels, overheating of residual propellants or deliberate fragmentation. (U.S. Department of the Air Force, 2000) The interaction among these three classes combined with their long residual times in orbit creates concern that there may be collisions producing additional fragments and causing the total debris population to grow, which may increase the chance of debris reentry into Earth's atmosphere.

The National Research Council (NRC) estimated that there are more than 10,000 objects greater than 10.2 centimeters (four inches) in size in orbit (including the almost 8,0999 tracing by AFSPC), tens of millions between 0.099 and 10.2 centimeters (0.039 and four inches) in size, and a trillion less than 0.099 centimeters (0.0.39 inch) in size. (U.S. Department of the Air Force, 2000)

A 2006 Executive Branch policy directive, National Space Policy, provides guidance for orbital debris: "The United States shall seek to minimize the creation of orbital debris by government and non-government operations in space in order to preserve the space environment for future generations...Departments and agencies shall continue to follow the United States Government Orbital Debris Mitigation Standard Practices...The Secretaries of Commerce and Transportation, in coordination with the Chairman of the Federal Communications Commission, shall continue to address orbital debris issues through their respective licensing procedures."

Hazards to Space Operations from Orbital Debris

The effects of launch-vehicle-generated orbital debris impacts on other spacecraft depend on the altitude, orbit, velocity, angle of impact, and mass of the debris. Debris particles defined as "small" in size would cause surface pitting and erosion. Over a long period of time, the cumulative effect of individual particles colliding with a satellite may become significant. Medium sized debris would produce significant impact damage that can be serious, depending on system vulnerability and defensive design provisions. Large particles can produce catastrophic damage. Astronauts or cosmonauts engaging in extra-vehicular activities could be vulnerable to the impact of small debris. On average, debris 1 millimeter (0. 04 inch) is capable of perforating current U.S. space suits. (Cour-Palais, 1991, as referenced in Commission on Engineering and Technical Systems, 1995)

Solid rocket motors eject Al_2O_3 dust (typically less than 0.004 inch) into the orbital environment, and may release larger chunks of unburned solid propellant or slag. However, solid rocket motor particles typically either decay very rapidly, probably within a few perigee (lowest point of orbit) passages, or are dispersed by solar radiation pressure. Thus, the operational threat of solid rocket motor dust is probably limited to brief periods of time related to specific mission events. (U.S. Department of the Air Force, 2000)

Orbital debris generated by launch vehicles contributes to the larger problem of pollution in space that includes radio-frequency interference and interference with scientific observations in all parts of the spectrum. For example, emissions at radio frequencies often interfere with radio astronomy observations (Office of Technology Assessment, 1990). Not only can orbital debris interfere with the performance of scientific experiments, but may even accidentally destroy them. (U.S. Department of the Air Force, 2000)

Over a long period of time, the cumulative effect of individual particles colliding with a satellite might become significant because the number of particles in this size range is very large in LEO. Although solid rocket motor ejecta are very small, long-term exposure of payloads to such particles is likely to cause erosion of exterior surfaces, chemical contamination, and may degrade operations of vulnerable components such as optical windows and solar panels. (DOT, 2001b)

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APPENDIX I
CUMULATIVE IMPACTS

CUMULATIVE IMPACTS

Background

Cumulative impacts are defined as the sum of the incremental impacts of a proposed action when added to the impacts of the activities of other past, present, and reasonably foreseeable future actions, regardless of the agency or person who undertakes them. As discussed in Section 4.2.3, the proposed action is worldwide in its scope and potential application; therefore, similar actions, which are worldwide in scope, have been considered for this analysis.

Worldwide commercial and government launch programs were determined to be activities of international scope that might reasonably be considered along with projected BMDS launches for cumulative impacts in this PEIS. Launches can contribute to cumulative impacts including ozone depletion, global warming, and orbital debris. In the stratosphere, cumulative impacts of worldwide launches could affect global warming and depletion of the stratospheric ozone layer because combustion products emitted during launch activities can play a role in these atmospheric conditions.

In the stratosphere, cumulative impacts of worldwide launches could affect global warming and depletion of the stratospheric ozone layer because launch emissions and their subsequent exhaust and atmospheric reaction products could play a role in causing or exacerbating these conditions. The cumulative impact, however, on global warming from launches would be insignificant when compared to other industrial sources of greenhouse gases and ozone-depleting substances. Further, the cumulative impact on stratospheric ozone depletion from launches would be far below and indistinguishable from the effects attributable to other natural and man-made causes. Ongoing research in this area indicates that ozone depletion from launch exhaust is limited spatially and temporally, and that these reactions do not have a globally significant impact on stratospheric chemistry. (Ross et al, 1997 as referenced in DOT, 2001b)

There has been extensive research on the potentially harmful effects of large solid propellant exhaust on global ozone depletion supported by the Air Force and NASA. These studies are generally based on a high launch rate, which allows for evaluation of large chlorine loads to the stratosphere. One such study by the World Meteorological Organization (1994 as referenced in DOT, 2001b) examined the effects of 10 launches annually of each of the following vehicles: Space Shuttle, Titan IV, and Ariane 5, which release 62, 29, and 52 metric tons (68, 32, and 57 tons) of atomic chlorine (Cl) per launch, respectively, directly into the stratosphere. A total of 1,424 metric tons (1,570 tons) of Cl deposited in the stratosphere each year from these launches corresponds to only 0.064% of the

1994 total stratospheric burden of chlorine from industrial sources. Analyses in the Rocket Impact on Stratospheric Ozone study (Ross, 1998 as referenced in DOT, 2001b) have confirmed that ozone loss occurs in the plume wakes of large solid propellant boosters (e.g., Titan IV and Space Shuttle), but the amount and duration of the loss appears to be temporary and limited.

This appendix presents the methodology used to estimate BMDS and other worldwide launch emission loads to the stratosphere as discussed in Section 4.2.3. These launch emission loads were then used to determine the cumulative impact on global warming from CO and CO_2 emissions and the cumulative impact on stratospheric ozone depletion from chlorine emissions.

Major inputs needed to determine the emission loads to the stratosphere and troposphere were

- Booster residence time, or the amount of time it takes the booster to travel through each layer of the atmosphere,
- Projected number of BMDS and worldwide launches, and
- Emission weight fractions, or the amounts of each emission (such as hydrogen chloride [HCl] and Al_2O_3) from combustion of the propellant.

Booster Residence Time

The booster residence time is determined based on the amount of time it takes the booster to travel through each layer of the atmosphere. The four layers of the Earth's atmosphere are the troposphere, extending from the surface to 10 kilometers (six miles); stratosphere, extending 10 to 50 kilometers (six to 31 miles); mesosphere, extending 50 to 80 kilometers (31 to 50 miles); and ionosphere, extending 80 to 1,000 kilometers (50 to 621 miles). See Exhibit 3-20 in Section 3.2.11. The residence time is used as the basis for determining the amount of propellant expended and thereby the amount of combustion products emitted in each layer of the atmosphere. The time a booster spends in an atmospheric layer is roughly correlated with the size of the booster. A smaller booster moves faster and therefore, spends less time in each atmospheric layer. The atmospheric interceptor technology (*ait*) booster is representative of boosters that would be part of the BMDS. The *ait* has been shown to spend approximately 25 seconds in both the troposphere and stratosphere. This PEIS provides a conservative analysis, which assumes that all boosters would spend approximately 60 seconds in both the troposphere and stratosphere. This residence time is sufficiently conservative to account for emissions from BMDS launches and from other worldwide launches of larger boosters. Because the residence time for boosters traveling through the troposphere and stratosphere was the same, it was assumed that the type and quantity of combustion product emissions would be the same in both the troposphere and stratosphere. (Department of Air Force, 1990 as referenced in DOT, 2001b)

Projected Number of BMDS and Worldwide Launches

The number of BMDS projected launches was estimated at 515[15] during the years 2004 to 2014. Worldwide projected launches, which include 77 United States (U.S.) commercial launches (FAA Office of Commercial Space Transportation [AST], 2003); 99 U.S. government launches (NASA, 2003a; NASA, 2003b; NASA, 2003c); 183 foreign commercial launches (COMSTAC, 2003); and 476 foreign government launches (NASA, 2004; Gunter's Space Page, 2004; Spaceflight Now, 2004a; Spaceflight Now, 2004b), were estimated to total 835 launches during the years 2004 and 2014. U.S. military launches were either captured under BMDS launches or under U.S. government launches (e.g., NASA launching a military satellite).

Launches were categorized by classes of boosters using a method developed in the PEIS for Licensing Launches. (DOT, 2001b) Boosters were classified into ranges based on the size of the propulsion system, specifically, the amount of propellant consumed in both the troposphere and the stratosphere. The ranges are

- Low (up to 75,000 kilograms [165,347 pounds] of propellant);
- Medium (75,000-100,000 kilograms [165,347-220,462 pounds] of propellant);
- Intermediate (100,000-200,000 kilograms [220,462-440,925 pounds] of propellant); and
- High (greater than 200,000 kilograms [440,925 pounds] of propellant).

Exhibit I-1 shows the number of BMDS launches and worldwide launches.

[15] Projected number of launches based on internal proposed test events.

Exhibit I-1. Projected Number of BMDS and Worldwide Launches (2004-2014) by Amount of Propellant Consumed in Troposphere and Stratosphere

Launch Type	Projected Number of Launches	Booster Classification By Amount of Propellant Consumed in the Stratosphere	Number of Boosters per Range of Propellant Used
BMDS Launches	515	Low	515
		Medium	0
		Intermediate	0
		High	0
U.S. Commercial[a]	77	Low	11
		Medium	11
		Intermediate	22
		High	33
U.S. Government[b]	99	Low	11
		Medium	44
		Intermediate	11
		High	33
Foreign Commercial[c]	183	Low	39
		Medium	17
		Intermediate	90
		High	37
Foreign Government[d]	476	Low	38
		Medium	8
		Intermediate	32
		High	398

Sources:
[a]AST, 2003
[b]NASA, 2003a; NASA, 2003b; and NASA, 2003c
[c]COMSTAC, 2003
[d]NASA, 2004;Gunter's Space Page, 2004; Spaceflight Now, 2004a and Spaceflight Now, 2004b

BMDS and worldwide launches use various types of propellants. Exhibit I-2 shows the number of flights through the stratosphere of boosters by launch and propellant type.

Exhibit I-2. Projected Number of Flights Through Stratosphere by Launch and Propellant Type

Launch Type	Booster Classification	Propellant Type	Number of Flights Through Stratosphere
BMDS Launches	Low	Solid	413
		Liquid Hypergolic	68
		Liquid Oxygen (LOX)-Rocket Propellant 1 (RP1)	34
	Medium	-	-
	Intermediate	-	-
	High	-	-
U.S. Commercial Launches	Low	Solid	11
	Medium	Solid	11
	Intermediate	LOX-RP1/Solid	16
		Hybrid	6
	High	Solid/LOX-LH_2 [16]	8
		LOX-RP1	17
		Solid/LOX-RP1	8
U.S. Government	Low	Solid	10
		Hypergolic	1
	Medium	Solid	4
		Solid/LOX-RP1	18
		Solid/LOX-LH_2	11
		LOX-RP1	11
	Intermediate	Solid	2
		LOX-RP1	6
		LOX-RP1	1
		LOX-LH_2	2
	High	Solid/LOX-LH_2	24
		LOX-RP1	2
		Solid/Hypergolic	5
		LOX-LH_2	2
Foreign Commercial	Low	Solid	14
		Hypergolic	25
	Medium	Solid	5
		Hypergolic	9
		Solid/Hypergolic	3

[16] LH_2 is liquefied hydrogen (H_2).

Exhibit I-2. Projected Number of Flights Through Stratosphere by Launch and Propellant Type

Launch Type	Booster Classification	Propellant Type	Number of Flights Through Stratosphere
	Intermediate	Hypergolic	36
		Solid/LOX-LH_2	9
		LOX-RP1	45
	High	Hypergolic	22
		LOX-RP1	9
		Solid	6
Foreign Government	Low	Solid	13
		Hypergolic	25
	Medium	Solid	2
		Hypergolic	4
		Solid/Hypergolic	1
	Intermediate	Hypergolic	13
		Solid/LOX-LH_2	4
		LOX-RP1	16
	High	Hypergolic	239
		LOX-RP1	100
		Solid	59

Emission Weight Fraction

The emissions from booster launches depend on the propellants used. BMDS boosters would use three primary propellant combinations: solid, LOX-RP1, and liquid hypergolic. Pre-fueled liquid propellant boosters would use liquid hypergolic propellants and non-pre-fueled liquid propellant boosters would use LOX-RP1 propellants. Even though the same emissions are produced by boosters using the same propellants, the amounts of emissions produced vary. The amount of each combustion product can be calculated using weight fractions. The weight fractions of combustion products of concern for propellants used in BMDS launches are listed in Exhibit I-3. (DOT, 2001b) Note that because some of the combustion products react with oxygen in the exhaust plume immediately upon being emitted, forming other emission products (e.g., one molecule of N_2 reacts with oxygen to generate two molecules of NO_X) the sum of the weight fractions in Exhibit I-3 may be greater than one.

Exhibit I-3. Weight Fraction of Propellant Emissions for BMDS Launches

Propellant	HCl	Al_2O_3	CO_2	H_2O*	H_2	OH**	N_2	Cl	NO_X	CO
Solid	0.21	0.38	0.46	0.27	-	-	-	0.0028	0.27	-
LOX-RP1	-	-	0.931	0.34	-	0.035	-	-	-	-
Liquid Hypergolic	-	-	0.22	0.35	-	-	-	-	1.36	-

*H2O is water.
**OH is the hydroxyl radical.

Worldwide launches may use propellant types not used or proposed to be used by the MDA. Therefore, weight fractions for other types of propellants used in worldwide launches were developed to support this analysis. The weight fractions for propellants used in worldwide launches are listed in Exhibit I-4. (DOT, 2001b) For both BMDS and worldwide launches, CO will react almost completely with oxygen in the air to form CO_2 in the high temperatures of the exhaust plume in the troposphere and stratosphere. Likewise, H_2 and N_2 in the exhaust plume will react almost completely with oxygen to form H_2O and NO_X, respectively. Consequently, the weight fractions in Exhibits I-3 and I-4 are based on the assumptions that the entire amount of CO emitted reacts to form CO_2, all H_2 forms H_2O, and all N_2 forms NO_X. (DOT, 2001b) As noted above the sum of the weight fractions in Exhibit I-4 may be greater than one.

Exhibit I-4. Weight Fraction of Propellant Emissions for Worldwide Launches

Propellant	HCl	Al_2O_3	CO_2	H_2O	H_2	OH	N_2	Cl	NO_X	CO
Solid	0.21	0.38	0.46	0.27	-	-	-	0.0028	0.27	-
LOX-RP1	-	-	0.931	0.34	-	0.035	-	-	-	-
Hybrid	-	-	0.931	0.34	-	0.035	-	-	-	-
Liquid Hypergolic	-	-	0.22	0.35	-	-	-	-	1.36	-
Solid/LOX-RP1	0.105	0.185	0.69	0.31	-	0.018	-	0.0014	0.13	-
Solid/LOX-LH_2	0.105	0.19	0.23	0.635	-	-	-	0.0014	0.135	-
Solid/ Hypergolic	0.105	0.19	0.34	0.31	-	-	-	0.0014	0.815	-

Calculation of Emission Loads for Projected BMDS Launches

As shown in Exhibit I-2, of the 515 projected BMDS launches, it was estimated that 413 of these launches would be solid propellant boosters; 34 would be non-pre-fueled liquid propellant boosters; and 68 would be pre-fueled liquid propellant boosters. All of the BMDS launches fell in the “Low” booster classification range. However, within the Low range there are many types and sizes of solid propellant boosters. Therefore, these boosters were further classified (as shown in Exhibit I-5) based on the quantity of propellant consumed in the stratosphere to obtain a more accurate representation of emission loads to the stratosphere from proposed BMDS launches.

Exhibit I-5. Further Classification of Solid-Propellant BMDS Launches during 2004-2014 Based on Propellant Consumed in Stratosphere

Booster Classification	Maximum Propellant Quantity Consumed in Stratosphere in kilograms (pounds)[a]	Percent of BMDS Launches in Each Booster Classification	Number of Booster Flights Through Stratosphere
Low (A)	Up to 500 (1,102)	13%	54
Low (B)	500-1,000 (1,102-2,205)	10%	41
Low (C)	1,000-5,000 (2,205-11,023)	10%	41
Low (D)	5,000-8,000 (11,023-17,637)	22%	91
Low (E)	8,000-15,000 (17,637-33,069)	29%	120
Low (F)	15,000-30,000 (33,069-66,139)	3%	12
Low (G)	30,000-60,000 (66,139-132,277)	13%	54

[a]Amount of propellant quantity consumed in the stratosphere was based on review of existing booster propellant information and booster residence time

Exhibit I-6 presents the estimated emissions loads to the stratosphere from BMDS launches from 2004 to 2014. Exhibit I-6 includes

- Propellant type used during flight through stratosphere;
- Number of booster flights through the stratosphere; and
- Maximum quantity of propellant consumed in the stratosphere, which is determined based on the booster residence time in the stratosphere (60 seconds assumed).

Exhibit I-6. Estimated Emission Loads to Stratosphere from Proposed BMDS Launches from 2004-2014[17]

Booster Classification*	Propellant Type	Number of Flights Through Stratosphere	Maximum Propellant Quantity Consumed in Stratosphere in kilograms (pounds)	Emission Loads in kilograms x 10^3 (pounds x 10^3)**					
				Al_2O_3	Cl	CO_2	H_2O	HCl	NO_X
Low (A)	Solid	54	500 (1,102)	10 (23)	0.08 (0.2)	12 (27)	7 (16)	6 (13)	7 (16)
Low (B)		41	1,000 (2,205)	16 (34)	0.1 (0.3)	19 (42)	11 (24)	9 (19)	11 (24)
Low (C)		41	5,000 (11,023)	78 (172)	0.6 (1)	94 (208)	55 (122)	43 (95)	55 (122)
Low (D)		91	8,000 (17,637)	277 (610)	2 (4)	335 (738)	197 (433)	153 (337)	197 (433)
Low (E)		120	15,000 (33,069)	684 (1508)	5 (11)	828 (1825)	486 (1071)	378 (833)	486 (1071)
Low (F)		12	30,000 (66,139)	137 (302)	1 (2)	166 (365)	97 (214)	76 (167)	97 (214)
Low (G)		54	60,000 (132,277)	1,231 (2,714)	9 (20)	1,490 (3,286)	875 (1,929)	680 (1,500)	875 (1,929)
Low	Liquid Hypergolic	68	1,000 (2,205)	-	-	15 (33)	24 (52)	-	92 (204)
Low	LOX-RP1	34	5,000 (11,023)	-	-	158 (349)	58 (127)	-	-
Total in kilograms x 10^3 (pounds x 10^3)				2,432 (5,362)	18 (39)	3,118 (6,873)	1,810 (3,990)	1,344 (2,963)	1,821 (4,014)
Total in metric tons (tons)				2,432 (2,680)	18 (20)	3,118 (3,436)	1,810 (1,994)	1,344 (1,481)	1,821 (2,006)

*Refer to Exhibit I-2 for description of Booster Classification
** Calculations subject to rounding

[17] The load to the troposphere would be the same as the load to the stratosphere because the residence time is the same (60 seconds) and the propellant type used is the same.

The number of flights through the stratosphere was multiplied by the maximum quantity of propellant consumed in the stratosphere to find the total amount of propellant consumed in the stratosphere for projected BMDS launches. The total amount of propellant was then multiplied by the appropriate weight fraction based on the type of propellant used (listed in Exhibit I-3 for BMDS launches).

Calculation of Emissions Loads for Worldwide Launches

Exhibits I-7 and I-8 present the estimated emission loads to the stratosphere from U.S. commercial and government launches from 2004 to 2014, respectively. Within each booster classification (Low, Medium, Intermediate, and High) the percent of rockets using various propellants was calculated based on previous studies. (DOT, 2001b) Representative vehicles were used for each propellant within each vehicle classification to determine emission loads. Propellant quantities and types for U.S. commercial and government vehicles in the Low propellant use vehicle classification were based on quantities currently used for commercial launches. Propellant quantities and types for U.S. commercial and government vehicles in the High propellant use vehicle classification were based on the Titan IV and Space Shuttle. (Isakowitz, 1999 as referenced in DOT, 2001b)

Exhibits I-7 and I-8 also include the maximum quantity of propellant consumed in the stratosphere, which was determined based on the booster's residence time. The number of flights was multiplied by the maximum quantity of propellant consumed to determine the total amount of propellant consumed in the stratosphere for projected U.S. commercial and government launches. The total amount of propellant was then multiplied by the appropriate weight fraction based on the propellant used (listed in Exhibit I-4 for worldwide launches).

Exhibits I-9 and I-10 present the emission loads to the stratosphere from foreign commercial and government launches from 2004 to 2014, respectively. Within each vehicle classification (Low, Medium, Intermediate, and High) the percent of vehicles using various propellants was calculated based on previous studies. (DOT, 2001b) Representative boosters were used for each propellant within each booster classification to determine emission loads. Specific international vehicles that are used currently or are under development were examined. These include the Zenit (Russia), Proton (Russia), Ariane IV and V (European Space Agency), Long March (China), H2 (Japan), GSLV (India), PSLV (India), and M-V (Japan). The propellant quantities and types used in various layers of the Earth's atmosphere were developed from previous studies. (Isakowitz, 1999 as referenced in DOT, 2001b)

Exhibits I-9 and I-10 also include the maximum quantity of propellant consumed in the stratosphere, which was determined based on the booster's residence time in the stratosphere. The number of flights was multiplied by the maximum quantity of propellant consumed to determine the total amount of propellant consumed in the stratosphere for projected foreign commercial and government launches. This total amount of propellant was then multiplied by the appropriate weight fraction based on the propellant used (listed in Exhibit I-4 for worldwide launches).

Exhibit I-7. Estimated Emission Loads to Stratosphere from U.S. Commercial Launches from 2004-2014

Booster Classification	Percent Boosters using Various Propellant Types During Flight through Stratosphere	Example of Booster Type	Number of Flights Through Stratosphere	Maximum Propellant Quantity Consumed in Stratosphere in kilograms (pounds)	Emission Loads in kilograms x 10^3 (pounds x 10^3)*					
					Al_2O_3	Cl	CO_2	H_2O	HCl	NO_X
Low	100% Solid	Taurus/ Athena	11	30,000 (66,139)	125 (276)	0.9 (2)	152 (335)	89 (196)	69 (153)	89 (196)
Medium	100% LOX-RP1/Solid	Delta 2	11	75,000 (165,347)	153 (336)	1 (3)	569 (1,255)	256 (564)	87 (191)	107 (236)
Intermediate	75% LOX-RP1/Solid	Delta 3, Atlas IIAS	16	100,000 (220,462)	296 (653)	2 (5)	1,104 (2,434)	496 (1,093)	168 (370)	208 (459)
	25% Hybrid	To be developed	6	100,000 (220,462)	-	-	559 (1,231)	204 (450)	-	-
High	25% Solid/LOX-LH2	Delta 4H Commercial	8	110,000 (242,508)	167 (369)	1 (3)	202 (446)	559 (1,232)	92 (204)	119 (262)
	50% LOX-RP1	Zenit Sea Launch/BA-2	17	250,000 (551,156)	-	-	3,957 (8,723)	1,445 (3,186)	-	-
	25% Solid/LOX-RP1	Atlas 5 Commercial	8	250,000 (551,156)	370 (816)	3 (6)	1,380 (3,042)	620 (1,367)	210 (463)	260 (573)
Total in kilograms x 10^3 (pounds x 10^3)					1,111 (2,450)	8 (19)	7,923 (17,466)	3,669 (8,088)	626 (1,381)	783 (1,726)
Total in metric tons (tons)					1,111 (1,225)	8 (9)	7,923 (8,734)	3,669 (4,044)	626 (690)	783 (863)

* Calculations subject to rounding

Exhibit I-8. Estimated Emission Loads to Stratosphere from U.S. Government Launches from 2004-2014

Booster Classification	Percent Boosters using Various Propellant Types During Flight through Stratosphere	Example of Booster Type	Number of Flights Through Stratosphere	Maximum Propellant Quantity Consumed in Stratosphere in kilograms (pounds)	Emission Loads in kilograms x 10^3 (pounds x 10^3)*					
					Al_2O_3	Cl	CO_2	H_2O	HCl	NO_X
Low	90% Solid	Pegasus/ Taurus	10	30,000 (66,139)	114 (251)	0.8 (2)	138 (304)	81 (179)	63 (139)	81 (179)
	10% Hypergolic	Titan 2	1	50,000 (110,231)	-	-	11 (24)	18 (39)	-	68 (150)
Medium	10% Solid	Medium Vehicle	4	75,000 (165,347)	114 (251)	0.8 (2)	138 (304)	81 (179)	63 (139)	81 (179)
	40% Solid/LOX-RP1	Delta 2	18	75,000 (165,347)	250 (551)	2 (4)	932 (2054)	419 (923)	142 (313)	176 (387)
	25% Solid/LOX-LH_2	Delta 4 Medium	11	75,000 (165,347)	157 (346)	1 (3)	190 (418)	524 (1,155)	87 (191)	111 (246)
	25% LOX-RP1	Atlas 5 Medium	11	75,000 (165,347)	-	-	768 (1,693)	281 (618)	-	-
Intermediate	20% Solid	Intermediate Vehicle	2	100,000 (220,462)	76 (168)	0.6 (1)	92 (203)	54 (119)	42 (93)	54 (119)
	55% Solid/LOX-RP1	Atlas 2/ Delta 3	6	100,000 (220,462)	111 (245)	0.8 (2)	414 (913)	186 (410)	63 (139)	78 (172)
	5% LOX-RP1	Atlas 3/ Atlas V Intermediate	1	150,000 (330,693)	-	-	140 (308)	51 (112)	-	-
	20% Solid/LOX-LH_2	Delta 4 Intermediate	2	150,000 (330,693)	57 (126)	0.4 (1)	69 (152)	191 (420)	32 (69)	41 (89)
High	75% Solid/LOX-LH_2	Space Shuttle	24	586,000 (1,291,909)	2,672 (5,891)	20 (43)	3,235 (7,131)	8,931 (19,688)	1,477 (3,256)	1,899 (4,186)
	5% LOX-RP1	Atlas 5 Government	2	400,000 (881,849)	-	-	745 (1642)	272 (600)	-	-
	15% Solid/Hypergolic	Titan 4b	5	315,000 (694,456)	299 (660)	2 (5)	536 (1,181)	488 (1,076)	165 (365)	1,284 (2,830)
	5% LOX-LH_2	Delta 4 Government	2	205,000 (451,947)	-	-	-	410 (904)	-	-
Total in kilograms x 10^3 (pounds x 10^3)					3,850 (8,489)	28 (63)	7,408 (16,327)	11,987 (26,422)	2,134 (4,704)	3,873 (8,537)
Total in metric tons (tons)					3,850 (4,244)	28 (31)	7,408 (8,166)	11,987 (13,213)	2,134 (2,352)	3,873 (4,269)

*Calculations subject to rounding

Exhibit I-9. Estimated Emission Loads to Stratosphere from Foreign Commercial Launches from 2040-2014

Booster Classification	Percent Boosters using Various Propellant Types During Flight through Stratosphere	Example of Booster Type	Number of Flights Through Stratosphere	Maximum Propellant Quantity Consumed in Stratosphere in kilograms (pounds)	Emission Loads in kilograms x 10^3 (pounds x 10^3)*					
					Al_2O_3	Cl	CO_2	H_2O	HCl	NO_X
Low	35% Solid	Leolink/ Shavit/M5	14	40,000 (88,185)	213 (469)	2 (3)	258 (568)	151 (333)	118 (259)	151 (333)
	65% Hypergolic	Kosmos Rokot	25	40,000 (88,185)	-	-	220 (485)	350 (772)	-	1,360 (2,998)
Medium	30% Solid	PSLV, VLS	5	100,000 (220,462)	190 (419)	1 (3)	230 (507)	135 (298)	105 (231)	135 (298)
	55% Hypergolic	Tsyklon/ Long March 2c	9	70,000 (154,324)	-	-	139 (306)	221 (486)	-	857 (1,889)
	15% Solid/Hypergolic	GSLV	3	100,000 (220,462)	57 (126)	0.4 (1)	102 (225)	93 (205)	32 (69)	245 (539)
Intermediate	40% Hypergolic	Long March 3b/Ariane 4	36	100,000 (220,462)	-	-	792 (1,746)	1,260 (2,778)	-	4,896 (10,794)
	10% Solid/LOX-LH_2	H-2A	9	85,000 (187,393)	145 (320)	1 (2)	176 (388)	486 (1,071)	80 (177)	103 (228)
	50% LOX-RP1	Soyuz	45	100,000 (220,462)	-	-	4,190 (9,236)	1,530 (3,373)	-	-
High	60% Hypergolic	Proton	22	210,000 (462,971)	-	-	1,016 (2,241)	1,617 (3,565)	-	6,283 (13,852)
	25% LOX-RP1	Zenit	9	140,000 (308,647)	-	-	1,173 (2,586)	428 (944)	-	-
	15% Solid	Ariane 5	6	237,000 (522496)	540 (1,191)	4 (9)	654 (1,442)	384 (846)	299 (658)	384 (846)
Total in kilograms x 10^3 (pounds x 10^3)					1,145 (2,525)	8 (18)	8,950 (19,730)	6,655 (14,671)	634 (1,394)	14,414 (31,777)
Total in metric tons (tons)					1,145 (1,262)	8 (9)	8,950 (9,866)	6,655 (7,336)	634 (699)	14,414 (15,889)

*Calculations subject to rounding

Exhibit I-10. Estimated Emission Loads to Stratosphere from Foreign Government Launches from 2004-2014

Booster Classification	Percent Boosters using Various Propellant Types During Flight through Stratosphere	Example of Booster Type	Number of Flights Through Stratosphere	Maximum Propellant Quantity Consumed in Stratosphere in kilograms (pounds)	Emission Loads in kilograms x 10^3 (pounds x 10^3)*					
					Al_2O_3	Cl	CO_2	H_2O	HCl	NO_X
Low	35% Solid	Leolink/ Shavit/M5	13	40,000 (88,185)	198 (436)	1 (3)	239 (527)	140 (310)	109 (241)	140 (310)
	65% Hypergolic	Kosmos Rokot	25	40,000 (88,185)	-	-	220 (485)	350 (772)	-	1,360 (2,998)
Medium	30% Solid	PSLV, VLS	2	100,000 (220,462)	76 (168)	0.6 (1)	92 (203)	54 (119)	42 (93)	54 (119)
	55% Hypergolic	Tsyklon/Long March 2c	4	70,000 (154,324)	-	-	62 (136)	98 (216)	-	381 (840)
	15% Solid/Hypergolic	GSLV	1	100,000 (220,462)	19 (42)	0.1 (0.3)	34 (75)	31 (68)	11 (23)	82 (180)
Intermediate	40% Hypergolic	Long March 3b/Ariane 4	13	100,000 (220,462)	-	-	286 (631)	455 (1003)	-	1,768 (3,898)
	10% Solid/LOX-LH2	H-2A	4	85,000 (187,393)	65 (142)	0.5 (1)	78 (172)	216 (476)	36 (79)	46 (101)
	50% LOX-RP1	Soyuz	16	100,000 (220,462)	-	-	1,490 (3,284)	544 (1,199)	-	-
High	60% Hypergolic	Proton	239	210,000 (462,971)	-	-	11,042 (24,343)	17,567 (38,727)	-	68,258 (150,482)
	25% LOX-RP1	Zenit	100	140,000 (308,647)	-	-	13,034 (28,735)	4,760 (10,494)	-	-
	15% Solid	Ariane 5	59	237,000 (522,496)	5,314 (11,714)	39 (86)	6,432 (14,180)	3,775 (8,323)	2,936 (6,474)	3,775 (8,323)
Total in kilograms x 10^3 (pounds x 10^3)					5,672 (12,502)	41 (91)	33,009 (72,771)	27,990 (61,707)	3,134 (6,910)	75,864 (167,251)
Total in metric tons (tons)					5,672 (6,252)	41 (45)	33,009 (36,386)	27,990 (30,854)	3,134 (3,455)	75,864 (83,626)
*Calculations subject to rounding										

APPENDIX J
GLOSSARY

GLOSSARY

A-weighted decibels (dBA) – Unit of measurement representing the sound level which is frequency-weighted according to a prescribed frequency response established by the American National Standards Institute (1983) and accounts for the response of the human ear.

Active Sensor – A sensor that illuminates a target, producing return-secondary radiation for tracking and/or identifying the target. An example is radar.

Air Quality – A resource area determined by the type and amount of pollutants emitted into the atmosphere, the size and topography of the air basin, and the prevailing meteorological conditions.

Air Quality Control Region – A contiguous geographic area designated by the Federal government in which communities share a common air pollution status.

Air Route Traffic Control Center (ARTCC) – A facility established to provide air traffic control services to aircraft operating on IFR flight plans within controlled airspace and principally during the en route phase of flight. When equipment capabilities and controller workload permit, certain advisory/assistance services may be provided to aircraft operating under VFR.

Air Traffic Control – A service operated by appropriate authority to promote the safe, orderly, and expeditious flow of air traffic.

Airspace – The space lying above a nation and coming under its jurisdiction.

American National Standards Institute (ANSI) – An organization which fosters the creation of consensus standards developed by representatives of industry, scientific communities, physicians, government agencies, and the public.

Apogee – The point in an object's orbit of the Earth where it is farthest from the Earth's surface.

Aquifer – The water-bearing portion of subsurface earth material that yields or is capable of yielding useful quantities of water to wells.

Atmosphere – An environment that includes the atmosphere enveloping all areas of the Earth. It consists of four principle layers: troposphere, stratosphere, mesosphere, and ionosphere (or thermosphere).

Atmospheric Dispersion – The process of air pollutants being distributed into the atmosphere. This occurs by wind carrying pollutants away from their source and by turbulent-air motion resulting from solar heating of the Earth's surface and air movement over rough terrain and surfaces.

Atmospheric drag – Refers to the collisions with air particles at high altitudes that slowly act to circularize and reduce the speed of a spacecraft's orbit, which causes it to drop to lower altitudes.

Attainment Area – An air quality control region that has been designated by the U.S. EPA and the appropriate state air quality agency as having ambient air quality levels as good as or better than the standards set forth by the NAAQS, as defined in the Clean Air Act. A single geographic area may have acceptable levels of one criteria air pollutant, but unacceptable levels of another; thus, an area can be in attainment and non-attainment status simultaneously.

Azimuth – The horizontal direction from one point on the earth to another, measured clockwise in degrees (0-360) from a north or south reference line.

Background Noise – The total acoustical and electrical noise from all sources in a measurement system that may interfere with the production, transmission, time averaging, measurement, or recording of an acoustical signal.

Ballistic Missile – Any missile that does not rely upon aerodynamic surfaces to produce lift and consequently follows a ballistic trajectory when thrust is terminated.

Ballistic Missile Defense System (BMDS) – An integrated system that employs layered defenses to intercept missiles during their boost, midcourse, and terminal flight phases.

Benchmark Dose – A dose that produces a predetermined change in response rate of an adverse effect (called the benchmark response) compared to background.

Bioaccumulation – The process by which chemical contaminants become more concentrated in the tissues of organisms as they pass higher up the food chain.

Biological Resources – A collective term for native or naturalized vegetation, wildlife, and the habitats in which they occur.

Biome – A major type of natural vegetation that occurs wherever a particular set of climatic and soil conditions prevail, but that may contain different taxa in different regions.

Biotransformation – Any chemical conversion of substances that is mediated by living organisms or biological enzymes.

Blocks – A biennial increment of the BMDS that provides an integrated set of capabilities, which has been rigorously tested as part of the BMDS Test-bed and assessed to adequately characterize its military utility. Once tested, elements and components are available for limited procurement, transition to production, or for emergency deployment as directed. These "off ramps" may occur at any time during the Block Cycle to support timely execution of these transition or deployment decisions.

The configuration for each Block is drawn from the following sources:

- The prior BMDS Block;
- BMDS elements, components, technologies, and concepts;
- BMDS Battle Management, Command, Control, and Communications (BMC2/C) specifications and products;
- Externally managed systems, elements, or technologies (e.g., DSP, Global Command and Control System, MILSTAR, etc).

Each successive Block provides increasing levels of capability to counter ballistic missiles of all ranges and complexity.

Boost Phase – The first phase of a ballistic missile trajectory during which it is being powered by its engines. During this phase, which usually lasts 3 to 5 minutes for an intercontinental ballistic missile, the missile reaches an altitude of about 200 kilometers (124 miles) whereupon powered flight ends and the missile begins to dispense its reentry vehicles.

Booster – An auxiliary or initial propulsion system that travels with a missile or aircraft and that may not separate from the parent craft when its impulse has been delivered; may consist of one or more units.

Broad Ocean Area (BOA) – An environment that includes the Pacific, Atlantic, and Indian Oceans, and is the area outside of the Exclusive Economic Zone, which extends 322 kilometers (200 miles) off shore.

Carbon Monoxide (CO) – A colorless, odorless, poisonous gas produced by incomplete fossil-fuel combustion; one of the six pollutants for which there is a NAAQS (see Criteria Pollutant).

Chemical Oxygen Iodine Laser (COIL) – A laser in which chemical action is used to produce the laser energy.

Chlorofluorocarbons (CFCs) – A group of inert, nontoxic, and easily liquefied chemicals (such as Freon) used in refrigeration, air conditioning, packaging, or insulation or as solvents or aerosol propellants.

Coastal Zone – Lands and waters adjacent to the coast that exert an influence on the uses of the sea and its ecology, or, adversely, whose uses and ecology are affected by the sea.

Command and Control, Battle Management, and Communications (C2BMC) – The overall integrator of the BMDS, would consist of electronic equipment and software that enable military commanders to receive and process information, make decisions, and communicate those decisions regarding the engagement of threat missiles.

Community Noise Equivalent Level – Describes the average sound level during a 24-hour day in dBA.

Component – Subsystem, assembly, or subassembly of logically grouped hardware and software, that performs interacting tasks to provide BMDS capability at a functional level.

Congenital – Any trait present at birth, whether the result of a genetic or non-genetic factor.

Controlled Airspace – Airspace of defined dimensions within which air traffic control service is provided to IFR flights and to VFR flights in accordance with the airspace classification. Controlled airspace is divided into five classes, dependent upon location, use, and degree of control: Class A, B, C, D, and E.

Controlled Firing Area – Airspace wherein activities are conducted under conditions so controlled as to eliminate hazards to non-participating aircraft and to ensure the safety or person and property on the ground.

Cooperating Agency – Any Federal agency, other than a lead agency, that has jurisdiction by law or special expertise with respect to any environmental impact involved in a proposal (or reasonable alternative) for legislation or other major Federal action significantly affecting the quality of the human environment.

Council on Environmental Quality (CEQ) – Established by NEPA, the CEQ consists of three members appointed by the President. A CEQ regulation (Title 40 CFR 1500-1508, as of July 1, 1986) describes the process for implementing NEPA, including preparation of EAs and EISs, and the timing and extent of public participation.

Countermeasures – Tactical or technical actions taken to alter ballistic missile characteristics to hinder or prevent BMDSs from identifying or hitting the incoming missiles.

Criteria Pollutants – Pollutants identified by the U.S. EPA (required by the Clean Air Act to set air quality standards for common and widespread pollutants) and established under state ambient air quality standards. There are standards in effect for seven criteria pollutants: CO, lead, ozone, NO_2, PM_{10}, $PM_{2.5}$, and SO_2.

Critical Habitat – Specific areas within a geographical area occupied by threatened or endangered species at the time they are listed which contain the physical or biological features essential to conservation of the species and may require special management considerations or protection.

Cultural Resources – The prehistoric and historic artifacts, archaeological sites (including underwater sites), historic buildings and structures, and traditional resources (such as Native American and Native Hawaiian religious sites).

Cumulative Impact – The impact on the environment which results from the incremental impact of the action when added to the other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

Day/Night Average Sound Level (L_{dn}) – The average sound level during a 24-hour day, reported in dBA and used to predict human annoyance and community reaction to unwanted sound.

Decibel (dB) – A unit of measurement on a logarithmic scale which describes the magnitude of a particular quantity of sound pressure or power with respect to a standard reference value; the accepted standard unit for the measurement of sound.

Decommissioning – The removal or the rendering useless of obsolete or no longer needed components of the BMDS from service.

Demilitarization – The act of destroying a system's offensive and defensive capabilities to prevent the equipment from being used for its intended military purpose.

Deployment – Fielding a weapon system by delivering the completed production system to operational use with units in the field/fleet and placing it on alert.

Development – The various activities that would support research and development of the BMDS components and the overall system. Activities include planning, budgeting, research and development, systems engineering, maintenance and sustainment, manufacture of test articles (prototypes) and initial testing, and tabletop exercises.

Directed Blast Fragmentation – Weapon technology that involves the interceptor approaching the threat ballistic missile and exploding close to it, thereby disrupting the path of the threat missile and possibly destroying it.

Disposal – The process of redistributing, transferring, donating, selling, abandoning, destroying or any other disposition of a property.

Dose-response relationship – The relationship between the dose of some agent (such as a drug), or the extent of exposure, and a physiological response. A dose-response effect means that as the dose increases, so does the effect.

Dosimetry – A general term applied to the practice of measuring radiation exposure.

Ecosystem – The set of biotic (living) and abiotic (nonliving) components in a given environment.

Effluent – An outflowing branch of a main stream or lake; waste material (such as smoke, liquid industrial refuse, or sewage) discharged into the environment.

Electroexplosive Device – A single unit, device, or subassembly, in which electrical energy is used to initiate an enclosed explosive, propellant, or pyrotechnic material.

Electromagnetic Radiation (EMR) – Waves of energy with both electric and magnetic components at right angles to one another.

Element – A complete, integrated set of components capable of autonomously providing BMDS capability.

Endangered Species – A plant or animal species that is threatened with extinction throughout all or a significant portion of its range.

Engagement Sequence – A unique combination of detect-control-engage functions performed by BMDS components (such as sensors, weapon and C2BMC equipment) used to engage a threat ballistic missile. The command and control, battle management, and fire control functions enable the engagement sequence functions.

Engagement Sequence Group (ESG) – The logical categorization of engagement sequences based upon common capabilities or characteristics (e.g., effectiveness or functionality). Creating ESGs requires identification of the components (e.g., sensors, weapons and C2BMC equipment) that perform overlapping or similar functions in the execution of an engagement.

Environmental Justice – The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. EO 12898 requires identification of potential disproportionately high and adverse impacts on low-income and/or minority populations that may result from proposed Federal Actions.

Epidemiologic – Of or relating to epidemiology, which is the branch of medicine that deals with the study of the causes, distribution, and control of disease in populations.

Equivalent Noise Level (L_{eq}) – Energy mean A-weighted sound level during a stated measurement period.

Erosion – The wearing away of a land surface by water, wind, ice, or other geologic agents.

Essential Fish Habitat – Those waters and substrate (sediment, hard bottom) necessary to fish for spawning, breeding, feeding or growth to maturity.

Estuary – A water passage where the tide meets a river current; an arm of the sea at the lower end of a river; characterized by brackish water.

Exclusive Economic Zone – An offshore boundary, set at 200 nautical miles (320 km), establishing a nation's economic sovereignty over the resources present within that perimeter.

Exoatmosphere – The outer most part of the earth's atmosphere.

Explosive Safety Quantity-Distance (ESQD) – The quantity of explosive material and distance separation relationships providing defined types of protection based on levels of risk considered acceptable.

Fielding – Activities which include acquiring and transferring BMDS components to military services.

Flight Level (FL) – A level of constant atmospheric pressure related to a reference datum of 76 centimeters (29.92 inches) of mercury stated in three digits that represent hundreds of feet. For example, FL 250 represents a barometric altimeter indication of 7,620 meters (25,000 feet); FL 255 represents an indication of 7,772 meters (25,500 feet).

Flight Termination System (FTS) – All components, onboard a launch vehicle, which provide the ability to end a launch vehicles flight in a controlled manner. An FTS consists of all command destruct systems, inadvertent separation destruct systems, or other systems or components that are onboard a launch vehicle and used to terminate flight.

Floodplain – Areas of low-level ground present along a river or stream channel. Such lands may be subject to periodic or infrequent inundation due to rain or melting snow.

Fugitive Dust – Any solid PM that becomes airborne, other than that emitted from an exhaust stack, directly or indirectly as a result of the activities of man. Fugitive dust may include emissions from haul roads, wind erosion of exposed soil surfaces, and other activities in which soil is either removed or redistributed.

Functional Capabilities – The functional capabilities of the proposed BMDS are to detect, identify, track, discriminate, intercept, and destroy a threat ballistic missile during a specific phase of flight. They also include the long-term flexibility of the BMDS to evolve to meet future threats whether they are technological or geographic in nature.

Geologic Hazards – Geologic phenomena such as landslides, flooding, ground subsidence, volcanic activity, faulting, earthquakes, and tsunamis (tidal waves).

Geology – The study of the composition and configuration of the Earth's surface and subsurface features.

Geosynchronous Earth Orbit (GEO) – An orbit approximately 36,000 kilometers (22,000 miles) in altitude that is synchronized with Earth's rotation.

Gestational – Referring to the period of pregnancy from conception to birth.

Global Positioning System (GPS) – A space-based radio positioning, navigation, and time-transfer system. The system provides highly accurate position and velocity information, and precise time, on a continuous global basis to unlimited number of properly equipped users. The system is unaffected by weather, and provides a worldwide common grid reference system.

Greenhouse Gases – Atmospheric gases (principally CO_2, water vapor, nitrous oxide, chlorofluorocarbons, and methane) that absorb infrared radiation and contribute to the "greenhouse effect."

Ground water – Water within the earth that supplies wells and springs; specifically, water in the zone of saturation where all openings in rocks and soil are filled, the upper surface of which forms the water table.

Habitat – The area or type of environment in which a species of ecological community normally occurs.

Hazardous Air Pollutants (HAPs) – A group of 188 chemicals identified in the 1990 Clean Air Act Amendments. Exposure to these pollutants can cause or contribute to cancer, birth defects, genetic damage, and other adverse health effects.

Hazardous Material – A substance that can cause, because of its physical or chemical properties, an unreasonable risk to the health and safety of individuals, property, or the environment.

Hazardous Waste – A waste, or combination of wastes, which, because of its quantity, concentration, or physical, chemical, or infectious characteristics, may either cause or significantly contribute to an increase in mortality or an increase in serious irreversible illness or pose a substantial present or potential hazard to human health or the environmental when improperly treated, stored, transported, disposed of, or otherwise managed.

Health and Safety – Includes consideration of any activities, occurrences or operations that have the potential to affect the well being, safety, or health of workers or members of the general public.

Hertz – A unit of frequency equal to one cycle per second.

Historic Properties – Under the National Historic Preservation Act, these are properties of national, state, or local significance in American history, architecture, archaeology, engineering, or culture, and worthy of preservation.

Hit-to-Kill Technology – Using only the force of the direct collision to destroy the target.

Hypergolic – The self-ignition of a fuel and an oxidizer upon mixing with each other without a spark or other external energy.

Hyperthyroidism – Overactivity of the thyroid gland resulting in an excess of thyroid hormone production.

Hypothyroidism – Underactivity of the thyroid gland resulting in a deficiency of thyroid hormone production.

Immediately Dangerous to Life and Health (IDLH) – An atmospheric concentration of any toxic, corrosive or asphyxiant substance that poses an immediate threat to life or would cause irreversible or delayed adverse health effects or would interfere with an individual's ability to escape from a dangerous atmosphere.

Immunologic response – A biological defense function that recognizes and responds to foreign substances introduced into the body.

Impacts (Effects) – An assessment of the meaning of changes in all attributes being studied for a given resource; an aggregation of all the adverse effects, usually measured using a qualitative and nominally subjective technique.

Infrared – A range of electromagnetic-radiation wavelengths longer than visible light and shorter than microwave wavelengths.

Infrared Sensors – A sensor designed to detect the EMR in the wavelength region of 1 to 40 microns.

Infrastructure – The system of public works of a country, state, or region, such as utilities or communication systems; resource area analyzed in NEPA documents.

Initial Defensive Capability (IDC) – The sensors, C2BMC, and weapons from the Block 04 Toolbox that are available for limited, militarily useful capability by September 2004. This initial defense capability includes early warning and tracking sensors based on land, at sea, and in space, command and control, and ground-based interceptors for midcourse and terminal intercepts.

Initial Defensive Operations (IDO) – The acceptance of the IDC by the combatant commander based on military utility. To declare IDO the combatant commander determines through military judgment that adequate doctrine, organization, training, materiel, leadership, personnel, and facilities exist to operate the system.

Institute of Electrical and Electronics Engineers (IEEE) – A non-profit, technical professional association of engineers with expertise in computer engineering, biomedical technology, telecommunications, electric power, aerospace and consumer electronics, which creates consensus-based standards.

Instrument Flight Rules (IFR) – Rules governing the procedures for conducting instrument flight; also a term used by pilots and controllers to indicate type of flight plan.

Integrated Ground Test (GT) – A test that uses tactical BMDS Element hardware and software in conjunction with modeling and simulation assets to simulate and stimulate Elements. Integrated Ground Tests are used to collect data for risk reduction and for scenario exploration where flight-testing is either impractical or impossible. This data provides a stronger understanding of each component and how it reacts in different situations and enables each component to be tested with other components.

Integrated Missile Defense Wargames – Simulations of military operations involving two or more opposing forces, using rules, data, and procedures designed to depict an actual or assumed real-life situation. They are designed to gain insight into how human decision-making affects the use of BMDS components.

Ion Chromatography - A form of liquid chromatography that uses ion-exchange resins to separate atomic or molecular ions based on their interaction with the resin.

Ionizing Radiation – Particles or photons that have sufficient energy to produce direct ionization in their passage through a substance. X-rays, gamma rays, and cosmic rays are forms of ionizing radiation.

Ionosphere – The part of the earth's upper atmosphere which is sufficiently ionized by solar ultraviolet radiation so that the concentration of free electrons affects the propagation of radio waves. Its base is at about 70 or 80 kilometers (43 to 50 miles) and it extends to an indefinite height.

Jet Route – A route designed to serve aircraft operating from 5,486 meters (18,000 feet) up to and including FL 450, referred to as J routes with numbering to identify the designated route.

Jettison - The disposal of unwanted equipment or material by establishing it in a trajectory that will allow a predictable reentry into the atmosphere.

Kill Vehicle (KV) – The portion of the interceptor that performs the intercept and destroys the threat missile.

Kinetic Energy – The energy from the momentum of an object, i.e., an object in motion.

Land Use – The human use of land resources for various purposes, including economic production, natural resources protection, or institutional uses.

Laser – An active-electron device that converts input power into a very narrow, intense beam of coherent visible or infrared light. The input power excites the atoms of an optical resonator to a higher-energy level, and the resonator forces the excited atoms to radiate in phase. Derived from Light Amplification by Stimulated Emission of Radiation and classified from Class I to Class IV according to its potential for causing damage to the eye.

Laser Sensor – A sensor that uses laser energy of various energy levels and frequencies to illuminate an object to detect the object's motion.

Leaching – The process by which soluble materials in the soil, such as salts, nutrients, pesticide chemicals, or contaminants, are washed into a lower layer of soil or are dissolved and carried away by water.

Low Earth Orbit (LEO) – An orbit at an altitude approximately 1,600 kilometers (1,000 miles) above the surface of the Earth.

Lowest Observed Adverse Effect Level (LOAEL) – The lowest exposure level at which there are biologically significant increases in frequency or severity of adverse effects between the exposed population and its appropriate control group.

Lead (Pb) – A heavy metal which can accumulate in the body and cause a variety of negative effects; one of the six pollutants for which there is a NAAQS (see Criteria Pollutants).

Lethality – A measure of the ability of the BMDS to prevent a threat ballistic missile from producing lethal effects.

Lethality Enhancers – Non-nuclear explosive devices that increase the probability of destroying the threat missile and its payload (e.g., explosives, chemical or biological agents).

Material Safety Data Sheet – Presents information, required under the Occupation Safety and Health Act Standards, on a chemical's physical properties, health effects, and use precautions.

Maximum Permissible Exposure (MPE) – Established by the Nuclear Regulatory Commission, an exposure standard set at a level where apparent injury from ionizing radiation during a normal lifetime is unlikely.

Mean Sea Level (MSL) – The average height of the sea surface if undisturbed by waves, tides, or winds.

Mesosphere – The atmospheric shell between about 45 to 55 kilometers (28 to 34 miles) and 80 to 85 kilometers (50 to 53 miles), extending from the top of the stratosphere to the mesopause; characterized by a temperature that generally decreases with altitude.

Midcourse Phase – That portion of a ballistic missile's trajectory between the boost phase and the reentry phase when reentry vehicles and penaids travel at ballistic trajectories above the atmosphere. During this phase, a missile releases its warheads and decoys and is no longer a single object, but rather a swarm of reentry vehicles and penaids falling freely along present trajectories in space.

Military Operating Area (MOA) – An airspace assignment of defined vertical and lateral dimensions established outside Class A areas to separate certain military activities from IFR traffic and to identify for VFR traffic where these activities are conducted.

Military Training Routes – Airspace of defined vertical and lateral dimensions established for the conduct of military flight training at airspeeds in excess of 250 knots.

Missile – A projectile weapon that is fired or otherwise propelled toward a target.

Missile Defense Integration Exercises (MDIE) – Test activities that support the characterization of the degree of integration and interoperability among the BMDS block elements to operate as a single system

Mitigation – A method or action to reduce or eliminate adverse environmental impacts.

Mixing Height – Altitude at which pollutants and atmospheric gases are thoroughly combined.

Mobile Sources – Any movable source that emits any regulated air pollutant.

National Airspace System (NAS) – The 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. Included are system components shared jointly with the military.

National Ambient Air Quality Standards (NAAQS) – Set by the U.S. EPA under Section 109 of the Clean Air Act, nationwide standards for limiting concentrations of certain widespread airborne pollutants to protect public health with an adequate margin of safety (primary standards) and to protect public welfare, including plant and animal life, visibility and materials (secondary standards). Currently, seven pollutants are regulated: CO, lead, NO_2, ozone, particulate matter with a diameter of less than ten microns, particulate matter with a diameter of less than 2.5 microns, and SO_2 (see Criteria Pollutants).

National Environmental Policy Act (NEPA) – Public law 91-190, passed by Congress in 1969. The Act established a national policy designed to encourage consideration of the influences of human activities, such as population growth, high-density urbanization, or industrial development, on the natural environment. NEPA procedures require that environmental information be made available to the public before decisions are made.

Information contained in NEPA documents must focus on the relevant issues to facilitate the decision-making process.

National Register of Historic Places – A register of districts, sites, buildings, structures, and objects important in American history, architecture, archaeology, and culture, maintained by the Secretary of the Interior under authority of Section 2 (b) of the Historic Site Act of 1935 and Section 101 (1) of the National Historic Preservation Act of 1966, as amended.

Nitrogen Dioxide (NO_2) – Gas formed primarily from atmospheric N_2 and oxygen when combustion takes place at high temperatures; one of the six pollutants for which there is a NAAQS (see Criteria Pollutant).

Nitrogen Oxides (NO_X) – Gases formed primarily by fuel combustion.

Noise – Unwanted or annoying sound typically associated with human activity; resource area analyzed in NEPA documents.

Non-attainment Area – An area that has been designated by the U.S. EPA or the appropriate state air quality agency as exceeding one or more of the national or state ambient air quality standards.

Non-ionizing Radiation –EMR at wavelengths whose corresponding photon energy is not high enough to ionize an absorbing molecule. All radio frequency, infrared, visible, and near ultraviolet radiation are non-ionizing.

Nonpoint Source – Type of pollution originating from a combination of sources.

Notice to Airmen (NOTAM) – A notice containing information, not known sufficiently in advance to publicize by other means, the establishment, condition, or change in any component (facility, service, or procedure of, or hazard in the National Airspace System) the timely knowledge of which is essential to personnel concerned with flight operations.

Notice to Mariners (NOTMAR) – A notice containing information, not known sufficiently in advance to publicize by other means, the establishment, condition, or change in any component (facility, service, or procedure of, or hazard in the broad ocean area) the timely knowledge of which is essential to personnel concerned with sea-based activities.

Orbital Debris – Material that is on orbit as the result of space initiatives, but is no longer serving any function.

Ozone – A compound consisting of three oxygen atoms; one of the six pollutants for which there is a national ambient air quality standard (see Criteria Pollutant).

Ozone-Depleting Substances – A group of chemicals that are inert under most conditions but within the stratosphere react catalytically to reduce ozone to oxygen.

Particulate Matter (PM) – Particles small enough to be airborne, such as dust or smoke (see Criteria Pollutants); one of the six pollutants for which there is a NAAQS (see Criteria Pollutant).

Passive Sensor – A sensor that detects naturally occurring emissions from a target for tracking and/or identification purposes.

Permafrost – Permanently frozen subsoil, for a minimum of 2 years, occurring in perennially frigid areas.

Permissible Exposure Limit (PEL) – Exposure level expressed in electric field, magnetic field, or plane wave power density to which an individual may be exposed and which, under conditions of exposure, will not cause detectable bodily injury in light of present medical knowledge.

Platform – Location from which a missile, target, or other test object is launched.

PM_{10} – Particulate matter less than or equal to 10 micrometers in diameter.

$PM_{2.5}$ – Particulate matter less than or equal to 2.5 micrometers in diameter.

Point Source – A distinct and identifiable source, such as a sewer or industrial outfall pipe, from which a pollutant is discharged.

Pounds per Square Foot – Measure of pressure, used to measure sonic booms.

Population Density – The average number of individuals per unit of space.

Programmatic Environmental Impact Statement (PEIS) – A document prepared in accordance with NEPA for the adoption of programs, such as a group of concerted actions to implement a specific policy or plan; systematic and connected agency decisions allocating agency resources to implement a specific statutory program or executive directive (40 CFR 1508.18). As defined in 40 CFR 1508.28, such documents assist in tiering, which refers to the coverage of general matters in broader EISs (such as national program or policy statements) with subsequent narrower statements or environmental analyses (such as regional or basin-wide program statements or ultimately site-specific statements) incorporating by reference the general discussions and concentrating solely on the issues specific to the statement subsequently prepared.

Propellants – Balanced mixtures of fuel and oxidizer designed to produce large volume of hot gases at controlled, predetermined rates, once the burning reaction is initiated.

Radar – A radio device or system for locating an object by means of radio waves reflected from the object and received, observed, and analyzed by the receiving part of the device in such a way that characteristics (such as distance and direction) of the object may be determined.

Region of Influence – The geographical region that would be expected to be affected in some way by the Proposed Action and alternatives.

Restricted Area – Airspace designated under FAA Regulation part 73, within which the flight of aircraft, while not wholly prohibited, is subject to restriction. Most restricted areas are designated joint use, and IFR/VFR operations in the area ay be authorized by the controlling air traffic control facility when it is not being utilized by the using agency. Restricted areas are depicted on en route charts.

Scoping – A process initiated early during preparation of an EIS to identify the scope of issues to be addressed, including the significant issues related to the Proposed Action. During scoping, input is solicited from affected agencies as well as the interested public. (40 CFR 1501.7)

Sensitive Habitat – Habitat that is susceptible to damage from intrusive actions.

Short Term Exposure Limit (STEL) – The level of exposure that must not be exceeded at any time during a workday when the exposure is averaged over 15 minutes.

Socioeconomics – The basic attributes and resources associated with the human environment, in particular population and economic activity.

Soils – The unconsolidated materials overlying bedrock or other parent materials. Soils are typically described in terms of their composition, slope, and physical characteristics.

Solid Rocket Motor Propellant – A fuel/oxidizer mix that continually combusts when ignited.

Solid Waste – Municipal waste products and construction and demolition materials; includes non-recyclable materials with the exception of yard waste.

Solvent – A substance that dissolves or is capable of dissolving a substance.

Sonic Boom – Sound, resembling an explosion, produced when a shock wave formed at the nose of an aircraft or launch vehicle traveling at supersonic speed reaches the ground.

Special Use Airspace – Airspace of defined dimensions identified by an area on the surface of the earth wherein activities must be confined because of their nature and/or wherein limitations may be imposed upon non-participating aircraft.

Spiral Development – An iterative process for developing a defined set of capabilities within one increment. This process provides the opportunity for interaction between the user, tester, and developer. In this process, the requirements are refined through experimentation and risk management, there is continuous feedback, and the user is provided the best possible capability within the increment. Each increment may include a number of spirals. Spiral development implements evolutionary acquisition.

State Historic Preservation Officer – The official within each state, authorized by the state at the request of the Secretary of the Interior, to act as liaison for purposes of implementing the National Historic Preservation Act.

Stationary Source – Any building, structure, facility, installation, or other fixed source that emits any regulated air pollutant.

Stratosphere – The atmospheric shell above the troposphere and below the mesosphere; it extends from the tropopause to about 55 kilometers (34 miles), where the temperature begins again to increase with altitude.

Sulfur Dioxide (SO_2) – A toxic gas that is produced when fossil fuels, such as coal and oil, are burned; one of the six pollutants for which there is a NAAQS (see Criteria Pollutant).

Surface Water – Water resource that consists of lakes, rivers and streams.

Support Assets – Auxiliary equipment and infrastructure that facilitate BMDS operations.

Sustainment – Includes various maintenance and operating activities as they pertain to deploying the BMDS.

System Integration Flight Tests (SIFTs) – Tests designed to measure BMDS component interoperability and assess BMDS functional capabilities in each developmental Block.

System Integration Tests– Tests designed to assess the ability of the BMDS components to work as a unit and to meet the required functional capabilities.

Targets – Launch systems, payloads including countermeasures and re-entry vehicles, and extensive instrumentation and avionics designed to test the performance of missile defense sensors and weapons.

Telemetry – Automatic data measurement and transmission from remote sources, such as space vehicles, to receiving station for recording and analysis.

Terminal Phase – That final portion of a ballistic missile's trajectory between the midcourse phase and trajectory termination.

Test Assets – Assets used for testing that are not components of the BMDS but are critical to its effective development and testing; these include test range facilities, sensors used only for test purposes, targets, countermeasure devices and warhead simulants.

Test Bed – The collection of integrated BMD element development hardware, software, prototypes, and surrogates, as well as supporting test infrastructure (e.g., instrumentation, safety/telemetry systems, and launch facilities) configured to support realistic development and testing of the BMDS.

Test – Any program or procedure which is designed to obtain, verify, or provide data for the evaluation of any of the following: 1) progress in accomplishing developmental objectives, 2) the performance, operational capability and suitability of systems, subsystems, components, and equipment items, and 3) the vulnerability and lethality of systems, subsystems, components, and equipment items.

Theater – The geographical area outside the continental United States for which a commander of a unified or specified command has been assigned.

Theater Ballistic Missile – A ballistic missile whose target is within a theater or which is capable of attacking targets in a theater.

Theater Missile Defense (TMD) – The strategies and tactics employed to defend a geographical area outside the United States against attack from short-range, intermediate-range, or medium-range ballistic missiles.

Threatened Species – A plant or animal species likely to become endangered in the foreseeable future.

Threshold Limit Value (TLV) – The upper values of a toxicant concentration to which an average healthy person may be repeatedly exposed to day after day without suffering adverse effects.

Topography – The configuration of a surface including its relief and the position of its natural and man-made features.

Trajectory – The curve described by an object moving through space.

Transportation – Resource area analyzed in NEPA documents that encompasses ground, aviation, and ocean transport systems.

Troposphere – The portion of the atmosphere from the earth's surface to the tropopause, that is, the lowest 10 to 20 kilometers (6 to 12 miles) of the atmosphere. It is the turbulent and weather region containing 75% of the total mass of the Earth's atmosphere. It is characterized by decreasing temperature with increasing altitude. The manor components of the troposphere are N_2 (76.9%) and oxygen (20.7%).

Uncontrolled Airspace – Uncontrolled airspace, or Class G airspace, has no specific definition but generally refers to airspace not otherwise designated and operations below 365.7 meters (1,200 feet) above ground level. No air traffic control service to either IFR or VFR aircraft is provided other than possible traffic advisories when the air traffic control workload permits and radio communications can be established.

Utilities – Refers to those facilities and systems that provide power, water, wastewater treatment, and the collection and disposal of solid waste.

Visible Technology Sensors – Generally passive sensors that detect objects of missiles by collecting light energy or radiation emitted from the target in wavelengths visible to the human eye.

Visual Flight Rules (VFR) – Rules that govern the procedures for conducting flight under visual conditions. Pilots and controllers also use them to indicate type of flight plan.

Visual Resources – The natural and man-made features that constitute the aesthetic qualities of an area.

Volatile Organic Compound (VOC) – One of a group of chemicals that react in the atmosphere with NO_X in the presence of heat and sunlight.

Wastewater – Water that has been previously utilized; sewage.

Water Resources – Resource area analyzed in NEPA documents, which includes surface water, ground water, and floodplains.

Wetlands – Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. This classification includes swamps, marshes, bogs, and similar areas.

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