HIGH ENDOATMOSPHERIC DEFENSE INTERCEPTOR (HEDI)

TECHNOLOGY TESTING PROGRAM

MAY 1989

U.S. ARMY SDC

ENVIRONMENTAL ASSESSMENT

DEPARTMENT OF THE ARMY
OFFICE OF THE COMMANDING GENERAL
U.S. ARMY STRATEGIC DEFENSE COMMAND
P.O. BOX 15280, ARLINGTON, VA 22215-0280

REPLY TO
ATTENTION OF

CSSD-RM

5 JUL 1989

MEMORANDUM FOR WHOM IT MAY CONCERN

SUBJECT: High Endoatmospheric Defense Interceptor (HEDI) Technology Testing Program

1. Enclosed for your use and information is the High Endoatmospheric Defense Interceptor (HEDI) Technology Testing Program Environmental Assessment and the associated "Finding of no Significant Impact" (FNSI). The HEDI environmental assessment is the latest environmental analysis document to be released as part of the overall Strategic Defense Initiative Program.

2. Questions regarding this document or requests for additional copies, should be addressed to:

U.S. Army Strategic Defense Command
CSSD-H-SSP
Post Office Box 1500
Huntsville, Alabama 35807

FOR THE COMMANDER:

WAYNE T. FUJITO
Colonel, GS
Chief of Staff

2 Encls
1. HEDI Environmental Assessment
2. HEDI FNSI

FINDING OF NO SIGNIFICANT IMPACT

UNITED STATES ARMY STRATEGIC DEFENSE COMMAND

AGENCY: United States Army Strategic Defense Command

COOPERATING AGENCY: Strategic Defense Initiative Organization

ACTION: Technology testing of the High Endoatmospheric Defense Interceptor (HEDI).

BACKGROUND: Pursuant to Council on Environmental Quality regulations for implementing the procedural provisions of the National Environmental Policy Act (40 CFR Parts 1500-1508), the Department of Defense (DOD) Directive on Environmental Effects in the United States of DOD Actions, and Army Regulation 200-2, the United States Army Strategic Defense Command (USASDC) has conducted an assessment of the potential environmental consequences of technology testing of the HEDI developed by the USASDC for the Strategic Defense Initiative Organization. A no-action alternative was also considered.

SUMMARY: The HEDI is a technology that would employ ground-based missiles to intercept and destroy hostile submarine-launched and intercontinental ballistic missiles in the terminal portion of their trajectory. The HEDI vehicle would consist of a two-stage launch vehicle (booster) and a kill vehicle with a conventional warhead.

The HEDI technology test program will be conducted in two parts. Each part will test a particular aspect of the technology and provide information and data necessary to make decisions for advancing to the next phase of testing. The first part, which includes the Kinetic Kill Vehicle Integrated Technology Experiment (KITE), will consist of a number of test activities to be conducted at nine different testing sites culminating with a series of flight tests at White Sands Missile Range, New Mexico. These activities are categorized as analyses, simulations, component/assembly testing, and flight testing. Part two includes the HEDI Experimental Test Vehicle (XTV) development, which is expected to conclude with two flight tests at the U.S. Army Kwajalein Atoll. The specifics of the HEDI XTV testing activities have been broadly defined. If substantive revisions are made, then further environmental analysis will be conducted as the program progresses. This Environmental Assessment, submitted in accordance with applicable directives and policies and made available to the public, provides information on the potential environmental effects of conducting the testing activities described and known at this time.

Technology testing would involve four types of tests: analyses, simulations, component/assembly tests, and flight tests. The locations of test activities for the HEDI are:

INSTALLATION	TEST TYPE
California	
McDonnell Douglas Space Systems Company	Analysis, Simulation, Component/Assembly Tests
Vandenberg Air Force Base/Western Test Range	Analysis Tests
Colorado	
National Test Facility, Falcon Air Force Base	Analysis, Simulation Tests
Maryland	
Naval Surface Warfare Center	Analysis, Simulation Tests
New Mexico	
Sandia National Laboratories	Analysis, Component/ Assembly Tests
White Sands Missile Range	Analysis, Simulation, Component/ Assembly, Flight Tests
Republic of the Marshall Islands	
U.S. Army Kwajalein Atoll	Analysis, Component/ Assembly, Flight Tests
Tennessee	
Arnold Engineering Development Center, Arnold Air Force Base	Analysis, Simulation Tests
Utah	
Hill Air Force Base	Analysis, Component/ Assembly Tests

To determine the potential for significant environmental impacts of the technology testing of the HEDI, the magnitude and frequency of the tests that would be conducted at the proposed test locations were compared to the current activities at those locations.

To assess impacts, the activity was evaluated in the context of the environmental considerations for air quality, biological resources, cultural resources, hazardous waste, infrastructure, land use, noise, public health and safety, socioeconomics, and water quality. As a result of that evaluation, consequences were assigned to one of three categories: insignificant, mitigable and nonsignificant, or potentially significant.

Environmental consequences were determined to be insignificant if no serious concerns existed regarding potential impacts of the potentially affected area. Consequences were deemed mitigable and nonsignificant if concerns existed but it was determined that all of those concerns could be readily mitigated through standard procedures or by measures recommended in existing environmental documentation. If serious concerns were identified that could not be readily mitigated, the activity was determined to represent potentially significant consequences.

FINDINGS: No significant impacts would result from analyses, simulations, and component/assembly testing of the HEDI KITE. Mitigable and nonsignificant impacts will occur resulting from the HEDI XTV flight testing at the U.S. Army Kwajalein Atoll, Republic of the Marshall Islands, and from the HEDI KITE flight testing at White Sands Missile Range, New Mexico. Analyses, simulations, and component/assembly testing of the HEDI KITE will have insignificant environmental consequences at all of the test locations identified. Flight tests at the U.S. Army Kwajalein Atoll, Republic of the Marshall Islands, will have mitigable and nonsignificant environmental consequences for infrastructure and socioeconomics (housing). Potential infrastructure impacts that will be mitigated by construction of a proposed desalination plant are impacts on water supply. Potential infrastructure impacts that will be mitigated by participation in water conservation procedures, continued wastewater monitoring, and participation in a wastewater treatment effectiveness study are impacts on the wastewater treatment system. Potential socioeconomic (housing) impacts that will be mitigated by the construction of new housing units and the retention of trailers beyond their planned phase-out date are impacts on an anticipated housing shortage. Potential impacts from solid and hazardous waste will be avoided by requiring HEDI XTV contractors to manage their waste in accordance with appropriate Federal requirements.

Flight tests at the White Sands Missile Range will have mitigable and nonsignificant environmental consequences for biological and cultural resources. Potential biological resource impacts that will be mitigated by avoidance are impacts on threatened and endangered plant and animal species. Potential cultural resource impacts that will be mitigated by avoidance and/or data recovery are impacts on historic and prehistoric archaeological sites. Overall, no significant impacts would result.

DEADLINE FOR RECEIPT OF PUBLIC COMMENTS: ______________________

POINT OF CONTACT: A copy of

High Endoatmospheric Defense Interceptor
Technology Testing Program,
Environmental Assessment,
May 1989

is available from

U.S. Army Strategic Defense Command
Attn: Dru Barrineau, CSSD-H-SSP
P.O. Box 1500
Huntsville, AL 35807-3801

Dated 9 Jun 89

Robert D. Hammond
Lieutenant General, USA
Commander
U.S. Army Strategic Defense Command

Lead Agency: United States Army Strategic Defense Command

Cooperating Agency: Strategic Defense Initiative Organization

Title of Proposed Action: Technology Testing of High Endoatmospheric Defense Interceptor Technology

Affected Jurisdictions: White Sands Missile Range, NM; U.S. Army Kwajalein Atoll, Republic of the Marshall Islands; Arnold Engineering Development Center, Arnold Air Force Base, TN; Hill Air Force Base, UT; National Test Facility, Falcon Air Force Base, CO; Naval Surface Warfare Center, MD; Sandia National Laboratories, NM; Vandenberg Air Force Base, CA/Western Test Range; and the prime contractor facility, McDonnell Douglas Space Systems Company, Huntington Beach, CA.

PROPONENT: William B. Ingler DATE: 7 June 89

for ALAN D. SHERER
Project Manager
High Endoatmospheric Defense Interceptor

APPROVED BY: Robert D. Hammond DATE: 9 Jun 89

ROBERT D. HAMMOND
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Commander
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This Environmental Assessment documents the results of an analysis of the potential for and magnitude of impacts from technology test activities of the High Endoatmospheric Defense Interceptor (HEDI).

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EXECUTIVE SUMMARY

The Strategic Defense Initiative (SDI), announced by President Reagan on March 23, 1983, initiated an extensive research program to determine the feasibility of developing an effective ballistic missile defense system. The technological progress that has been made on the SDI research program since 1983 has advanced at an unexpectedly fast pace, and is still accelerating. Recognizing that no strategic defense system could be deployed all at once, the Strategic Defense Initiative Organization is using an evolutionary approach to strategic defense known as the concept of phased, or incremental, development/ deployment. This concept addresses the question of how to deploy strategic defenses in the event a decision is made in the future. It does not constitute a decision to develop or deploy.

The High Endoatmospheric Defense Interceptor (HEDI) is one of the many technologies being considered in the SDI technology research program and has the potential to support the requirements for the strategic defense system. The purpose of this Environmental Assessment (EA) is to analyze the environmental consequences of testing activities for the HEDI technology test program in compliance with the National Environmental Policy Act, the Council on Environmental Quality regulations implementing the Act, Department of Defense Directive 6050.1, and Army Regulation 200-2.

The HEDI is a technology that would employ ground-based missiles to intercept and destroy hostile submarine-launched ballistic missiles and intercontinental ballistic missiles during that portion of flight that puts the target in the high endoatmosphere (the terminal portion of an attacking missile trajectory). The HEDI vehicle would consist of a two-stage launch vehicle (booster) and a kill vehicle with a conventional warhead. The basic thrust of the efforts already accomplished has been to assess the operational utility of HEDI in the context of a complete strategic defense system.

The HEDI technology test program will be conducted in two parts. Each part will test a particular aspect of the technology and provide information and data necessary to make decisions for advancing to the next phase of testing. The first part, which includes the Kinetic Kill Vehicle Integrated Technology Experiment (KITE), will consist of a number of test activities to be conducted at nine different testing sites culminating with a series of flight tests at White Sands Missile Range, New Mexico. These activities are categorized as analyses, simulations, component/assembly testing, and flight testing. Part two includes the HEDI Experimental Test Vehicle (XTV) development, which is expected to conclude with two flight tests at the U.S. Army Kwajalein Atoll. The specifics of the HEDI XTV testing activities have been broadly defined. If substantive revisions are made, further environmental analysis will be conducted as the program progresses. This EA, submitted in accordance with applicable directives and policies and made available to the public, provides information on the potential environmental effects of conducting the testing activities described and known at this time.

In particular, this EA examines the proposed sites for testing activities. For each site, the assessment evaluates potential impacts on the environment. To assess the significance of any impact, a two-step methodology has been utilized. The first step was the application of assessment criteria to identify test activities deemed to present no potential for significant environmental consequences. If a proposed activity was determined to present some potential for impact, no matter how slight, the second step in the methodology was undertaken. This step consisted of evaluating the activity in terms of potential for significant impacts on a number of broad environmental attributes, such as air quality, biological resources, cultural resources, hazardous waste, infrastructure, land use, noise, public health and safety issues, socioeconomics, and water quality.

Based on the application of this methodological approach, the following determinations on the environmental consequences of HEDI technology testing were made:

- McDonnell Douglas Space Systems Company, Huntington Beach, California - insignificant consequences
- Arnold Engineering Development Center, Arnold Air Force Base, Tennessee - insignificant consequences
- Hill Air Force Base, Utah - insignificant consequences
- National Test Facility, Falcon Air Force Base, Colorado - insignificant consequences
- Naval Surface Warfare Center, Maryland - insignificant consequences
- Sandia National Laboratories, New Mexico - insignificant consequences
- U.S. Army Kwajalein Atoll, Republic of the Marshall Islands - mitigable and nonsignificant consequences
- Vandenberg Air Force Base, California/Western Test Range - insignificant consequences
- White Sands Missile Range, New Mexico - mitigable and nonsignificant consequences.

HEDI XTV tests at the U.S. Army Kwajalein Atoll, Republic of the Marshall Islands, will have mitigable and nonsignificant environmental consequences for infrastructure and socioeconomics (housing). Potential infrastructure impacts that will be mitigated by construction of a proposed desalination plant are impacts on water supply. Potential infrastructure impacts that will be mitigated by participation in water conservation procedures, continued wastewater monitoring, and participation in a wastewater treatment effectiveness study are impacts on the wastewater treatment system. Potential socioeconomic (housing) impacts that will be mitigated by the construction of additional housing units and the retention of trailers beyond their planned phase-out date are impacts on an anticipated housing shortage.

HEDI KITE technology tests at White Sands Missile Range will have mitigable and nonsignificant environmental consequences for biological and cultural resources. Potential biological resource impacts that will be mitigated by avoidance are impacts on threatened and endangered plant and animal species. Potential cultural resource impacts that will be mitigated by avoidance and/or appropriate recovery and documentation of data are impacts on historic and prehistoric archaeological sites.

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1.0 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

The National Environmental Policy Act (NEPA), the Council on Environmental Quality regulations implementing the Act (40 CFR 1500-1508), Department of Defense (DOD) Directive 6050.1, and Army Regulation (AR) 200-2, which implements these regulations, direct that DOD and Army officials take into account environmental consequences when authorizing or approving major Federal actions in the United States. Accordingly, this Environmental Assessment (EA) analyzes the potential environmental consequences of technology testing activities for a proposed High Endoatmospheric Defense Interceptor (HEDI). Because the proposed action would involve the U.S. Army Kwajalein Atoll (USAKA), Republic of the Marshall Islands (RMI), the Compact of Free Association (166) and related agreements between the RMI and the United States also apply.

HEDI is one of the technologies being considered in the Strategic Defense Initiative (SDI) program. The tests and evaluations associated with the technology test program would be in compliance with the Antiballistic Missile (ABM) Treaty. Conduct of the test activities for HEDI would not indicate that HEDI would be developed or deployed, nor would it preclude the possibility of testing or advancing other technologies in the acquisition process.

This section describes the purpose and need for the action, the proposed HEDI technology test program and alternatives, and the related environmental documentation. Section 2.0 describes the affected environment at installations where the testing activities would be conducted. Section 3.0 assesses the potential environmental consequences of the proposed action at these installations, and Section 4.0 discusses measures that would be taken to minimize impacts at affected installations.

1.1 BACKGROUND

The SDI, announced by President Reagan on March 23, 1983, initiated an extensive research program to determine the feasibility of developing an effective ballistic missile defense system. Subsequently, the Strategic Defense Initiative Organization (SDIO) was established to plan, organize, coordinate, direct, and enhance the research and testing of technologies applicable to strategic defense.

The acquisition process for defense programs is divided into distinct phases that are separated by major milestone decision points. They are: Milestone 0 - Program Initiation/Mission-Need Decision (Concept Exploration), Milestone I - Concept Demonstration/Validation Decision, Milestone II - Full-Scale Development Decision, Milestone III - Full-Rate Production Decision, Milestone IV - Logistics Readiness and Support Review, and Milestone V - Major Upgrade or System Replacement Decision. Each of these decision points establishes program goals that the Program Manager is expected to meet and the information required for the next decision point.

Central to the conduct of the SDI research program and determination of feasible technologies that could be applicable to an effective ballistic missile defense system are the Concept Exploration and Demonstration/Validation activities. As part of the acquisition process, Concept Exploration activities assess such things as program alternative tradeoffs, performance/cost and schedule tradeoffs, and the operational utility of the prototype concept. Demonstration/Validation activities then examine operational suitability and effectiveness by testing to determine the technology's ability to meet the specified requirements. These activities would provide the necessary information required for future acquisition decisions regarding a Strategic Defense System (SDS).

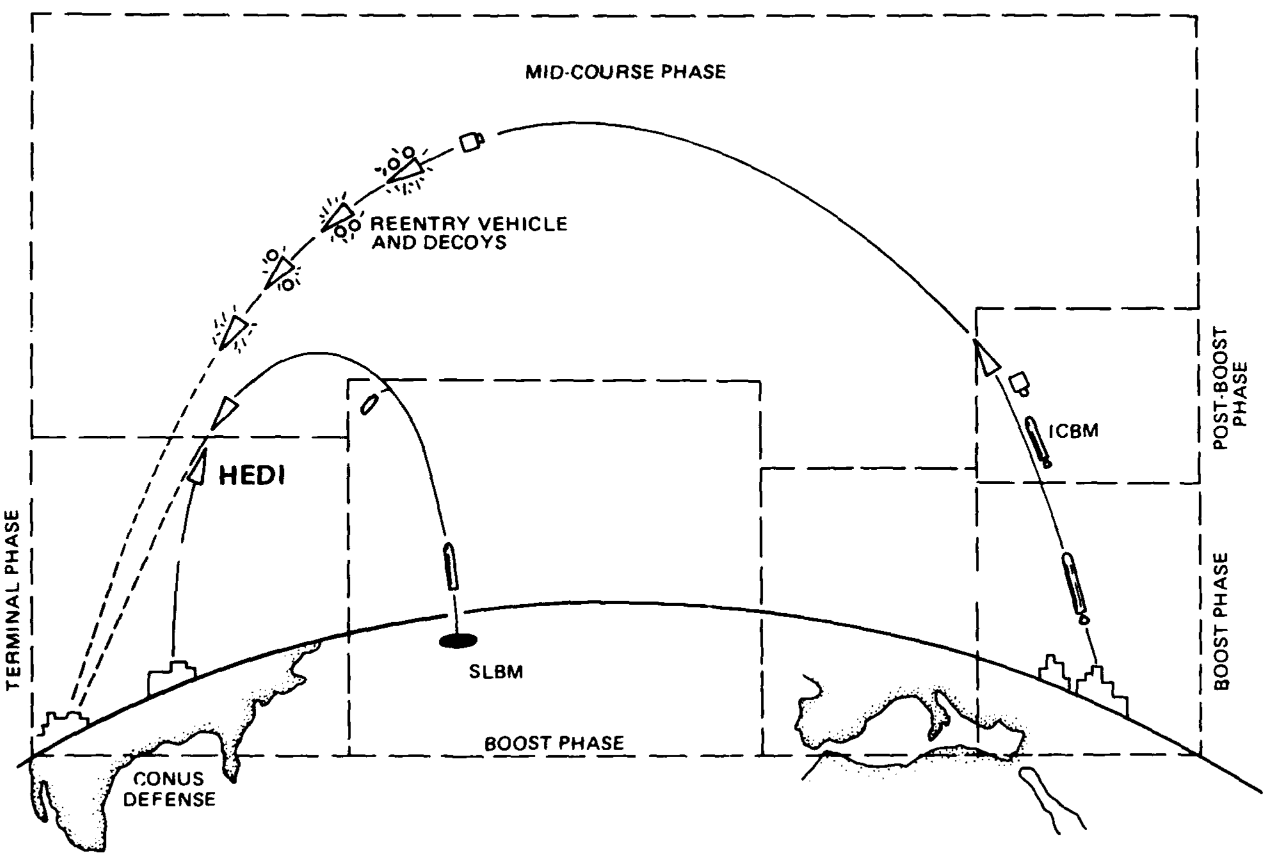
The technological progress that has been made on the SDI research program since 1983 has advanced at an unexpectedly fast pace, and is still accelerating. Recognizing that no SDS could be deployed all at once, the SDIO is using an evolutionary approach to strategic defense known as the concept of phased, or incremental, development/deployment. This concept addresses the question of how to deploy strategic defenses in the event a decision is made in the future. It does not constitute a decision to develop or deploy. In September 1987, some technologies were advanced into the Demonstration/Validation phase under this approach because they were judged to be mature enough in concept definition to warrant further evaluation. They are the Boost Surveillance and Tracking System (BSTS), Space-Based Surveillance and Tracking System (SSTS), Space-Based Interceptor (SBI), Exoatmospheric Reentry Vehicle Interception System (ERIS), Ground-Based Surveillance and Tracking System (GSTS), and Battle Management/Command, Control, and Communications (BM/C^3). EAs were prepared for these six technologies in the SDI Demonstration/Validation program in August 1987 (10, 11, 12, 13, 15, 16). An SDI Demonstration/Validation Program Environmental Assessments Summary (17) was also prepared. In March 1989, an EA was prepared for Ground-Based Radar (GBR) (9). In May 1989, the public comment period ended and environmental requirements were satisfied. This was in preparation for the advancement of GBR to the Demonstration/Validation phase.

1.2 PURPOSE AND NEED FOR THE ACTION

The HEDI technology is presently in the Concept Exploration phase, which determines the operational utility of the concept in an SDS. Activities have included study of flight vehicle stability, the vehicle propulsion system, the control system, the infrared seeker, the conventional warhead, and cooling and thermal protection techniques.

The HEDI is a technology that would employ ground-based missiles to intercept and destroy hostile submarine-launched ballistic missiles (SLBMs) and intercontinental ballistic missiles (ICBMs) when the attacking missile is reentering the atmosphere (the terminal portion of an attacking missile trajectory) (Figure 1-1). The HEDI vehicle would consist of a two-stage launch vehicle and a kill vehicle (KV) with a conventional warhead. The proposed test activities for the HEDI are intended to resolve critical technical issues to demonstrate the ability to conduct intercepts of ballistic reentry vehicles (RVs) high within the atmosphere.

Conduct of the test activities for HEDI does not preclude the possibility of testing or advancing other technologies in the acquisition process, nor is it a decision that indicates that HEDI or an SDS will be developed and deployed. Further advancement and testing of HEDI in the acquisition process will be supported by additional



EXPLANATION

1. HEDI – HIGH ENDOATMOSPHERIC DEFENSE INTERCEPTOR
2. ICBM – INTERCONTINENTAL BALLISTIC MISSILE
3. SLBM – SUBMARINE-LAUNCHED BALLISTIC MISSILE

Functional Concept of the High Endoatmospheric Defense Interceptor

Figure 1-1

environmental analysis and documentation in compliance with NEPA. The purpose of this EA is to analyze the environmental consequences of testing activities for the HEDI technology development program in compliance with all pertinent regulations and agreements.

1.3 PROPOSED ACTION

The proposed action is implementation of the HEDI technology test program. This program will be conducted in two parts. Each part will test a particular aspect of the technology and provide information and data necessary to make decisions for advancing to the next phase of testing. The first part, which includes the Kinetic Kill Vehicle Integrated Technology Experiment (KITE), will consist of a number of test activities to be conducted at nine different testing sites and will culminate with a series of flight tests at White Sands Missile Range (WSMR), New Mexico. Part two of the technology testing includes the HEDI Experimental Test Vehicle (XTV) development, which is expected to conclude with two flight tests at USAKA. Since many of the specific details of the HEDI XTV effort are not yet defined, the discussion of this effort will be programmatic in nature. Further environmental analysis will be conducted as the HEDI XTV planning progresses and new information is identified.

This EA addresses the HEDI technology test program only. Any decision to advance beyond this program will be supported by further environmental analysis under NEPA. In addition, this EA will be reevaluated if the HEDI program changes.

1.3.1 Part I - HEDI KITE

This part of the HEDI technology test program is intended to demonstrate whether the HEDI KITE can meet the following specific requirements:

- Safely and accurately launch a booster vehicle
- Track an infrared (IR) target flare, providing aero-optical measurement data
- Intercept a surrogate RV.

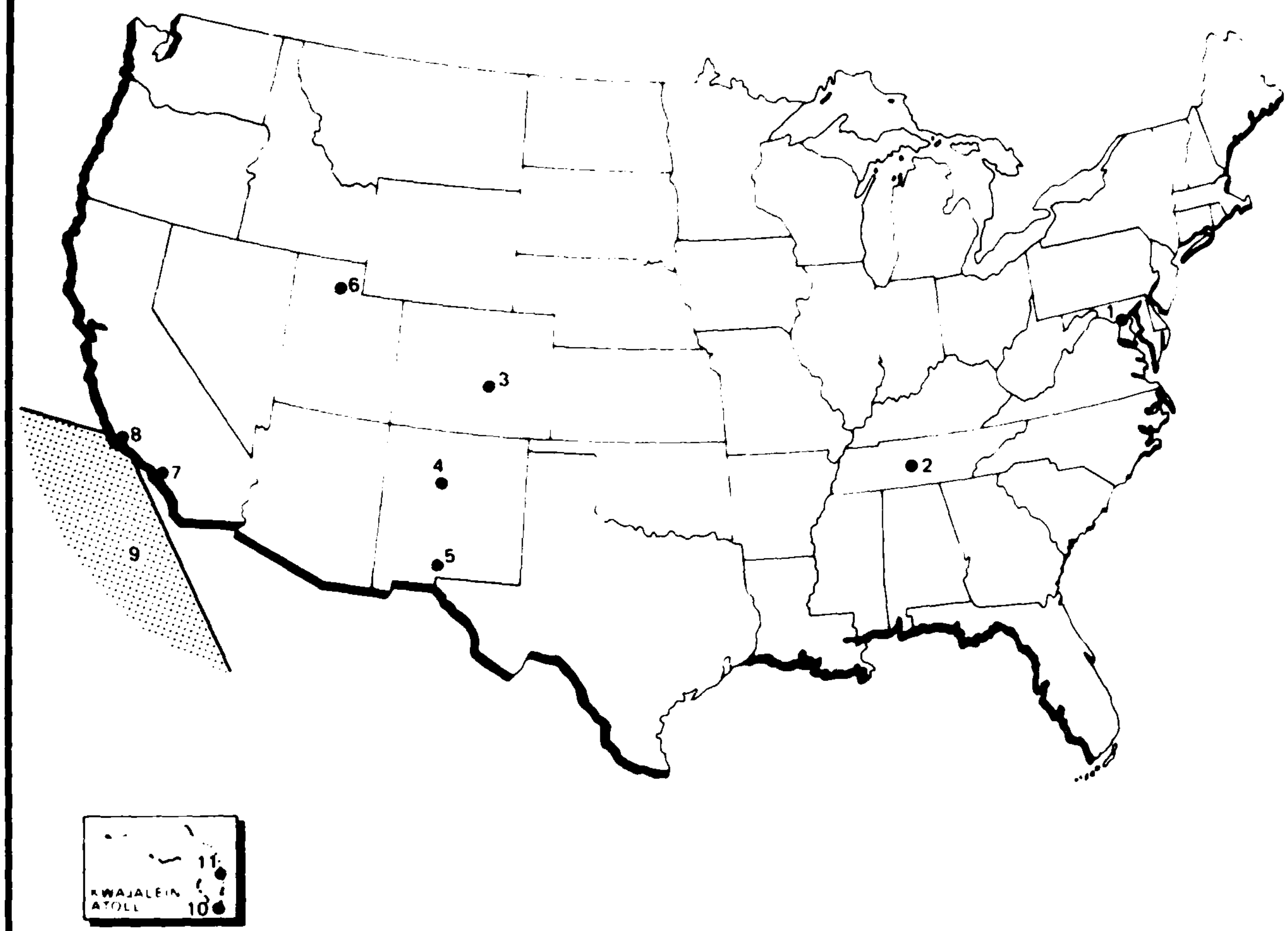
The HEDI KITE test activities are categorized as analyses, simulations, component/assembly testing, and flight testing. Table 1-1 delineates the various activities and the locations associated with each activity; the test locations are shown in Figure 1-2. Test activities will involve evaluating the technology for KV intercept of a target in the high endoatmosphere. This phase of the technology test program will focus on three specific test protocols conducted at WSMR, each test more complex and more difficult than the preceding one. This flight testing at WSMR will be conducted over a 3-year period, beginning in 1989. An optional fourth flight may be conducted if a further demonstration is necessary and/or as a test of emerging technology. Flight one (KITE I) will test the ability to safely and accurately launch the booster vehicle, a two-stage SPRINT booster, to obtain cooling measurement data, and to demonstrate nonnuclear warhead detonation. In flight two (KITE 2), the HEDI seeker will track an IR target flare to collect aero-optical measurement data. Flight three (KITE 3) will be an actual intercept test, featuring an HEDI KV engaging a surrogate RV.

Table 1-1. HEDI KITE TEST ACTIVITIES AND LOCATIONS

TEST ACTIVITIES	ANALYSIS	SIMULATIONS	COMPONENT/ASSEMBLY	FLIGHT	LOCATIONS
Basic flight test	X			X	White Sands Missile Range, NM
Second flight test using infrared target flare	X			X	White Sands Missile Range, NM
Third flight test using target reentry vehicle	X			X	White Sands Missile Range, NM
ALL THREE FLIGHT TESTS					
Refurbish SPRINT booster	X		X		Sandia National Laboratories, NM
Assemble kill vehicle	X		X		White Sands Missile Range, NM
Evaluate window cooling system	X			X	White Sands Missile Range, NM
Evaluate reception of pre-launch intercept data	X		X		White Sands Missile Range, NM
Evaluate launch support equipment	X	X	X		White Sands Missile Range, NM

Table 1-1. HEDI KITE TEST ACTIVITIES AND LOCATIONS

TEST ACTIVITIES	ANALYSIS	SIMULATIONS	COMPONENT/ASSEMBLY	FLIGHT	LOCATIONS
THIRD FLIGHT TEST ONLY					
Refurbish target rocket motor systems	X		X		Hill AFB, UT
Assemble target reentry vehicle	X		X		Sandia National Laboratories, NM
Manufacture air vehicle and test launch control equipment	X	X	X		McDonnell Douglas Space Systems Company, Huntington Beach, CA
Perform wind tunnel testing of flight components	X	X			Arnold Engineering *Dev. Ctr., TN*
Validate jet interaction	X	X			Arnold Engineering Dev. Ctr., TN
Evaluate window cooling system	X	X			Naval Surface Warfare Center, MD
Use of infrared target tracking system	X				White Sands Missile Range, NM
	X				U.S. Army Kwajalein Atoll, RMI
	X				Vandenberg AFB, CA/ Western Test Range
Simulate exercise test mission	X	X			National Test Facility, *Falcon* AFB, CO



EXPLANATION

1. NAVAL SURFACE WARFARE CENTER
2. ARNOLD ENGINEERING DEV. CENTER, ARNOLD AFB
3. NATIONAL TEST FACILITY, FALCON AFB
4. SANDIA NATIONAL LABORATORIES
5. WHITE SANDS MISSILE RANGE
6. HILL AFB
7. McDONNELL DOUGLAS SPACE SYSTEMS CO.
8. VANDENBERG AFB
9. WESTERN TEST RANGE
10. KWAJALEIN ISLAND, U.S. ARMY KWAJALEIN ATOLL
11. MECK ISLAND, U.S. ARMY KWAJALEIN ATOLL

0 150 300 600
Kilometers

0 100 200 400
Miles

High Endoatmospheric Defense Interceptor Test Facilities

Figure 1-2

In preparation for the flight tests, the following activities, also shown in Table 1-1, will be performed:

- Refurbishment, modification, and testing of existing SPRINT Stage I and II propulsion and control assemblies

- Assembly of the HEDI KITE vehicle, which involves attaching the KV to the two-stage, modified SPRINT Propulsion and Control Assembly (PACA) on the launch pad located at Launch Complex 37, WSMR

- Evaluation of the window cooling system, which involves ensuring that the cooling system can dissipate the heat generated on the window during flight to ensure that the HEDI seeker can acquire and track the target

- Evaluation of the reception of prelaunch intercept data, which is a test of the ability of the overall system to receive sufficient target data to allow the accurate ground launch of the HEDI KITE

- Evaluation of launch support equipment, which involves testing the equipment required to safely launch the HEDI KITE. The equipment provides the necessary environmental or missile conditions for operators and/or range safety officers.

Unique to the third flight test (KITE 3) will be two additional activities:

- Refurbishment of an existing rocket motor to prepare it for assembly/integration as the HEDI target launch vehicle

- Assembly of the target vehicle, involving fabrication of a target RV with an enhanced IR signature.

The remaining technology test activities shown in Table 1-1 will be conducted prior to or concurrent with the WSMR flight tests. These activities will include:

- Manufacture of the KV, its ground support equipment, including its electronic test equipment, and the actual fabrication of hardware

- Wind tunnel testing of flight components, involving placing either a full-sized or reduced model of the test object in the tunnel and moving air past the object. This testing simulates high-speed flight and allows testing of aerodynamic characteristics using sensors and high-speed photography

- Validation of jet interaction, which evaluates the maneuvering capability of the HEDI KV under extreme conditions

- Evaluation of the window cooling system, which ensures that the cooling system can dissipate the heat generated on the window during flight. This is necessary to ensure that the IR seeker can acquire and track the target

- Utilization of the Infrared Instrumentation System (IRIS), involving flying the IRIS on board a Learjet to gather IR signature data on actual RVs and their associated objects

- Simulation of the exercise test mission, which involves developing and using computer programs that will simulate the expected test scenario before actual hardware testing.

The following sections describe more fully the types of test activities that will take place and the pertinent information regarding each test location.

1.3.1.1 Analyses

Analysis activities for the HEDI program will consist of evaluating data generated by the other test program activities. By necessity, this analysis will occur after each testing phase. Analysis is a scientific exercise conducted to determine the cause or reasons for simulated or real phenomena noted during testing and/or evaluation. This analysis will be used to eliminate potential problems and/or to enhance positive results. HEDI KITE analyses are scheduled at all of the locations where test activities will be conducted (Table 1-1) and will be undertaken by the staff that routinely performs these test program activities. No additional personnel will be required for any analysis activity.

In addition to the evaluation of data generated by test program activities, the analyses will also involve the collection of data utilizing the IRIS tracking system at WSMR and USAKA, RMI. While at USAKA, the IR target tracking system will take advantage of targets of opportunity launched out of Vandenberg Air Force Base (AFB), California. IRIS will also be utilized during the HEDI KITE tests at WSMR. The data collection tests are described in more detail below.

WHITE SANDS MISSILE RANGE

Use of the IR target tracking system is scheduled at WSMR. Utilization of the IRIS tracking system will involve flying the IRIS on board the Learjet on the day of each of the flight tests to gather IR signature data from the target (KITE 2 and 3 launches) at WSMR. The IRIS is an airborne/radiometric system capable of acquiring, tracking, processing, and recording data within the HEDI seeker bandwidth and will be flown on board a Learjet 35 to gather data pertinent to HEDI seeker development. Prior to each flight, an Operations Requirement (OR) Report will be filed with WSMR for approval. Approximately 11 transient personnel will be needed for IRIS for the duration of the KITE 2 and 3 tests. Existing facilities will be used, and aircraft fuel will be handled in accordance with the safety plan for WSMR.

U.S. ARMY KWAJALEIN ATOLL

Utilization of the IRIS is also scheduled at USAKA. The system will also be flown on board a Learjet 35 staged at USAKA. The aircraft will be serviced and maintained within an existing hangar at USAKA. Approximately six to ten targets of opportunity will be observed by IRIS each year during technology testing for the HEDI KITE program. Prior to each target of opportunity mission, an OR Report will be filed with USAKA for approval from the applicable offices (i.e., safety, security, etc.). Approximately 11 transient personnel will be needed for IRIS activities approximately 4 months per year. No additional facilities need to be constructed. Aircraft fuel will be handled in accordance with the safety plan for USAKA.

VANDENBERG AIR FORCE BASE/WESTERN TEST RANGE

Utilization of the IRIS to obtain IR signature data will involve the use of targets of opportunity launched from Vandenberg AFB. Because these launches are regularly scheduled and routine for Vandenberg AFB, no additional personnel will be required for HEDI activities. Vandenberg AFB routinely launches several types of missiles, among them the PEACEKEEPER, MINUTEMAN, and Titan. Any combination of these missiles may be launched during the technology testing timeframe and personnel requirements will vary. As an example, MINUTEMAN launches require approximately 55 persons (195).

1.3.1.2 Simulations

HEDI technical and operational requirements will be verified by component subsystem-system level tests and computer simulations. Simulation involves testing a physical entity (machine, system component, etc.) by developing a computer model of that entity or by using a special simulation facility such as a wind tunnel.

Emphasis will be placed on building the qualifications history and databases from the component level to permit cost-effective element testing. Table 1-1 delineates the location of each simulation. HEDI KITE launch support equipment simulations are scheduled at WSMR. Equipment and flight test simulations will be conducted at the McDonnell Douglas Space Systems Company (MDSSC) facility in Huntington Beach, California. Wind tunnel testing of flight components and jet interaction/validation simulations are scheduled at the Arnold Engineering Development Center (AEDC), Arnold AFB, Tennessee, and wind tunnel tests are scheduled at the Naval Surface Warfare Center (NSWC), White Oak, Maryland, to validate aero-effects and window/forebody cooling performance. Exercise test mission simulations incorporating data from HEDI are scheduled at the National Test Facility (NTF), Falcon AFB, Colorado. These simulation activities are described in more detail below.

WHITE SANDS MISSILE RANGE

The launch support equipment simulation tests at WSMR will be conducted in an existing facility, the Launch Control Center at Launch Complex 37, in conjunction with flight tests for KITEs 1, 2, and 3. These tests will simulate use of the launch control equipment; flight simulation tests are expected to run for a few months. Approximately 30 additional contractor personnel will be present for these simulation tests (20).

MCDONNELL DOUGLAS SPACE SYSTEMS COMPANY

The launch control equipment simulations at MDSSC's Huntington Beach installation will be conducted in existing facilities, the System Integration Laboratory in Building 14, where flight simulation tests will be performed using computer models. Approximately five persons will be involved in these simulation tests (26); no additional personnel will be required.

ARNOLD ENGINEERING DEVELOPMENT CENTER

The wind tunnel testing of flight components and jet interaction/validation simulations at AEDC will be conducted in existing facilities (the von Karman facility). These tests involve placing either a full-sized or reduced model of the KV in the wind tunnel and moving air past it. Flight component testing simulates high-speed flight and allows testing of aerodynamic characteristics using sensors and high-speed photography. Jet interaction/validation simulations involve the evaluation of the maneuvering capability of the KV. During these tests, a gas generator, used to raise the temperature in the wind tunnel, will emit a small quantity of the combustion products of butane and liquid oxygen (i.e., carbon dioxide, water, and carbon monoxide). Apart from the liquid oxygen, which is produced on site, and the butane, which is purchased locally, no additional material will be required for these tests. Wind tunnel tests usually require several weeks to set up and evaluate but last only a matter of seconds when actually conducted. AEDC employs approximately 3,800 persons (44); approximately 500 work in the von Karman facility on similar test programs. Of these 500 personnel, 3 or 4 will work on HEDI KITE activities; an additional 20 to 30 contractor personnel will be involved in the HEDI KITE tests (49).

NAVAL SURFACE WARFARE CENTER

The wind tunnel tests at the NSWC at White Oak, to validate aero-effects and window/forebody cooling performance, will be conducted in an existing facility, Hypervelocity Wind Tunnel No. 9. This wind tunnel is a high Reynolds number facility for aerodynamic testing of weapons and vehicles, including the critical low-altitude flight regime of advanced interceptors and full-scale reentry bodies. The tests will involve placing either a full-sized or reduced model of the KV in the wind tunnel and moving nitrogen past it at high speed. High-pressure (138,000 kilo pascals [20,000 pounds per square inch]) nitrogen will be passed through a nozzle over the test object to a low-pressure chamber. This testing simulates high-speed flight and allows testing of the window/forebody cooling system and the validation of aero-effects using sensors and high-speed photography. Other than the nitrogen used as the working fluid in the wind tunnel test, no additional material will be required for the tests. Although the wind tunnel tests last only a matter of seconds, the entire process - including preparatory work beforehand and evaluation afterward - will take 2 to 3 months. Eight to ten full-time staff members are engaged in wind tunnel tests at Wind Tunnel No. 9. Three or four additional personnel are expected as observers during the tests (98, 102, 103).

NATIONAL TEST FACILITY, FALCON AIR FORCE BASE

The computer simulations at Falcon AFB, which serves as a repository for all SDIO technical information, will be part of a larger, overall SDI simulation effort. This effort will take advantage of data from all of the SDI technologies. These simulations will take place in the existing interim facility (the Consolidated Space Operations Center) and the new NTF, but will not involve or require any building modifications to the Consolidated Space Operations Center. When the new NTF, which is still under construction, is fully operational, it will employ approximately 2,700 of Falcon AFB's potential workforce of 6,000 employees (75, 76, 78, 83, 85). Other than these already-scheduled people, no additional personnel will be required.

1.3.1.3 Component/Assembly Tests

Component/assembly testing, which is necessary for the preparation of the actual flight test hardware, includes all aspects of site activation. The basic concept of component/assembly testing is to control the physical conditions under which hardware is tested. Tests are typically conducted in controlled environments, and data are collected regarding the performance of an individual hardware item and/or how it reacts to a specific environment. The scope of the tests may range from single components to major subassemblies.

The majority of the HEDI KITE component/assembly tests (Table 1-1) will be conducted at WSMR. These will involve assembling the KV, evaluating the reception of prelaunch intercept data, and evaluating the launch support equipment. HEDI KITE component/assembly tests involving the refurbishment of the target rocket motor systems used in KITE 3 are scheduled at Hill AFB, Utah. Target vehicle component/assembly tests for KITE 3 and refurbishment of the SPRINT booster rocket for KITEs 1, 2, and 3 are scheduled at Sandia National Laboratories in Albuquerque, New Mexico. Air vehicle and ground equipment component/assembly tests will be conducted at MDSSC's Huntington Beach installation for all three KITE launches. These component/assembly activities are described in more detail below.

WHITE SANDS MISSILE RANGE

The component/assembly tests at WSMR will involve evaluating the launch support equipment (equipment installation and checkout, calibration, and maintenance) and prelaunch intercept data reception, which will be conducted in the Launch Control Center at Launch Complex 37, and assembling the KV with the SPRINT booster, which will be conducted in the KV Missile Assembly Building (MAB). These component/assembly tests will be conducted in existing facilities at WSMR. Approximately ten additional contractor personnel will be required for these component assembly tests (20).

HILL AIR FORCE BASE

The component/assembly tests at Hill AFB will involve the refurbishment of the M56A1 rocket motor(s) to prepare them for assembly as the ARIES target delivery system for the KITE 3 target, and will take place in existing facilities that are routinely used for this type of activity for other projects. Refurbishment involves: overhauling the nozzle control unit; X-raying the motor for voids; verifying that all "O"-rings are present; leak testing, which involves using nitrogen gas at 207 kilo pascals (30 pounds per square inch) to adhere to a 30-milliliter (1-ounce)-per-year leak criterion; inspecting for cracks; electrical checks; checking the raceway cables; checking the insulator to boot gap; ultrasonic imaging of components (if necessary); and Computerized Axial Tomography scanning (if necessary). Solvents are used in quantities of less than 30 milliliters (1 ounce) in the refurbishment area to clean the nozzle and explosive safety quantity distances (ESQDs) have been established around the missile maintenance area (52, 53). This procedure is a routine operation at Hill AFB. Approximately 15 personnel (53) are involved in the refurbishing process, which takes place in the refurbishing bays of Building 2114. No additional personnel or modifications to existing facilities will be required (53).

SANDIA NATIONAL LABORATORIES

Simultaneous with the ARIES activities at Hill AFB, a target vehicle upper stage will be fabricated at the Sandia National Laboratories. The target vehicle will be assembled in Building 808 of Technical Area I. Vibration testing (Building 6560) and centrifuge testing (Building 6520) will take place in Technical Area III. Additional tests involved in the component/assembly activities will take place in remote testing areas of the facility. These tests will include two types of X-band radar cross-sectioning (Buildings 9970-C and 9972) and antenna pattern measurements (Building 9970). This type of testing and assembly is within Sandia's routine operations and no additional personnel will be required (111).

In addition to the target vehicle testing and assembly, Sandia National Laboratories will also refurbish the SPRINT booster rockets for KITEs 1, 2, and 3. This refurbishment, which is a routine operation for Sandia National Laboratories, involves both rocket stages. First-stage refurbishment consists of removing the fairing, thrust vector controls, nozzle, and igniters; X-raying the motor; modifying the electrical wiring and performing electrical continuity tests; plugging the thrust vector ports on the nozzle; and reassembling the motor and nozzle with the new fairing. As part of the first-stage nozzle and air vane control section assembly, a small amount of asbestos putty is used for sealing joints. Existing putty will be removed and replaced with new putty. Handling and disposal of asbestos putty will be performed by Sandia National Laboratories in accordance with applicable Federal and state regulations (110). Second-stage refurbishment consists of removing the nozzle, air vane control fins, and igniters; X-raying the motor; modifying the electrical wiring and performing electrical continuity tests; installing modified air vane control fins from MDSSC's Huntington Beach installation; and reattaching the nozzle. After the two stages have been refurbished, they will be reassembled. This process, which takes approximately 3 months, requires four Sandia personnel and an additional two or three MDSSC personnel (119). Refurbishment of the SPRINT booster rocket will take place in the SPRINT Assembly Building (Building 6736) in Technical Area III in accordance with Sandia's standard safety procedures (114).

MCDONNELL DOUGLAS SPACE SYSTEMS COMPANY

The air vehicle and ground equipment component/assembly tests will be conducted at MDSSC's Huntington Beach, California, installation. The fabrication and assembly of the KV and the wiring and fitting check for the entire missile will be performed in the existing fabrication building (Building 39). The launch control equipment will be assembled and tested in the Subsystem Integration Laboratory's simulation center. MDSSC employs approximately 10,000 people at its Huntington Beach installation, of whom 230 will be involved in HEDI KITE operations (26). The actual component assembly tests will involve 12 to 15 personnel. No additional personnel will be required.

1.3.1.4 Flight Tests

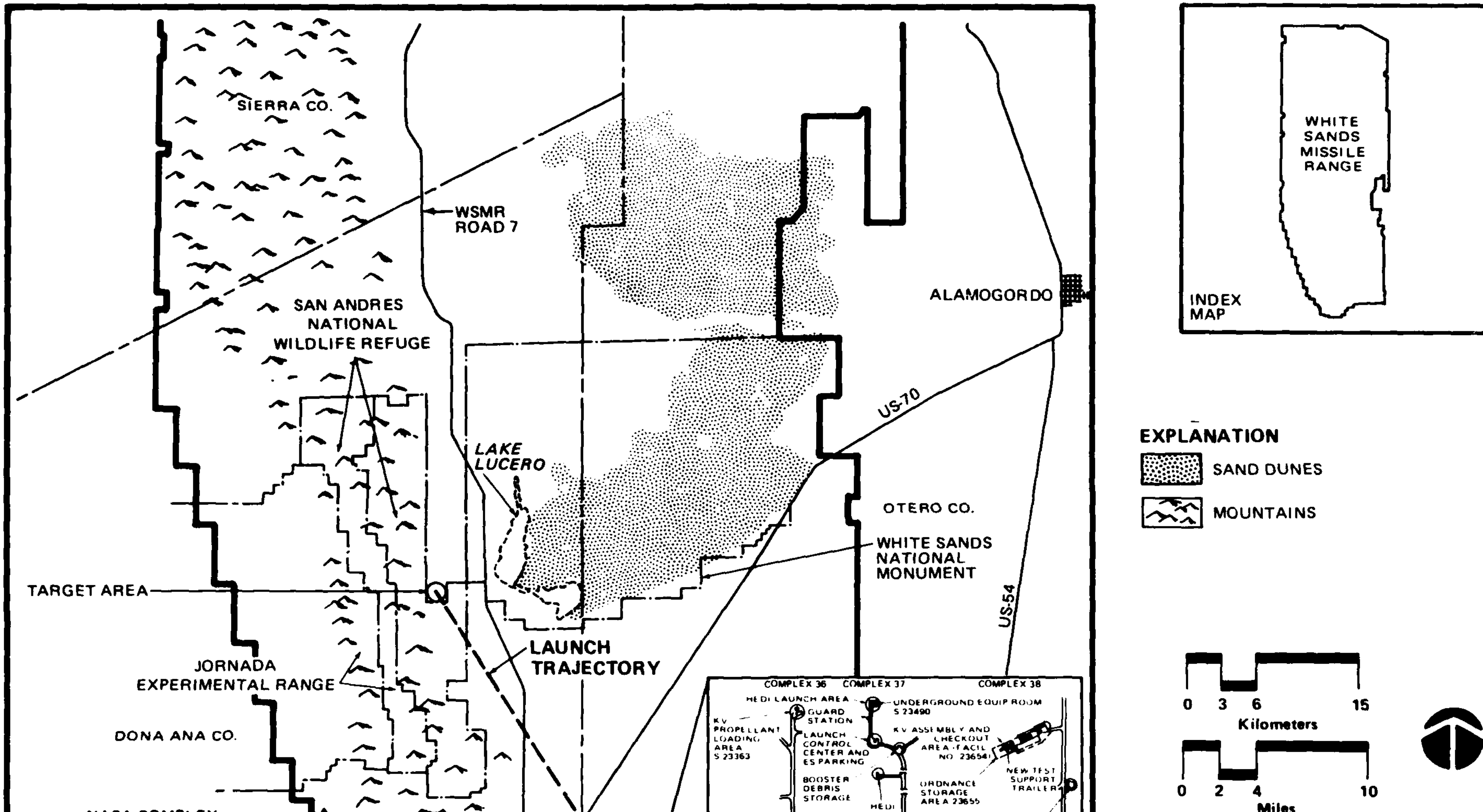
Flight and validation testing (Table 1-1) is that portion of the program that involves real-world conditions. In the case of HEDI KITE, it will involve the actual launch and control of the total interceptor weapon at WSMR. The flight validation tests are described in more detail below.

WHITE SANDS MISSILE RANGE

The HEDI KITE flight test program at WSMR will consist of three flight tests. These tests will focus on the resolution of critical technology issues supporting the development of a conventional high endoatmospheric missile system capable of intercepting SLBM and ICBM RVs during their reentry into the Earth's atmosphere. Tests will occur annually, beginning in 1989, and will be scheduled to minimize potential impact on the San Andres National Wildlife Refuge (NWR) (Figure 1-3), in coordination with the New Mexico Department of Game and Fish.

For each KITE flight, an OR Report must be submitted to the National Range Operations Division. The OR Report is prepared by the range user to identify requirements directly related to the conduct of a particular test or series of identical or similar tests. This report provides specific details of the flight trajectory, measurement requirements, and support requirements, such as timing, recovery, and real-time displays. The OR Report is coordinated with the appropriate divisions at WSMR and approved prior to conducting the tests.

Each flight is designed to obtain function and performance data on designated key issues and related interceptor equipment. Flight one (KITE 1) will be a basic test of the ability to safely and accurately launch the booster vehicle. The booster vehicle (the first- and second-stage rocket motors from a SPRINT missile) will be launched along a trajectory with an azimuth of 330 degrees (Figure 1-3) from Launch Complex 37. This trajectory was selected based on evaluations made early in the HEDI KITE planning stages using the following criteria: fulfilling technical operational requirements, avoiding populated areas and the White Sands National Monument, and containing debris within WSMR. The trajectory was approved by the WSMR Safety Office and the WSMR Master Planning Board.



HEDI KITE Trajectory and Test Facilities Site Plan

Figure 1-3

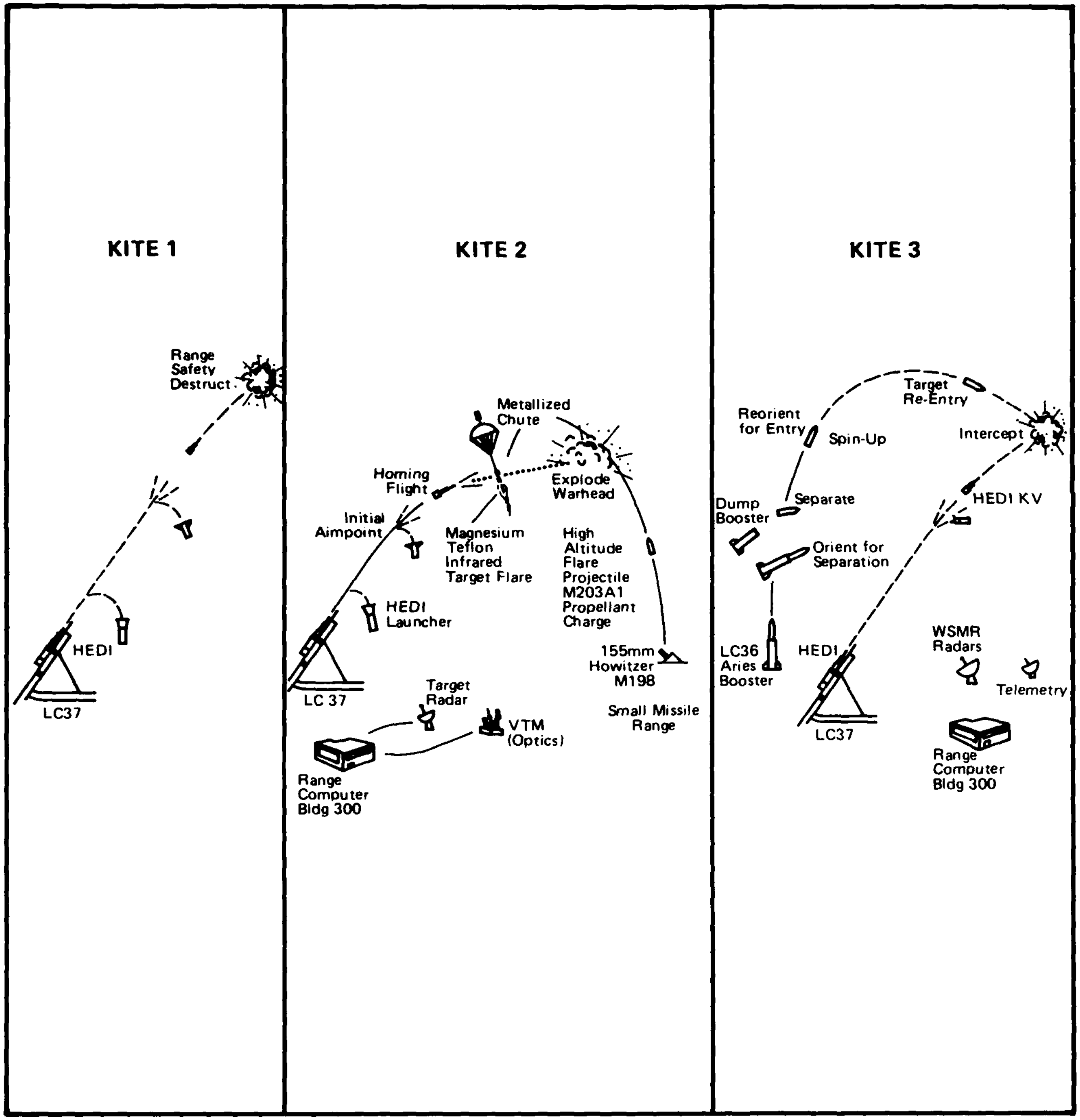
The HEDI KITE 1 flight will be terminated by detonation of the HEDI warhead (Figure 1-4). Prior to the flight termination, the HEDI KV will have separated from the SPRINT PACA, which will land along the trajectory shown in Figure 1-3. At the time of the KITE 1 flight launch, the HEDI KV will weigh 365 kilograms (806 pounds). Of that weight, approximately 81 kilograms (178 pounds) are the warhead and other expendables, such as cooling gases, KV control fuels, etc. These expendables will be consumed either in flight or by the detonation of the HEDI warhead. The balance of the weight is debris from the explosion. The SPRINT second stage and shroud separation points and warhead detonation point (at 15,240 meters [50,000 feet]) are also shown in Figure 1-4.

Debris will be handled in accordance with WSMR's existing prescribed policies, responsibilities, and procedures for the security, recovery, and disposition of classified, unclassified, and hazardous test material impacting on and off the range (WSMR Regulation 70-8). Any debris that impacts in the White Sands National Monument will be cleaned up to the satisfaction of the Superintendent of the White Sands National Monument, in accordance with the Master Special Use Agreement between the Department of the Interior and the Department of the Army (260). If debris falls in the San Andres NWR, the Manager of the Refuge will be contacted before any attempt is made to recover the debris and will be invited to accompany recovery personnel if recovery is deemed necessary.

Flight two (KITE 2) will be an experiment in which the HEDI seeker will track an IR target flare to measure seeker performance. The target flare will be fired from the vicinity of the Small Missile Range (Figure 1-3) using a 155-mm Howitzer, whereas the HEDI KITE 2 vehicle (a first- and second-stage SPRINT missile plus the HEDI KV) will be launched from Launch Complex 37 along the same trajectory as KITE 1 (Figure 1-3). The debris will also impact along the same trajectory as the KITE 1 flight test debris but will cover a smaller area. The debris will be handled in the same manner as debris from KITE I.

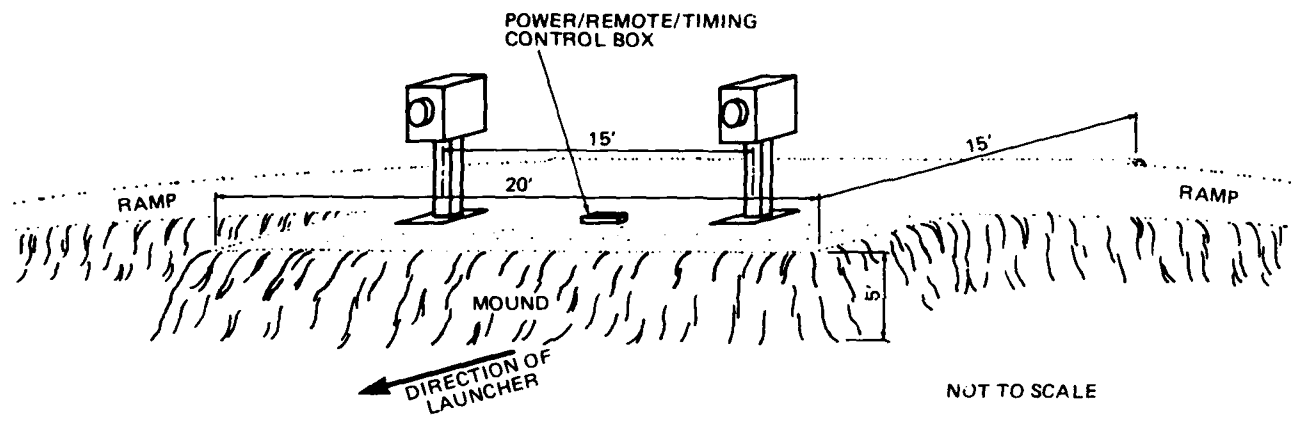
Flight three (KITE 3) will be an actual intercept test, featuring a HEDI KV engaging a surrogate RV (attached to an ARIES booster), which will be launched from Launch Complex 36, just west of Launch Complex 37 (Figure 1-3). The latter test will include evaluation of the seeker system, fusing performance, and overall evaluation of the performance of the conventional warhead. The HEDI KV will be launched from Launch Complex 37 along the same trajectory as KITE 1 (Figure 1-3). Debris will impact along the same trajectory and will be handled in the same manner as debris from KITE 1. An optional fourth flight may be conducted if a further demonstration of KITE 3's performance is necessary and/or as a test of emerging technology. If required, the test will be essentially identical to HEDI KITE 3 with respect to trajectory, debris impact areas, etc.

Two types of cameras, tracking and fixed, will be used during technology testing to monitor all three of the HEDI KITE flight tests at WSMR. The tracking cameras will be placed on existing camera stands along the flight trajectory and will not require new construction. There will be 23 fixed cameras (Figure 1-5) at 11 sites. Construction



HEDI KITE WSMR Flight Tests

Figure 1-4



Typical Camera Stand

Figure 1-5

will be required at the 11 fixed-camera sites shown in Figure 1-6. Of these 11 sites, 7 (Sites 1 through 7) will be manned and thus will require only timing circuits, which will be connected with surface field cables to avoid trenching and land disturbance. The cables will be removed after each test flight. The start and timing circuit cables for three of the four unmanned sites (Sites 10, 11, and 12 in Figure 1-6) will be buried in trenches to the nearest cable head, involving a total of 489 meters (1,604 feet) of trenching. All of this work will take place in previously disturbed areas. The general location of Camera Site 9 is known and, at most, Camera Site 9 will require 489 meters (1,604 feet) of cable trenching in relatively undisturbed terrain. Every effort will be made to minimize the distance of required cable burial.

Trenching will be accomplished with the use of a Caterpillar D7 or D8, which needs a 3-meter (10-foot) right-of-way, but the plow will disturb a path only 46 centimeters (18 inches) wide where the cable is actually laid. The trenching will take approximately 2 days and involve a crew of two. If new camera mounds are required, construction will consist of blading and compacting the contiguous soil to conform to the following approximate dimensions: 4.6 meters (15 feet) wide, 6 meters (20 feet) long, and 1.5 meters (5 feet) high. New rights-of-way (approximately 3 meters [10 feet] wide) may have to be created to access any new camera mounds. However, the rights-of-way, except at Site 9, would be located in areas that have been previously disturbed to some degree.

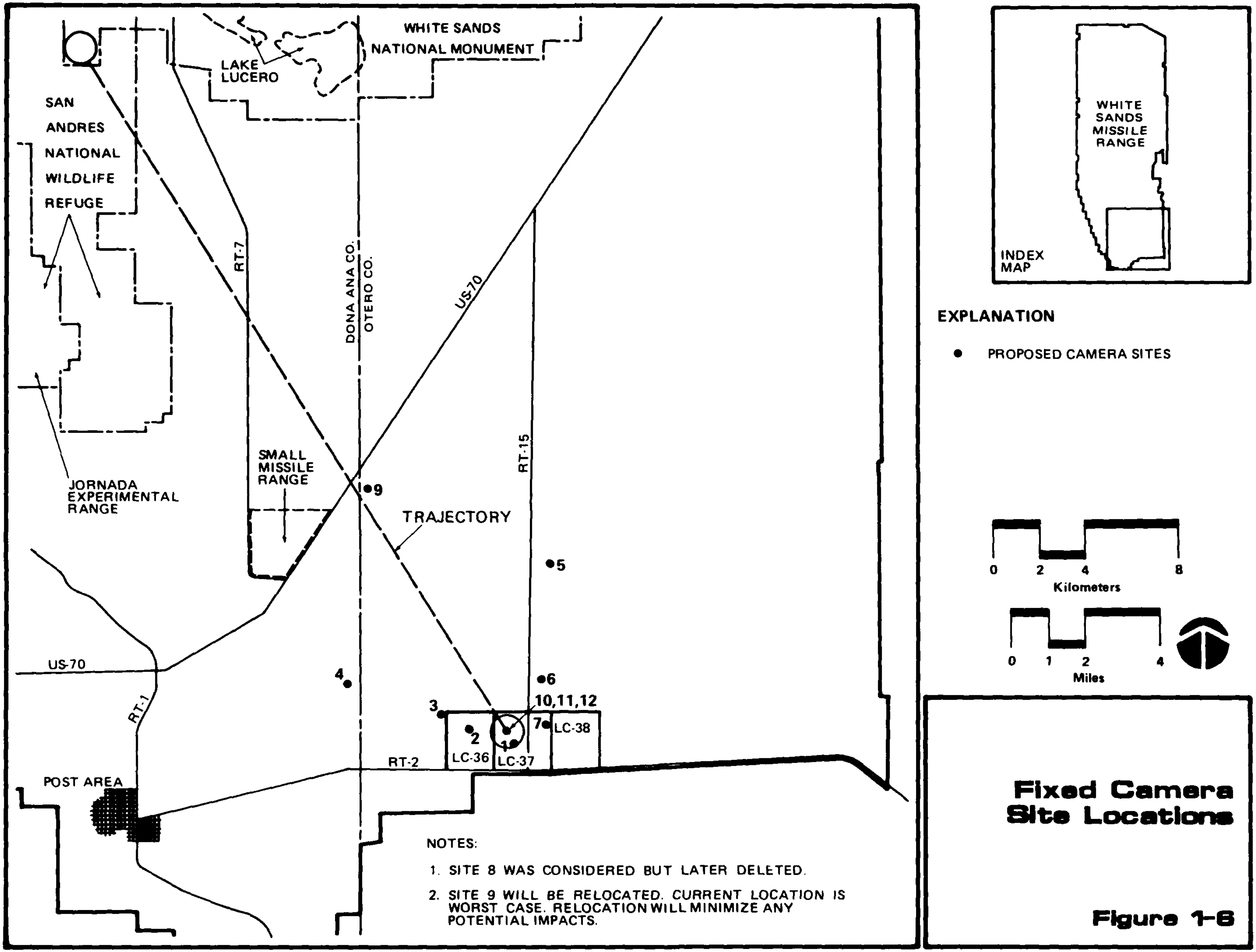
Maximum use will be made of existing camera mounds and stands and existing rights-of-way for access for cable routing. Wherever possible, common use of rights-of-way for access and cable routing will be made. Any new camera mounds will be left in place after the HEDI KITE flight tests to minimize environmental disturbance.

The WSMR Optics Branch, in coordination with the HEDI Project Office, will determine the precise final locations of the fixed camera sites, the vehicle access routes, and the communication cable routes. These locations will be selected with the assistance of a biologist and an archaeologist/cultural resource specialist to avoid disturbance of any sensitive plants and any historic or prehistoric archaeological sites and historic buildings.

To support flight test activities at WSMR, 1 additional full-time contractor individual will be required for the technology testing period, and 30 to 40 additional contractor personnel would be at WSMR on temporary duty from approximately 6 months before until 1 month after each of the HEDI KITE flight tests.

1.3.2 Part II - HEDI XTV

The HEDI XTV part of the HEDI technology test program has as its objective the development and testing of the interceptor hardware and software necessary to demonstrate endoatmospheric, nonnuclear kill of strategic RVs at near-tactical engagement velocities. The HEDI XTV effort will involve hardware improvements to the KV and development of a new booster to replace the SPRINT booster used in the HEDI KITE tests.



Fixed Camera Site Locations

Figure 1-6

Many of the specific details of HEDI XTV testing are not known at this time, primarily because the exact type of booster to be used has not yet been determined. The type of booster and the locations for booster testing will be determined as a result of the competitive procurement process conducted by the prime contractor to select a booster subcontractor. This selection is expected to be made in early 1990. The discussion of HEDI XTV testing in this document will be programmatic in nature, describing the general nature of activities planned and drawing comparisons to similar activities in the HEDI KITE testing. Further environmental analysis will be conducted as the planning progresses and new information is identified. In those cases where specific details are already available, such as for launch facility construction at USAKA, detailed discussion is provided in this document.

The HEDI XTV test activities can be categorized as analyses, simulations, component/assembly testing, and flight testing. This testing will focus on two specific test protocols conducted at USAKA. These flight tests will involve HEDI XTV launches from Meck Island, USAKA, over a 2-year period beginning in 1993. Flight one will test the ability to safely and accurately launch the new booster vehicle. Flight two will also test the ability to track and home in on a target vehicle at near-tactical velocities.

1.3.2.1 Analyses

Analysis activities for the HEDI XTV effort are similar to those previously described for HEDI KITE. They involve evaluation of data generated by other test program activities after each test is conducted. Analyses will be scheduled at all of the locations where HEDI XTV test activities will occur and will be undertaken by the staff that performs the test program activities.

Additionally, the collection of data utilizing the IRIS target tracking system at USAKA to observe targets of opportunity launched out of Vandenberg AFB will be continued during the HEDI XTV effort to support continuing development of HEDI seeker capability. This activity was discussed in Section 1.3.1.1.

1.3.2.2 Simulations

Simulation activities for the HEDI XTV effort are expected to begin in 1991 and will be similar to those planned for HEDI KITE and previously described.

Launch control equipment simulations are expected to be conducted at MDSSC's Huntington Beach installation, as performed for HEDI KITE; launch support equipment simulation tests are anticipated at USAKA in conjunction with the flight tests from Meck Island. Exercise test mission simulations will be scheduled at the NTF at Falcon AFB as part of a larger, overall SDI simulation effort. Again, this activity will be similar to that planned for HEDI KITE and described in Section 1.3.1.2.

Wind tunnel testing of the new booster and/or of the improved KV may be required. Existing facilities at either AEDC or NSWC will be utilized to conduct these tests. Facilities at both of these government installations will be used for HEDI KITE testing and HEDI XTV wind tunnel testing would be similar to that discussed for HEDI KITE components in Section 1.3.1.2.

1.3.2.3 Component/Assembly Tests

Component/assembly fabrication for the HEDI XTV effort is expected to begin in the last quarter of 1991. The scope of the testing may range from tests on single components to those on major subassemblies. In general, the same types of tests will be required as were discussed for HEDI KITE.

The majority of the HEDI XTV component/assembly tests will involve evaluating ground support and launch equipment performance, KV assembly and readiness evaluations, and validating prelaunch intercept data reception. Some of these tests are expected to be conducted at MDSSC's Huntington Beach installation; most will be conducted in conjunction with prelaunch activities at USAKA.

Component/assembly testing of the new booster will include a series of static test firings. Although these tests could be accomplished at several government installations already utilized for test firings, they may also be accomplished at existing facilities of the booster subcontractor. This will be determined at the time of subcontractor selection.

Component/assembly testing will also be required to support use of a target for the second XTV test flight. The location of testing of the target itself will be determined as a result of a U.S. Army Strategic Defense Command (USASDC) competitive procurement for determining a targets contractor. The nature of the tests will be similar to those described for HEDI KITE at Sandia National Laboratories.

The target launch vehicle will be either a MINUTEMAN I launched from Vandenberg AFB, California, or a Strategic Target System (STARS) vehicle launched from the Pacific Missile Range Facility at Barking Sands, Hawaii. If a MINUTEMAN I is used, component assembly tests involving the refurbishment of MINUTEMAN I rocket motors will be required at Hill AFB. If a STARS launch vehicle is used, tests will be required at Hill AFB for the first- and second-stage rocket motors and at either Sandia or Barking Sands for the third-stage rocket motor. In either case, rocket motor refurbishment discussed in Section 1.3.1.3 for HEDI KITE will be representative of the type of activity required. Site-specific activities at the target launch site will be described and analyzed in subsequent environmental documentation once the launch site and type of target launch vehicle is determined.

1.3.2.4 Flight Tests

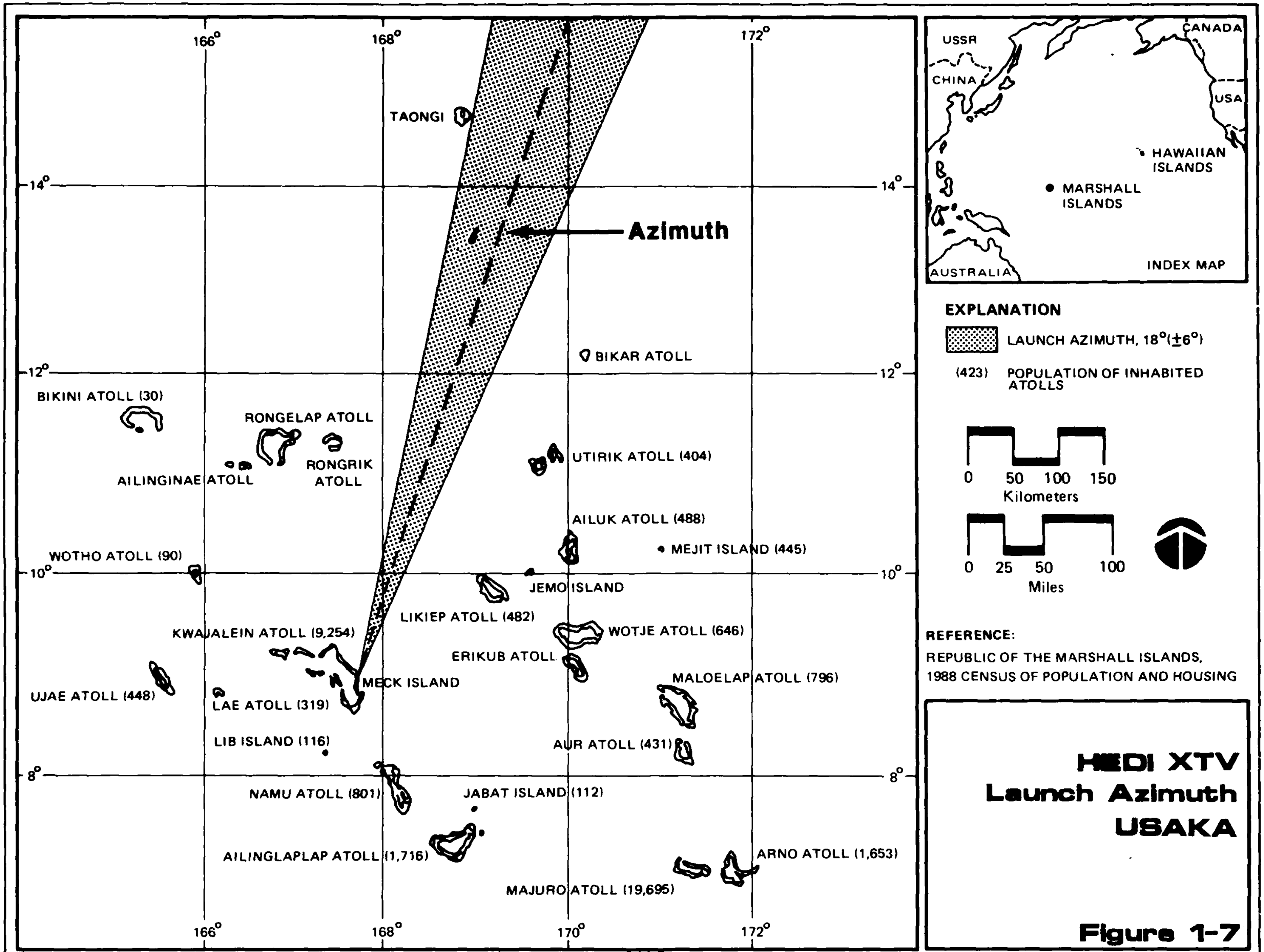
Flight and validation testing is that portion of the HEDI XTV effort that will involve the actual launch and control of the total interceptor at Meck Island, USAKA. The two planned flights for the HEDI XTV effort differ in that the second flight will involve use of a target vehicle while the first flight is basically planned as a test of the new booster. Activities at USAKA will be essentially the same for each flight and will be typical of previous USAKA flight tests.

Missile booster sections and other flight hardware will be transported to USAKA by Military Airlift Command flights into Bucholz Airfield on Kwajalein Island. Materials will be off-loaded from aircraft in controlled areas ("hot spots"), operated according to USAKA safety procedures, and moved on designated roadways to the cargo pier. Barges will be used to transport the missile components to Meck Island, where the components will be stored in the MAB in preparation for each flight. USAKA policies restrict the number and types of boosters that may be stored on Meck Island at any one time. The type of booster to be used for the HEDI XTV effort is expected to use a 1.3 explosive class solid propellant rather than the 1.1 explosive class solid propellant used in earlier SPRINT boosters previously launched from Meck Island. The 1.3 explosive class will be less hazardous than the SPRINT 1.1 explosive class. The propellant and ordnance storage areas utilized will comply with quantity-distance building separation standards. Transportation, storage, assembly, and launch activities will be carried out according to DOD 6055.9-STD, Ammunition and Explosives Safety Standards, and USAKA Regulation 385-75, Explosives Safety. Sites for flight test activities have been reviewed and approved by the DOD Explosives Safety Board (129) based on the 1.1 explosive class propellant. The ESQDs and launch safety procedures will be adequate for the storage, handling, and normal launch operations, and in the unlikely occurrence of a booster conflagration.

Missile assembly, and other prelaunch and launch activities for HEDI XTV flight tests will be typical of the activities routinely conducted for previous USAKA test programs. Missile assembly operations will include lifting missile components onto assembly stands, surface preparation and cleaning using solvents, mechanical assembly of components, and testing. The contractor will be responsible for handling, treatment, storage, and disposal of any waste materials including any hazardous and toxic materials (e.g., explosives, liquid propellants, battery packs, cleaning fluids) utilized at the launch complex, in accordance with applicable USAKA safety standards and applicable Federal environmental standards. Positioning of the assembled missile on the launch pad will be scheduled to minimize exposure to the harsh USAKA environment.

Launch activities will be conducted with strict control of both the immediate area of the launch and the much larger area of Kwajalein Atoll, the broad ocean area (BOA) northeast of the atoll, and the airspace affected by the launch activities. Personnel on Meck Island will either be moved off the island or required to be in designated shelters for protection against the effects of propellant combustion, in accordance with USAKA Regulation 385-4. Commercial aircraft and ocean vessels will be notified in advance of launch activities by Notice to All Airmen (NOTAM) and Notice to Mariners (NOTMAR), respectively, so that alternate routes can be used during the flight tests. This notification affects primarily the BOA where the flight will occur and where spent booster cases and debris are calculated to fall. The launch azimuth for both HEDI XTV test flights is expected to be approximately 18 degrees, as shown in Figure 1-7.

The type of booster to be used for the HEDI XTV effort is expected to be solid propellant. The primary emission products expected in that case would be aluminum oxide, hydrogen chloride, carbon monoxide, carbon dioxide, water, hydrogen, and nitrogen. The primary debris would be expected to consist of steel, titanium, and aluminum fragments, plus spent booster casings.



HEDI XTV
Launch Azimuth
USAKA

Figure 1-7

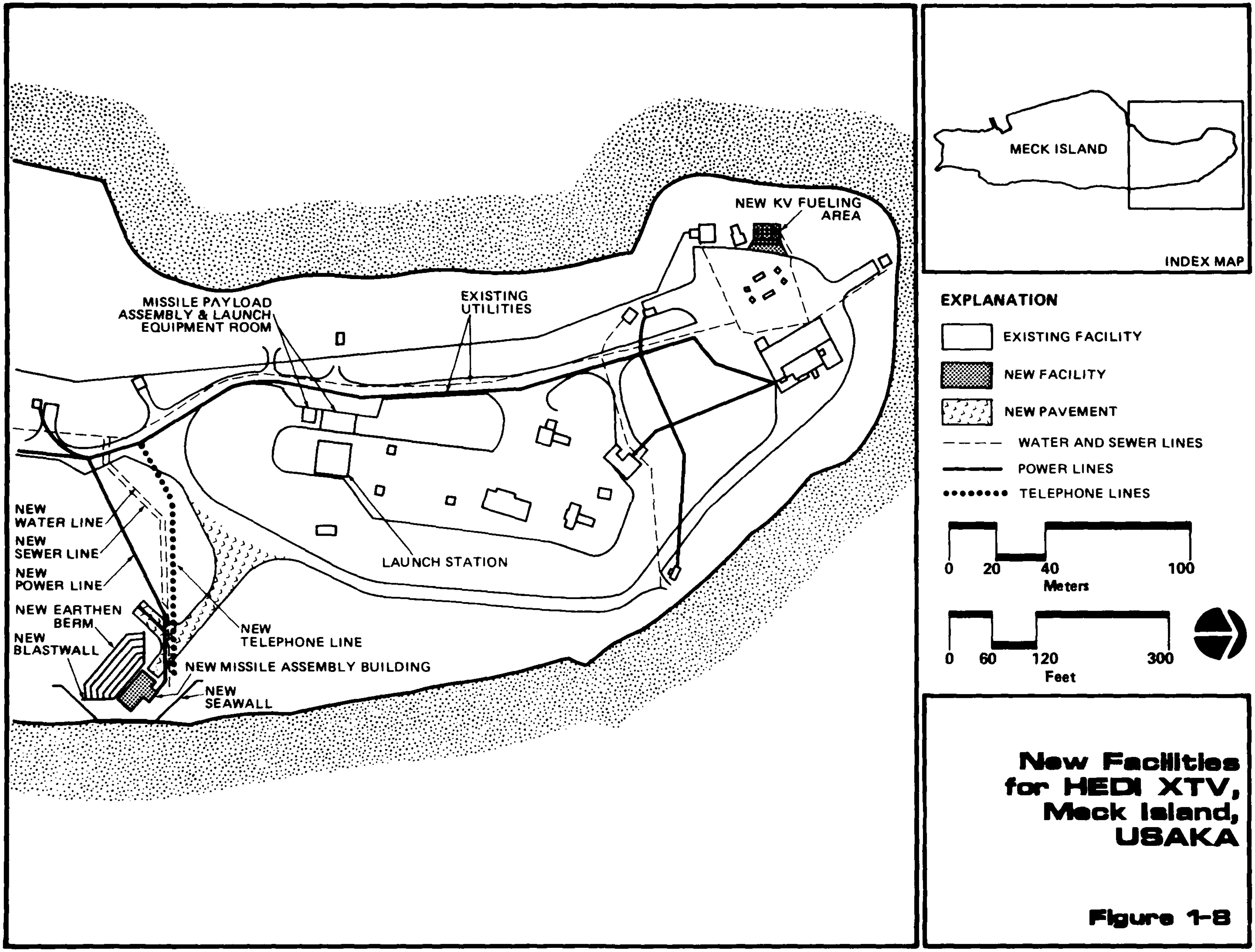
A large variety of sensing, tracking, and safety instrumentation is available at USAKA to support the HEDI XTV flight tests. Instrumentation that would potentially be used includes the GBR to be located at Building 1500 on Kwajalein Island, the USAKA link to the Global Positioning System, cameras located on Meck Island in support of ERIS, meteorological rocket launches from Kwajalein or Omelek islands, and the Kwajalein Range Safety System. All instrumentation utilized that emits electromagnetic energy would be operated within existing USAKA safety standards. The potential use of the GBR to augment USAKA tracking and range safety instrumentation during HEDI XTV launches would require GBR operation below its normal minimum elevation of 2 degrees above the horizontal. This minimum beam elevation was established to ensure safety of personnel from adverse effects of electromagnetic radiation. The operation of GBR with its main beam below the normal minimum elevation does not adversely affect its range safety operation and it has been previously analyzed. The following operational constraints have been imposed for such operation: only the Full-Field-of-View antenna will be used and the radar will operate at a low-duty cycle of no greater than 0.2 percent so that resulting power densities will not exceed permissible exposure limits. Initial indications show that these operating procedures for controlling possible human exposure will reduce any impact of the GBR electromagnetic fields on possible fuel hazards or inadvertent detonation of electroexplosive devices or ordnance.

Full discussion of the potential effects of electromagnetic radiation, safety standards, and an analysis of GBR operations on USAKA are presented in the Ground-Based Radar Environmental Assessment (9), which is incorporated by reference. This EA specifically addressed the potential use of GBR at elevations of less than 2 degrees and concluded with a Finding of No Significant Impact (FNSI).

Construction of facilities on Meck Island to support the HEDI XTV flight tests began in August 1988 and is scheduled for completion in November 1989. The early construction effort was required because safety constraints of other programs launching from Meck Island would affect HEDI construction in later years and because some facilities were planned for joint use with other programs with earlier test schedules. Construction of Meck Island facilities is supported by other environmental documentation, which is described in Section 3.0 and incorporated by reference.

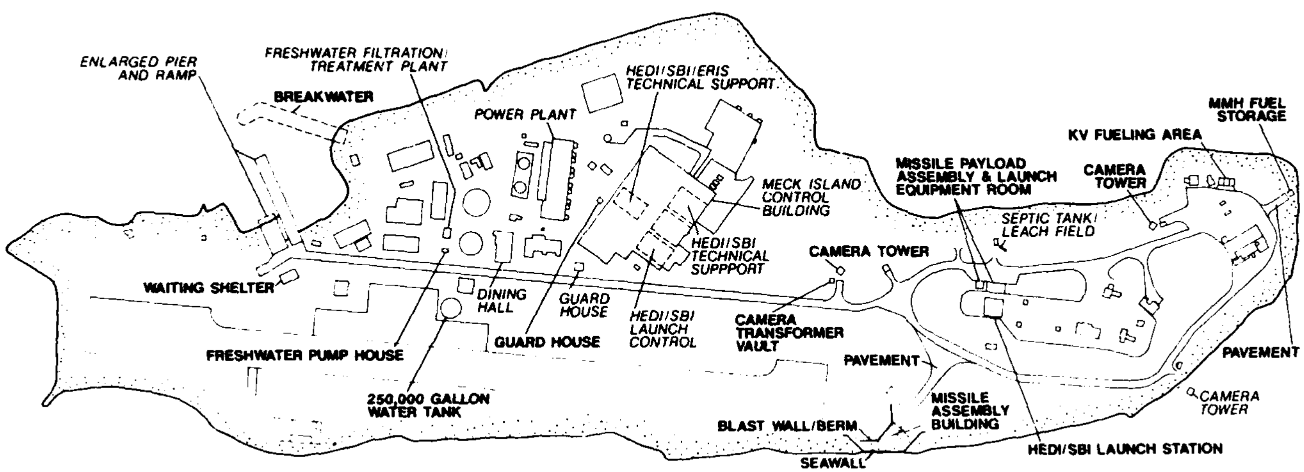
HEDI XTV facilities at Meck Island (Figure 1-8) will be used on an alternate basis with the SBI program. Construction for the HEDI/SBI programs includes a new MAB, modification of an existing launch station (a 1-meter [3-foot]-thick concrete slab in an area now covered by asphalt), a launch equipment room and payload assembly building, and a new KV fueling area. The HEDI/SBI MAB is shielded by a new reinforced concrete blast wall. The site includes a small area of fill on the northeast side of the island and a seawall approximately 76 meters (250 feet) long and 3-5 meters (10-15 feet) high. Extensive renovations at the Meck Island Control Building provide space for HEDI/SBI launch control and the technical support.

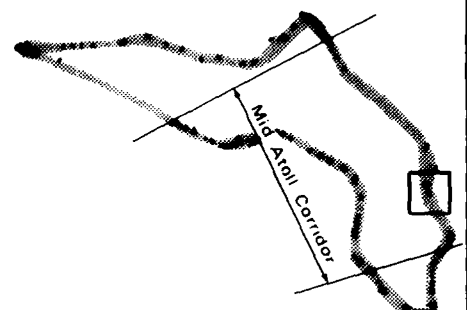
A number of new facilities on Meck Island are being constructed for joint use by the HEDI/SBI and ERIS programs (Figure 1-9). These include a new water storage tank (0.95-million-liter [250,000-gallon] capacity, open concrete) to store rainwater that is collected from the runway catchment area and the roof of the Meck Island Control



New Facilities for HEDI XTV, Meck Island, USAKA

Figure 1-8



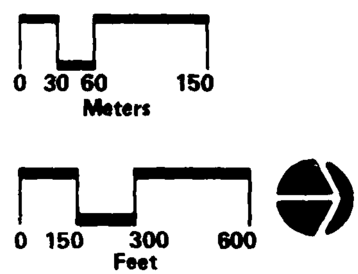


KWAJALEIN ATOLL

EXPLANATION

MMH FUEL STORAGE NEW FACILITIES (BOLD)

GUARD HOUSE RENOVATED FACILITIES (ITALICS)



SDI Construction and Renovation, HEDI-SBI-ERIS Facilities, Meck Island, USAKA

Figure 1-9

Building; a new breakwater, enlarged pier, and waiting shelter ("Small Craft Berthing Facility"); a camera transformer vault; a guardhouse; a freshwater pump house; two camera towers; and a new monomethylhydrazine (MMH) fuel storage building and associated 23-meter (75-foot) asphalt pavement. Support facilities on Meck Island that are undergoing rehabilitation include the dining hall, guardhouse, freshwater filtration/treatment plant, septic tank/leach field systems, and a camera tower.

The Meck Island power plant has been reactivated and renovated. Earlier programs utilizing Meck Island required nine 1,500-kilowatt diesel units; the new programs do not require as much power. Five new 565-kilowatt units have been installed, replacing the existing nine 1,500-kilowatt units.

A new 557-square-meter (6,000-square-foot) warehouse and associated driveway are being constructed on Kwajalein Island just north of Lagoon Road adjacent to Building 1010 (Figure 1-10).

The HEDI XTV activities at USAKA will require an estimated support staff of 56 accompanied personnel and 8 unaccompanied personnel. An additional 25 transient engineers and technicians will be required to support flight tests. All personnel will be housed on Kwajalein Island. An additional 130 family housing units and 400 unaccompanied personnel housing (UPH) units meeting Army housing standards are scheduled for completion in 1992. Many of the 254 trailers, substandard by current Army standards, will be retained to accommodate additional personnel. HEDI XTV activities will not create new jobs available to the Marshallese population.

A 568,000-liter-per-day (150,000-gallon-per-day) desalination plant will be constructed on Kwajalein Island in 1990 to increase the capacity of the freshwater supply provided by the water catchment and lens well systems. The HEDI XTV program will participate in water conservation procedures, continued monitoring, and a wastewater treatment effectiveness study to ensure that the wastewater treatment plant continues to meet effluent standards.

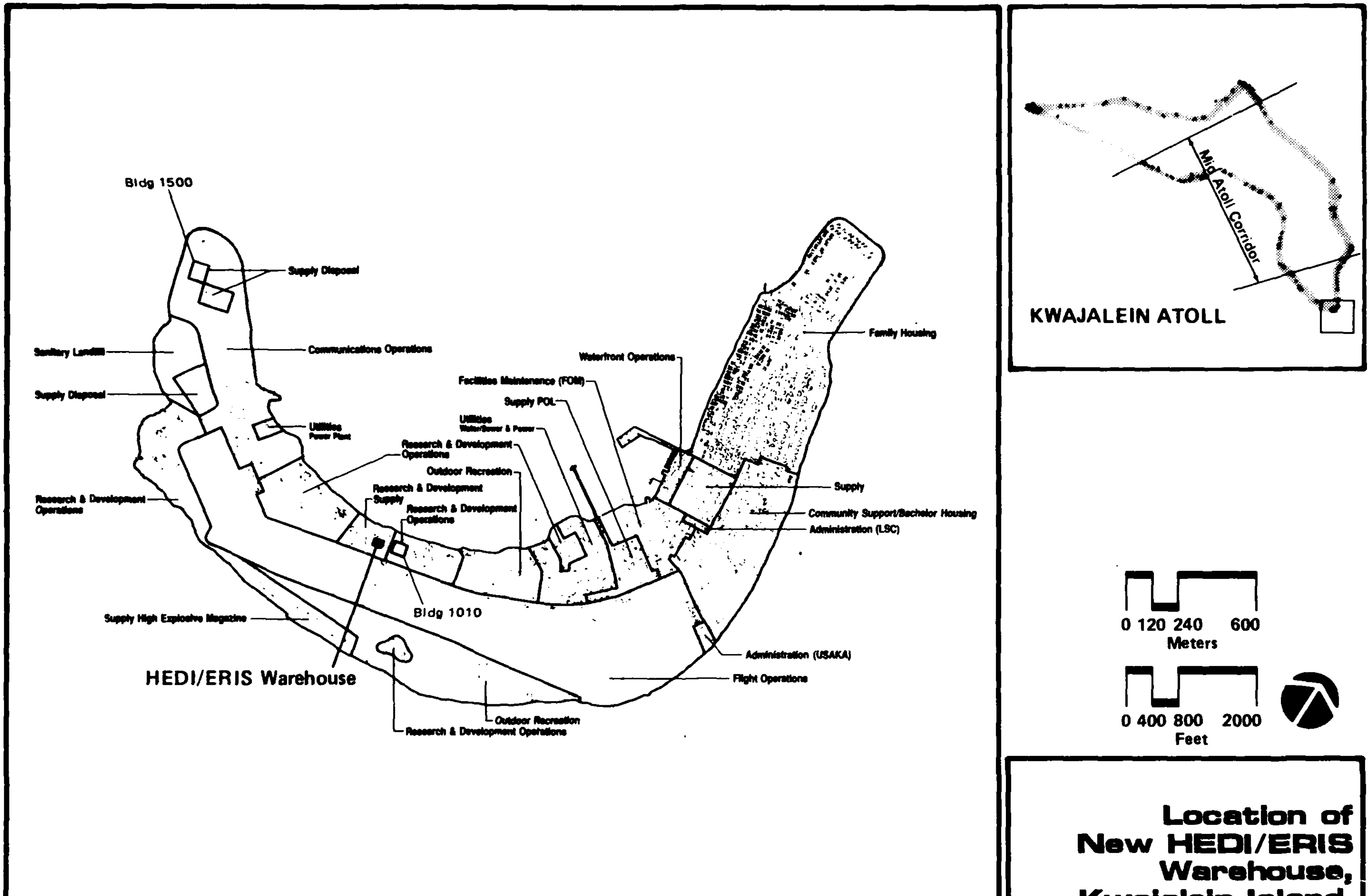
1.4 ALTERNATIVES OTHER THAN THE PROPOSED ACTION

No other alternative locations were considered reasonable for the proposed action because it was desired to maximize use of existing facilities in order to minimize cost and the potential environmental impacts of new construction. Similarly, maximum utilization of targets of opportunity was desired.

MDSSC was selected as a result of the competitive procurement process. They proposed use of their Huntington Beach, California, facility for HEDI KITE testing, because it is routinely utilized for similar fabrication, assembly, and test activities.

AEDC and the NSWC were chosen as locations for wind tunnel testing of flight components and window/forebody cooling, respectively, because of the capabilities and availability of existing facilities and staff routinely engaged in this type of testing.

Hill AFB was chosen as the site of target rocket motor refurbishment to take advantage of ongoing refurbishment programs there.



Reference: US Army Kwajalein Atoll (Draft) Master Plan 1988

Location of New HEDI/ERIS Warehouse, Kwajalein Island, USAKA

Figure 1-10

Falcon AFB was the only reasonable site for simulation activities because of previous SDIO selection of the NTF as the focal point for all SDIO integrated simulations. The selection of Sandia National Laboratories for component/assembly of the target vehicle and SPRINT booster refurbishment was based on the availability of existing facilities and staff routinely utilized for similar activities.

Vandenberg AFB was selected for targets of opportunity and USAKA for IRIS data collection activities based on the ability to satisfy HEDI requirements while taking advantage of existing government programs.

WSMR was selected for the HEDI KITE flight tests oased on three primary factors. First, by utilizing a national test range within the bounds of the Continental United States (CONUS), costs can be significantly reduced. Second, WSMR is the only national test range within the CONUS that possesses adequate range space to perform the HEDI KITE flight tests. Third, WSMR has significant instrumentation capabilities and experience in similar test programs that are unique among CONUS test ranges. Specifically, WSMR optics, telemetry receiving stations, real-time computers, and radars are superior to those found on other test ranges. Additionally, SPRINT missiles have been tested at WSMR in the past, providing valuable experience for testing the HEDI KITE modified SPRINT boosters. Other test programs featuring missile intercepts in similar test configurations have been performed previously at WSMR, and the range also has an established capability to support the target delivery scenarios that are essential to a successful HEDI KITE flight test program. Based on these factors, WSMR was chosen as the most reasonable site for HEDI KITE flight tests.

USAKA was selected for HEDI XTV flight tests based on the requirement for representative target and interceptor trajectories. No CONUS test range has adequate space to accommodate HEDI XTV testing at realistic ranges and with the target representation necessary to achieve HEDI XTV objectives. No other non-CONUS test range has the existing instrumentation, infrastructure, and experience to accommodate HEDI XTV testing. Within USAKA, siting at Meck Island allowed new construction to be minimized by rehabilitation of existing facilities and joint use of new facilities with other programs. Moreover, USAKA is one of only two ranges recognized in the ABM Treaty for the field testing of land-based ABM components and systems. Because HEDI will be tested as an ABM system, the tests must take place at either USAKA or WSMR. For HEDI XTV, USAKA provides the only ABM-recognized range that allows for realistic and safe testing.

1.5 NO-ACTION ALTERNATIVE

The no-action alternative is to continue with present activities without conducting the planned testing activities at this time. Failure to conduct the planned test activities would result in a restructured, delayed, and more costly program. This is not a desirable option, inasmuch as the no-action alternative would preclude the timely evaluation of the HEDI technology and risk the loss of important information required for future decisions regarding the SDS.

2.0 AFFECTED ENVIRONMENT

The test activities of the HEDI technology test program and the installations where they would be conducted were identified in Section 1.0. Section 2.0 describes the environmental setting of each installation in terms of physical and operational characteristics, permit status, and previous environmental documentation. Specific physical characteristics include installation size, support and test facilities, and environmental and public health and safety conditions. Operational characteristics include the socioeconomic variables of staffing, payroll, and housing; the characteristics of the surrounding communities; and the infrastructure characteristics of electricity, solid waste, sewage treatment, transportation, and water supply. Referenced permits are those that relate to air quality, water quality, and hazardous waste. Previous environmental documentation includes records of environmental consideration, EAs, and environmental impact statements (EISs).

For each of the installations that will be used in the program, available literature, such as EAs, EISs, and base master plans, was acquired and data gaps (i.e., questions that could not be answered from the literature) were identified. To fill the data gaps, all of the installations were visited, and follow-up telephone calls were made to installation personnel. Information collected through site visits and telephone interviews, and other appropriate references, are presented in Section 7.0, References. The following subsections describe the environmental setting of each of the installations where technology test activities are planned.

Ten broad environmental attributes were considered and addressed to provide a context for understanding the potential effects of the proposed action and to provide a basis for assessing the significance of any potential impacts. The data presented are commensurate with the importance of the potential impacts, with attention focused on the key issues. These ten areas of environmental consideration are (1) air quality, (2) biological resources, (3) cultural resources, (4) hazardous waste, (5) infrastructure, (6) land use, (7) noise, (8) public health and safety, (9) socioeconomics, and (10) water quality.

Several of these broad environmental attributes are regulated by Federal and/or state environmental statutes, many of which specifically set standards (see Appendix A). These Federal- and/or state-mandated standards provide a benchmark that aids in determining the significance of environmental impacts under NEPA. Where mandated standards do not exist, qualitative evaluations were made. The ten areas of environmental consideration are discussed briefly below.

Air Quality - Air quality at each installation was reviewed with particular attention paid to background ambient air quality compared with the primary National Ambient Air Quality Standards and whether the installation was located in an attainment or nonattainment area. Existing air emissions sources at each installation were evaluated to determine compliance with the emissions standards contained in the associated state implementation plan. Possible new air emissions sources, such as those associated with expansion of facilities and new construction, were evaluated using the New Source Performance Standards (see Appendix A).

Biological Resources - Existing flora and fauna at each installation were reviewed, with particular attention paid to the existence of any protected species and Federal- or state-listed threatened or endangered species, to determine if there were any significant biological resources in proximity to the facilities that could be affected by test activities.

Cultural Resources - Existing cultural and historical resources at each installation were reviewed, with particular attention paid to known National Register of Historic Places sites and Native American sacred sites, to determine if there were any significant cultural resources in proximity to the facilities that could be affected by test activities.

Hazardous Waste - Existing hazardous waste management practices and the record of compliance were reviewed to determine the installation's capability to handle any additional wastes and to determine any potential problems with hazardous waste use, handling, treatment, or disposal.

Infrastructure - Electricity, solid waste, sewage treatment, water supply, and transportation are examples of infrastructure requirements that ultimately limit the capacity for growth. Capacity and current demand were examined for each installation.

Land Use - Base master plans, environmental management plans, and other documentation were reviewed to determine any known conflicts between existing facilities and any planned expansions that could be affected by HEDI test activities.

Noise - Existing environmental documentation was reviewed to determine if noise concerns were an issue at any of the installations.

Public Health and Safety - Existing environmental documents were reviewed to determine if public health and safety concerns were an issue at any of the installations.

Socioeconomics - Key socioeconomic indicators (population, housing, employment, and income data) for the supporting region of each installation were examined to evaluate the potential consequences of increased population, expenditures, and employment.

Water Quality - Water quality concerns at each location were identified and the installation's record of compliance with permits was examined.

The following sections present a brief description of each installation where HEDI technology test activities are planned. The text emphasizes the affected environment, i.e., the nature of the environmental characteristics that may be changed by the proposed action, and includes detailed information only where it is relevant to understanding the potential impacts. Appendix B contains tables with more detailed descriptions of each installation's physical and operational characteristics, permit status, and additional environmental information.

2.1 McDONNELL DOUGLAS SPACE SYSTEMS COMPANY

MDSSC's (formerly McDonnell Douglas Astronautics Company) Huntington Beach installation is in Orange County, California, in the Los Angeles metropolitan area, just southeast of Long Beach (Figure 2-1). This installation is a commercial/industrial operation that existed at the time the HEDI contract was awarded. Approximately 10,000 people are employed at the installation, some 230 of whom will be involved in HEDI activities (26). The facilities in which these 230 individuals will work already exist, support many other activities (governmental and commercial), and require no modification or refurbishment for the HEDI activities.

This installation possesses all applicable Federal, state, and local permits and authorizations necessary for installation operation as part of the conditions of the current contract in support of the HEDI technology test program (24). There are no known Federal- or state-listed threatened or endangered species, and there are no recorded historic or archaeological sites. Installation infrastructure is supported by the adjacent municipalities and demand is well within capacity. Land use is in accordance with Huntington Beach's zoning plan. Noise is not an issue, and no public health and safety issues have been identified (27).

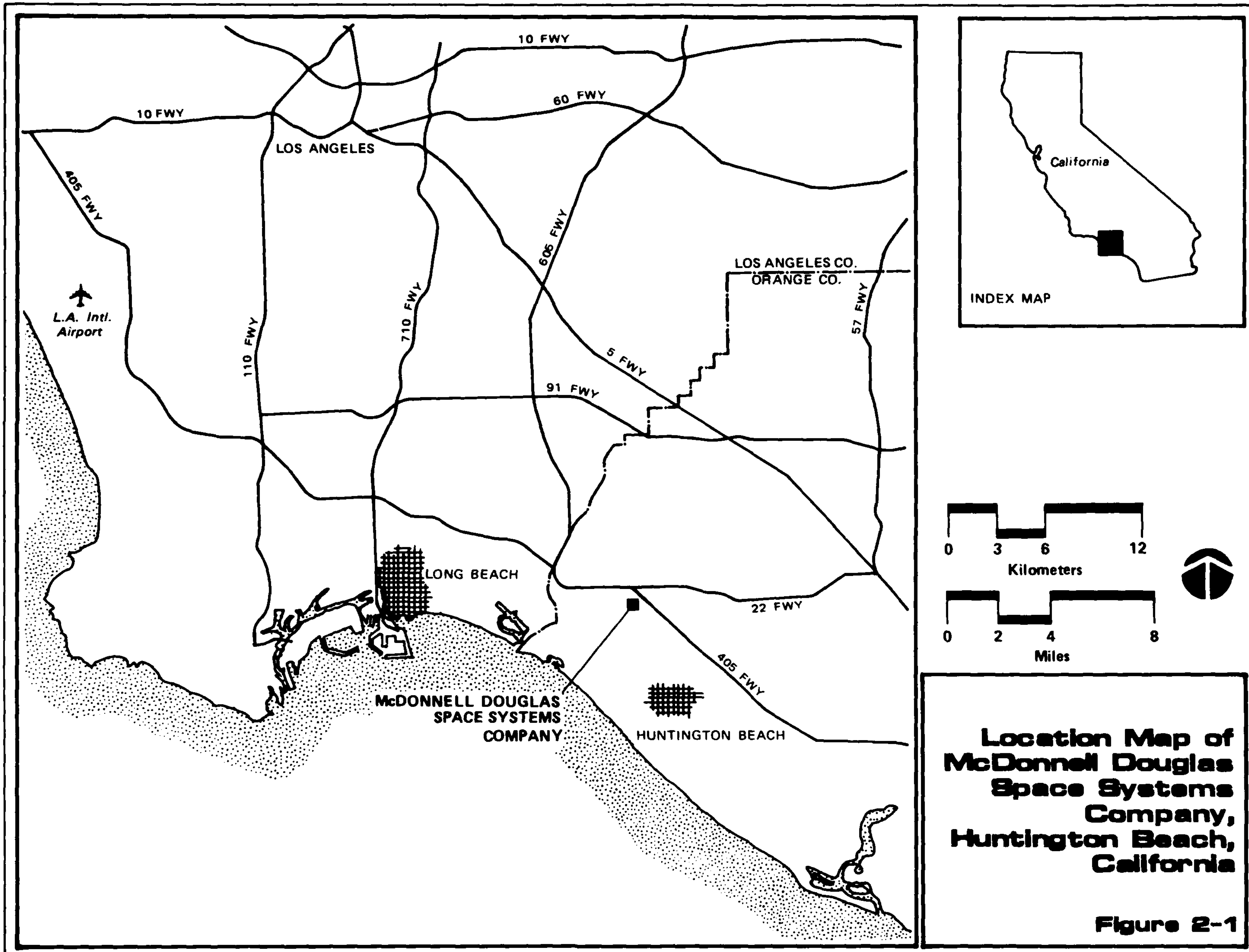
2.2 ARNOLD ENGINEERING DEVELOPMENT CENTER

AEDC at Arnold AFB is approximately 96 kilometers (60 miles) southeast of Nashville, Tennessee, and approximately 11 kilometers (7 miles) southeast of Manchester, Tennessee (Figure 2-2). AEDC is the nation's largest complex of wind tunnels, jet and rocket engine test cells, space simulation chambers, and hyperballistic ranges. The wind tunnels are routinely used to test missile components and assemblies in an environment that simulates high-speed flight (32). A description of AEDC and its environment is presented in Table B-1, Appendix B.

AEDC complies with Federal standards for air quality, water quality, and hazardous waste (33, 37, 40, 46, 48). Three Federally listed endangered species exist on the base, and there are two designated wetland areas (19, 40). No significant cultural resources have been identified (29, 33, 40, 41, 47). Installation infrastructure demands are all within capacity (29, 35, 36, 43, 47) and land use is in accordance with the Base Master Plan (33). Although sometimes in excess of safety levels within the test areas, noise is appropriately confined and mitigated (29, 33, 37, 40); no potentially significant public health and safety issues have been identified. The surrounding communities in Coffee and Franklin counties have a combined population of 74,000 (6, 8).

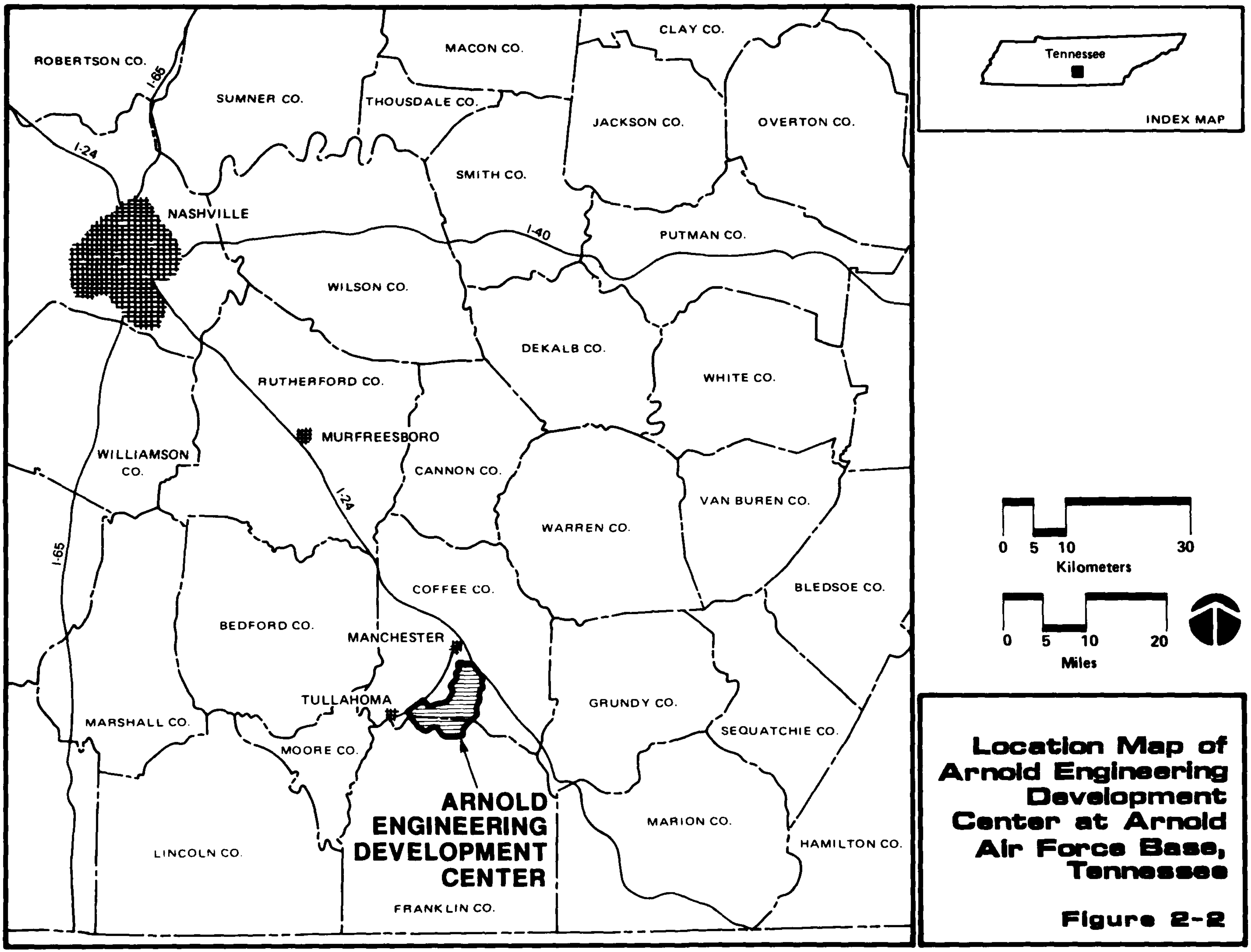
2.3 HILL AIR FORCE BASE

Hill AFB is 8 kilometers (5 miles) south of Ogden, Utah (Figure 2-3). The base furnishes logistics support and system management for MINUTEMAN and PEACEKEEPER



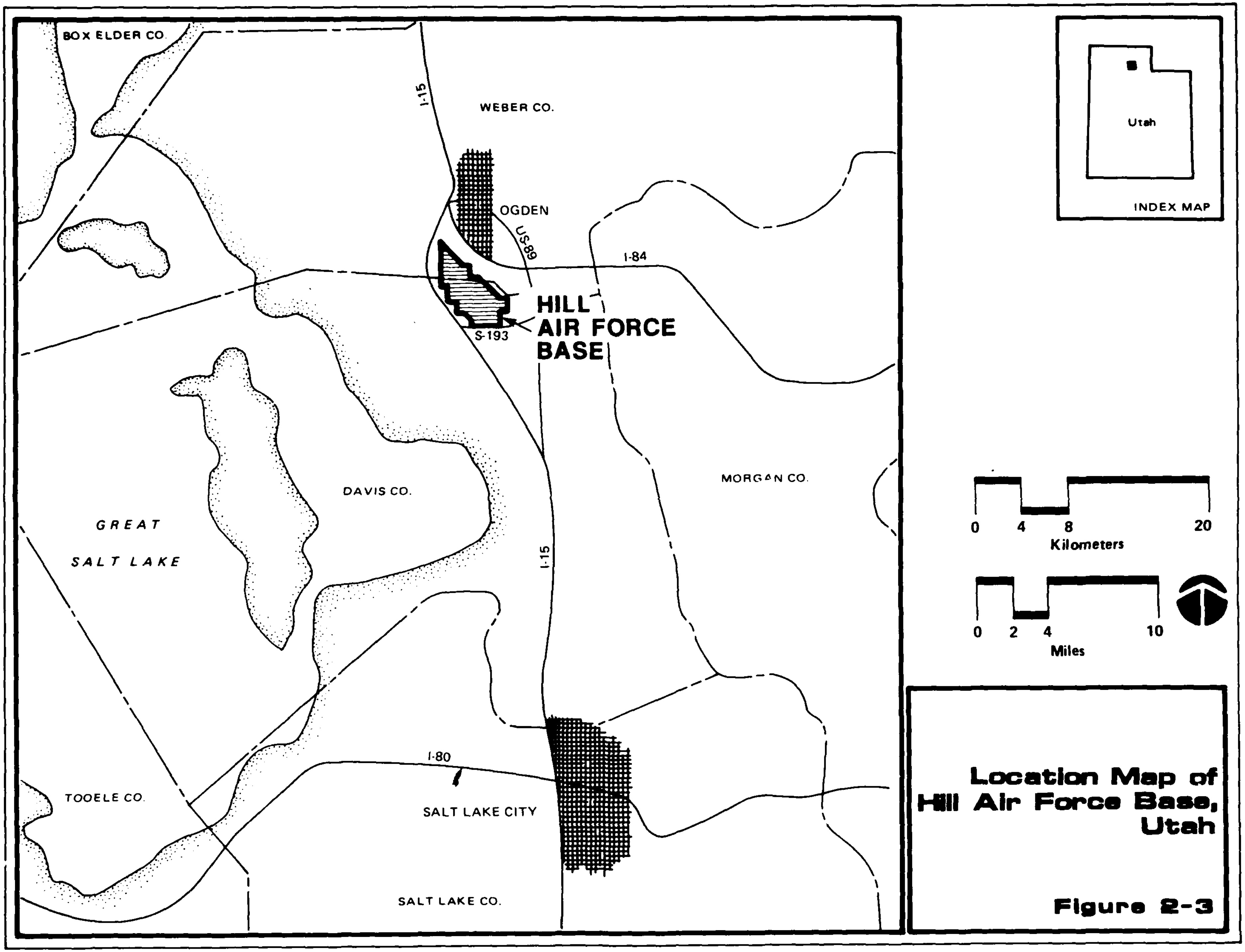
Location Map of McDonnell Douglas Space Systems Company, Huntington Beach, California

Figure 2-1



Location Map of Arnold Engineering Development Center at Arnold Air Force Base, Tennessee

Figure 2-2



Location Map of Hill Air Force Base, Utah

Figure 2-3

missiles, laser and electro-optical guided bombs, F-4 and F-16 aircraft, air munitions, aircraft landing gear, and photographic and aerospace training equipment. The base also manages the Utah Test and Training Range (2). A description of Hill AFB and its environment is presented in Table B-2, Appendix B.

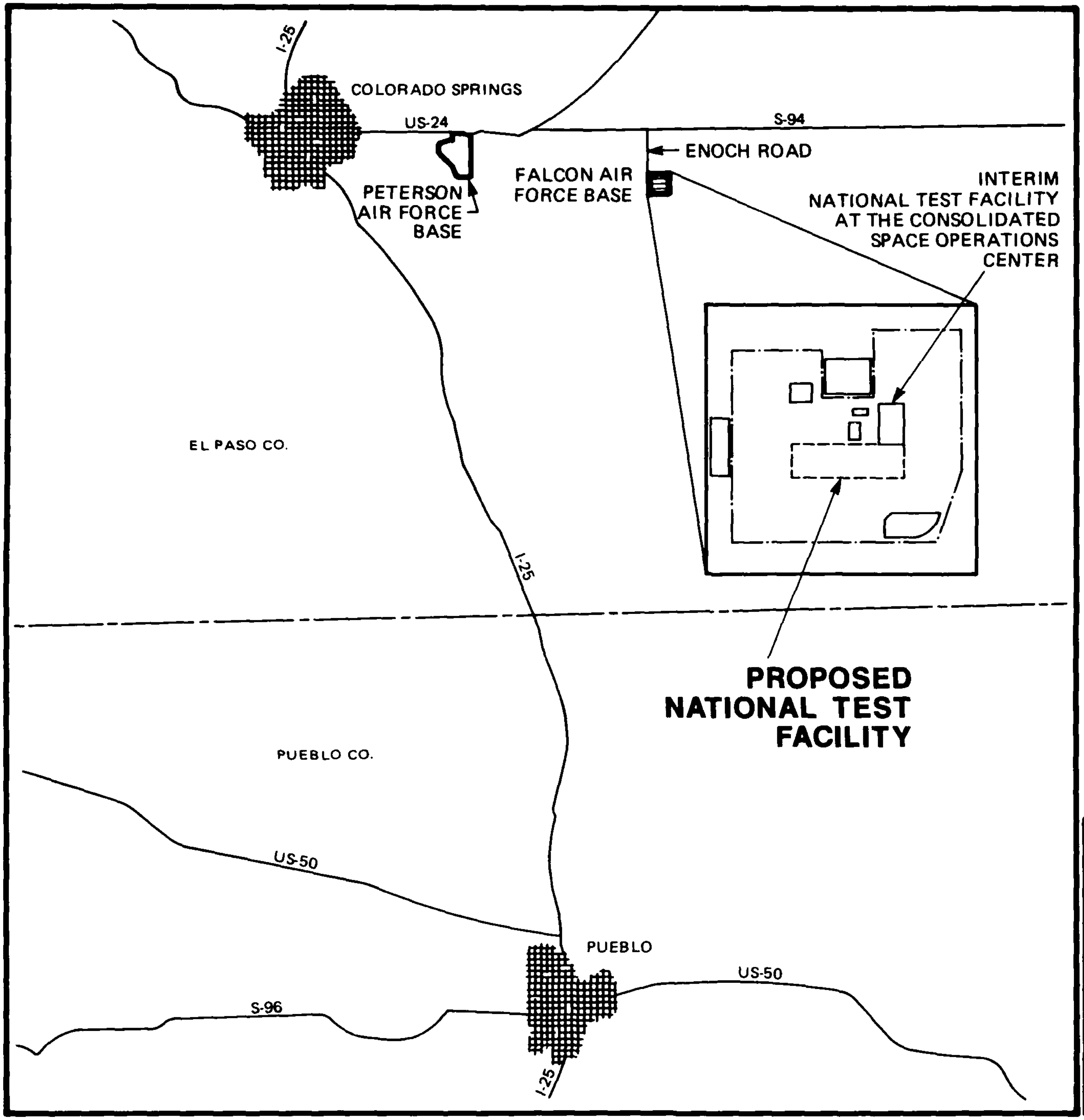
The installation complies with Federal standards for water quality and air quality, although Hill AFB is located within a nonattainment area for ozone and carbon monoxide (61, 71). The base was placed on the National Priorities List on October 9, 1984, for potential threat of hazardous substances (65). The listing currently cites ten areas of hazardous waste disposal that cover a total area of 22 hectares (54 acres). The base is participating in the Installation Restoration Program (IRP), which identifies, evaluates, and controls the migration of hazardous contaminants from hazardous waste sites (64, 65). Two Federally listed threatened and two endangered species occur in the area; one of the endangered species (the bald eagle) has been sighted at the base (55, 70). No known cultural resources exist (71). Facility infrastructure is generally adequate (66, 70, 71), and land use is in accordance with the Base Master Plan (52). Noise levels are consistent with air base operations with specified attenuation goals (52, 68); no significant public health and safety issues have been identified. The surrounding communities in Davis and Weber counties have a combined population of 340,000 (6, 7).

2.4 NATIONAL TEST FACILITY, FALCON AIR FORCE BASE

The NTF is under construction at Falcon AFB (78) in El Paso County, Colorado, about 19 kilometers (12 miles) east of Colorado Springs (Figure 2-4). An interim facility is operating out of the existing Consolidated Space Operations Center, also at Falcon AFB. The present mission of the Consolidated Space Operations Center is to provide support for military space operations through communications centralization and data link operations (12).

The Consolidated Space Operations Center was built to house the Satellite Operations Center and the Space Shuttle Operations Center (76). The former performs command, control, and communications service functions for orbiting spacecraft. The latter conducts DOD Shuttle flight planning, readiness, and control functions. The interim NTF is located at the Consolidated Space Operations Center because adequate support facilities are available (77). The permanent location of the NTF will be next to the Consolidated Space Operations Center; construction should be complete in late 1989 (75). A description of the NTF, Falcon AFB, and its environment is presented in Table B-3, Appendix B.

Falcon AFB, including the Consolidated Space Operations Center and the NTF, is in compliance with Federal standards for air quality, water quality, and hazardous waste (75, 78, 79, 80, 82). No known threatened or endangered species exist on the base and no significant cultural resources have been identified (78). Installation infrastructure demands overall are within capacity (75, 78, 79, 82) and no land-use or zoning conflict issues have been identified. Noise levels are within acceptable limits, and no significant public health and safety issues have been raised (75 78,



Location Map of National Test Facility at Falcon Air Force Base, Colorado

Figure 2-4

80). The surrounding communities in El Paso County have a combined population of 380,000 (6,7).

2.5 NAVAL SURFACE WARFARE CENTER

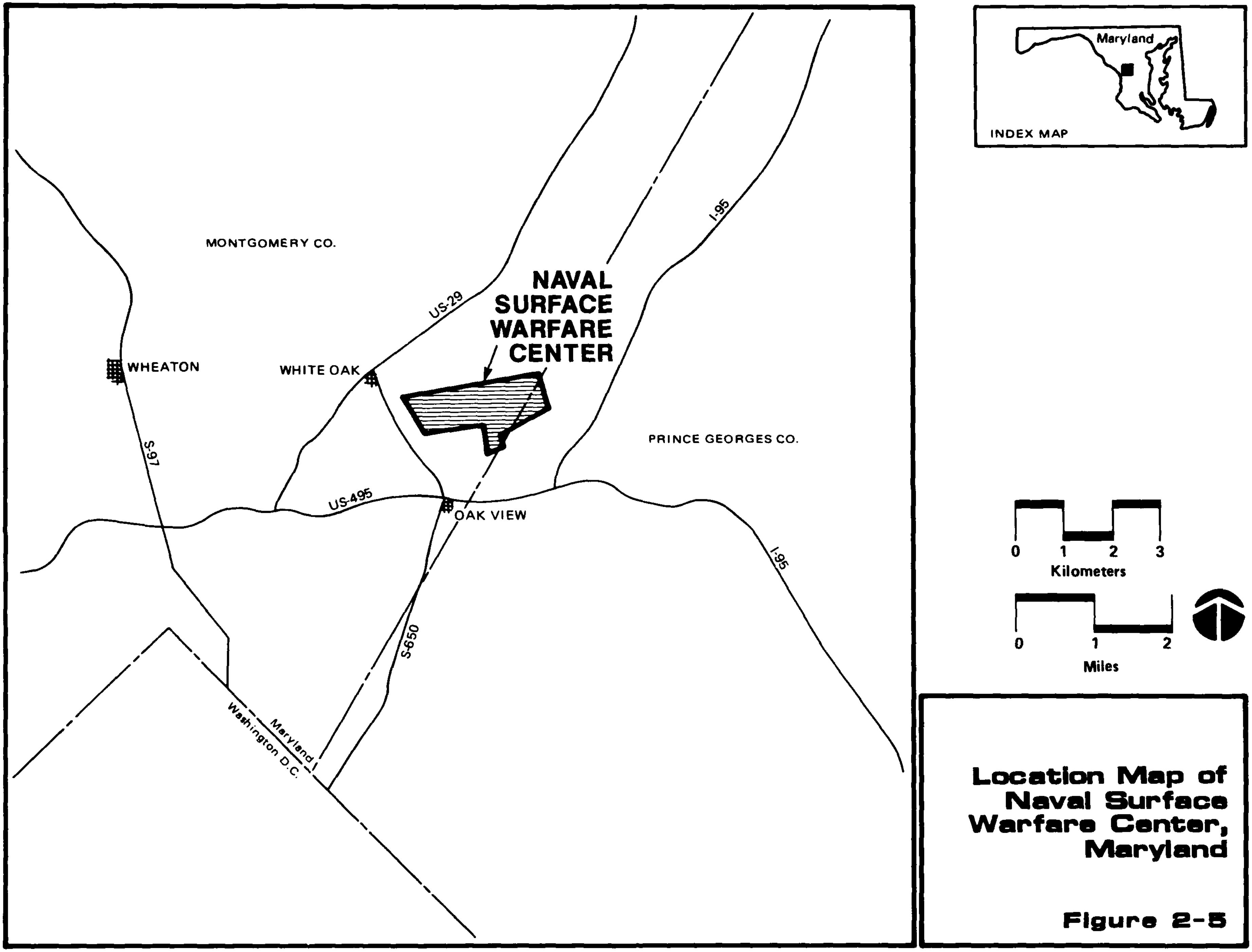
The NSWC is in White Oak, Maryland, just north of Washington, DC (Figure 2-5). The center provides technical support for ship combat systems, ordnance, naval mines, and strategic systems. In developing and acquiring combat systems with their sensors, weapons, and control subsystems, the center uses a diverse, complex mix of facilities to support research and development projects (88). A description of the NSWC and its environment is presented in Table B-4, Appendix B.

The NSWC complies with Federal standards for air quality, water quality, and hazardous waste (90, 94, 99, 100). There are no known Federal- or state-listed threatened or endangered species, and there are no recorded historic or archaeological sites (104). Installation infrastructure is supported by the adjacent municipalities and demand is well within capacity (87, 94, 96); land use is in accordance with the Base Master Plan (93). Noise is not an issue because testing areas are dispersed and buffered by a thick hardwood forest (104); no public health and safety issues have been identified (91). The surrounding communities in the metropolitan area have a combined population in excess of 3 million (6, 8).

2.6 SANDIA NATIONAL LABORATORIES

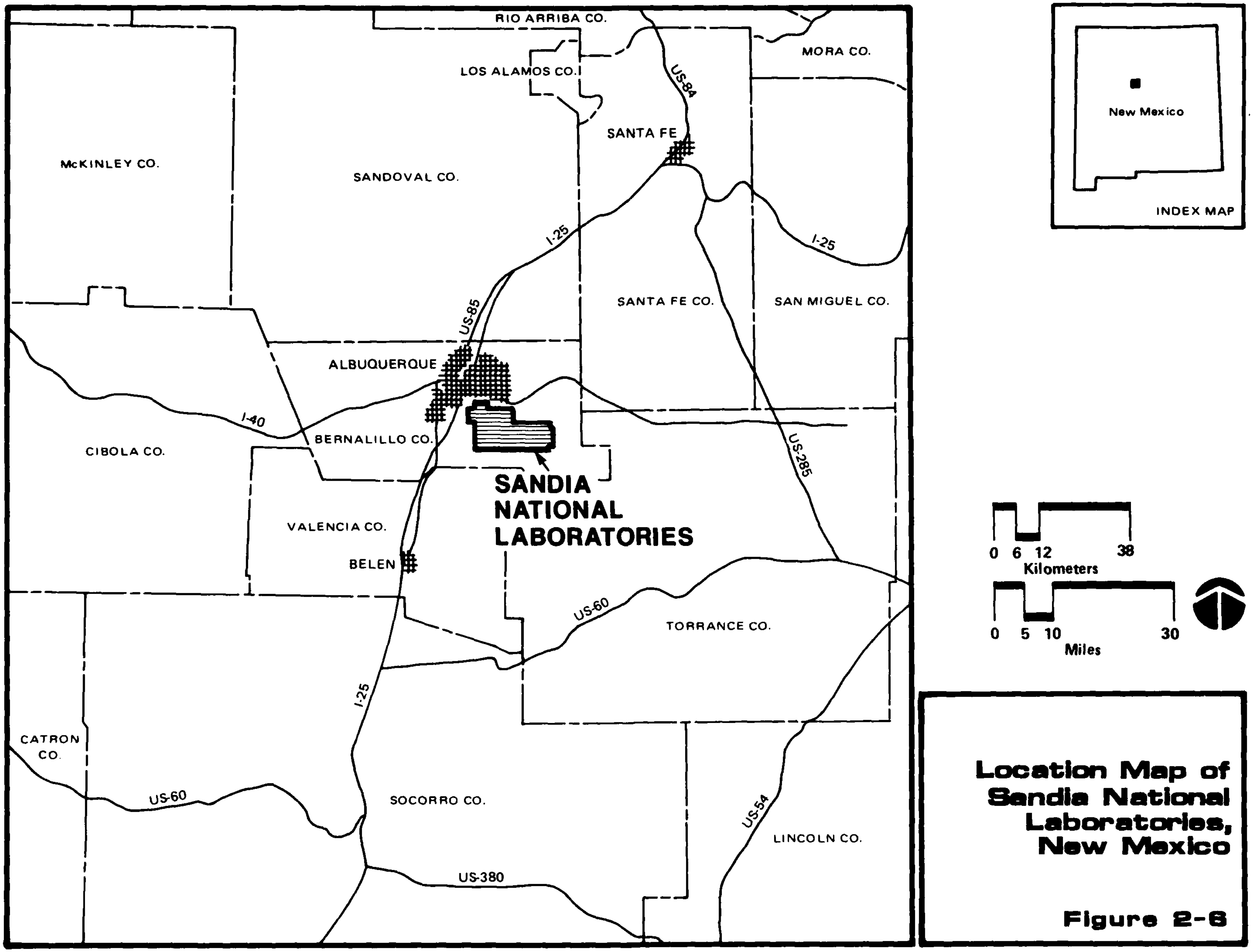
The Sandia National Laboratories is on Kirtland AFB, adjacent to and south and east of Albuquerque, New Mexico (Figure 2-6). The laboratory facilities comprise five technical areas where research and development of weapons systems, limited assembly of weapons system components, and other related activities are conducted (110). A description of Sandia National Laboratories and its immediate environment is presented in Table B-5, Appendix B.

Sandia National Laboratories complies with Federal standards for water quality, hazardous waste, and air quality, although the installation is located within a nonattainment area for carbon monoxide (108, 110, 121). No threatened or endangered species or cultural resources are known to exist on the installation (107, 108, 117). Infrastructure demands are within capacity (107, 108, 110, 116, 118, 123) The installation has no noise problems, but the potential for fire, explosions, release of toxic and radiological materials, aircraft crashes, electrical failures, and high-power microwave emissions has been identified as a public health and safety issue at Sandia National Laboratories (107) The surrounding communities in Bernalillo County have a combined population of 475,000 (6,7).



Location Map of Naval Surface Warfare Center, Maryland

Figure 2-5



Location Map of Sandia National Laboratories, New Mexico

Figure 2-6

2.7 U.S. ARMY KWAJALEIN ATOLL

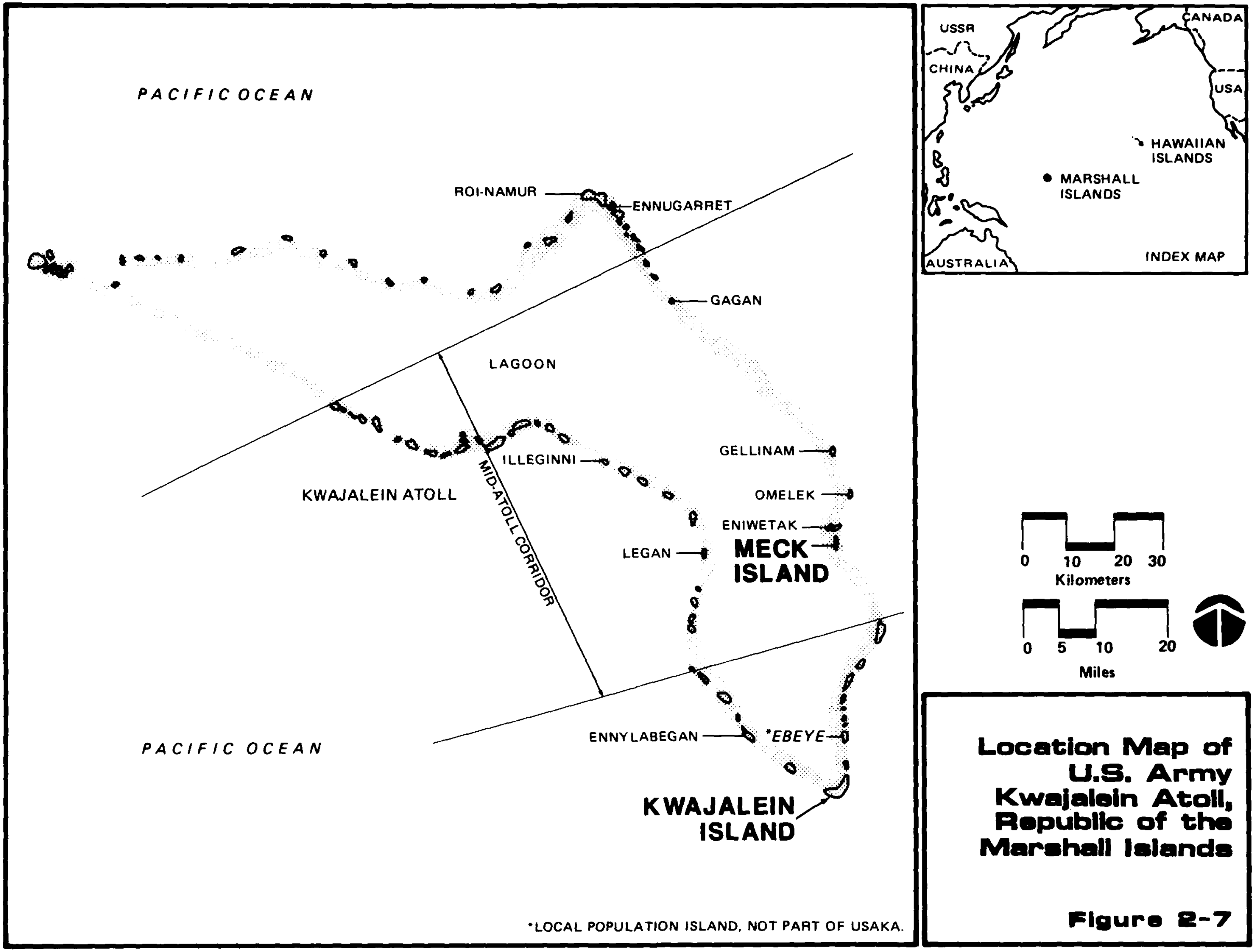
Kwajalein Atoll is within the Ralik Chain in the western part of the RMI, in the west-central Pacific Ocean southwest of Hawaii (Figure 2-7). The Marshall Islands were previously administered by the United States under a strategic trust established by the United Nations (138). The Compact of Free Association between the United States and the RMI (U.S. Public Law 99-239) was bilaterally implemented by the signatories on October 21, 1986. The Compact created the sovereign nation of the RMI. Additionally, the Compact provides, in Section 161, that the United States, in the conduct of its activities in the RMI, will in some cases comply with standards substantively similar to those set forth in certain environmental laws, in particular, the Endangered Species Act, Clean Air Act, Clean Water Act, Ocean Dumping Act, Toxic Substances Control Act, and the Resource Conservation and Recovery Act (RCRA).

Kwajalein Atoll consists of a very large interior lagoon (2,850 square kilometers [1,100 square miles]) surrounded by approximately 100 component islands/islets. USAKA includes 11 leased islands (Kwajalein, Roi-Namur, Ennylabegan, Meck, Gagan, Gellinam, Omelek, Eniwetak, Legan, Ennugarret, and Illeginni) and a Mid-Atoll Corridor (Figure 2-7). This corridor and the islands/islets it includes have certain restrictions on access during range up-time for safety reasons. All USAKA-leased islands, except Ennugarret, have facilities on them. U.S. citizen populations are located on Kwajalein and Roi-Namur islands. Marshallese resident populations are located on several islands within the atoll; however, all are outside the Mid-Atoll Corridor.

The primary mission of USAKA is to support missile flight testing for DOD research and development efforts. Technical facilities on USAKA include multiple launch facilities and numerous supporting elements, such as tracking radar, optical instrumentation, satellite communications, and telemetry stations (139). A description of the installation and its environment is presented in Table B-6, Appendix B.

Air quality is currently not a problem because of the constant tradewinds, the island's low profile, and the few sources of air pollutants. Sources of air pollutants include the small number of motor vehicles, power plants, aircraft operations, missile launches, and waste incineration. Estimates show localized problems in the vicinity of the power plants and the burn pits on Kwajalein Island.

One Federally listed endangered species, the hawksbill turtle, one threatened species, the green sea turtle, and one rare species, the giant clam, have been observed in Kwajalein Atoll (172). In compliance with the Fish and Wildlife Coordination Act and the Endangered Species Act, the activities at USAKA have been coordinated with Federal agencies including the National Marine Fisheries Service (see Appendix C). There are some known prehistoric sites on Kwajalein Island, and the original island (excluding 83 hectares [205 acres] of added fill) is listed as a World War II battlefield on the National Register of Historic Places (145, 147, 155). The Kwajalein Battlefield is, as well, a National Historic Landmark (144).



Location Map of U.S. Army Kwajalein Atoll, Republic of the Marshall Islands

Figure 2-7

Current USAKA solid and hazardous waste-handling practices are deficient in some areas. Studies have been initiated to assess waste management practices. A Waste Management Plan is being prepared for USAKA and a draft of the Present Practices and Corrective Actions Report has been issued. Once the waste management plan is completed, it will be one of several instruments used to bring USAKA into compliance (142).

The installation infrastructure demands of both Kwajalein and Meck islands are within capacity (130, 139, 155, 172, 187, 191), except for wastewater treatment on Kwajalein Island. The wastewater treatment plant on Kwajalein Island is currently operating near hydraulic capacity but is meeting required effluent standards. Land use is in accordance with the installation's Draft Base Master Plan (155).

The principal existing noise sources on Kwajalein Island are aircraft operations and power plant operations, particularly the diesel engine generators of Power Plant No. 1, which are not equipped with exhaust silencers. Similarly, the principal noise sources on Meck Island are the diesel engine generators and helicopters. Noise is generally not a problem except in the vicinity of the power plant on Kwajalein Island.

Public health and safety hazards have been identified for Kwajalein and Meck islands, and include explosive storage and launch facilities, the electronic environment (radio frequency [RF] radiation), and aircraft zones for Kwajalein Island (155); and facility separation distances for Meck Island.

In early data contacts and during the April 1989 site visit, potential concerns were identified regarding HEDI's effect on the marine biological resources off Meck Island, cultural resources on Kwajalein Island, water supply and wastewater treatment on Kwajalein Island, and housing on Kwajalein Island. Consequently, additional background information regarding these topics is presented in the following sections.

2.7.1 Biological Resources (Marine)

Meck Island is a heavily disturbed, 22.3-hectare (55-acre) island on the lower windward perimeter of Kwajalein Atoll, bordered by Eniwetak Passage to the north and shallow rubble flats to the south. The island was relatively undisturbed until the period between 1964 and 1969, when it was completely graded. Using dredged coral, 7.3 hectares (18 acres) of landfill were created for runway and seawall construction. Most of the island is bordered by seawalls constructed of reef caprock limestone and concrete debris.

The lagoon intertidal and subtidal zones, including the lagoon terrace and slope, have been completely altered by past dredging, filling, dumping of surplus equipment, and seawall construction activities. Areas not destroyed by dredging or filling were nearly destroyed as a result of dredging-induced sedimentation and siltation. The only shallow marine areas around Meck Island that have not been extensively altered, or have at least recovered to a great extent, are at the north and south ends of the island. However, the lagoon waters abutting the metal and concrete scrap dump at the extreme south side of the island also show evidence of biological disturbance. Both areas are shallow intertidal reef flat but have different exposures and wave energy (156).

Water quality parameters measured in April 1989 were within the normal range for Kwajalein Atoll. Lagoon and ocean water temperatures averaged 28.9 degrees C (84 degrees F) (Table D-5, Appendix D), salinity about 33.4 parts per thousand, and dissolved oxygen between 6.8 and 8.9 parts per million. The warmest water temperature reading, 33.4 degrees C (92.1 degrees F), was recorded in isolated tide pools on the seaward reef flat during low tide. Sea turtles, although known to occur widely throughout Kwajalein Atoll, were not observed in the vicinity of Meck Island.

Lagoon - The lagoon side of Meck Island consists of a harbor near the southern end, a large fill area in the central portion that has many facilities, and a man-made sand beach near the northern end. The harbor is a dredged area with a cargo/personnel pier, a marine ramp, and a new breakwater. The entire harbor basin is dominated by rock, coral rubble, and, in places, a loose, unconsolidated silt and sand bottom. Except for the man-made sand beach and harbor, the entire lagoon shoreline is riprap (156).

As observed in April 1989, the algal community of the harbor basin was composed of patchy, silt-laden growths of green algae (Halimeda opuntia), brown algae (Ralfsia sp.), and one species of an unidentified blue-green algae (Table D-1, Appendix D). Fewer algal species were seen in the harbor basin than in any other marine habitat surveyed on Meck Island (132).

The diversity and density of corals in the harbor basin were extremely low. Only five species (representing four families) were recorded within the harbor basin (Table D-2, Appendix D). They included small colonies of hard corals (Porites lutea, Pocillopora meandrina, and Pocillopora damicornis). The latter two species are often regarded as pioneer species because they are frequently the first corals to become established in areas previously disturbed. The other two corals recorded (Millepora dichotoma and Pavona varians) were observed on steel girders supporting the fuel pier and are thus not truly representative of the harbor basin biota. Overall coral coverage in the harbor basin was low, about 0.1 percent (132).

Only 21 species of fish, representing 14 families, were observed (Table D-3, Appendix D). The paucity of fish is not unusual considering the absence of coral reef habitat. The majority of the fishes were observed on the south side of the harbor, where vertical escarpments provide topographic relief. The harbor waters accounted for several species that were not observed elsewhere in the vicinity of Meck Island. These included the eagle ray (Aetobatus narinari), a school of carangid (Trachinotus blochii), goby (Ptereleotris heteropterus), and many (unidentified) blennies. The most numerous species included rabbitfish (Siganus argenteus) (found around the upper reaches of the water column near the cargo and fuel piers) and a type of surgeonfish (Acanthurus triostegus). The basin also harbored an unusually large number of triggerfish (Rhinecanthus rectangulus and R. aculeatus) and a sizable population of lizardfish (Synodus variegatus) (132).

Seven species of invertebrates, including several types of sponges, were observed (Table D-4, Appendix D). Three species of echinoderms (holothurians) were present (Bohadschia argus, Holothuria atra, and Thelenota ananas). The only specimen of T. ananus observed during the Meck Island marine surveys was more than 0.7 meter (2 feet) long, and was the largest noncoral invertebrate recorded in the harbor basin (132).

The intertidal fauna of the limestone rock (revetment), concrete rubble, and limited sandy shorelines fronting the harbor was dominated by the neritid snail (Nerita polita) (found only in the supratidal zone) and the shore crab (Grapsus tenuicrustatus) (132).

Seaward Reef Platform - The northern end of the ocean reef flat is the only area that has not been quarried. It is relatively narrow and has a superficial development of surge channels that approach the beach. The channels are probably formed by high intensity wave action on this area facing the Eniwetak Passage (156).

Six quarries, dredged in 1964-1965, are on Meck's outer ocean reef flat. The quarries were designed as a series of cells parallel to the shoreline, roughly rectangular in shape and decreasing in size toward the north. The edges were left jagged and irregular to create a more complicated, heterogeneous habitat. Some armor stone blocks remain in some of the quarries, resulting in a varied relief. The overall effect is a diverse habitat and biota quite unlike that on the surrounding reef flat (156).

The results of biological surveys conducted in April 1989 in three of the reef flat quarries showed that these man-made quarries provide an important, if not unique, habitat for a diversity of algae, corals, fishes, and invertebrates. The distribution of biota in each quarry is patchy because of varied topography and coral habitat (132).

The total of 17 species of algae recorded during these surveys were found only in the wave-protected reaches of each quarry. Not reflected in the list of algae (Table D-1, Appendix D) were at least five other macrothallic algae that could not be identified because heavy fish grazing has reduced some stands to only holdfasts. Many additional species would be present along the wave-exposed seaward margins (132).

Corals (including hydrozoans and anthozoans) were represented by at least 8 families and 35 species (Table D-2, Appendix D). General coral coverage across a typical mid-section of the quarries ranged between 3 and 5 percent. Topographic relief was provided by remnants of former reef cap limestone or boulders remaining after dredging operations. Coral patches in areas of significant topographic relief often showed more than 50 percent coverage. Represented corals included attached colonies - reflecting recruitment over the past 20 to 25 years, since the mining of the quarries - and unattached colonies presumably deposited into the quarry basins by storm wave action. Acroporids and faviids dominated the represented coral fauna with seven species from each family recorded, followed by pocilloporids and poritids, with five and three species recorded, respectively. The largest coral (hydrozoan) colony recorded (Millepora dichotoma) was about 2 meters (6 feet) in diameter. Numerically, Montipora digitata and various branching and table Acropora were the most abundant species. Colonies of the soft coral (Sinularia) were well represented, with some colonies exceeding a meter in diameter (132).

Fish were fairly abundant, represented by at least 21 families and 81 species (Table D-3, Appendix D). In general, greater degrees of topographic relief or coral coverage resulted in greater diversity and density of represented fishes. Wrasses (labrids) and surgeonfishes dominated the fish fauna, with 18 and 13 species recorded, respectively. Damselfishes (pomacentrids) and butterflyfishes (chaetodontids) accounted for 11 and 7 species, respectively. Both numerically and in terms of biomass, a species of surgeonfish (A. triostegus) was the most common species represented in all quarries surveyed. Rabbitfish (Siganus argenteus) were exceptionally abundant along the landward margin of the middle quarry, and schools of more than 500 individuals were recorded. The largest fishes recorded were the jack (Caranx melampygus) (usually recorded as a "pair") and the grouper (Epinephelus hexagonatus), a bottom dweller (132).

The invertebrate fauna was represented by a total of 22 species (Table D-4, Appendix D), the largest and most conspicuous of which were echinoderms. Most numerous in areas of mixed sand and coral rubble, these included Actinopyga echinites, A. mauritiana, and Bohadschia argus. The rocky margins of the quarries harbored sizeable populations of the burrowing urchin (Echinometra mathaei) and the black urchin (Echinostrephus aciculatus). Gastropods were represented by various cowries, strombids, cone snails, and large numbers of trochids (Trochus niloticus), which were present in densities of approximately 3 to 5 per square meter in some areas. Both T. iniloticus and the various represented strombids (Lambis truncata, L. corcata, and Strombus luhuanus) are popular subsistence seafoods in the Marshall Islands (132).

High Intertidal Zone of the Reef Platform - The high intertidal zone exhibits very low biological diversity and density because during low tide periods the reef platform is exposed and temperatures can be very high. A temperature of 33.4 degrees C (92.1 degrees F) was recorded in several pools during the survey (Table D-5, Appendix D).

The entire intertidal reef flat is dominated by a low algal turf comprising several species of blue-green algae (Table D-1, Appendix D). In the April 1989 survey, small tidepools at the toe of the seawall were colonized by juvenile surgeonfish (A. triostegus), moray eels (Echidna nebulosa), and a school of about two dozen juvenile fish that could not be identified. There were few invertebrate species and these were found only in the larger solution pools and cracks in the reef platform caprock, which provided some degree of protection from predators. At least three species of cowries (Cypraea moneta, C. depressa, and an unidentified species) were observed on the platform in limited numbers and may represent wave-tossed specimens thrown onto the reef flat from the adjacent offshore quarries. Small hermit crabs (Calcinus and Clibanarius) were also observed. Although corals were not observed on the reef platform fronting the HEDI/SBI MAB facility, small Porites microatolls were found in a reef flat pool about 100 meters (328 feet) south of the HEDI/SBI MAB seawall (132).

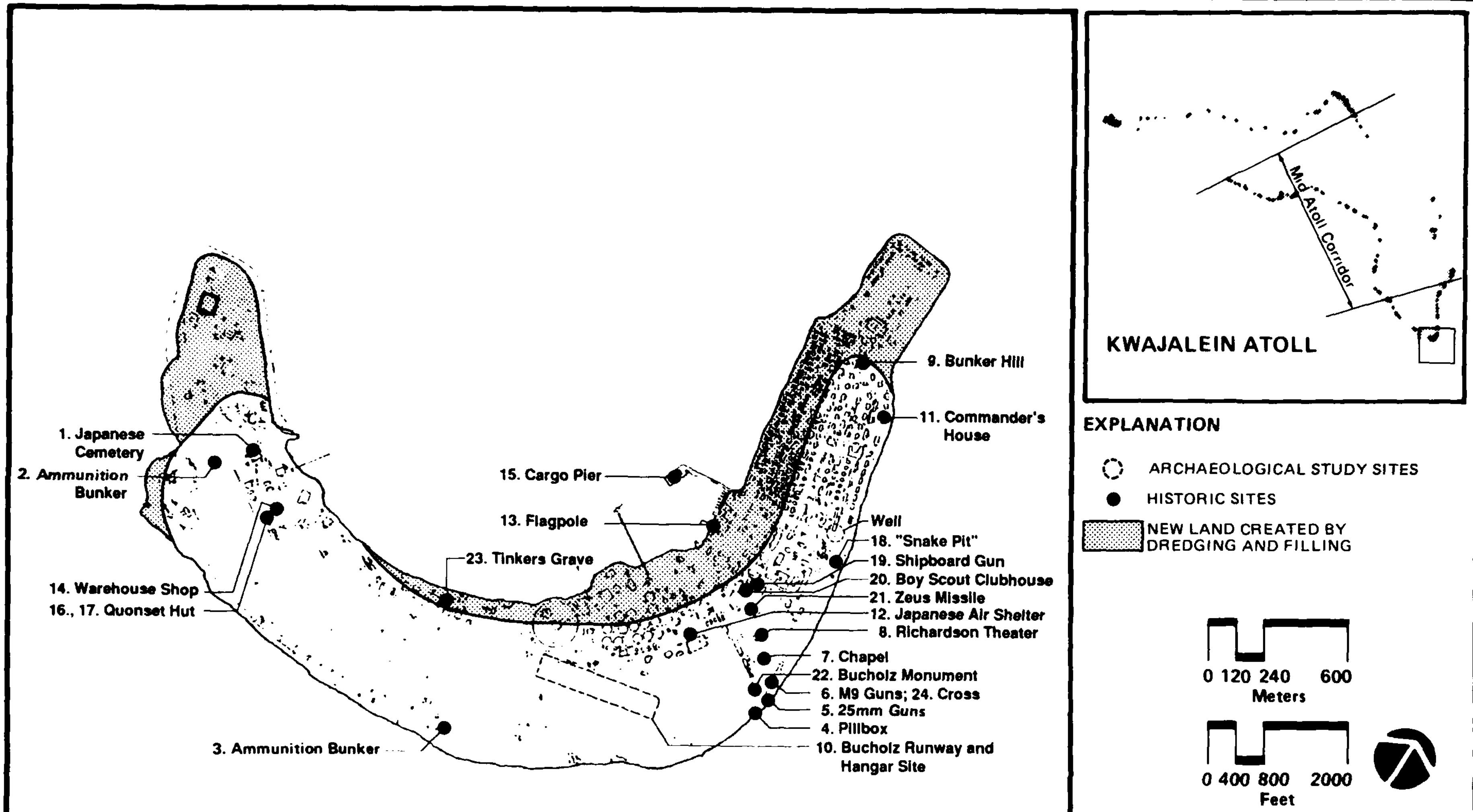
Shoreline crabs (Grapsus tenuicrustatus and Pachygrapsus planifrons) were the largest and most conspicuous of the intertidal invertebrates found along the mixed coral and concrete rubble shoreline abutting either side of the HEDI/SBI MAB seawall (Table D-4, Appendix D). Small hermit crabs (Clibanarius and Coenobita) were also abundant. The new concrete seawall provided a supratidal habitat for several hundred snails (Nerita plicata) which were found from immediately above the high-water mark to the top of the seawall (132).

In compliance with the Fish and Wildlife Coordination Act and the Endangered Species Act, the HEDI XTV project followed the procedures established at USAKA for coordination with appropriate Federal agencies. The marine biological assessment was discussed with the U.S. Fish and Wildlife Service, Pacific Islands Office. This correspondence is included in Appendix C.

2.7.2 Cultural Resources

Archaeological and historic resources on Kwajalein Island date from circa 350 BC. Although little archaeological and cultural exploration has been done on the island, it is possible that both prehistoric period resources (350 BC to 1500 AD) and historic period resources (1500 AD to present) may be present (Figure 2-8). Possible prehistoric resources include permanent living sites, subsistence sites, and temporary occupation-exploitation sites (155). Possible historic resources could include sites and artifacts from various Spanish explorers of the 16th century, and from the German and Japanese occupation periods of 1870 to 1914 and 1914 to 1944, respectively. The main study areas that have been examined for archaeological resources are located on the present taxiway and aircraft maintenance hangar sites, and along a saltwater-lined trench that parallels Ocean Road. Some of the archaeological and historical findings on Kwajalein Island are shown in Figure 2-8 and described in Table 2-1. The Kwajalein Island Battlefield is listed on the National Register of Historic Places because of its military significance in World War II (145, 147, 155) and is also listed as a National Historic Landmark (144).

Since 1944, the island has been considerably enlarged by dredging and filling at its west and north ends and along its lagoon side; therefore, there is no potential for cultural resource impacts on these parts of the island. There is no potential for new cultural resource impacts on Meck Island because most of the island has been disturbed previously. The natural configuration of the island has been completely altered by the removal and addition of soil; the entire lagoon side has been built up and most of the island has been bulldozed. No evidence for subsurface cultural deposits has been found (143) and no native domiciles or remnants of native culture remain on the island (171).



References: Modified from US Army Kwajalein Atoll (Draft) Master Plan 1988
National Register of Historic Places Inventory Nomination Form/ Kwajalein Island Battlefield, 1984

Existing Archaeological and Historic Resources, Kwajalein Island, USAKA

Figure 2-8

TABLE 2-1. KWAJALEIN ARCHAEOLOGICAL AND HISTORIC RESOURCES

ARCHAEOLOGICAL

1. From a cultural layer, two charcoal samples that date back to A.D. 40 to 355 and to 140 B.C. to A.D. 255, respectively.
2. Charcoal flecks.
3. Faunal remains (possibly those of a turtle).
4. Possible remnants of a taro swamp.
5. A shell weaving implement.

Source: Shun and Athens, 1987:7-12.

HISTORIC RESOURCES

1. A Japanese cemetery built in 1969--a reminder of Kwajalein's Japanese defense.
2. 7th Infantry Division landing monument/ammunition storage bunker--one of the few Japanese fortifications that still stands on Kwajalein. It is a monument to the 7th Infantry Division landing.
3. Ammunition storage bunker (adaptive reuse as weather satellite antenna)--a uniquely structured ammunition bunker (a vault constructed with a case-matted window in the ammunition room).
4. Beach defense fire control post pillbox--this is the only example of a fire control post on Kwajalein. The structure possibly could have been moved to this locale at an earlier time.
5. 25 mm AA gun emplacement.
6. Two 3" M-9 field guns (Rock Island arsenal, 1943).
7. Island Memorial Chapel--built in 1944-1945. The chapel, along with the commander's house and a shed of the Richardson Theater, are the only three structures that have survived since that period under American presence. The chapel has been dedicated to the men who gave their lives in the fight for Kwajalein.
8. Richardson Outdoor Theater--of the structure, the stage and screen/restroom elements date from 1945.
9. "Bunker Hill," 12.7 cm AA dual purpose type 89 gun position--some believe that this flag raising site marked the final victory of Kwajalein, although this has not been confirmed.
10. Bucholz Army Airfield Runway--current runway marks the approximate position and location of the previous Japanese runway, taxiway, and apron.
11. Commander's house, Building 241.
12. "Japanese Air Shelter" at fuel tank farm.
13. Marina Beacon Flagpole.
14. "Warehouse Shop" Butler-type building (S-1309).
15. Cargo Pier--built by the Japanese in 1944.
16. Quonset Hut (S-1336).
17. Quonset Hut (S-1337).
18. Ocean View Club, "Snake Pit"--built in 1945.
19. Shipboard gun, static display.
20. Boy Scout Clubhouse (no longer in existence).
21. Zeus Missile.
22. Bucholz Monument--this monument has been erected for PFC Bucholz, who died during the battle on Kwajalein on February 4, 1944.
23. Tinker's Grave and Monument.

Source: Duane Denfeld, 1981:22-32.

2.7.3 Infrastructure

Water Supply - Fresh water is readily available during the rainy season (normally June through November); however, during the dry season, fresh water consumption exceeds the amount of rainfall obtainable from catchments. In order not to deplete the supply of stored water from which day-to-day needs are drawn, it is necessary to obtain fresh water by extracting it from lens wells on Kwajalein Island. Projects are planned to improve water treatment capabilities and allow supplemental water supplies through desalination. Meck Island has a water storage capacity of 2.85 million liters (750,000 gallons) supplied by catchment and supplemented by supplies barged from Kwajalein Island when required.

Wastewater Treatment - The wastewater system for Kwajalein Island consists of a gravity collection system, nine pump stations, a secondary treatment plant, and an outfall extending into the lagoon. The treatment plant has a design capacity of 1.7 million liters per day (450,000 gallons per day). During the period between September 1988 and February 1989, wastewater flow averaged 1.8 million liters per day (465,600 gallons per day), thus exceeding the nominal plant capacity (142). The treatment plant is reaching its hydraulic capacity; however, the organic loading of the plant appears to be at only 70 percent of the design organic capacity.

2.7.4 Socioeconomics (Housing)

Because USAKA is dedicated to military missions and populated by U.S. residents, the normal concept of describing the surrounding community's ability to support and absorb project-related immigration is not valid. Military and contractor personnel and their dependents are not allowed to reside on Kwajalein Island unless approved housing is available. Family housing units on Kwajalein Island are located in the northeastern one-third of the island. Family units include 254 temporary trailers that were installed in 1962 and 1968, 128 permanent concrete-block structures that comprise 289 single and multifamily dwelling units built in the mid-1950s, and 136 new units completed in March 1989. Many of the old trailers were scheduled for replacement by the new units; however, they will be used through 1992 in order to accommodate unaccompanied personnel.

There are 434 UPH units on Kwajalein Island located in nine two- and three-story walkup buildings. A mid-1988 USAKA report indicated that there were 763 unaccompanied personnel living in facilities that were intended for 434 persons (based on recently adopted standards of Army Regulation 210-11).

In 1988, improvements began on the old Kwajalein Lodge to modernize accommodations for 122 transient personnel. Construction is scheduled for completion by late 1989. Future housing construction will seek civilian third-party contractors to develop housing on a build-lease basis.

Construction of new housing units on Kwajalein Island for the families of U.S. personnel was addressed in a 1986 study by the U.S. Army (174), and the first phase of construction of 136 additional housing units was completed in early 1989. Another

130 housing units and 400 UPH units are scheduled to be completed by 1992 to replace some of the 254 substandard trailers.

Housing on Meck Island is provided by the construction contractor during the construction period only.

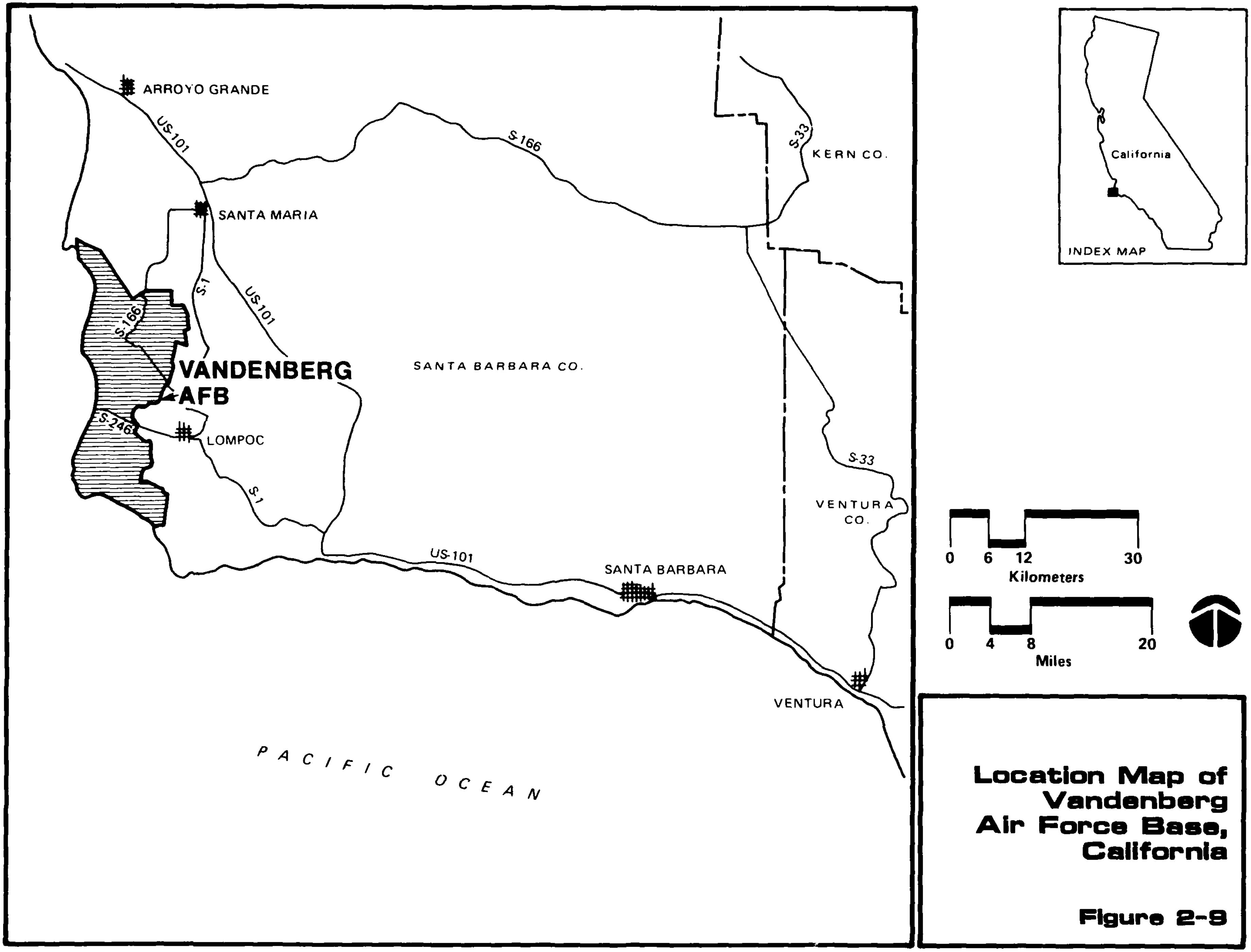
2.8 VANDENBERG AIR FORCE BASE/WESTERN TEST RANGE

Vandenberg AFB is on the coast of California about 89 kilometers (55 miles) north of Santa Barbara (Figure 2-9). The third largest air base in the United States, it occupies approximately 39,800 hectares (98,400 acres) along 56 kilometers (35 miles) of Pacific coastline within Santa Barbara County (214). Vandenberg AFB is the Strategic Air Command's pioneer base and the headquarters of the 1st Strategic Aerospace Division and the Space and Missile Test Organization (214). Facilities house DOD, government, and civilian contractor personnel and provide the necessary support for missile test launches. Existing launch facilities are scheduled to test launch intercontinental ballistic missiles, including the MINUTEMAN, PEACEKEEPER, and Atlas (205). Approximately 17 to 28 missiles are launched into the Western Test Range annually (195). A description of the installation and its environment is presented in Table B-7, Appendix B.

The Western Test Range includes a broad area of the Pacific Ocean that extends offshore from Vandenberg AFB on the coast of California (Figure 2-10) to the Indian Ocean. The range functions as the test area for space and missile operations. It includes a network of tracking and data-gathering facilities throughout California, Hawaii, and the South Pacific, supplemented by instrumentation on aircraft (218, 219, 238). Only that portion of the range affected by a launch is usually activated; activation consists of instructing ships and airplanes to stay out of the affected area and either sheltering or evacuating people living in the activated area. Launch and spacecraft operations are monitored and supported by the Air Force Satellite Control Facility, the Consolidated Space Operations Center, and the MILSTAR Satellite Communication system.

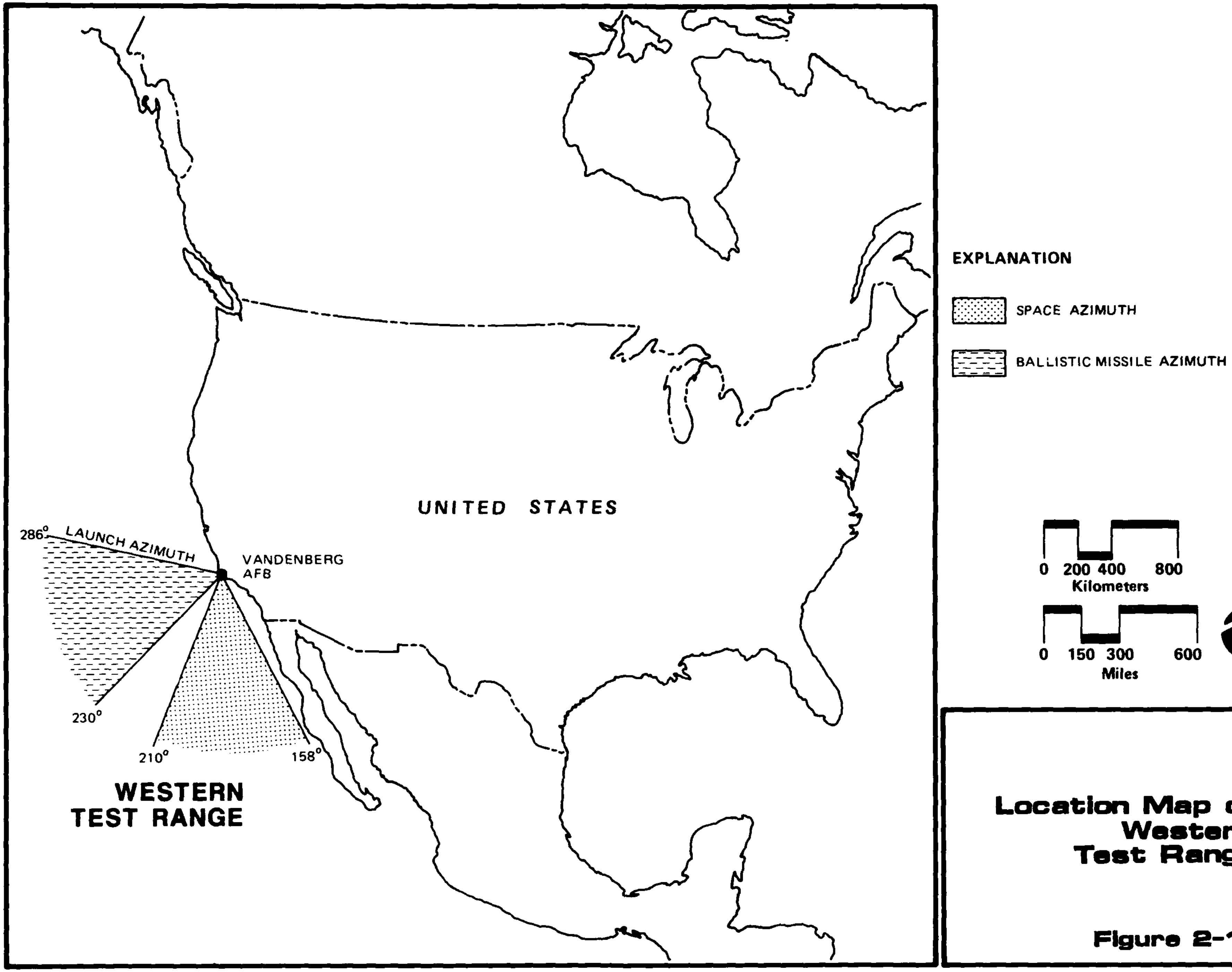
Vandenberg AFB complies with all Federal standards for air quality, water quality, and hazardous waste (231, 232, 236, 239). Recently, all of northern Santa Barbara County (where Vandenberg AFB is located) was declared a nonattainment area for ozone and particulate matter (233). There are five Federally listed endangered and two threatened animal species on the base; there are no Federally listed threatened or endangered plants (206). Many designated wetlands are present on the base (195). Over 600 known cultural resources, mostly archaeological sites, exist on the base (206); of these, one is listed on the National Register of Historic Places, and others may qualify (223).

Installation infrastructure demands are within capacity (195, 202, 206, 227, 228, 230, 236); however, water is supplied by on-base wells from two aquifers that are currently being overdrawn (206). Land use is in accordance with the Base Master Plan. Noise levels have not been identified as a problem, although they are monitored



Location Map of Vandenberg Air Force Base, California

Figure 2-9



Location Map of Western Test Range

Figure 2-10

closely; no significant public health and safety issues have been identified. The surrounding communities in Santa Barbara County have a combined population of almost 340,000 (6,7).

2.9 WHITE SANDS MISSILE RANGE

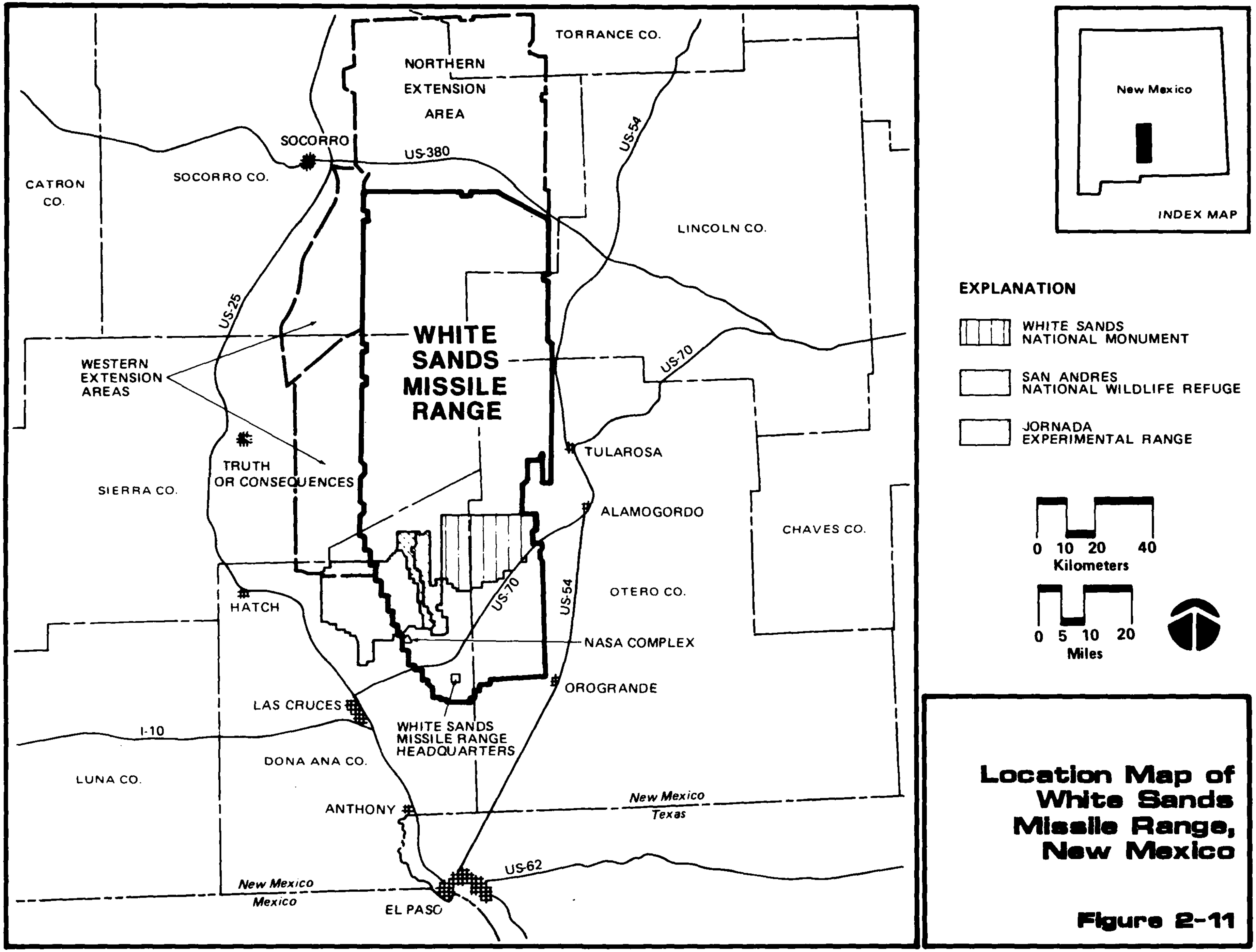
WSMR is in the Tularosa Basin of south-central New Mexico (Figure 2-11). The range is approximately 161 kilometers (100 miles) long and 64 kilometers (40 miles) wide and has the largest land area of any military reservation in the U.S. It is bordered on the west by Las Cruces and on the east by Alamogordo. El Paso, Texas, is 64 kilometers (40 miles) to the south.

WSMR has been in operation since 1945. It is a national range that supports missile development and test programs for the Army, Navy, Air Force, National Aeronautical and Space Administration (NASA), and other government agencies. The range is equipped with a network of highly accurate optical and electronic data-gathering instruments that are essential for valid, valuable testing (267). Sophisticated computer systems process and correlate the data to provide scientists and range users with timely, reliable performance records (267).

WSMR has more than 1,000 precisely surveyed instrumentation sites and approximately 700 of the most modern types of optical and electronics instrument systems, including long-range cameras, tracking telescopes, ballistic cameras, radars, and telemetry. Both mobile and fixed radars and optical systems are in use. Since 1945, a total of 36,622 launches have been made, 331 in the first half of 1988 (275). A description of this installation and its environment is presented in Table B-8, Appendix B.

WSMR complies with Federal standards for air quality, water quality, and hazardous waste (257, 275). Installation infrastructure demands are within capacity (257, 275), although some concerns have been expressed over the declining water table (257). Water supply in the long term is of some concern because the water table in the headquarters area is declining as a result of groundwater pumping. Land use is in conformity with the installation's Master Plan. Noise concerns have been identified, but administrative controls have been implemented, and most noise does not affect areas accessible to the public. Fires, noise, potential ionizing radiation, RF radiation, and exposure to radioactive materials have been identified as public health and safety issues (257, 288). The surrounding communities in Dona Ana and Otero counties, New Mexico, and El Paso County, Texas, have a combined population of 750,000 (7).

Potential impacts on threatened and endangered species and cultural resources have been identified as a concern during technology testing for HEDI KITE. Consequently, more detailed information relevant to understanding these potential impacts is provided in the following sections.



Location Map of White Sands Missile Range, New Mexico

Figure 2-11

2.9.1 Biological Resources

WSMR contains a large area of native plant communities, which forms a valuable habitat for many desert, grassland, and mountain species. Several unique and endemic plants and animals are found within the Tularosa Basin, including one plant with a distribution limited to two small canyons on WSMR. This section discusses the vegetation and habitat observed within the project areas that could be affected by HEDI KITE activities. A review of the protected species found at WSMR, along with those that might be found within the project area, is presented in Appendix E.

The proposed locations for installation of HEDI facilities and the potential impact area under the KITE trajectories were inspected in October 1988 to identify the presence of biological resources. The wildlife biologist for WSMR and the wildlife biologist for the San Andres NWR accompanied the HEDI KITE environmental review team to the potential impact areas.

Four principal natural communities are present: mesquite hummocks, creosote bush scrub, a diverse shrub grassland, and pinyon juniper woodland. The desert communities occupy the camera site locations identified in Figure 1-6 (Section 1.0) and most of the area under the expected HEDI KITE trajectory. Shrub-grassland and pinyon juniper communities are under the trajectory at the higher elevations in the San Andres Mountains and the foothills on the southeastern edge of this range.

Mesquite hummocks, partially covered with blown sand, form the dominant vegetation at all camera sites near Launch Complex 37. Although this community has already been disturbed by historic grazing practices and more recent construction activities at WSMR, a number of annual and perennial native plants are present, particularly snakeweed (Gutterezia sarothrae), four-winged saltbush (Atriplex canescens), sunflowers (Helianthus), desert aster (Macheranthera linearis), and desert marigold (Baileya pleniradiata). Areas recently disturbed contain invasive plants such as Russian thistle (Salsola kali) and coyote melon (Cucurbita foetidissiam). It was estimated that 20 percent of the mesquite hummock area near Launch Complex 37 was vegetative cover. No protected plant species are known to be present in the area, although it is possible that the dune unicorn plant (Proboscidea sabulosa) and the sand prickly pear (Opuntia arenaria) may be present. These species, however, were not observed during the field inspection of the camera stand locations.

The wildlife habitat in the mesquite-snakeweed community supports a number of common desert species. The vertebrate species observed during the site inspection were the mourning dove (Zenaida macroura), sage sparrow (Amphispiza belli), side-blotched lizard (Uta stansburiana), and antelope ground squirrel (Ammospermophilus leucurus). The area around Launch Complex 37 does not provide unique or essential habitat for any of the protected wildlife known to be present at WSMR.

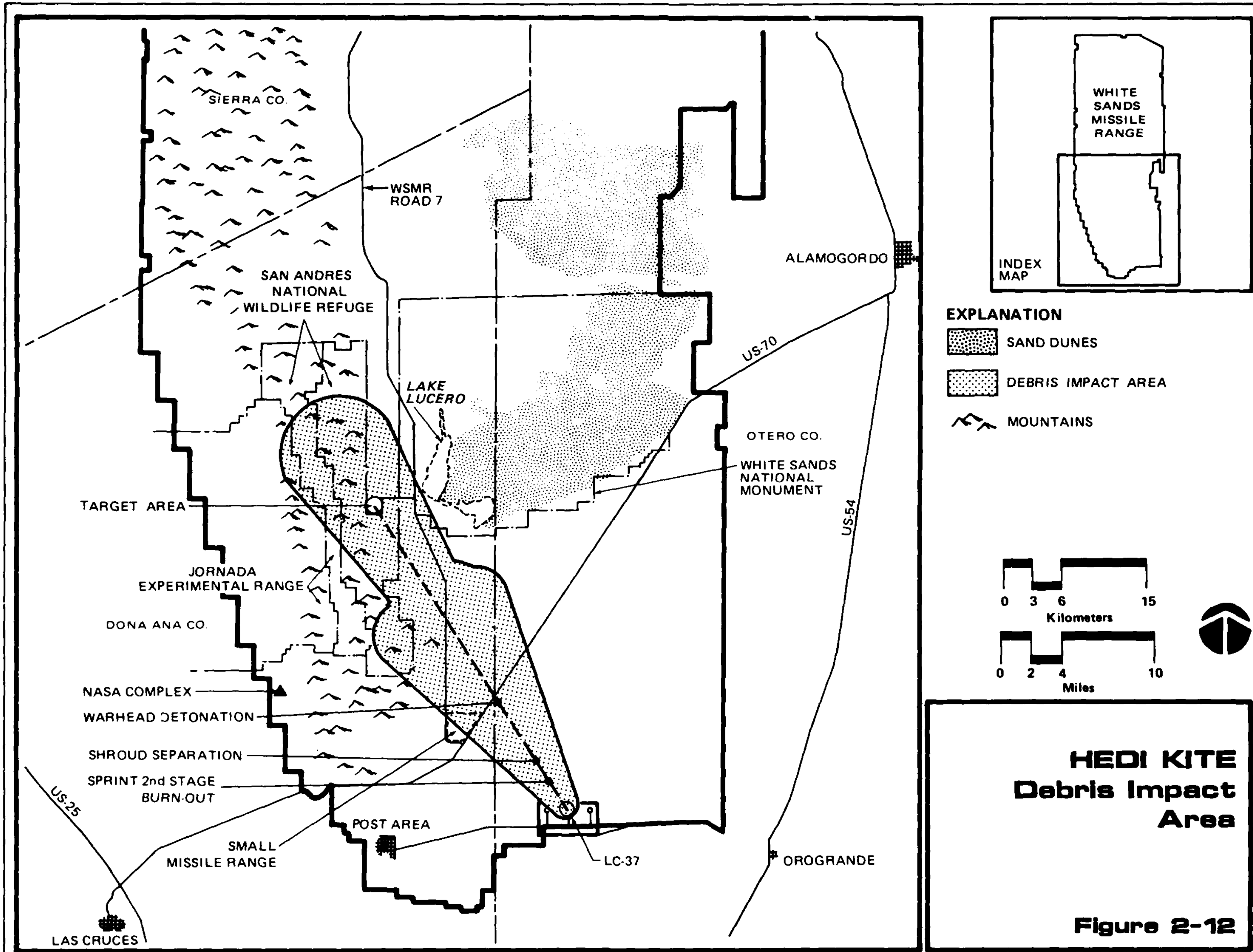
A relatively undisturbed creosote bush scrub plant community occupies the northernmost camera site (Site 9). Dominant species include creosote bush (Larrea tridentata), peppergrass (Lepidium montanum), and a variety of perennial grasses, such as dicranocarpus (Dicranocarpus parviflorus), beardgrass (Bothriochloa barbinoides), and poverty grass (Aristida purpurea). During the field inspection, golden crownbeard (Verbisina encelioides) and crownseed (Pectis papposa) were flowering. The amount of total vegetative cover was low, estimated at 15 to 20 percent. None of the protected plants known to be present at WSMR have suitable habitat within the creosote bush scrub community at the northern camera sites.

Like the mesquite-snakeweed vegetation, the creosote bush scrub community provides habitat for common desert wildlife. This very widespread desert community is noted for its variety of reptiles and nocturnal mammals, although the diversity of birds, amphibians, and fish is much lower than that in habitats with more water. Protected species from this community include occasional migrant bands of Swainson's hawk (Buteo swainsoni), which are present for short periods during the spring and fall in substantial numbers, and possible colonies of the black-tailed prairie dog (Cynomys ludovicianus). In addition, the trans-Pecos rat snake (Elaphe subocularis) may be present.

The outer edges of the debris impact area (Figure 2-12) under the trajectory include the foothill and mountainous ecological communities. The foothill zone has a diverse shrub-grassland plant community, sometimes termed footslope grassland (257). In 1988, the amount of summer rainfall was greater than normal, and the grassland aspect of this foothill community near the target area was very well developed. Especially abundant during the field inspection were bush muhly (Muhlenbergia porteri), spike dropseed (Sporobolus contractus), sideoats (Bouteloua curtipendula), blue grama (Boueloua gracilis), poverty grass, Plains bristlegrass (Setaria macrostachya), silver bluestem (Andropogon saccharoides), and a number of other plants. The varieties of dominant shrubs were also very diverse and included little leaf sumac (Rhus microphylla), peppergrass, false tarragon (Artemisia dracunculus), and four-winged saltbush. Perennials constituted more than 50 percent of the total vegetative cover; this was the most productive vegetation observed within the HEDI KITE project area. A small possibility exists that several protected plant species may be present in the foothill plant associations, although no listed threatened or endangered species are expected. The plant species that may occur include Alamo beard tongue (Penstemon alamosensis), Organ Mountains evening primrose (Oenothera organensis), and curl-leaf needlegrass (Stipa curvifolia).

The shrub-grassland community provides very good wildlife habitat for most vertebrates, although there are few water sources. Oryx (Oryx gazella) are common, and signs (scat, browsed plants) of this introduced game species were observed. Red-tailed hawk (Buteo jamaicensis), mourning dove, side-blotched lizard, and patch-nosed snake (Salvadora hexalepis) were the vertebrates observed on October 6, 1988.

This community provides good foraging habitat for birds of prey that nest in the adjacent mountains, including the golden eagle (Aquila chrysaetos) and prairie falcon (Falco mexicana). The trans-Pecos rat snake and gray vireo (Vireo vicinior) are protected species that might be found in the shrub-grassland community, although there are no known records of their presence in the HEDI KITE project area.



HEDI KITE Debris Impact Area

Figure 2-12

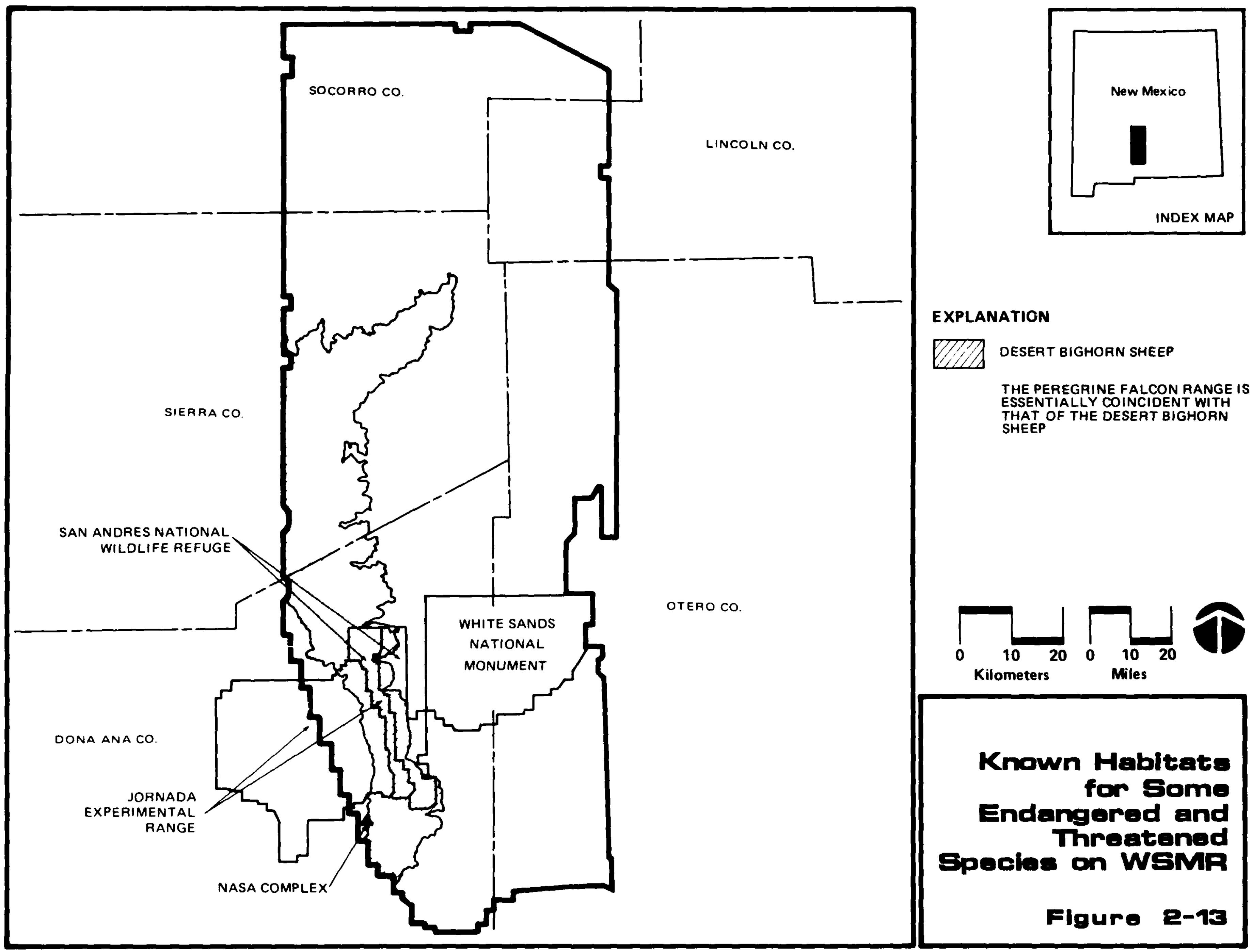
The higher elevations of the San Andres Mountains constitute the remainder of the outer debris impact area (Figure 2-12). This region consists of bare rock outcrops, with intervening benches and slopes containing the pinyon juniper plant community. Pinyon pine (Pinus edulis), alligator juniper (Juniperus deppeana), and one variety of seed juniper (Juniperus monosperma) are the visually dominant tree species in this community. However, a large number of shrubs, forbs, and grasses are also present (257). The amount of vegetative cover varies widely, depending on the local extent of rock outcrops, but is generally less than 30 percent. A small possibility exists that the Nooding cliff daisy (Perityle cernua) may be present.

The mountainous area is habitat for the desert bighorn sheep (Ovis canadensis) (Figure 2-13), which is designated as an endangered species by the State of New Mexico. The number of bighorn in the San Andres Mountains at WSMR has varied from a high of about 300 animals in 1970 to a low of about 34 animals today (260). The San Andres Mountains herd is the indigenous population of desert bighorn in New Mexico and represents a unique genetic stock. Intensive efforts have been made in the past to protect the sheep from disease and predation, and the bighorn are intensively managed today. The daily and seasonal movements and activity patterns of many sheep are monitored with radio collars. Current information (278) indicates a population of 34 sheep in two or three herds, consisting of 11 ewes, 10 rams, 8 yearlings, and 5 lambs. Lamb production was 100 percent in 1988, a very positive sign of recovery, considering the loss of productivity noted in the last decade.

The desert bighorn sheep occupy all of the San Andres Mountains, utilizing different areas during different seasons. Areas of consistently high use include the Sputh Brushy Mountain and San Andres Peak in the San Andres NWR. The population is considered to be under stress from scabies, noise disturbances, and predation. The sheep habitat within the HEDI KITE debris impact area is of importance to the species, especially during the early part of the year when it is used for browsing, resting, and lambing. During the lambing season, disturbance to the sheep potentially jeopardizes lamb survival, and thus the overall stability of the herd. The peak of the lambing season generally occurs between February and May, but may extend as long as December to June.

The mountains also provide high-quality habitat for other wildlife. High-interest species known to be present include the prairie falcon, golden eagle, mountain lion (Felis concolor), and mule deer (Odocoileus hemionus). Protected species that may be present at higher elevations include the occult bat (Myotis lucifugus occultus), the spotted bat (Euderma maculata), and the Organ Mountains chipmunk (Eutamias quadrivittatus australis). Significant biological features include the natural seeps and springs and the developed water sources for wildlife (guzzlers, catchment basins, and tanks). The mountainous regions, along with the adjacent foothill communities, appear to provide suitable habitat for the Federally listed endangered northern Aplomado falcon (Falco femoralis septentrionalis). The southwest portion of the San Andres Mountains could be a potential reintroduction site for this predatory bird, which is presumed to be extirpated from the United States.

In compliance with the Fish and Wildlife Coordination Act and the Endangered Species Act, the HEDI KITE project followed the procedures established at WSMR for



Known Habitats for Some Endangered and Threatened Species on WSMR

Figure 2-13

coordination with state and Federal agencies. The biological survey was submitted to the base biologist, who transmitted it to the U.S. Fish and Wildlife Service, New Mexico Department of Game and Fish, and the New Mexico Department of Energy, Minerals and Natural Resources. This correspondence is included in Appendix C.

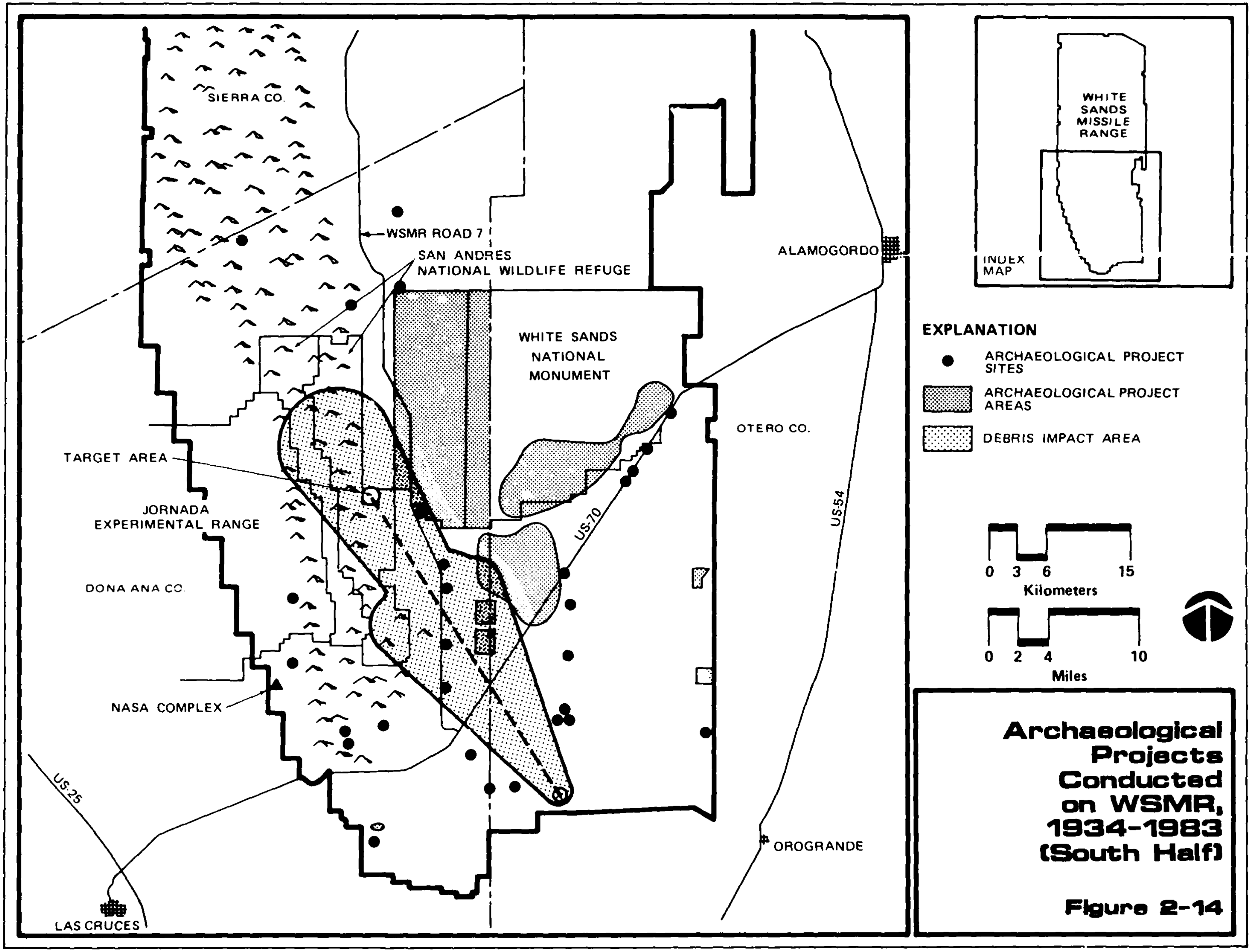
2.9.2 Cultural Resources

Much of the information pertaining to cultural resources at WSMR has been compiled in the cultural resource overview prepared by Soil Systems, Inc. (241). Prior to this report, 331 recorded prehistoric sites had been described in 61 cultural resource investigations undertaken on or adjacent to WSMR. Early studies concentrated on larger or unique archaeological sites, primarily for descriptive and chronological purposes. However, 51 of the 61 projects have been performed as a result of recent cultural management laws and procedures; 296 of the 331 sites have been recorded since 1970 during such survey programs. The locations of these studies are depicted in Figure 2-14.

Locations of known sites are closely correlated with the study areas, because cultural resources have been inventoried in only a small part of the range. All of the range areas studied, except the playa lake beds, contain prehistoric properties. Large sites (greater than 10,000 square meters [107,643 square feet]) of the El Paso phase are known to exist in the bajada areas adjacent to the San Andres Mountains. Lower bajada areas contain chipped stone scatters, bedrock mortar sites associated with Archaic through Formative settlements, and Formative villages; prehistoric agriculture field and ditch systems may also be present. Upper bajada areas are expected to contain mostly low-density lithic scatters resulting from plant-gathering activities spanning the full chronological range of prehistoric occupations. Smaller sites are common in the mountains and in the basin. In the mountains, the probability of isolated finds and sites from all prehistoric periods is high. Site types would include small scatters representing hunting camps and kill sites; lithic quarries; planting, gathering, and processing sites; and seasonally occupied rock shelters and caves. Small villages and trails could also be recorded. Breternitz and Doyel (241) provide more detail about the purposes of these studies and the structure and composition of the recorded archaeological sites.

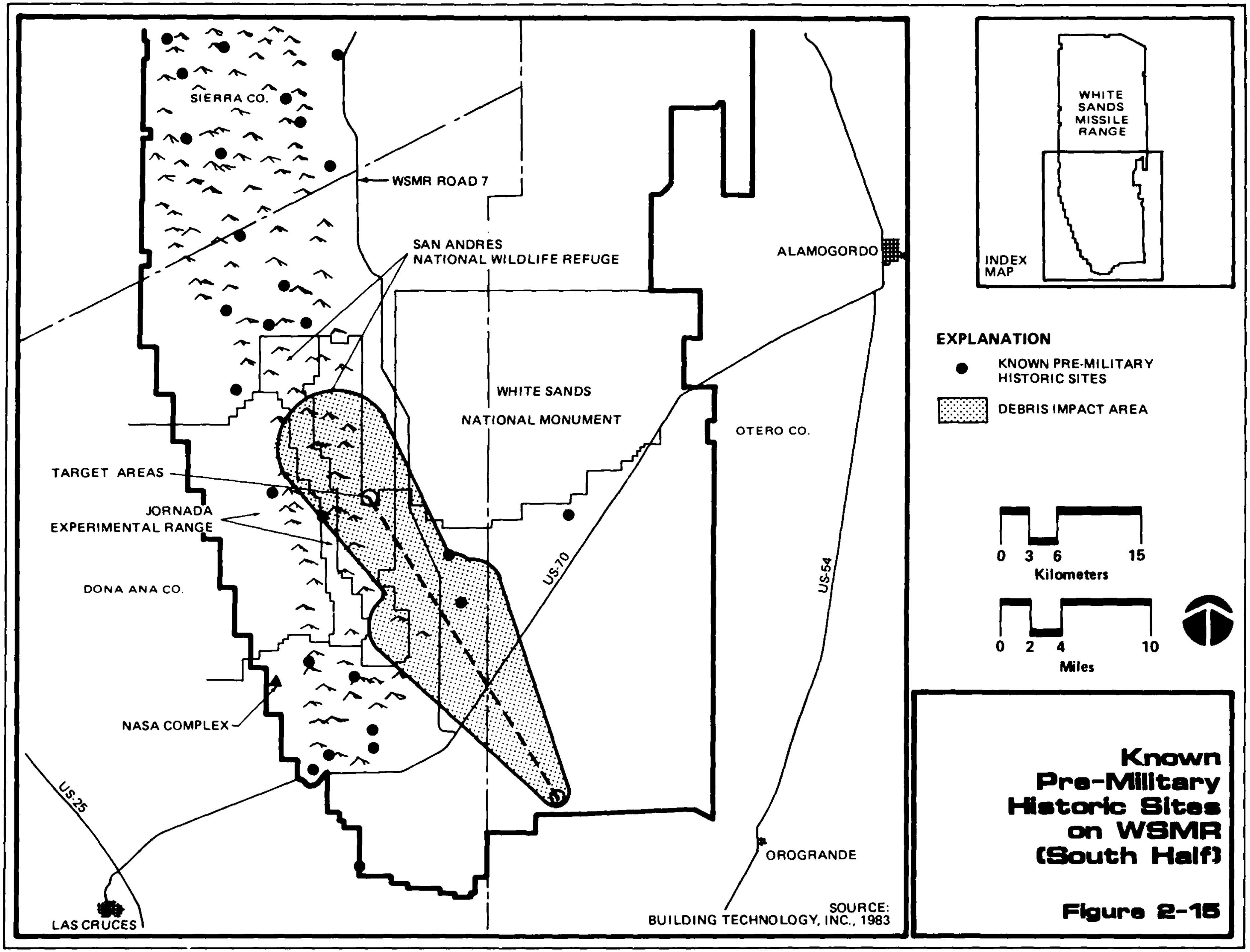
More recently, sample archaeological surveys have been performed at three locations proposed for the Ground-Based Free Electron Laser Technology Integration Experiment (249). The site most pertinent to the current EA is the area north of the NASA site. Within the 14-percent sample area, 66 archaeological sites were recorded. These surveys are indicative of the large numbers of unrecorded archaeological sites that may be present in areas of the WSMR that have not been intensively surveyed.

Breternitz and Doyel (241, Table 4-2) tabulate known standing historic structures, citing a recent historic properties survey by Building Technology, Inc. (1983), which inventories historic military sites and premilitary ranches and their associated corrals, wells, and tanks. Seventy-nine historic ranch sites are located in WSMR, several of which are depicted on Figure 2-15. Other known historic site types, which have not been thoroughly recorded, include other ranch complexes and mines and



Archaeological Projects Conducted on WSMR, 1934-1983 (South Half)

Figure 2-14



Known Pre-Military Historic Sites on WSMR (South Half)

Figure 2-15

mining camps dating from 1880 to 1942. Breternitz and Doyel (241, Table 4-3) also list 127 potential locations of prehistoric or historic sites associated with known historic water sources within WSMR.

In addition to prehistoric and historic archaeological sites and historic structures, sites utilized by Mescalero Apache could be identified during intensive field surveys. These could include sacred sites such as graves and shrines, as well as hunting sites, mescal pits, gathering sites, campsites, and sites of military encounters. Salinas Peak and Hembrillo Canyon are two known Mescalero Apache sacred sites (241) outside the current project area.

Two cultural resources within WSMR are listed on the National Register of Historic Places. The Trinity Site, the location of the detonation of the world's first atomic explosion, consists of the blast area (ground zero); the McDonald Ranch House, where the device was assembled; Trinity Camp, where troops were housed; and several concrete bunkers. The Site, which is in the northern section of the range, has been completely bulldozed and fenced. The other site is Launch Complex 33, on Nike Road within WSMR, just east of the Post area. In addition, two sites are listed on the State of New Mexico Cultural Property Register: Army Blockhouse/V-2 Gantry Crane and the 500K Static Test Stand, both of which are part of Launch Complex 33.

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3.0 ENVIRONMENTAL CONSEQUENCES

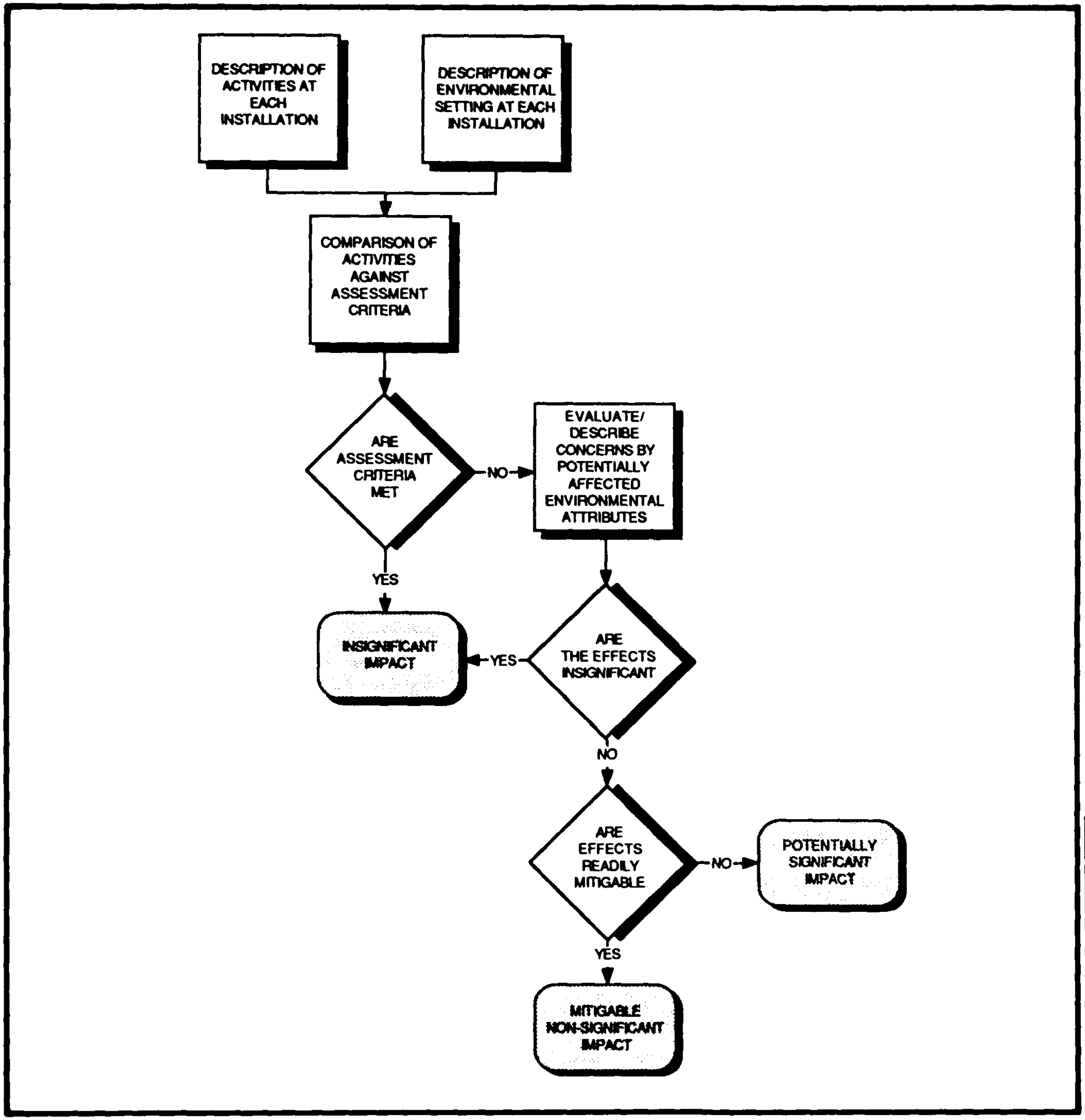
This section assesses the significance of potential environmental consequences of the proposed HEDI technology test program. It is based on a comparison of the test requirements described in Section 1.0 with the facilities to be utilized at proposed test locations and their affected environments, as described in Section 2.0. Any environmental documentation that addresses the types of activities proposed for the installations is incorporated by reference.

To assess the potential for and significance of the impacts from HEDI technology testing at each installation, a two-step methodology was utilized (Figure 3-1). The first step was the application of assessment criteria developed by the EA team to identify activities deemed to present no potential for significant environmental consequences. Activities were deemed to present no potential for significant environmental consequences provided they met all of the following criteria:

- The installation and its associated infrastructure are deemed adequate for the proposed activity (i.e., the tests can be conducted without new construction, excluding minor modifications).
- The current installation staffing is adequate to conduct the test(s), excluding minor staff-level adjustments.
- The resources of the surrounding community are deemed adequate to accommodate the proposed testing.
- The activities do not threaten a violation of Federal, state, or local laws or regulations imposed for the protection of the environment (see Appendix A).
- The activities do not adversely affect public health or safety.
- The activities do not adversely affect or result in the loss of unique environmental, scientific, cultural, or historical resources.
- The activities are not highly uncertain and do not involve unknown risk.
- The activities do not result in irreversible and irretrievable commitments of unique or important environmental resources.

HEDI activities proposed for each installation were also reviewed against existing environmental documentation on current and planned actions, anticipated future projects, and existing conditions at each installation to determine potential for cumulative impacts.

If a proposed technology testing activity was determined to present a potential for impact, i.e., if one or more of the above criteria are not met, the second step in the methodology was implemented. In this step, the potential that the proposed activities would cause significant impacts was evaluated for one or more of the following broad environmental attributes: air quality, biological resources, cultural resources,



Method for Assessing Potential Environmental Consequences

Figure 3-1

hazardous waste, infrastructure, land use, noise, public health and safety, socioeconomics, and water quality. As a result of that evaluation, consequences were assigned to one of three categories: insignificant, mitigable and nonsignificant, and potentially significant.

Environmental consequences were determined to be insignificant if, in the judgment of the preparers of this document or as concluded in existing environmental documentation of similar actions, no potential for significant environmental impacts exists. Consequences were deemed mitigable and nonsignificant if concerns exist but it was determined that all potential consequences could be readily mitigated through standard procedures, or by measures recommended in existing environmental documentation. In this EA mitigation includes: (1) avoiding the impact altogether by not taking action or parts of an action, (2) minimizing impacts by limiting the degree or magnitude of the action and its implementation, (3) rectifying the impact by repairing, rehabilitating, or restoring the affected environment, (4) reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action, or (5) compensating for the impact by replacing or providing suitable resources or environments. If consequences exist that could not be readily mitigated, the activity was determined to present potentially significant environmental impacts.

Subsection 3.1 provides a discussion of the potential environmental consequences for each location proposed for the HEDI technology test program. The amount of detail presented in the following environmental consequences subsections is proportional to the potential for impacts. Subsections 3.2 through 3.8 provide discussions of the following: environmental consequences of the no-action alternative; any conflicts with Federal, regional, state, local, or Indian tribe land-use plans, policies, and procedures; energy requirements and conservation potential; natural or depletable resource requirements; adverse environmental effects that cannot be avoided; the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity; and any irreversible or irretrievable commitment of resources that would accompany HEDI technology testing activities.

3.1 ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION

3.1.1 McDonnell Douglas Space Systems Company

The HEDI KITE tests to be conducted at MDSSC's Huntington Beach, California, installation will use several existing facilities to conduct the launch control equipment simulations, fabricate and assemble the KV, and assemble the launch control equipment. Similar HEDI XTV tests are expected to be conducted at MDSSC. These activities are routine at this installation, with no new personnel required; thus, no infrastructure or socioeconomic impacts will occur. The installation is in compliance with environmental standards (24) and no significant biological or cultural resources exist at the installation (27).

Based on meeting all of the assessment criteria, the environmental consequences of testing for HEDI are considered to be insignificant. HEDI activities were reviewed against existing environmental documentation on current and planned actions and anticipated future projects and no cumulative impacts were identified as a result of the HEDI testing.

3.1.2 Arnold Engineering Development Center

The HEDI KITE tests to be conducted at AEDC will use several existing wind tunnels to test flight components and obtain jet interaction validation data. HEDI XTV wind tunnel tests of the new booster and/or of the improved KV may also be conducted at AEDC. The wind tunnels are used regularly and this type of testing is considered routine. At present, most of the 3,800 employees are dedicated to wind tunnel testing or maintenance of the tunnels (39). An additional 20 to 30 contractor personnel will be required temporarily to conduct both the HEDI KITE and the HEDI XTV tests, but this 0.5 to 0.8 percent increase in staff will not tax the installation's infrastructure, nor the ability of the surrounding communities (with a population of 97,000) to accommodate these additional temporary personnel. Thus, no socioeconomic impacts are expected. Although three Federally listed endangered species (the gray bat, the Indiana bat, and the red-cockaded woodpecker) and two designated wetland areas exist on the base, the proposed HEDI activities would be similar to the routine missions of AEDC, and will not pose any new or additional threat to the endangered species, nor encroach on the wetlands areas. The installation is in compliance with environmental standards.

Based on the presence of adequate facilities and staff, adequate resources in the surrounding community, and compliance with environmental standards, the environmental consequences of testing for HEDI are anticipated to be insignificant. HEDI activities were reviewed against existing environmental documentation on current and planned actions and anticipated future projects, and no cumulative impacts were identified as a result of the HEDI testing.

3.1.3 Hill Air Force Base

The HEDI KITE tests at Hill AFB will involve the refurbishment of the target rocket motor systems (ARIES boosters) (53). HEDI XTV tests may involve the refurbishment of MINUTEMAN I rocket motors or tests of the first- and second-stage rocket motors of the STARS launch vehicle. This activity is routine at Hill AFB, well within the capability of existing facilities, with no new personnel required (53); thus, no infrastructure or socioeconomic impacts will occur. The installation is in compliance with Federal standards for water quality and air quality, although Hill AFB is located within a nonattainment area for ozone and carbon monoxide (61, 71). Because the HEDI test activities at Hill AFB will not emit pollutants to the atmosphere and no additional personnel will be involved, HEDI activities will not contribute to or exacerbate the current ozone and carbon monoxide problem.

Solvents will be used in the refurbishment of the target rocket motor systems, but the quantities are small (less than 30 milliliters [1 ounce]). Current waste-handling activities are in compliance with the RCRA and past contamination conditions are being addressed under the U.S. Air Force IRP remedial actions (64, 65). Although one endangered species, the bald eagle, has been sighted at the base (55, 70), HEDI activities will be part of the routine mission of Hill AFB and will not pose any new or additional threat to the bald eagle.

Based on the above analysis, the environmental consequences of testing for HEDI will be insignificant. HEDI activities were reviewed against existing environmental documentation (54, 55) on current and planned actions and anticipated future projects, and no cumulative impacts were identified as a result of the HEDI testing.

3.1.4 National Test Facility, Falcon Air Force Base

The NTF will be used for the storage, analysis, and application of data from flight tests of the HEDI in simulation exercises. The functions of the NTF in storing and utilizing data obtained from the HEDI KITE and XTV tests are consistent with its overall mission. Environmental effects of construction and operation of the NTF are presented in the National Test Facility Environmental Assessment (78), which resulted in a FNSI.

Until the NTF is completed, the staff is operating in an existing interim facility, the Consolidated Space Operations Center at Falcon AFB. The environmental consequences of the proposed use of these existing facilities were addressed in a Request for Environmental Impact Analysis (77), which concluded that the action qualified for a categorical exclusion (CATEX) and that no significant impact on the environment would result.

Because the HEDI testing will be part of the NTF's other SDI activities, which have already been assessed and found to have insignificant impacts, impacts from the HEDI technology testing activities are considered insignificant. HEDI activities were reviewed against existing environmental documentation (76, 78) on current and planned actions and anticipated future projects, and no cumulative impacts were identified as a result of the HEDI testing.

3.1.5 Naval Surface Warfare Center

The HEDI KITE tests to be conducted at NSWC involve simulations in Wind Tunnel No. 9 to evaluate HEDI's window/forebody cooling system. HEDI XTV wind tunnel tests of the new booster and/or of the improved KV may also be conducted at NSWC. The base's four wind tunnels are used regularly, and this type of activity is considered routine (102). At present, 5,200 employees are dedicated to this, the Navy's principal research, development, test, and evaluation installation (88). No additional staff will be required, although three or four additional personnel are expected as observers during the tests. Consequently, no socioeconomic or infrastructure impacts are expected. The installation complies with environmental standards, and no significant biological or cultural resources exist at the center.

Because the center meets all of the assessment criteria, the environmental consequences of testing for HEDI are considered to be insignificant. HEDI activities were reviewed against existing environmental documentation on current and planned actions and anticipated future projects, and no cumulative impacts were identified as a result of the HEDI testing.

3.1.6 Sandia National Laboratories

The HEDI KITE activities to be conducted at Sandia National Laboratories will involve component/assembly testing of the target vehicle and refurbishment of the SPRINT booster rocket. HEDI XTV tests may involve tests of the third-stage rocket motor of the STARS launch vehicle. The five existing technical testing areas are routinely used for this type of activity; no additional staff will be required, although an additional two or three contractor personnel will be temporarily assigned to Sandia for the duration of the tests. Thus, no socioeconomic or infrastructure impacts are expected.

The installation complies with Federal standards for water quality, hazardous waste, and air quality, although Sandia National Laboratories is located within a nonattainment area for carbon monoxide. However, because HEDI test activities will not emit pollutants to the atmosphere, and only two or three additional temporary contractor personnel will be involved, HEDI activities that contribute to or exacerbate the current carbon monoxide problem (from automobile pollution, etc.) are insignificant. Similarly, HEDI test activities will not contribute to or exacerbate the potential public health and safety problems that have been identified.

Applying the assessment criteria against the test activities, all of the criteria for the no significant impact determination are met. As a result, the environmental consequences of testing for HEDI at Sandia National Laboratories are considered to be insignificant for all environmental attributes. HEDI activities were reviewed against existing environmental documentation on current and planned actions and anticipated future projects, and no cumulative impacts were identified as a result of the HEDI testing.

3.1.7 U.S. Army Kwajalein Atoll

Activities for the HEDI KITE and XTV programs are proposed for USAKA. The HEDI KITE activities at Kwajalein Island, USAKA, will involve collecting IR signature data for use in developing the HEDI seeker. Data will be collected with the IRIS on board a modified Learjet six to ten times a year. This use of USAKA facilities is consistent with the current missions and operations of those facilities. Use of existing facilities is planned to support this data collection and no new permanent personnel requirements have been identified, although 11 transient personnel associated with IRIS will be stationed at USAKA for approximately 4 months per year. These 11 transient personnel will represent a 0.9 percent temporary increase in staff and will not tax the installation's infrastructure nor induce any socioeconomic impacts. Storage of liquid nitrogen, which will be used to cool the aircraft window, is an ongoing activity and will not cause a problem.

HEDI XTV activities on Kwajalein Island involve the construction of a new 557-square-meter (6,000-square-foot) warehouse, to be shared with ERIS; an associated driveway just north of Lagoon Road adjacent to Building 1010; and the connection/hook-up of new power lines. The site of the warehouse has been previously disturbed and is in an area of other warehouses and supply activities.

Although the Federally endangered hawksbill turtle, the threatened green sea turtle, and the rare giant clam have been observed off Kwajalein Island, and the original island is listed on the National Register of Historic Places, HEDI activities will be similar to the routine mission of USAKA and will not pose any new or additional threat to the threatened and endangered species, nor any new or additional disturbance to the island's cultural resources.

In addition, other HEDI XTV activities are proposed for Meck Island, USAKA. These activities will involve launch support equipment simulation tests; component/ assembly tests of the ground support and launch equipment, KV assembly and readiness evaluations, and validating prelaunch intercept data reception; and flight tests, including a ballistic test of the new booster and an intercept test using a target vehicle.

HEDI XTV facilities at Meck Island will be used on an alternate basis with the SBI program, and include construction of a new MAB; modification of an existing launch station (a 1-meter [3-foot]-thick concrete slab in an area now covered by asphalt), launch equipment room, and payload assembly building; and renovation of the Meck Island Control Building. These construction, modification, and renovation activities are covered in a Record of Environmental Consideration (136), which concluded that the actions qualified for a categorical exclusion.

The new facilities being constructed on Meck Island (Section 1.0, Figure 1-9) for joint use by the HEDI/SBI and ERIS programs include: a new 0.95-million-liter (250,000-gallon) water storage tank; a new breakwater, an enlarged pier, and waiting shelter; a camera transformer vault; a guardhouse; a freshwater pumphouse; two camera towers; and a new MMH fuel storage building and associated 23-meter (75-foot) asphalt pavement. Support facilities undergoing rehabilitation and renovation include: the dining hall, guardhouse, freshwater filtration/treatment plant, septic tank/leach field systems, a camera tower; and the power plant, respectively. This joint-use construction, rehabilitation, and renovation is covered in a Record of Environmental Consideration (135), which concluded that the actions qualified for a categorical exclusion.

The only new construction activities on Meck Island not covered by the two Records of Environmental Consideration are: the approximately 76-meter (250-foot) long, 3-5-meter (10-15-foot)-high seawall to protect the HEDI/SBI MAB; the power, telephone, sewer, and water lines and road that will connect the MAB to existing power and utility lines and to an existing roadway; and the KV fueling area (Section 1.0, Figure 1-8).

The type of booster to be used for the HEDI XTV effort is expected to use a 1.3 explosive class solid propellant rather than the 1.1 explosive class solid propellant used in earlier SPRINT boosters previously launched from Meck Island. The 1.3 explosive class will be less hazardous than the SPRINT 1.1 explosive class. The propellant and ordnance storage areas utilized will comply with quantity-distance building separation standards. Transportation, storage, assembly, and launch activities will be carried out according to DOD 6055.9-STD, Ammunition and Explosives Safety Standards, and USAKA Regulation 385-75, Explosives Safety.

Sites for flight test activities have been reviewed and approved by the DOD Explosives Safety Board (129) based on the 1.1 explosive class propellant. The ESQDs and launch safety procedures will be adequate for storage, handling, and normal launch operations, and in the unlikely occurrence of a booster conflagration.

Missile assembly, and other prelaunch and launch activities for HEDI XTV flight tests will be typical of the activities routinely conducted for previous USAKA test programs. Missile assembly operations will include lifting missile components onto assembly stands, surface preparation and cleaning using solvents, mechanical assembly of components, and testing. The contractor will be responsible for handling, treatment, storage, and disposal of any materials including any hazardous or toxic materials (e.g., explosives, liquid propellants, battery packs, cleaning fluids) utilized at the launch complex. Minimal amounts of hazardous or toxic waste are expected to be generated for HEDI XTV activities; handling and disposal will be in accordance with USAKA safety standards and existing Federal standards, and these minimal amounts will not contribute to or exacerbate USAKA's existing waste management situation. Positioning of the assembled missile on the launch pad will be scheduled to minimize exposure to the harsh USAKA environment.

Launch activities will be conducted with strict control of both the immediate area of the launch, the much larger area of Kwajalein Atoll, the BOA northeast of the atoll, and the airspace affected by the launch activities. Figure 1-7 (Section 1.0) shows the launch azimuth for both HEDI XTV test flights, expected to be nominally 18 degrees. This launch azimuth avoids overflight of any populated areas. Personnel on Meck Island will either be moved off the island or required to be in designated shelters for protection against the effects of propellant combustion, in accordance with USAKA Regulation 385-4. Commercial aircraft and ocean vessels will be notified in advance of launch activities through the use of NOTAM and NOTMAR, respectively, so that alternate routes can be used during the flight tests. This notification affects primarily the BOA where the flight will occur and where spent booster cases and debris are calculated to fall.

A large variety of sensing, tracking, and safety instrumentation is available at USAKA to support the HEDI XTV flight tests. Some instrumentation that would potentially be used is the GBR to be located at Building 1500 on Kwajalein Island, the USAKA link to the Global Positioning System, cameras located on Meck in support of ERIS, meteorological rocket launches from Kwajalein or Omelek islands, and the Kwajalein Range Safety System. All instrumentation utilized that emits electromagnetic energy would be operated within existing USAKA safety standards. With the exception of the GBR, all instrumentation is already in routine use to support ongoing USAKA activities.

The potential use of the GBR to augment USAKA tracking and range safety instrumentation during HEDI XTV launches would require GBR operation below its normal minimum elevation of 2 degrees above the horizontal. This minimum beam elevation was established to ensure safety of personnel from adverse effects of electromagnetic radiation. The operation of GBR with its main beam below the normal minimum elevation does not adversely affect its range safety operation and it has been previously analyzed. The following operational constraints have been imposed for such operation: only the Full-Field-of-View antenna will be used and the radar will operate at a low duty cycle of no greater than 0.2 percent so that resulting power densities will not exceed permissible exposure limits. Initial indications show that these operating procedures for controlling possible human exposure will reduce any impact of the GBR electromagnetic fields on possible fuel hazards or inadvertent detonation of electroexplosive devices or ordnance.

A full discussion of the potential effects of electromagnetic radiation, safety standards, and an analysis of GBR operations on USAKA is presented in the Ground-Based Radar Environmental Assessment (9), which is incorporated by reference. This EA specifically addressed the potential use of GBR at elevations of less than 2 degrees and concluded with a FNSI. Consequently, HEDI XTV tests will not contribute to or exacerbate the potential public health and safety issues previously identified.

The type of booster to be used for the HEDI XTV is expected to be solid propellent. The primary emission products are expected to be aluminum oxide, hydrogen chloride, carbon monoxide, carbon dioxide, water, hydrogen, and nitrogen. Ground-level concentrations would not affect the ambient air quality, except during the few seconds at liftoff. Air quality is not normally monitored during launches at USAKA, and launches do not pose an air quality problem. Late-stage emissions will quickly dissipate high in the atmosphere and not cause an impact at sea level. Emission levels are judged to be insignificant. HEDI flight tests on Meck Island will not contribute to or exacerbate any possible localized air quality problems on Kwajalein Island.

Noise associated with the HEDI XTV launches on Meck Island will be of high intensity but only a few seconds duration. Essential mission personnel left on Meck Island during a launch will be inside the Meck Island Control Building, will be adequately protected from any noise impacts in accordance with AR 200-1. No significant impacts from launch noise are expected on Meck Island or any of the populated islands.

The primary debris would be expected to consist of steel, titanium, and aluminum fragments, plus spent booster casings. Debris will be handled in accordance with USAKA's prescribed policies, responsibilities, and procedures for the security, recovery, and disposition of classified, unclassified, and hazardous test material impacting on and off the range (161). Because the debris footprint will be in the unpopulated BOA northeast of the atoll, no significant impacts will result.

The total construction program on Meck Island will require an estimated 105 workers (70-75 construction workers will be housed in contractor-supplied trailers on Meck Island and 30 will commute daily from Kwajalein Island). There will be an estimated operational support staff of 56 accompanied personnel and 8 unaccompanied personnel. An additional 25 transient engineers and technicians will be required to support test flights. All of the operational support personnel will be housed on Kwajalein Island in existing housing. This represents less than a 3 percent increase in personnel over Kwajalein Island's currently projected population of approximately 3,000 in the first quarter of 1993. This 3 percent increase could have an impact on socioeconomics (housing) and infrastructure. Marshallese employment increases on USAKA are not anticipated and further Marshallese inmigration is regulated by the Kwajalein Missile Range Employment Ordinance of 1986. However, no HEDI-induced changes to the local Marshallese conditions are anticipated.

Applying the assessment criteria against the HEDI-related test activities, all of the criteria for the no significant impact determination are met, except in the areas of biological resources (marine), cultural resources, infrastructure, and socioeconomics (housing). Consequently, these areas are discussed in more detail below.

3.1.7.1 Biological Resources (Marine)

Potential impacts from the HEDI XTV test activities could arise from construction activities associated with the approximately 76-meter (250-foot)-long, 3-5-meter (10-15-foot)-high seawall built on the edge of the high intertidal zone of the seaward reef flat platform (Section 1.0, Figure 1-8) and the possible need for a protective off-shore seawall located between the existing seawall and the reef platform quarry to prevent undermining the existing seawall and HEDI/SBI MAB during storm-wave events.

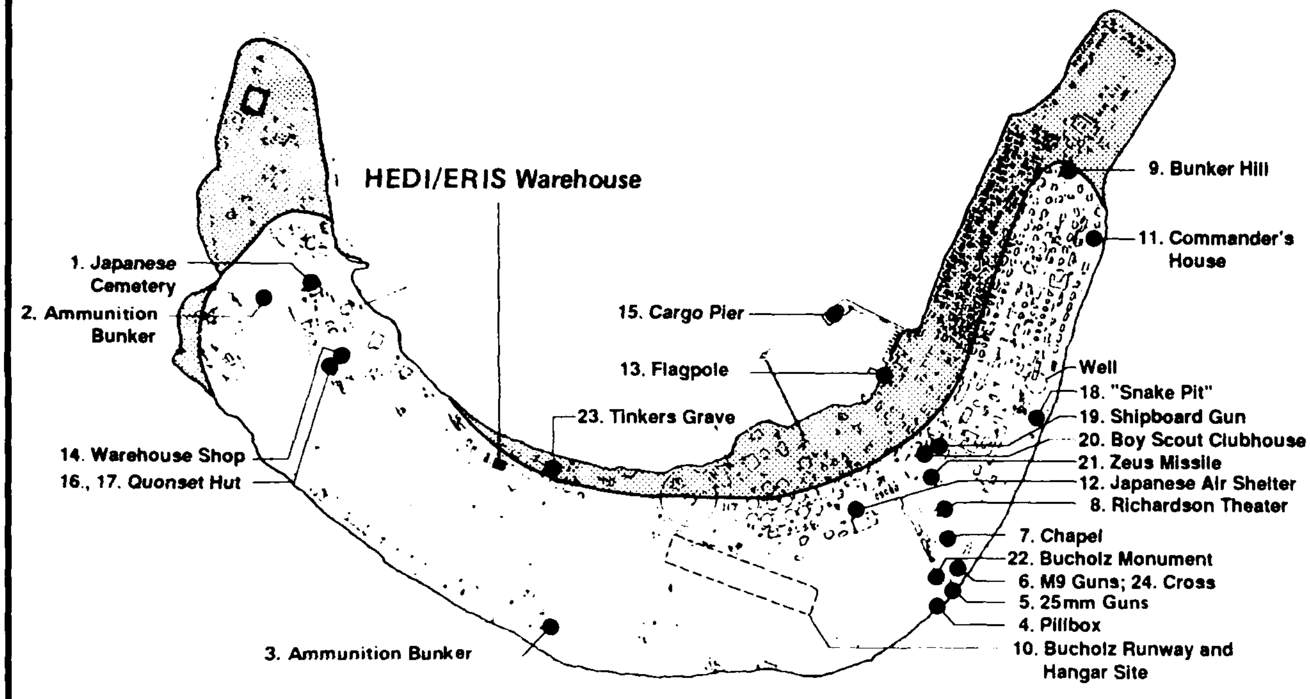
Analysis of adjacent areas suggests that the site was a previously disturbed, intertidal, rubble beach and back beach area. As noted in Section 2.7.1, the site is characterized by very low biological diversity and density because the reef platform is exposed during low tide periods. Moreover, the biota of the small pools and depressions in the high intertidal zone of the reef platform is limited because of the exceptionally high temperatures (33.4 degrees C [92.1 degrees F]) that prevail during low tide periods. Consequently, potential impacts on marine biology are believed to be insignificant. No cumulative impacts that would further jeopardize any marine biological resources have been identified.

3.1.7.2 Cultural Resources

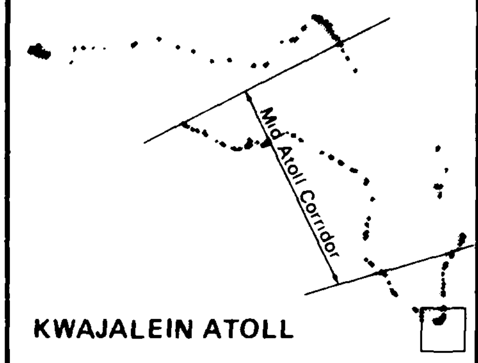
Potential impacts from the HEDI XTV test activities could occur from construction activities and sewer and utility line connections/hookups.

Kwajalein Island - Direct impacts on cultural resources could result from the construction of the joint HEDI/ERIS warehouse and associated driveway. However, the warehouse site has been disturbed previously and is not located on or near the known archaeological and historic sites (Figure 3-2).

Meck Island - Direct impacts on cultural resources could occur from: the connection/hookup of the power, telephone, sewer, and water lines, and the new road that will connect the HEDI/SBI MAB to existing power and utility lines and to the existing roadway; and the construction of the KV fueling area. However, the new road and the power and utility lines will be constructed and laid in a previously disturbed (bulldozed) area with no known archaeological or historic sites. Similarly, the KV fueling area will be built on a site with an existing concrete slab that will be removed, and the new water and utility lines will be placed along existing asphalt pavement that will be removed and replaced in an area previously bulldozed and disturbed and with no known archaeological or historic sites.



References: Modified from US Army Kwajalein Atoll (Draft) Master Plan 1988
National Register of Historic Places Inventory Nomination Form/ Kwajalein Island Battlefield, 1984



EXPLANATION

- ARCHAEOLOGICAL STUDY SITES
- HISTORIC SITES
- NEW LAND CREATED BY DREDGING AND FILLING

0 120 240 600
Meters

0 400 800 2000
Feet

Cultural Resource Sites and New HEDI/ERIS Warehouse, Kwajalein Island, USAKA

Figure 3-2

Consequently, potential impacts on cultural resources from HEDI XTV test activities are believed to be insignificant. No cumulative impacts that would further jeopardize any cultural resources have been identified.

3.1.7.3 Infrastructure

Potential impacts on water supply and wastewater treatment on Kwajalein Island could arise from the less than 3 percent increase in personnel in the first quarter of 1993 attributable to the HEDI XTV test activities.

Water Supply - Demands on the Kwajalein Island groundwater lens would increase during the dry season and particularly during drought periods. The potential to overpump the groundwater lens would increase, resulting in an increased potential for groundwater quality degradation as a result of saltwater infiltration. However, water conservation techniques are a necessary and routine part of life at USAKA during such times. Furthermore, any water shortfall would be mitigated by the installation of the proposed 568,000-liter-per-day (150,000-gallon-per-day) desalination plant planned for completion prior to the start of HEDI XTV activities at USAKA.

Consequently, potential direct impacts on water supply and potential indirect impacts on groundwater quality are considered to be mitigable and nonsignificant.

Wastewater Treatment - The Kwajalein Island wastewater treatment plant is currently reaching its hydraulic capacity, but the organic loading is only 70 percent of the design organic capacity. Increased demand on the wastewater treatment system could result in periodic discharges of excessive suspended solids and primary treatment criteria might not be met. However, these potential impacts would be readily mitigated by water conservation, continued wastewater monitoring, and by participation in a wastewater treatment effectiveness study to ensure that wastewater effluent standards are met.

Consequently, potential impacts on the wastewater treatment system are considered to be mitigable and nonsignificant.

HEDI activities were reviewed against existing environmental documentation on current and planned actions and anticipated future projects, and the potential for cumulative impacts on water supply and wastewater treatment infrastructure exists. However, the potential cumulative impacts can be mitigated effectively by the mitigation measures cited above, which have also been made a part of the proposed action and described in Section 1.0.

3.1.7.4 Socioeconomics (Housing)

Potential impacts on housing could arise from the estimated additional operational support staff of 56 accompanied personnel, 8 unaccompanied personnel, and 25 transient engineers and technicians required to support the HEDI XTV test flights. These additional personnel will contribute to a predicted housing shortage in the fiscal year 1992-1993 time frame even after construction of the proposed 130 new family housing units and 400 UPH units.

However, because USAKA is dedicated to military missions and populated by U.S. residents, the military and contractor personnel and their dependents are not allowed to reside on Kwajalein Island unless approved housing is available. In addition, the anticipated housing shortage is predicated on the planned phase-out of the 254 trailers after fiscal year 1992. The predicted shortage would be mitigated by the construction of the proposed 130 new housing units, 400 UPH units, and by retaining as many of the current 254 trailers, substandard by current Army standards, as will be required to house personnel supporting HEDI and other programs at USAKA.

Consequently, potential impacts on housing are considered to be mitigable and nonsignificant.

HEDI activities were reviewed against existing environmental documentation on current and planned actions and anticipated future projects, and the potential for cumulative impacts on housing exists. However, the potential cumulative impacts can be effectively mitigated by the mitigation measures cited previously, which have also been made part of the proposed action and described in Section 1.0.

As a result of the Summary EA prepared in August 1987 for technologies in the SDI Demonstration/Validation program, the SDIO and the USASDC determined that the Demonstration/Validation activities proposed for these technologies and the associated facilities needed to support them at USAKA could have significant and cumulative effects on the environment of Kwajalein Atoll (17). An EIS is being prepared for USASDC by the Pacific Ocean Division of the U.S. Army Corps of Engineers at Fort Shafter, Hawaii. Meanwhile, routine range operations continue.

3.1.8 Vandenberg Air Force Base/Western Test Range

The HEDI test program will collect IR signature data (utilizing the IRIS target tracking system) from launches of MINUTEMAN missiles out of Vandenberg AFB into USAKA to aid in development of the HEDI seeker. HEDI XTV may require a dedicated launch of a MINUTEMAN missile. Regularly scheduled launches are a continuation of activities that are within the existing operational limits of Vandenberg AFB. No new construction or additions to staff will be required (195, 224); thus, no infrastructure or socioeconomic impacts will occur. HEDI technology testing activities will not create additional launches. Environmental effects of MINUTEMAN and Thor missile launches at Vandenberg AFB have been addressed in an EA (216), which concluded that there would be no adverse environmental impacts.

There are five Federally listed endangered species (the California brown pelican, California least tern, least Bell's vireo, American peregrine falcon, and unarmored three-spine stickleback), two threatened species (the southern sea otter and the Guadalupe fur seal), and over 600 known cultural resources (one site is on the National Register of Historic Places for Vandenberg AFB). However, HEDI activities are similar to the routine mission activities of Vandenberg AFB and will not pose any new or additional threat to the threatened and endangered species nor disturb the archaeological sites. Because no additional permanent personnel will be required, HEDI activities will not contribute to or exacerbate the aquifer overdraft problem or the nonattainment status of northern Santa Barbara County for ozone and particulate matter.

All of the criteria for the no significant impact determination are met when the assessment criteria are applied against the test activities at Vandenberg AFB. The Western Test Range also meets all the assessment criteria. HEDI activities were reviewed against existing environmental documentation on current and planned actions and anticipated future projects, and no cumulative impacts were identified as a result of the HEDI testing.

3.1.9 White Sands Missile Range

The HEDI KITE tests to be conducted at WSMR are: analyses and component/assembly tests to evaluate nontactical launch equipment, analyses and component/assembly tests to evaluate the reception of prelaunch intercept data, component/assembly tests of the KV, analysis and component/assembly tests to evaluate the window cooling system, and actual flight testing of KITE 1 through KITE 3. Existing facilities will be utilized, the most recent construction and refurbishment of which is covered in the Record of Environmental Consideration (251).

The only new construction at WSMR in support of HEDI tests will be the siting and construction of new fixed recording camera stands along the missiles' trajectory and the possible burying of the connecting fiber-optic cables in shallow trenches, as detailed in Section 1.0. Additional HEDI KITE-related personnel requirements have been estimated at 1 full-time individual and 35 to 40 additional contractor personnel on temporary duty from approximately 6 months before until 1 month after each of the three HEDI KITE test flights. This represents an approximate 0.4-percent increase in staff and will not tax the installation's infrastructure nor the ability of the surrounding communities (which have a combined population of 750,000) to accommodate WSMR personnel. Additional water consumption by these individuals will be minor and temporary, and, therefore, will not contribute significantly to the current groundwater overdraft situation. Flight operations will involve the use of small amounts of hazardous and toxic materials (see Appendix F). Any hazardous or toxic waste will be collected and disposed of by an approved and licensed contractor(s) in accordance with State of New Mexico and Environmental Protection Agency (EPA) regulations. Debris will be handled in accordance with WSMR's existing prescribed policies, responsibilities, and procedures for the security, recovery, and disposition of classified, unclassified, and hazardous test material impacting on and off the range (WSMR Regulation 70-8). HEDI KITE tests will not contribute to or exacerbate the potential public health and safety issues previously identified (see Table B-8, Appendix B).

Both stages of the SPRINT system and the ARIES booster use solid propellant. The primary emission products will be aluminum oxide, hydrogen chloride, carbon monoxide, carbon dioxide, water, hydrogen, and nitrogen. Ground-level concentrations would not affect vegetation, wildlife, or the ambient air quality, except during the few seconds at liftoff. Air quality monitoring during launches is not normally done at WSMR, and launches do not pose an air quality problem. The second-stage emissions will quickly dissipate high in the atmosphere and not cause an impact at the ground level. With KITEs 1 and 2 representing just one launch each and KITE 3 two launches (SPRINT and ARIES), compared to a baseline average of 852 test flights per year since 1945, these emission levels are considered minor.

Applying the assessment criteria against the test activities, all of the criteria for the no significant impact determination are met, except in the areas of biological resources, cultural resources, infrastructure (transportation), and land use. Consequently, these areas are discussed in more detail in the following sections.

3.1.9.1 Biological Resources

Potential impacts from the HEDI KITE test activities could arise from construction activities associated with establishment of the trajectory monitoring stations (camera stations), from falling debris, or from noise. Similarly, there exists a small chance that fires started by falling debris could affect several plant and animal species, but this is considered nonsignificant because WSMR has a fire response unit that normally contains the small fires caused occasionally by falling debris. The most recent fire occurred in 1987 and biological damage was minimal. Protected species within the project area that are subject to these direct and indirect impacts are listed in Table 3-1.

Construction Impacts - Few direct impacts are anticipated from the HEDI testing program because no major construction is anticipated. The camera stations near Launch Complex 37 are in a previously disturbed area, and no significant biological impacts are expected from construction. However, if new camera sites, connecting cables, and access roads must be placed in natural (undisturbed) terrain, there is a small possibility for losses of individual plants of two protected plant species: the dune unicorn plant and sand prickly pear. Relatively undisturbed creosote bush scrub vegetation will be affected by construction of the northernmost camera site (Site 9). Protected species that may be present in this community include the black-tailed prairie dog and trans-Pecos rat snake.

The mitigation measures proposed for locating the camera monitoring sites will ensure that a minimum of native ground is disturbed by construction and that impacts on sensitive plants will be avoided (see Section 4.0). A key aspect of this mitigation is a walkover survey to be performed, prior to any construction, by the WSMR wildlife biologist or other WSMR-designated biologist. If protected plant or animal species are located, the alignment of the facilities will be moved to avoid the protected species.

Table 3-1. PROTECTED SPECIES KNOWN OR POSSIBLY OCCURRING WITHIN THE HEDI KITE CAMERA SITE AND DEBRIS IMPACT AREAS AT WSMR

FEDERAL DESIGNATIONS

Category 2 (possibly endangered or threatened; more data required)

BIRDS:
Swainson's hawk (*Buteo swainsoni*)
Southern spotted owl (*Strix occidentalis lucida*)
Mountain plover (*Charadrius montanus*)

MAMMALS:
Spotted bat (*Euderma maculatum*)
Occult bat (*Myotis lucifugus occultus*)
Arizona prairie dog (*Cynomys ludovicianus arizonensis*)

PLANTS:
Dune unicorn plant (*Proboscidea sabulosa*)
Grama grass cactus (*Pediocactus papyracanthus*)
Nooding cliff daisy (*Perityle cernua*)
Alamo beard tongue (Penstemon alamosensis)
Gray sibara (*Sibara grisea*)
Organ Mountains evening primrose (*Oenothera organensis*)
Sand prickly pear (*Opuntia arenaria*)
Curl-leaf needle grass (*Stipa curvifolia*)

NEW MEXICO LISTED SPECIES

BIRDS:
Gray vireo (*Vireo vicinior*) Endangered, Group 2.

MAMMALS:
Desert bighorn sheep (*Ovis canadensis*) Endangered, Group 1.

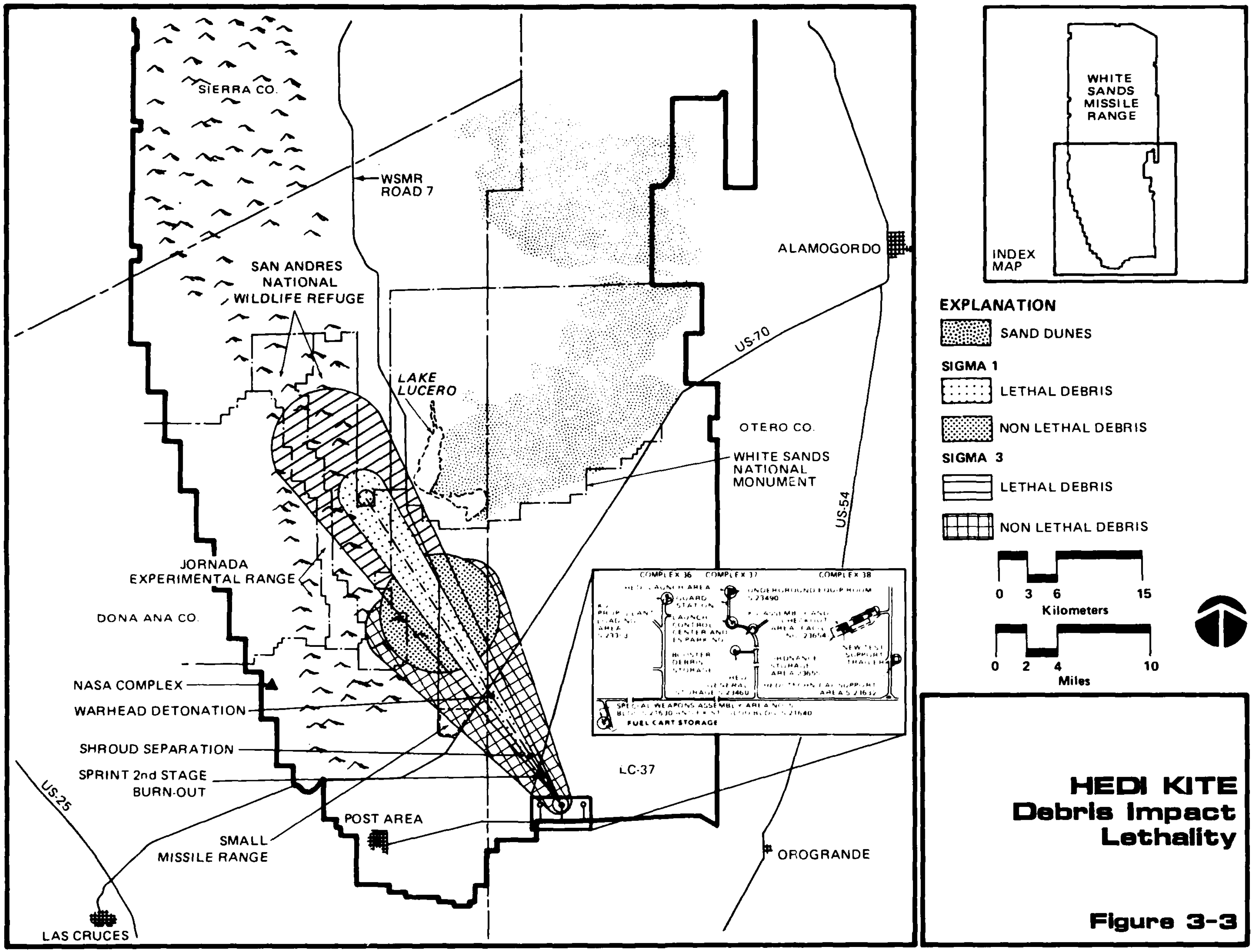
REPTILES:
Trans-Pecos rat snake (*Elaphe subocularis*) Endangered, Group 2.

Impacts from Falling Debris - The HEDI KITE debris impact trajectory contains two areas (Figure 3-3). The Sigma 1 area is that area in which 68 percent of the debris is expected to fall (see Appendix G). The Sigma 3 area is that area in which 95 percent of the debris is expected to fall. The Sigma 3 area that is outside the Sigma 1 area is, thus, that area in which 27 percent of the debris is expected to fall. The lethality of the debris is a function of the kinetic energy of the pieces of debris as they would hit the ground. A number of models have been developed to estimate the characteristics of debris fragments. These models were used to estimate the number, size, weight, density, and construction of lethal fragments resulting from the destruction of the HEDI KV. These results were used, along with the size of the debris areas, to determine probabilities of lethal debris falling in a given area. (Additional discussion is presented in Appendix G.)

Many protected species are found within the debris impact areas. The plants, if present, will not suffer adverse effects from the minor amounts of debris. There is a remote chance that animals will be disturbed or harmed by falling debris, and this impact is judged to be insignificant.

The desert bighorn sheep in the San Andres NWR will be exposed to an extremely remote chance of impacts from falling debris. It is predicted that 190 pieces of debris will fall with a lethal force within the debris impact area of 48,255 hectares (119,236 acres). The probability of a piece of lethal debris falling in any 0.4 hectare (1 acre) in the Sigma 1 area is 0.0023296 (1 in 450), and 0.0008043 (1 in 1,250) that lethal debris will fall in the Sigma 3 area outside the Sigma 1 area (see Appendix G). Assuming that a sheep covers an area of 0.46 square meters (5 square feet), the probability that a sheep in the Sigma 1 area will be hit by a piece of lethal debris is 0.000000267 (1 in 4 million), and 0.000000093 (1 in 11 million) that a sheep in the Sigma 3 area outside the Sigma 1 area will be hit (see Appendix G). Moreover, the possibility that a sheep will be in the debris impact area is small. (Although the projected flight and fallout path will cover approximately one-third of the eastern and northern portions of the refuge, it will cover less than 10 percent of the total range of the sheep, as shown in Section 2.0, Figure 2-13). The HEDI KITE flights 2 and 3, along a similar trajectory and producing similar amounts of debris, will have essentially the same debris impact areas as HEDI KITE 1. Therefore, it is concluded that the falling debris will not have a significant impact on the desert bighorn sheep population.

Noise Impacts - Existing information on responses of bighorn sheep to noise is equivocal, consisting of anecdotal observations. For example, Monson and Sumner (244) report that "sonic booms sometimes startle bighorn, but on other occasions the bighorn pay no attention to them." They also cite Geralo I. Day of the Arizona Fish and Game Department: "Jets, sonic booms, and artillery fire practically overhead did not seem to disturb bighorn." Another observer stated, "I can relate experiences of having seen bighorn become startled with sonic booms. Again there are those that pay little or no attention to the boom. I did observe several bighorn go into headlong flight when the scream of rockets was heard nearby." An observation from California stated "Sonic booms have startled bighorn, causing them to leap into the air and lose their footing while they were being observed in the Santa Rosa Mountains." Information is not available on noise levels within the San Andres NWR caused by



HEDI KITE
Debris Impact Lethality

Figure 3-3

WSMR activities. The local desert bighorn sheep are expected to be most sensitive to noise disturbance during the lambing season (February to May).

Impacts on the bighorn from noise caused by sonic booms emanating from the HEDI KITE tests were also judged to be insignificant. This is because the HEDI KITE test site will be very far away (15 kilometers [9 miles]) from the sheep, and because only three tests, about one per year, are planned. The disturbance from these tests will be far less than that now experienced by the local desert bighorn from aircraft overflights, which occur frequently. Tests will occur annually, beginning in 1989, and will be scheduled to minimize potential impact on the San Andres NWR, in coordination with the New Mexico Department of Game and Fish.

Other types of noises definitely are known to cause panic in desert bighorn. Low-altitude helicopter flights can cause the bighorn to "dart in all directions, bowling over their lambs, and in general showing great fear" (244). In the remote event of a failure during the HEDI KITE tests, recovery of debris in the mountainous areas using helicopters may be necessary. This worst-case scenario, which has a very low probability, could cause adverse impacts on the local desert bighorn sheep population if recovery efforts were conducted in proximity to the sheep. In the event such recovery is necessary, mitigation measures will be implemented to minimize potential impacts on the bighorn sheep. The biologist at the San Andres NWR will be contacted before any recovery effort will be made to determine whether any bighorn sheep are in the recovery area. If there are sheep in the area, recovery will be delayed until they have moved. During the recovery operation, the biologist will accompany the recovery team to ensure that recovery efforts are not conducted in areas then inhabited by bighorn sheep.

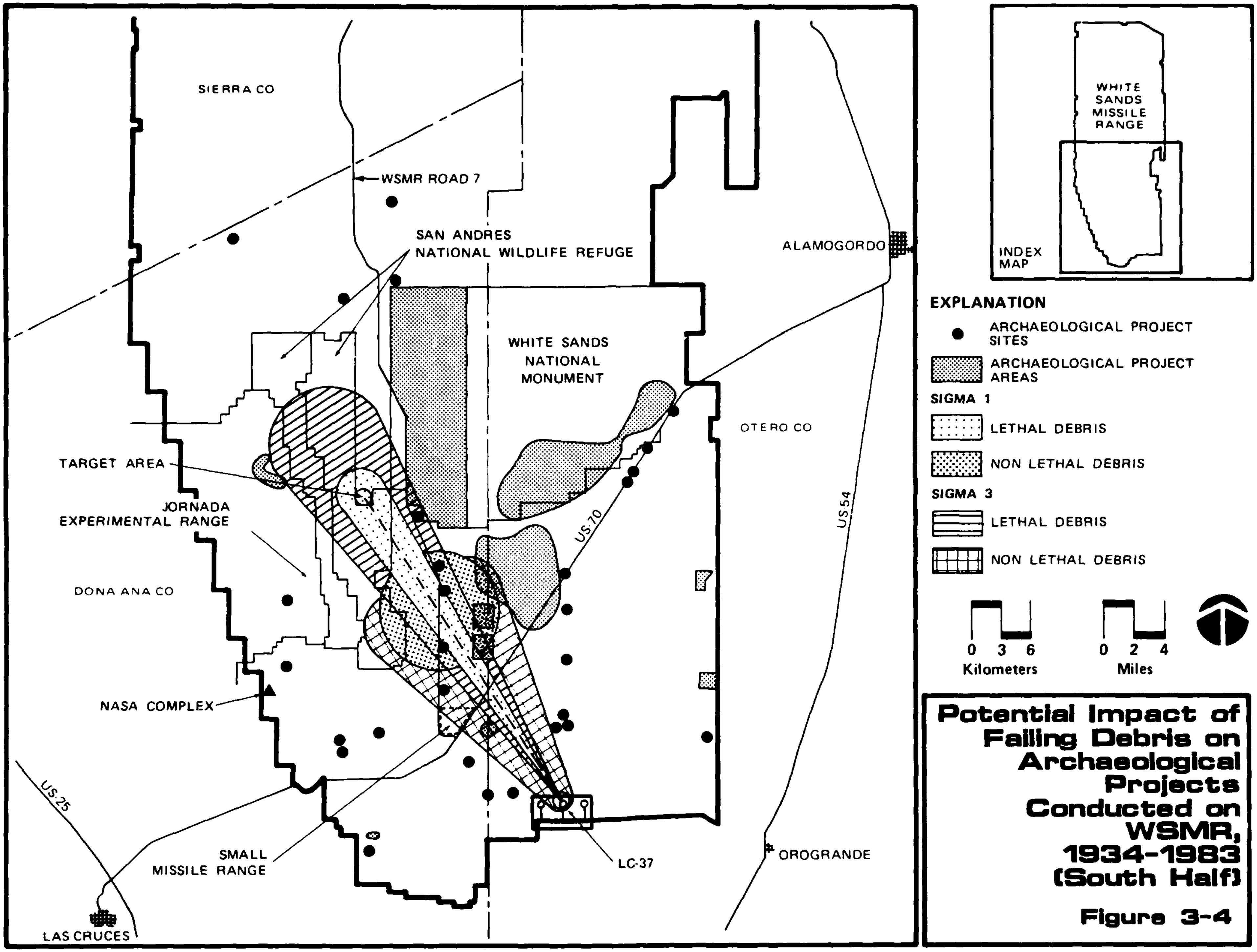
Overall, however, potential impacts on biological resources are considered to be mitigable and nonsignificant. No cumulative impacts on biological resources have been identified.

3.1.9.2 Cultural Resources

Potential impacts from the HEDI KITE test activities could occur from construction activities associated with establishing the fixed camera stands and from falling debris.

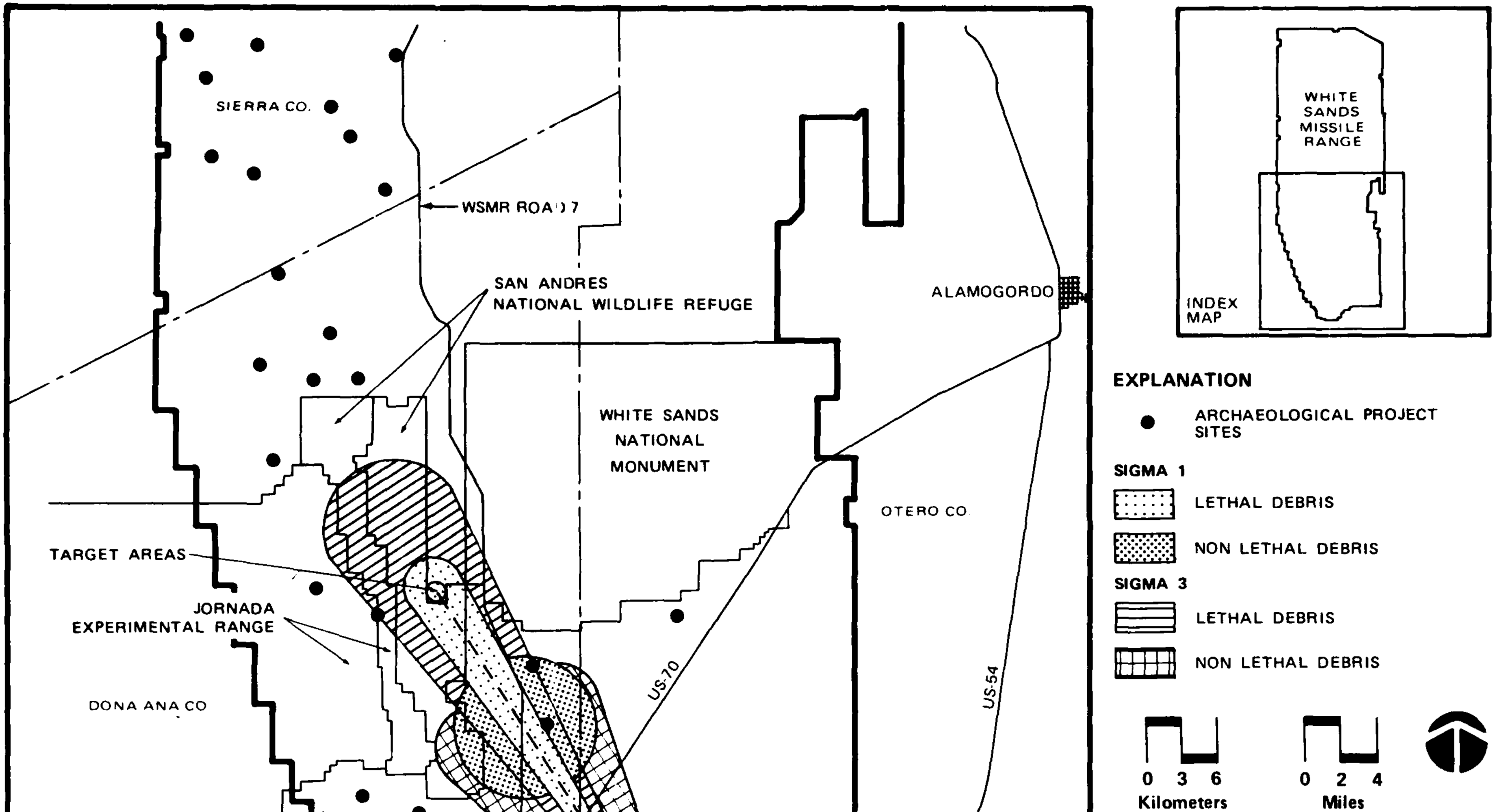
Construction Impacts - Direct impacts on cultural resources could occur from the construction of camera stands and the placement of communications cables. However, an archaeological survey will be performed prior to any construction, and, if any sites are located, they will either be avoided or significant data will first be recovered, after consultation with the State Historic Preservation Officer (SHPO). The results of such archaeological surveys at WSMR are routinely coordinated via written reports to the SHPO and any necessary actions handled in accordance with the Programmatic Memorandum of Agreement (PMOA) among the DOD, the New Mexico SHPO, and the Advisory Council on Historic Preservation (261). Similarly, any Mescalero Apache sacred sites located would be avoided and reported to tribal authorities.

Impacts from Falling Debris - Figures 3-4 and 3-5 show the anticipated flight trajectory superimposed on a map showing the locations of known prehistoric and



Potential Impact of Falling Debris on Archaeological Projects Conducted on WSMR, 1934-1983 (South Half)

Figure 3-4



Potential Impact of Falling Debris on Known Pre-Military Historic Sites on WSMR (South Half)

Figure 3-5

historic sites. Only five known archaeological sites are in the Sigma 3 area, one of which is just on the border of the debris impact area (Figure 3-4). Only three known premilitary historic sites are located within the Sigma 3 debris impact area (Figure 3-5). Prehistoric sites are expected in all major landforms within WSMR, except alkali flats; site type distributions and frequencies are expected to vary concomitantly (241). Given the low probability of large debris pieces falling in any 1 acre, the probability of impacts on any one prehistoric or historic archaeological site is very low; therefore, debris impact damage is highly unlikely and considered insignificant. The two National Register of Historic Places sites (Trinity Site and Launch Complex 33) are not in the debris impact area and will not be affected by HEDI KITE activities, nor will the two New Mexico Cultural Property Register sites.

Overall, potential impacts on cultural resources are believed to be insignificant. No cumulative impacts that would further jeopardize any cultural resources have been identified.

3.1.9.3 Infrastructure (Transportation)

Infrastructure impacts of HEDI tests at WSMR involve closing U.S. Highway 70, which crosses the lower portion of the range north of the launch complexes, between Las Cruces and Alamogordo. For safety reasons, this portion of the highway is routinely closed before all test flights and remains closed until after the test, for a total of no more than 80 minutes. This practice is routine and normal for the range and local population. The impact of HEDI's one test flight per year, compared to the average of 850 test flights per year, is considered insignificant.

3.1.9.4 Land Use

Potential land-use impacts of HEDI tests include the evacuation of ranchers in the co-use area adjacent to the western boundary of the range. When firings are scheduled, residents (approximately 21 in the affected area) leave their homes for a specified time, generally a maximum of 12 hours. Upon completion of the firings, all-clear notices are broadcast from area radio stations as public service announcements. In addition to being paid for the use of their land, these ranch families, adults and children, are paid for the hours they spend away from home each time they are evacuated. This evacuation occurs periodically for particular launch trajectories.

Evacuations are limited to a maximum of four per month by terms of the agreement between WSMR and the ranchers (289). Because there would be only one scheduled HEDI launch each year and routine procedures and agreements exist for such evacuations, impacts from these evacuations are considered insignificant.

A potential indirect impact of the HEDI KITE test activities is the increased likelihood that use of this part of the range (debris impact area) will be increased to take advantage of the new instrumentation. This possibility, however, is considered small, because the trajectory requirements of HEDI KITE (high altitude, short range) are unusual and not typically required of other test programs, and the new instrumentation is confined to the southernmost part of the range south of U.S. Highway 70 and not located along the length of HEDI KITE's trajectory. In addition, any future program that might desire use of similar trajectories or debris impact areas would require separate environmental analysis and documentation. This EA does not address the use of this part of the range for anything other than the specific HEDI KITE flight tests described.

HEDI activities were reviewed against existing environmental documentation on current and planned actions and anticipated future projects, and no cumulative impacts were identified as a result of the HEDI testing.

3.2 ENVIRONMENTAL CONSEQUENCES OF NO ACTION

If the no-action alternative is selected, no additional environmental consequences are anticipated. Present activities would continue at current installations with no change in operations; however, the no-action alternative would preclude the timely evaluation of the HEDI technology.

3.3 CONFLICTS WITH FEDERAL, REGIONAL, STATE, LOCAL, OR INDIAN TRIBE LAND-USE PLANS, POLICIES, AND CONTROLS

All of the technology test activities at all locations, except WSMR and USAKA, will take place in existing or modified/refurbished facilities. The HEDI KITE flight test activities at WSMR will also utilize existing, modified, or refurbished facilities, with the one exception of requiring the construction of new fixed recording camera stands. Because WSMR has been dedicated to supporting missile development and test programs since 1945, HEDI KITE activities will pose no conflicts with land-use plans, policies, and controls. The low probability of debris impacting on the westernmost edges of the White Sands National Monument is recognized by the Master Special Use Agreement (260) (and its renewal through December 31, 1996) between the Department of the Interior and the Department of the Army. This agreement permits concurrent use of specified areas within the boundaries of the White Sands National Monument when necessary for technical testing of space and missile materials.

HEDI XTV test activities at USAKA will also utilize existing, modified, or refurbished facilities, with the exception of the new joint HEDI/ERIS warehouse on Kwajalein Island and the new HEDI/SBI MAB seawall; power, telephone, sewer, and water lines and road; and KV fueling area on Meck Island. Because USAKA has been dedicated to supporting ICBM programs, various orbital programs, and other research programs since the 1950s, HEDI activities will pose no conflicts with land-use plans, policies, and controls.

3.4 ENERGY REQUIREMENTS AND CONSERVATION POTENTIAL

Anticipated energy requirements of each technology test activity at each location are well within the energy supply capacity of each installation (see the Electricity section of Tables B-1 through B-8, Appendix B), as validated by site visits. Energy requirements will be subject to the routine energy conservation practices at each installation. No new power generation capacity will be required for any of the HEDI technology test activities at any of the locations identified, because the activities will be compatible with the installations' ongoing missions.

3.5 NATURAL OR DEPLETABLE RESOURCE REQUIREMENTS

Other than the various metallic and nonmetallic structural materials and fuel resources used in the technology test activities, there are no significant natural or depletable resource requirements associated with the program. Only existing or modified facilities will be used to conduct the various analyses, simulations, and component/assembly activities for HEDI KITE and even the flight tests will use refurbished SPRINT boosters for KITEs 1, 2, and 3 and an ARIES booster for the KITE 3 target vehicle. For HEDI XTV, the same types of tests will be required, although a new booster will be fabricated and new facilities will be constructed at USAKA.

3.6 ADVERSE ENVIRONMENTAL EFFECTS THAT CANNOT BE AVOIDED

There are no known adverse environmental effects that cannot be avoided for any of the technology test activities at any of the locations identified.

3.7 RELATIONSHIP BETWEEN SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Technology test activities at all locations involved in the proposed action, with the exception of WSMR and USAKA, will take advantage of existing facilities and infrastructure using modified or refurbished facilities. Activities at WSMR will necessitate the construction of new fixed recording camera stands and associated cable trenches on part of the range that has been dedicated to supporting missile development and test programs since 1945. Similarly, activities at USAKA will necessitate the construction of a new warehouse and associated roadway on Kwajalein Island and the connection/hookup of power and other utility lines and a new road on Meck Island on part of the range that has been dedicated to supporting ICBM orbital and other research programs since the 1950s. Therefore, the proposed action does not eliminate any options for future use of the environment for any of the locations under consideration.

3.8 IRREVERSIBLE OR IRRETRIEVABLE COMMITMENT OF RESOURCES

The proposed action will result in no loss of habitat for plants or animals, no loss or impact on threatened and endangered species that cannot be mitigated, and no loss of cultural resources, such as archaeological or historical sites, that cannot be mitigated by avoidance or data recovery. Moreover, there will be no changes in land use nor preclusion of development of underground mineral resources that were not already precluded.

The amount of materials required for any technology test-related construction and energy use during project utilization will be small. However, development of the HEDI through the technology test phase would result in irreversible and irretrievable commitment of resources, such as electronic components, various metallic and nonmetallic structural materials, fuel, and labor. This commitment of resources is not different from that necessary for many other aerospace research and development programs; it is similar to the activities that have been carried out in previous aerospace programs over the past several years.

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4.0 MITIGATION MEASURES

Environmental consequences of HEDI technology test activities are deemed to be insignificant for all locations except USAKA and WSMR. The detailed mitigation actions described here are an integral part of the proposed action, as discussed in Subsection 1.3.

4.1 U.S. ARMY KWAJALEIN ATOLL, REPUBLIC OF THE MARSHALL ISLANDS

Potential HEDI XTV infrastructure and socioeconomic (housing) impacts at USAKA will be mitigated by the installation of the proposed desalination plant in the case of water supply; water conservation, wastewater monitoring, and participation in a wastewater treatment effectiveness study in the case of wastewater treatment; and construction of new housing and retention of as many of the trailers due to be phased out as necessary to house personnel supporting HEDI in the case of housing, resulting in nonsignificant impacts.

4.1.1 Infrastructure

Water Supply - Demands on the Kwajalein Island freshwater supply would increase with HEDI XTV test activities and the potential to overpump the groundwater lens would also increase. This will be mitigated by:

- Constructing the proposed 568,000-liter-per-day (150,000-gallon-per-day) desalination plant to increase the capacity of the freshwater supply provided by the water catchment and lens well system.

Wastewater Treatment - Demands on the Kwajalein Island wastewater treatment system could result in periodic discharge of excessive suspended solids and primary treatment criteria might not be met. This will be mitigated by:

- Participation in water conservation procedures
- Continued wastewater monitoring
- Participation in a wastewater treatment effectiveness study to ensure that the wastewater treatment plant continues to meet effluent standards.

4.1.2 Socioeconomics (Housing)

Demands on Kwajalein Island housing could result in a potential housing shortage. This will be mitigated by:

- Retention of as many of the 254 trailers due to be phased out after fiscal year 1992 as necessary to house personnel supporting HEDI
- Construction of 130 housing units and 400 UPH units.

4.2 WHITE SANDS MISSILE RANGE

Potential HEDI KITE biological and cultural resource impacts at WSMR will be mitigated by avoidance, resulting in nonsignificant impacts.

4.2.1 Biological Resources

Installation of Fixed Camera Sites - Although biological impacts on native vegetation and habitat at the camera sites were judged to be nonsignificant, the HEDI KITE testing program is committed to reducing the amount of new construction in undisturbed natural communities. Therefore, the installation of the camera sites will proceed under the following guidelines:

- Existing camera sites and access roads will be utilized to the greatest extent possible.

- Connecting cables between fixed-camera stands will be laid on the ground surface at several sites, avoiding trenching through undisturbed terrain, unless the location is determined to require protection for the cable to ensure operational capability. Cable laid on the surface will be removed after each mission.

- For the northernmost camera site (Site 9), the trench right-of-way will be combined with the road access. The shortest distance from existing access roads and electrical cables will be used for new construction.

- Prior to construction through undisturbed terrain, the wildlife biologist for WSMR or other designated biologist will perform a walkover survey of the right-of-way. If protected plant or animal species are located, the alignment of the facilities will be moved to avoid the protected species.

Debris Impact Area - The impact of falling debris on biological resources was judged to be insignificant. However, in the remote possibility of a flight failure for any of the three HEDI KITE tests, recovery of the fragments may be necessary. Because of the sensitivity of the desert bighorn sheep population in the San Andres Mountains, the following guidelines will be followed for debris recovery in the mountainous areas:

- Prior to the recovery effort, WSMR safety and recovery personnel will contact Ms. Patricia Hoban, the wildlife biologist at the San Andres NWR, for clearance to proceed.

- No helicopter flights will take place within the debris impact area inside the San Andres NWR without contacting the San Andres NWR.

- The wildlife biologist at the San Andres NWR will be invited to accompany recovery personnel during the helicopter flights to ensure that recovery flights are not conducted in areas then inhabited by the bighorn sheep.

4.2.2 Cultural Resources

Installation of Fixed Camera Sites - Although impacts on cultural resources at the camera sites were judged to be nonsignificant, the HEDI KITE testing program is committed to minimizing the amount of construction in undisturbed areas. Therefore, the installation of the fixed camera sites will proceed under the same guidelines previously outlined for biological resources, with the one difference that, prior to construction, the WSMR archaeologist will perform a walkover survey of the right-of-way. If cultural resources are located, the alignment of the facilities will be moved to avoid the cultural resource sites.

In addition, compliance procedures pertaining to potential impacts on cultural resources will be implemented in a manner consistent with the WSMR Historic Preservation Plan (250) and the PMOA among the Department of the Army, the New Mexico SHPO, and the Advisory Council on Historic Preservation (261).

Cultural resource surveys will be undertaken along the access routes connecting recording camera sites commensurate with planned construction activities and other impacts that could occur as a result of project implementation. Such surveys will identify and evaluate potentially affected historic and prehistoric archaeological sites and historic buildings. Appropriate consideration will be given to potential impacts on Native American sacred sites. Resources identified will be evaluated with regard to criteria of eligibility for National Register listing and for criteria of effect. If necessary, mitigation measures will be developed in consultation with the SHPO and implemented in a manner that will allow for appropriate data recovery, analysis, archival curation, and dissemination of results. Cultural resources located during construction procedures will be handled in a manner prescribed by the PMOA.

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5.0 GLOSSARY

ABM:	Antiballistic Missile
AEDC:	Arnold Engineering Development Center
Ambient Air Quality Standards:	Standards established on a state or Federal level that define the limits for airborne concentrations of designated "criteria" 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).
Alluvial Fan:	A cone-shaped area that is generally formed by mountain stream deposits as they run out onto a lowland plain.
Aquifer:	The water-bearing portion of subsurface earth material that yields or is capable of yielding useful quantities of water to wells.
Archaeology:	A scientific approach to the study of human ecology, cultural history, and cultural process, emphasizing systematic interpretation of material remains.
Attainment Area:	An air quality control region that has been designated by the EPA and the appropriate state air quality agency as having ambient air quality levels better than the standards set by the National Ambient Air Quality Standards (NAAQS).
Azimuth:	A distance in angular degrees in a clockwise direction from the north point.
Bajada (bahada):	In arid or semiarid areas, the nearly flat surface created where two or more alluvial fans join at the foot of a mountain range.
Biological Diversity:	Refers to the number of species and their relative abundance in an area or habitat.
Biota:	The animal and plant life of a particular region.
BOA:	Broad Ocean Area
Boost Phase:	The first phase of a ballistic missile trajectory during which it is powered by its engines. During this phase, which usually lasts 3 to 5 minutes for an ICBM, the missile reaches an altitude of about 200 kilometers (124 miles).

Candidate Species:	Species for which listing as Threatened or Endangered is possible, but for which more biological and threat data are needed before a final determination is made.
CERCLA:	Comprehensive Environmental Response, Compensation, and Liability Act
Concept Exploration:	Provides the research to determine whether a technology can meet a mission need. After reviewing the status of concept exploration, a decision will be made regarding advancement of the technology to demonstration/validation.
CONUS:	Continental United States
Cultural Resources:	Prehistoric and/or historic districts, sites, structures or other physical evidence of human use considered of some importance to a culture, subculture, or community for scientific, traditional, religious, or other reasons.
Demonstration/Validaation Program:	A program designed to determine the ability of the technology to perform its intended function and to provide the information necessary to make an informed decision whether to proceed with full-scale development.
DOD:	Department of Defense
DOPAA:	Description of Proposed Action and Alternatives
DPDO:	Defense Property Disposal Office
Endangered Species:	A species that is threatened with extinction throughout all, or a significant portion, of its range.
Endoatmosphere:	Within the earth's atmosphere, generally altitudes below 33,500 meters (110,000 feet).
Environmental Assessment (EA):	A concise public document in which a Federal agency provides sufficient analysis and evidence for determining the need for an Environmental Impact Statement (EIS) or Finding of No Significant Impact (FNSI). EAs provide agencies with useful data regarding compliance with the NEPA and are an aid in the preparation of an EIS.
Environmental Impact Statement (EIS):	A detailed analysis of environmental aspects of a proposed project that is anticipated to have a significant effect on the human environment.

EPA:	Environmental Protection Agency
ESQD:	Explosive Safety Quantity Distance
Fauna:	Animals: organisms of the animal kingdom of a given area taken collectively.
Flora:	Plants: organisms of the plant kingdom taken collectively.
FNSI:	Finding of No Significant Impacts
FY:	Fiscal Year
GBR:	Ground-Based Radar
Groundwater:	All the water derived from percolation of rainwater, from water trapped in a sediment at its time of deposition, and from magmatic sources lying under the surface of the ground above an impermeable layer, but excluding underground streams.
Hazardous Waste:	The RCRA defines hazardous waste as any discarded material that may pose a substantial threat or potential danger to human health or the environment when improperly handled. Some of the characteristics of these wastes are toxicity, ignitability, corrosivity, and reactivity.
HEDI:	High Endoatmospheric Defense Interceptor
ICBM:	Intercontinental Ballistic Missile
Impact:	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 by a qualitative and nominally subjective technique.
IR:	Infrared
IRIS:	Infrared Instrumentation System
IRP:	Installation Restoration Program
Kinetic Energy	The energy created by the motion of an object.

Kinetic Kill Vehicles:	Weapons that would attack the warhead-carrier buses in the post-boost phase as they deploy their warheads and decoys.
KITE:	Kinetic Kill Vehicle Integrated Technology Experiment. This relates to a conventional kill of an RV.
KV:	Kill Vehicle
kWh:	Kilowatt-hour
Landfill:	Land waste disposal site that is located to minimize water pollution from runoff and leaching; waste is spread in thin layers, compacted, and covered with a fresh layer of soil each day to minimize pest, aesthetic, disease, air pollution, and water pollution problems.
Ldn:	The 24-hour average-energy sound level expressed in decibels, with a 10-decibel penalty added to sound levels between 10 p.m. and 7 a.m.
Lithic Scatter:	The debris left from the construction of stone tools.
MAB:	Missile Assembly Building
MDSSC:	McDonnell Douglas Space Systems Company
Milliwatt:	One one-thousandth of a watt
Mitigation:	A method or action to reduce or eliminate program impacts.
MMH	Monomethylhydrazine Fuel - a colorless, odorless, corrosive rocket fuel.
NAAQS:	National Ambient Air Quality Standards
NCO Housing:	Housing for non-commissioned officers
NEPA:	National Environmental Policy Act
NOI:	Notice of Intent
Nonattainment Area:	An air quality control region that has been designated by the EPA and the appropriate state air quality agency as having ambient air quality levels below the primary standards set by NAAQS.

NOTAM:	Notice to All Airmen
NOTMAR:	Notice to Mariners
NPDES:	National Pollutant Discharge Elimination System. Regulates discharges into the nation's waters with a Federal permit program designed to reduce the amount of pollutants in each discharge.
NTF:	National Test Facility
OR Report:	Operation Requirement Report
Outcrop:	That part of a geologic formation or structure that appears at the surface of the Earth.
PACA:	Propulsion and Control Assembly
PCBs:	Polychlorinated Biphenyls
PMOA:	Programmatic Memorandum of Agreement
PSD:	Prevention of Significant Deterioration regulations. Prevents degradation of air that is already cleaner than that required by NAAQS.
RCRA:	Resource Conservation and Recovery Act. Established in 1976 to protect human health and the environment from improper waste management practices.
Reentry Vehicle (RV):	The part of a ballistic missile that carries the nuclear warhead to its target. The reentry vehicle is designed to reenter the Earth's atmosphere in the terminal portion of its trajectory and proceed to its target.
Revegetation:	Regrowth or replacement of a plant community on a disturbed site. Revegetation may be assisted by site preparation, planting, and treatment, or it may occur naturally.
RMI:	Republic of the Marshall Islands
SBI:	Space-Based Interceptor
SDI:	Strategic Defense Initiative
SDIO:	Strategic Defense Initiative Organization

Seeker: Infrared sensor in the KV that is used to acquire, angle track, and provide closure information on a targeted RV.

Sensitive Species: Species for which more scientific information is needed to determine its current biological status.

SHPO: State Historic Preservation Officer

SLBM: Submarine-Launched Ballistic Missile

Sludge: The accumulated semi-liquid suspension of settled solids deposited from wastewaters or other fluids in tanks or basins.

STARS: Strategic Target System

Tactical: (As in tactical missiles). Of or pertaining to the technique of securing the objectives designated by strategy.

Target of Opportunity: A target launched as part of one program that can be used by another program as well, e.g., for tracking tests.

Taxa: A taxonomic entity (species, subspecies, or variety) or a group of such entities.

Terminal Phase: The final phase of a ballistic missile trajectory during which warheads and penetration aids reenter the atmosphere. This phase follows the end of the midcourse phase and continues until impact or arrival of the missile in the vicinity of the target.

Threatened Species: Taxa likely to become endangered in the foreseeable future.

Trajectory: The curved path of an object hurtling through space, especially that of a projectile from the time it is fired.

UPH: Unaccompanied Personnel Housing

USAKA: U.S. Army Kwajalein Atoll - USAKA includes 11 leased islands (Kwajalein, Roi-Namur, Ennylabegan, Meck, Gagan, Gellinam, Omelek, Eniwetak, Legan, Ennugarret, and Illeginni) in the Kwajalein Atoll, Republic of the Marshall Islands.

USASDC: U.S. Army Strategic Defense Command

Wetlands:	Areas that are inundated or saturated with surface or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil, including swamps, marshes, bogs, and similar places.
Wind Tunnel Test:	Test environment that simulates high-speed flight; used to evaluate the guidance and control system in various flowfields.
Window Cooling System:	The equipment that passes liquid nitrogen over the sapphire window of the KV to cool it and prevent distortion.
WSMR:	White Sands Missile Range
WTR:	Western Test Range
XTV:	Experimental Test Vehicle

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6.0 AGENCIES CONTACTED

U.S. DEPARTMENT OF THE ARMY

U.S. Army Kwajalein Atoll
APO San Francisco, California
96555-2526

U.S. Army Strategic Defense Command
Crystal Mall #4, Suite 900
1641 Jefferson Davis Highway
Crystal City, Virginia 22215

U.S. Army Strategic Defense Command
P.O. Box 1500
Huntsville, Alabama 35807-3801

U.S. Army White Sands Missile Range
STEWS-EL-N
White Sands, New Mexico 88002-5076

U.S. DEPARTMENT OF THE AIR FORCE

Arnold Engineering and Development Center, AEDC/DE
Arnold AFB, Tennessee [illegible]389-5000

Hill AFB
Environmental Office
2849 ABG/DEV
Hill Air Force Base, Utah 84056

National Test Facility
Consolidated Space Operations Center
Falcon AFB
1003 SSG/DEEV
Peterson AFB, Colorado 80914

Vandenberg AFB
1 STRAD/ET
Vandenberg AFB, California
92437-5000

U.S. DEPARTMENT OF THE NAVY

Naval Surface Warfare Center
10901 New Hampshire Avenue
Silver Springs, Maryland 20903

U.S. DEPARTMENT OF ENERGY

Department of Energy
Albuquerque Operations Office
P.O. Box 5400
Albuquerque, New Mexico 87115

U.S. DEPARTMENT OF THE INTERIOR

U.S. Fish and Wildlife Service
Endangered Species
P.O. Box 1306
Albuquerque, New Mexico 87103

U.S. Fish and Wildlife Service
2800 Cottage Way, Room #1803E
Sacramento, California 95825

U.S. Fish and Wildlife Service
San Andres National Wildlife Refuge
P.O. Box 756
Las Cruces, New Mexico 88004

White Sands National Monument
P.O. Box 458
Alamogordo, New Mexico 88310

U.S. Fish and Wildlife Service
Pacific Islands Office
P.O. Box 50167
Honolulu, Hawaii 96850

OTHER FEDERAL AGENCIES

Environmental Protection Agency
401 "M" Street, SW
Washington, DC 20460

Environmental Protection Agency
215 Fremont Street
San Francisco, California 94105

Environmental Protection Agency
Hazardous Waste Division
Superfund Office - Remedial Branch
999 18th Street, Suite #200
Denver, Colorado 80202

CONTRACTORS

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5301 Bolsa Avenue
Huntington Beach, California 92647

Teledyne Brown Engineering
Cummings Research Park
300 Sparkman Drive
Huntsville, Alabama 35807-7007

STATE AGENCIES

Utah Department of Health
Bureau of Air Quality
288 North, 1460 West
Salt Lake City, Utah 84116

Maryland Department of Environment
Division of Air Monitoring/Engineering
Air Management Administration
201 W. Preston Street
Baltimore, Maryland 21201

State Agencies Cont.

New Mexico State Historic
Preservation Officer
Office of Cultural Affairs
Historic Preservation Division
228 East Palace Avenue
Santa Fe, New Mexico 87503

New Mexico Department of Game
and Fish
Biological Services Division
State Capitol Complex,
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Santa Fe, New Mexico 87503

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