September

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Final

Description of Proposed Action and Alternatives

for the Programmatic Environmental Assessment Addressing Air Force Research Laboratory Research, Development, Test, and Evaluation Activities at Kirtland Air Force Base, New Mexico

United States Air Force
United States Space Force
Kirtland Air Force Base
Air Force Research Laboratory

PRIVACY ADVISORY

The Draft PEA will be provided for public comment in accordance with the National Environmental Policy Act of 1969, as amended, (Title 42 United States Code Section 4321 et seq.), Council on Environmental Quality regulations for implementing the National Environmental Policy Act (Title 40 Code of Federal Regulations Parts 1500–1508, as amended by 87 Federal Register 23453–23470), and 32 Code of Federal Regulations Part 989, *Environmental Impact Analysis Process*.

The Environmental Impact Analysis Process provides an opportunity for public input on USAF decision making, allows the public to offer input, and solicits comments on USAF's analysis of environmental impacts. Public commenting allows USAF to make better-informed decisions. Letters or other written or oral comments provided may be published in the Final PEA. As required by law, comments provided will be addressed in the Final PEA and made available to the public. Providing personal information is voluntary. Private addresses may be compiled to develop a mailing list for those requesting copies of the PEA. Only the names of the individuals making comments and specific comments will be disclosed in the Final PEA. Personal information, home addresses, telephone numbers, and email addresses will not be published in the Final PEA.

This EA has been verified to be compliant with the 75-page limit, not including appendices, required by 40 CFR Section 1501.5(f). As defined in 40 CFR Section 1508.1(v) a "page" means 500 words and does not include maps, diagrams, graphs, tables, and other means of graphically displaying quantitative or geospatial information. This document is compliant with Section 508 of the Rehabilitation Act. This allows assistive technology to be used to obtain the available information from the document. Due to the nature of graphics, figures, tables, and images occurring in the document, accessibility is limited to a descriptive title for each item.

ACRONYMS AND ABBREVIATIONS

ABW	Air Base Wing
AFB	Air Force Base
AFRL	Air Force Research Laboratory
BC-TRAIL	Beam Control Targeting Resource Advanced Integration Laboratory
BEL	Battlespace Environment Laboratory
BLM	Bureau of Land Management
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
DE	directed energy
DoD	Department of Defense
DOPAA	Description of Proposed Action and Alternatives
EA	Environmental Assessment
EIAP	Environmental Impact Analysis Process
ELTF	Environmental Laser Test Facility
EO	Executive Order
FONSI	Finding of No Significant Impact
HEL	high energy laser
HEML	High Energy Microwave Laboratory
HERTF	High Energy Research and Technology Facility
HiJENKS	High-Power Joint Electromagnetic Non-Kinetic Strike
HPEM	high-power electromagnetic
HPM	high-power microwave
ISOON	Improved Solar Observing Optical Network
LETF	Laser Effects Test Facility
NEPA	National Environmental Policy Act
NOA	Notice of Availability
OLPFA	Outdoor Laser Propagation and Firing Area
PEA	Programmatic Environmental Assessment
RD	Directed Energy Directorate
RDT&E	research, development, test, and evaluation
REVIL	Re-Entry Vehicle Integration Laboratory
RMO	Range Management Office
RV	Space Vehicle Directorate
SDA	space domain awareness
SHPO	State Historic Preservation Officer
SKYWAVE	Skywave Technologies Laboratory
SOR	Starfire Optical Range
South Park	South Park Antenna Field
sUAS	small unmanned aerial system
TAC Lab	Telescope/Atmospheric Compensation Laboratory
UAS	unmanned aerial system
USAF	United States Air Force
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USSF	United States Space Force
WSMR	White Sands Missile Range

COVER SHEET

FINAL
DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES FOR THE PROGRAMMATIC ENVIRONMENTAL ASSESSMENT ADDRESSING AIR FORCE RESEARCH LABORATORY RESEARCH, DEVELOPMENT, TEST, AND EVALUATION ACTIVITIES AT KIRTLAND AIR FORCE BASE, NEW MEXICO

Responsible Agencies: United States Air Force (USAF), United States Space Force (USSF), Kirtland Air Force Base (AFB), Air Force Research Laboratory (AFRL).

Affected Location: Kirtland AFB, New Mexico.

Proposed Action: AFRL research, development, test, and evaluation (RDT&E) activities at Kirtland AFB, New Mexico.

Report Designation: Final Description of Proposed Action and Alternatives (DOPAA).

Abstract: This DOPAA was developed in compliance with the USAF's *Environmental Impact Analysis Process*. It supports a proposal by AFRL for the USAF and USSF to continue conducting current RDT&E activities and implement future RDT&E activities on Kirtland AFB, New Mexico.

AFRL has been conducting RDT&E activities on Kirtland AFB since the 1960s. There are many existing Environmental Assessments and Environmental Impact Analysis Process documents, including Air Force Form 813s, spanning the decades from 1970 to present day. The Proposed Action consolidates all current and proposed future AFRL RDT&E activities into one Programmatic Environmental Assessment (PEA), ensuring these activities can continue to occur on Kirtland AFB into the future. Two units of AFRL conduct these activities, ARFL's Directed Energy Directorate (AFRL/RD) and AFRL's Space Vehicle Directorate (AFRL/RV).

AFRL/RD develops directed energy weapons (including high energy lasers, high-power microwave, and high-power electromagnetic system prototypes) to counter, disable, and attack adversary sources. Equipment, components, and designs for warfighter weapons are created and tested in laboratories across Kirtland AFB before being tested outdoors at the High Energy Research and Technology Facility (HERTF)/HERTF Canyon, Frustration Canyon, Starfire Optical Range/1-Mile and 2-Mile sites, and Outdoor Laser Propagation and Firing Area to evaluate performance of the new technology.

AFRL/RV ensures that the United States and its allies maintain space superiority by developing and transitioning technologies that provide space-based capabilities to the nation. Equipment, components, and designs for space-based technologies are created in laboratories across Kirtland AFB and then tested outdoors at the Skywave Technologies Laboratory, Improved Solar Observing Optical Network, and South Park Antenna Field.

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1.0 PURPOSE AND NEED FOR THE PROPOSED ACTION

1.1 INTRODUCTION

Kirtland Air Force Base (AFB), located southeast of the city of Albuquerque, New Mexico (see **Figure 1-1**), is home to the 377th Air Base Wing (ABW) of the Air Force Global Strike Command. The installation is a center for research, development, and testing of nonconventional weapons, space and missile technology, and directed energy (DE) systems. The 377 ABW ensures readiness and training of airmen for worldwide duty and prepares personnel to deploy worldwide on a moment's notice. The installation encompasses 51,585 acres.

The Air Force Research Laboratory (AFRL) is the primary scientific research and development center for the United States Air Force (USAF). AFRL plays an integral role in leading the discovery, development, and integration of affordable warfighting technologies for the United States' air, space, and cyberspace force. With a workforce of more than 12,500 individuals across 9 technology areas and 40 other operations across the globe, AFRL provides a diverse portfolio of science and technology ranging from fundamental to advanced research and technology development. AFRL has been conducting research, development, test, and evaluation (RDT&E) activities on Kirtland AFB since the 1960s (see **Appendix A** for the history of AFRL at Kirtland AFB). This Proposed Action consolidates all current and proposed future AFRL RDT&E activities into one Programmatic Environmental Assessment (PEA), ensuring these activities can continue to occur on Kirtland AFB into the future. Two units of AFRL conduct these activities, ARFL's Directed Energy Directorate (AFRL/RD) and AFRL's Space Vehicle Directorate (AFRL/RV).

AFRL/RD develops DE weapons (including high energy laser [HEL], high-power microwave [HPM], and high-power electromagnetic [HPEM] system prototypes) to counter, disable, and attack adversary sources. Equipment, components, and designs for warfighter weapons are created and tested in laboratories across Kirtland AFB before being tested outdoors at the High Energy Research and Technology Facility (HERTF)/HERTF Canyon, Frustration Canyon, Starfire Optical Range (SOR)/1-Mile and 2-Mile sites, and Outdoor Laser Propagation and Firing Area (OLPFA) to evaluate performance of the new technology.

AFRL/RV ensures that the United States and its allies maintain space superiority by developing and transitioning technologies that provide space-based capabilities to the nation. Equipment, components, and designs for space-based technologies are created in laboratories across Kirtland AFB and then tested outdoors at the Skywave Technologies Laboratory (SKYWAVE), Improved Solar Observing Optical Network (ISOON), and South Park Antenna Field (South Park).

This Description of Proposed Action and Alternatives (DOPAA) lays the framework for the PEA, detailing the proposed activities under the Proposed Action. The PEA is a planning and decision-making tool that will be used to guide the USAF in implementing the Proposed Action in a manner that complies with all applicable federal, state, and local environmental laws and regulations and is consistent with USAF standards for environmental stewardship. This DOPAA supports a proposal by USAF, United States Space Force (USSF), Kirtland AFB, and AFRL to conduct a range of RDT&E activities at Kirtland AFB.

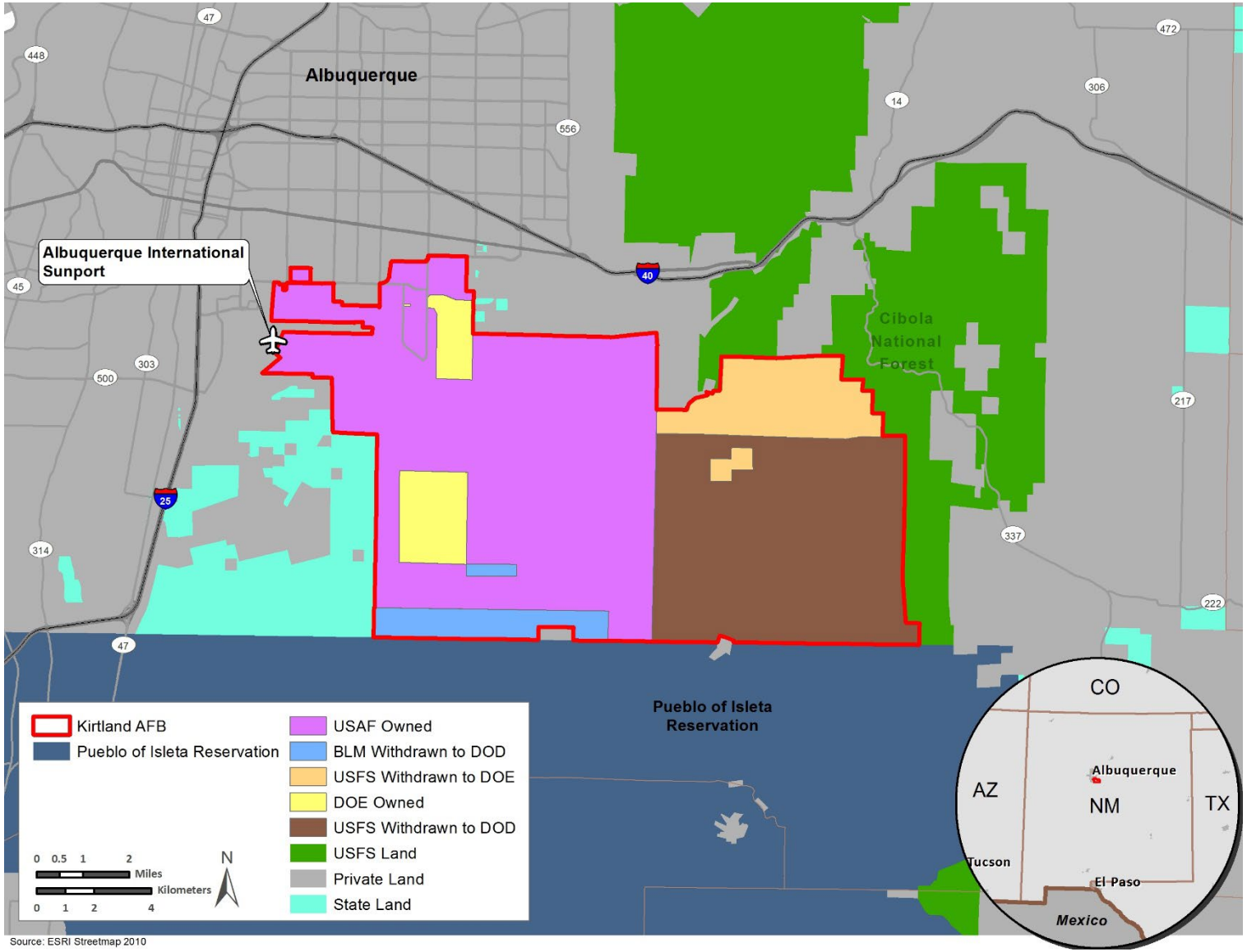

Figure 1-1. Kirtland AFB Vicinity Map

1.1.1 AFRL/RD Operations

The AFRL/RD mission is to "Lead the discovery, development and delivery of DE science and technology for National Security." AFRL/RD specializes in HPM, HPEM, and HEL technology development. These areas of research offer the warfighter innovative technologies that enable a variety of non-traditional counter electronic and thermal effects that can be either lethal or non-lethal. HPM weapons create beams of electromagnetic energy over a broad spectrum of radio and microwave frequencies in both narrow- and wide-band with the intent of coupling/interacting with electronics within targeted systems either by causing damage or temporary disruption from which the system cannot self-recover in time to accomplish its mission. HPEM systems enable low collateral damage methods to disturb, deny, or damage electronics contained in adversary systems or buildings. HEL systems enable pinpoint accurate methods to degrade or destroy adversary systems. These technologies operate by emitting high bursts of photons, but the damage mechanisms vary depending on the photon energies emitted. This vision of modern DE warfare is enabled by recent revolutionary advances and anticipated advances.

1.1.2 AFRL/RV Operations

AFRL/RV served as the USAF's center of excellence for space technology research and development until it was reorganized under the USSF in 2020. AFRL/RV develops and transitions space technologies to provide space-based capabilities. Primary mission activities include space-based intelligence, surveillance, and reconnaissance; space domain awareness (SDA); space communications, position, navigation, and timing; and defensive space control (protecting space assets from man-made and natural effects). AFRL/RV leverages commercial, civil, and other government resources to stay one step ahead in space and to ensure the United States' advantage.

1.2 PURPOSE OF AND NEED FOR THE PROPOSED ACTION

The purpose of the Proposed Action is to ensure that all current and proposed AFRL RDT&E activities can continue to occur on Kirtland AFB into the future. The need for the Proposed Action is to allow users the ability to test concepts to improve the technology discussed in **Section 1.1.1** and **Section 1.1.2**. Such tests are needed to determine the survivability and vulnerability of structures and targets for national security. In turn, these tests allow for the delivery of innovative and affordable weapons, materials, and methods to the warfighter in time to meet their mission demands. Because of ever-changing threat scenarios, the RDT&E activities conducted by these agencies are a critical element in the development of new capabilities for the nation's security and provide an important component of the United States' global leadership in safety, science, and technology.

1.3 DECISION TO BE MADE

The PEA will evaluate whether the Proposed Action would result in significant impacts on the environment. If significant impacts are identified, USAF would undertake mitigation measures to reduce impacts to below the level of significance, undertake the preparation of an Environmental Impact Statement addressing the Proposed Action, or abandon the Proposed Action. If significant impacts are not identified, a Finding of No Significant Impact (FONSI) would be signed and AFRL would continue to conduct current and implement future RDT&E activities on Kirtland AFB. The decision would be made by the approving official and could incorporate the Proposed Action, its alternatives, or any combination of the Proposed Action and alternatives. The PEA will be prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, as amended (42 United States Code Sections 4321 et seq.), the regulations of the President's Council on

Environmental Quality (CEQ) that implement NEPA procedures (40 Code of Federal Regulations [CFR] Parts 1500–1508), and the USAF Environmental Impact Analysis Process (EIAP) Regulations at 32 CFR Part 989.

1.4 RELATED ENVIRONMENTAL DOCUMENTATION

40 CFR Section 1501.11 allows tiering, or incorporation of existing Environmental Assessments (EAs) or completed analysis, into other NEPA documents. Tiering allows analysis of actions at a programmatic level for those actions that are similar in nature be used in other analysis efforts in order to keep environmental documents brief (40 CFR Section 1501.11). Tiering eliminates repetitive discussions of the same issues and allows analysis to focus on the key issues at each level of project review. The following NEPA documents have been reviewed and are incorporated by reference into this PEA.

- *Environmental Assessment for the Air Force High Energy Laser Program* (KAFB 1976). Hereafter referred to as the HEL EA.
- *Environmental Assessment of the Proposed Addition to the Air Force Weapons Laboratory Optics Development Lab* (KAFB 1984). Hereafter referred to as the Optics Lab EA.
- *Environmental Assessment for the Construction and Operation of the High Energy Microwave Laboratory (HEML)* (KAFB 1987). Hereafter referred to as the HEML EA.
    - *Amendment to Environmental Assessment for the Operation and Maintenance of the High Energy Microwave Laboratory* (KAFB 1992). Hereafter referred to as the Amended HEML EA.
- *Environmental Assessment for the Construction and Operations of the High Energy Research & Technology Facility Kirtland Air Force Base, New Mexico* (KAFB 1989). Hereafter referred to as the HERTF EA.
- *Environmental Assessment for the Laser Effects Test Facility, Kirtland Air Force Base, Bernalillo County, New Mexico* (KAFB 1990). Hereafter referred to as the Laser Effects Test Facility (LETF) EA.
- *Environmental Assessment for the US Air Force Phillips Laboratory Starfire Optical Range Facility Kirtland AFB, New Mexico* (KAFB 1991). Hereafter referred to as the SOR EA.
- *Environmental Assessment Consolidation of Phillips Laboratory Split Directorates Kirtland Air Force Base, New Mexico* (KAFB 1993). Hereafter referred to as the Directorate Consolidation EA.
- *Environmental Assessment for Advanced Laser Facility Kirtland Air Force Base, Albuquerque, New Mexico* (KAFB 1997). Hereafter referred to as the Advanced Laser Facility EA.
- *Environmental Assessment for the ADT Battlelab Phase III Demonstration* (KAFB 1999). Hereafter referred to as the Battlelab EA.
- *Environmental Assessment for the Telescope/Atmospheric Compensation Laboratory* (KAFB 2001). Hereafter referred to as the Telescope/Atmospheric Compensation Laboratory (TAC Lab) EA.
- *Environmental Assessment for Outdoor Laser Propagation Firing Area Including US/UK Focal Plane Array Counter Measures Experiment* (KAFB 2002). Hereafter referred to as the OLPFA EA.

- *Environmental Assessment Air Force Research Laboratory Fixed Panel Array* (KAFB 2006). Hereafter referred to as the Fixed Panel Array EA.
- *Environmental Assessment of the Realignment of the Battlespace Environment Laboratory Kirtland Air Force Base Albuquerque, New Mexico* (KAFB 2007). Hereafter referred to as the Battlespace Environment Laboratory (BEL) EA.
- *Environmental Assessment Addressing the High-Powered Electromagnetic Laboratory at The Air Force Research Laboratory at Kirtland Air Force Base, New Mexico* (KAFB 2019). Hereafter referred to the HPEM Laboratory EA.
- *Environmental Assessment Addressing Construction and Operation of Re-Entry Vehicle Integration Laboratory Facilities at Kirtland Air Force Base, New Mexico* (KAFB 2022). Hereafter referred to as the Re-Entry Vehicle Integration Laboratory (REVIL) EA.
    - The REVIL EA includes construction, operation, and maintenance of the Facility for Explosives and Radiological Materials Imaging.

1.5 INTERGOVERNMENTAL COORDINATION AND CONSULTATIONS

1.5.1 Interagency and Intergovernmental Coordination and Consultations

Executive Order (EO) 12372, *Intergovernmental Review of Federal Programs*, as amended by EO 12416, requires federal agencies to provide opportunities for consultation by elected officials of state and local governments that would be directly affected by a federal proposal. In compliance with NEPA, Kirtland AFB will notify relevant stakeholders about the Proposed Action and alternatives (see **Appendix B** for all stakeholder coordination materials). The notification process will provide these stakeholders the opportunity to cooperate with Kirtland AFB and provide comments on the Proposed Action and alternatives.

Per the requirements of Section 106 of the National Historic Preservation Act (NHPA) and implementing regulations (54 USC Section 306108), Section 7 of the Endangered Species Act and implementing regulations (50 CFR Part 402), findings of effect and a request for concurrence will be transmitted to the State Historic Preservation Officer (SHPO) and the United States Fish and Wildlife Service (USFWS). A brief summary of comments received will be included in the Final PEA. All correspondence with SHPO and USFWS will be included in **Appendix B**. Correspondence regarding the findings, concurrence, and resolution of any adverse effect will also be included in **Appendix B**.

1.5.2 Government to Government Coordination and Consultations

Section 106 of the NHPA and implementing regulations 36 CFR Part 800 requires federal agencies to consult with federally recognized tribes historically affiliated with the area of potential effects (APE) for the project to determine the presence of and resolve adverse effects to Traditional Cultural Properties. To comply with legal mandates, federally recognized tribes that are historically affiliated with the geographic region will be invited to consult on all proposed undertakings that have a potential to affect properties of cultural, historical, or religious significance to the tribes (see **Appendix B** for all tribal coordination materials).

Scoping letters will be provided to Native American tribes whose ancestors were historically affiliated with the land underlying Kirtland AFB, inviting them to consult on the proposed undertakings outlined within the PEA.

1.6 PUBLIC AND AGENCY REVIEW OF DRAFT PEA

A Notice of Availability (NOA) will be published in *The Albuquerque Journal* announcing the availability of the Draft PEA. Letters will be provided to relevant federal, state, and local agencies and Native American tribal governments informing them that the Draft PEA is available for review. The publication of the NOA will initiate a 30-day comment period. A copy of the Draft PEA will be made available for review at the San Pedro Public Library, 5600 Trumbull Avenue SE, Albuquerque, New Mexico. A copy of the Draft PEA will also be made available for review online at http://www.kirtland.af.mil under the Environment Information tab. At the closing of the public review period, applicable comments from the general public and interagency and intergovernmental coordination and consultation will be incorporated into the analysis of potential environmental impacts performed as part of the PEA, where applicable, and included in **Appendix B** of the Final PEA.

2.0 DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

2.1 PROPOSED ACTION

The USAF proposes that AFRL continue to conduct current and implement future RDT&E activities on Kirtland AFB, New Mexico. Given the length of time that has elapsed since the completion of the environmental documents listed in **Section 1.4** and the need to analyze the cumulative impacts of AFRL activities at Kirtland AFB, the USAF determined that a comprehensive PEA was necessary.

2.2 SELECTION STANDARDS

Selection standards were developed to assist the USAF in determining reasonable alternatives and the basis for eliminating any of them. The following selection standards were used to determine the feasibility of each alternative and to determine which of the alternatives would be the best fit to meet the needs of the project:

- The alternative(s) must meet the purpose of and need for the Proposed Action (see **Section 1.2**) The alternatives must allow users the ability to test concepts to improve the technology discussed in **Sections 1.1.1** and **1.1.2**.
- The alternative(s) must comply with all applicable USAF, federal, state and local requirements.
- The alternative(s) must avoid and/or mitigate direct and indirect, adverse impacts on safety, cultural or natural resources, or other environmental constraints, such as impacts on an environmental restoration site.

2.3 DETAILED DESCRIPTION OF THE ALTERNATIVES

2.3.1 Proposed Action

This PEA incorporates current and proposed RDT&E activities for both AFRL/RD and AFRL/RV. The following sections describe the types of activities that are proposed at each test site/facility[1]. Radioactive and toxic wastes are not generated during RDT&E activities. Hazardous wastes generated during RDT&E activities and their associated initial accumulation points will be analyzed in the PEA.

2.3.1.1 High Energy Microwave Laboratory

The High Energy Microwave Laboratory (HEML), located on USAF-owned lands (see **Figure 1-1**), consists of 25,484 square feet of laboratory and administration space for developing/testing HPM systems and performing vulnerability studies. HEML has a large anechoic chamber[2] (echo and reverberation free with an attenuation containment factor of 10 billion) that holds airplanes for electronic systems tests. Shielded rooms contain state-of-the-art instrumentation for operating

[1] Due to the sensitive nature of these activities, specific locations or details are not provided.

[2] An anechoic chamber is a room designed to absorb sound and electromagnetic waves to create a completely isolated environment. Anechoic chambers are typically used for testing and measuring acoustic and electronic devices. The walls, ceiling, and floor of an anechoic chamber are covered with materials that absorb sound, such as fiberglass and foam wedges. Additionally, the walls of the chamber may be coated with a layer of radio frequency absorbing material to prevent any electromagnetic interference from entering the space. The design of the chamber allows for minimal sound reflection, creating a space that is almost entirely devoid of echoes.

HPM sources and measuring pulsed radiation characteristics and electrical responses. A suite of narrow- to wide-band sources produce output in the frequency range of the anechoic quiet zone. HEML hosts joint experiments with all three services, other government agencies, and foreign countries. Technologies developed at this facility are field tested on Kirtland AFB at HERTF Canyon, Frustration Canyon, and CHESTNUT Test Range. Activities were previously analyzed in the HEML EA and Amended HEML EA.

2.3.1.2 High-Power Joint Electromagnetic Non-Kinetic Strike Facility and 909 Complex

The High-Power Joint Electromagnetic Non-Kinetic Strike (HiJENKS) Facility and the 909 Complex, located on USAF-owned lands (see **Figure 1-1**), house several laboratories that are used for planning, developing, prototyping, testing, and deploying high-powered radio frequency weapon systems. Technologies developed at this facility are field tested on Kirtland AFB at HERTF Canyon, Frustration Canyon, and CHESTNUT Test Range. Activities in these areas were previously analyzed on various Air Force Form 813s and issued a categorical exclusion (CATEX).

2.3.1.3 High-Powered Electromagnetic Laboratory

The High-Powered Electromagnetic (HPEM) Laboratory, to be constructed on USAF-owned lands (see **Figure 1-1**), will consist of 48,000 square feet of modern, flexible HPEM laboratory space for development of advanced HPM and high energy density physics research. Technologies developed at this facility will be field tested on Kirtland AFB at HERTF Canyon, Frustration Canyon, and CHESTNUT Test Range. Construction and operation of this facility were previously analyzed in the HPEM Laboratory EA.

2.3.1.4 High Energy Research and Technology Facility/HERTF Canyon

HERTF and HERTF Canyon are located on United States Forest Service (USFS) lands withdrawn to the Department of Defense (DoD) (see **Figure 1-1**). HERTF provides a unique capability for the development of HPM, high-energy advanced pulse-power (including explosives devices), and very high-energy plasmas. It also provides a research environment for exploring a variety of related technologies. The remote location of the facility on Kirtland AFB is coupled with unique construction, which is designed to withstand blasts and intense radiation from a variety of sources, including high-energy microwaves and x-rays. HERTF has a four-story high-bay laboratory, 80 by 100 feet, with a concrete roof and walls 4 feet thick for blast and radiation shielding. The high bay includes two bridge cranes, cable trays, a 12-foot-deep pit for intense radiation source experiments, and access tunnels to an explosive firing area near the high bay. Up to 1,000 pounds of high explosives can be safely detonated in this area to produce hundreds of mega joules of electrical energy needed for advanced experiments. Additionally, advanced weapons environments can be created to allow scientists to assess the potential threat of these weapons to US military systems. The facility also contains offices and smaller laboratories where advanced weapons technology experiments and demonstrations can be conducted safely and securely. Technologies developed at this facility are field tested at HERTF Canyon. Activities were previously analyzed in the HERTF EA.

2.3.1.5 Frustration Canyon

Frustration Canyon, located on USFS lands withdrawn to DoD (see **Figure 1-1**), is used by AFRL to test HPEM and HEL systems, and to train drone, unmanned aerial system (UAS), and small unmanned aerial system (sUAS) targets that measure the system's parameters. Portable generators are used to power such tests. Drone, UAS, and sUAS pilots are certified and their

operations comply with AFRL/RD sUAS Standard Operating Procedures. Frequencies are coordinated with the installation's Frequency Manager.

AFRL also proposes to install a new 50- by 50-foot concrete pad in Frustration Canyon to serve as an alternative test site for firing to SOR's 2-Mile Site. This will enable future HPEM testing with different, more powerful source parameters. Use of microwave systems at Frustration Canyon was previously analyzed in the Battlelab EA.

2.3.1.6 Starfire Optical Range

SOR, located on USAF-owned lands (see **Figure 1-1**), is a world-class optical research facility located on a hilltop site (6,240 feet above sea level) in the southeastern portion of Kirtland AFB. SOR's primary mission is to develop optical sensing, imaging, and propagation technologies to support USAF aerospace missions. It is a major component of AFRL. SOR leads the development of laser beacon adaptive optics for military uses and civilian applications such as astronomy. SOR houses the world's premier adaptive optics telescope capable of tracking low-earth orbiting satellites. Activities were previously analyzed in the SOR and TAC Lab EAs.

Due to encroachment issues in Frustration Canyon and the upgrade of SAR East to fire 0.50-caliber munition items, AFRL proposes to relocate the current 2-Mile Site approximately 4,600 feet south of the current site. The current 2-Mile Site would not be demolished.

2.3.1.7 Outdoor Laser Propagation and Firing Area and Associated Laser Facilities

OLPFA, located on USAF-owned lands (see **Figure 1-1**), is a laser test range used by USAF, US Navy, and US Army units to perform research, developmental, and limited operational laser testing. OLPFA has been in continuous operation since 2002. Activities at the range are coordinated and scheduled with the 377 ABW/Range Management Office (RMO). Research and developmental lasers are brought to evaluate new technologies under development. Operational lasers, including prototype weapon systems, are brought in as part of acceptance testing to determine whether they are ready to be evaluated.

Outdoor environmental conditions have significant impacts on laser propagation. Laser experiments using targets, vehicles, and aircraft with diverse environmental conditions are needed to further the development of systems for countermeasures and weapons. Six target sites are used to measure beam propagation, the 1-, 2-, 4-, 5-, 6-, and 7-Kilometer Sites. Beam propagation is terminated at these locations with specially designed target boards and concrete walls. Any reflections are contained so reflected laser light is not a safety issue to surrounding personnel or aircraft. Activities were previously analyzed in the OLPFA EA.

Additionally, the Environmental Laser Test Facility (ELTF) is designed to provide the ability to propagate a laser to a remote site to exercise customer beam control systems. The ELTF provides risk reduction and technology readiness level verification for various DoD programs. DoD customers and their contractors utilize this facility to test their laser systems prior to integration on aircraft. The Beam Control Targeting Resource Advanced Integration Laboratory (BC-TRAIL) is under the Laser Integration and Demonstration Program. BC-TRAIL is a beam control and laser testbed developed to focus on the research and development of beam control and targeting. Under this Proposed Action, AFRL proposes to continue performing outdoor propagation from both the ELTF and BC-TRAIL to the 1- and 2-Kilometer Sites for testing. These tests occur multiple times a year and are coordinated through 377 ABW/RMO.

Lastly, the LETF conducts laser/material interaction test events using several high-power laser sources. This data is required to assess the effectiveness of lasers on certain materials and components and to assess the response of different materials to laser irradiation. The LETF directly supports the development and demonstration of laser's effects on various materials and provides valuable information necessary to the Laser Technology Program. Activities were previously analyzed in the LETF EA.

2.3.1.8 Plant 1 in the Manzano Mountain Complex

AFRL uses a portion of Plant 1, located on USAF-owned lands (see **Figure 1-1**), as an indoor DE test facility, primarily for Ultrashort Pulsed Laser characterization. Its half-mile long hallways and limited access make it ideal for characterizing laser systems.

2.3.1.9 SKYWAVE Facility

SKYWAVE and the surrounding area composed of the former Digital Ionospheric Sounding System and Tumbleweed Sites are located on USAF-owned lands (see **Figure 1-1**). SKYWAVE is an ionospheric remote sensing laboratory, capable of taking measurements of the ionosphere and providing real-time, on-site processing and analysis to characterize the ionospheric state. Instruments used at SKYWAVE include ionospheric radars, meteor wind radars, optical interferometers, all-sky cameras, global navigation satellite system (GNSS) receivers, and satellite beacon receivers. These data feed models of the ionosphere to better understand the drivers of the dynamic ionospheric state. AFRL researchers use the SKYWAVE facility to foster collaboration with the US and international academic institutions as well as other DoD and Department of Energy laboratories.

As an active antenna deployment test bed, AFRL proposes to temporarily deploy up to 30 antennas per year for a variety of testing purposes. These antennas would not exceed 120 feet in height and would require 36-inch stakes driven into the ground to anchor the antenna via guy wires. The antennas would be installed in areas that are known to be clear of utilities; therefore, AFRL proposes that a dig permit would not be required to bury the stakes for the guy wires in the area presented in **Figure 2-1**. Coaxial cables would be run from the antenna to the SKYWAVE Facility where instrumentation/processing would occur. Cables would be run on the ground surface except for the cables presently running from the Beacon RX antenna to the SKYWAVE Facility. AFRL proposes to bury these 2 to 3 feet below the ground surface. Any permanent antenna installation would be required to undergo separate Kirtland AFB EIAP review. Activities were previously analyzed on various Air Force Form 813s and issued a CATEX.

2.3.1.10 Improved Solar Observing Optical Network

The Improved Solar Observing Optical Network (ISOON) telescope, located on Bureau of Land Management (BLM) lands withdrawn to DoD (see **Figure 1-1**), has not been in operation since 2020, but it could potentially be restarted for the current solar maximum. The ISOON location, which is well away from high-traffic areas, makes it suitable for radio applications that wish to minimize electromagnetic interference. Several radio-based studies of the upper atmosphere are sited at ISOON. Activities were previously analyzed in the BEL EA.

Figure 2-1. Proposed Area with No Known Utilities for Antenna Installations at SKYWAVE

2.3.1.11 South Park Antenna Field

South Park is located on BLM lands withdrawn to DoD (see **Figure 1-1**). The current mission is to operate as a satellite communications site and test bed for new types of satellite antennas. Existing AFRL antennas at the site communicate with USSF satellites. The site itself consists of approximately 15 acres of flat, open space with unimpeded lines of sight to the atmosphere and little to no vehicle or personnel traffic for optimal sensor readings. AFRL proposes the following actions at the South Park Antenna Field. Activities were previously analyzed in the Fixed Panel Array EA.

Roadway Improvement and Routine Maintenance. AFRL proposes to regrade the gravel road leading from Lovelace Road around South Park, regrade the dirt roads that travel through South Park, and establish a dirt vehicle turn around and staging area. The existing 2-track roadway does not provide an adequate system for transportation.

Installation of Additional Antennas. AFRL proposes to install both permanent and temporary antennas in South Park for future tests. Under the Proposed Action, AFRL would be able to install up to five antennas per year at South Park. These antennas would not exceed 70 feet in height. Some antennas would require a new sunken concrete base, while others could make use of existing concrete or gravel pads. The new concrete bases would remain for future use after an antenna is taken down. Coaxial, fiber, and electrical cables would be run from the antenna to containers on site where instrumentation and processing would occur. Cables would be run on the ground surface or buried 3 feet below the ground surface.

South Park Electrical Service and Substation 9 Upgrades. AFRL proposes to install a new 12,470-volt overhead power line to upgrade the electrical service to South Park as well as upgrade Substation 9. The power lines would be installed from Substation 9 to South Park. This action would include the demolition of existing overhead lines connected to the site. Additionally, transformers, power panels, and electrical lines would need to be installed or modified throughout the site. This electrical upgrade would be in direct support of the mission critical antenna projects at South Park.

South Park Water System Upgrades. AFRL proposes to repair and improve existing water lines buried beneath South Park. Water access at the site was shut off due to an unidentified leak. AFRL would repair this leak to restore water access and add additional water access points at the site. The upgrades would provide access to a sewer line and potable water for personnel use while working at South Park. Water access allows for washing antennas. It is anticipated that up to 5 acres of the ground surface would be disturbed for the water system upgrades.

South Park Permanent Facility Construction. AFRL proposes the construction of a new permanent facility at South Park. The proposed facility would include areas for personnel to access restrooms, drinkable water, air conditioning, Non-secure Internet Protocol Router/network access, usable electricity, and a designated parking area for personnel to park their vehicles on a regular basis.

2.3.2 No Action Alternative

Under the No Action Alternative, operations would continue as usual for Kirtland AFB, consistent with mission and management plans. Planned efforts would not increase over current operating levels and would not deviate from already approved activities. No new test activities would occur; this includes any expanded RDT&E operations that would pose new impacts on environmental resources. CEQ regulations (40 CFR Section 1502.14[c]) and the USAF EIAP (32 CFR Section

989.8[d]) require consideration of the No Action Alternative. Therefore, this alternative will be carried forward for detailed analysis in the PEA. However, the No Action Alternative would not meet the purpose of or need for the Proposed Action as described in **Section 1.2**.

2.4 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM FURTHER CONSIDERATION

The following alternatives were eliminated from further consideration based on the selection standards outlined in **Section 2.2** and other reasons as explained below.

2.4.1 White Sands Missile Range

White Sands Missile Range (WSMR) is located south of Albuquerque, New Mexico, approximately 100 miles from Kirtland AFB. WSMR is managed by the US Army and has an Environmental Impact Statement that covers range activities. WSMR is DoD's largest, fully instrumented, open-air (outdoor) range and provides the United States' Armed Forces, allies, partners, and defense technology innovators with the world's premiere RDT&E, experimentation, and training facilities to ensure our nation's defense readiness. All proposed actions in **Section 2.3.1** were considered at WSMR.

However, although WSMR could provide the land and airspace for the Proposed Action, the scheduling and availability of the range extremely limits the ability of users to accomplish mission tasks. Therefore, this potential alternative was considered but eliminated from further analysis.

2.4.2 Melrose Air Force Range

Melrose Air Force Range (Melrose) is located approximately 180 miles west of Kirtland AFB and is comprised of approximately 70,000 acres. Operations on Melrose also cover an area of 2,500 square miles of airspace. The primary focus for activities on Melrose is training, supporting daily air-to-ground and electronic combat training for approximately 3,400 F-16 wing sorties annually. Melrose is also used by the New Mexico Air National Guard, based at Kirtland AFB, and other United States and allied aircrew accounting for an additional 1,400 sorties annually. All proposed actions in **Section 2.3.1** were considered at Melrose.

However, the usage of Melrose would limit several proposed activities. Further, the configuration of the site severely limits how the range could be used and does not provide the ability to conduct both HEL and HPEM test activities in conjunction with targets and drones to the extent needed for mission tasks. Therefore, this potential alternative was considered but eliminated from further analysis.

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APPENDIX A

HISTORY OF AIR FORCE RESEARCH LABORATORY OPERATIONS AT KIRTLAND AIR FORCE BASE

Appendix A

Brief History of Air Force Research Laboratory Operations at Kirtland Air Force Base

The Department of Defense (DoD) Armed Services perform research and development to support the discovery of technologies to meet increasing threats and challenges encountered by the military under Title 10 of the United States Code Chapter 139. In 1949, the United States Air Force (USAF) established its own Special Weapons Center and test laboratory at Kirtland Field near Sandia Base, which eventually became the Air Force Weapons Laboratory (AFWL) in 1963 under the Air Force Systems Command (AFSC). AFWL conducted scientific research on weapons and their effects, as well as explored military uses of nuclear power, weapons, and support equipment seeking to reduce the vulnerability of United States systems to enemy weapons. In the 1960s, AFWL's work moved toward laser research with the establishment of the Airborne Laser Laboratory Program in the 1970s. In 1990, AFSC reorganized 13 laboratories across the country into four super laboratories and AFWL became Phillips Laboratory at Kirtland Air Force Base (AFB), devoted to space and missiles research and development. Then in 1997, the laboratories were reorganized again and named the Air Force Research Laboratory (AFRL), as it is known today. Two directorates of AFRL remained at Kirtland AFB to continue research in space (AFRL/RV) and directed energy (AFRL/RD). All current training activities and facilities are situated on lands owned by the USAF or on lands withdrawn from public use by the Bureau of Land Management or the United States Forest Service (USFS) and given to the USAF for military research, testing, and development activities.

Today, AFRL is the primary scientific research and development center for the USAF. AFRL's mission is to lead the discovery, development, and integration of affordable warfighting technologies for United States air, space, and cyberspace forces. With a workforce of more than 12,500 across 9 technology areas and 40 other operations across the globe, AFRL provides a diverse portfolio of science and technology ranging from fundamental to advanced research and technology development.

DIRECTED ENERGY DIRECTORATE

BACKGROUND

The AFRL/RD mission is to "Lead the discovery, development and delivery of directed energy science and technology for National Security." The research originally conducted by AFWL evolved into weapons that are very precise, can focus energy, cause minimal damage to surrounding personnel, and can counter threats employed by adversaries. Today AFRL/RD develops directed energy (DE) weapons to counter, disable, and attack adversary sources. As this technology develops, scientists and engineers expand the concepts to ensure they can work for the warfighter.

AFRL/RD specializes in high energy laser (HEL), high-power microwave (HPM), and high-power electromagnetic (HPEM) technology development. These areas of research offer the warfighter innovative technologies that enable a variety of non-traditional counter electronic and thermal effects that can be either lethal or non-lethal. HPM weapons create beams of electromagnetic energy over a broad spectrum of radio and microwave frequencies in both narrow- and wide-band with the intent of coupling/interacting with electronics within targeted systems either by causing damage or temporary disruption from which the system cannot self-recover in time to accomplish

its mission. HPEM systems enable low collateral damage methods to disturb, deny, or damage electronics contained in adversary systems or buildings. HEL systems enable pinpoint accurate methods to degrade or destroy adversary systems. These technologies operate by emitting high bursts of photons, but the damage mechanisms vary depending on the photon energies emitted. This vision of modern DE warfare is enabled by recent revolutionary advances and additional anticipated advances.

HISTORY OF OPERATIONS

High Energy Microwave Laboratory

Since its opening in 1993, a variety of counter electronic/HPM tests have been performed in the High Energy Microwave Laboratory (HEML). The following sections describe examples of tests that have historically occurred at the HEML.

HPEM Empirical Effects Test Activities. The AFRL/RD HPEM Effects Program conducts effects testing to improve weapons effectiveness for platforms needed by the warfighter to include the Tactical High-Power Microwave Operational Responder (THOR).

MAX POWER System Test Activities. These tests were part of a program to develop an Improvised Explosive Device neutralization system. The tests included integration of the HPM device on a Palletized Loading System vehicle at the HEML with antenna characterization and system demonstration outside at HERTF Canyon.

Ground Mobile HPM (GMHPM) Source Test Activities. The GMHPM System was a developmental system intended for the military counter-electronics mission. It was a self-contained HPM source, including an internal battery system and fixed horn antenna designed to defeat electronic systems. The tests included characterization of the system's output power and beam pattern, effects tests on targets, and an operational assessment of the system's potential military utility.

High Energy Research and Technology Facility and HERTF Canyon

HERTF has been operated for over 30 years by AFRL for the purposes of HPM source testing. It has developed safety processes to minimize potential negative impacts on licensed radio frequency (RF) services, as well as established safety controls for other potential hazards to test personnel and the public. AFRL has established and maintains the Manzano Mountain Controlled Firing Area agreement with the Federal Aviation Administration which contains specific safety requirements for the performance of HPM testing at the site. At the time of its construction, no facility such as HERTF existed in the free world, though several similar facilities exist in the Soviet Union. Research and development at high energy is needed not only to advance technology to the military application level, but to avoid technological surprises that may occur as energy thresholds are surpassed. At the time, it was thought that the Soviets were conducting an aggressive research and development program in an energy regime unexplored in the United States. HERTF made it feasible and economical for the United States to explore this energy regime and gain insight into possible Soviet activities.

High-Power Joint Electromagnetic Non-Kinetic System (HiJENKS) Program Test Activities. HiJENKS was a joint effort between AFRL and the Office of Naval Research (ONR) to integrate an HPM payload into an airborne platform. HiJENKS was a follow-on to the Counter-electronics High-Power Microwave Advanced Missile Project (CHAMP) Program. During tests, the HiJENKS

HPM device illuminated targets inside a facility near HERTF to determine effectiveness. One 10-kilowatt diesel generator was used to operate the payload for a total of 80 hours for these tests.

Frustration Canyon

Frustration Canyon has been the home of active denial testing since 1995 and has been used for other DE testing since the 2000s. The following sections describe examples of tests that have historically occurred at Frustration Canyon.

THOR Test Activities. THOR is an AFRL-developed HPM system to counter unmanned aerial systems (UASs). THOR was operated in Frustration Canyon to characterize its RF beam parameters and assess its effectiveness against UAS.

Active Denial Testing. The Active Denial System is a counter-personnel, non-lethal, directed energy weapon. Traveling at the speed of light, the energy strikes the subject and only reaches a skin depth of about 1/64th of an inch. It produces a heat sensation that within seconds becomes intolerable and forces the targeted individual to instinctively move.

Air Force Life Cycle Management Center Architecture and Integration Directorate Prototype Counter Unmanned Aerial System (CUAS) Phase 2B Test Activities. To counter threats to US bases and civilian airports posed by sUAS, these tests focused on understanding the capabilities and limitations offered by existing off-the-shelf HEL systems against UASs. The Counter Small Unmanned Aerial Systems (C-sUAS) tested were HEL systems designated Low-Cost CUAS for Targeting (LOCUST and the Kord HEL-Sword). Both the Blue Halo LOCUST and Kord HEL-Sword were ground-based, palletized HEL systems that incorporated mid-wave infrared, short wave infrared, visible electro-optical camera, target illuminating laser, and laser rangefinder. The C-sUASs were launched and flown from different locations in HERTF Canyon. Downed targets were immediately recovered. The laser was not propagated over the canyon walls or over the horizon.

Starfire Optical Range

The Starfire Optical Range (SOR), located in an isolated area of Kirtland AFB, has long been utilized as a test site by various agencies of the US Government. As part of Sandia Base, the area now known as SOR was the subject of a Memorandum of Understanding (MOU) between the Armed Forces Special Weapons Project and the US Atomic Energy Commission as early as 22 October 1952. Sandia Base, which was under the jurisdiction of the Armed Forces Special Weapons Project, was merged with Kirtland AFB in 1972. Subsequent modifications to the MOU made in 1957, 1958, and 1961 clearly defined the US Government's interest in the area for advanced research and development testing.

On 9 May 1969, the US Atomic Energy Commission (now the US Department of Energy) entered into an agreement with the AFWL to allow for the construction of an optical test range. SOR was established by the AFWL as the Sandia Optical Range as a major USAF facility for HEL research and development. SOR was chosen to be located at Kirtland AFB in part because the installation was the center of a region where a large amount of the nation's most advanced weapons research and development was conducted. The AFWL and Sandia National Laboratories are collocated at Kirtland AFB and Los Alamos National Laboratory and White Sands Missile Range are located with 150 to 300 kilometers of Kirtland AFB, all of which are heavily involved in the development of laser weapons systems. In addition, SOR is bound on the east, south, and north by the Manzano and Manzanita mountains which act as a shield to block any potential stray laser radiation from irradiating populated areas.

Facilities at the Sandia Optical Range initially were used to support beam propagation and effects research for HELs. State-of-the-art equipment was installed at SOR in 1970 and 1971. The Field Test Telescope, a three gim-balled telescope stabilized by two gyroscopes, featured hydraulically actual inner gimbals allowing for azimuth and elevation movements. The Field Test Telescope was designed to point an HEL beam generated by the laser to various static targets located at sites with ranges of 350 meters, 750 meters, and 1 mile types of DE technologies, such as microwaves and particle beams.

The Directed Energy Experimental Range (DEER) became the home of RADLAC II, a relativistic electron beam device in 1985. Until late 1990, RADLAC II was operated from existing SOR facilities by personnel of Sandia National Laboratories. RADLAC II demonstrated for the first time stable electron beam propagation in the air, a significant advance in the vulnerability and damage effects arena.

During 1985 to 1986, SOR was inactive with no laser propagation experiments being conducted. In late 1987, the 1.5-meter telescope facility became operational and a pulsed copper vapor laser operating at approximately 250 watts was utilized for the propagation of beams in the atmosphere 45 to 90 degrees above the horizon. The 1.5-meter telescope is currently in operation for atmospheric propagation experiments in support of the DoD's ground-based laser technology development program.

In December 1988, DEER was redesignated as SOR. Planning for a proposed 3.5-meter telescope facility was initiated in earnest in 1988 and an EA with a FONSI was completed and approved by Headquarters, Military Airlift Command in September 1990 for the construction of the 3.5-meter telescope SOR Facility. The most recent EA was signed in June 2001 and was for the construction of a 54,000 square foot Telescope/Atmospheric Compensation Laboratory (TAC Lab) within the USFS withdrawn area that included a coating chamber to provide an on-site capability for the required periodic recoating of the 3.5-meter telescope.

The following sections describe recent construction projects that have occurred or are currently underway at SOR.

Construction of a Satellite Assessment Laboratory for Space Situational Awareness (SALSSA). AFRL would construct up to a 6,500 square foot secure addition and renovate up to 4,000 square feet of the TAC Lab to provide a centralized facility for satellite analyses supporting space domain awareness (SDA) strategies. SALSSA would add office space and update restrooms, breakrooms, conference rooms, and the facility’s heating and cooling systems. SALSSA would require the relocation of the TAC Lab’s existing emergency generator. The area of ground to be disturbed would be approximately 10,000 square feet.

Renovation, Expansion, and Modernization of an Existing Optical Research Facility at SOR (Project Name: STARQUEST). STARQUEST would enable next-generation technologies in support of SDA applications for the United States Space Force (USSF) and DoD as well as future research. The goal of STARQUEST is to provide essential infrastructure for mission critical science and technology efforts. STARQUEST would upgrade the 40-year-old laboratory, add a new optics laboratory and office space (including a conference room and restrooms), and demolish the existing office trailer, shed, and storage facilities. The new construction would total approximately 2,500 square feet. Upgrades to the facility’s utilities would also occur. Construction would be anticipated to begin in 2025.

Space Technology and Research Laboratory Optical Resiliency Design (STARLORD) Project. STARLORD would increase emergency power capability at SOR enabling 24/7

operations and upgrade water capacity and storage to provide backup capability for potable use as well as critical cooling systems. STARLORD would also provide additional protection for critical infrastructure from damage during power brownouts and loss. SOR has had power interruptions for many years and the water system is at capacity and cannot support the modernization of SOR. The interruptions often cause equipment issues that need resolution. In the case of a power interruption, SOR must provide 24/7 security/fire watch personnel, thus affecting critical missions and the safety and security of personnel. The main requirements of STARLORD would include emergency power system upgrades at the site as well as the offsite substation; water distribution and storage system upgrades for a 5-day redundant water supply and a 54,000-gallon storage capacity; and installation of up to five 1-megawatt paralleled generators and their associated infrastructure to replace the existing generator system.

The following section describes an example testing that has historically occurred at SOR.

Low-Power Microwave Source Site Verification Test Activities. AFRL/RD previously conducted Low-Power Microwave Source Site Verification Tests near SOR and the 2-Mile Site. These tests compared the received power and what was expected from the Joint RF Effectiveness Models, allowing for AFRL/RD to verify the model's performance and understand how the selected site performs as a test site for HPM events. For proper utility of the site, AFRL/RD constructed a dirt road that was graded and a 75- by 75-foot ground pad. Additionally, AFRL/RD cleared a 10- by 10-foot patch directly outside of the SOR 2-Mile Site.

Outdoor Laser Propagation and Firing Area and Associated Laser Facilities

The Airborne Laser (ABL) Program at Kirtland AFB developed an ABL to destroy ballistic missiles during their boost phase. The ABL system, which flew aboard a modified Boeing 747 aircraft, incorporated an Active Ranging System (ARS) laser, a Track Illuminator Laser (TILL), and a Beacon Illuminator Laser (BILL); a laser-beam control system designed to focus the beam on a target; and a Chemical Oxygen Iodine Laser (COIL) designed to destroy the target. The ARS, a lower-power gas laser, was the first to fire, sending a beam to the proposed target using the returned signal to provide continuous, high-resolution tracking data. The TILL, a lower-power solid-state laser, produced a pulsed laser beam that illuminated the body of the missile and the beam from the BILL, also a lower-power solid-state laser, would bounce off the target and return to the aircraft where optical/software equipment would measure and compensate for distortion in the atmosphere between the aircraft and the target. Finally, the COIL, an HEL, would heat the skin of the missile causing it to deform resulting in internal depressurization, which caused the missile to explode.

The Advanced Laser Facility originally was used for research and development of chemical, electric, and hybrid lasers for ground-, airborne-, and space-based systems. It consisted of several laboratories; a central vacuum building; a device test areas; administrative areas; and a central heating, ventilation, and cooling building. The laser research conducted at the Advanced Laser Facility covered a wide spectrum of laser technology, including chemical and electric lasers. Some experiments focused on research and development of new lasers and laser systems, while others explored optical or other aspects of the field. Experiments concentrated on chemical laser research and development and range from small installations utilizing a few hundred square feet for a duration of several months to a relatively permanent installation utilizing over 1,000 square feet. Experiments also concentrated on electric laser and laser research and development and range from large, relatively permanent experiments to small installations that could be in place for only a few weeks. The following sections describe examples of tests and construction activities that have historically occurred at OLPFA.

Plasma Enhanced Chemical Vapor Deposition (PECVD) System. The purpose of the PECVD System was to provide AFRL researchers optical-quality dielectric thin films on gallium antimonide semiconductor laser material. These optical thin films were engineered to operate as anti- and high-reflective coatings on the semiconductor laser facets. It also provided silicon nitride electrical isolation thin film layers deposited on gallium antimonide for electrically pumped semiconductor lasers. These thin-film systems allow AFRL researchers to further their scientific advances in development of mid-infrared semiconductor lasers for military applications such as military asset self-protection.

Advanced COIL Test Stand (ACTS). ACTS was a COIL test stand that was set up to develop and research COIL technologies. ACTS evaluated new COIL technologies including chemical fuel mixtures, singlet oxygen generators, and injection nozzle designs.

High-Power Adaptive Directed Energy System (HADES). HADES originated as a Small Business Innovation Research effort to develop coherent beam combining technology. This effort started in 2011 and concluded in 2019. OLPFA's Range was used for some of the concept testing.

Laser System Integration Technology Program. The Laser System Integration Technology Program conducted research in laser vibration and thermal management to improve laser quality and efficiency. The program performed various experiments to examine efficient means to dissipate heat generated by HEL operations. Initially, experiments were performed to determine if ammonium carbamate could be used to cool laser devices. Ammonia was then generated from chemical dissociation of ammonium carbamate in a heat exchanger creating a cooling effect for the laser device.

Sonic Anemometer Turbulence Characterization Data Collection. The AFRL atmospheric propagation team conducted a series of data collections to aid in the development of a point turbulence characterization capability using sonic anemometers. The primary purpose of these sonic anemometer data collects was to (1) provide data for the evaluation of processing methods; (2) determine optimum sampling rates and effects of other measured meteorological parameters such as humidity; and (3) compare turbulence measurements based on sonic anemometer to path averaged and path resolved optically based techniques of determining turbulence parameters.

For the experiments comparing anemometer results to optically based devices, two test locations were utilized, the Environmental Laser Test Facility (ELTF)-R arroyo and ELTF-R remote sites. The first location was the ELTF-R arroyo because the infrastructure needed was already in place. Light emitting diode beacons were set up at the 1-or 2-Kilometer Sites and the receivers at the ELTF with anemometers placed at each end. The third location was the road leading to the remote sites, 4- to 7-kilometer berms. This path is flat dirt and provides a different geometry than the arroyo path. The initial path was 500 meters, but the road allows for paths up to 5 kilometers and anemometers were placed along the path length. Initial ELTF-R testing consisted of a few short (less than 1 day) data collections followed by a few longer duration data collections.

Temporary Tower Installation and Test. AFRL/RD has previously conducted laser propagation test utilizing the OLPFA Range. These tests propagated lasers between facilities and required atmospheric instrumentation to be installed along the path to collect data in support of model validation. As part of this test, AFRL/RD installed six temporary 10-meter-tall towers. The towers contained atmospheric diagnostic equipment used as inputs for laser propagation models. The tower heights were needed to get the atmospheric equipment up to the beam height since the

atmospheric parameters being measured varied depending on height above the ground. A 5-foot grounding rod was installed at each location.

Plant 1 in the Manzano Mountain Complex

AFRL began working in Plant 1 in 1994. The following sections describe examples of tests that have historically occurred at Plant 1.

Seismic Acoustic Detection and Ranging (SADAR) and SADAR-3D Prototype Installations. SADAR and SADAR-3D prototype installations were required to test developmental prototype sensor arrays to localize and identify equipment/activity in underground facilities. SADAR and SADAR-3D were passive (collect only) seismic detection systems composed of an array of 3-inch by 3-inch by 3-inch seismic sensors to point a vector to a noise (vibration) source (walkers, vehicles, etc.). 3D added the capability to better localize underground activity such as digging or tracking movement in underground facilities.

Propagation High Energy Electron and Nonlinear Interaction Experiments (PHEENIX). The objective of this ultra-short pulsed laser (USPL) research was to demonstrate a femtosecond laser capability to generate militarily relevant plasmas. The focus of the work was on generating RF from ultra-short pulse laser interactions with various materials, both conductors and insulators. Plant 1 houses a state-of-the-art laser system designed to facilitate this research.

SPACE VEHICLE DIRECTORATE

BACKGROUND

AFRL/RV served as the USAF's center of excellence for space technology research and development until it was reorganized under the USSF in 2020. The directorate develops and transitions space technologies to provide space-based capabilities. Primary mission activities include space-based intelligence, surveillance and reconnaissance; space domain awareness; space communications, position, navigation and timing; and defensive space control (protecting space assets from man-made and natural effects). AFRL/RV leverages commercial, civil, and other government resources to stay one step ahead in space and to ensure the United States' advantage.

HISTORY OF OPERATIONS

South Park Antenna Field

The South Park Antenna Field (South Park) was first established as the Fixed Panel Array Site following the Fixed Panel Array EA in 2006. At that time, it was to be a passive, fixed panel array experiment area on approximately 15 acres to establish a robust capability to quantify the accuracy of sensing tools in a realistic test environment. Peripheral structures with power and Local Area Network, concrete and gravel pads of various sizes up to 200 feet long, and some green metal structures were erected to support satellite calibration activities from space. In 2019, AFRL/RV assumed responsibility for the site and built upon the existing infrastructure to install two satellite communications antennas. At this point, the site became the South Park and began active transmissions.

The following sections describe examples of tests and construction activities that have been approved to occur at South Park since 2019.

Installation of 13 Meter Antenna for National Space Test and Training Complex. AFRL is installing a 13-meter parabolic dish antenna in South Park. The antenna will be enclosed in a radome 68 feet in diameter (widest point) and 55 feet tall. All support equipment for the antenna will be within the radome. The project also requires installation of a concrete pad approximately 60 by 60 feet and electrical and communication line modifications at the site. Trenching between the concrete pad and the tower on Pad 1 will be performed to tie in the 13-meter system with the site network. Conduit will be installed in a trench and mated to the existing conduit system and buried. Fiber optic cable will be pulled through the conduit to connect the pad to the site's fiber drop.

Space Development Agency Optical Ground Entry Point. The Space Development Agency selected Kirtland AFB as one of the four optimal locations for an optical ground station. An existing concrete pad required modification to accommodate the foundation and anchoring of the telescope. An 8- by 10-foot CONEX was placed directly adjacent to the concrete pad to house network and modem equipment. On the concrete pad, a small structure was built to house the optical telescope. The telescope is roughly 20 feet off ground level. Fencing was placed in accordance with designated protection levels. The system was designed to incorporate its own backup generator to provide reliable power to the system.

USSF Space Rapid Capability Office (SpRCO) Satellite Communication Augmentation Resource (SCAR) Test and Site Construction for Test. The SpRCO proposes to use South Park for initial qualification and subsequent acceptance testing of the SCAR systems. The systems would be tested as units comprised of four transportable phased-array antennas (BADGERs) and a Mission Support CONEX. The systems would augment the increasingly strained capacity of the Satellite Control Network, a legacy satellite control system that supports the communication and command and control of satellites operated by the DoD and other government agencies. Major on-site activities would include transition and reception of satellite communication signals, failure mode operations, as well as formal testing.

Skywave Technologies Laboratory

The Digital Ionospheric Sounding System (DISS) Site was relocated from Hanscom AFB in Massachusetts to Kirtland AFB as a result of the Base Realignment and Closure Commission’s 2005 decision. This site was needed by AFRL researchers and customers, such as the Air Force Weather Agency (AFWA) who sponsor the deployment and support of ionospheric sounders and subsequently use the data in various models.

The original site proposal included a 30- by 30-foot air-conditioned facility to house electronic equipment, computers, a small office and workshop area, and spare part storage. A concrete pad adjacent to the building supports a 40-foot trailer with connections to power and communication lines, and a 16-square foot concrete pad for a small satellite dish was also required. The testbed was to have up to 100-foot antenna towers for transmitters and space for receiver antennas. All antennas required guywires. DISS housed a high frequency ionospheric radar system capable of making measurements of the overhead ionosphere. It was both an active transceiver (radar), as well as a passive receiver system.

The facility was not constructed under the original request, only the testbed, concrete pads that housed portable trailers, and limited infrastructure were constructed. In 2012, a 101-foot tall digisonde antenna was installed on the DISS Site. In 2018, the requirement to have a 3,500-square foot facility on-site reemerged and in 2023 the Skywave Technologies Laboratory was constructed.

Improved Solar Observing Optical Network

The facility was constructed in 2012 to house the Improved Solar Observing Optical Network (ISOON) telescope. The telescope was designed and constructed over a period of more than 10 years at the Sacramento Peak Observatory in southern New Mexico by an AFRL detachment. The telescope was a joint project between AFRL and the National Solar Observatory, to act as a replacement for an aging solar optical network run by the AFWA for operational space weather applications. In 2014, the AFWA decided not to proceed with ISOON, and the building and telescope were reverted to AFRL. The telescope has been conducting solar observations since 2012.

The following sections describe examples of tests and construction activities that have historically occurred at ISOON.

Installation of 40-Foot-Tall Antenna. AFRL previously installed a 40-foot-tall antenna within the fenced area of the ISOON Facility. This equipment required 36-inch stakes driven into the ground to anchor the antenna. The antenna receives signals transmitted from an AFRL site on the east coast. Data collected at this site assists with research advancing high frequency communication data rates, range, and reliability.

Installation of Variometer (Magnetometer) Station. AFRL previously installed and currently operates a prototype Variometer (Magnetometer) Station west of ISOON. This station was part of a program to provide the USAF with state-of-the-art monitoring of the Earth's magnetic field. It required the installation of concrete piers to mount the instruments.

APPENDIX B

INTERAGENCY AND INTERGOVERNMENTAL COORDINATION FOR ENVIRONMENTAL PLANNING AND PUBLIC INVOLVEMENT MATERIALS

Appendix B

Interagency and Intergovernmental Coordination for Environmental Planning and Public Involvement Materials

Federal, State, and Local Agencies – Scoping Letter Distribution List

Mr. Matt Wunder, Chief
Ecological & Environmental Planning
New Mexico Department of Game and Fish
PO Box 25112
Santa Fe NM 87504

Ms. Patricia Mattingly, Regional Director
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Southwest Regional Office
1001 Indian School Road NW
Albuquerque NM 87104

Ms. Sabrina Flores, District Manager
Bureau of Land Management
Albuquerque District Office
100 Sun Avenue NE
Pan American Building, Suite 330
Albuquerque NM 87109-4676

Ms. Becky Collins, Regional Environmental Officer
Office of Environmental Policy and Compliance , Albuquerque Region
US Department of the Interior
1001 Indian School Road NW, Suite 348
Albuquerque NM 87104

Mr. Rob Lowe, Regional Administrator
Federal Aviation Administration
Southwest Region
10101 Hillwood Parkway
Fort Worth TX 76177

Mr. J. Xavier Montoya
State Conservationist
Natural Resources Conservation Service
Albuquerque Service Center
100 Sun Avenue NE, Suite 160
Albuquerque NM 87109

Ms. Danielle Galloway, Chief
Environmental Resources Section
US Army Corps of Engineers - Albuquerque District
4101 Jefferson Plaza NE
Albuquerque NM 87109

Dr. Earthea Nance, Regional Administrator
US Environmental Protection Agency
Region 6
1201 Elm Street, Suite 500
Dallas TX 75270

Ms. Cheryl Prewitt
Regional Environmental Coordinator
US Forest Service, Southwestern Region
333 Broadway Boulevard SE
Albuquerque NM 87102

Board of Directors
Mid-Region Council of Governments
809 Copper Avenue NW
Albuquerque NM 87102

Mr. Jeff M. Witte, Director/Secretary
New Mexico Department of Agriculture
MSC 3189, Box 30005
Las Cruces NM 88003

Mr. Bruce Baizel, Director
Compliance and Enforcement Division
Office of General Counsel & Environmental Policy
New Mexico Environment Department
PO Box 5469
Santa Fe NM 87502-5469

Ms. Shirley M. Ragin, Interim County Manager
Bernalillo County Manager's Office
415 Silver SW, 8th Floor
Albuquerque NM 87102

Mr. Jim Sanderson
Department of Energy
National Nuclear Security Administration
Headquarters General Council (NA-GC-10)
1000 Independence Avenue SW
Washington DC 20585

Ms. Adria Bodour, NEPA Compliance Officer
Department of Energy
National Nuclear Security Administration
Sandia Field Office
PO Box 5400
Albuquerque NM 87187

Ms. Kelly Bowles, NEPA Program Manager
Sandia National Laboratories, New Mexico
PO Box 5800, MS 0915
Albuquerque NM 87185

The Honorable Martin Heinrich
Senator
United States Senate
303 Hart Senate Office Building
Washington DC 20510

The Honorable Ben Ray Luján
Senator
United States Senate
498 Russell Senate Office Building
Washington DC 20510

The Honorable Gabe Velasquez
Representative
United States House of Representatives
1517 Longworth House Office Building
Washington DC 20515

The Honorable Melanie Stansbury
Representative
United States House of Representatives
1421 Longworth House Office Building
Washington DC 20515

The Honorable Teresa Leger Fernandez
Representative
United States House of Representatives
1432 Longworth House Office Building
Washington DC 20515

Ms. Stephanie Garcia Richard
Commissioner of Public Lands
New Mexico State Land Office
310 Old Santa Fe Trail
Santa Fe NM 87501

Ms. Melanie A. Kenderdine, Cabinet Secretary
New Mexico Energy, Minerals and Natural Resources Department
Wendell Chino Building
1220 South St. Francis Drive
Santa Fe NM 87505

Commissioners
Bernalillo County Board of Commissioners
One Civic Plaza NW, 10th Floor
Albuquerque NM 87102

Councilmember
Albuquerque City Councilmembers
PO Box 1293
Albuquerque NM 87103

Mr. Shawn Sartorius, Field Supervisor
New Mexico Ecological Services Field Office
2105 Osuna Road NE
Albuquerque NM 87113-1001

Ms. Staci Drangmeister, Director of Communications and Marketing
City of Albuquerque: Communications and Marketing Department
PO BOX 1293
Albuquerque NM 87103

Mr. Alan Valera, Director of Planning
City of Albuquerque: Planning Department
Plaza Del Sol Building
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Joint Land Use Study Memorandum of Understanding – Scoping Letter Distribution List

Mr. Jim Bordegaray, Director
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State Historical Preservation Office – Scoping Letter Distribution List

Ms. Michelle Ensey, Interim State Historic
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Department of Cultural Affairs
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Native American Tribes – Scoping Letter Distribution List

Governor Randall Vicente
Pueblo of Acoma
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Pueblo of Cochiti
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Chairman Timothy L. Nuvangyaoma
The Hopi Tribe
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Governor Max Zuni
Pueblo of Isleta
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Isleta NM 87022

Governor Peter Madalena
Pueblo of Jemez
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Governor Wilfred Herrera, Jr.
Pueblo of Laguna
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Laguna NM 87026

President Thora Walsh Padilla
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Mescalero NM 88340

Governor Nathaniel Porter
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Santa Fe NM 87506

President Buu Nygren
Navajo Nation
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Window Rock AZ 86515

Governor Larry Phillips, Jr.
Ohkay Owingeh
PO Box 1099
San Juan Pueblo NM 87566

Governor Craig Quanchello
Pueblo of Picuris
PO Box 127
Peñasco NM 87553

Governor Jenelle Roybal
Pueblo of Pojoaque
78 Cities of Gold Road
Santa Fe NM 87506

Governor Felix Chaves
Pueblo of Sandia
481 Sandia Loop
Bernalillo NM 87004

Governor Anthony Ortiz
Pueblo of San Felipe
PO Box 4339
San Felipe Pueblo NM 87001

Governor Christopher Moquino
Pueblo of San Ildefonso
02 Tunyo Po
Santa Fe NM 87506

Governor Myron Armijo
Pueblo of Santa Ana
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Santa Ana Pueblo NM 87004

Governor J. Michael Chavarria
Pueblo of Santa Clara
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Española NM 87532

Governor Frank P. Nieto
Pueblo of Santo Domingo
PO Box 99
Santo Domingo Pueblo NM 87052

Governor Fred L. Romero
Pueblo of Taos
PO Box 1846
Taos NM 87571

Governor Milton Herrera
Pueblo of Tesuque
Route 42 Box 360-T
Santa Fe NM 87506

Chairwoman Kasey Velasquez
White Mountain Apache Tribe
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Whiteriver AZ 85941

Governor E. Michael Silvas
Ysleta del Sur Pueblo
P119 S Old Pueblo Road
Ysleta del Sur TX 79917

Governor Ben Shije
Pueblo of Zia
135 Capitol Square Drive
Zia Pueblo NM 87053

Governor Arden Kucate
Pueblo of Zuni
PO Box 339
Zuni NM 87327

Chairman Manuel Heart
Ute Mountain Ute Tribe
PO Box JJ
Towaoc CO 81334

Chairwoman Jennifer Heminokeky
Fort Sill Apache Tribe of Oklahoma
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Apache OK 73006

Chairman Durell Cooper
Apache Tribe of Oklahoma
PO Box 1330
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Chairman Lawrence SpottedBird
Kiowa Tribe of Oklahoma
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Carnegie OK 73015

Chairman Forrest Tahdooahnippah
Comanche Nation of Oklahoma
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President Misty M. Nuttle
Pawnee Nation of Oklahoma
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Pawnee OK 74058

Chairman Terry Rambler
San Carlos Apache Tribe
PO Box 0
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Chairman Melvin J. Baker
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All Pueblo Council of Governors
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Mr. Joshua Madalena, Executive Director
Five Sandoval Indian Pueblos
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Rio Rancho NM 87144

Mr. Gilbert Vigil, Executive Director
Eight Northern Indian Pueblos Council
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Honorable Crystalyne Curley
Speaker of the Navajo Nation
25th Navajo Nation Council
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Window Rock AZ 86515

US Fish and Wildlife Service - Scoping Letter Distribution List

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