Finding of No Significant Impact
Final Environmental Assessment
Environmental Protection Plan

BMDO RAPTOR/TALON PROGRAM

BALLISTIC *MISSILE DEFENSE* ORGANIZATION

June 1993

Acronyms

AFB	Air Force Base
BLM	Bureau of Land Management
BMDO	Ballistic Missile Defense Organization
CFR	Code of Federal Regulations
DMA	Defense Mapping Agency
DoD	Department of Defense
EAFB	Edwards Air Force Base
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
GAFB	George Air Force Base
HEDI	High Endoatmospheric Defense Interceptor
IRP	Installation Restoration Program
LLNL	Lawrence Livermore National Laboratory
NAFB	Norton Air Force Base
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
NPL	National Priorities List
OSHA	Occupational Safety & Health Agency
PL	Phillips Laboratory
PM	Particulate Matter
RAPTOR	Responsive Aircraft Program for Theater Operations
SETP	Solar Electric Test Platform
TALON	Theater Applications—Launch on Notice
UAV	Unmanned Aerial Vehicle
USAFETAC	United States Air Force Environmental and Technical Applications Center
WSMR	White Sands Missile Range

Measurements

Consistent with national and DoD efforts toward conversion to the metric system, weights and measures for the BMDO RAPTOR/TALON Program are expressed throughout this document in both English and metric units.

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Finding of No Significant Impact

BMDO
RAPTOR/TALON PROGRAM

BALLISTIC
MISSILE
DEFENSE
ORGANIZATION

Finding of No Significant Impact
Ballistic Missile Defense Organization
U.S. Department of Defense

Agency

U.S. Department of Defense
Ballistic Missile Defense Organization (BMDO)

Action

To design, develop, and demonstrate the Responsive Aircraft Program for Theater Operations (RAPTOR), an unmanned aerial vehicle capable of sustained, high altitude, long-term flight, and to design, develop, and demonstrate the Theater Applications—Launch on Notice (TALON), a miniaturized kinetic kill interceptor for deployment aboard the RAPTOR. The RAPTOR/TALON system is a technology program, the concept of which is intended as a Boost Phase Interceptor capable of destroying tactical ballistic missiles during the first few minutes of flight.

Background

Pursuant to the Council on Environmental Quality Regulations (40 CFR 1500-1508) for implementing the procedural provisions of the National Environmental Policy Act (42 U.S.C. 4321 et. seq.) and the U.S. Department of Defense (DOD) Directive 6050.1 (Environmental Effects in the United States of DOD Actions), the Ballistic Missile Defense Organization (BMDO) has conducted an assessment of the potential environmental consequences of technology program activities pertaining to the design, development, and demonstration of the RAPTOR/TALON and related activities.

The BMDO is proposing to design, develop, and demonstrate technologies supporting platforms and interceptors capable of meeting hostile theater ballistic missile threats. Activities in support of the BMDO RAPTOR/TALON Program would occur iteratively. Succeeding generations of launch platforms and interceptors would reflect technological advances as they are achieved during the program's progress. Major program activities would occur at several California locations: Lawrence Livermore National Laboratory (LLNL), Simi Valley, Mojave, the former George Air Force Base (AFB), Edwards AFB, and Norton AFB (slated for closure March 31, 1994). Activities would also occur at the Department of Energy's Nevada Test Site and at White Sands Missile Range, New Mexico.

Activities in support of the BMDO RAPTOR/TALON Program would fall into one or more of the following categories:

- Development and refinement of a solar electric test platform (SETP);
- Development of a follow-on generation SETP based on technologies and principles demonstrated with the first SETP;
- Development and demonstration of a conventional design fixed-wing gasoline engine-powered aircraft;
- Potential follow-on efforts directly resulting from technology advances in one or more of the preceding areas to produce ultimately a suitable platform;
- Potential development of an air-deliverable platform that would be based on the design concept of either the SETP, fixed-wing, or subsequent aircraft concepts;
- Design, development, and demonstration of a miniaturized lightweight kinetic kill interceptor missile using state-of-the-art sensors, guidance control, and miniaturized propulsion systems;
- Demonstration of an integrated platform and interceptor capable of intercepting theater ballistic missiles in their boost phase.

The prime SETP candidate would be a refurbished unmanned modular wing first developed by the Government for other purposes in the early 1980s. It would be refurbished for testing by AeroVironment, Inc., Simi Valley, California. Materials used in the battery-powered, eight-motor "wing" and future versions would be predominantly styrofoam, balsa, tape, and composites. A second candidate RAPTOR platform would be a more conventional design fixed-wing unmanned aerial vehicle. Scaled Composites, Inc., of Mojave, California, would manufacture the airframe. This platform would be powered by a turbocharged gasoline engine. It would be constructed primarily of composite materials. A ssubstantial portion of the BMDO RAPTOR/TALON Program would be a research effort to design, develop, and demonstrate an efficient solar-powered energy supply. To do so would require major advances in fuel cell technology.

The TALON would be a high endoatmospheric or exoatmospheric kinetic kill interceptor designed for launch from the RAPTOR platform. The TALON would attain a typical speed of 2 to 3 kilometers per second (approximately 4470 to 6700 miles per hour) and have an intercept range of approximately 100 kilometers (62 miles). The TALON interceptor would make use of a miniature pumped-propulsion system developed at LLNL, Livermore, California, and would use hydrazine or hydrazine/nitrogen tetroxide as its propellant.

Ground testing of RAPTOR would be at contractor facilities at Simi Valley and Mojave Airport, California. Initial aerial testing of the SETP would likely occur at the former George AFB, California, or at Norton AFB, another location near the Simi Valley facility. The fixed-wing aircraft would likely be tested at Edwards AFB, California. White Sands Missile Range would also be considered for RAPTOR flight testing. The RAPTOR proof-of-concept would eventually require sustained flight over many thousands of miles, with the capability to maintain flight 24 hours per day.

The TALON interceptor would require design, component, and subsystem testing. It would be designed to operate from the RAPTOR platform. Design testing would occur at LLNL. The TALON propulsion components would be tested at LLNL. Tether testing of the divert thrusters would be accomplished at the Department of Energy Nevada Test Site, and flight testing of TALON would occur at White Sands Missile Range, New Mexico. Integrated testing of RAPTOR and TALON would occur at White Sands Missile Range.

Transportation of either RAPTOR or TALON components would require standard commercial tractor-trailer assemblies. Fuel not transported for the systems would be obtained locally for testing.

The no action alternative was considered. The alternative of not conducting RAPTOR/TALON research and development was rejected since ramifications of the no action alternative would be that during military operations, potentially optimal area defense might not be achieved. Advances in sensor and interceptor technologies research might be delayed to the detriment of the overall Theater Missile Defense.

Findings

The potential for significant impacts was determined through an analysis of the activities that would be conducted at the proposed locations. The potential impacts of the proposed action were assessed against the following environmental considerations found to be most relevant: biological resources, cultural resources, air quality, noise, meteorology, airspace use, and safety. Not all environmental resources were found to apply in each of the various locations where the proposed action and alternative might take place. The methodology consisted of identifying potential environmental issues and determining their significance.

The design, development, and demonstration of the RAPTOR/TALON system and its components would be conducted in or at existing facilities that are routinely used for such activities. No significant impacts were found to occur as a result of using these facilities.

The BMDO RAPTOR/TALON Program would not cause any significant impacts on environmental resources or the human environment at LLNL. The LLNL's function in the BMDO RAPTOR/TALON Program would be primarily administrative, with minor component assembly and testing of the TALON interceptor. These activities are well within the existing capacity and present practices of LLNL. No construction, additional concerns for air and water quality, or additional hazardous waste issues would be anticipated.

The BMDO RAPTOR/TALON Program would not cause any significant impacts on environmental resources or the human environment at AeroVironment, Inc. in Simi Valley or at Scaled Composites, Inc. in Mojave, California. Program-related activities at those sites would not result in increased generation of air or water discharges or hazardous waste. All program activities would be consistent with ongoing operations that are in compliance with applicable Federal, State, and local laws and regulations.

Ground testing of the TALON at the Nevada Test Site would occur at a facility compatible with research and development of missile functions. Noise and air emissions outputs would not be expected to exceed previous outputs at the test facility.

Flight testing of the RAPTOR and TALON interceptor would not cause any significant impacts to environmental resources or the human environment. Candidate locations for flight testing of the SETP include the former George AFB, Edwards AFB, Norton AFB, and Mojave Airport. Testing of the fixed-wing RAPTOR would occur at Edwards AFB. Testing of the integrated RAPTOR and TALON would occur at White Sands Missile Range. Evaluation of potential impacts at these locations revealed none of significance. In like manner, movement of the RAPTOR and TALON interceptor to and from the test sites, posing no special requirements, would cause no significant impacts on transportation.

Potential cumulative impacts of the BMDO RAPTOR/TALON Program were evaluated. Flight preparation, operations, and recovery of RAPTOR platforms would occur within areas normally used for aviation activity. The program would not create a measurable increase in those activities, nor would it create a situation where an environmental resource would reach a threshold of concern. The TALON interceptor activities would not increase the stress level on any environmental resource. The BMDO RAPTOR/TALON Program would not result in any accumulation of impacts on noise, common resources, or infrastructure.

Portions of the proposed action could occur outside the United States. Four areas of concern warranted analysis for potential environmental impacts in the global commons: air quality, aviation safety, public safety, and conservation of resources. Activities in the global commons were found to cause no impacts of significance to the areas evaluated.

Overall, no significant impact will result from conducting the RAPTOR/TALON Program. Therefore, no environmental impact statement will be prepared for the proposed action.

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Date

Final Environmental Assessment

BMDO
RAPTOR/TALON PROGRAM

BALLISTIC
MISSILE
DEFENSE
ORGANIZATION

Responsible Agency	Ballistic Missile Defense Organization (BMDO)
Proposed Action	BMDO RAPTOR/TALON Program
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Designation	Environmental Assessment

Abstract

The National Environmental Policy Act (NEPA), the Council on Environmental Quality Regulations implementing NEPA (40 CFR 1500-1508), and the Department of Defense (DoD) Directive 6050.1 direct that DoD officials take into account environmental consequences when authorizing or approving major Federal actions. This environmental assessment presents an analysis of the environmental consequences of conducting activities in support of the BMDO RAPTOR/TALON Program.

The proposed action is to design, develop, and demonstrate an integrated air-based launch platform and lightweight interceptor system for use against theater ballistic missiles in their boost phase. Program efforts would focus on (1) the design, development, and demonstration of the Responsive Aircraft Program for Theater Operation (RAPTOR), an unmanned aerial vehicle capable of sustained, high-altitude, long-term flight, and (2) the design, development, and demonstration of technologies for Theater Applications-Launch On Notice (TALON), a miniaturized kinetic kill interceptor capable of deployment on high-altitude platforms. The proposed action would involve integration and testing of BMDO's RAPTOR/TALON technologies. Succeeding generations of launch platforms and interceptors would reflect technological advances as achieved during the programs' progress. The environmental analysis demonstrates that no significant impacts to the environment would occur as a result of implementing the proposed action.

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Executive Summary

As part of its responsibility to develop defenses against limited ballistic missile attacks, the Ballistic Missile Defense Organization must demonstrate technologies capable of intercepting theater ballistic missiles.

The proposed action is to design, develop, and demonstrate technologies for an integrated air-based launch platform and lightweight interceptor system for use against theater ballistic missiles in their boost phase. Program efforts will be focused on two principal areas:

- The design, development, and demonstration of the Responsive Aircraft Program for Theater Operations (RAPTOR), an unmanned aerial vehicle capable of sustained, high-altitude, long-term flight
- The design, development, and demonstration of technologies for Theater Applications—Launch On Notice (TALON), a miniaturized kinetic kill interceptor multiple deployment on high-altitude platforms

Activities in support of the RAPTOR/TALON Program would occur in stages, each building on its predecessor, with succeeding generations of launch platforms and interceptors reflecting technological advances as they are achieved during the program's progress. Major program activities could occur at several California locations: Lawrence Livermore National Laboratory, Simi Valley, Mojave, the former George Air Force Base, Edwards Air Force Base, and Norton Air Force Base. Activities would also occur at the Nevada Test Site and White Sands Missile Range, New Mexico. There would possibly be a circumnavigational flight test of the RAPTOR platform.

The potential for environmental impacts was determined through analyses of program activities in the context of the above locations. Principal environmental resources and aspects of the human environment considered include biological resources, air quality, noise, airspace use, and safety.

The methodology consisted of identifying potential environmental issues and determining their potential significance. Upon application of the evaluative process, the RAPTOR/TALON Program is not anticipated to create any potentially significant impacts to environmental resources or the human environment.

1.0 Description of Proposed Action and Alternatives

The National Environmental Policy Act, Council on Environmental Quality regulations implementing NEPA (40 CFR 1500–1508), and Department of Defense (DoD) Directive 6050.1 direct DoD officials to take into account environmental consequences when authorizing or approving major Federal actions. Accordingly, this environmental assessment has been prepared to analyze the environmental consequences of the proposed Responsive Aircraft Program for Theater Operations/Theater Applications—Launch on Notice (RAPTOR/TALON) Program. Test and evaluation associated with the technology program would be in compliance with the Antiballistic Missile Treaty of 1972.

The RAPTOR/TALON Program has as its objective the design of an effective boost phase defense against theater ballistic missiles. A high-altitude platform stationed in the combat theater of operations would carry a high-energy interceptor to interdict theater ballistic missile threats.

Chapter 1 of this environmental assessment describes the background, purpose, and need for the action, the proposed action, and the no-action alternative. Chapter 2 describes the affected environment at military installations and other locations where RAPTOR/TALON activities would be conducted. Chapter 3 assesses the potential environmental consequences of the proposed RAPTOR/TALON activities on the environmental components studied, as well as the measures that would be taken to mitigate potential impacts. Chapter 4 discusses RAPTOR/TALON activities as they relate to global commons.

The Strategic Defense Initiative Organization (SDIO) program, announced by then President Reagan on March 23, 1983, is an extensive research program originally designed to determine the feasibility of developing an effective ballistic missile defense system. On May 13, 1993, the Strategic Defense Initiative Organization was renamed the Ballistic Missile Defense Organization (BMDO).

During development of SDI architecture, four fundamental tiers of ballistic missile defense were identified for research and system definition. These tiers correspond to the boost, postboost, midcourse, and terminal phases of a typical ballistic missile flight trajectory. During the boost phase, the first- and second-stage engines of a rocket motor burn, providing intense heat that is highly observable to sensors. In the postboost phase, multiple warheads and decoys may be released from the postboost vehicle. The decoys are designed to confound a defensive system, increasing the probability of warheads reaching their destinations. During the midcourse phase, the warheads and decoys travel on ballistic trajectories in the exoatmosphere. Finally, in the terminal phase, warheads and decoys reenter the atmosphere.

Ballistic Missile Defense was originally developed to be a national defense system, but as the program has evolved, its potential use in protecting our allies and troops deployed abroad has become evident. The RAPTOR/TALON Program, derived from technologies developed for use in global or limited ballistic missile defense, is a technology program which seeks to develop a theater ballistic missile defense system to intercept hostile theater missiles in their boost phase.

1.1 Purpose and Need for the Action

As a technology program, the purpose of the RAPTOR/TALON Program is to design, develop, and demonstrate the capability of an air-based, lightweight projectile to intercept targets in the high endoatmospheric and exoatmospheric regions. Specifically, the purpose of the program is to achieve the following:

- Design, develop, and demonstrate an unmanned platform capable of sustained long-term flight
- Design, develop, and demonstrate technologies leading to miniaturization of interceptor components so as to allow deployment of multiple interceptors on platforms capable of sustained, high-altitude flight

The Persian Gulf War in Iraq in 1991 demonstrated the need for a theater ballistic missile defense system. Theater ballistic missiles, sometimes called short-range ballistic missiles, travel at high speed and often slip through air defense networks. Terminal defense systems, such as the Patriot, attack missiles in the last seconds of their flight. The war in Iraq showed that poorly made theater ballistic missiles break apart during reentry into the atmosphere. A defensive missile system capable of intercepting theater ballistic missiles during their ascent would improve theater defense coverage.

To attack an ascending target successfully, it is necessary to detect the launch as early as possible. Additionally, the counterweapon may have to be directed at the target from a comparatively short range because of the brief time of flight of the target. This dictates that the detection system and counterweapon system be located as close to the target launch site as possible. In some instances, this could be along the border of a neighboring country. In other cases, it may be necessary to overfly an aggressor country. Stationing of the defensive missile system over the combat operational theater would require a high-altitude platform to avoid the reach of surface-to-air missiles.

RAPTOR would be an unmanned aerial vehicle (UAV) designed to overfly aggressor air defense networks while seeking theater ballistic missile launches. The autonomous RAPTOR would use a suite of sensors for horizon-to-horizon launch detection. Upon detecting the launch of a hostile theater ballistic missile, RAPTOR would release a TALON interceptor to engage the ascending target. The TALON is a miniature high-speed interceptor that would collide with and destroy the target by kinetic effects.

Deployment of a RAPTOR/TALON system would give a theater commander defense in depth. Forward deployment of a RAPTOR/TALON system in the battle area to engage and intercept theater missiles would improve the abilities of the theater commander to protect population centers, airfields, logistics centers, and other strategic and tactical assets.

1.2 Proposed Action

The Ballistic Missile Defense Organization (BMDO) seeks to design, develop, and demonstrate technologies supporting platforms and interceptors capable of meeting the hostile theater ballistic missile threat. The action would involve research and development of several platform candidates and development of the TALON interceptor. These activities would occur at several locations. Depending on achievement of technological advances and attainment of compatibilities among the operating systems, the program would culminate in testing and demonstration of an integrated platform and interceptor system.

Activities in support of demonstrating technologies supporting a combination of platform and interceptors capable of meeting theater commanders' needs may fall into one or more of at least seven categories:

- Development and refinement of a solar electric test platform (SETP)
- Development of a follow-on generation SETP, based on technologies and principles demonstrated with the present SETP
- Development and demonstration of a conventional design fixed-wing gasoline-engine-driven aircraft
- Potential followup efforts directly resulting from technology advances in one or more of the preceding areas to produce an ultimate suitable platform
- Potential development of an air-deliverable platform that would be based on the design concept of either the SETP, fixed-wing, or subsequent aircraft concepts
- Design, development, and demonstration of a small, lightweight kinetic kill projectile using state-of-the-art miniaturized sensors, guidance control, and propulsion systems
- Demonstration of an integrated platform and interceptor capable of intercepting theater ballistic missiles in their boost phase

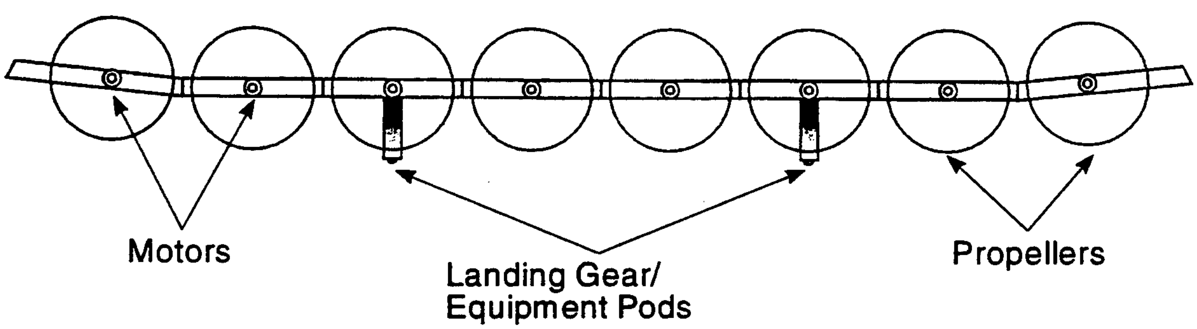
1.2.1 Research, Development, and Manufacture of Major Components and Subsystems

The long-term objective of the RAPTOR/TALON Program is to develop a platform and interceptor missile capable of destroying theater ballistic missiles in their boost phase. A key element of this objective is to produce a multi-thousand-hour solar electric

RAPTOR. Because the need for technologies supporting theater ballistic missile defense boost-phase intercept is near term, the RAPTOR Program is responding with an evolutionary program strategy. Under the proposed action, at least two RAPTOR platforms would undergo research and development: an SETP and a fixed-wing gasoline-engine-driven aircraft. Component and subsystem technological advances of either platform may be found adaptable to the other.

The prime solar electric candidate is a modular span loader first developed by the Government for other purposes in the early 1980s. It is commonly referred to as "the wing" because it has no fuselage or tail assembly. The SETP has been in storage since 1983, when its further development was abandoned in favor of other technologies.

The SETP would be refurbished for RAPTOR testing. AeroVironment, Incorporated, Simi Valley, California, would perform the work in preparation for flight tests. As shown in Figure 1-1, the SETP is essentially an airfoil. It is extremely lightweight, consisting of styrofoam, balsa, tape, and composite materials. Future versions of the SETP would likely use tedlar in favor of mylar. Having a wingspan of 100 feet (30.5 meters) and a chord of 8 feet (2.4 meters), it weighs 380 pounds (171 kilograms). Eight small-battery-driven motors power its propellers to achieve a maximum airspeed of less than 30 knots (approximately 35 miles per hour).



Major components:

- 100' span x 8' chord
- 8 motor positions
- Twin landing gear/equipment pods
- Flight control system
- Data acquisition system
- Telemetry system

Flying testbed for experiment-driven refinements of:

- Solar arrays
- Energy storage
- Electric propulsion
- High efficiency power management
- Autonomous flight control
- Systems' mass reduction

Figure 1-1. Refurbished SETP for RAPTOR Testing

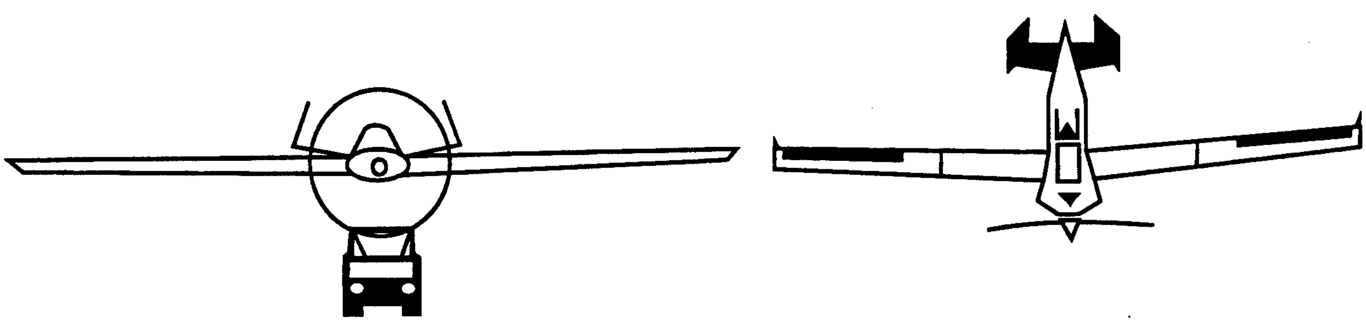
The SETP would serve as a test vehicle leading to even more advanced designs for a platform. It is anticipated that research and development related to the SETP must focus improvements in solar arrays, energy storage, electric propulsion, high-efficiency power management, autonomous flight control, and system mass reduction.

A second candidate RAPTOR platform would be a fixed-wing UAV. Scaled Composites, Incorporated, Mojave, California, would manufacture the airframe. Tests would occur to determine its suitability for platform use and continued development. A drawing of a current concept is shown in Figure 1–2.

The RAPTOR would be a cantilever wing monoplane, with a wingspan of 66 feet. Power would be by gasoline engine. The structure would be primarily formed of graphite reinforced composite materials. In initial testing the aircraft would use a naturally aspirated engine configuration; later development would add turbocharging in order to enable the aircraft to cruise at higher altitudes. The RAPTOR platform would be capable of airspeeds between 100 and 240 knots (115 to 276 miles per hour) at 65,000 feet cruising altitude.

Development of either of the two present platform candidates must be iterative. Upon refurbishment of the SETP and development of the fixed-wing aircraft and studies of their performances, follow-on generations would be developed to exploit technological

Cantilever wing monoplane with twin tail



Payload	150 lbs	(68 kg)
Fuel	750 lbs	(340 kg)
Gross wt.	1700 lbs	(771 kg)
Landing* wt. *empty	850 lbs	(385 kg)
Span	66 ft	(20.1 m)
Length	23 ft	(7.0 m)

Figure 1–2. Current RAPTOR Airframe Concept

advances and to test yet further refinements to produce a platform capable of meeting mission requirements. Among other goals, the ultimate platform must be capable of low maintenance and lengthy, autonomous flight, and it must be able to carry multiple TALON interceptors.

A portion of the RAPTOR/TALON Program research effort would be to design, develop, and demonstrate an efficient solar-powered energy supply. To do so would require major advances in fuel cell technology. Use of fuel cells to store energy would permit continuous, 24-hour operation of the RAPTOR platform. With energy input provided by solar cells, fuel cells electrolyze water into hydrogen and oxygen; energy is produced by reversal of the process. Fuel cells involve no hazardous materials and produce no hazardous wastes. A schematic diagram of a fuel cell is provided in Figure 1–3. Today's fuel cells are able to provide the requisite power density but weigh too much to be borne by the platform. A fuel cell system's requirements for ion exchange membranes, liquid and gas storage tanks, wiring, controls, and piping currently involve relatively heavy components whose weight must be reduced to achieve the RAPTOR platform requirements.

In addition to seeking progressive technological improvements in power systems, flight performance, weight reduction, and the like, research and development would explore the feasibility of designing a UAV that could be air delivered. To elude most surface-to-air missile threats, RAPTOR would be required to operate at very high altitudes. Attaining increasingly higher operating altitudes above 60,000 feet (18,288 meters) (ranging up to 90,000 feet (27,432 meters)) would likely require a lighter UAV. Because reducing the weight of the UAV could affect the platform's strength, and because jet streams from 30,000 to 35,000 feet (9,144 to 10,668 meters) can place great stress on an airframe, research would explore the feasibility of initiating RAPTOR flight by aerial delivery from transport aircraft at altitudes above the jet stream or other turbulence.

TALON would be an air-to-air high endoatmospheric or exoatmospheric kinetic kill interceptor. It would be designed and developed to operate from a RAPTOR platform. To reach target missiles in their boost phase, TALONs would be developed to attain velocities of 2 or more kilometers per second and have a range of approximately 100 kilometers.

Target acquisition, track, and interception would be achieved by a combination of RAPTOR and TALON sensors and guidance control, with TALON homing sensors assuming end-game control. Figure 1–4 demonstrates the concept of RAPTOR/TALON employment.

TALON would make use of a miniature pumped-propulsion system developed at Lawrence Livermore National Laboratory. A leading candidate for application to TALON involves use of a hot gas at high pressure being generated by the catalytic dissociation of hydrazine propellant. The hot gas drives reciprocating piston pumps.

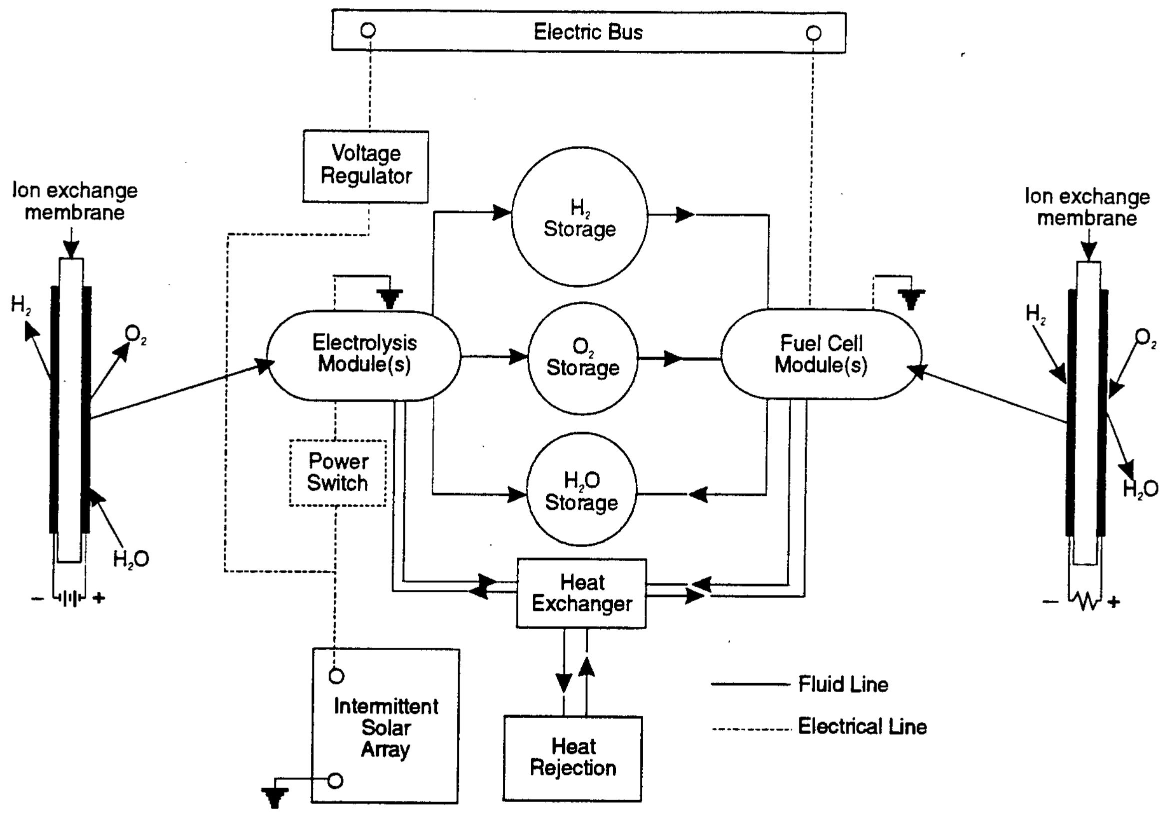


Figure 1–3. Schematic Diagram of a Fuel Cell

The pumps draw fuel (monopropellant hydrazine) or fuel and oxidizer (bipropellant hydrazine and nitrogen tetroxide) from lightweight low-pressure tanks for delivery to thrusters at working pressure. Research, development, and manufacture would seek to achieve the TALON interceptor's performance criteria using not more than 10 liters of fuel (less than 3 gallons). This results in a propulsion system with a high propellant mass fraction (ratio of propellant mass to total mass). Additionally, the high-pressure propellant can be delivered to axial thrusters, divert thrusters, or both.

Development of TALON is being carried out by the Lawrence Livermore National Laboratory. Figure 1–5 shows examples of a cylindrical-tank monopropellant TALON and a spherical-tank bipropellant TALON. TALON components would be made of aluminum, stainless steel, titanium, inconel, plastics, and ceramics. No special handling of these materials is required for safety, but they must be handled so as to avoid contaminating their surfaces.

Advanced technologies for portions of the TALON sensor, guidance, and ranging systems already exist in BMDO technology programs. TALON would draw upon or adapt existing technologies and hardware to the maximum extent possible.

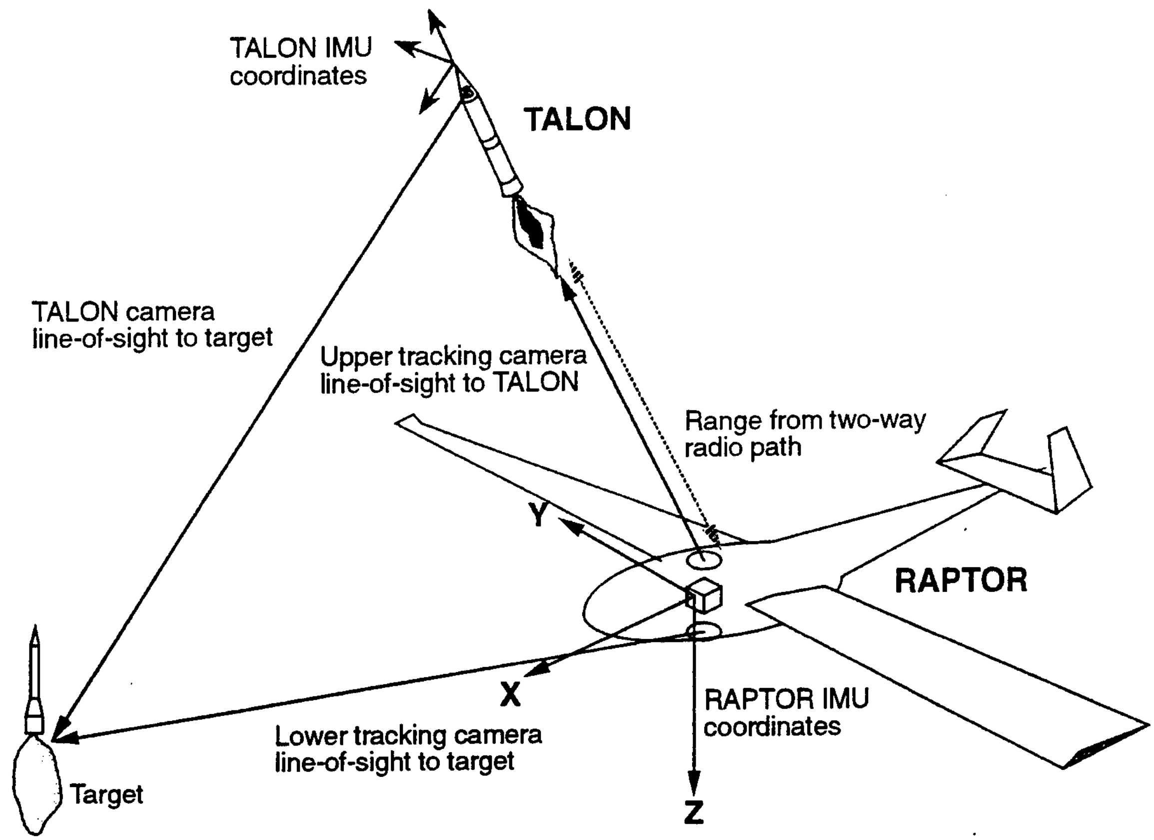


Figure 1–4. RAPTOR/TALON Employment Scheme

In addition to the individual components and subsystems required of each of the test platforms and the TALONS, the RAPTOR/TALON Program would utilize high-density electronic packaging to provide optimum computing power in a small package. This packaging would be similar to that employed by high-end workstation manufacturers for commercial products. RAPTOR would also be required to maintain a precise understanding of its position, orientation, and attitude. This would necessitate the use of global positioning system signals, an inertial measurement unit, and other instruments.

Manufacture of both near-term and future iterations of the UAV platforms, their components, and the TALON interceptor missile could involve some minor amounts of solvents that may be classifiable as hazardous waste after use. These amounts would be measurable in pints and quarts, and their use would be consistent with that of a small quantity generator.

The efforts of several public and private-sector entities would be required for development of the RAPTOR and TALON systems. Principal participants and their contributions are listed below and include Lawrence Livermore National Laboratory, Livermore, California, providing program technical direction; AeroVironment, Incorporated, Simi Valley, California, providing refurbishment and development of the SETP RAPTOR platform; Scaled Composites, Incorporated, Mojave, California, providing

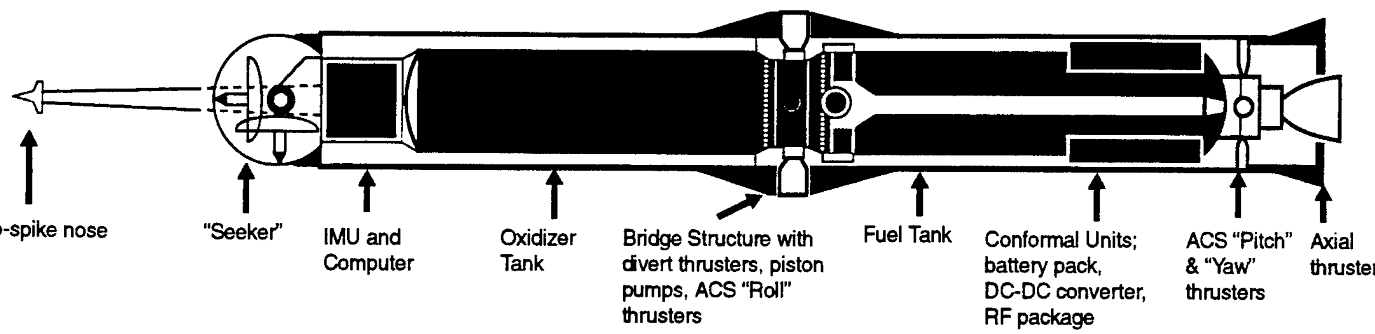


Figure 1–5. Example TALON Designs

manufacture and development of the fixed-wing RAPTOR platform; Hughes Aircraft Company, Canoga, California, providing engineering development of TALON; and Rocket Research Company, Redmond, Washington, providing propulsion testing and research for TALON.

1.2.2 Ground Testing of RAPTOR and TALON

Both the SETP and the fixed-wing UAV would be required to undergo ground tests prior to aerial performance. Frequency and duration of each test to be performed by program personnel and contractors would depend on the particular platform or interceptor, subsystem, or component. Inputs such as electrical power and outputs such as air or water emissions or hazardous wastes would depend on the particular item and its stage of development or manufacture. Given the limited number of items involved (constrained primarily by efforts to reduce weight and mass), the number of test events and their protocols would be principally aimed at ensuring reliability of components and subsystems, as well as safety.

Ground testing of the SETP would occur at AeroVironment's facility in Simi Valley, California. The battery-powered motors (as well as more power-efficient motors that would be installed), command and control systems, solar cells, and fuel cells could be tested at the AeroVironment facility.

Ground testing of the fixed-wing aircraft built by Scaled Composites would primarily involve engine performance and command and control system reliability. These functions would be tested at the Mojave Airport, the manufacturing site, Mojave, California.

Most ground testing of future RAPTOR platforms could occur at their point of manufacture. For either platform, sensor and guidance systems could be tested at their point of origin, at the Lawrence Livermore National Laboratory, and at the site of installation onto the platform.

TALON propulsion components would be tested at Lawrence Livermore National Laboratory using hot helium for the "hot gas" and water standing in for hydrazine. Tests requiring hydrazine would be conducted using special equipment located at the Rocket Research Company, Redmond, Washington. Tether tests related to divert thrusters would be conducted at the Nevada Test Site. Nose-panel separation tests could be conducted at any of several wind tunnel facilities. TALON electronics systems, sensors, computer, communications equipment, global positioning systems, navigational aids, and control devices would be tested using simulated inputs at their point of manufacture and again at Lawrence Livermore National Laboratory prior to any flight tests. Such preflight tests in the laboratory would involve commercial workstations, logic analyzers, scopes, and the like. The TALON interceptor laser, a low-energy device to provide range to target during the final moments of an engagement, would be ground-tested at Lawrence Livermore National Laboratory in any of several facilities designed for use of such devices.

1.2.3 Transportation of Materials and Fuels

Transportation of RAPTOR platforms would be required from point of refurbishment or manufacture to suitable flight-test airspace. The SETP that would be retrieved from storage and refurbished disassembles to five sections. Similarly, the fixed-wing aircraft can be disassembled for transport by tractor-trailer truck.

The SETP would likely be tested at the former George Air Force Base, California, or at another location close to the Simi Valley facility. Edwards Air Force Base, California, would be the likely location for flight testing of the fixed-wing aircraft. These locations provide suitable uncongested airspace that would be within responsive distance of the facilities and resources supporting program research and development. Future generations of the RAPTOR platform would similarly require ground transportation to suitable testing facilities. Other test sites could be located, but their choice likely would again be influenced by convenience and distance rather than concerns for any burdens associated with shipping airframes.

The SETP would not require transportation of fuel. Arrangements would be made to obtain fuel for the fixed-wing aircraft at its flight-test location.

The TALON interceptor would be transported from its point of manufacture or assembly to the Nevada Test Site for tether testing and to other locations, principally WSMR, for performance testing. TALON transport would be by truck or air. Interceptor fuel tanks would be empty during transport. For testing and evaluation events at WSMR, fuel to be used by the TALON interceptor (hydrazine or hydrazine and nitrogen tetroxide) would be obtained as a matter of WSMR support from the NASA Site storage location. Transport of the fuel to the TALON launch site would be dictated by WSMR operational and safety requirements.

1.2.4 RAPTOR Flight Preparation, Operations, and Recovery

The RAPTOR platforms would need to be subjected to flight tests, both to prove their inherent air worthiness and to show that they could carry program payloads. RAPTOR flight tests would occur at any of several locations. Military air bases having restricted airspace are preferred test sites to provide for maximum freedom from congestion associated with general or commercial aviation. Use of restricted airspace also provides greater safety to the public in the event of a mishap. Given the relatively slow airspeed of the SETP, restricted airspace would be less in demand for that platform's flights. The former George Air Force Base, California; Edwards Air Force Base, California; and White Sands Missile Range, New Mexico, would be leading candidates for flight-test use. Other airspace could be used, depending primarily on the nature of tests, proximity to research centers, availability, and lack of potential for congestion and interference with existing aviation activity.

Preparation for flight would entail transportation of the aircraft to the test site and its assembly and preparation. When flight testing of the SETP occurs, its power sources (batteries, solar cells, and fuel cells), command and control systems, and mechanical condition would have to be inspected. Flight testing of a fixed-wing aircraft would involve similar preparation, except that provision would be made for supplies of gasoline.

Operation of the RAPTOR platform would involve progressively longer flights, at increasingly higher altitudes. Duration of flight test would be influenced by purpose of the particular event, weather conditions, and the status of winds aloft. Flight test altitudes would range from only a few hundred feet during initial testing to many thousands of feet in subsequent testing. Since one program goal is to achieve a platform with the capability of operating at altitudes in excess of 65,000 feet, testing could involve flights at such altitude. Operation of a platform such as the SETP would require a runway possibly as short as 100 feet; the fixed-wing platform would require a runway of possibly 1,000 feet or more.

Safety would be a key consideration in any flight operations testing of the SETP or fixed-wing UAV. Tests would be conducted under the supervision of test directors who would thoroughly brief all participants. Onboard safety features would include external lighting, redundant command and control systems, and surplus power supplies (flights would be scheduled not to exceed a predetermined safe percentage of onboard power supply). Testing would be confined to locations so that, in the event of a mishap, there would be no harm to persons or property. In the event of a mishap, spotter aircraft could be employed to assist in locating debris and heavy-lift a helicopter could be used for recovery from remote or sensitive areas such as the White Sands National Monument. Members of a mishap team would be identified and on standby. Test protocols would identify those circumstances that posed risks and implement procedures, standards, and policy (for example, no flight testing when winds exceeded 20 knots (23 miles per hour) appropriate to the UAV's stage of development, or respecting the off-limits status of Lake Lucero at White Sands National Monument).

One platform variant involves development of capability to "fold" a RAPTOR to permit aerial launch from a transport aircraft at an altitude sufficient to avoid jet streams and to conserve the power supply or fuel otherwise required to attain operational altitude. Another variant would involve towing of the RAPTOR by another aircraft. Flight tests such as these would occur within restricted airspace.

Recovery of the RAPTOR platform would prefer controlled airspace as a safety precaution. Recovery of the UAV would involve controlling the descent of the platform and navigating its approach toward a suitable landing surface. In the case of the SETP, its relatively slow airspeed would require only a short, cleared paved area for its landing.

RAPTOR proof of concept would ultimately require sustained flight over many hundreds or thousands of miles. This would require development of the capability to maintain flight 24 hours per day and, for the SETP, would require development of fuel cells that could provide power during hours of darkness. One goal that RAPTOR development would move toward is the ability of the platform to circumnavigate the globe. Such a flight would provide a complete demonstration and validation of navigational flight and avionics systems, aircraft airframe construction, and their integration into a flying platform capable of supporting components of a BMDO architecture for long-term airborne operations. Should technological developments progress to a point where an attempt at circumnavigational flight were feasible, operations could involve use of conventional aircraft and personnel to track and monitor the progress of the platform. In this kind of testing, foreign country overflight permission may be required, depending on operating altitude. Also depending on operating altitude, attention would concentrate on potential for changing weather.

1.2.5 TALON Interceptor Testing

The TALON interceptor would require design and component and subsystem testing. Design testing would occur primarily at Lawrence Livermore National Laboratory. Component testing, such as tests of the miniaturized propellant pumps and divert thrusters, would occur at Lawrence Livermore National Laboratory and the Nevada Test

Site, respectively. Tests of other components such as sensors, onboard computers, or command functions would occur at other facilities and sites specifically designed to accommodate such tests.

Testing of the TALON would occur at White Sands Missile Range (WSMR). Initial tests would likely involve launch from a conventional aircraft at high altitude. Initial test engagements would be versus a "point in space" or may involve simulated engagement of air-breathing targets. Assuming technical concept feasibility and progress in development of the TALON interceptor, the TALON would be tested against a target missile. RAPTOR/TALON Program officials would identify a missile with suitable short-range ballistic missile characteristics (altitude, speed, trajectory, size) and request its launch by personnel at WSMR. Launch of the target missile would have to meet all applicable WSMR operational and environmental requirements. The extent of environmental documentation required for launch of the target missile would be determined based on the type of target missile and WSMR requirements. Since insufficient details are presently known about the potential target missile flight requirements, environmental analysis of that activity and any decision to proceed on a particular alternative are premature.

1.2.6 RAPTOR/TALON Flight Preparation, Operations, and Recovery

Once the individual tests of RAPTOR and TALON were completed, the two systems would be integrated. A final round of test flights would be required to validate the program. This last series of test flights of RAPTOR and TALON would occur at WSMR. Tests would evaluate the integrated system's ability to acquire, track, and intercept a theater ballistic missile in its boost phase from a high-altitude, loitering platform.

For comprehensive demonstration of an integrated RAPTOR/TALON system, the proposed action contemplates there being one or more launches of a short-range ballistic missile that would be engaged by the TALON interceptor. These launches would occur at WSMR. As required by WSMR, flight termination and debris would be confined to those portions of the range used or assigned for such purposes. RAPTOR/TALON engagement against a mock hostile missile would be calculated to ensure that no test projectile or debris exceeded impact areas selected and used for interceptor tests. Planning would take into account requisite considerations such as launch plans and procedures, safety procedures, potential involvement of hazardous materials, debris retrieval, air emissions, and facility and personnel requirements identified as relevant to the test.

1.3 No-Action Alternative

The no-action alternative is not conducting RAPTOR/TALON research and development. The ramifications of the no-action alternative would be that during some types of future military operations, potential gaps in area defense might not be filled. Such potential gaps could lead to increased risks of injury or death of U.S. and allied personnel, loss of or damage to equipment and supplies, and impairment of the effectiveness and efficiency of deployed theater military forces. Breakthroughs in continuing research in sensor and interceptor technologies might be delayed, to the detriment of the overall Ballistic Missile Defense, and emerging technologies and innovative concepts, such as refinements in fuel cell technologies, would not be exploited.

1.4 Scope of Environmental Resources Considered

The scope of the environmental analysis has been limited to the environmental issues relevant to implementing the proposed action or its alternative. Evaluation of the description of the proposed action and its alternative revealed that the following environmental parameters are principally appropriate and relevant for discussion in the sections on the "affected environment" and "environmental consequences and mitigation": biological resources, cultural resources, air quality, noise, meteorology, airspace use, and safety. Additional matters considered but typically found to have little bearing on the proposed action included utilities, energy, transportation, land use, hazardous materials and hazardous waste, and regulatory compliance. Not all environmental parameters apply in each of the various locations where the proposed action and alternative might occur.

Evaluation of the description of the proposed action and alternative further reveals that several environmental parameters do not generate relevant considerations. Accordingly, these subjects are not discussed in the sections on "affected environment" and "environmental consequences and mitigation." Parameters that have been considered but have been determined not to warrant further study include surface and ground water quality, lakes and impoundments, flood plains, wetlands, drinking water, domestic and industrial waste treatment, stormwater, petroleum/oils/lubricants, herbicides and pesticides, underground storage tanks, minerals, soils, geology, socioeconomics, air installation compatible use zones, special pollutants (for example, asbestos, radon, lead, and radioactive materials), electromagnetic emanations, energy conservation, hazardous waste cleanup, and aesthetics.

2.0 Description of the Affected Environment

Chapter 2 describes the setting for each of the proposed activities under the RAPTOR/TALON Program. The information provided in this chapter will provide a baseline for determining the potential environmental impacts, if any, from the proposed action.

The sites for the proposed activities are varied, as is the scope and magnitude of the activities planned for the different sites. The discussions of physical and operational characteristics for each location vary, depending on the depth of detail required for the impact analysis. In general, the following environmental components were considered for each location: biological resources; air quality; noise; water resources; meteorology; utilities, energy, and transportation; cultural resources; land use; and regulatory compliance. Those environmental components found to have relatively greater bearing on impacts analysis received more in-depth attention. Relevant data was gathered from existing National Environmental Policy Act documents, site visits, and telephone interviews.

2.1 Program Management, Manufacturing, Component Assembly, and Ground Test Locations

The management, manufacturing, and ground testing of the RAPTOR/TALON components will occur in several locations. Each of the proposed locations and the relevant environmental considerations are described in the following sections.

2.1.1 Lawrence Livermore National Laboratory

Lawrence Livermore National Laboratory (LLNL) would serve as the administrative headquarters for the RAPTOR/TALON Program. Some minor component assembly and testing of subsystems would occur there. LLNL is located on an 821-acre site at the eastern end of Livermore Valley in southeastern Alameda County, California. It is operated by the University of California under contract with the Department of Energy. LLNL is a multiprogram, mission-oriented institution that conducts abstract and applied research programs (DOE, 1990).

LLNL is located within the Bay Area Air Quality Management District. Air quality issues include concern for radionuclide emissions (tritium, plutonium, uranium) and solvent use records.

Activities related to surface water quality are subject primarily to California Regional Water Quality Control Board and City of Livermore Wastewater Reclamation Plant requirements. LLNL utilizes to a great extent administrative and engineering controls to minimize impacts to the city's wastewater treatment plant or the environment.

Groundwater occurs at LLNL at depths of 25 to 140 feet (7.6 to 42.6 meters). Volatile organic compounds contaminate groundwater onsite. Leaks from underground storage tanks are addressed by the LLNL's Environmental Protection Department.

LLNL generates a wide variety of hazardous wastes at several locations within the laboratory complex. Hazardous waste generation, storage, and disposal are subject to both California's hazardous waste program and the Federal Resource Conservation and Recovery Act regulations. Satellite accumulation points, 90-day waste accumulation areas, and storage at an approved location are used prior to disposal of wastes. LLNL has implemented a waste generator training program and has a waste minimization program plan in effect.

2.1.2 AeroVironment, Incorporated

AeroVironment, Incorporated would perform restoration and alteration of the solar electric test platform (SETP), the first generation of solar-powered platforms that would be developed in the RAPTOR/TALON Program. The company's facility is located in an urban area of Simi Valley, California. The facility consists of three bays in an industrial park and provides about 15,000 square feet (4,572 square meters) of working space. Of 20 people employed at the Simi Valley facility, 8 to 10 work on the RAPTOR Program. No air or water permits are required for the facility. Materials used in the facility do not require reporting under hazardous materials and waste regulations. The facility is connected to city water and sewer systems and requires no special permits or pretreatment for effluents prior to discharge. The extent of the facility's regulatory compliance occurs via periodic inspections conducted by the local fire department.

2.1.3 Scaled Composites, Incorporated

Scaled Composites, Incorporated would design, fabricate, and assemble the fixed-wing gasoline-engine-driven RAPTOR platform. As for the past 7 years, the company operates out of Hangar 78 at Mojave Airport, Mojave, California. The facility consists of a 14,000-square-foot (4,267-square-meter) main shop, a 20,000-square-foot (6,096-square-meter) annex, and 6,000 square feet (1,829 square meters) of office space. Of an average of nearly 50 on-site employees working at the facility on a daily basis, 6 to 8 fabrication technicians are employed on a daily basis for the RAPTOR project in approximately 3,000 square feet (914 square meters) of the facility. The RAPTOR platform work will not require any new facility construction or alter present operations in any substantial manner. Use of the facility is consistent with surrounding land uses, and it poses no concerns regarding environmental resources such as threatened or endangered species, wetlands, floodplains, or cultural resources.

The Scaled Composites, Incorporated facility uses dust stacks for a sanding station and paint booths with ducted exhaust outlets. These operate under air emissions permits issued by the State of California. The facility is connected to the municipal water system and requires no National Pollution Discharge Elimination System permit. Minor amounts of hazardous wastes are generated in facility operations. These include aircraft engine oils (which are recycled) and acetone. None are stored for longer than 90 days prior to recycling or disposal by a private contractor. An application has been submitted for State and Federal approval to store and handle high explosives onsite; such activity is unrelated to the RAPTOR work onsite.

2.1.4 Nevada Test Site

The Nevada Test Site (NTS), operated by the Department of Energy, would serve as the principal ground testing site for the TALON interceptor control systems. Located in south-central Nevada, NTS is bordered on three sides by Nellis Bombing and Gunnery Range and on the south by public lands. The airspace above NTS and Nellis is restricted.

The tether test would be conducted at the Bare Reactor Experimental Test-Nevada (BREN) tower at NTS's Area 25. The BREN tower originally was used in the 1960's to raise and lower an unshielded reactor and measure radiation doses within housing structures. In the more recent past, the tower has been used for gravity, weather, sonic boom, and missile thruster research. During tether testing, the TALON interceptor would be suspended from a cable attached to the tower, which is nearly 1,500 feet (457.2 meters) tall. The height of the tower and cable suspension enable flight simulation of the TALON interceptor and permit detailed validation of the interceptor's thrusters. Up to 20 personnel would be involved in testing of the thrusters. All planned testing would be reviewed by the NTS Operations Office before any test commenced. That Office's reviews would extend to plans for safety, security, and compliance with all NTS, DOE, DoD, and other environmental and health and safety regulations.

The BREN tower is located 13 miles (21 kilometers) from the nearest community. The area immediately surrounding the tower has been graded and covered with gravel. Vegetation adjacent to and surrounding the tower consists of low growing desert shrubs (creosote bush (*Larrea tridentata*), bursage (*Ambrosia dumosa*), and Indian ricegrass (*Oryzopsis hymenodes*)). No additional clearing or building would be required to test the TALON interceptor's control system. Air quality at NTS is considered excellent, with a very low particulate matter count. The area meets national ambient air quality standards for criteria pollutants of carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter, and sulfur dioxide.

The area surrounding the BREN tower is known to be within potential desert tortoise habitat. Surveys conducted between 1981 and 1991, however, failed to find any live tortoises within a 5-mile (8-kilometer) radius of the BREN tower. According to standard procedures at NTS, all personnel involved in this project would be briefed and given a copy of the DOE/Nevada Tortoise Protection brochure, which describes procedures used to ensure protection of the desert tortoises that may be found on the site.

2.2 Preflight and Flight Test Activity Locations

Any of several possible locations would be used for preflight and flight test activities for the RAPTOR/TALON Program. The SETP could be flown at the former George Air Force Base, California; Edwards Air Force Base, California; Mojave Airport, Mojave, California; Norton Air Force Base, San Bernardino, California; and White Sands Missile Range, New Mexico. The fixed-wing aircraft would be flown at Edwards Air Force Base, California, and White Sands Missile Range, New Mexico. Testing of the TALON interceptor would occur at White Sands Missile Range. Integrated testing of the platform and the interceptor would occur at White Sands Missile Range. The locations of the California sites are illustrated in Figure 2–1. Descriptions of the main, relevant features of each of the potential test flight locations are given below.

2.2.1 The Former George Air Force Base, California (GAFB)

The Base Closure and Realignment Act of 1989 included GAFB among the military bases slated for closure. Beginning in June 1992, military aircraft and their support personnel and materials for their missions were relocated to other Air Force installations. On

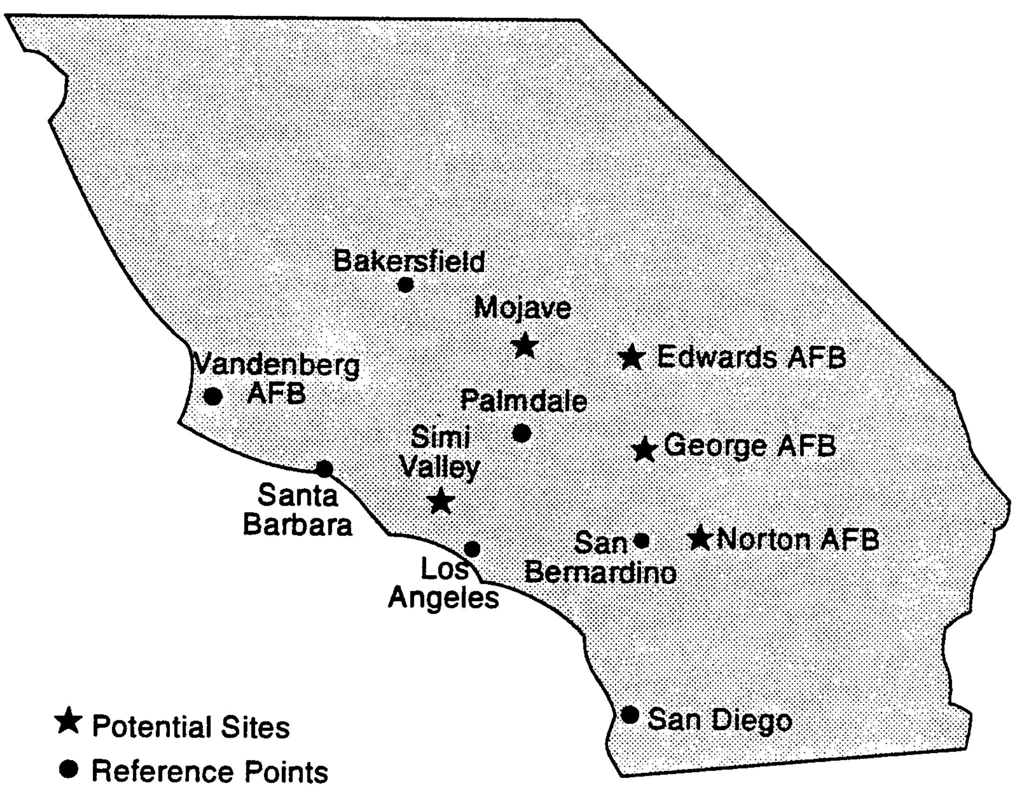


Figure 2–1. Potential Sites in Southern California

December 15, 1992, military activity at the base ceased and a small caretaker force undertook providing only essential maintenance. The DoD policy of not using closed military installations for weapons system testing is recognized. However, the BMDO RAPTOR/TALON Program could request use of the former GAFB runway facilities from the transferee at such time as the program requirements mature and specific needs arise. The information in the following discussions is from the George Air Force Base, Base Closure Environmental Impact Statement, 1990.

GAFB is located in southwestern San Bernardino County outside Victorville, California (Figure 2–2). Originally 5,237 acres in size, the base consisted of runways, industrial areas, and other support facilities. Restricted airspace R–2509 in Superior Valley, formerly controlled by GAFB, is now controlled by Naval Air Weapons Center, China Lake. The airspace is enclosed by other restricted areas controlled by Edwards AFB, China Lake Naval Air Station, and Fort Irwin. Historically, there has been and continues to be extensive glider activity and ultralight activity in the vicinity of GAFB on weekends. Flight testing of the SETP would somewhat resemble glider and ultralight activity.

The former GAFB is surrounded on three sides by the City of Adelanto (western and part of the northern and southern boundaries) and Victorville (eastern and southern boundaries). Urban development from these areas has expanded closer to the former base. Adjacent public lands are under the jurisdiction of the Bureau of Land Management (BLM). The major surface water feature near the former GAFB is the Mojave River, in intermittent stream approximately 125 miles long. GAFB lies in the southern portion of the Mojave Desert. The former base is situated at 2,875 feet (876.3 meters) above mean sea level. Electricity at the former GAFB is provided by Southern California Edison, furnished from the Victorville substation. Natural gas, supplied by Southwest Gas Corporation of Las Vegas, Nevada, is used for most heating at the former base. GAFB is located near several railroad lines and the Interstate Highway system. Cultural resource surveys at the former GAFB have identified three archeological sites, one prehistoric, one historic, and one of unknown temporal affiliation. Archeological survey and inventory work in 1990 identified one low-intensity prehistoric lithic scatter, one rock cairn, one historic trash dump, and 13 isolates. Many of the buildings on the base were built during World War II and may be significant historical-architectural resources. None of these sites have yet been evaluated for inclusion on the National Register of Historic Places.

2.2.1.1 *Biological Resources*

The dominant vegetation community on the former GAFB is Mojave creosote bush scrub. Plants in this community include creosote bush (*Larrea tridentata*), bur sage (*Ambrosia dumosa*), burro bush (*Hymenoclea salsola*), and indigo bush (*Dalea fremontii*). Introduced species, such as Russian thistle (*Salsola kali*) and wild mustard (*Brassica geniculata*) are found in disturbed areas.

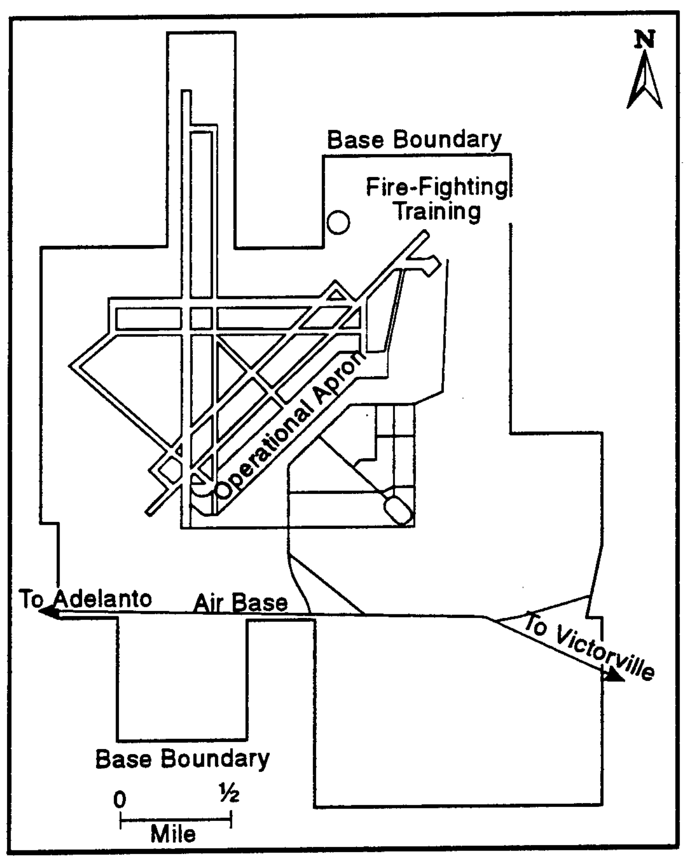


Figure 2–2. George Air Force Base

Wildlife species on the former base are low in both diversity and abundance because of the lack of adequate food, sparse ground cover, and unreliable sources of water. Species found on the former base include the common raven (*Corvus corax*), red-tailed hawk (*Buteo jamaicensis*), black-tailed jackrabbit (*Lepus californicus*), coyote (*Canis latrans*), and zebra-tailed lizard (*Callisaurus draconoides*).

The desert tortoise (*Gopherus agassizii*) is the federally listed threatened species of principal concern known to occur on the former GAFB. Sensitive species found on the base include the burrowing owl (*Athene cunicularia*), LeConte's thrasher (*Toxostoma lecontei*), Cooper's hawk (*Accipter cooperii*), prairie falcon (*Falco mexicanus*), golden eagle (*Aquila chrysaetos*), and the Mojave ground squirrel (*Spermophilius mohavensis*).

2.2.1.2 *Air Quality*

The former GAFB is located in the Southeastern Desert Air Basin, which has been declared a nonattainment area for ozone. The former base itself was not declared a nonattainment area. The area within a 5-mile (8-kilometer) radius of Victorville is also a nonattainment area for suspended particulate matter. The main sources of air pollution for the Victor Valley are interbasin-transported pollutants from the South Coast and from the San Joaquin Valley.

2.2.1.3 *Noise*

Historically, noise levels at the former GAFB were similar to those at most Air Force bases. Nonaircraft noises were associated with maintenance activities, ground transportation, and occasional construction activities. This noise was confined to the base. Aircraft related noise included engine warmup, maintenance and testing, taxiing, takeoffs, and landing. Noise complaints from the community were infrequent.

2.2.1.4 *Meteorology*

Precipitation in the vicinity of the former GAFB is light. Only about 4.5 inches (11.4 centimeters) of precipitation falls on average per year. Most of the precipitation is induced by the mountains in the vicinity of the base; almost none is caused by thunderstorms, which occur an average of less than 7 days per year.

The topography of the area affects the winds. During the late spring and summer, a daily temperature and pressure differential develops between the high desert and the coastal basin. This gives rise to a "heating wind" that occurs during the late afternoon and evening. Wind speeds under these conditions can exceed 40 knots (46 miles per hour). Average winds at the former GAFB are predominantly from the south throughout the year at less than 10 knots (12 miles per hour). Peak winds as high as 62 knots (71 miles per hour) have been recorded.

Table 2–1 provides data on the frequency of occurrence of weather that may affect testing of the solar electric test platform and other RAPTOR aircraft at the former GAFB.

Table 2–1. Frequency (Days) of Occurrence of Significant Weather at GAFB

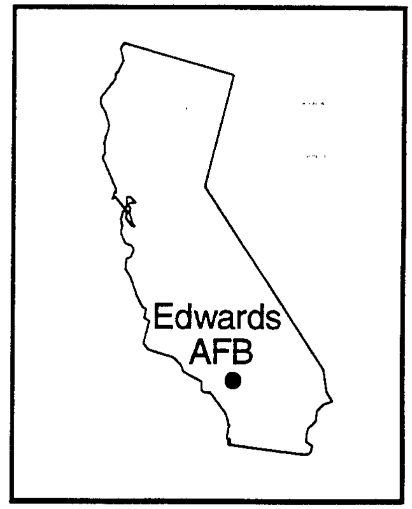
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Ceiling ≤ 3,000 ft	5.0	3.0	3.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	<1.0	1.0	4.0	1.0
Wind ≥ 10 kt	12.6	17.9	26.3	26.3	26.7	23.7	18.6	16.4	13.3	10.7	13.0	11.1	18.0

Data from USAFETAC.

2.2.2 Edwards Air Force Base, California (EAFB)

EAFB covers 470 square miles in Kern, Los Angeles, and San Bernardino Counties of southern California (Figure 2–3). The base has 65 square miles (169 square kilometers) of usable landing area, including 7.5 miles (12 kilometers) of runway. EAFB is generally regarded as being ideally suited for flight testing, with 350 days per year of flying weather. It has several dry lakebeds suitable for emergency landings. Major tenant activities at EAFB include the NASA Ames-Dryden Flight Research Center, the Jet Propulsion Laboratory, and the Rocket Propulsion Directorate of Phillips Laboratory. There are approximately 14,670 military personnel and dependents, civilian employees, and contractors on base.

EAFB has several distinguishing physical and operating features. The base is located in the Antelope Valley in the Mojave Desert. The valley is a closed topographic basin with interior drainage; infrequent storms drain into either Rosamond Dry Lake or Rogers Dry Lake. Elevations in the valley range from 2,271 to 3,246 feet (692 to 989 meters) above sea level. EAFB's wells draw water from the Antelope Valley aquifer; some water rationing occurs in the summer. The electrical system is being upgraded to handle all future power demands. A new tertiary treatment sewage treatment plant is expected to be operational by 1995. Land use and land-use planning at EAFB generally focus on four developed areas: North Base, Main Base, South Base, and Phillips Laboratory. Much of the land not included in these areas is undeveloped. The Air Force has developed a noise program for EAFB, which delineates noise-level guidelines for land uses and activities. Noise levels are greatest near the aircraft ramps and taxiways. EAFB is on the Environmental Protection Agency's (EPA's) National Priority List. Remedial investigations indicate volatile organic compound contamination of ground water, and waste oil, solvent, and nitric acid contamination of soils (DoD 1990). EAFB officials have signed an agreement with the U.S. EPA, the California EPA, Department of Toxic Substances Control, and the Lahontan Regional Water Quality Control Board to remediate the contaminated sites.



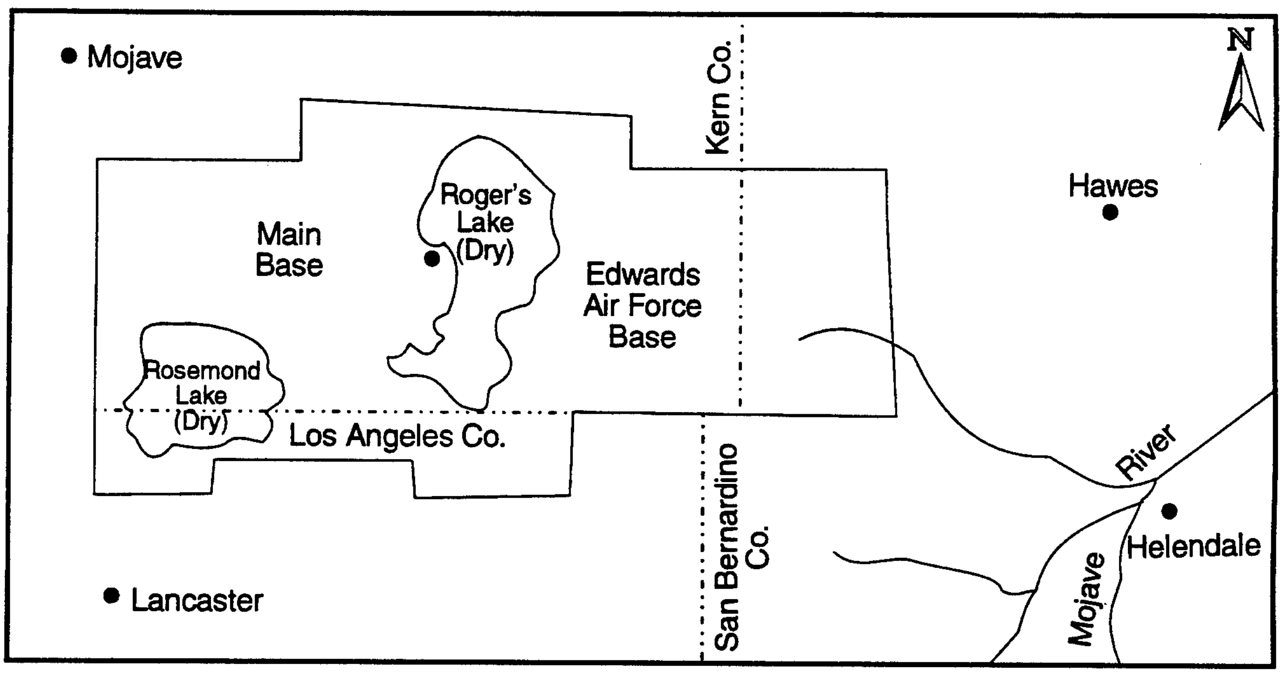


Figure 2–3. Edwards Air Force Base

The primary source for the information in this section comes from the Environmental Assessment for the Relocation of the 4950th Test Wing to Edwards AFB, California, May 1992.

2.2.2.1 *Biological Resources*

EAFB is located in the saltbush scrub community, dominated by allscale (*Atriplex polycarpa*). Other plant species found on the base include rubber rabbitbush (*Chrysothamnus nauseous*), filaree (*Erodium cicutarium*), autumn vinegarweed (*Lessingia lemmonii*), and desert calico (*Langloisia matthewsii*). The Mojave spineflower (*Chorizanthe spinosa*), a species on the State's "Watch List" (but not classified as either endangered or threatened), has been found on the base. No federally listed threatened or endangered plant species have been found.

Typical animal species on EAFB include the western whiptail (*Cnemidophorus tigris*), western meadowlark (*Strunella neglecta*), sage sparrow (*Amphispiza belli*), jackrabbit (*Lepus californicus*), and various kangaroo rat species (*Dipodomys* ssp.). The desert tortoise (*Gopherus agassizii*) is the only federally listed threatened animal species located on EAFB. The base is located within the geographic range of one State-listed threatened species, the Mojave ground squirrel (*Spermophilus mohavensis*).

2.2.2.2 *Air Quality*

Because of rapid nighttime cooling in fall and winter months, the area surrounding EAFB experiences a large number of temperature inversions and subsequent air pollution. In addition, moderate southwesterly winds can bring pollution in from the Los Angeles Basin. State standards for ozone and suspended particulate matter have been exceeded in the EAFB area.

The southeastern desert portion of the Kern County Air Pollution Control District, where EAFB is located, is designated as "serious" for nonattainment of standards for ozone and its precursors. The area must achieve State standards not later than December 31, 1996.

2.2.2.3 *Meteorology*

The climate and weather of EAFB is similar to that of the former GAFB. Both installations lie in the Mojave Desert and experience similar effects of terrain on the weather. EAFB annually receives approximately 4.1 inches (10.4 centimeters) of precipitation. EAFB experiences slightly higher temperatures than the former GAFB, with extreme temperatures in the 110 to 114 °F (43 to 46 °C) range. Winds are generally west-southwesterly at 10 knots (12 miles per hour) or less and slightly stronger in the summer months.

Table 2–2 provides data on the frequency of occurrence of weather that may affect testing of the solar electric test platform and other RAPTOR aircraft at EAFB.

Table 2–2. Frequency (Days) of Occurrence of Significant Weather at EAFB

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Ceiling ≤ 3,000 ft	3.0	3.0	2.0	<1.0	0.0	0.0	0.0	0.0	<1.0	0.6	0.6	1.5	1.0
Wind ≥ 10 kt	15.8	23.7	37.5	43.4	46.9	44.5	38.8	32.3	25.6	19.7	20.8	14.8	30.4

Data from USAFETAC.

2.2.3 Mojave Airport, California

Mojave Airport is within the restricted airspace of the Naval Air Warfare Center at China Lake, California. Mojave, at an elevation of 2,787 feet (849.5 meters), has three runways and a relatively light air traffic load. The airport sometimes hosts a number of military aircraft. Mojave Airport operates under visual flight rules only, with restricted operating hours and no onfield meteorological support. It is geographically close to the contractor that would be refurbishing the solar electric test platform (AeroVironment, Incorporated) and is the location of the contractor that would design, fabricate, and assemble the fixed-wing RAPTOR UAV.

The climate and weather of the Mojave Airport vicinity is similar to that of EAFB. Mojave is about 16 miles (25.8 kilometers) to the northwest from EAFB. Table 2–3 provides data on the frequency of occurrence of weather that may affect testing of the solar electric test platform and other RAPTOR aircraft at Mojave Airport.

Table 2–3. Frequency (Days) of Occurrence of Significant Weather at Mojave Airport

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Ceiling ≤ 3,000 ft	3.0	3.0	2.0	<1.0	0.0	0.0	0.0	0.0	<1.0	0.6	0.6	1.5	1.0
Wind ≥ 10 kt	15.8	23.7	37.5	43.4	46.9	44.5	38.8	32.3	25.6	19.7	20.8	14.8	30.4

Data from USAFETAC.

2.2.4 Norton Air Force Base, California (NAFB)

NAFB, near San Bernardino, California, offers a single long runway and surrounding airfield property for possible RAPTOR testing. While near the contractor locations, NAFB has a relatively high volume of air traffic. It is scheduled to close March 31, 1994, under the DoD base closure program.

NAFB lies at the foot of the San Bernardino Mountains in the Los Angeles coastal basin. The climate and weather of NAFB is characterized by hot and dry summers and relatively moist and moderate winters. Norton has approximately 13.2 inches (33.5 centimeters) of precipitation annually. Maximum temperatures in the summer exceed 90 °F (32 °C) during most months, dropping to near 65 °F (18 °C) for high temperatures in winter. Winds are generally west-southwesterly at 10 knots (12 miles per hour) or less, becoming easterly during the cooler months of the year.

Table 2–4 provides data on the frequency of occurrence of weather that may affect testing of the solar electric test platform and other RAPTOR aircraft at NAFB.

Table 2–4. Frequency (Days) of Occurrence of Significant Weather at NAFB

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Ceiling ≤ 3,000 ft	12.0	15.0	15.0	16.0	27.0	22.0	9.0	12.0	17.0	20.0	14.0	13.0	16.0
Wind ≥ 10 kt	5.8	6.2	6.6	7.2	7.0	6.5	7.3	7.7	7.8	6.5	6.2	5.9	6.5

Data from USAFETAC.

2.2.5 White Sands Missile Range, New Mexico (WSMR)

WSMR is located in south-central New Mexico, 40 miles (64 kilometers) north of El Paso, Texas (Figures 2–4 and 2–5). The range is 100 miles (161 kilometers) long and 40 miles (64 kilometers) wide. The majority of the installation is located in the desert floor of the Tularosa Basin. The range is generally regarded as particularly suited for missile testing because it is flat and sandy, visibility is excellent year-round, and it is relatively remote and the immediately adjacent environs are sparsely populated.

WSMR has several distinguishing physical and operating features. The geology of WSMR is varied and covers mountain ranges, basins, salt flats, lava flows, deserts, and mesas. The Tularosa Basin is 200 miles (322 kilometers) long and from 24 to 60 miles (38 to 97 kilometers) wide. The San Andres Mountains are west of the Basin, stretching for 85 miles (137 kilometers) and ranging in elevation from 5,000 to 8,000 feet (1,524 to

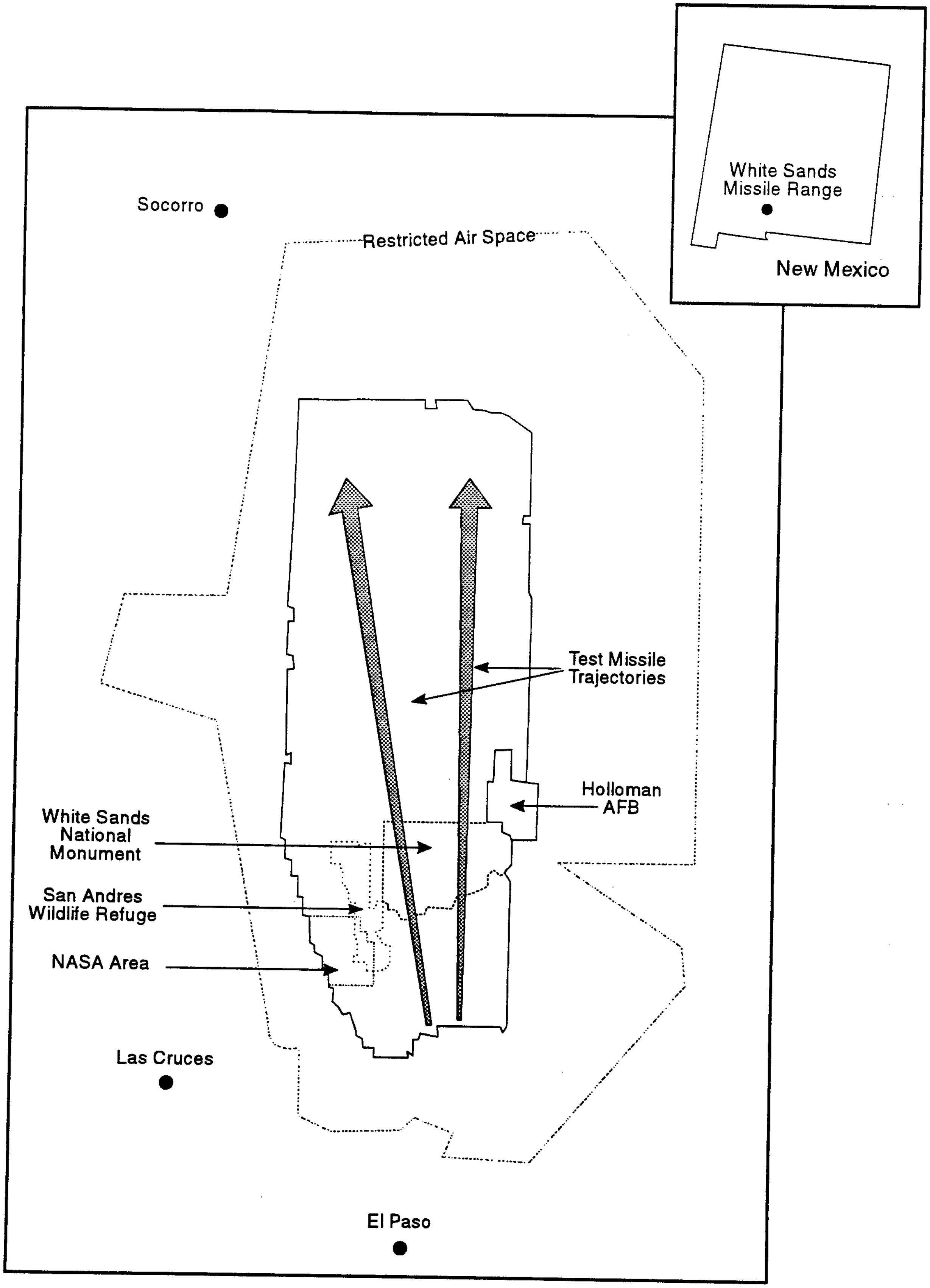


Figure 2–4. Nominal TALON Launch Azimuths at WSMR

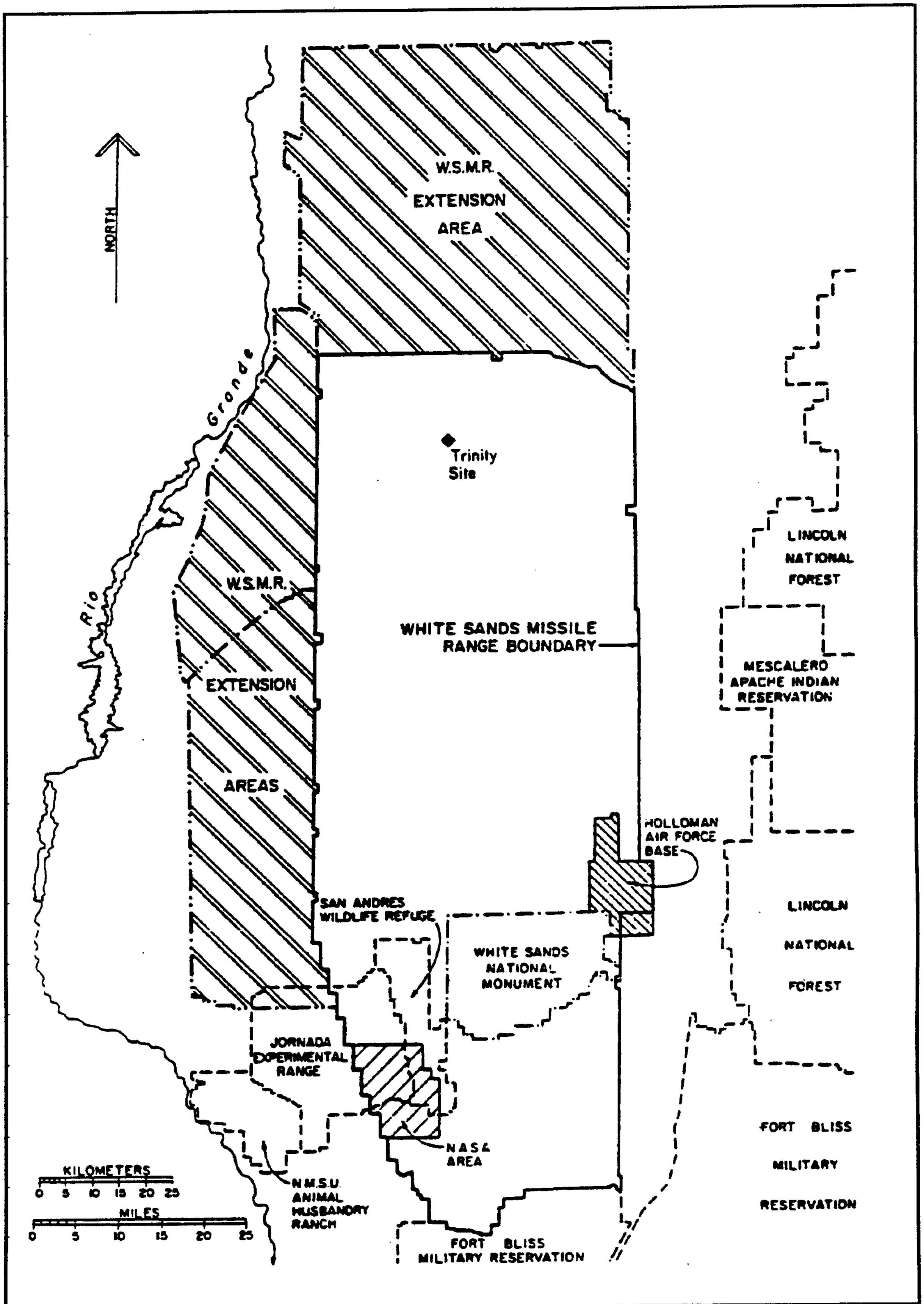


Figure 2–5. White Sands Missile Range (Detail)

2,438 meters) above sea level. Surface lakes and streams are almost nonexistent within WSMR boundaries except for the gypsum water in Lake Lucero and the saline water in Salt Creek and Malpais Springs. Groundwater is a highly valued resource and is the source of water for WSMR. Water for the post area at WSMR is supplied from 10 gravel pack wells. The well water is pumped into a common collection system, through a sand trap, and into one of two 400,000-gallon (1.5-million-liter) ground level storage tanks located at the Central Booster Station (WSMR EIS 1985). Solid waste is collected throughout the main post and deposited in landfills registered with the State. The post's sewage treatment plant provides complete treatment with primary clarifiers, trickling filters, secondary clarifiers, and a recirculating system (WSMR EIS 1985). The range is traversed by more than 1,900 miles (3,060 kilometers) of roads, of which about 800 miles (1,288 kilometers) are paved. WSMR is located between two railroad lines, an Atchison, Topeka, and Santa Fe branch and a Southern Pacific Railroad branch.

WSMR maintains an installation master plan to provide for sound resource management. The plan accommodates requirements for administrative and technical facilities, troop and family housing, community and medical facilities, recreational facilities, and industrial and support facilities. The installation mission is supported by several major complexes, including a Launch Complex, South Range, Rhodes Canyon Range Center, Stallion Range Center, Oscura Range Center, North Oscura Range Center, Tularosa Range Camp, and associated impact areas. Joint use of real property resources extends to facilities set aside for the U.S. Air Force, the NASA Test Facility, the White Sands National Monument (the world's largest desert of pure white gypsum), and the San Andres National Wildlife Refuge.

In 1933, White Sands National Monument was set aside to preserve the unique gypsum dunes. The monument, which covers 143,733 acres, is administered by the National Park Service and receives approximately 600,000 visitors annually. The San Andres National Wildlife Refuge lies within WSMR. The U.S. Fish and Wildlife Service operates the 57,200-acre refuge.

WSMR supports a wide variety of research, development, test, and evaluation activity. Its resources are used for several types of air activities, including those associated with air-to-air missiles, air-to-surface missiles, surface-to-air missiles, surface-to-surface missiles, fixed- and rotary-wing aircraft, aerial targets, mid-air recovery procedures, space vehicle components, and fighters, bombers, cargo, and reconnaissance aircraft. Numerous communications, telemetry, and radar sites across the range are used to record data during the testing which occurs there. WSMR is in compliance with applicable noise standards. WSMR has programs in place for compliance with all Federal, state, and local standards for air quality, water quality, and hazardous waste. WSMR operates facilities for hazardous material storage and transfer; petroleum, oil, and lubricants; liquid propellants; and polychlorinated biphenyls.

The primary sources of information in this section come from the High Endoatmospheric Defense Interceptor (HEDI) Technology Testing Program Environmental Assessment, May 1989, and the Department of the Army, U.S. Army White Sands Missile Range, New Mexico, Installation Environmental Assessment, March 1985.

2.2.5.1 *Biological Resources*

The ecosystems at WSMR illustrate the interaction of several environmental factors. WSMR consists of mountain ranges, basins, salt flats, lava flows, deserts, mesas, and other environmental regions. As a result of this physical diversity, WSMR contains a large number of native plant communities that form an important 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 in WSMR. Four principal natural communities are present at WSMR: mesquite hummocks, creosote bush scrub, a diverse shrub grassland, and pinyon juniper woodland. The mesquite and creosote bush scrub communities provide habitat for common desert wildlife. Foothill and mountainous ecological communities at WSMR have a diverse shrub-grassland plant community, sometimes termed footslope grassland.

Review of the scientific and regulatory literature indicates that many protected species are known to exist or could potentially exist at WSMR. As many as 8 federally designated threatened or endangered animal species, and 6 federally designated threatened or endangered plant species may be present at WSMR; one animal species proposed for listing may also be present. Additionally, there are 28 candidate species of animals and plants, as well as 43 species of animals and plants designated as sensitive by the State of New Mexico possibly present at WSMR. The eight federally protected species are the bald eagle (*Haliaeetus leucocephalus*), the Aplomado falcon (*Falco femoralis septentrionalis*), the interior least tern (*Sterna antillarum athalassos*), the whooping crane (*Grus americana*), the American peregrine falcon (*Falco peregrinus anatum*), the Mexican gray wolf (*Canis lupus baileyi*), the Arctic Peregrine falcon (*Falco peregrinus tundrius*), and the Piping plover (*Charadrius melodus circumcintus*); the Mexican spotted owl (*Strix occidentalis lucida*) has been proposed for listing. The federally protected species of plants are the Sneed pincushion cactus (*Coryphantha sneedii* var.), Lloyd hedgehog cactus (*Echinocereus lloydii*), Todsen's pennyroyal (*Hedeoma todsenii*), Kuenzler's hedgehog cactus (*Echinocereus fendleri*), Sacramento prickle-poppy (*Argemone pleiacantha*), and Sacramento mountain thistle (*Cirsium vinaceum*). In addition to the federally protected species, desert bighorn sheep (*Ovis canadensis*), designated as an endangered species by the State of New Mexico, inhabit the San Andres Mountains at WSMR. The population of the desert bighorn sheep dropped from approximately 300 in 1970 to a low of 34 in 1988 (HEDI 1989). The desert bighorn sheep occupy the entire mountain area, utilizing different areas during different seasons. The population is considered to be under stress from scabies, noise disturbances, and predation. During the lambing season, disturbance to the sheep potentially jeopardizes lamb survival, and thus the overall stability of the herd

(HEDI 1989). A complete listing of Federal and State designated threatened and endangered species, as well as candidate species, is provided in Tables B–1, B–2, and B–3 of Appendix B.

2.2.5.2 *Air Quality*

Air quality at WSMR is generally very good. Emissions are within the ambient air quality standards for particulate matter (PM_{10}), sulfur dioxide, carbon monoxide, nitrogen dioxide, ozone, and lead, the six criteria pollutants regulated under the Clean Air Act. Particulates, primarily from blowing dust, are occasionally of minor concern in the WSMR area.

2.2.5.3 *Meteorology*

WSMR is in the arid Southwest. The subtropical desert climate is characterized by generally low annual precipitation, low frequency of occurrence of low ceilings, and a relatively wide range of temperatures, both daily and annually. Mean annual precipitation is 8.3 inches (21 centimeters), most of which falls during July through October, mostly from thunderstorms. Thunderstorms are most frequent during July and August, when there is a 35- to 40-percent probability of a thunderstorm during any one day. Maximum daily temperatures range from 54 to 93 degrees Fahrenheit (°F), or 13 to 34 degrees Celsius (°C), with an extreme high of 109 °F (43 °C). Surface winds are generally southerly at nearly 5 knots (6 miles per hour). Peak gusts with thunderstorms or rapidly moving pressure systems have exceeded 65 knots (75 miles per hour).

Despite the infrequence of low ceilings at WSMR, occasional clouds could affect launch of RAPTOR aircraft. Clouds covering more than 4/8 of the sky (ceiling) are generally the result of maritime airflow from the Gulf of Mexico, mainly during the summer months; when combined with instability and lifting of air caused by the mountainous terrain, clouds produce afternoon and evening thunderstorms and resulting ceilings. Fronts arriving from the west, northwest, and northeast, primarily during October through April, also bring cloud cover greater than 4/8 coverage.

Winds of greater than 10 knots could restrict RAPTOR testing and operations. During winter, winds greater than 10 knots can occur as much as 36 hours ahead of fronts and persist 10 to 20 hours after frontal passage. During the summer, the primary cause of winds greater than 10 knots is thunderstorms. Occasional frontal passages will also bring winds greater than 10 knots.

Table 2–5 provides data on the frequency of occurrence of weather that may affect testing of the solar electric test platform and other RAPTOR aircraft at WSMR.

Table 2–5. Frequency (Days) of Occurrence of Significant Weather at WSMR

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Ceiling ≤ 3,000 ft	6.0	2.0	2.0	2.0	<1.0	<1.0	<1.0	<1.0	2.0	3.0	4.0	4.0	2.0
Wind ≥ 10 kt	12.5	14.0	15.1	17.4	18.2	19.4	22.6	23.7	21.4	20.0	18.6	16.2	18.2

Data from USAFETAC.

2.2.5.4 *Cultural Resources*

Much of the information pertaining to cultural resources at WSMR has been compiled in a cultural resource overview. As of 1985, 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 archeological sites, primarily for descriptive and chronological purposes. However, 51 of the 61 projects were performed as a result of recent cultural management laws and procedures; 196 of the 331 sites have been recorded since 1970 during such survey programs. Most of WSMR has not been surveyed.

All of the range areas studied, except the playa lakebeds, contain prehistoric properties. Large sites of more than 10,000 square meters 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 agricultural 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. Sample archeological surveys at three locations proposed for the Ground-Based Free Electron Laser Technology Integration Experiment indicated a large number of unrecorded archeological sites that may be present in areas of WSMR that have not been intensively surveyed.

Seventy-nine historic ranch sites are located in WSMR. Other known historic site types, which have not been thoroughly recorded, include other ranch complexes and mines and mining camps dating from 1880 to 1942.

In addition to prehistoric and historic archeological 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, gathering sites, campsites, and sites of military encounters.

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 blast area of the Trinity Site, which is in the northern section of the range, has been bulldozed and fenced. The second site is Launch Complex 33, on Nike Road within WSMR, just east of the post area. In addition, the Army Blockhouse/V–2 Gantry Crane and the 500K Static Test Stand are listed in the State of New Mexico Cultural Property Register. Additional cultural resources are located at White Sands National Monument, including a National Register Historical District, archeological sites, and hundreds of "hearth sites" which contain artifacts seeds, bone, charcoal, and other items encased in plaster casts produced by fires dehydrating the gypsum into a crude form of plaster of paris.

3.0 Environmental Consequences and Mitigations

This chapter addresses potential impacts to environmental resources and the human environment from the proposed RAPTOR/TALON Program. Program activities, as described in Chapter 1, are examined in the context of the locations where these activities would occur, as described in Chapter 2.

Impacts and their environmental consequences were determined using a systematic framework to identify significant effects that might arise from the proposed action. This approach hinges on the cause-effect relationship between the proposed action and the impacts generated thereby. The major activities, as described in section 1, are identified. Information such as the materials used, locations, duration, magnitude of an activity, and outputs or products of an activity is obtained and analyzed as a potential cause of an effect on an environmental resource. Indirect effects are also analyzed, such as whether effects on one resource would in turn affect another resource.

After potentially affected resources are identified, the likelihood or severity of an impact is determined based on its magnitude, likelihood, context, intensity, duration, and permanence.

3.1 Research, Development, and Manufacture of Components and Subsystems

The RAPTOR/TALON program consists of research and development of three major components: the TALON interceptor and two different RAPTOR platforms: a solar electric test platform (SETP) and a fixed-wing gasoline-engine-driven aircraft.

The SETP candidate would be refurbished for RAPTOR testing by AeroVironment, Incorporated, of Simi Valley, California. Research related to the SETP would focus on improvements in solar arrays, energy storage, electric propulsion, high-efficiency power management, autonomous flight control, and system mass reduction.

A second candidate RAPTOR platform would be a fixed-wing unmanned aerial vehicle (UAV). Scaled Composites, Incorporated, of Mojave, California, would design, fabricate, and assemble the aircraft and conduct tests related to determining its suitability for platform use and continued development. Initial testing of the fixed-wing aircraft would be with conventional engine operation. Later development would involve turbocharged models seeking to obtain higher altitude performance. Research would continue until achievement of a platform capable of meeting mission requirements. The ultimate platform must be capable of low maintenance and lengthy, autonomous flight and it must be able to carry multiple TALON interceptors.

The TALON would be an air-to-air high endoatmospheric or exoatmospheric kinetic kill interceptor designed and developed to operate from a RAPTOR platform. Development goals for the TALON interceptor would include ability to attain velocities of 2 or more kilometers per second, to have a range of approximately 100 kilometers, and to be light enough for multiple deployment from the RAPTOR platform. Development of the TALON would be carried out by the Lawrence Livermore National Laboratory (LLNL). Advanced technologies for portions of the TALON interceptor sensor, guidance, and ranging systems already exist in BMDO technology programs. The TALON interceptor would draw upon or adapt existing technologies and hardware to the maximum extent possible.

3.1.1 Lawrence Livermore National Laboratory

The RAPTOR/TALON Program would not be expected to cause any significant impacts on environmental resources or the human environment at LLNL. While minor component assembly and testing would occur in the LLNL "O" Division area, most activity related to the proposed action would be primarily administrative, occurring at office spaces in temporary trailers, with existing personnel resources. These activities are well within the existing capacity and present practices of LLNL. No construction, additional concerns for air or water quality, or additional hazardous wastes issues would be anticipated.

3.1.2 AeroVironment, Incorporated

The RAPTOR/TALON Program would not be expected to cause any significant impacts on environmental resources or the human environment at the AeroVironment, Incorporated, facility in Simi Valley, California. Program activities would be small in scale and would not result in an increased generation of air or water discharges or hazardous waste. All program-related activities would be consistent with ongoing operations that are in compliance with applicable Federal, State, and local regulations.

3.1.3 Scaled Composites, Incorporated

The RAPTOR/TALON Program would not be expected to cause any significant impacts on environmental resources or the human environment at the Scaled Composites, Incorporated, facility in Mojave, California. RAPTOR/TALON Program activities at this location would comprise only a fraction of the facility's activity. There would be no increased generation of air or water discharges or hazardous waste. All program-related activities would be consistent with ongoing operations that are in compliance with applicable Federal, State, and local regulations.

3.2 Ground Testing of RAPTOR and TALON

The RAPTOR/TALON Program ground testing activities would not be expected to cause any significant impacts to environmental resources or the human environment. Ground testing activities that would occur at the foregoing research, development, and manufacturing sites (section 3.1, above) would have no additional impacts beyond those already described. Any additional testing, likely to be in the nature of quality control, would pose no additional concerns.

Ground testing of the TALON interceptor at the Nevada Test Site's BREN tower would occur at a facility compatible with research and development of missile functions. Since no prototype of the TALON yet exists, tether testing's noise levels cannot be predicted beyond an estimation that the TALON would produce the same kind of noise as similar small missiles. Tether tests would be of short duration, generally no more than 5 seconds for each event. Assuming a TALON interceptor produced a sound level of 120 decibels at a distance of 10 meters, sound levels at a distance of 100 meters would be approximately 80 decibels and at 1,000 meters would be approximately 60 decibels. Personnel would not be exposed to noise in excess of the OSHA standard of an 8-hour time-weighted average sound level of 85 decibels for occupational noise (29 C.F.R. 1910.95). Nevertheless, personnel in the vicinity of the testing and not otherwise protected (for example, indoors) would be provided personal protective equipment. The quality of air emissions during tether testing would depend on whether hydrazine (monopropellant) or hydrazine and nitrogen tetroxide (bipropellant) were used for the test. Both fuels have previously been used in similar tests at the BREN tower. Tether testing would require substantially less fuel than would be required in other types of testing (the fuel tanks would need to contain only a fraction of their capacity). Total event gas and particulate emissions would be substantially less than those on other types of flights and would be dispersed by prevailing wind. Noise and air emission outputs, which would be brief and localized, would not be expected to exceed previous outputs at the test facility.

3.3 Transportation of Materials and Fuels

The RAPTOR/TALON Program would not be expected to cause any significant impacts on transportation.

Candidate RAPTOR platforms would be designed for disassembly and reassembled at flight-test locations. Movement of platforms from the manufacturing locations to flight-test locations would be via commercial trucking. The transport vehicles would not require any specialized licensing for this type of cargo.

The SETP would not require the transportation of fuels. The fixed-wing aircraft would use gasoline, which would be routinely available at the flight-test location.

Transport of the TALON interceptor would pose no special requirements. Program efforts would focus on miniaturization of components to render the TALON's weight to under 20 kilograms (fuel-loaded). An object of this size could be transported or sent to any location with ease. TALON interceptors would be shipped without fuel. For component and function testing of the TALON at the Nevada Test Site, hydrazine or hydrazine and nitrogen tetroxide fuel would be obtained locally. During a final phase of testing that would occur at White Sands Missile Range, fuel would be obtained from officials at the NASA Site. At both test locations, transportation of fuels would be in accordance with Department of Transportation regulations (Title 49, Code of Federal Regulations, Part 178). Handling requirements for fuels proposed for the tests of the TALON interceptor would be fully coordinated by Program personnel with WSMR safety and industrial hygiene personnel. During fueling operations, specially trained personnel would wear OSHA Level B personal protective suits at all times. Other controls would derive from reliance on existing local safety operations plans and procedures.

3.4 RAPTOR Flight Preparation, Operations, and Recovery

Evaluation of RAPTOR flight preparation, operations, and recovery activities would involve testing of each generation of solar electric test platform (SETP) and testing of the fixed-wing aircraft. Testing of an integrated RAPTOR and TALON interceptor system is discussed in section 3.6.

3.4.1 Environmental Impacts of Testing of SETPs

The RAPTOR/TALON Program flight preparation, operations, and recovery activities as related to testing of SETPs would not be expected to cause any significant impacts to environmental resources or the human environment.

Development of SETPs would involve several iterations or "generations," each building upon the technical improvements of its predecessor to attain greater engineering efficiencies. The ultimate goal would be to design, develop, and demonstrate a platform capable of sustained, unmanned flight while carrying multiple TALON interceptors. Flight tests for each generation of SETP would follow a similar pattern of progressively higher, longer, and more demanding aerial tests.

The first step in preparation of any flight test of the SETP would be the administrative planning for the particular evaluation. The purposes of the test, the test elements needed to obtain the data, and the personnel required to conduct the test would be determined. The formalities of the testing protocols would likely vary with each flight test, depending on the nature of the particular test and the logistics that may be required. Administrative planning and arrangements for logistics requirements would occur primarily at LLNL.

Flight preparation for testing of SETPs would involve transport from the AeroVironment, Incorporated, facility in Simi Valley, California, to a suitable test flight area. To transport the 400-pound (180-kilogram) SETP, the propellers, motors, and electronics packages would be removed. The SETP would be disassembled to five sections. All parts would be loaded onto a commercial truck trailer having shipping cradles for the wing segments. Upon arrival at the flight test location, the SETP would be reassembled and inspected. The test flight location would have a hangar large enough to accommodate the SETP and to protect it and the test crew in the event of inclement weather. No hazardous materials or specialized equipment would be required for disassembly, transport, or reassembly procedures.

As a result of various controls over flight testing, safety is not anticipated to be compromised. Flight tests would be scheduled to occur at places having a low volume of aviation activity. Portions of airfields or other locations would be selected so as not to interfere with other potential aviation activities. Locations having an air traffic control tower and meteorology service would be preferred, though these services are not essential. Flights would generally occur early in the day, prior to development of local winds and commencement of most commercial or general aviation activities. Operation of the UAV would have redundant command and control systems to control the aeronautical performance of the craft. Flight profiles (altitudes, speeds, maneuvers) would be limited until the command and control systems were demonstrated to be reliable.

Initial test flights would originate at airfield runways, aprons, or similar hard-pack areas. In view of the craft's light weight, takeoff can be achieved within relatively short distances. Risks associated with bird strikes would not be any greater than with other aircraft. It would be anticipated that platform designs of the SETP would yield cruising airspeeds of 10 to 15 knots (12 to 23 miles per hour) and maximum airspeeds of about 30 knots (approximately 35 miles per hour). Normal operations for initial testing would be at altitudes sufficient to avoid ground thermal effects but low enough to keep the SETP within visual range of the controlling party (generally less than 2,000 feet (610 meters)). Flight tests would likely be accompanied by small aircraft to film or videotape SETP aerial performance. When airborne observation occurred, pilots would maintain adequate separation between the manned and unmanned craft as a safety measure. To minimize the handling and control difficulties that might develop later in the day because of increased wind velocities, flight tests in the early daylight hours would generally last no more than 1 to 2 hours. Recovery of the SETP would involve navigating it to successively lower altitudes and reducing its airspeed so that it could land on a runway, apron, or other open, hard surface. Controlling the landing of the platform would involve gauging ground thermal effects, permitting the platform to settle down. Initial testing of the SETP would focus on checking out basic airworthiness, safety, responsiveness of control systems, and specific subsystems. Later testing of each generation of platform would seek evaluation of power source endurance, altitude, and other sophisticated parameters such as global system positioning reporting or sensor operability.

SETP flight preparation, operations, and recovery during testing would not involve actions that result in air emissions or degradation of air quality. No hazardous materials would be used, and no hazardous wastes would be generated. Other than for the welfare of test crew personnel, there would be no reliance on, or requirement for, water resources. There would be no expected impacts on birds or wildlife. Use of controlled or unimpeded airspace and maintenance of positive control over platform aerial performance would preclude the potential for significant impacts to public safety.

The precise locations for solar electric test platform flight preparation, operations, and recovery activities cannot be flawlessly predicted. Given the preference to conduct flight tests within close distance of Simi Valley, there are four locations that would most likely be used: George Air Force Base, Edwards Air Force Base, Norton Air Force Base, and Mojave Airport. To validate the conclusion that testing would not result in any potentially significant environmental impacts, regardless of location, evaluation of potential impacts at those four most likely places is provided.

3.4.1.1 *George Air Force Base (GAFB)*

The RAPTOR/TALON Program initial testing of the SETP at GAFB would not be expected to cause any significant environmental impacts. Air traffic control and meteorological support as needed would be provided by the test personnel, and all necessary approvals would be obtained. In the short- and mid-term, there would be no conflict with other aircraft, as the airfield would be closed. Over the long-term, new activities under new ownership and management of the installation may have to be reviewed. For example, there is a possibility that the military would seek use of the facility for infrequent aviation operations in support of activities at the National Training Center at Fort Irwin. This type of activity, however, presents an issue of scheduling to avoid conflicts rather than inherent potential for significant environmental impacts. In the short-term (less than one year), the flight testing would have no impact on the base closure.

3.4.1.2 *Edwards Air Force Base (EAFB)*

The RAPTOR/TALON Program initial testing of the SETP at EAFB would not be expected to cause any significant environmental impacts. Flight testing of this type would be well within the scope of activities routinely conducted at EAFB. There are large areas suitable for SETP testing. Busy sections of the airfield and high-traffic portions of airspace would be avoided. As the power source for the SETP is not an internal combustion engine, there would be no potential to add to air emissions concerns at the base or areas surrounding it.

3.4.1.3 *Norton Air Force Base (NAFB)*

The RAPTOR/TALON Program initial testing of the SETP at NAFB would not be expected to cause any significant environmental impacts. NAFB, which operates a single major runway, bears a relatively high volume of aviation activity. Planning for initial SETP testing would ensure minimization or elimination of interference or conflicts with other aircraft.

3.4.1.4 *Mojave Airport*

The RAPTOR/TALON Program initial testing of the SETP at Mojave Airport would not be expected to cause any significant environmental impacts. Air traffic at Mojave Airport is light, so potential interference with or by other aircraft would be minimal.

3.4.2 Environmental Impacts of Testing the Fixed-Wing Platform

The RAPTOR/TALON Program flight preparation, operations, and recovery activities in connection with testing of the fixed-wing aircraft would not be expected to cause any significant impacts to environmental resources or the human environment.

Flight testing of the fixed-wing aircraft would occur most likely at EAFB. There would be several similarities between SETP and fixed-wing platform testing: test planning and logistic arrangement, disassembly, transport, reassembly, and inspection. These steps would not be expected to generate any significant environmental impacts.

Flight testing of the fixed-wing RAPTOR platform at EAFB would be scheduled to occur and would be conducted so as not to interfere with other aviation activities. The characteristics of the fixed-wing flight test would differ from the characteristics of the SETP in a few important respects. The fixed-wing platform would likely operate at speeds between 60 and 140 knots (69 and 161 miles per hour) at low altitudes. Unlike the SETP, the fixed wing platform would not be able to rise from a virtually standing still position. A runway or takeoff field area would be required. All test sites considered have adequate runways.

Testing altitudes would be sufficient for safety. The fixed-wing platform would perform much like a small airplane, but would have no pilot. Risks associated with bird strikes would not be any greater than with other aircraft. Given the greater similarities of the fixed-wing aircraft to conventional general aircraft, flight testing would likely have to be at altitudes higher than the test altitudes of the SETP. Test durations would initially be up to 1 or 2 hours. Flight durations would increase as subsequent iterations of the platform were tested and as systems integration established reliability in the key areas of control and aeronautical performance.

Relevant environmental resource and human environment areas are discussed in the below subsections.

3.4.2.1 *Biological Resources*

The RAPTOR/TALON Program flight tests of the fixed-wing aircraft would not be expected to cause any significant impacts on biological resources.

The activities involved with the testing would take place in the air or on the runway surface, not on the ground surface, where sensitive plants or wildlife occur. As in any aviation activity, there would be the possibility for bird strikes. There is no reason to believe, however, that risks associated with RAPTOR platform bird strikes would be any greater than with other aircraft or that potential impacts are significant.

3.4.2.2 *Air Quality*

The RAPTOR/TALON Program flight tests of the fixed-wing aircraft would not be expected to cause any significant impacts on air quality.

A near-term candidate engine for the fixed-wing aircraft would be a four-cylinder 80-horsepower internal-combustion engine using electronic fuel injection. A powerplant of this size would produce air emissions of approximately the same magnitude as a small general aviation aircraft. The platform's operating altitude would assist in dispersion of emissions. While EAFB lies within an area declared to be in nonattainment for ozone and particulate matter, contributions to those contaminants would be minuscule and would not create any significant impact within the vicinity of the flight test. Later iterations of the fixed-wing aircraft would involve use of a turbocharged engine. This would result in a more fuel-efficient powerplant, producing fewer combustion pollutant byproducts.

3.4.2.3 *Noise*

The RAPTOR/TALON Program flight tests of the fixed-wing aircraft would not be expected to cause any significant impacts on the noise environment.

Noise is considered to be unwanted sound that interferes with normal activities or otherwise diminishes the quality of the environment. It may be intermittent or continuous, steady or impulsive. Human and wildlife response to noise varies with the type and characteristics of the noise, sensitivity of the receptor, time of day, and distance between the noise source and the receptor.

Although the fixed-wing aircraft has not been built and flown, it is reasonable to assume that the noise levels to be produced would likely be similar to small aircraft having like-sized engines. The type and loudness of noise that would be produced by the fixed-wing aircraft would be generally consistent with that occurring across an airfield. Flight tests of the fixed-wing aircraft would generally last between 1 and 2 hours. Later tests would be of greater duration but at higher altitudes and, therefore, less likely to be perceived at ground level.

Sound levels in close proximity to the fixed-wing aircraft could reach levels exceeding the standard time-weighted average permitted by occupational safety and health standards. To reduce aircraft weight and to maximize payload capacity, devices to muffle noise would likely not be introduced in the design process. While in close proximity to the aircraft, personnel operating the fixed-wing aircraft would be required to wear hearing protective devices. Persons at greater distances, such as beyond the edge of a ramp, apron, or runway, would likely find the noise to be minimal and would not be affected.

3.4.2.4 *Airspace Use*

The RAPTOR/TALON Program flight tests of the fixed-wing aircraft would not be expected to cause any significant impacts on air space use.

Appendix A contains information on airspace controls applicable to EAFB. Flight tests of the fixed-wing aircraft would occur within the boundaries of the restricted airspace controlled by EAFB. Eventually, testing would likely extend to airspace outside the EAFB vicinity. Such flights, however, would be on the basis that the fixed-wing aircraft would operate by the same rules as any other aircraft subject to Federal Aviation Administration requirements. Tests outside the EAFB controlled airspace would not interfere with or impinge upon commercial or general aviation use of that airspace.

3.4.2.5 *Public Safety*

The RAPTOR/TALON Program flight tests of the fixed-wing aircraft would not be expected to cause any significant impacts on public safety.

Flight tests of the fixed-wing aircraft would occur within the confines of the EAFB controlled airspace and over land areas generally devoid of human activity or development. Tests would be iterative in their development of longer and higher flights, permitting the aircraft and operators more assurances of aircraft capabilities. Flight tests would occur as distant as reasonably possible from areas that might, in event of a catastrophe, incur significant injury to persons or damage to property. EAFB provides ample resources to permit such separation between test activity and potentially affected areas.

The composite construction of the fixed-wing aircraft involves epoxy, epoxy-reinforced honeycomb structural materials, and graphite-reinforced fabrics. When burned under reduced oxygen conditions, these materials may produce a fine, fibrous high-carbon combustion by-product (akin to sooty smoke) capable of interfering with on-board radio control equipment. Engineering design would minimize the potential for electrical shorts and preclude contact with hot exhaust gases which might ignite the epoxy or other materials. In the unlikely event of a fire during ground taxiing or aerial testing, rapid air movement over and around the aircraft's surfaces would preclude any build-up of soot that could degrade radio-link control of the aircraft while navigating it to the safest available landing site.

3.5 TALON Interceptor Testing

The RAPTOR/TALON Program testing of the TALON interceptor would not be expected to cause any significant impacts to environmental resources or the human environment.

TALON interceptor testing would occur at WSMR. Initial tests would likely occur from a conventional aircraft platform and be directed against a "point-in-space" (telemetric confirmation) or an airborne object (drone or missile).

TALON interceptor tests in conjunction with a RAPTOR/TALON Program platform are discussed in section 3.6, below. The following subsections evaluate potential impacts related to testing of only the TALON at WSMR.

3.5.1 Biological Resources

The RAPTOR/TALON Program testing of the TALON interceptor would not be expected to cause any significant impacts to biological resources.

TALON interceptor testing would occur in the air, at altitudes far above levels occupied by wildlife and birds. As in any testing at WSMR that could produce debris, an estimate would be made of the debris profile (size of pieces and dispersion at ground level). The debris profile would be plotted to avoid areas that are sensitive because of wildlife or plant habitat, cultural resources, or human safety concerns.

3.5.2 Air Quality

The RAPTOR/TALON Program testing of the TALON interceptor would not be expected to cause any significant impacts on air quality.

A primary purpose of the RAPTOR/TALON Program is to design, develop, and demonstrate a TALON interceptor capable of being deployed on a platform that can operate at high altitudes (beyond the reach of surface-to-air missiles). This important design criterion dictates miniaturization of all components and reduction in over-all size of the interceptor. Accordingly, the TALON interceptors that would be tested at WSMR would represent a new generation of interceptor, smaller than any predecessors of equal kinetic kill lethality, speed, or capability. The reduced size of the TALON would also reduce the amount of propellants being employed. To reach the required performance criteria, fuel for each TALON would be expected not to exceed 10 liters (less than 3 gallons).

Tests of TALON interceptors would occur at high altitudes (upwards of 60,000 feet (18,288 meters)), and the liquid propellants that would be used would reach a high combustion temperature and burn completely. The high operational altitude would ensure wide dispersion of emissions of the resultant combustion byproducts.

3.5.3 Noise

The RAPTOR/TALON Program testing of the TALON interceptor would not be expected to cause any noise that would have significant impacts on the environment.

Noise associated with testing of the TALON interceptor would occur from point of launch to point of impact. Noise from the TALON would occur at high altitudes, over areas at WSMR that are generally desolate and unpopulated. In those tests employing a conventional aircraft to launch the TALON interceptor, the aircraft's noise would be typical of, consistent with, and within acceptable limits of the noise patterns frequently experienced at the installation.

TALON interceptor noise measurements are not available because none has ever been built or flown. During testing at WSMR, the TALON interceptor would operate at and above 60,000 feet (18,288 meters). Assuming for analytic purposes that the TALON interceptor's motor would produce the relatively loud sound level of 130 decibels at a distance of 1 meter, sound levels reaching receptors at ground level would be less than 50 decibels. The rarefied atmosphere in which the TALON interceptor would operate would limit sound wave transmission and reduce further the amount of sound reaching receptors on the ground. In similar fashion, the lesser atmospheric pressures at and above 60,000, combined with the interceptor's small cross-section (assumed to be less than 50 square inches (322 square centimeters), would reduce the accumulation of overpressures contributing to sonic boom phenomena.

3.5.4 Airspace Use

The RAPTOR/TALON Program testing of the TALON interceptor would not be expected to cause any significant impacts on airspace use.

TALON interceptor testing would occur only in special use airspace. There would be no use of adjacent airspace. Potential for interference with adjacent airspace would be reduced by providing reduced amounts of fuel to the interceptor, rendering it unable to travel beyond WSMR boundaries.

3.5.5 Public Safety

The RAPTOR/TALON Program testing of the TALON interceptor would not be expected to cause any significant impacts on public safety.

During TALON interceptor testing, there is a possibility that debris from the TALON interceptor or a target missile could land offsite. There is also the possibility that a TALON interceptor could miss its target, continue flight, and land in an unanticipated area. In preparing for any TALON interceptor test, program personnel and range officials would consider debris profiles, the areal extent of the impact area, and the areal extent of the buffer zones needed to conduct the tests. WSMR is the continental United States' largest missile test range. Its size results in maintaining test articles within its confines in nearly all instances. Even so, additional safeguards would be designed for each TALON interceptor test. One such safeguard would be to reduce the amount of fuel of the TALON interceptor to prevent its flight out of the controlled test area. In addition to existing range safety programs and procedures, other safety procedures may be developed as required to maintain risks at their absolute lowest levels and to maintain the public's confidence in WSMR test activities.

The propellants that would be used in TALON interceptor tests are extremely hazardous (Table 3–1). Only small quantities would be required (not more than 10 liters). There are risks associated with handling of liquid propellants. WSMR Safety Division oversight and project personnel familiarity with procedures for safe handling of the fuels would reduce risk of an accidental release. In the event of an accidental release while handling fuel, potential impacts to the natural environment would be limited because of the minor quantities of fuel involved, employment of safety procedures such as the Spill Prevention, Containment, and Countermeasures Plan to control released liquids, and location generally removed from populated areas, wildlife, and vegetation. Potential impacts to personnel would be mitigated through use of engineering controls, work practices, and protective clothing, or conbinations thereof.

3.6 RAPTOR/TALON Integrated Flight Tests

The RAPTOR/TALON Program testing of an integrated platform and interceptor would not be expected to cause any significant impacts on environmental resources or the human environment.

Final phase development and demonstration testing under the proposed action would be the flight testing of the integrated RAPTOR/TALON. This final round of testing would occur at WSMR to demonstrate the operability of both systems as a unit. These tests would evaluate all parts of the systems abilities, from flight to acquisition to interception.

Table 3–1. Properties of TALON Propellants

Characteristic	Hydrazine	Nitrogen Tetroxide
Chemical Formula and Molecular Weight	N_2H_4 32.05	N_2O_4 46.01
Physical State, Color, and Odor	Oily, liquid, colorless with strong ammonia-like odor	Liquid under pressure, reddish-brown, irritating odor
Melting Point (°C)	2	–9.3
Boiling Point (°C)	113.5	21.5
Flammability	Very explosive with flash point of 38 °C	Not flammable, supports combustion with Carbon, Sulphur, and Phosphorus
Inhalation-rate LC_{50} (ppm/4 hrs.)	570	67
Threshold Limit Value for exposure (ppm)	0.1	5
Skin Irritability	Severe irritant causing blistering dermatitis	Irritant causing yellow brown discoloration
Eye Irritability	Conjunctivitis with corneal necrosis	Conjunctivitis with corneal ulceration
Exposure Symptoms	Nausea, dizziness, and headache; severe exposure may cause death	Nausea, dizziness, headache, respiratory complications
Aquatic Toxicity	146 ppm killed rainbow trout in 30 minutes	Data not available

Sources: Hazardous Substances Data Bank. 1992. Online data base. National Library of Medicine, Bethesda, MD.
The Merck Index. 1989. Merck and Co., Incorporated, Rahway, NJ.
Toxic and Hazardous Industrial Chemicals Safety Manual. 1976. The International Technical Information Institute, Tokyo, Japan.

Integrated tests of the RAPTOR and TALON interceptor would require the launch and destruction of a target missile. In the event research and development of a RAPTOR platform and TALON interceptor missile reached a point at which integrated testing were warranted and feasible, RAPTOR/TALON Program officials would need to define the parameters of a target missile with short-range ballistic missile characteristics and request its launch from WSMR. Launch of the target missile would have to meet all applicable WSMR operational and environmental requirements. The extent of environmental documentation required prior to launch of the target missile would be determined based on type of target missile and WSMR requirements.

Potential impacts of integrated tests at WSMR are described below.

3.6.1 Biological Resources

The RAPTOR/TALON Program testing of an integrated platform and interceptor would not be expected to cause any significant impacts on biological resources.

RAPTOR platform operations were described in section 3.4, above. Platform operations would generally occur in the air or on a runway surface, not in open ground or areas where sensitive plants or wildlife occur. As in other testing iterations, there would be a possibility for a bird strike, but this possibility is remote and not significant. Thorough planning of debris profiles and adherence to WSMR procedures would reduce the possibility that debris from an interceptor or target missile would fall in an unacceptable location.

3.6.2 Air Quality

The RAPTOR/TALON Program testing of an integrated platform and interceptor would not be expected to cause any significant impacts on air quality.

Use of a platform such as the SETP would result in no air emissions during integrated RAPTOR/TALON tests. Use of a fixed-wing platform would produce negligible air emissions; that platform's operating altitude would assist in dispersion of emissions. Air emissions impacts produced by the TALON interceptor resulting from its propellant would be minimal in light of the high operating altitudes (between 60,000 and 90,000 feet (18,288 and 27,432 meters)) and wide dispersion by the winds. Air emissions of the target missile would be consistent with those routinely fired at WSMR and would be within acceptable limits (types and quantities of contaminants produced and dispersed); however, the types of targets to be used is presently not determined.

3.6.3 Cultural Resources

The RAPTOR/TALON Program testing of an integrated platform and interceptor would not be expected to cause any significant impacts on cultural resources.

WSMR is steward to a large land tract containing numerous sites considered to be cultural resources. Several prehistoric and historic sites have been identified; there remains much work to be done to investigate and record fully the base's archeological resources. Integrated platform and interceptor testing would involve activities at several locations across WSMR: the launch complex, a platform takeoff and landing site, telemetry sites, radar sites, communications sites, a command and control ground station, and an impact/debris area. Most testing support locations that would be used are already heavily disturbed or builtup places. Portions of WSMR impact areas have been disturbed in the past by facilities, utilities, and road construction, as well as preceding missile and ordnance experimentation and associated fallout and collection of debris. While RAPTOR platform operations would not be expected to affect cultural resources, there is some potential that missile or TALON interceptor debris could land near a site of archeological interest. Especially during post-engagement portions of testing, care to abide by sound resource management practices would control the potential for impacts to cultural resources. As required, consultations would be conducted per Section 106 of the National Historic Preservation Act prior to implementation of recovery procedures. During testing and, especially, during debris collection, personnel would adhere to WSMR practices limiting off-road and cross-country vehicle travel. A helicopter would be used to retrieve large missile debris when terrain or other circumstances prevented use of ground vehicles. Throughout the activities, all personnel would be strictly prohibited from collecting artifacts, relics, or "souvenirs."

3.6.4 Noise

The RAPTOR/TALON Program testing of an integrated platform and interceptor would not be expected to cause any significant impacts on the noise environment.

Discussions of noise created by the fixed-wing aircraft and the TALON interceptor are presented in section 3.4.2.3 and section 3.5.3, respectively. Personnel operating the fixed-wing aircraft in preflight and flight tests would need to wear hearing protection devices when in close proximity to the aircraft; the levels of sound reaching other potential receptors would be at acceptable levels. Sound levels associated with flight of the TALON interceptor would be at high altitude and of no impact to ground receptors. Should a platform such as the SETP be employed, there would be virtually no noise impacts. Noise associated with the launch of the target missile would be brief, rising (fading), and within parameters acceptable to the launch area. All noise produced by the integrated tests would be confined within the boundaries of WSMR.

3.6.5 Airspace Use

The RAPTOR/TALON Program testing of an integrated platform and interceptor would not be expected to cause any significant impacts on airspace use.

Appendix A contains information on airspace controls applicable to WSMR. Integrated tests platform and interceptor would occur within the boundaries of the restricted airspace controlled by WSMR. There would be no use of adjacent airspace. Potential for interference with adjacent airspace would be reduced by providing reduced amounts of fuel to the interceptor, rendering it unable to travel beyond WSMR boundaries. The target missile would be plotted to remain within WSMR boundaries as well.

3.6.6 Public Safety

The RAPTOR/TALON Program testing of an integrated platform and interceptor would not be expected to cause any significant impacts to public safety.

Integrated tests of the RAPTOR platform and TALON interceptor would occur within the confines of the WSMR, within controlled airspace and over land areas devoid of human activity or development. The integrated tests would be the culmination of many preceding iterations in which development of longer and higher flights permitted the greater assurances of aircraft and interceptor capabilities. Integrated tests would occur as distant as reasonably possible from areas that might, in event of a catastrophe, result in significant injury to persons or damage to property. With dimensions of 100 miles by 40 miles (161 kilometers by 64.4 kilometers), WSMR provides ample room to obtain separation between test activity and potentially affected areas.

Tests involving the TALON interceptor would deal with the remote possibility that debris from the interceptor or a target missile could land offsite. There is also the possibility that a TALON interceptor could miss its target, continue flight, and land in an unanticipated area. These possibilities are discussed in detail at section 3.5.5, above. Based on similar reasoning as provided in the section, there would be no potential for significant concern to public safety.

3.7 Environmental Consequences of the No-Action Alternative

The "no-action" alternative denies the BMDO the opportunity to pursue design, development, and demonstration of high altitude platform and miniaturized missile technologies, as contemplated, to counter theater ballistic missiles. Failure to pursue the proposed action would result in continuation of other, ongoing activities at their present levels at the identified locations. The consequences of not conducting the RAPTOR/TALON program would potentially affect future military operations on both strategic and tactical levels. There would be no foreseeable environmental consequences to not conducting the RAPTOR/TALON research and development program.

3.8 Cumulative Effects

The RAPTOR/TALON Program would not be expected to cause any significant cumulative impacts.

The Council on Environmental Quality's regulations define a cumulative impact as "the impact on the environment which results from the incremental impact of the action when added to other past, present, or reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions." 40 CFR Part 1508.7. Design, development, and demonstration of RAPTOR platforms and TALON interceptors are actions that are independent of other, ongoing activities at the locations where they would occur. The numbers of research and development events and their variables for either the RAPTOR platform or the TALON interceptor are unknown. In light of the generally short duration of each event, the small to moderate number of personnel involved in each event, and indication that events would be non-continuous, it is reasonable to assume there will be no residual effects on the environments in which they occur. Flight preparation, operations, and recovery of RAPTOR platforms would occur within areas normally used for aviation activity. The occurrence of RAPTOR Program activities would not create a measurable increase in those activities, nor would it create any situations where an environmental resource reached a critical point or threshold for concern. In the same manner, TALON interceptor activities would not increase any stress level on any environmental resource. The RAPTOR/TALON Program would not be expected to result in any cumulative noise or infrastructure impacts.

3.9 Adverse Environmental Effects Which Cannot be Avoided

The RAPTOR/TALON Program presents no known adverse environmental effects that cannot be avoided.

3.10 Irreversible and Irretrievable Commitments of Resources

The RAPTOR/TALON Program would not be expected to result in any significant irreversible and irretrievable commitments of resources. The proposed action would require the use of fuels, materials, and labor to accomplish its execution, but the levels required are consistent with similar BMDO and defense-related research and development efforts. The proposed action is not anticipated to result in the loss of any wetlands, cultural resources, or habitat for animals or plants, nor will it affect Federal or State- protected lands, prime agricultural lands, coastal zones, aquifers, or rivers designated as, or eligible for inclusion as, wild and scenic rivers.

3.11 Relationship Between Short-Term Uses of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity

The RAPTOR/TALON Program would largely involve the use of existing facilities and resources. Private contractors involved in the program would use existing structures and facilities to support program activities. Activities would occur at or near locations dedicated to similar use. There would be no net loss of any significant environmental resources such as prime agricultural land, wetlands, or historical properties and no loss of significant amounts of natural resources.

The RAPTOR/TALON Program's efforts toward design, development, and demonstration of a more efficient power source for use with the RAPTOR platform may lead to a capability to achieve long-duration flights without the use of internal-combustion engines. Development of fuel cells, for use in conjunction with solar cells, could result in less reliance on fossil fuels. A breakthrough such as this could enhance long-term productivity by reducing costs.

That aspect of the RAPTOR/TALON Program's proposed action which pertains to attaining improvements in the RAPTOR platform power source may also bring about significant advances in pollution prevention. Fossil fuel-burning internal combustion engines are central to many pollution concerns such as air emissions and fuel spills. Efforts today could lead to development of a pollution-free technology that could provide virtually unlimited power for aircraft (and possibly other applications).

3.12 Energy Requirements and Conservation Potential of Various Alternatives and Mitigation Measures

The RAPTOR/TALON Program would incur limited energy requirements. Energy would be required for production and manufacturing facilities, flight tests, and associated Program activities. All energy requirements are within the energy supply capacities of each location where the proposed action would occur. Energy requirements would be subject to the routine energy conservation practices at each site. No new power generation requirements would be needed at any location.

3.13 Natural or Depletable Resources Requirements and Conservation Potential of Various Alternatives and Mitigation Measures

The RAPTOR/TALON Program would not be expected to significantly impact natural or depletable resources. Except for the structural materials used manufacturing the RAPTOR platforms and the TALON interceptors, no significant natural or depletable resource requirements are associated with the program. Development of advanced solar cell and fuel cell technologies under this program may have potentially beneficial impacts to the environment over the longer term by subsequent application of those technologies in areas presently relying on fossil fuels.

4.0 Global Commons

Portions of the proposed action would occur outside the United States. Executive Order 12114, "Environmental Effects Abroad of Major Federal Actions," furthers the purposes of the National Environmental Policy Act by providing a way for responsible officials to be informed of pertinent environmental considerations when making decisions on proposed actions that would occur abroad. This section provides information relevant to complying with Executive Order 12114.

Executive Order 12114 states that oceans and Antarctica are examples of global commons. For the purposes of this environmental assessment, airspace above the oceans is also considered global commons because it represents an environmental resource outside the jurisdiction of any nation.

The proposed action includes the possibility that there would be a nonstop, around-the-world flight of the RAPTOR. Overflight permission would have to be obtained from nations above which the RAPTOR would travel. This section addresses global commons airspace—those regions of the world for which overflight permission would not have to be sought. Four areas of concern warrant analysis for potential environmental impacts: air quality, aviation safety, public safety, and conservation. A general description of the flight and these areas of concern are discussed in the following subsections.

4.1 Description of the Flight

The RAPTOR/TALON Program would conduct technology program research on and development of both a platform and TALON interceptors. The aircraft platforms to be developed in this program would be capable of very long range flight. The program would design, develop, and demonstrate platforms iteratively; that is, the technological advances of each generation of work would be incorporated in subsequent platform designs. Two leading candidates to attempt the circumnavigational flight are a solar electric test platform (SETP) and a fixed-wing, gasoline-engine-driven aircraft. The one selected depends on technological advances and several factors that remain to be explored, such as endurance abilities, fuel or energy requirements, payload capacity for command and control functions, and the like.

A RAPTOR flight involving the SETP would likely have to operate between the 38th northern and southern latitudes to exploit available sunlight. A fixed-wing, gasoline-engine-driven aircraft would not be so constrained and could fly even to the polar regions. Flight altitudes would remain to be determined. An altitude providing the least turbulence and headwinds would be favored for either platform. The flight would likely also necessitate arrangement for monitoring stations along the route or the use of conventional aircraft and personnel to provide updated route selection instructions to onboard controls programs.

The circumnavigational flight would likely originate and terminate at an airfield in southern California, though other locations could be chosen based on technical or safety requirements. The duration of the flight would depend on the flight route chosen, the platform's normal operating altitude and airspeed capabilities, and other factors such as the occasional need to avoid adverse weather conditions. A fixed-wing aircraft would be able to complete its flight in perhaps 7 to 10 days, while the SETP would require four to five times as long because of its slower airspeed.

4.2 Areas of Concern

4.2.1 Air Quality

Air quality in the global commons would not be affected by RAPTOR operations. The solar energy power supply and fuel cell system of the SETP would not create any air emissions and would not contribute to problems associated with any of the six criteria pollutants of lead, carbon monoxide, ozone, particulate matter, nitrogen oxide, or sulfur dioxide. The gasoline-driven engine of the fixed-wing aircraft could produce minor amounts of lead, carbon monoxide, and particulate matter emissions. These emissions would be far less than those produced by commercial or military aircraft, and they would be dispersed rapidly by prevailing winds. Advanced generations of the fixed-wing aircraft's engine would likely be turbocharged, yielding more complete and efficient combustion of fuel, thereby reducing emissions even further as compared to other aircraft. Neither the SETP or fixed-wing RAPTOR generate chlorine-depleting emissions that would threaten the ozone layer.

4.2.2 Aviation Safety

Aviation safety in the global commons would not be adversely affected by RAPTOR operations. The probability of a midair mishap is believed to be remote. Commercial aviation would be informed of the platform's location at all times. The platform would be equipped with high-intensity strobe lights. The onboard command and control package would include a global positioning system unit to report on location and a transponder that could be used by ground stations to track the platform's course. Program personnel would monitor the progress of the flight and provide notices to aviators along the flight route. In the event development of the platform progressed to such a degree that normal operating altitudes of more than 45,000 or 50,000 feet (13,720 or 15,250 meters) could be maintained, any risks posed by having to share commercial air routes would be significantly reduced or eliminated.

4.2.3 Public Safety

Public safety in the global commons would not be adversely affected by RAPTOR operations. A RAPTOR circumnavigational flight would be attempted only after substantial testing of components and subsystems. As a result of several iterations of testing and refinement, flight endurance and flight control reliability would be at mature, rather than initial or experimental, developmental stages. While there would always be some possibility of a mechanical failure that could cause premature termination of the flight, the likelihood of creating risks to persons at the surface below global commons airspace is remote.

Global commons airspace is above the oceans and other large bodies of water. Prior to commencement of flight operations, program personnel would obtain overflight permission to transit other countries' airspace. Implicit in such grants of permission is the possibility that a flight might have to be terminated for unforeseen reasons. Flight termination over land would be favored because ending a flight at sea virtually ensures that the platform would not be recovered, and the evidence or information as to what caused the need for flight termination would be lost.

Premature flight termination of the RAPTOR, wherever it might occur, would involve an attempt to navigate the platform to a controlled landing. The slow airspeed of the SETP permits a relatively gentle landing that can occur in nearly any open area. For the fixed-wing aircraft, a landing strip or other suitable open area would be preferred but is not essential. The lightweight materials of both platforms, the absence of large amounts of flammable fuels, and the slow landing-approach speeds that can be used would reduce the probability of serious injury or damage to persons or property.

4.2.4 Conservation

Important aspects of evaluating the potential impacts of a proposed action relate to the irreversible or irretrievable commitments of resources, the relationship between short-term uses of the environment and maintenance and enhancement of long-term productivity, and the use of natural or depletable resources. In the context of the global commons, the importance of these aspects is heightened by understanding that all nations share an obligation to conserve resources and that no nation is privileged to exploit resources to the detriment of other nations.

Global commons resources would not be adversely affected by RAPTOR operations. Activities occurring in the global commons would last only the number of days required for transit. There would be no consumption of resources associated with operations in the global commons. Operations would not rely on use of global commons assets, nor would they degrade resources. No significant impacts would occur to air quality, water quality, or the marine environment.

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6.0 List of Agencies and Persons Consulted

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ATTN: STEWS-ES-E (Bldg. T-150)
White Sands Missile Range,
New Mexico 88002-5048

Dear Commander:

This responds to your letter received in our office on April 5, 1993 requesting review of the Environmental Assessments for the SDIO Raptor/Talon Program (EA #01392) and the Balloon Program (EA #01492). This office has reviewed these documents for impacts to the San Andres National Wildlife Refuge (NWR) resources, or to the desert bighorn sheep within the San Andres Mountains. Questions and concerns for each program are discussed below.

SDIO Raptor/Talon Program

Figure 2-4 indicates the nominal TALON launch azimuths at WSMR, but I did not find any flight paths specified for the launch platforms (SETP and the fixed-wing gasoline engine driven aircraft). Section 3.5.5 specifies that the propellants that would be used in TALON are extremely hazardous. Will the launch platforms be restricted to flight over controlled test areas while carrying TALON interceptors? The target missiles will be destroyed over test areas that are cleared for missile target practice. If the San Andres Mountains are avoided by both the launch platforms and TALON missiles, we conclude that there will be no significant environmental impact on the San Andres NWR or the desert bighorn sheep from this proposed program.

SDIO Balloon Program

Section 3.4.2.1 mentions that the descent and impact point of the balloon could be controlled to some extent, and that every effort would be made to avoid descent into areas occupied by desert bighorn sheep. This statement seems realistic in acknowledging that unforeseen circumstances or conditions may affect movement of the balloon, especially wind and weather changes. The desert bighorn sheep are considered to be very susceptible to disturbance considering the other stress factors affecting them at this time as mentioned in section 2.1.1. We would like to see more specific plans that further minimize the chances of low overflight or payload dropping in areas inhabited by desert bighorn sheep. What restrictions will be placed on monitoring aircraft while tracking a balloon near the San Andres Mountains? We would like for these aircraft to avoid low overflight of areas occupied by desert bighorn sheep.

Section 3.4.2.4 states "In the event that the transfer duct from the tow balloon failed to inflate the main balloon, there is potential for the tow balloon's drifting out of cleared airspace or WSMR's restricted airspace." It later mentions that a similar hazard may occur if it were to develop a slow leak preventing its reaching the desired altitude. It concludes that such a disabled balloon could float at an altitude that could present a potential hazard to military, commercial, or general aviation aircraft. Could the balloon similarly float into the San Andres Mountains where it might impact resources and could present removal problems? Would the early flight termination devices preclude this from occurring?

Section 1.2.4.3 specifies that land-based recovery would be done with a winch truck or a heavy lift helicopter. We anticipate resource impacts from either of these methods and would like some assurances that no payloads would drop within the San Andres NWR or in areas occupied by desert bighorn sheep.

Section 3.4.1.3.1 mentions that laser risks to wildlife will be minimized or eliminated. This section further states that laser beams would be pointed toward outer space and not below the horizon. Thus we do not anticipate any impacts from laser.

Section 3.4.2.1 in the final sentence specifies that any wildlife that may have been injured by the balloon system could be identified and treated at the time of balloon system recovery. If the payload were to land in the steep, rugged terrain of the San Andres Mountains, it is likely that it would roll or bounce and impact additional vegetation and possibly wildlife. We feel that it is not likely that injured wildlife would be identified and treated at the time of recovery if recovery were made in the San Andres Mountains. To whatever extent possible, we would like to see this program avoid these mountains.

We appreciate the opportunity to review and comment on these proposed programs. If you have any questions, please contact me at (505) 382-5047.

Sincerely,

Stephen Berendzen

Stephen Berendzen,
Refuge Manager

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Ecological Services
Suite D, 3530 Pan American Highway, NE
Albuquerque, New Mexico 87107

April 22, 1993

Cons. #2-22-93-I-263
2-22-93-I-264

Commander
U.S. Army, White Sands Missile Range
ATTN: STEWS-ES-E (Bldg. T-150)
White Sands Missile Range,
New Mexico 88002-5048

Dear Commander:

This responds to your letter received by our office on March 31, 1993, requesting review of the Environmental Assessments for the SDIO Raptor/Talon Program (EA # 01392) and the Balloon Program (EA # 01492). The U.S. Fish and Wildlife Service (Service) has reviewed these documents for impacts to resources of concern including those species federally listed under the Endangered Species Act. Our concerns for each program are discussed below.

SDIO Raptor/Talon Program

Activities associated with the Raptor/Talon Program that will occur on White Sands Missile Range (WSMR) include the Talon Interceptor testing, Raptor flight testing, and testing of the integrated Raptor/Talon system. This final test will include launch and destruction of target missiles.

Correspondence with Mr. Joaquin Rosales of your office has indicated only existing facilities will be utilized for the testing procedures. We also understand that missile launches used in Raptor/Talon test are those already planned and covered under environmental documentation for other WSMR activities. The proposed activities involve the testing of the two alternative launch platforms (the SETP and a fixed-wing gasoline-engine-driven aircraft), and target missiles which will be destroyed only over areas already environmentally cleared or used for missile target practice. We recommend flight tests avoid sensitive areas such as the San Andres National Wildlife Refuge and the Oscura Mountains. So long as such areas are avoided the Service does not believe any significant environmental impacts will occur as a result of the program, including no affect on endangered or threatened species.

Balloon Program

Activities associated with the Balloon Program that will occur at WSMR include the launch of the Kestrel balloon from the portable HABE land-based launch facility and using equipment located on the balloon to track missiles using illuminating lasers. Lasers would be used only when target missiles were at a height equal to or greater than the balloon's altitude, thus avoiding impacts to the eyes or skin of wildlife that could intercept the beam. As with the Raptor/Talon Program, missiles utilized in this exercise will be launched as a result of other exercises already covered by environmental documentation.

Other potential impacts identified by the EA would be as a result of wildlife being struck by the balloon system as it hits the ground after completion of its mission. In addition, some disturbance of habitat by recovery vehicles may occur. The descent of the balloon can be controlled to some extent, thus the Service believes sensitive areas can be avoided. Since the EA states that recovery teams will utilize existing roads to the maximum extent to minimize disturbance of wildlife habitat in recovery efforts, the Service believes the majority of impacts to the environment will be avoided and no effect on endangered or threatened species will occur.

We appreciate the opportunity to comment on potential impacts of the proposed programs. If you have any questions regarding the above, please contact Ms. Karen Cathey at (505) 883-7877.

Sincerely,

Jennifer Fowler-Propst
Field Supervisor

cc:
Director, New Mexico Department of Game and Fish, Santa Fe, New Mexico
Director, New Mexico Energy, Minerals and Natural Resources Department, Forestry and Resources Conservation Division, Santa Fe, New Mexico
Steve Berendzen, San Andres National Wildlife Refuge, Las Cruces, New Mexico

State of New Mexico
ENERGY, MINERALS and NATURAL RESOURCES DEPARTMENT
Santa Fe, New Mexico 87505

New Mexico DRUG FREE It's a State of Mind!

BRUCE KING
GOVERNOR

ANITA LOCKWOOD
CABINET SECRETARY

13 May 1993

Commander
U.S. Army, White Sands Missile Range
ATTN: STEWS-ES-E (Bldg. T-150)
White Sands Missile Range, NM 88002-5048

Dear Mr. Ladd:

Thank you for the opportunity to comment on the EA for the SDIO RAPTOR/TALON project proposal at the White Sands Missile Range. Since this project will not involve any new disturbance of native plant communities, we concur that there will be no impact to any rare or endangered plant species.

Sincerely,

Raymond R. Gallegos
State Forester

By: Robert Sivinski

Robert Sivinski

VILLAGRA BUILDING - 408 Galisteo
Forestry and Resources Conservation Division
P.O. Box 1948 87504-1948
827-5830

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GOVERNOR
Bruce King

DIRECTOR AND SECRETARY
TO THE COMMISSION
Bill Montoya

STATE OF NEW MEXICO
DEPARTMENT OF GAME & FISH

Villagra Building
P.O. Box 25112
Santa Fe, N.M. 87504

May 4, 1993

Commander, U. S. Army
White Sands Missile Range
ATTN: STEWS-ES-E (Bldg. T-150)
White Sands Missile Range, New Mexico 88002-5048

Dear Mr. Ladd:

Thank you for your request for information and comments from the Department of Game and Fish (Department) regarding the Environmental Assessment for the SDIO Raptor/Talon, #01392, and Balloon Program, #01492. The Department is very interested in this project considering the potential implications to wildlife and its habitat. However, due to staff reductions, we are unable to effectively respond to your request. We hope this situation is temporary and that you continue to coordinate project planning with the Department.

Sincerely,

Bill Montoya
Director

BM/JTK/mlm

cc: Dick McCleskey (Assistant Director, NMGF)
Andrew Sandoval (HEP Division Chief, NMGF)
Robert Jenks (HEP Assistant Division Chief, NMGF)

United States Department of the Interior

NATIONAL PARK SERVICE
White Sands National Monument
P.O. Box 1086
Holloman AFB, New Mexico 88330-1086

TAKE PRIDE IN AMERICA

IN REPLY REFER TO:

L7619

May 12, 1993

Commander, US Army
White Sands Missile Range
ATTN: STEWS-ES-S, Bldg. T-150
White Sands Missile Range, New Mexico 88002-5048

Dear Sir:

Enclosed are comments from White Sands National Monument regarding the two SDIO projects which are seeking environmental review. The RAPTOR/TALON and BALLOON projects are addressed separately but many of the comments reflect common concerns.

We appreciate the opportunity to review these projects and any others which may affect Monument operations or resources.

Dennis L. Ditmanson
Superintendent

7.0 List of Preparers

Ballistic Missile Defense Organization:

Crate Spears—SDIO Environmental Coordinator
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Appendix A. Ranges and Airspace

A.1 General

Federal Aviation Administration (FAA) regulations designate airspace assignments and prescribe the requirements for use of restricted and prohibited areas. FAA regulations specify general operating and flight rules for aircraft within the United States and territorial waters.

Restricted areas are established because of the existence of unusual hazards to aircraft. The hazards can include air-to-surface bombardment, aerial gunnery, artillery firing, or activities associated with weapons or test ranges. When activities are not taking place in restricted areas and when control of the airspace has been returned to an Air Traffic Control (ATC) facility, flights through the area may be authorized by ATC upon request.

Controlled airspace is airspace of defined dimensions within which air traffic control service is provided to controlled flights. U.S.-controlled airspace consists of the following:

- Airport Traffic Areas, a cylindrical space of a 5-mile (8.04-km) radius around an airport extending to 3,000 ft (914 m) above ground level (AGL).
- Control Zones of varying distances from an airport extending up to 14,500 ft (4,420 m) above mean sea level (MSL).
- Transition Areas extending from 700 ft (213 m) AGL to 1,200 ft (366 m) AGL near airports.
- Federal Airways extending from 1,200 ft AGL to 18,000 ft (5,486 m) MSL.
- Jet Routes extending from 18,000 ft MSL to 45,000 ft (13,716 m) MSL.
- The Positive Control Area extending from 18,000 ft MSL to 60,000 ft (18,288 m) MSL.
- The Continental Control Area extends from 14,500 ft MSL to no specified upper limit. The Continental Control Area includes the airspace of the contiguous states and Alaska excluding the peninsula west of 160 deg West. (DMA, 1992a)

Activities of RAPTOR/TALON at various Air Force bases and operational ranges will affect operations at those bases and ranges. Planned activity will need to be scheduled at the ranges through the Universal Documentation System used by the ranges or specific requests for activities at an Air Force base. Actions described here assume nominal flight profiles as discussed in the Description of Proposed Action and Alternatives.

A.2 RAPTOR Flight Test Activity

A.2.1 The Former George Air Force Base, California

The former George Air Force Base (GAFB) is located in the High Desert area of southern California near Victorville. Field elevation is 2,875 ft (876 m). Restricted airspace R–2509 in Superior Valley is controlled by Naval Air Weapons Center, China Lake. This area is enclosed by other restricted areas controlled by Edwards Air Force Base, China Lake Naval Air Station, and Fort Irwin. There is extensive glider and ultralight aircraft activity in the vicinity of GAFB on weekends. Bird activity is a concern during October through March each year (DMA, 1992a). GAFB ceased operations on December 15, 1992, and the base entered a "caretaker" status. Testing of the RAPTOR Wing at the former GAFB would require advanced coordination with the transferee. Local air traffic control and weather support services available during test events may be limited.

Figure A–1 shows the runway configuration for GAFB. Table A–1 provides additional information on GAFB.

A.2.2 Edwards Air Force Base, California

Edwards Air Force Base (EAFB) is also located in the High Desert area, approximately 60 mi (96 km) northeast of Los Angeles. The nearest city is Lancaster. Field elevation of EAFB is 2,302 ft (702 m). EAFB is home of the Air Force Flight Test Center (AFFTC), and the mission of Edwards is flight testing of new and modified military aircraft. In addition to the main runway at Edwards, the Rogers Lakebed has large runway complexes that are available for flight test use during most of the year. The AFFTC controls R–2515 (Muroc Lake) to its northeast. Other nearby restricted airspace is scheduled by the Central Coordination Facility located at Edwards.

Any aircraft with a requirement to operate out of Edwards on any type of support mission, regardless of agency or project being supported, must contact the AFFTC/XR for approval and assignment of a sponsor or project officer (DMA, 1992a).

Figure A–2 shows the runway configuration for EAFB. Table A–1 provides additional information on Edwards.

A.2.3 Holloman Air Force Base/White Sands Space Center, New Mexico

Holloman Air Force Base (HAFB) and White Sands Space Center (WSSC), New Mexico, are within the restricted airspace of White Sands Missile Range (WSMR). Holloman is located near the city of Alamagordo, New Mexico, and has a field elevation of 4,093 ft (1,248 m). Holloman's primary mission is fighter training; a secondary mission of

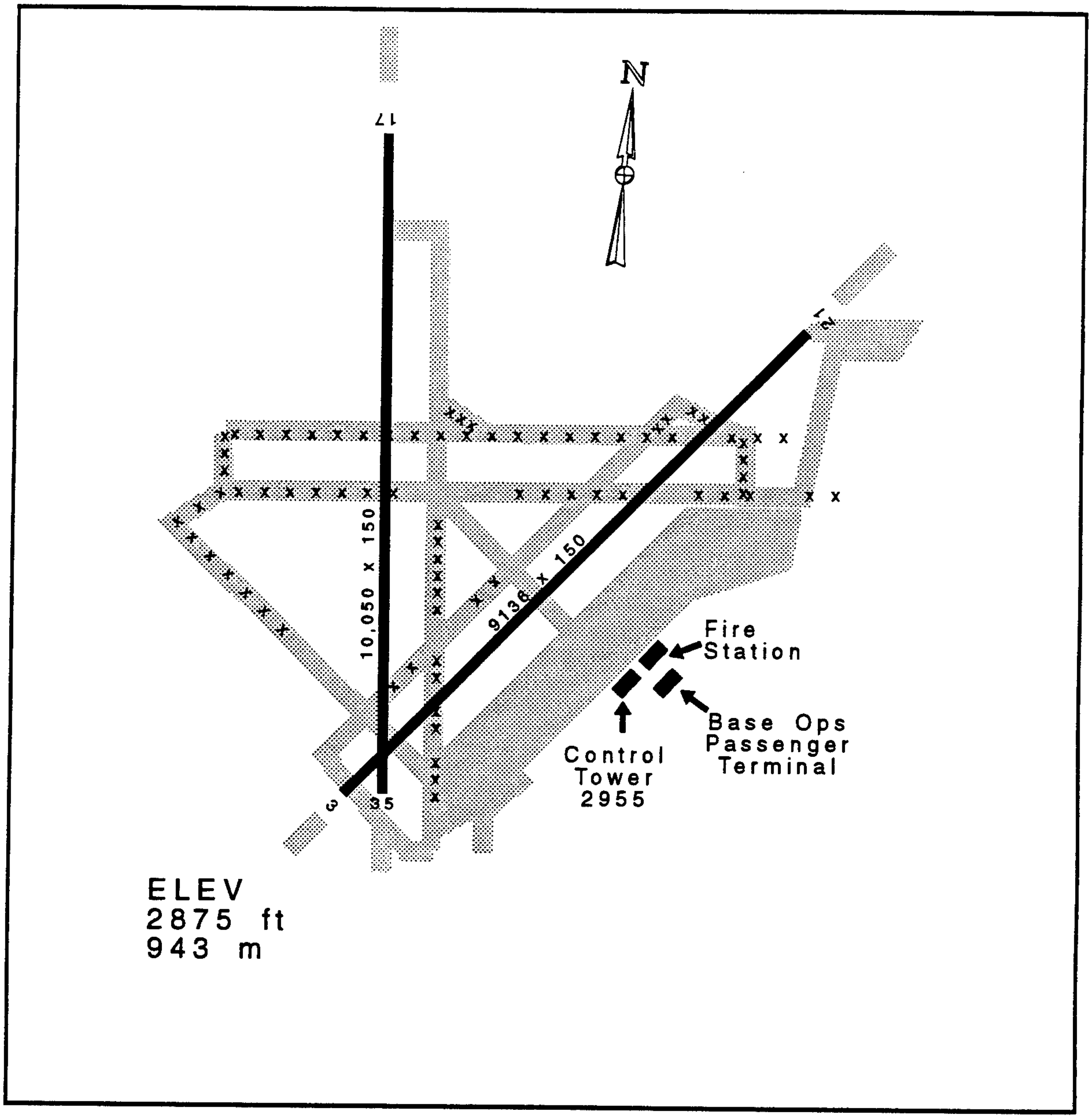

Figure A–1. Runway Configuration for George Air Force Base, California

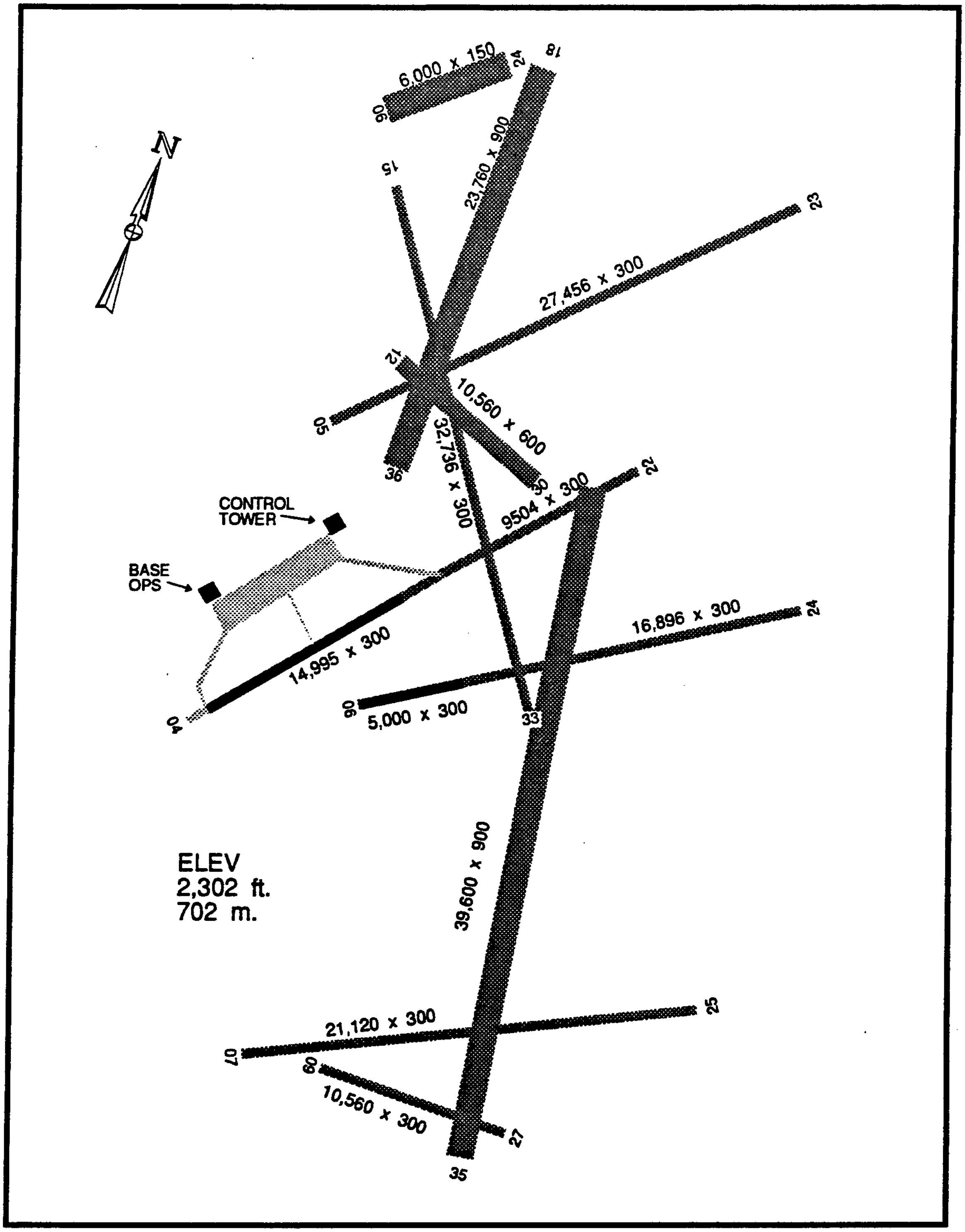

Figure A–2. Runway Configuration for Edwards Air Force Base, California

Table A–1. Airfield Information—RAPTOR Test Activity

Airfield Parameters	Edwards AFB	Holloman AFB	George AFB
Runway Length/Width	R/W 04–22 14,995 x 300 R/W 17–35 (Rogers) 39,600 x 900 R/W 18–36 (Rogers) 23,760 x 900 plus others	R/W 16–34 12,131 x 150 R/W 07–25 8,054 x 150 R/W 04–22 10,575 x 300	R/W 03–21 9,136 x 150 R/W 17–35 10,050 x 150
Minimums	200 – 3/4	300 – 1	
ARTCC	LAX	ABQ	LAX
Volume of Air Traffic	Moderate	High	Low to Moderate
Type of Air Traffic	Test aircraft, multiple	Fighter	Fighter
Weather Station	Yes 1400–0200Z	Yes	Yes
Airfield Hours	1400–0600Z	1300–0530Z	1530–0030Z
Remarks			Closed 15 Dec 92

Holloman is to support research, development, and testing activities. The WSSC is an alternate landing site for the space shuttle. RAPTOR aircraft could be tested at Holloman and within the restricted airspace of WSMR.

Flight activity is extensive within a 150 nm (278 km) radius of HAFB with the fighter training mission. In addition, atmospheric balloon launches and unmarked balloon operations occur on and in the vicinity of the airfield (DMA, 1992a).

Figure A–3 shows the runway configuration for HAFB/WSSC. Table A–1 provides additional information on Holloman.

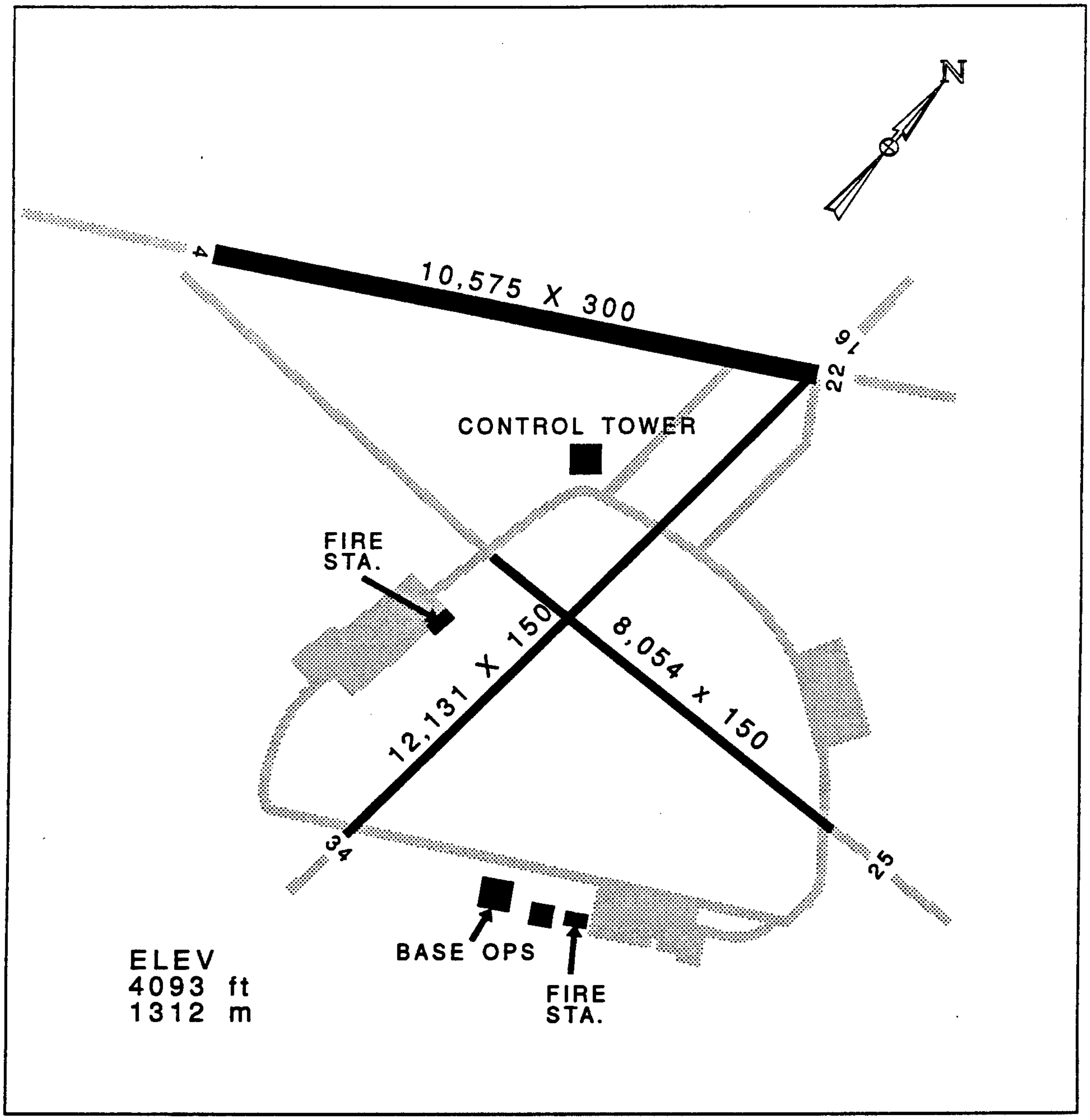

Figure A–3. Runway Configuration for Holloman Air Force Base/White Sands Space Center, New Mexico

A.3 Additional Test Facilities

A.3.1 Mojave Airport, California

Mojave Airport is within the restricted airspace of the Naval Air Warfare Center at China Lake, California. Mojave, at an elevation of 2,787 ft (849 m), has three runways and a relatively light air traffic load, though it sometimes is host to a number of military aircraft. Mojave is a visual flight rules airport only with restricted operating hours and no onfield meteorological support. It is close to the Wing refurbishing contractor and is home of the RAPTOR UAV contractor.

Figure A–4 is a sketch of the runway configuration for Mojave Airport. Table A–2 provides additional information on Mojave Airport.

A.3.2 Palmdale Production Flight/Test Installation, California

Palmdale is a support airport for Air Force Production Plant 42. It has two long runways and relatively little air traffic. Palmdale's field elevation is 2,542 ft (775 m). Table A–2 provides additional information on Palmdale. Figure A–5 shows the runway configuration for Palmdale Installation.

A.3.3 Vandenberg Air Force Base, California

Vandenberg Air Force Base (VAFB) has one long runway with little air traffic. No aircraft are assigned to Vandenberg and little airfield support is available. Meteorological facilities are located on Vandenberg, but not at the airfield. Field elevation is 367 ft (112 m). Table A–2 provides additional information on VAFB. Figure A–6 shows the runway configuration for VAFB.

A.3.4 Norton Air Force Base, California

Norton Air Force Base (NAFB), near San Bernardino, California, offers a single long runway for possible RAPTOR testing. While near to the contractor locations, Norton has a relatively high volume of air traffic. It is also scheduled to close in 1994. Figure A–7 shows the runway configuration for NAFB.

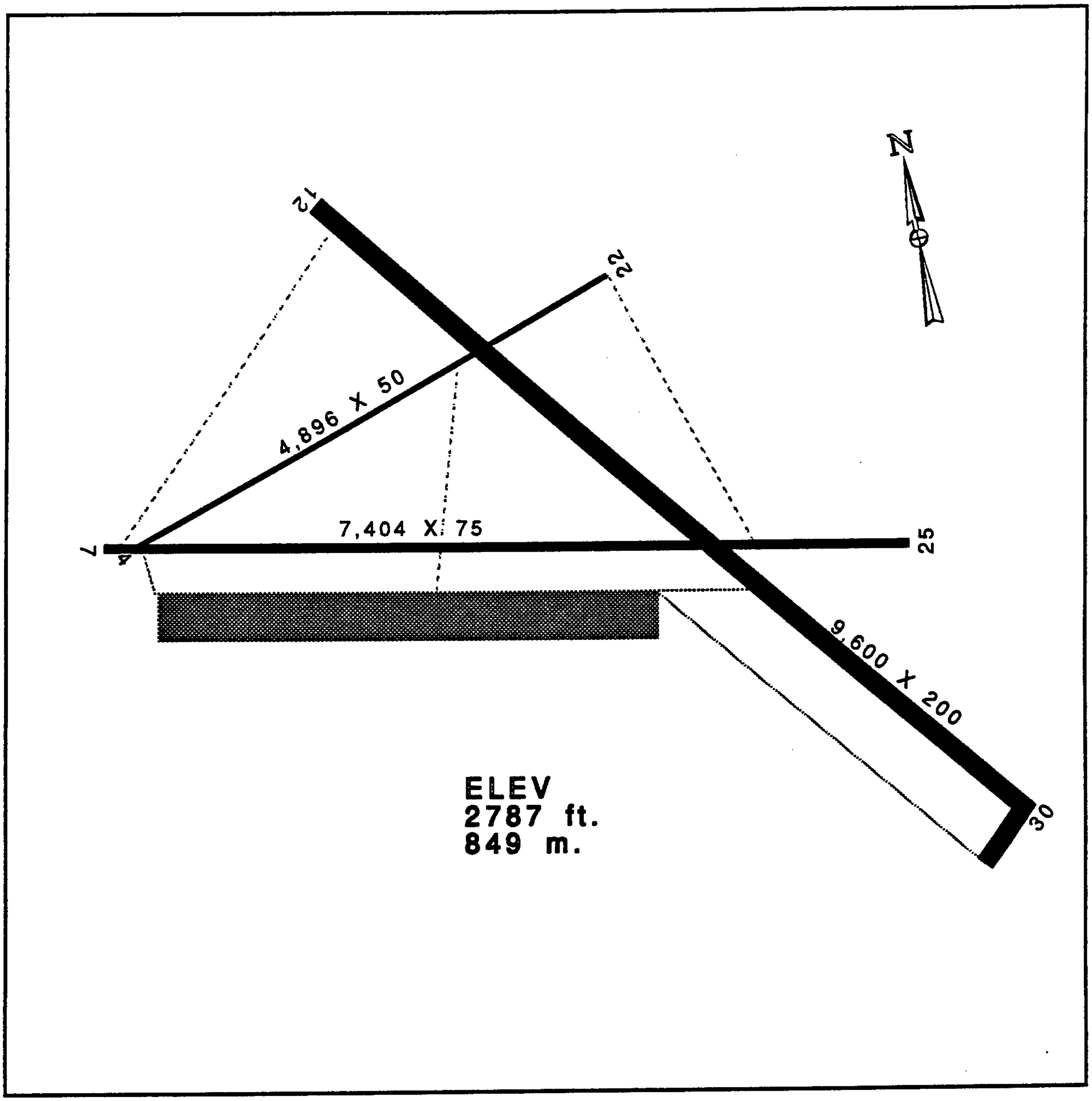

Figure A–4. Runway Configuration for Mojave Airport, California

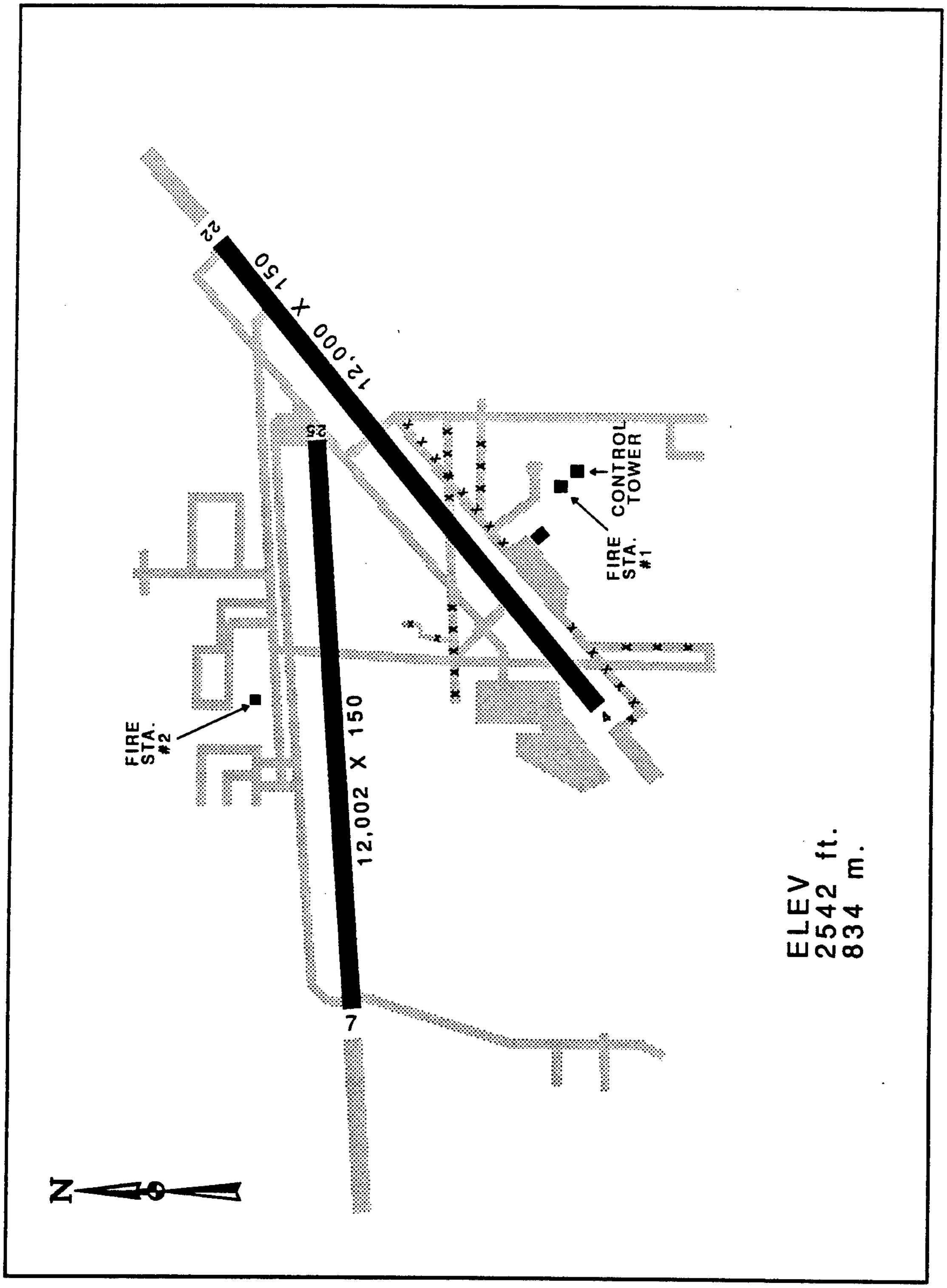

Figure A-5. Runway Configuration for Palmdale Installation, California

Table A–2. Airfield Information—Additional Test Facilities

Airfield Parameters	Airfields: Norton AFB	Mojave	Palmdale	Vandenberg AFB
Runway Length/Width	R/W 06-24 10,000 x 200	R/W 12-30 9,600 x 200 R/W 04-22 4,896 x 50 R/W 07-25 7,040 x 75	R/W 07-25 12,000 x 150 R/W 04-22 12,000 x 150	R/W 12-30 15,000 x 200
Minimums	500 - 3/4	VFR	400 - 1	100 - 1/2
ARTCC	LAX	LAX	LAX	LAX/Frontier
Volume of Air Traffic	Heavy	Light	Light	Minimal, no base aircraft assigned
Type of Air Traffic	Transport	Multi	Multi	Multi
Weather Station	Yes	Call Edwards Weather	Call Edwards Weather	Yes. Limited hours
Airfield Hours		1515-0200Z	1400-0800Z	1600-0100Z
Remarks	Civilian light airplane activity in vicinity to 2,000 ft (610 m)	No base operations, limited facilities	No base operations, limited facilities	Runway repair planned/on-going Frontier Control will control air traffic in VBG restricted areas

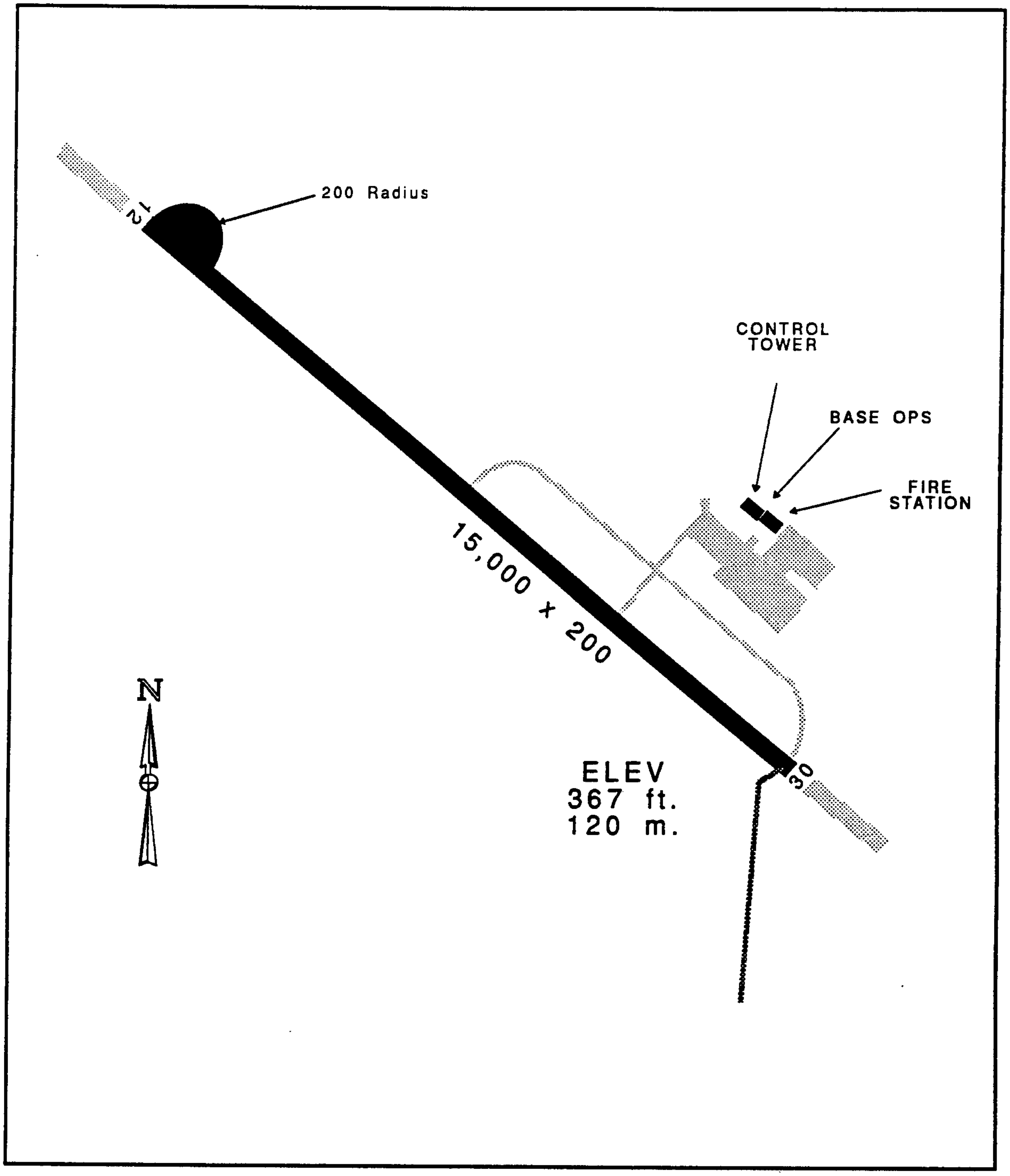

Figure A–6. Runway Configuration for Vandenberg AFB, California

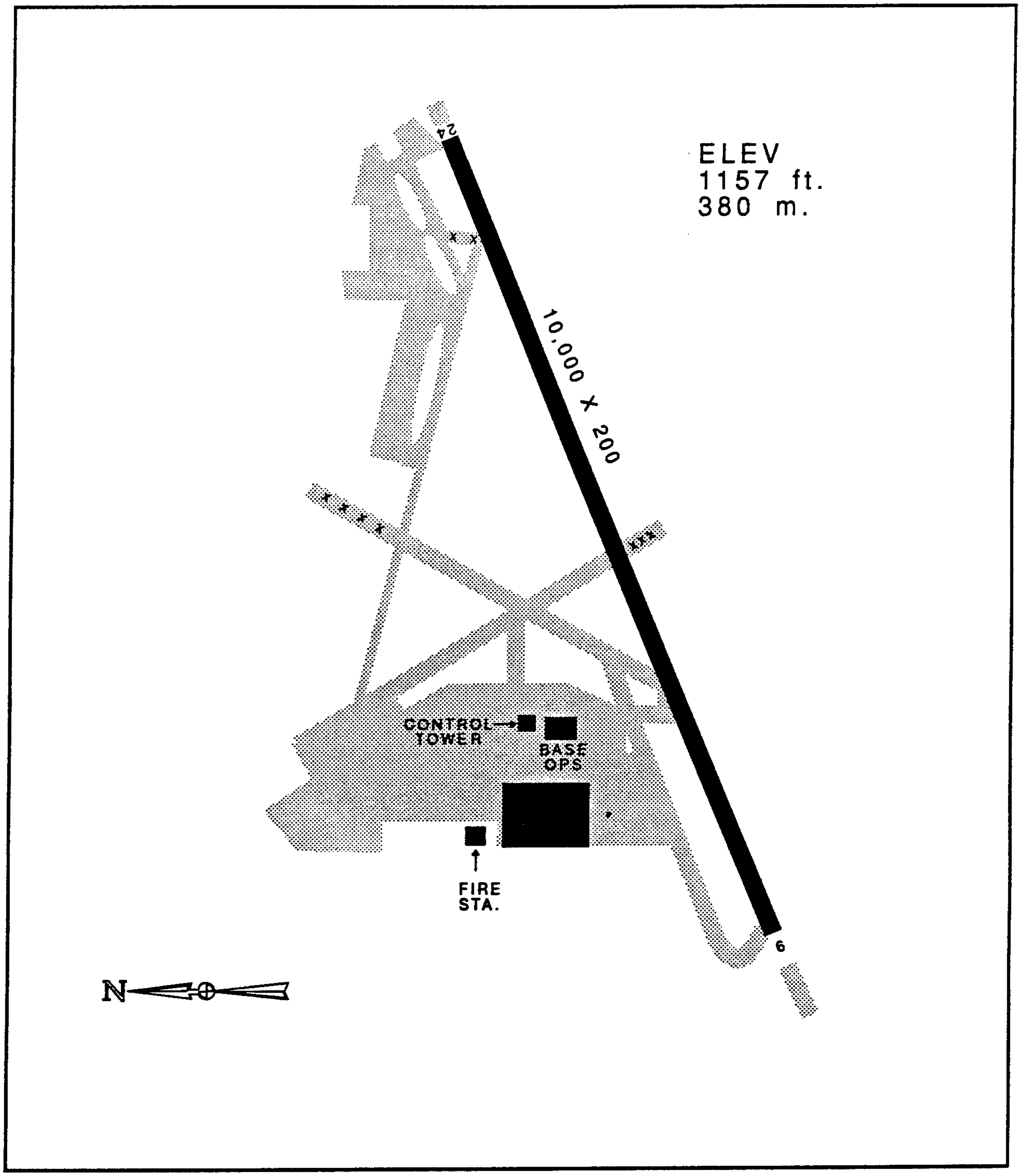

Figure A–7. Runway Configuration for Norton Air Force Base, California

A.4 TALON & RAPTOR/TALON Flight Testing

Flight testing of TALON is currently planned for White Sands Missile Range (WSMR), New Mexico. Testing could be either from ground platforms or, more likely, would involve launch from a conventional high performance aircraft over the range. Restricted areas of WSMR include airspace where this type of testing could occur.

Flight testing of the TALON mated to RAPTOR would also occur at WSMR. No additional restricted airspace would be needed to accommodate this testing.

References

DMA, 1992a. *Area Planning (AP/1)—North and South America.* Defense Mapping Agency Aerospace Center, St. Louis, MO. 25 June 1992.

DMA, 1992b. *Area Planning, Special Use Airspace (AP/1A)—North and South America.* Defense Mapping Agency Aerospace Center, St. Louis, MO. 25 June 1992.

Acronyms

ABQ	Albuquerque, NM
AFB	Air Force Base
AFFTC	Air Force Flight Test Center
AGL	Above Ground Level
ARTCC	Air Route Traffic Control Center
ATC	Air Traffic Control
CA	California
DMA	Defense Mapping Agency
FAA	Federal Aviation Administration
LAX	Los Angeles International Airport
MSL	(above) Mean Sea Level
NAS	Naval Air Station
NM	New Mexico
RAPTOR	Responsive Aircraft Program for Theater Operations
TALON	Theater Applications—Launch on Notice
UAV	Unmanned Aerial Vehicle
VBG	Vandenberg AFB
VFR	Visual Flight Rules
WSMC	Western Space and Missile Center, Vandenberg AFB, CA
WSSC	White Sands Space Center
WSMR	White Sands Missile Range, NM
Z	Universal Coordinated Time

deg	degree
ft	foot (feet)
km	kilometer
m	meter
nm	nautical mile
smi	statute mile

Appendix B. Wildlife and Plant Species

Table B–1. Federally Protected Species Known To Potentially Occur at WSMR

Species	Federal Status
Animals	
Bald eagle *Haliaeetus leucocephalus*	E
Mexican gray wolf *Canis lupus baileyi*	E
Arctic peregrine falcon *Falco peregrinus tundrius*	T
Piping plover *Charadrius melodus circumcinctus*	T
Mexican spotted owl *Strix occidentalis lucida*	T
Northern Aplomado falcon *Falco femoralis septentrionalis*	E
Interior least tern *Sterna antillarum athalassos*	E
Whooping crane *Grus americana*	E
American peregrine falcon *Falco peregrinus anatum*	E
Plants	
Sneed's pincushion cactus *Coryphantha sneedii* var. *sneedii*	E
Kuenzler's hedgehog cactus *Echinocereus fendleri* var. *kuenzleri*	E
Sacramento prickle-poppy *Argemone pleiacantha* ssp. pinnatisecta	E
Sacramento mountain thistle *Cirsium vinaceum*	T
Lloyd's hedgehog cactus *Echinocereus lloydii*	E

Table B–1. Federally Protected Species Known To Potentially Occur at WSMR (continued)

Species	Federal Status
Todsen's pennyroyal *Hedeoma todsenii*	E

E = Endangered. Any species that is in danger of extinction throughout all or a significant portion of its range.
T = Threatened. Any species that is likely to become an endangered species within the forseeable future throughout all or a significant portion of its range.
P = Proposed. Any species proposed for listing as threatened or endangered.

Table B–2. Federal Candidate Species Known To Potentially Occur at WSMR

Species
Category 1
Animals
Southwestern willow flycatcher (*Empidonax traillii extimus*)
New Mexico meadow jumping mouse (*Zapus hudsonius luteus*)
Category 2
Animals
Ferruginous hawk (*Buteo regalis*)
Western snowy plover (*Charadrius alexandrinus nivosus*)
White-faced ibis (*Plegatus chihi*), Great Basin population
Mountain plover (*Charadrius montanus*)
White Sands pupfish (*Cyprinodon tularosa*)
Texas horned lizard (*Phrynosoma cornutum*)
Northern goshawk (*Accipiter gentilis*)
Baird's sparrow (*Ammodramus bairdii*)
Spotted bat (*Euderma maculatum*)
Little brown bat (*Myotis lucifugus*)
Southwestern cave bat (*Myotis velifer brevis*)
Organ Mountain Colorado chipmunk (*Eutamias quadrivittatus australis*)
Arizona black-tailed prairie dog (*Cynomys ludovicianus arizonensis*)
Hot Springs cotton rat (*Sigmodon fulviventer goldmani*)
White Sands woodrat (*Neotoma micropus leucophaea*)
Greater western mastiff bat (*Europs perotis californicus*)

Table B–2. Federal Candidate Species Known To Potentially Occur at WSMR (continued)

Animals (continued)

Loggerhead shrike (*Lanius ludovicianus*)

Plants

Night-blooming cereus (*Cereus greggii*)

Grama grass cactus (*Pediocactus papyracanthus*)

Nodding cliff daisy (*Perityle cernua*)

Alamo beard tongue (*Penstemon alamosensis*)

Smooth figwort (*Scrophularia laevis*)

Mescalero milkwort (*Polygala rimulicola* var. *mescalerorus*)

Duncan's pincushion cactus (*Coryphaptha duncanii*)

Sand prickly pear (*Opuntia arenaria*)

Organ Mountain evening primrose (*Oenothera organensis*)

Category 1 = A candidate species for federal listing as threatened or endangered for which substantial information currently exists to support a listing proposal; proposed status is anticipated but backlogged.
Category 2 = A candidate species for federal listing as threatened or endangered for which listing may be appropriate pending the accumulation of conclusive data regarding biological vulnerability or threat.

Table B–3. Species Considered Endangered by the State of New Mexico

Species
Animals
Spotted bat (*Euderma maculatum*), Group 2
Common black-hawk (*Buteogallus anthracinus*), Group 2
Varied bunting (*Passerina versicolor*), Group 2
Organ Mountain Colorado chipmunk (*Eutamias quadrivittatus australis*), Group 2
Neotropic cormorant (*Phalacrocorax brasiliensis*), Group 2
Whooping crane (*Grus americana*), Group 2
Bald eagle (*Haliaeetus leucocephalus*), Group 2
American peregrine falcon (*Falco peregrinus anatum*), Group 1
Arctic peregrine falcon (*Falco peregrinus tundrius*), Group 1
Northern Aplomado falcon (*Falco femoralis septentrionalis*), Group 1
Southwestern willow flycatcher (*Empidonax traillii extimus*), Group 2
New Mexico meadow jumping mouse (*Zapus hudsonius luteus*), Group 2
Piping plover (*Charadrius melodus circumcinctus*), Group 1
White Sands pupfish (*Cyprinodon tularosa*), Group 2
Desert bighorn sheep (*Ovis canadensis mexicana*), Group 1
Baird's sparrow (*Ammodramus bairdii*), Group 2
Arizona grasshopper sparrow (*Ammodramus savannarum amnollegus*), Group 2
Interior least tern (*Sterna antillarum athalassos*), Group 1
Bell's vireo (*Vireo bellii*), Group 2
Mexican gray wolf (*Canis lupus baileyi*), Group 2
Gray vireo (*Vireo vicinior*), Group 2
Plants
Button cactus (*Epithelantha micromeris* var. *micromeris*), Group 1
Grama grass cactus (*Toumeya papyracantha*), Group 1
Pineapple cactus (*Neolloydia intertexta* var. *dasyacantha*), Group 1
Night-blooming cereus (*Cereus greggii*), Group 1
Nodding cliff daisy (*Perityle cernua*)
Organ Mountain evening primrose (*Oenothera organensis*), Group 1

Table B–3. Species Considered Endangered by the State of New Mexico (continued)

Plants (continued)

Prairie gentian (*Eustoma exaltatum*), Group 1

Kuenzler's hedgehog cactus (*Echinocereus fendleri* var. *kuenzleri*)

Lloyd's hedgehog cactus (*Echinocereus lloydii*)

Mescalero milkwort (*Polygala rimulicola* var. *mescalerorum*), Group 1

Todsen's pennyroyal (*Hedeoma Todsenii*), Group 1

Duncan's pincushion cactus (*Coryphantha duncanii*)

Orcutt's pincushion cactus (*Coryphantha orcuttii*)

Organ Mountain pincushion cactus (*Coryphantha organensis*), Group 1

Sandberg's pincushion cactus (*Escobaria sandbergii*), Group 1

Scheer's pincushion cactus (*Coryphantha scheeri* var. *valida*), Group 1

Sneed's pincushion cactus (*Coryphantha sneedii* var. *sneedii*)

Wright's pincushion cactus (*Mamnillaria wrightii* var. *wrightii*), Group 1

Sacramento prickle-poppy (*Argemone pleiacantha* ssp. *pinnatisecta*)

Sand prickly pear (*Opuntia arenaria*)

Alamo beard tongue (*Penstemon alamosensis*), Group 1

Sacramento Mountain thistle (*Cirsium vinaceum*)

Group 1 = Endangered animal species whose prospects of survival or recruitment within the state are in jeopardy; plant species which are in danger of becoming extinct or are in danger of extirpation from the State of New Mexico within the forseeable future.
Group 2 = Endangered animal species whose prospects of survival or recruitment within the state are likely to become jeopardized in the foreseeable future.

Table B–4. Species Considered Sensitive by the State of New Mexico

Species
Animals
Greater western mastiff bat (*Europs perotis californicus*)
Little brown bat (*Myotis lucifugus*)
Southwestern cave bat (*Myotis velifer brevis*)
Hot Springs cotton rat (*Sigmodon fulviventer goldmani*)
Northern goshawk (*Accipiter gentilis*)
Ferruginous hawk (*Buteo regalis*)
White-faced ibis (*Plegadis chihi*)
Land snail (*Ashmunella harrisi*)
Land snail (*Ashmunella kochi caballoensis*)
Land snail (*Ashmunella kochi kochi*)
Land snail (*Ashmunella kochi sanandresensis*)
Land snail (*Ashmunella salinasensis*)
Land snail (*Orehelix socorroensis*)
Texas horned lizard (*Phrynasoma cornutum*)
Mountain plover (*Charadrius montanus*)
Western snowy plover (*Charadrius alexandrinus nivosus*)
Arizona black-tailed prairie dog (*Cynomys ludovicianus arizonensis*)
Loggerhead shrike (*Lanius ludovicianus*)
Mexican spotted owl (*Strix occidentalis lucida*)
White Sands wood rat (*Neotoma micropus leucophaeus*)
Plants
Mosquito plant (*Agastache cana*)
Supreme sage (*Salvia summa*)
Dune unicorn plant (*Proboscidea sabulosa*)
Standley's whitlowgrass (*Draba standleyi*)
Guadalupe Mountain mescal bean (*Sophora gypsophila* var. *quadalupensis*)
Vasey's bitterweed (*Hymenoxys vaseyi*)
Cliff brittlebush (*Apacheria chiricahuensis*)

Table B-4. Species Considered Sensitive by the State of New Mexico (continued)

Plants (continued)

- Plank's catchfly (*Silene plankii*)
- Payson's cryptanth (*Cryptantha paysonii*)
- Smooth cucumber (*Sicyos glaber*)
- Smooth figwort (*Scrophularia laevis*)
- Long-stemmed flame flower (*Talinum longipes*)
- Castetter's milkvetch (*Astragalus castetteri*)
- Desert parsley (*Pseudocynopterus longiradiatus*)
- San Andres rock daisy (*Perityle staurophylla* var. *homoflora*)
- Mescalero pennyroyal (*Hedeoma pulcherrinum*)

Sensitive = New Mexico species which have been singled out for special consideration, typically as being formally listed as threatened, endangered, or in the pipeline for becoming so (this designation should be considered the state's equivalent of "candidate").

Environmental Protection Plan

BMDO
RAPTOR/TALON PROGRAM

BALLISTIC
MISSILE
DEFENSE
ORGANIZATION

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Ballistic Missile Defense Organization RAPTOR/TALON Program Environmental Protection Plan

1.0 Introduction

1.1 General

This Environmental Protection Plan supports the goals and policies of the National Environmental Policy Act (NEPA) and the Ballistic Missile Defense Organization's fulfillment of its environmental compliance and protection responsibilities.

The National Environmental Policy Act, Council on Environmental Quality regulations implementing NEPA (40 CFR 1500–1508), and Department of Defense (DoD) Directive 6050.1 require that DoD officials take into account environmental consequences when authorizing or approving major Federal actions. Analyses of potential environmental impacts of proposed actions also permit development of mitigation of those predicted impacts.

Evaluation of the Responsive Aircraft Program for Theater Operations/Theater Applications—Launch on Notice (RAPTOR/TALON) Program from an environmental perspective, in accordance with regulations issued by the Council on Environmental Quality, has led to a Finding of No Significant Impact. However, any action has the potential to impact the environment. This Environmental Protection Plan reflects BMDO's affirmation of responsible environmental stewardship to ensure its programs achieve maximum environmental protection.

1.2 BMDO RAPTOR/TALON Program Objectives

The BMDO RAPTOR/TALON Program seeks an effective boost phase defense against theater ballistic missiles. The Program seeks to achieve a high-altitude platform that could be stationed over a combat theater of operations and that could carry a kinetic kill interceptor to interdict theater ballistic missile threats.

The purpose of the BMDO RAPTOR/TALON Program is to design, develop, and demonstrate technologies related to an aerial platform-based, lightweight projectile to intercept targets in the high endoatmospheric and exoatmospheric regions. Specifically, the purposes of the technology program are to achieve the following:

- Design, development, and demonstration of an unmanned platform capable of sustained long-term flight, and

- Design, development, and demonstration of technologies leading to miniaturization of interceptor components so as to allow deployment of multiple interceptors on platforms capable of sustained, high-altitude flight.

RAPTOR would be an unmanned aerial vehicle (UAV) designed to overfly aggressor air defense networks while seeking theater ballistic missile launches. Upon detecting the launch of a hostile theater ballistic missile, RAPTOR would release a TALON interceptor to engage the ascending target. The TALON, a miniature high-speed interceptor, would collide with and destroy the target by kinetic effects.

1.3 BMDO RAPTOR/TALON Program Activities

Activities in support of demonstrating a combination of platform and interceptors such as RAPTOR and TALON capable of meeting theater commanders' needs may fall into one or more of at least seven categories:

- Development and refinement of a solar electric test platform (SETP),
- Development of a follow-on generation SETP, based on technologies and principles demonstrated with the present SETP,
- Development and demonstration of a conventional design fixed-wing gasoline-engine-driven aircraft,
- Potential followup efforts directly resulting from technology advances in one or more of the preceding areas to produce an ultimate suitable platform,
- Potential development of an air-deliverable platform that would be based on the design concept of either the SETP, fixed-wing, or subsequent aircraft concepts,
- Design, development, and demonstration of a small, lightweight kinetic kill projectile using state-of-the-art miniaturized sensors, guidance control, and propulsion systems, and
- Demonstration of an integrated platform and interceptor capable of intercepting theater ballistic missiles in their boost phase.

1.4 Development and Implementation of Environmental Management

This Environmental Protection Plan recognizes the desirability of minimizing environmental effects of several types of activities encompassed by the BMDO RAPTOR/TALON Program. The developmental nature of the BMDO RAPTOR/TALON

Program, occurring over a period of years, supports identification of several kinds of mitigation responses. As a general rule, mitigation supporting BMDO RAPTOR/TALON Program activities include:

- Avoiding a predicted impact altogether by not taking certain action or parts of an action,
- Minimizing impacts by limiting the degree or magnitude of an action and its implementation,
- Rectifying an impact by repairing, rehabilitating, or restoring an affected environment,
- Reducing or eliminating an impact over time by preservation and maintenance operations during the life of an action, and
- Compensating for an impact by replacing or providing substitute resources or environments.

NEPA articulates national policies to encourage productive and enjoyable harmony between man and his environment, to promote efforts which will prevent or eliminate damage to the environment and biosphere, and to enrich the understanding of the ecological systems and natural resources important to the Nation. These policies have been borne in mind in developing the proposed actions constituting the BMDO RAPTOR/TALON Program. The policies also serve as major guideposts in formulating mitigation measures.

2.0 Laws and Regulations

The following statutes, regulations, and guidance create environmental obligations applicable to various BMDO RAPTOR/TALON Program personnel and their activities:

2.1. National Environmental Policy Act of 1969 (NEPA)

This law requires that all Federal agencies give appropriate predecisional consideration to environmental effects of proposed actions in their planning and decisionmaking. Agencies must prepare detailed statements regarding such considerations and the resulting recommendations for major Federal actions significantly affecting the quality of the human environment.

2.2 Council on Environmental Quality Regulations

This executive branch agency is designated by Congress as the principal authority for NEPA. CEQ regulations at Title 40 Code of Federal Regulations Parts 1500–1508 provide all necessary procedural requirements for compliance with NEPA.

2.3 DOD Directive 6050.1

This DOD directive implements NEPA and CEQ regulations.

2.4 Comprehensive Environmental Response, Compensation, and Liability Act of 1980; Superfund Amendments and Reauthorization Act of 1986

This law, also known as "superfund," regulates cleanup of hazardous waste sites. It also regulates releases of hazardous substances into the environment. Among other matters, it imposes a duty on officials to notify the National Response Center whenever there is an unpermitted release of a hazardous substance in excess of the "reportable quantity" established by the Environmental Protection Agency.

2.5 Resource Conservation and Recovery Act of 1976

This law establishes guidelines and standards for hazardous waste generations, transportation, treatment, storage, and disposal.

2.6 Endangered Species Act of 1973

This law requires that actions of federal agencies do not jeopardize the existence of threatened or endangered species or destroy or adversely impact critical habitats of such species. Criminal penalties may be imposed on individuals for knowing "takings" of protected fish, wildlife, or plant species or their habitat.

2.7 National Historic Preservation Act

This law requires that Federal agencies consider effects of their actions on cultural and historic resources. Actions which may trigger NHPA requirements can include construction, leasing, land transactions, or activities, to include research and development activities.

3.0 Commitments to Resource Protection

From its inception, the BMDO RAPTOR/TALON Program has taken a proactive approach to ensure protection of environmental values. Consideration of potential environmental impacts has occurred with the development of each activity proposed for inclusion in the program.

This Environmental Protection Plan identifies all reasonably foreseeable opportunities to avoid, minimize, rectify, reduce, or compensate for impacts. Substantial preservation and maintenance of environmental values have already been achieved through sound planning, selection of materials, choice of location, means of execution, and like considerations for several of the events predicted to occur throughout the program. As additional mitigation opportunities arise, they will be evaluated and, as appropriate, implemented.

In formulating this Environmental Protection Plan, BMDO has found two areas to be of vital importance to support and enhancement of environmental values.

- **Pollution Prevention.** In its research and technology endeavors, BMDO is in a position to exert substantial influence over tomorrow's waste disposal issues by today exercising good hazardous materials/wastes practices and by selecting materials that will reduce or eliminate future disposal problems. It is BMDO's policy to make pollution prevention its principle of first choice. By its example, BMDO seeks to instill in all those associated with research and development an ethic of looking ahead to prevent problems. Taking a proactive approach to potential pollution issues makes sense with regard to both cost and environmental protection. Chief avenues that continue to be emphasized and exploited include good work practices, product and process changes, source reduction, recycling, and education.

- **Responsibility Tasking.** The Environmental Protection Plan requires concerted effort by all personnel associated with the BMDO RAPTOR/TALON Program. For the Program's success, appropriate individual performance must be obtained from all contributors. To ensure that mitigation opportunities are fully, timely recognized and exploited, certain of the foreseeable measures have been tasked to specific individuals. This responsibility tasking enables identification and allocation of resources to carry out the measures. It also provides a basic framework for the overall mitigation effort so that nothing is inadvertently omitted.

Table 3–1 identifies opportunities to promote the values set forth in NEPA. For each Resource that has been identified as potentially affected, there is an available Action that can be taken to avoid, minimize, rectify, reduce or eliminate, or compensate for a predicted or potential impact. In several instances, elements of the proposed action are included in the "Action" column. These already-identified measures are recited merely to emphasize their function in BMDO's efforts to ensure environmental protection; their exclusion would be inconsistent with BMDO's intent to inculcate in all personnel a complete understanding of their roles. In the column marked "Execution," the Environmental Protection Plan identifies the Program official responsible for carrying out the identified Action. In each instance, a person is tasked with responsibility for conducting or supervising the particular avoidance, minimization, rectification, reduction or elimination, or compensation measure. Where appropriate, the Execution information provides specific additional information, instruction, reference material, or aid in performing the cited task.

Table 3–1
BMDO RAPTOR/TALON Program
Mitigation Measures

Resource	Action	Execution
Air Quality	Operate RAPTOR engine efficiently.	Project Manager: Operate and adjust RAPTOR fixed-wing aircraft engine in accordance with design specifications to obtain optimal energy performance at minimal air emissions
	Promote alternative energy development	Project Manager: Develop Solar Electric Test Platform (SETP) fuel cells for optimal performance. As developments progress, note potential alternative applications of fuel cell technologies.
Hazardous Materials and Hazardous Wastes	Use TALON propellants in minimal quantities.	Test Director: Manage liquid propellant usage to obtain only minimal amounts required on-site for TALON tests. Return unused propellants to supply source for other use or disposal, local standard operating procedures.
	Dispose of properly all paint residues, solvents, battery acids, oily rags, and similar shop and operations-related materials.	Project Manager: Designate a project team member to establish liaison with hazardous waste collection point managers to ensure proper handling, storage, and delivery of wastes. Supervise designee to identify responsible office and SPCC proponent at each facility hosting activities. As appropriate, establish liaison with SPCC proponents and obtain copies of the local SPCC plans at the Nevada Test Site, WSMR, Edward AFB, and Norton AFB. Ensure personnel are aware of waste disposal requirements and duties. Note that under the Resource Conservation and Recovery Act, criminal liabilities can attach to improper transport, treatment, storage, or disposal of hazardous wastes, leading to confinement of up to 5 years and fines.

Table 3–1
BMDO RAPTOR/TALON Program
Mitigation Measures

Resource	Action	Execution
		Test Director: During field experiments, supervise operations to ensure the proper disposal of hazardous and other wastes.
	Comply with federal notice requirements in the event of any unpermitted release of any hazardous substance.	Project Manager: Ensure personnel are aware of regulatory requirements related to handling of hazardous substances.
		Test Director: Serve as responsible official for any unpermitted releases of hazardous substances. In the event of any spill which meets or exceeds the reportable quantity for a hazardous substance, the Test Director shall, with 24 hours, notify the National Response Center at 1-800-424-8802 to make a report as required by Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Note that the Reportable Quantity for hydrazine fuel, proposed for use with the TALON interceptor, is 1 pound; no Reportable Quantity has been established for nitrogen tetroxide. Note that failure to make the report required by CERCLA may lead to criminal liability of the responsible official and result in not more than 3 years confinement and a fine.
	Recover materials for re-use or recycling.	Project Manager: Review activity plans to identify recoverable or recyclable materials. Note that pollution prevention, source reduction and "operating smarter," are preferable to waste recycling, treatment or, ultimately, disposal.

Table 3–1
BMDO RAPTOR/TALON Program
Mitigation Measures

Resource	Action	Execution
		Test Director: Supervise recovery or collection of materials for re-use, recycling, or disposal.
Safety	Equip each RAPTOR platform with onboard safety devices	Program Manager: Review RAPTOR platform design to ensure inclusion of onboard safety devices and considerations such as running lights, command and control redundancies, adequate fuel supply, and the like.
		Test Director: Develop a checklist for inspecting and exercising (as appropriate) each RAPTOR platform system safety device. Prior to each flight, conduct a complete safety inspection of the platform system. Where feasible, test and exercise safety devices to ensure operational functionality (e.g., back-up command and control modes) during ground testing or during initial phase of aerial operation.
	Provide notice to FAA and military Air Traffic Control agencies during aerial operations.	Test Director: Initiate contact with servicing ATC agencies when operating in other than restricted airspace.
	Limit TALON on-board fuel supply to ensure flight only within test area boundaries.	Test Director: Calculate fuel requirements to provide adequate test performance with minimal excess fuels that might result in flight beyond test area boundaries.
	Safeguard against potentially harmful exposure to liquid propellants.	Test Director: Ensure safe handling practices, to include wearing of protective clothing and use of other devices, during fueling operations.

Table 3–1
BMDO RAPTOR/TALON Program
Mitigation Measures

Resource	Action	Execution
	Adhere to all relevant operational and safety requirements when operating at a host testing facility.	Project Manager: During program introduction process, obtain copies of local operating and safety standing operating procedures. Incorporate local operational and safety-related requirements into test protocols.
		Test Director: Supervise tests in accordance with local operational and safety standard operating procedures.
Noise	Safeguard against hearing loss by use of appropriate personal protective devices during RAPTOR and TALON testing.	Test Director: Exercise preventive and precautionary measures concerning noise. Prescribe and supervise use of hearing protective devices by personnel in high noise working environments.
Historic and Cultural Resources	Limit vehicular traffic to existing roadways during testing at WSMR.	Project Manager: Approve number of personnel and vehicles involved in tests at WSMR.
		Test Director: Use spotter aircraft in conjunction with RAPTOR testing and helicopter support for locating TALON debris. Effect recovery of test articles with only minimally required number of vehicle assets.
	Conduct cultural resources briefings for personnel prior to field activities at WSMR.	Test Director: Establish liaison with WSMR environmental affairs office to obtain personnel briefing support.
	Configure TALON test debris impact areas to avoid historic and cultural resource areas.	Test Director: Establish liaison with WSMR environmental affairs office to obtain assistance in defining debris profiles to avoid injury to historic and cultural resource areas.

Table 3–1
BMDO RAPTOR/TALON Program
Mitigation Measures

Resource	Action	Execution
	Comply with federal and state historic preservation requirements	Test Director: Establish liaison with WSMR environmental affairs offices to ensure compliance with NHPA and coordination with SHPO, as required.
	Prohibit disturbances to historic and cultural resources.	Project Manager: Strictly prohibit any personnel's artifact or relic collecting during field operations in the vicinity of WSMR.
		Test Director: Strictly prohibit any personnel's artifact or relic collecting during field operations in the vicinity of WSMR.
Biological Resources	Conduct briefings on the desert tortoise prior to TALON tests at the Nevada Test Site.	Test Director: Establish liaison with NTS environmental affairs office to obtain personnel briefing support and copies of brochures concerning local desert tortoise protection efforts
	Configure TALON test debris impact areas to avoid sensitive wildlife and plant habitat areas.	Test Director: Establish liaison with WSMR environmental affairs office to obtain assistance in defining debris profiles to avoid injury to sensitive wildlife and plant habitat areas.
	Comply with federal and state endangered species laws and regulations.	Test Director: Ensure personnel are aware of the applicability of the Endangered Species Act to RAPTOR/TALON Program operations (e.g., the WSMR area supports 9 species of threatened or endangered wildlife and 6 species of threatened or endangered plants). Note that knowing violation of the Act (typically a "taking" of wildlife or plant species) can result in up to one year confinement and a $50,000 fine.

Table 3–1
BMDO RAPTOR/TALON Program
Mitigation Measures

Resource	Action	Execution
Meteorology	Obtain complete meteorological information prior to RAPTOR flight testing.	Test Director: Obtain meteorological data prior to SETP flight testing to ensure safe launch and recovery of craft.
Air Space	Provide notice to FAA and military Air Traffic Control when conducting RAPTOR and TALON tests.	Program Manager: Review test and operational plans to ensure they provide for appropriate notice being given to ATC agencies.
		Test Director: Provide appropriate launch notices, periodic position reports, and termination notices to FAA and military ATC agencies when conducting RAPTOR flight tests.
Transportation	Transport fueled interceptors per WSMR operational and safety requirements.	Test Director: Test TALON fuel tanks (with inert material) for tank integrity prior shipment and use. Establish liaison with WSMR for operational and safety requirements related to TALON propellant handling.

4.0 Briefing Bullets

4.1 Application

This section of the Environmental Protection Plan contains material that may be used to brief program personnel on their obligations and responsibilities related to the environment. This briefing material is organized as Basic Precepts that can be implemented by BMDO program personnel. Adherence to these Basic Precepts can lead to the avoidance, minimization, rectification, reduction or elimination of, and compensation for environmental impacts.

4.2 Basic Precepts

Basic Precepts for all personnel associated with the BMDO RAPTOR/TALON Program are as follows:

Ask Before Acting. Wherever actions occur, familiarize yourself with local environmental requirements. These may pertain to energy conservation, disposal of small amounts of hazardous waste (for example, oily rags, spent batteries, lubricants and solvents, paints and coatings, and so forth), wildlife or plant species protection, and natural and cultural resources protection. Especially when away from your "home base," familiarize yourself with applicable local requirements.

Prevent Pollution. Environmentally harmful processes and products can often be replaced, resulting in reduction or elimination of adverse effects. In many cases, environmentally friendly processes and products produce long term cost savings. It's true that an ounce of prevention can be worth a pound of cure. DoD policy is to look for the ounce.

Don't Pollute. Dispose of all solid and hazardous waste properly. Federal, state, and local regulations now prohibit most "past practices" related to waste disposal. Unpermitted releases of environmentally harmful substances might or might not result in BMDO's having to foot the bill for cleanup. At the least, Program management would be distracted from more productive uses of time in the event of careless releases.

Think Safety. The devices which are the subject matter of the BMDO RAPTOR/TALON Program are capable of producing death or serious bodily injury. Know and always adhere to safety margins. Where SOP's provide for safety practices, follow them. Look for ways to reduce risks of injury to personnel or damage to property.

Conserve and Protect Resources. Use resources only in the amounts needed to achieve program goals. Safeguard from loss, damage, or diminution resources not used toward program goals. Be particularly alert with respect to specially protected classes of resources such as archeological remains, artifacts, and endangered or threatened species of plants and wildlife.

Keep Everyone in the Loop. Management, technical, administrative, logistical, and environmental functions each contribute to program success. Exploit all, exclude none.

Read the Plan. Each major research and development iteration will include appropriate consideration of its environmental aspects. As design, development, and demonstration events progress, all personnel must know and adhere to the plan. Important site-specific environmental considerations will be addressed.