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AIR FORCE RESEARCH LABORATORY (AFMC)

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Air Force Research Laboratory, Directed Energy Directorate  
3550 Aberdeen Ave. SE  
Kirtland AFB, NM 87117

Ms. Genevieve Salmonson, Director  
Office of Environmental Quality Control  
235 South Beretania Street, Suite 702  
Honolulu, Hawaii 96813

Dear Ms. Salomonson,

The Air Force Research Laboratory (AFRL) has prepared the draft environmental assessment (EA) for The Modernization of Maui Space Surveillance Site (MSSC) facilities and Equipment at Haleakala, Maui Hawaii and anticipates a Finding of No Significant Impact (FONSI) determination. Please publish the draft EA and draft FONSI on the OEQC site for notice of availability for public comment on this project in the February 23, 2015 Environmental Notice. We have enclosed a completed OEQC Publication form, four copies of the draft EA and draft FONSI, and the project summary on a disk. Please call the Mr. Joseph Volza, at 505-846-4050 if you have any questions.

Sincerely,

Michelle L. Hedrick, DRIV  
Lead Test & Environmental Engineer

Attachments:  
OEQC Publication Form  
Draft EA (4copies)  
Draft FONSI (4 copies)  
Project Summary (disk)

**NEPA Action EA/EIS  
Publication Form**

**The Modernization of Maui Space Surveillance Site (MSSC) Facilities and Equipment,  
Haleakala, Maui, HI DEA (AFONSI)**

**Island:** Maui

**District:** Haleakala

**TMK:**

**Permits:** N/A

**Applicant or Proposing**

**Agency:** Det 15, Air Force Research Laboratory, 550 Lipoa Parkway, Kihei, HI 96753

Contact: Jim Gardner, 808-891-7748

**Approving**

**Agency:**

Air Force Research Laboratory, 3550 Aberdeen SE, Kirtland AFB, New Mexico 87117

Contact: Joseph Volza, 505-846-4050

**Consultant:** N/A

**Status:** Statutory 30-day public review and comment period starts; comments are due by March 25, 2015. Please send comments to the applicant, approving agency.

The Air Force Research Laboratory has prepared an Environmental Assessment (EA) for a proposed action to modernize the current facilities with updated equipment at the Maui Space Surveillance Complex (MSSC) located on Mount Haleakalā, Maui, HI. This modernization effort is a continuation of previously performed activities that support research and development associated with space observation. The modernization will include renovations of buildings and structures as needed to maintain state of the art facilities without increasing the current building footprint at MSSC. This modernization will also include equipment upgrades, replacement of existing domes, and the replacement of sensors in the form of cameras and lasers. One of the new sensors is a Frequency Addition Source of Optical Radiation (FASOR) laser that will be used to create an artificial guide star in the earth's sodium layer, similar to systems in use at other astronomical observatories, needed to enhance space object viewing. It is anticipated that no significant long-term adverse environmental impacts on Biological Resources, Cultural Resources, Visual Resources, Land Use, Air Quality, Infrastructure, Traffic and Roads, Utilities, Public Health and Safety, Hazardous Materials and Waste, and Socioeconomics would result from the proposed action.

## **COVER SHEET**

**Lead Agency for the EA:** United States Air Force Research Laboratory, Directed Energy Directorate (AFRL/RD Detachment 15, Maui)

**Title of Proposed Action:** Environmental Assessment (EA) for the Facility and Equipment Modernization at the MSSC, Haleakalā, Maui, Hawaii

**Affected Jurisdiction:** U.S. Department of Defense and Air Force Research Laboratory Maui Space Surveillance Site, Haleakalā, Maui, Hawaii

**Designation:** Environmental Assessment

### **For Additional Information:**

#### **Air Force Research Laboratory Detachment 15**

(AFRL/DET 15 Maui)  
550 Lipoa Parkway,  
Kihei, Hawaii 96753

### **ABSTRACT:**

This Environmental Assessment (EA) has been prepared for a proposed action to modernize the current facilities with updated equipment at the Maui Space Surveillance Complex (MSSC) located on Mount Haleakalā, Maui, HI. The modernization will include renovations of buildings and structures as needed to maintain state of the art facilities without increasing the current building footprint at MSSC. This modernization would include equipment upgrades, replacement of existing domes, and the replacement of sensors in the form of cameras and lasers. One of the new sensors is a Frequency Addition Source of Optical Radiation (FASOR) laser that will be used to create an artificial guide star in the earth's sodium layer, similar to systems in use at other astronomical observatories, used to enhance space object viewing.

This modernization effort is a continuation of previously performed activities that support research and development associated with space observation, illumination, and ranging capabilities. It is anticipated that no significant long-term adverse environmental impacts on Biological Resources, Cultural Resources, Visual Resources, Land Use, Air Quality, Infrastructure, Traffic and Roads, Utilities, Public Health and Safety, Hazardous Materials and Waste, and Socioeconomics would

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## Environmental Assessment for Modernization of Facilities and Equipment at MSSC, Haleakala Maui Hawaii

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result from the proposed action.

The overall benefit would allow the Air Force to meet state-of-the-art space observation, illumination, and ranging capabilities at MSSC by operating the proven sodium guide star laser from the Advanced Electro-Optical System (AEOS) 3.6 m telescope; and replacing and repairing aging telescope domes on the site. The MSSC mission is required for the space monitoring network of the U.S. Air Force serving a dual role:

- 1) Providing electro-optical facilities for the collection of data from suborbital, near earth, and deep-space objects; and
- 2) Serving as a test site for sensor/laser research.

Additionally, the installation will provide the University of Hawaii (UH), Institute for Astronomy (IfA), with enhanced capabilities through facility sharing agreements with the USAF.

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Environmental Assessment for Modernization of Facilities and Equipment at MSSC,  
Haleakala Maui Hawaii

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## **ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED MODERNIZATION OF MAUI SPACE SURVEILLANCE COMPLEX FACILITIES/EQUIPMENT**



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## **ACRONYMS AND ABBREVIATIONS**

°c	degree Celsius
°f	degree Fahrenheit
ac	acre
AEOS	Advanced Electro-Optical System
AFRL	Air Force Research Laboratory (U.S.)
AMOS	Air Force Maui Optical and Supercomputing Site
ATST	Advanced Technology Solar Telescope
CDUP	Conservation District Use Permit
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CZM	Coastal Zone Management
dB	decibels
dBA	decibels A-weighted scale for sound level
DLNR	Department of Land and Natural Resources
DBEDT	Department of Business, Economic Development and Tourism
DoD	Department of Defense
DOE	Department of Energy (U.S)
DOH	Department of Health
DRMO	Defense reutilization and Marketing Office
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency (U.S.)
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FONSI	Finding of No Significant Impact
GEODSS	Ground-Based Electro-Optical Deep Space Surveillance System
HAR	Hawai'i Administrative Rules
HAZMAT	Plan Hazardous Material Emergency Planning and Response Plan
HECO	Hawaiian Electric and Light Company
HRS	Hawai'i Revised Statutes
IfA	Institute for Astronomy
INRMP	Integrated Natural Resources Management Plan
kV	kilovolt
kW	kilowatt
LRDP	Long Range Development Plan
LU RE	Lunar and Satellite Ranging Observatory
MAGNUM	Multi-color Active Galactic Nuclei Monitor
MCS	Mirror Coating Shop
MECO	Maui Electrical Company, Inc.
MSO	Kenneth Mees Solar Observatory
MSSC	Maui Space Surveillance Complex
MSSS	Maui Space Surveillance System
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act

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## Environmental Assessment for Modernization of Facilities and Equipment at MSSC, Haleakala Maui Hawaii

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NHPA	National Historic Preservation Act
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
RCRA	Resource Conservation and Recovery Act (Federal)
SHPD	State Historic Preservation Division
SHPO	State Historic Preservation Office
SIHP	State Inventory of Historic Places
UH	University of Hawai'i
U.S.	United States
USA CE	U.S. Army Corps of Engineers
USC	United States Code
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

## **Glossary of Hawaiian Words**

'ahinahina	Silversword plant
'ua'u	Hawaiian Dark-rumped Petrel
Ali'I	royalty
Haleakalā	House of the Sun
IWI	bones
Kahuna	priest, clergyman
Kanaka maoli	true aboriginal person
ko'I	adze, a bladed tool
Kumu Hula	hula teacher
Kupuna	elder
Makahiki	ancient annual festivals
Mana	supernatural or divine power
Nene	Hawaiian Goose
Pa Ka'oao	White Hill
Paliku	an order of priesthood
Pu'u Ula'ula	Red Hill
wahi pana	legendary place

## **CHAPTER 1.0 PURPOSE OF AND NEED FOR ACTION**

### **1.1 Proposed Action**

The U.S. Air Force, Air Force Research Laboratory, Detachment 15 (AFRL/DET 15) proposes to modernize the facilities and equipment at the Maui Space Surveillance Complex (MSSC) located at Haleakalā, Maui Hawaii, Figure 1. In this action, AFRL proposes to repair, maintain and update current buildings and equipment within their existing footprint over the next five - ten years. Additionally, AFRL/DET 15 proposes the installation and operation of a sodium laser known as Frequency Addition Source of Optical Radiation (FASOR) for enhanced research and development activities associated with space observation, illumination, and ranging capability by the spring of 2015.

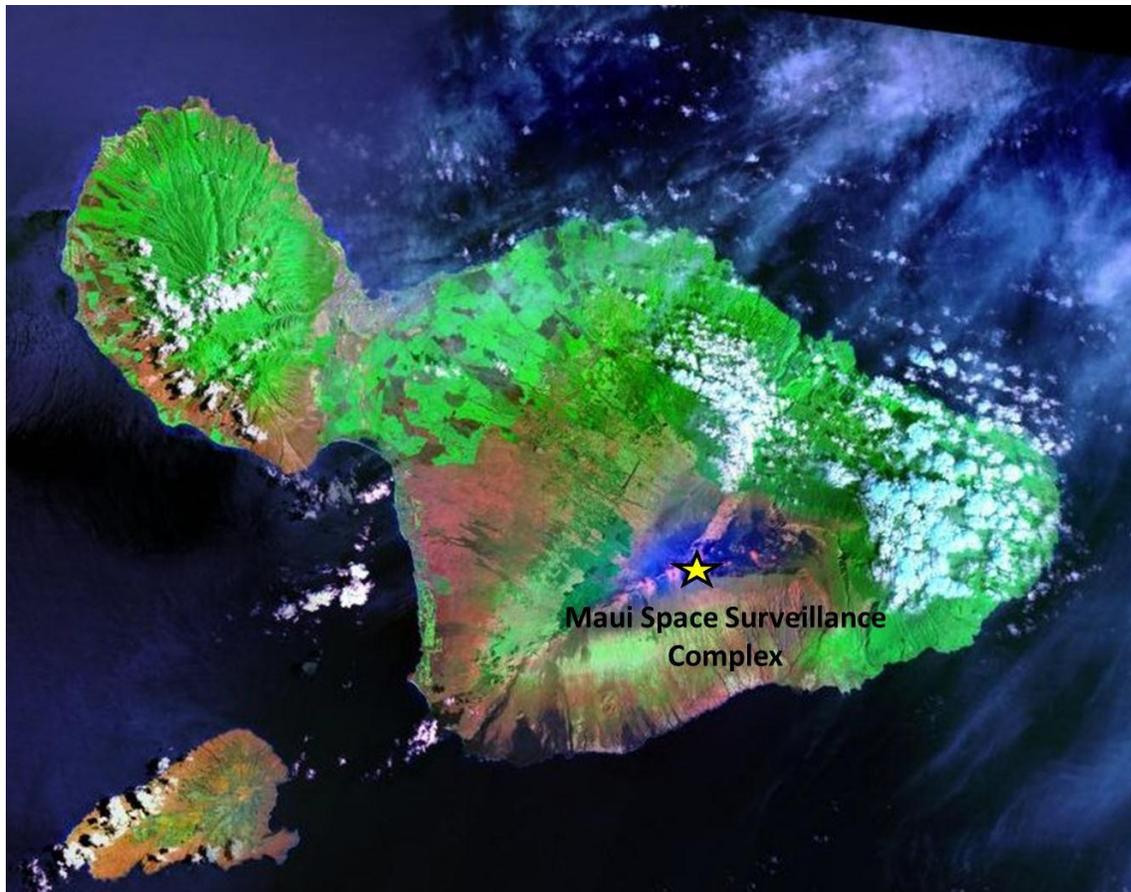


Figure 1: The Maui Space Surveillance Complex (MSSC) is located on the top of Mount Haleakalā on Maui Hawaii.

## 1.2 Background

The AFRL/DET 15 currently operates three main facilities within the Maui Space Surveillance Complex and a variety of visible and invisible lasers and sensors for the purpose of conducting research and development (R&D) for tracking, ranging, illuminating, communicating with, and observing space objects. These existing and past research efforts have included the use of lasers focused on satellites, stars, space debris, missiles, spacecraft and static ground targets. These activities and all MSSC operations have been evaluated for their impact on the environment, for adverse impacts on Hawaiian resources or threatened and endangered species, and for compliance with the National Environmental Policy Act (NEPA)(42 United States Code (USC) §4321 *et seq.*) and the implementing regulations of the Council on Environmental Quality (CEQ) (40 Code of Federal Regulations (CFR), 2014).

## 1.3 History of Laser Activities at the MSSC

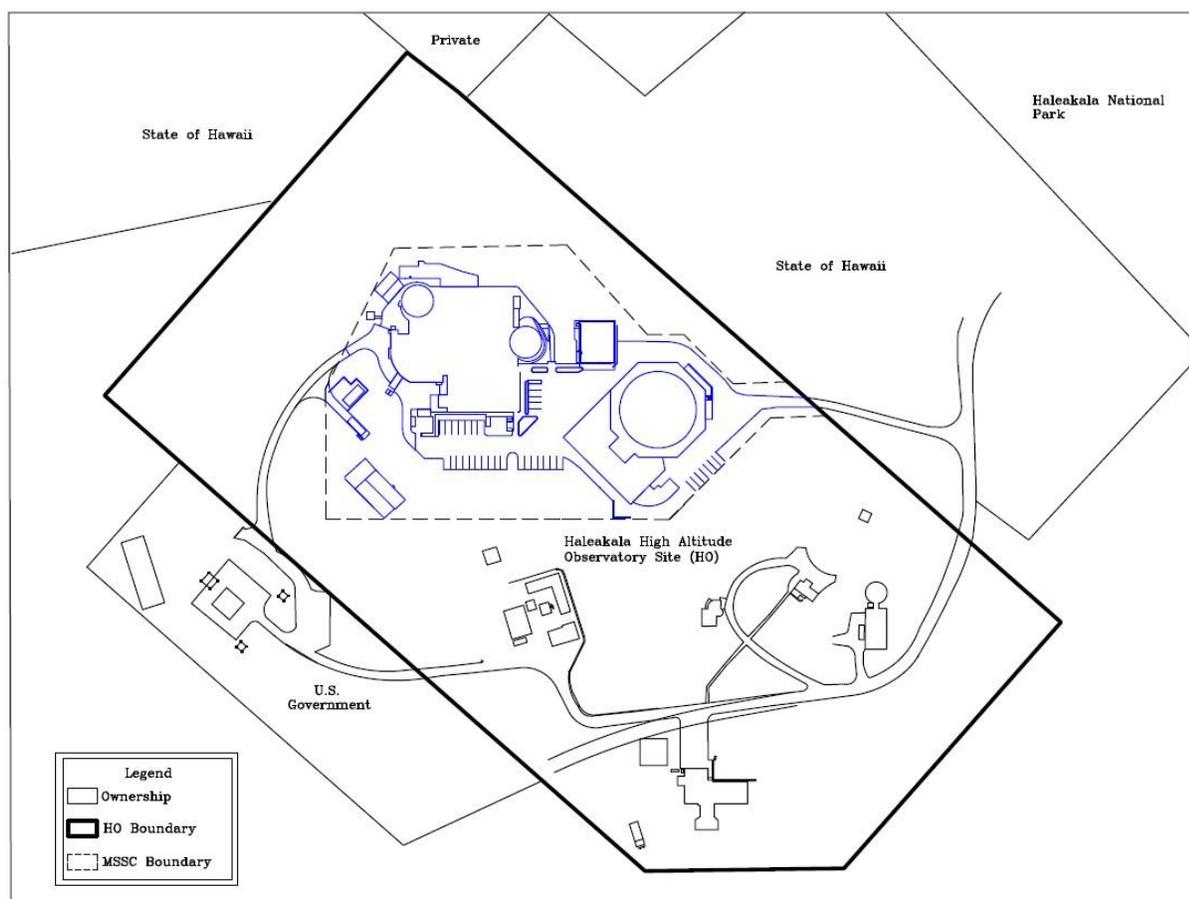
The MSSC was established by the Advanced Research Projects Agency (ARPA) under the Department of Defense (DoD), Public Law 85-325 in February of 1958. Some of ARPA's programs formed the foundation of sensor, surveillance and directed energy research and development; particularly in the study of radars, infrared sensing, and x-ray/gamma ray detection. The first telescope facility was constructed in 1963. Around 1972, routine Midcourse Optical Station missions were performed using directed energy sensors for tracking and collecting data from missiles and other targets. Additional telescopes were installed and the use of directed energy laser sources to sense track and collect data has continued to the present time. This research has led to significant discoveries in the fields of telecommunications, signal processing, and space object identification and imaging.

The most prominent structure at the MSSC is the Advanced Electro-Optical System (AEOS) telescope, designed and built by the USAF in 1995. AEOS houses a 3.67 meter (12 foot) diameter telescope mirror, considered the largest and most sensitive telescope in the DoD. It provides superb spatial and temporal resolution and atmospheric measurement capabilities. Its sensors produce simultaneous images in the visible and infrared spectrum, and it has the capability to track both satellites and missiles. This world class national asset was used by NASA when they suspected a problem with the Passive Thermal Control System on the Space Shuttle Mission, STS-134 in 2011. The AFRL/DET 15 team was able to discover a leak that helped NASA formulate a response that contributed to the health of NASA's STS 134, a \$150B asset, and the safety of 6 astronauts.

The MSSC is an integral part of the space monitoring network of the U.S. Air Force serving a dual role: an electro-optical facility for the collection of imagery and space situational awareness data from suborbital, near earth, and deep –space objects, supporting real-world operations; and a test site for sensor/laser technology research. The MSSC is located in an area known as Science City or Haleakalā High Altitude Observatory (HO) site, located just outside Haleakalā National Park on the peak of Mount Haleakalā at an altitude of 3050 m (10,010 feet) on the Island of Maui. The HO site is an 18-acre parcel of land ceded to the University of Hawai'i in 1961 through State of Hawai'i Executive Order 1987. MSSC comprises approximately 4.4 acres of land leased by the United States Air Force and owned by the University of Hawai'i. Initial construction at the MSSC site occurred in 1963 and is currently operated by the AFRL/DET15. MSSC is adjacent to the boundary

of Haleakalā National Park and the Kula Forest Reserve, Figure 2.

Another major part of the MSSC is the Ground-Based Electro-Optical Deep Space Surveillance (GEODSS) System, which is operated for the Air Force Space Command, Detachment 3. The GEODSS at HO is one of three operational sites in the world performing ground-based optical tracking of space objects. The GEODSS site performs its mission using three powerful telescopes; low light level, electro-optical cameras; and high speed computers. Detachment 3 uses three, 1-meter telescopes with a 1.68-degree field of view. GEODSS telescopes primarily operate between civil sunset and civil sunrise, just before all ambient light is out of the atmosphere. The telescopes are able to see objects 10,000 times dimmer than the human eye can detect.



**Figure 2: The US Air Force operates the MSSC which is located within the Haleakalā High Altitude Observatory Site (HO). The HO site is located adjacent to State of Hawai'i land and the Haleakalā National Park.**

### 1.4 Purpose and Need for the Proposed Action

The purpose of this action is for AFRL/DET 15 to modernize research equipment and facilities in order to continue meeting its DoD operational requirements and research objectives. The MSSC mission is required for the space monitoring network of the U.S. Air Force serving a dual role:

facilities for the collection of electro-optical data from suborbital, near earth, and deep-space objects and as a test site for sensor/laser research.

## **1.5 Relevant Resources and Issues**

This EA focuses on the following environmental resources and issues of concern:

- Land Use/Noise
- Air Quality
- Infrastructure, Traffic and Roads
- Hazardous Materials/Waste
- Biological Resources
- Cultural Resources to include View Shed
- Safety
- Cumulative Impacts

Impacts on Land Use, Water Quality, Socioeconomics, Geology and Soils Resources are deemed to be negligible and are not analyzed in detail. The primary environmental impacts of this action will be a temporary increase in vehicle traffic and construction activities on the site as a result of dome refurbishment and upgrade; and increased visible laser beam activities from the AEOS telescope due to installation of the FASOR Sodium Guide Star instrument. Impacts on all other environmental resources will be minimal and are discussed below.

## **1.6 Objectives of the Proposed Action**

Objective 1:

Modernization of current facilities to include replacement, renovation, repair, and maintenance of the existing facilities, within the existing footprint.

Objective 2:

Modernization and upgrade of equipment and instrumentation at MSSC to accomplish state-of-the-art space observation, illumination, and ranging capabilities. This objective includes the installation of new cameras and lasers to support operational requirements. One of the primary lasers to be installed would be the FASOR Sodium Guide Star laser.

## **1.7 Purpose of this Document**

This Environmental Assessment (EA) was prepared in accordance with NEPA, as amended (42 USC §§4321 *et seq.*); CEQ regulations, as amended (40 CFR Chapter V Parts 1500 *et seq.*; Department of the Air Force Environmental Impact Analysis Process (32 CFR Part 989); the Hawaii Environmental Policy Act (Chapter 343, Hawaii Revised Statutes (HRS); and the Hawaii Administrative Rules (HAR)(Title 11, Chapter 200, HAR). This EA identifies the purpose and need for the proposed action, reasonable alternatives, existing environmental

conditions, environmental consequences, and measures to avoid or minimize potential impacts. Although the proposed addition of new research equipment and renovations to existing MSSC facilities do not change land use, their siting on state land within a historic district necessitates review in accordance with Chapter 343, HRS.

## **1.8 Decision(s) to be Made**

The decision to be made by AFRL is whether or not to pursue the renovations and upgrades of current facilities and equipment with a finding of no significant impact (FONSI), determine if an EIS needs to be prepared or to do nothing and continue current operations with existing technologies, equipment and buildings.

## **1.9 Regulatory Overview and Required Permits/approvals**

A number of Federal laws and associated consultations are relevant to analyzing the Proposed Action and its potential impact on the environment. These are discussed below.

### **National Environmental Policy Act (NEPA):**

NEPA establishes national environmental policy and goals for the protection, maintenance, and enhancement of the environment and requires all Federal government agencies to assess the environmental impacts of proposed federal agency actions prior to their execution. To determine if a proposed Federal action would have significant environmental impacts, NEPA requires that a document be prepared to assess the potential impacts and examine alternative actions. As indicated in the introduction of this chapter, this EA document is intended to comply with NEPA.

### **National Historic Preservation Act:**

The National Historic Preservation Act (NHPA) of 1966, as amended (16 USC §470), recognizes the nation's historic heritage and establishes a national policy for the preservation of historic properties as well as the National Register of Historic Places (NRHP). Section 106 of the NHPA requires Federal agencies to take into account the effects of Federal undertakings on historic properties, and affords the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment on such undertakings. The NHPA Section 106 process, as defined in 36 CFR Part 800, provides for the identification and evaluation of historic properties for determining the effects of undertakings on such properties and for developing ways to resolve adverse effects in consultation with consulting parties. An archaeological survey of was undertaken for this EA and the proposed action does not adversely impact historical or register eligible properties.

### **Native American Graves Protection and Repatriation Act:**

The Native American Graves Protection and Repatriation Act (NAGPRA) of 1990 (25 USC§3011, 1990) provides for the protection and repatriation of Native American and Native Hawaiian human remains and cultural items discovered on Federal lands. NAGPRA provides a process for Federal agencies to return certain cultural items (i.e., human remains, funerary objects, sacred objects, or objects of cultural patrimony) to lineal descendants and culturally affiliated Native Hawaiian

organizations. NAGPRA includes provisions for unclaimed and culturally unidentifiable cultural items, intentional and inadvertent discovery of cultural items on Federal lands, and penalties for noncompliance and illegal trafficking.

### **Endangered Species Act:**

The Federal Endangered Species Act (ESA) of 1973 (16 USC §1531 et seq., 1973) establishes a process for identifying and listing threatened and endangered species. It requires Federal agencies to carry out programs for the conservation of federally-listed endangered and threatened plants, wildlife, and designated critical habitats for such species, and prohibits actions by Federal agencies that would likely jeopardize the continued existence of those species or result in the destruction or adverse modification of designated critical habitat. Section 7 of the ESA requires consultations with Federal wildlife management agencies on actions that may affect species or designated critical habitat. Section 9 of the ESA prohibits the “taking” (through harm or harassment) of endangered species without an agency-issued permit.

For this Proposed Action, it is anticipated that no rare, threatened, or endangered species (or their habitat) that occur in the area will be affected. The preparers of this EA have initiated dialogue with the U.S. Fish and Wildlife Service (USFWS) to determine if there would be any need for Section 7 consultation requirements, if any.

### **Migratory Bird Treaty Act (MBTA):**

The Migratory Bird Treaty Act of 1918 (16 U.S.C. §§ 703-712, 1918) implements various treaties and conventions between the U.S. and Canada, Japan, Mexico and the former Soviet Union for the protection of migratory birds. Unless permitted by regulations, the MBTA prohibits the pursuit, hunting, taking, capture or killing; attempted taking, capture or killing; possession, offer to or sell, barter, purchase, deliver or cause to be shipped, exported, imported, transported, carried or received any migratory bird, part, nest, egg or product, manufactured or not. Subject to limitations in the MBTA, the Secretary of the Interior (Secretary) may adopt regulations determining the extent to which, if at all, hunting, taking, capturing, killing, possessing, selling, purchasing, shipping, transporting or exporting of any migratory bird, part, nest or egg will be allowed, having regard for temperature zones, distribution, abundance, economic value, breeding habits and migratory flight patterns. Regulations are effective upon Presidential approval. Currently there are over 800 bird species covered by the MBTA. The USFWS is currently responsible for overseeing and enforcing the MBTA.

### **Clean Air Act:**

The Clean Air Act (CAA) and amendments (42 USC §7401 et seq.) are the comprehensive Federal law that regulates air emissions from area, stationary, and mobile sources. This law authorizes the U.S. Environmental Protection Agency (EPA) to establish National Ambient Air Quality Standards (NAAQS) to protect public health and the environment. Pursuant to the CAA and amendments, State operated permit programs serve to control emissions. In Hawaii, the State operating permit program is implemented by the State of Hawaii Department of Health (DOH) and emissions of regulated air pollutants within the state may be subject to permitting as required under Hawaii Administrative Rules (HAR) 11-60.1.

Other environmental regulatory requirements relevant to the Proposed Action include, but are not limited to:

**Occupational Safety and Health Act (OSHA):**

Congress enacted the Occupational Safety and Health Act of 1970 which created the Occupational Safety and Health Administration (OSHA). Its mission is to help employers and employees reduce on the job injuries, illnesses and deaths. OSHA directs national compliance initiatives in occupational safety and health.

**Chemical Hazard Communication Program:**

The Chemical Hazard Communication Program requires that chemical hazard identification, information and training be available to employees using hazardous materials and institutes safety data sheets (SDS) which provide this information.

**Air Force Instruction 91-203, Air Force Consolidated Occupational Safety Instruction, 15 June 2012:**

AFI 91-203 identifies occupational safety, fire prevention, and health regulations governing Air Force activities in the workplace. In conjunction with the USAF Mishap Prevention Program, these standards ensure all USAF workplaces meet Federal safety and health requirements.

**AFI 91-202, USAF Mishap Prevention Program:**

AFI 91-202 implements AFPD 91-2, Safety Programs. It establishes mishap prevention program requirements and assigns responsibilities for program elements, and contains program management information.

**Resource Conservation and Recovery Act (RCRA) of 1976:**

An amendment to the Solid Waste Disposal Act, RCRA authorizes USEPA to provide for “cradle-to-grave” management of hazardous waste and sets a framework for the management of nonhazardous municipal solid waste. Under RCRA, hazardous waste is controlled from generation to disposal through tracking and permitting systems, and restrictions and controls on the placement of waste on or into the land. Under RCRA, a waste is defined as hazardous if it is ignitable, corrosive, reactive, toxic, or listed by USEPA as being hazardous. With the Hazardous and Solid Waste Amendments (HSWA) of 1984, Congress targeted stricter standards for waste disposal and encouraged pollution prevention by prohibiting the land disposal of particular wastes. The HSWA strengthens control of both hazardous and nonhazardous waste and emphasizes the prevention of pollution of groundwater.

**Air Force Instruction 32-7086, Hazardous Materials Management, 11 April 2014:**

AFI 32-7086 establishes procedures and standards that govern management of hazardous materials (HAZMAT) throughout the Air Force. It applies to all Air Force personnel (at classified and

unclassified operations) who authorize, procure, issue, use, or dispose of HAZMAT in the course of their official duties; and to those who manage, monitor, or track any of the preceding processes, whether the processes are performed by government or contractor personnel.

### **Air Force Instruction 32-7042, Waste Management, 31 March 2010:**

AFI 32-7042 identifies compliance requirements for all solid waste (SW), including hazardous waste (HW), but excludes radioactive waste (except mixed waste) and medical waste. It applies to individuals at all levels who handle and/or manage waste.

### **Air Force Pamphlet (AFPAM) 32-7043 Hazardous Waste Management Guide, and AFI 32-7086 Hazardous Materials Management.**

This document describes the actions and procedures necessary to ensure compliance with all applicable federal, state, and local laws and regulations; executive orders; and DoD and Air Force policies.

#### **1.10 Related Documents:**

Previous EAs prepared for activities at AF facilities in Maui that may have relevance to this proposed action are:

*Programmatic Environmental Assessment for Maui Space Surveillance Site (MSSS), Haleakalā, Maui, FONSI dated 5 July 1991.* This EA discuss the AF desire to expand the MSSS within HO to increase the boundary and to add a pre-engineered metal maintenance shop warehouse. Additionally, this EA proposed activities to upgrade fuel storage, improve site access, enhance heat exchanger capability, expand utility capability, and demonstrate lasers.

Environmental Assessment for *Advanced Electro-optical System (AEOS) Telescope and Related Improvements at the Maui Space Surveillance Site (MSSS), Haleakalā, Maui, Hawaii, FONSI dated 24 July 1994.* In this EA, the Air Force proposed the construction and operation of the Advanced Electro-Optical System (AEOS) telescope to provide greater light gathering ability than any existing telescope at MSSS and enhance MSSS's infrared capabilities. This telescope was needed to increase research capabilities to improve resolution and allow more extensive work on exoatmospheric object characterization.

Environmental Assessment for *Proposed Advanced Electro Optical System Completion at the Maui Space Surveillance Complex (MSSC) Haleakalā, Maui, Hawaii.* In this EA, the AF proposed the completion of the Advanced Electro-Optical System (AEOS) telescope building by adding a mirror coating shop (MCS) at the Maui Space Surveillance Complex (MSSC) to accommodate the 3.67 meter mirror within the existing AF MSSC footprint atop Haleakalā, Maui, Hawai'i. The Proposed Action was previously identified in the 1994 Environmental Assessment for AEOS construction; however, the mirror coating shop was not completed due to a funding shortfall. The FONSI for this action was signed on September 13, 2005.

## **CHAPTER 2.0 PROPOSED ACTION AND ALTERNATIVES**

### **2.1 Introduction**

This chapter describes the Proposed Action and alternative actions that would meet the following objectives:

#### Objective 1:

Modernization of current facilities to include replacement, renovation, repair, and maintenance of the existing facilities, within the existing footprint.

#### Objective 2:

Modernization and upgrade of equipment and instrumentation at MSSC to accomplish state-of-the-art space observation, illumination, and ranging capabilities. This objective includes the installation of new cameras and lasers to support operational requirements. One of the primary lasers to be installed would be the FASOR Sodium Guide Star laser.

### **2.2 Description of Proposed Action**

The Air Force is committed to maintaining state-of-the-art integrated electro-optical systems and to expanding its current capabilities for the transition of R&D products for Air Force and National use. Upgrades and modernization of electronics, instrumentation, and data collection systems are needed to improve MSSC's ability to provide high-quality, timely products that enable US Space Superiority. The goal of this modernization is to enable net-centric communications and improve the site's ability to maintain awareness of deep space objects; to characterize objects and search for closely spaced objects in proximity to objects of interest; to discover dim objects; to improve fast-search capabilities; to perform tactical indications and warnings; and continue to provide space object identification (SOI) data products on Low Earth Orbit (LEO) and Geosynchronous Earth Orbit (GEO) objects. Mount Haleakalā, located at 3,050 meters (10,010 feet) in altitude, is above one third of the Earth's atmosphere and provides excellent conditions for astronomical observation. This combined with its remoteness from light pollution sources and high number of non-cloudy days makes it one of the best locations in the world for ground-based telescope observations. Haleakalā is an optimal location for obtaining the highest quality space object imagery required by the Air Force mission.

#### **2.2.1 Modernization, repair and maintenance of current facilities**

Modernization activities would include repairing, renovating, maintaining and updating existing facilities to maintain a state of the art facility. Repair and renovation activities would include building modifications, dome replacements, concrete repair and painting the building exterior. These activities would include utility connections, lightning protection, and other site improvements. Construction activities will utilize HO Long Range Development Plan (LRDP) (UH IfA, 2010) construction practices, as outlined in the *Haleakalā High Altitude Observatory Site Management Plan* for environmental protection of site resources. Dome replacements include the

inspection of supporting hardware; removal of defective components; and installation of replacement parts in their original attachment points. Facility and dome renovation activities may require the removal of lead based paint in accordance with 40 CFR 745. Dome replacements will require the use of an on-site crane to assist with the removal and installation of dome equipment. If the removed hardware, concrete grouting, and dome base ring(s) are determined to be non-hazardous they would either be disposed of at the land fill or recycled through the Defense Reutilization and Marketing Office (DRMO).

Construction equipment used for the modernization activities include: cranes, heavy-lift forklifts, temporary shelters to repair dome base, welders to weld brackets to base ring, and to cut recyclable materials and dumpsters for construction debris (non-hazardous). All construction equipment would be inspected by National Park Resource Management subject matter experts for invasive species and cleaned to prevent to introduction of non-native species at the MSSC. Staging of equipment will be limited to existing roadways and concrete pads within the Haleakalā Observatories property. Renovation construction and operation activities at MSSC would not restrict access to current public areas.

All hazardous materials would be stored in approved storage lockers and any accumulated hazardous waste would be captured IAW the AFRL/DET 15 Hazardous Waste Management Plan and disposed of at a qualified RCRA Transportation Storage and Disposal Facility.

## **2.2.2 Modernization and upgrade of equipment and instrumentation.**

The U.S. Air Force proposes to meet the need for this state-of-the-art space observation, illumination, and ranging capability by repairing, maintaining and updating existing equipment at MSSC. These upgrades will include modernization of sensors and equipment and will include the operation of a sodium laser known as FASOR from the existing AEOS 3.6m telescope. The improved adaptive optics system including Laser Guide star (LGS) and Natural Guide star (NGS) capabilities for the observation of stars and satellites would be used throughout the year.

The AEOS Adaptive Optics (AO) system requires sensing of the atmospherically-induced aberrations along the path from an object to the primary aperture so that the deformable mirror can compensate for those aberrations. This can be achieved by sensing the light from an object, if the object is bright enough and sky background is dim enough. However, when the object is dim, either due to its intrinsic reflectance or in earth shadow, or when the sky is quite bright in the daytime, the use of an artificial sodium guide star is an alternative source of reference light for wave front sensing. This is accomplished by using a laser to excite the sodium layer, located 80-105 km above the earth's surface, creating a virtual star. The laser excites a small spot in the naturally occurring sodium layer in the atmosphere making it emit light or “glow” and provides a moveable guide star reference point anywhere in the sky to allow adaptive optical compensation of images. Optical compensation greatly enhances image quality. This laser guide star technology is currently in use at observatories around the world, including the Keck Observatory on Mauna Kea, HI; the Lick and Palomar Observatories in California; the European Southern Observatory in Northern Chile; and the Air Force Starfire Optical Range, Albuquerque, NM.

The FASOR, a Class IV, 589-nm wavelength (orange color), 50 watt, continuous-wave laser propagated from the azimuthal base of the AEOS 3.67m telescope would be used to excite the sodium layer in the mesosphere to create a guide star. This laser, mounted on the existing AEOS telescope, would not change the dome or structure that houses the telescope. The laser equipment would occupy less than 13 square feet of space on the existing telescope mount and would not require heavy equipment for installation, operation or removal. Once installed, the sodium laser guide star system would be integrated into MSSC operations and become a standard instrument for collecting space object imagery in support of its mission. The sodium laser would be added to the list of existing laser devices at the MSSC, and operated in accordance with American National Standards for the Safe Use of Lasers, ANSI Z136.1, U.S. Air Force, AFOSH Standard 48-139 and Federal Aviation Administration 7400.2 Outdoor Laser Operation requirements. Laser operations would occur primarily at night, approximately 80 nights per year. The duration of testing is dependent on weather conditions, cloud cover and targets approved for imaging (4-6 hours estimated per night). A typical operation would consist of 5 to 10 minutes of laser propagation; laser OFF during computer selection of next target; confirmation of next target; and then ON 5 to 10 minutes for tracking and laser propagation. This is done for nominally 2-5 targets per operation night. Laser pointing elevation is limited to 30-90 degrees above the horizon; and 0-360 degrees in azimuth.

The new instrumentation would be operated and supported by the existing staff, so no increase in MSSC personnel would occur and no additional Anti-Terrorism/Force Protection standoff would be required.

### **2.3 No-Action Alternative.**

Under the No-Action Alternative, modernization of the facility will not occur, domes within the MSSC would not be replaced and equipment/sensors to include the FASOR sodium guide star laser would not be installed or operated at the MSSC. The objective to modernize current facilities (within existing footprint) and equipment at MSSC is necessary to accomplish state-of-the-art space observation, illumination, and ranging capabilities will not be met. Critical operational mission data collection, and research and development pertaining to improved image resolution would not occur. Operations and experiments involving the AEOS telescope would decrease. The MSSC capabilities would fall behind in its ability to provide relevant, high quality data to support Air Force mission needs and eventually become obsolete.

### **2.4 Alternatives Considered But Eliminated From Further Analysis.**

Alternative sites were considered for research activities that require the modernization at Maui. Modernization includes installation of new sensors; lasers, cameras and instrumentation and repair replacement of domes, and beam directors. The Starfire Optical Range at Kirtland AFB could be a potential location to perform the AFRL/DET 15 MSSC research activities. Operations at SOR consist of optical research and advanced imaging R&D experiments. These research efforts and associated experiments utilize similar equipment in the form of 3.5 m and 1.5 m telescopes and various lasers to obtain optical images. The facility is operated primarily from dusk to dawn including infrequent daylight operational experiments that do not require totally dark conditions.

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## Environmental Assessment for Modernization of Facilities and Equipment at MSSC, Haleakala Maui Hawaii

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SOR operates 5 days a week for 42 weeks out of the year. A typical night of testing encompasses approximately 10-12 hours per night with 6-8 hours being scheduled test hours. The SOR facility is shut down for approximately 8 weeks for engineering/maintenance and there is a 2 week shutdown during the holidays.

The SOR was eliminated as an alternative to the proposed action due to its current and projected future operations tempo, which is heavily programmed and scheduled for its current R&D mission. Additionally, SOR does not have the same climate and atmospheric conditions available at the MSSC, nor can SOR provide the AF Space Command with operational data and information for the on-going DoD operational mission as that available from the MSSC can.

## **CHAPTER 3.0 DESCRIPTION OF THE AFFECTED ENVIRONMENT**

The following resources were not evaluated in the EA since it was determined that the nature of the proposed action will not have an impact on them. These resources are:

Water Quality  
Geology and Soils  
Socioeconomics

Resources that may be impacted are as follows:

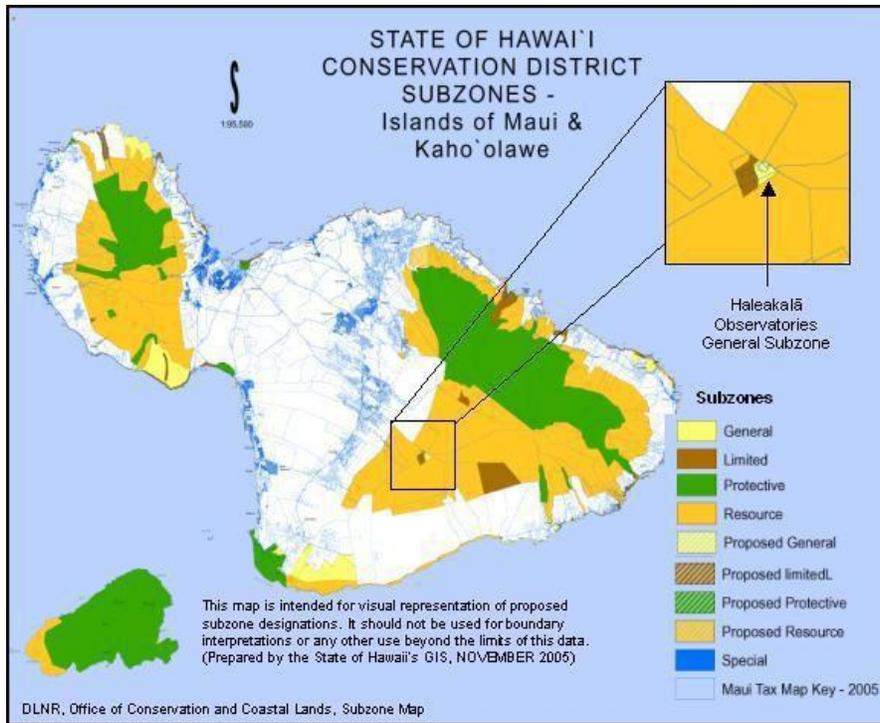
### **3.1 Land Use/Noise**

State Land Use District designations, established by the State Land Use Commission, categorize all land in one of four districts: Urban, Agriculture, Conservation, or Rural. Conservation District subzone designations, regulated by the State Department of Land and Natural Resources (DLNR), are Protective, Limited, Resource, General, and Special.

Astronomical research activities occur within the Haleakalā Observatories (HO) complex at the summit of Haleakalā. A repeater station that is part of the Federal Aviation Administration's (FAA) air traffic control system and a U. S. Department of Energy (DOE) research facility are situated immediately to the west of HO. Also bordering the HO parcel is an area owned by the State of Hawai'i, which is controlled by the State Department of Land and Natural Resources.

The HO complex is situated in the General subzone of the State Conservation District (Figure 3). Other nearby conservation areas include the National Park Service's Haleakalā National Park and four state forest reserves (Kula, Makawao, Ko'olau and Kahikinui) that function as watersheds and biological preserves. The forest reserves are also used for tourism and recreational purposes such as hiking, hunting and camping. Ranch lands used for cattle grazing border these conservation lands. Physical development (e.g., roads, buildings and water catchment projects) is minimal throughout these conservation and agricultural areas.

## Environmental Assessment for Modernization of Facilities and Equipment at MSSC, Haleakala Maui Hawaii



**Figure 3: State of Hawaii Conservation District Subzones.**

Over the past 45 years, HO has experienced managed growth of scientific research within its boundaries. The first major UH facility at HO was the C.E.K. Mees Solar Observatory (MSO). UH has operated the MSO facility since 1964. The scientific programs at the MSO facility emphasize studies of the solar corona and chromosphere. The LURE Observatory was operated by IfA under contract to the National Aeronautics and Space Administration (NASA) Goddard Space Flight Center from 1972 until 1993, to conduct highly accurate measurements of the distance between LURE and the Moon, as well as measurements of the distance between LURE and satellites in orbit about the Earth. From 1993 to 2004 LURE was operated for the NASA Space Geodesy and Altimetry Projects, providing NASA with highly accurate range measurements between LURE and satellites. The facility was also involved in the NASA Crustal Dynamics Project.

The Pan-STARRS (PS1) telescope was dedicated on June 30, 2006, and is within the footprint of the former LURE Observatory South Dome. The testing of extremely high resolution camera imagery will lead to development and deployment of a small, economical, four-telescope system for observing the entire available sky several times each month to discover and characterize Earth-approaching objects, both killer asteroids and comets, that might pose a danger to our planet.

The Daniel K. Inouye Solar Telescope (DKIST), formerly Advanced Technology Solar Telescope, operated by UH Institute for Astronomy, represents a collaboration of 22 institutions, and is the largest solar telescope in the world. The US and international solar physics community will use DKIST for observing and studying the fundamental astrophysical processes of the solar atmosphere.

The Faulkes Telescope Facility (FTF) was originally built by the Dill Faulkes Educational Trust and became operational in 2004. The goal of this facility is to give students and teachers in Hawai'i and the United Kingdom access to a research grade telescope. With its 2-meter diameter primary mirror, this telescope (along with its twin in Australia) is the largest telescope designated solely for educational use in the world. This 2-meter (6.6-foot) telescope is operated remotely over the Internet, without need for permanent on-site operational staff.

UH operates and maintains the Transportable Laser Ranging System (TLRS) number 4, under contract to NASA, providing satellite laser ranging (SLR) data as part of the worldwide system of SLR sites for satellite orbit and long period geophysical phenomena studies.

The Zodiacal Light Observatory houses multiple instruments for solar and coronal experiments and collection of atmospheric turbulence statistics.

The IfA has dedicated a small building for the Haleakalā Amateur Astronomers to organize and host programs for professors and students at Maui Community College (MCC), K-12, Boy Scout groups, Akamai students, community members and others to conduct astronomy observations at HO.

## **Noise**

Noise levels are dependent on (1) sound pressure measured in decibels (dB) and usually based on an A-weighted scale (dBA), which simulates the range of sound that is audible by the human ear; (2) distance to the affected individual; (3) medium present between the source and the affected individual; and (4) period of exposure.

Sources of noise at the MSSC include those associated with wind, vehicles (including twice weekly water deliveries by truck), air conditioning compressors, and exhaust fans. Two diesel-powered emergency generators, located in enclosed trailers at MSSC, run infrequently. Existing noise levels in the MSSC area are low, with wind-associated noises accounting for the majority of background noise. Vehicles driving to and from Haleakalā Observatories are the loudest man-made noise sources, with construction trucks generating 82 to 93 dBA at a distance of 50 feet. Air conditioning compressors and exhaust fans can be heard in certain areas, with compressors generating 73 to 84 dBA depending on your distance from the unit. Instantaneous noise levels on the order of 45 to 50 dBA were measured near the Butler Building on a day with moderate wind speeds.

## **3.2 Air Quality**

The affected environment for air quality includes the summit of Haleakalā and the Park Road corridor. All areas in Hawai‘i comply with federal and state ambient air quality standards; no areas of Hawai‘i are classified as nonattainment or maintenance areas. Therefore, all of Maui, including Haleakalā, is currently an attainment area for EPA “criteria” pollutants, which include sulfur dioxide, nitrogen oxides, carbon monoxide, ozone, lead, and certain particulate matter. Furthermore, the Park is categorized as a Class 1 area under the Clean Air Act’s Prevention of Significant Deterioration Program, a category the EPA reserves for the most pristine areas of the country in order to maintain the excellent level of air quality (NSF, 2009).

Another contributing factor to the excellent air quality at the summit of Haleakalā is the favorable meteorological conditions, including a temperature inversion layer that rings the mountain at an elevation of approximately 5,000 and 7,000 feet ASL. This inversion layer stabilizes the atmosphere above the basin and limits airborne pollutants from rising to the summit, including those from the largest source of air pollution in the area, Kilauea Volcano on the island of Hawai‘i. Additionally, prevailing trade winds from the northeast are persistently gusty at the summit, which accelerate the dilution of locally generated air emissions. Ambient winds of 20 to 50 miles per hour are commonly reported at the summit creating turbulence and accelerating the atmospheric dispersion.

## **3.3 Infrastructure, Traffic and Roads**

Vehicular traffic to and from Haleakalā Observatories is via Haleakalā Crater Road, a two-lane roadway through Haleakalā National Park. This road is owned and maintained by the National Park Service from its intersection with Haleakalā Highway to the park boundary adjacent to the Haleakalā Observatories. In accordance with the lease agreement, AFRL contributes financially to maintenance of the road through the Haleakalā National Park. Maintenance of the road segments within Haleakalā Observatories is the responsibility of UH and AFRL.

The majority of vehicles using Haleakalā Crater Road carry visitors to the Haleakalā National Park. In 2003, Haleakalā Crater Road traffic averaged approximately 1,900 vehicles per day. Of this fewer than five percent (96 vehicles) were estimated to be associated with facilities located in Haleakalā Observatories. The 2003 findings are consistent with a 1991 vehicular traffic study, which indicated an average of 95 vehicle trips associated with the Haleakalā Observatories on a daily basis (an average of 48 vehicles entering and leaving the area). The highest traffic volumes for the Haleakalā Observatories occur in the afternoon, with vehicles leaving the area. The high elevations, relatively steep grades, numerous switchback curves, and touring bikers on the road limit vehicle speeds.

## **3.4 Biological Resources**

### **‘ua’u (Hawaiian Dark-rumped Petrel)**

The endangered ‘ua’u, or Hawaiian dark-rumped petrel, *Pterodroma phaeopygia sandwichensis*, is known to nest and fly around the Haleakalā summit. The number of birds flying over the site

during the breeding season varies from year to year. 'Ua'u are prone to colliding with protruding foreign obstacles. Overhead power lines are of special concern. Fences, particularly barbed wire, are also a problem. Although the 'ua'u frequent the islands of Maui, Lana'i and Hawai'i, the only known breeding colony occurs on the summit of Haleakalā (Simons, 1985). Critical habitat has not been defined for this species. 'Ua'u can be found in deep burrows inside and outside Haleakalā Crater from late February to early November. They spend the remainder of the year at sea. All known burrows are at elevations ranging from about 7,000 feet to 9,500 feet. About 77 percent are located in three sub-colonies along the inner wall of the west crater rim, approximately 3,200 feet northeast of HO.

Most 'ua'u, arrive at the summit during March and April and egg-laying generally occurs in May. The eggs are incubated until July when hatching occurs. Adults that did not breed or whose eggs failed to hatch usually depart during August. 'Ua'u chicks are fed at approximately two- to three-day intervals for their first three months (July to September), then less frequently through October (Simons 1985). Fledgling occurs between mid-October and mid-November. 'Ua'u fly to and from their nests just after dark (Simons, 1985). Scientists believe the birds approach the crater from the west and leave through the Ko'olau Gap to the north, where rim elevations are less than 9,500 feet. Primary predators of the 'ua'u is thought to be rats, dogs and mongoose. Other principal threats to the birds are collapsing of burrows by feral goats, collision with artificial light sources, and disease (U.S Fish and Wildlife Service, 1983).

### **Nene (Hawaiian Goose)**

Another federally listed endangered species, the Nene or Hawaiian goose, *Nesochen sandwicensis*, occurs only on the islands of Maui (on Haleakalā) and Hawai'i (on Mauna Loa and Hualalai) above elevations of 4,000 feet. The Nene sanctuary on Haleakalā is located on the northeast slope between elevations of approximately 5,000 feet and 6,900 feet. Suitable habitat does not occur in the vicinity or elevation of the HO.

### **Hawaiian Hoary Bat**

The endangered Hawaiian hoary bat, *Lasiurus cinereus semotus*, has occasionally been observed at elevations up to 13,000 feet (U.S. Air Force, 1988). National Park Service records indicate that one bat was found in the south park boundary fence and another near Kalahaku Overlook at an elevation of about 9,200 feet. Other individuals have been found dead at about the same elevation, and observations of the bat flying in the summit area have been reported. It is considered extremely unlikely that this species is a resident at the summit, however, because it is not suited to cold temperatures (Tomich, 1986).

### **Invertebrate Fauna**

On Haleakalā, there is an Aeolian ecosystem extending up the summit from about the 7,550 feet elevation. It is characterized by relatively low precipitation, porous lava substrates that retain relatively little moisture, little plant cover, and high solar radiation. The dark, heat-absorbing cinder provides only slight protection from the extreme temperatures, and thermal regulation and moisture conservation are critical adaptations of arthropods occurring in this unusual habitat.

Due to the harsh environment, fewer insects are present at upper elevations on Haleakalā than are found in the warm, moist lowlands. However, an exceptional assemblage of insects and spiders make their home on the mountain's upper slopes. A survey and inventory of arthropod fauna was conducted for the 18 acres of HO in 2003 for the UH Long Range Development Plan. In this study, several species were added to the previous inventory site records. An additional survey including arthropod collection and analysis was conducted in 2005 at the MEES and Reber Circle sites for the proposed DKIST Project (Pacific Analytical, 2005). The arthropod species that were collected in this study were typical of what had been found during previous studies. Although the study was conducted during the fall months, no species were found that are locally unique to the site, nor were there any species found whose habitat is threatened by normal observatory operations. No invertebrate species listed as endangered, threatened, or that are currently proposed for listing under either Federal or State of Hawai'i endangered species statutes were found.

An arthropod survey was conducted in June 2009 (Gregory Brenner Pacific Analytics, 2009). This study found a number of additional species collected, including one endemic carabid beetle (*Mecyclothorax*), and two species of long horn beetles of the genus *Plagithmysus*. Carabid beetle populations appear to be impacted when alien predators are introduced to their habitats. The two species of long-horn beetles are considered rare and are infrequently collected (Gregory Brenner Pacific Analytics, 2009).

### 3.5 Cultural Resources

The cultural resources of Maui encompass pre-contact to present time, span legends and religious beliefs, and include activities ranging from spiritual use and hunting to tourism and high technology science. The cultural significance of Haleakalā has connections to the legends of Pele, who died at Haleakalā during a battle with her rival sister, and the demi-god Maui, who lassoed the sun to slow it down. (CKM Cultural Resources, 2002) Historical uses of Haleakalā included meditation and prayers by kahuna (priest, clergyman) and their students, who sometimes lived at Haleakalā. An order of priesthood, called Paliku, conducted ceremonies during the Makahiki (ancient annual festivals beginning around the middle of October and lasting about four months). Haleakalā has been and continues to be a source of spiritual guidance; it is considered a temple, a graveyard, and a focal point for mana (supernatural or divine power). The entire summit area, which includes Kolekole, is considered wahi-pana (a legendary place). (CKM Cultural Resources, Cultural Resources Evaluation For the Summit of Haleakala, 2003) The summit area has been used to train kahuna in the arts of healing and navigating with the stars and constellations. Given its religious significance, access to the summit area was limited to Ali'i (royalty) and kahuna, while commoners were only allowed here to gather stone in the quarry or to bury their dead Ali'i. The remains of Ali'i were buried in caves throughout the summit, crater, and adjoining areas. Those who brought the deceased to their final resting place were sacrificed and buried along with the royalty. The location of the burial was usually entrusted to one person, who kept the location secret until death.

Remnants of the physical and spiritual culture have survived. Several cultural resources of importance, such as wind shelters, petroglyph images, and burial and ceremonial sites are still found on Kolekole. Connections to the spiritual sensitivity remain as the summit is still the highest point

overlooking Maui and there is still a connection to ancient gods and goddesses and the past traditions. Modern uses of the Kolekole area include the gathering of flora and fauna for medicinal purposes and for adornments by Kumu Hula (hula teachers).

The terrain around HO is rugged, sparsely vegetated, and covered with an abundance of lava rock. The summit area's appearance is a sharp contrast to the lower slopes of Haleakalā and the more tropical environment at sea level. Adjacent to HO, the cinder cones of Haleakalā's summit dominate the panorama. The summit of Haleakalā is an important visual resource for Native Hawaiians, Maui residents, and tourists.

While the natural terrain hides the observatories from view from most points on the mountain, the Haleakalā Observatories are visible from the Pa Ka'oa (White Hill) Visitor Center and the Pu'u Ula'ula (Red Hill) Overlook (Figure 4). Additionally, when there is no cloud cover, the reflection of sunlight off the AEOS dome can be seen from Central Maui during the early morning and late afternoon hours. The visibility of the HO facilities varies depending upon one's vantage point. Several HO facilities are visible from Pu'u Ula'ula. Some HO facilities are partially visible from the Park entrance station to about the first mile of the Park road, the Park Headquarters Visitor Center, portions of the Park road corridor (particularly the last one-third of the Park road closest to the summit), and near the summit from the Haleakalā Visitor Center (Pa Ka'oa or White Hill).



Figure 3: View of HO from Pulu Ula ula.

Approximately 785,000 visitors annually (HALE 2010) are attracted to Haleakalā's various lookouts and vantage points for its spectacular vistas. Looking down the slopes to the northwest, a majestic view of Maui's isthmus and West Maui Mountains is afforded, while to the east are the richly colored scenes of the crater and, on minimal cloud-cover days, the slopes of Mauna Kea, Mauna Loa and Hualālai.

Overall, visibility of the HO facilities is highly variable depending on a combination of factors. These include locations from where one views them on the island, atmospheric conditions (e.g., dust content, humidity), time of day, cloud cover, and human activity (e.g., cane burning). For example, on a clear, low-humidity day, some of the facilities would be distinguishable as very small man-made objects from as far away as Ma'alaea Bay, which is a distance of approximately 17 linear miles. However, in humid and/or dusty conditions, they may not be visible at all from Ma'alaea Bay or even from locations in Upcountry Maui at half that distance.

Visibility of the summit area would be more likely in the early morning before the daytime cloud inversion layer builds up, and in the late afternoon after the inversion layer dissipates. When mid- and upper-level cloud cover is absent, a few of the existing structures at HO are, depending on one's vantage point are visible from miles away. Some of the facilities can also be seen from public viewpoints and highways that climb the slopes of the mountain (UH IfA, 2010).

The archaeological resources at Haleakalā Observatories are described in several studies conducted at the summit. No archaeological features have been identified within the boundaries of the MSSC; however, archaeological features at Haleakalā Observatories include four sites identified near the MSSC. The State Inventory of Historic Places (SIHP) lists several sites that consist of individual wind shelters and partial enclosures for temporary habitation, complexes of wind shelters, and one site that includes two petroglyph images and a possible burial location. Other sites, identified at Haleakalā Observatories, included wind shelters, a historic radio telescope foundation, and a probable trail segment.

### **3.6 Safety**

All construction efforts are designed and planned within the civil engineering branch of Det 15. Once those efforts have been determined to meet construction requirements they are then contracted to licensed contractors in accordance with federal, state and local regulations.

MSSC, Det 15 manages all laser projections by analyzing the hazards for each proposed test and determines the safest way to accomplish mission objectives. Standard best practices are implemented such as: coordination with FAA and adjacent users; establishing a laser footprint; limiting pointing angles; implementing operator situational awareness; designing safety interlock devices for equipment associated with the laser projection; and developing emergency stop procedures. The Outdoor laser propagation at MSSC is controlled using a tiered safety approach providing space asset protection via Predictive Avoidance (PA) for satellites, aircraft asset protection via a Federal Aviation Administration (FAA) radar feed and an outdoor spotter. All of the lasers at MSSC have shutters that block the laser beam from propagating inside and outside the facility. First, the FAA radar feed is linked with the mount/ laser beam software to provide aircraft position information in relation to the telescope mount orientation and beam projection angle;

second, the outdoor spotter visually monitors air traffic in relation to the telescope mount orientation and beam projection angle; and third, specific coordinates and times of satellite passes are entered into the mount software to prohibit laser projections to protect against inadvertent satellite illumination. All of these processes and procedures are used to ensure air and space assets are protected from laser operations.

The FAA Radar feed is a direct link into the control room at MSSC and provides real-time data on the location of all private and commercial aircraft in the area. If an aircraft enters the exclusion zone of the proposed laser projection, an automatic shutter is engaged. Additionally, the person monitoring this feed has the ability to shutter the laser beam if an aircraft approaches too close to the laser affected airspace.

The Safety Spotter is continually evaluating outdoor conditions to ensure laser propagation will not cause any hazards to aircraft, biological resources and personnel on or off the site. This will include but is not limited to an observation of the cloud cover and weather in the area, observation of personnel or equipment at outlying facilities, and evaluating the lasers proximity to aircraft. Any time the spotter recognizes an unsafe condition, the laser propagation is terminated. By the ANSI Z136.6 'Safe Use of Lasers Outdoors Standard' safety spotters "shall have the responsibility, capability, and authority to terminate laser beams immediately when an aircraft approaches, and before a potential hazard occurs." The Safety Spotters have a headset for communicating with the test laser safety officer, and a dead-man switch that allows the Plane Watch control over the Laser shutter.

Predictive Avoidance (P/A) is used to protect space assets. Projection of laser light on space targets must be authorized by the satellite owner. To help protect space assets P/A is coordinated through the AF Laser Clearinghouse.

### **3.7 Hazardous Materials/Waste**

#### Hazardous Materials

A hazardous material is any item or agent (biological, chemical, physical) which has the potential to cause harm to humans, animals, or the environment, either by itself or through interaction with other factors. Hazardous materials are defined and regulated in the United States primarily by laws and regulations administered by the U.S. Environmental Protection Agency (EPA), the U.S. Occupational Safety and Health Administration (OSHA), the U.S. Department of Transportation (DOT), and the U.S. Nuclear Regulatory Commission (NRC). Each has its own definition of a "hazardous material."

Hazardous materials management involves the proper storage, use, and disposal of any material that poses a potential threat to people or the environment. The MSSC HMMP (Hazardous Material Management Plan) applies to the authorization, procurement, use, storage, and disposal of hazardous materials incorporating AFI 32-7086, *Hazardous Materials Management* and the AFMC Supplement to this AFI. This plan has the following purposes: establish consistent policies, standards, and procedures for authorization, procurement, use, storage, and disposal of hazardous materials; reduce the risk of hazardous materials release or spillage; and reduce the quantity and

toxicity of chemicals used and hazardous waste generated.

### Hazardous Waste

The USAF strategy is to reduce the volume and toxicity of waste through source reduction, chemical substitution, process change, and other techniques to reduce generation of hazardous wastes. Hazardous materials are utilized to the maximum extent possible before being declared a waste. Spent Hazardous Materials or waste that cannot be reused or recycled must be disposed of in an environmentally safe manner, consistent with the requirements of all applicable laws, including Resource Conservation and Recovery Act (RCRA) as amended by the Hazardous and Solid Waste Amendments (HWA). The regulations promulgated under RCRA and codified in 40 Code of Federal Regulations (CFR) Parts 260 through 273 and 280 are enforced by the State of Hawaii Department of Health.

The AF Det 15 MSSC Hazardous Waste Management Plan (HWMP) implements Air Force Instruction (AFI) 32-7042 *Waste Management*, Air Force Pamphlet (AFPAM) 32-7043 *Hazardous Waste Management Guide*, and AFI 32-7086 *Hazardous Materials Management*. The HWMP describes the actions and procedures necessary to ensure compliance with all applicable federal, state, and local laws and regulations; executive orders; and DoD and Air Force policies. Issues addressed in this HWMP include: waste inventory, waste analysis plan, waste management procedures, reporting procedures, training plan, waste minimization plan, a pollution prevention plan, the MSSC Spill Prevention Countermeasures and Control Plan, and the MSSC Hazardous Materials Emergency Response Plan.

## **CHAPTER 4.0 ENVIRONMENTAL CONSEQUENCES**

### **4.1 Land Use/Noise**

The Proposed Action would have no significant impact on land use. It would support and be consistent with the goals and objectives of the following state, county, community, and University of Hawaii, Institute for Astronomy (UH IfA), Haleakalā Observatories plans:

- Similar research activities performed on HO by the AF, UH IfA, and NASA.
- AFRL's practices of handling MSSC's cultural and biological resources, which is consistent with HRS Chapter 344 State Environmental Policy.
- Acceptable land uses designated for the Conservation District General Subzone.
- Maui County's General Plan for growth in a manner sensitive to the protection and enhancement of cultural and historical resources. It would also support economic diversity by continuing to provide jobs in the high technology industry.
- Makawao Pukalani-Kula Community Plan including: complying with the UH IfA's LRDP and High Altitude Observatory Site Management Plan (HOMP) for Haleakalā Observatories, protecting biological resources and working to prevent the establishment and spread of invasive species, and participating in recycling.

Implementation of the Proposed Action would not restrict access to current public areas. MSSC buildings are considered secured military facilities and will continue to have restricted access. Areas surrounding the facilities are not restricted and access is allowed to prayer walls and recreational areas, such as the Skyline Trail and the Polipoli Trail.

#### **Noise**

Renovations proposed at MSSC would involve noise associated with typical building construction activities. The loudest potential noise sources include cranes (88 dBA), pneumatic tools (88 dBA), and trucks (93 dBA).

Noise-sensitive human uses identified within Haleakalā Observatories could include native Hawaiian traditional cultural practices and spiritual use. Other nearby noise-sensitive locations is the Pu'u Ula'ula (Red Hill) Overlook and the Pa Ka'oa (White Hill) Visitor Center. Construction activities would be short-term and temporary, and operational noise is expected to be minimal. The employees at MSSC and Haleakalā Observatories would be working within enclosed structures that would greatly attenuate the noise. Construction teams will be scheduled to ensure impacts on petrel habitats are avoided or minimized to acceptable levels. Any vibration and noise beyond 100 feet from AF activities would be mitigated to ensure biological resources would not be adversely impacted. The following noise ratings for construction equipment would be consulted for construction efforts.

Equipment	Db rating ~2 ft	Db rating ~4-8 ft	Db rating ~50 ft	Db rating ~100ft
Hammer Drill	100	86	50	20
Impact Wrench	100	88	52	24
Hammer	85	81	48	20
Crane	100	90	66	36
Forklift	90	80	38	20
Air Compressor	86	81	47	19
Saw	105.3	95.6	77.2	65.9

Construction workers in close proximity to the noise-generating equipment would be protected against noise exposure by following the State guidance provided in HAR§12-200.1 Occupational Noise Exposure. Appropriate noise-reducing measures, such as limiting unnecessary idling of equipment, or using quiet equipment where possible, would be considered as needed. Additionally, construction will be kept at least 91 meters (300 feet) away from ‘ua’u burrows during the nesting season (February to November), when the ‘ua’u are at Haleakalā. If use of heavy construction equipment is required during this time, consultation with UH IfA, DLNR Haleakalā National Park (HNP) and USFWS representatives will occur to determine feasibility of actions

Operation of the FASOR laser, research sensors, and ancillary equipment does not create a noise hazard above 80 dB as the equipment is contained within the MSSC facilities and AEOS Dome. Outdoor propagation of research sensors or the FASOR beam does not create a noise hazard; therefore, no noise impacts are anticipated from operation of the research equipment or FASOR Laser.

### **No Action Alternative**

There would be no impacts to Land Use/Noise under the No Action Alternative as the proposed MSSC modernization efforts would not be implemented.

## **4.2 Air Quality**

Air quality conditions, clear sky void of excess particulate, is critical to the research objectives the AF is pursuing. Consequently, AFRL Det 15 manages activities to ensure compliance with federal and state regulations for air emissions. A slight increase in criteria and hazardous air emissions would occur with the construction efforts associated with modernization of MSSC facilities; however, these emissions would not exceed regulatory action levels and would be temporary. Equipment would include mobile source emissions from cranes and possibly generators to power other construction-related equipment. These emissions, plus the tail-pipe emissions from construction-related vehicles would be temporary and would not significantly impact air quality.

Site renovation activities are likely to generate small amounts of fugitive dust. To minimize fugitive dust emissions, the construction staging areas will be limited to areas that currently possess concrete pavement or previously disturbed areas. Det 15 would implement construction best management practices to minimize fugitive dust, and prohibit oil or chemicals for dust control. For these reasons, no significant impacts on air quality would occur from fugitive dust.

The FASOR (*Sodium Guide Star Laser*) emits light at a wavelength of 589.2 nm. This causes

sodium atoms, which are naturally occurring in the mesosphere at an altitude of 90-105 km, to absorb laser light and fluorescence at the same wavelength. This fluorescence is not a chemical reaction, green-house gas or an air emission; it is caused by the sodium ions in the mesosphere absorbing the light from the FASOR, becoming excited, and reemitting the light omnidirectional like a lamp. Once the FASOR laser stops illuminating, the sodium ions will no longer be excited and will stop fluorescing. This process does not change the chemical make-up of the sodium ions and does not cause any off-gassing. No significant impacts on air quality would occur from the modernization of facilities, equipment or operation of the FASOR laser.

### **No Action Alternative**

There would be no impacts to air quality under the No Action Alternative as the proposed MSSC modernization efforts would not be implemented.

### **4.3 Infrastructure, Traffic and Roads**

There would be no significant impact to roads or traffic from the Proposed Action. Prior to construction activities, vehicle routes would be identified and scheduled with the National Park Service for transporting equipment and supplies to the summit.

Construction-related vehicles would temporarily increase the number of vehicles to the summit during renovation activities, which would be for a short duration. These vehicles would be used to transport workers, heavy equipment, and construction materials and supplies to the summit. The construction related traffic would not have a significant adverse impact on traffic, as it would be coordinated with the National Park Service and scheduled during off-peak hours.

Once at the construction site, vehicles and equipment would be operated within the Haleakalā Observatories boundary and specifically within the MSSC Property in a designated construction staging area. Construction practices would comply with the UH LRDP and would prohibit parking of heavy equipment and storage of construction materials outside the Haleakalā Observatories property.

Only minor infrastructure changes would occur with the modernization of the equipment and facilities. Any electrical changes required for equipment and facilities would meet National Electric Code requirements. No changes to the MSSC water or wastewater systems are expected. Minor modifications to heating and cooling systems may occur to accommodate research hardware requirements. No significant impacts to the environment are anticipated from these minor infrastructure activities.

### **No Action Alternative**

There would be no impacts to infrastructure, roads, or utility resources under the No Action Alternative as the proposed MSSC modernization efforts would not be implemented.

### **4.4 Biological Resources**

The proposed modernization of the MSSC facilities and equipment would have no significant impact biological resources.

Silversword or ‘ahinahina plants are present in and around MSSC facilities, ‘ua’u burrows have been identified near the Haleakalā Observatories, and Nēnē live on the slopes of Haleakalā below the Det 15, MSSC facilities. Informal consultation has been initiated with the USFWS for the Proposed Action, and the U.S. Air Force has requested concurrence with their determination that the Proposed Action is not likely to adversely affect listed species for the reasons listed below.

**‘Ahinahina.** No Silverswords are located in the project areas for modernization efforts; however, specific care is taken to protect any nearby Silverswords located within the MSSC during construction efforts. During all activities, steps will be taken to protect and avoid contact with any Silversword. This will be done by the placement of barrier crates over the Silversword areas near construction activities to ensure plants are protected from potential harm

**‘ua’u.** The use of heavy equipment near ‘ua’u burrows, which often results in noise and ground vibrations, could potentially affect ‘ua’u fledging success; however, studies indicate that construction noise levels up to 84 dBA at a burrow have no effects on ‘ua’u reproductive success. (URS Consultants, 1988) Noise levels at the nearest burrow are not anticipated to reach or exceed 84 dBA. Additional measures to minimize the potential adverse effects of construction activities on the ‘ua’u are included in the LRDP construction practices described below.

**Nēnē.** Although the summit area is outside the known feeding range of the Nēnē, additional traffic from construction vehicles ascending and descending the mountain could slightly increase the risk of traffic collisions with Nēnē. However, the risk of vehicle collision with Nēnē is expected to remain low. (UH IfA, 2010) Practices outlined in the LRDP, described below, would minimize potential adverse effects of construction activities on the Nēnē.

For these reasons, and the established practices designed to prevent impacts to flora and fauna, no significant impacts on biological resources are anticipated from the Proposed Action. The established practices that would be implemented as part of construction activities at Haleakalā Observatories, in accordance with the LRDP presented below. (UH IfA, 2010)

- The contractor will participate in pre-construction briefings on environmental sensitivities. Biological resources topics addressed in the briefings will include protecting the biological species in the area, preventing the introduction of unwanted species to the area, confining activities to the construction site and staging area, and minimizing the risk to species from vibration, noise, and lighting.
- A qualified biologist or agricultural inspector will inspect equipment, supplies, and containers that originate from other islands or the continental United States prior to these items being transported from Kahului to MSSC. Materials suspected to contain prohibited or harmful organisms would be handled under the direction of National Park Service and USFWS. The contractor will provide the National Park Service a one-week notification, prior to the initial entry, for coordination of inspections. Construction vehicles will be steam cleaned before being transported through Haleakalā National Park. Certification of inspections and vehicle cleaning will be maintained by the contractor.

- The contractor will not park heavy equipment or store construction materials outside of the Haleakalā Observatories boundaries. Their activities will be limited to the construction site and staging area to minimize risk to ‘ua’u in adjacent areas.
- The contractor will, on a timely basis, remove construction-related trash, including materials that could serve as a food source and increase the population of mice and rats that prey on native species.
- Importation of fill material, if needed, will be coordinated with the National Park Service. Fill will be handled as necessary to remove seeds, larvae, and other biota that could survive and propagate at the summit.
- The National Park Service will give the contractor current Haleakalā National Park maps of ‘ua’u burrow locations to identify and avoid these areas.
- The contractor will notify the UH IfA of any ‘ua’u mortalities.
- The contractor will avoid constructing fences, if possible, to prevent ‘ua’u mortality from collisions.
- The contractor will avoid, where possible, the use of lighting colors that could interfere with ‘ua’u activities. Lighting will be shielded from above and will focus on the ground to avoid attracting ‘ua’u. Prior to installation, lighting for construction hazards or night work will be approved by the UH IfA.
- The contractor will keep construction at least 91 meters (300 feet) away from ‘ua’u burrows during the nesting season (February to October), when the ‘ua’u are at Haleakalā. If use of heavy construction equipment is required during this time, consultation with UH IfA and avifaunal experts to determine feasibility will occur.

The potential threat to fauna from the installation and operation of the FASOR laser is from the visible light (589nm orange color) that would be propagated from the AFRL, MSSC 3.6 m AEOS telescope. As mentioned above past and existing visible laser have been used at the MSSC and HO, however these lasers have been in the blue and green visible spectrum. Since the FASOR is in the orange spectrum, the spectrum visible to avifauna and possibly a source of distraction to these species additional analysis was performed. To determine the impact on fauna; specifically the ua'u, Nēnē and hoary bat, an analysis of proposed operations and behavioral information for these species was analyzed with consideration for: 1) Direct laser illumination where the animal would be exposed by flying through the laser beam; and/or 2) distraction or disorientation by back scattered laser light.

#### **4.4.1 Direct Laser Illumination**

The theoretical worst case hazard to birds or bats directly exposed to the FASOR laser beam is retinal damage due to the species looking directly into the beam while simultaneously being illuminated. There is no surface or skin hazard due to the beam size, power, and notional exposure duration. The Avifauna retinal exposure hazard is expected to be very low because of laser tracking a target in space, the relatively short times during which such beams would be on (5-10 min), the relatively small diameters of the beam, the species flight speed, and low flight activity over the MSSC. A bird or bat flying at 48 km/h (30 mph) would pass through a 20cm (7.874 in.) diameter beam in less than 0.015 s. While an avian retinal damage event is possible, the combination of : the laser beam tracking an object in space; propagation path above 30 degrees; limited lasing times; relatively sparse bird activity over the MSSC; narrow laser beam parameters; and bird flight speed

makes it a highly unlikely event. Additionally, the bird or bat would need to focus on the beam, directly in-line with the beam projection in the very short time during which it flew through the beam further reducing the probability of a direct illumination blinding event.

The bird species of particular concern at the MSSC are the ua'u, or Hawaiian Petrel, which flies to and from nest sites at night; and the Nēnē, which has been re-introduced on Haleakalā. Although experiments using lasers could occur during the ua'u breeding season, impacts are expected to be unlikely because of the predominant flight path which takes the birds over the Haleakalā NPS Visitor Center and not over the MSSC. Laser projections at MSSC are primarily directly overhead where the beam is blocked from propagating below 30 degrees. However, on rare occasions the AF has received past missions that required night projections below this 30 degree limit. The probability still remains very low that a species would be impacted due to safety protocols implemented and positive laser controls. Typically, these sensors/communications lasers are invisible to both humans and birds thereby reducing the potential species will be disoriented. The Visitor's Center is approximately 965 m (3168 feet) from the AEOS telescope/FASOR laser would be located. At this laser projection limitation (30 degrees above horizon) the beam would be 557 m (1,827 feet) above the Visitor's Center. This would indicate that it is highly unlikely petrels would intercept the beam at this location, since the majority of petrels fly below 15m (49 feet) AGL.

According to National Park Service representatives and the Resources Biologist at the Daniel K. Inouye Solar Telescope (DKIST) less than 17 petrel incidents have been observed near, but not on the Haleakalā Observatory site, from 1988 to 2014:

The Nēnē population would not be affected as none are known to reside at the elevation of the MSSC facility. Although the hoary bat could potentially be in the MSSC area it is not expected due to the cooler temperatures at night and therefore would not be adversely impacted.

#### **4.4.2 Scattered Laser Light**

It is well documented that petrel fledglings are attracted to and disoriented by sources of anthropogenic light on their post-natal nocturnal flights to the ocean (Troy, Holmes, & Green, 2011). One explanation for this behavior is that petrels use moon light to navigate to their burrows. It is believed that the petrel focuses on other bright light sources that emanate omni-directionally causing disorientation. This disorientation can cause them to fall to the ground following exhaustion and/or crashing into manmade structures and vegetation in a phenomena termed "fallout." Once grounded, the birds become vulnerable to dehydration, starvation, and predation (Troy, Holmes, & Green, 2011). While it is unknown what threshold of light intensity is required to attract or disorient birds, experiments have been performed that demonstrated a 40% decreased attraction of fledgling Procellariiform birds (Newell's Shearwater, Dark-rumped Petrel, and Band-rumped Storm-Petrels) by shielding upward radiation of lights at the largest resorts on Kauai (Reed, Sincock, & Hailman, 1985). This shows that limiting light viewing angles and direct intensity significantly reduces the attraction potential of artificial lights. These results can be extrapolated to the FASOR case, where all but a very small angle of light is shielded from view (i.e. the main beam) and the backscattered light consisting of a low intensity cone of light would have minimal attraction to birds.

Due to a laser's directionality and coherence properties, the on-axis (in-beam direct view) is very bright (i.e. when the beam is pointed directly at the viewer); while the off-axis visibility is very dim. In a vacuum, when the viewer is off-axis to the beam, the laser beam itself is invisible because the photons are all going in the same direction, and none are impacting the receptors in the viewer's eye. When propagating through an atmosphere, the laser photons are scattered when they hit air molecules (primarily nitrogen and oxygen)--Rayleigh scattering; and larger particles (dust and water vapor)--Mie scattering. When there are enough photons received in the eye, it resolves it as a beam in the sky. The angular distribution of scattered radiation is complex; however, it can be simplified by imagining the photons as balls all travelling in a single direction and bouncing off of molecules that they encounter. The distribution of the bounced photons would vary, with more bouncing back towards the source and fewer bouncing to the angle normal to the original direction of the source. The result is a cone of intensity, so the apparent brightness will change depending upon the viewer's angle relative to the beam—the backscattered light is brightest when standing near the laser source and gets dimmer as the viewer moves laterally away. Also, the density of molecules in the air will change the number of photon collisions and therefore the off-axis apparent brightness (Prilutsky & Fomenkova, 1990). For Rayleigh scattering the atmospheric nitrogen and oxygen concentrations can be considered pretty constant; however the Mie scattering can vary wildly due to ambient conditions such as clouds and dust storms.

For this reason, MSSC operations are suspended during cloudy or extreme weather conditions. The easiest way to explain the off-axis our visibility of the laser beam is to compare its apparent brightness compared to stars observed in the night sky. Astronomers use an “apparent magnitude scale” to measure the brightness of objects in the night sky. The brighter an object appears, the lower the value of its magnitude. A star that is one magnitude number lower than another star is about two-and-a-half times brighter. Table 1 is a list of some common apparent magnitudes.

<b>Direct View Object</b>	<b>Apparent</b>	<b>Number of stars brighter than apparent magnitude</b>
<b>Sun</b>	<b>-26.74</b>	<b>0</b>
<b>Full-Moon</b>	<b>-12.92</b>	<b>0</b>
<b>International Space Station (when fully illuminated by the</b>	<b>-5.9</b>	<b>0</b>
<b>10 watt incandescent bulb (5%</b>	<b>-2</b>	<b>0</b>
<b>Sirius (brightest star in</b>	<b>-1.46</b>	<b>0</b>
<b>Vega</b>	<b>0</b>	<b>4</b>
<b>Calculated FASOR brightness directly below the source</b>	<b>2.5</b>	<b>between 48 and 171</b>

<b>Faintest star visible to Human</b>	<b>6.5</b>	<b>9096</b>
<b>Calculated FASOR brightness at 1.5 km with source</b>	<b>6.5</b>	<b>9096</b>
Source: Wikipedia		

**Table 1: The calculated brightness of the FASOR backscatter is less than many stars and diminishes as the viewer travels away from the laser source.**

To compare the FASOR laser brightness in the night sky AFRL/RDMT and AFRL/RDS conducted a test involving a Sodium Laser on Kirtland AFB, NM; using a 10 watt light bulb to provide a reference light source, Figure 4. The apparent brightness of this laser was much less than a 10 watt light bulb and no brighter than the average star in the sky.

The photo was taken on a clear night, so the majority of the laser light seen Figure 4 is caused by Rayleigh scattering. A 10W incandescent light bulb viewed from 500 m (1,640 ft.) has an apparent magnitude of around -2.00, assuming that the bulb is 5% efficient; and the Sodium Laser has a magnitude of around 2.5 when viewed from directly under the beam pointed at zenith (Hackett, 2014).

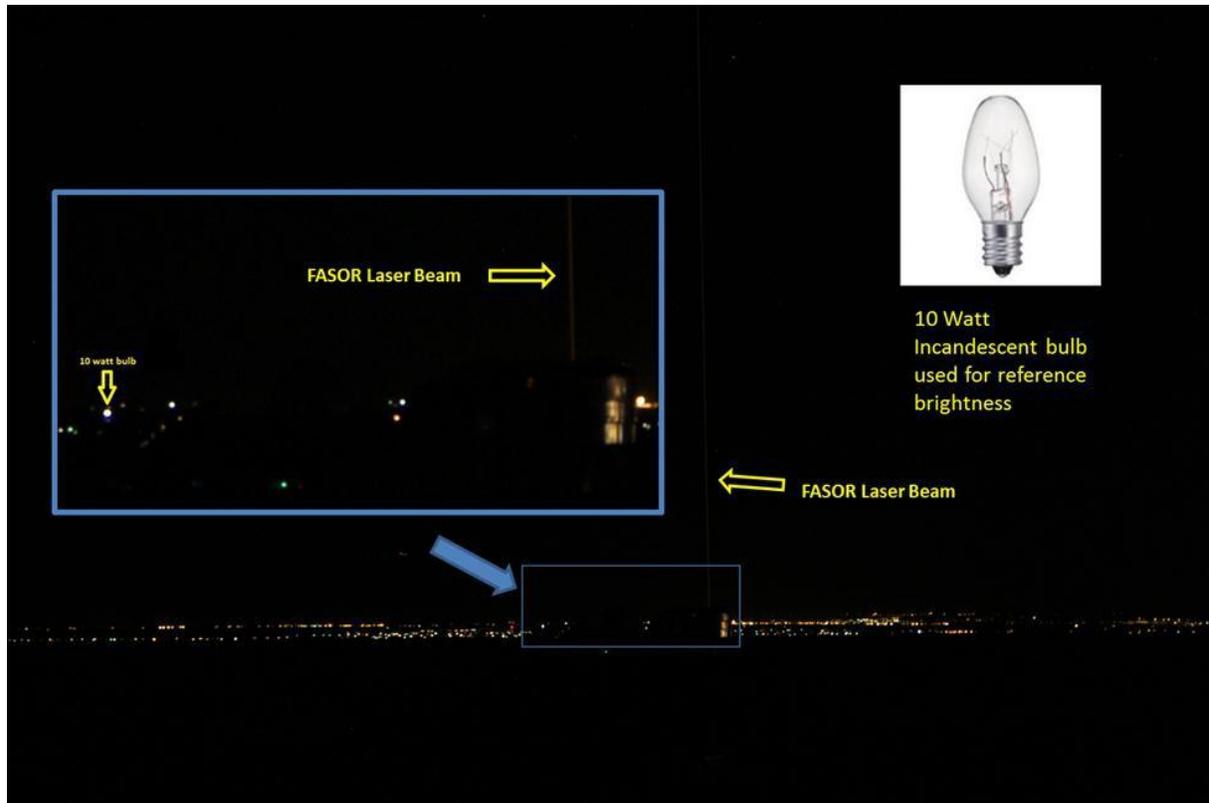


Figure 4: A 10 watt light bulb provides a relative brightness to the laser beam in this photo of the Sodium Guidestar laser at the Starfire Optical Range located on Kirtland Air Force Base, NM taken at a distance of 0.6 miles away.

Based upon this experiment and subsequent analysis, the operation of the sodium guidestar laser at MSSC is highly unlikely to adversely affect the wellbeing or flying behavior of any threatened or endangered species. Leading factors for this conclusion are:

- The sodium guidestar laser poses no surface or skin hazard due to the beam size, power, and notional exposure duration.
- The AFRL's MSSC has been performing outdoor laser and optical system testing since 2000 with negligible impact on environmental resources and no recorded impacts on any u'au or other wildlife form.
- While possible, it is extremely unlikely that a bird in flight near the laser projection (beam diameter 20 cm (7.874 in.)) would intersect resulting in retinal injury or surface injury, due to the; tracking and slewing of the laser beam, short exposure time to the beam, relative low bird activity over the MSSC, 30 degree laser elevation pointing limitation, and typical flight altitude (15m) of the petrel – below normal beam height above the ground.
- The backscattered sodium laser light will be 6.25 x dimmer than the brightest star in the sky, thus not constituting a bright light source. It is unlikely that a relatively dim, directional light would have the equivalent disorientation effects on petrels, as observed with bright

omni-directional light sources.

- The sodium guidestar laser would only be used intermittently and the duration of the laser beam projection is typically short (5-10 minutes in duration). If a bird were to become distracted or disoriented by the laser light, the light would be extinguished before the bird becomes exhausted, allowing it to recover and reorient its flight path.

### **No Action Alternative**

There would be no impacts to biological resources under the No Action Alternative as the proposed MSSC modernization efforts would not be implemented.

### **4.5 Cultural Resources**

All construction activities would be performed within the existing footprint of the MSSC. Digging would not be an expected modernization effort unless an emergency results and existing utilities need to be examined or repaired. These efforts would only occur as necessary and would follow strict LRDP construction practices and the AFRL Det 15 *Integrated Cultural Resources Management Plan*. Archaeological resources near the MSSC but not located within the MSSC boundaries would not be disturbed by the proposed activities. No soils or cinders would be removed from the site. Consultation has been initiated with the SHPD, and the AF has requested concurrence with their determination that the proposed action is not likely to adversely affect cultural resources.

The existing facilities can be seen faintly from Maui's central valley when clouds are absent and the air is clear. The existing relationships between the natural and man-made environments would be maintained. The proposed action would not affect visual resources and view planes from distances greater than 2 miles.

The primary impact on visual resources and view planes that would result from installation and operation of the FASOR laser is from the visible light (589 nm orange color) propagated from the AFRL MSSC AEOS telescope on the summit of Haleakalā. FASOR activities would be visible from various locations on the summit; mainly the Visitor's Center and the Summit Overlook. As mentioned above past and existing visible lasers have been used at the MSSC and HO, however these lasers have been in the blue and green spectrum. The FASOR laser is in the orange spectrum.

Visitors to these areas will be able to see the FASOR laser as it is propagated during nighttime hours. Although a photo is difficult to communicate the actual visibility of the FASOR laser beam, the image below was taken with a long exposure to relate the potential visibility depending on seeing conditions and background light. The sodium guide star laser would only be used intermittently and the duration of the laser beam projection is typically would be short (5-10 minutes in duration). During daylight activities, the FASOR would not be visible to the naked eye.



**Figure 5: The SOR Sodium Guidestar Laser, located South-East of the Albuquerque, NM metropolitan area, using a long exposure camera.**

However, to ensure protection of all nearby archaeological resources and maintain respect for the summit's cultural resources during significant construction efforts, the following measures would be implemented.

- A Cultural Specialist will be retained at the earliest stages of the planning process. This specialist will monitor the construction process, and consult with and advise the on-site Project Manager with regard to cultural or spiritual issues to be addressed. The Cultural Specialist would be a kanaka maoli (full-blooded Hawaiian person), preferably a kupuna (elder), and a kahuna as well, and one who has personal knowledge of the spiritual and cultural significance of Haleakalā.
- The cultural and archeological sites and features identified in the Archaeological Inventory Survey will be protected and preserved per HAR Title 13, Sub-Title 13, Chapter 277 "Rules Governing Requirements for Archaeological Site Preservation Development." Protection will include the establishment of clearly marked buffer zones and periodic monitoring by both the project Archaeologist and Cultural Specialist throughout the construction process.
- Construction crew members and permanent employees working at Haleakalā Observatories will attend UH-approved "Sense of Place" training prior to working at the project site. This training will instruct individuals on the cultural and historic significance of the Haleakalā Summit, as well as describe the spiritual essence of the area's natural resources.

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- Access to the area consisting of approximately 2,230 square meters (24,000 square feet) and located southwest of the AEOS, for the sole use of the kanaka maoli for religious and cultural purposes, would remain open on a non-interference basis with site activities.
- Passive in-place preservation will be continued for archaeological features. No new fencing or other demarcations would be added, so attention will not be drawn to them.

The Proposed Action would have no significant impact on cultural resources. This proposed action does not impact NAGPRA.

### **No Action Alternative**

There would be no impacts to cultural or visual resources under the No Action Alternative as the proposed MSSC modernization efforts would not be implemented.

## **4.6 Safety**

All MSSC modernization efforts would be managed to comply with OSHA, AFI 91-203, NEC specific codes unique to the activity and all safe construction practices would be adhered to. A pre-construction planning meeting would be held to ensure communication plans, schedules and procedures are established.

The lasers used at the MSSC range from eye-safe to those with significant eye and skin hazards. The most common MSSC laser hazard occurs when beams directly enter the eye, which could result in temporary flash blindness to permanent eye damage. To address this hazard, AFRL strictly adheres to OSHA, Air Force, and ANSI laser safety Standards and imposes strict safety protocols for all of its laser operations. For example, AFRL imposes a 30 degree minimum pointing angle for all laser operations—resulting in the elimination of laser hazards to the Public on the ground. The MSSC then incorporates a multi-tiered safety system to address inadvertent lasing of personnel on aircraft and space optical assets, by incorporating human outdoor safety spotters, monitoring Federal Aviation Administration (FAA) radar feed, and a space asset Predictive Avoidance (PA) system during all outdoor laser operations. Implementation of these safe guards has allowed MSSC to operate without incident for over twenty years.

No adverse or significant safety impacts are anticipated from the implementation of the proposed action to modernize and upgrade the MSSC facilities and equipment.

### **No Action Alternative**

There would be no impacts to public safety under the No Action Alternative as the proposed MSSC modernization efforts would not be implemented

## **4.7 Hazardous Material/Waste**

There would be no significant impacts to public health, safety or environmental resources associated with hazardous materials used or hazardous waste generated at the MSSC. Hazardous materials would be properly stored, used, and disposed of to prevent releases and to protect the ground from contamination. The volume and types of hazardous materials stored at the MSSC is not anticipated

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to change under the proposed action.

## **No Action Alternative**

There would be no impacts to Hazardous Materials/Waste under the No Action Alternative as the proposed MSSC modernization efforts would not be implemented

## **CHAPTER 5.0 CUMULATIVE IMPACTS**

A cumulative impact is the effect on the environment that could result from the incremental impact of a Proposed Action when added to other past, present, or reasonably foreseeable future actions. Cumulative impacts may result from individually minor but collectively significant actions that can take place over time. The actions proposed under the Preferred Alternative in this EA have the possibility to result in either positive or negative impacts in a cumulative manner. These projects all occur within a specific geographical region of influence and are limited on a temporal basis since they all have the potential to be implemented within a 20-year period, and therefore may increase the potential for cumulative effects. This cumulative impact analysis identifies and defines the scope of other actions and their interrelationship with the Proposed Action. This analysis is consistent with guidance published by the CEQ for implementing NEPA.

### **5.1 Cumulative Impacts from the Modernization of Current Facilities, Repair and Maintenance of Structures within the MSSC Existing Footprint.**

Cumulative impacts from construction activities related to renovations of the MSSC buildings and domes would include noise, air quality, biological resources, and roads and traffic.

Construction activities associated with this proposed action would add to current activities within the HO associated with building the DKST telescope. These activities are visible from various locations on Maui. The contribution of the proposed dome replacements would slightly increase air emissions, potential safety measures, roads and traffic activity and solid waste generation. Impacts on biological and cultural resources would be negligible since activities would be confined to the existing MSSC footprint. Minor increases in the dome dimensions would potentially impact visual resources; however, as a cumulative impact within the existing HO the impact would be negligible due to the AF commitment to stay within the MSSC footprint. Normal ambient noise levels within the HO are low; however, current construction activities for the DKST have already elevated these noise and vibration levels within the HO. The proposed action to modernize MSSC facilities and equipment are short-term and temporary and would not significantly add to the DKST noise and vibration levels. The MSSC modernization activities would be de-conflicted with other HO activities and would be managed to ensure levels are not elevated to adversely impact environmental resources.

Air quality is affected by various stationary and mobile sources, including vehicles, construction equipment, and generators. The proposed action would emit low-level exhaust emissions and fugitive dust. Construction equipment originating from other islands or the mainland could be infested by unwanted species when they arrive in Kahului. This impact would be minimized with the implementation of Park service inspections and vehicle steam cleaning, invasive species inspections, and rapid response to onsite discoveries of introduced species. Therefore, the Project contribution to impacts on botanical resources would be negligible and short-term, and the overall cumulative impact is considered minor. The Park road is the sole access corridor to Park recreation points, visitor centers, vista points, and to HO. Large volumes of traffic along the Park road corridor are typically associated with visitors to the Haleakalā Park. Because of the road conditions, all vehicles, and certainly larger ones such as buses and construction vehicles, have been slow moving, particularly around the extreme switchbacks and steep inclines. While this caused delays, the impact was detectable but not consequential.

Visitor use and experience are affected by collective use of the Park road that could restrict or hinder access to various recreational attractions throughout the Park. Because the Park road corridor provides the only access to these locations, consideration of cumulative impact from activities that hinder access is integral to determining the ultimate impact on visitors. The traffic along the Park road corridor has included personnel and service vehicles in support of HO activities. Occasionally, these activities have included slow-moving construction or service vehicles that have caused visitor traffic to be delayed on the way to or from the summit or other recreational areas accessed via the Park road. These delays have ranged from very infrequent (once or twice a month) to very frequent short-term delays.

As with the cumulative analysis for roadways and traffic, visitor use and experience at HO and the Park are affected by other construction and maintenance activities that occur at the same time visitors require use of the Park road. The potential contribution of the proposed actions, specifically as a result of additional slower moving wide and extra-wide construction vehicles, would have a noticeable impact on visitor access and travel delays. Measures to be taken to reduce this impact include the use of signage, coordination with the Park, and public notifications to inform visitors of roadway delays in advance to allow them to plan their trips accordingly. As necessary, road pull-offs and traffic monitors would allow traffic to flow and avoid inadvertent off-road travel, thus limiting roadside resource impacts. By employing such measures, this impact would still be detectable but would be reduced and avoided where possible. These impacts would be short-term. As such the cumulative impact on visitor use and experience after mitigation would be minor.

## **5.2 Modernization and Upgrade of Equipment and Instrumentation at MSSC needed to Accomplish State-Of-The-Art Space Observation, Illumination, and Ranging Capabilities.**

The primary cumulative impact from the modernization of equipment would be to the visual resources on the site. This impact would come from the fact that the FASOR laser is a visible laser and would be seen by visitors to the summit during nighttime hours on a regular basis. The FASOR sodium guide star laser would only be used intermittently and the duration of the laser beam projection would be short (5-10 minutes in duration) but would occur multiple times per hour over a 6-8 hour period. During daylight activities, the FASOR will not be visible to the naked eye. Laser usage has been in place at HO for decades. Currently lasers are being used for outdoor propagation by numerous entities on HO. The proposed visible FASOR laser is an addition to existing and previously used lasers in the HO. Visible lasers in the green spectrum are currently used by the AF and the University of Hawaii. The only difference is that the FASOR laser will be a different color (orange) than is currently being used. Overall, AFRL/Det 15 has significantly reduced the number of lasers used at the MSSC, adding the FASOR does not increase the operations tempo but does create a new visual image that visitors to the summit would potentially see. Cumulative operations of lasers, in addition to the FASOR laser, at MSSC are highly unlikely to adversely affect the well-being or flying behavior of any biological resources.

## **Chapter 6.0 LIST OF ORGANIZATIONS AND INDIVIDUALS CONTACTED, REVIEWERS, AND PREPARERS**

<b>Person and Agency</b>	<b>Subject/Role</b>
Michelle Hedrick, AFRL/RD, Lead Test and Environmental Office	Preparer
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Sarah Loney, AFRL/RDS/Det 15, Safety and Environmental Contractor	MSSC Site Operations Safety and History
Capt. Shawn Hackett, AFRL/RDSS, FASOR Laser Operations Specialist	FASOR Laser visibility calculations
Dr. Skip Williams, AFRL/RDSM/Det 15, Technical Advisor	MSSC & FASOR Operations

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## FINDING OF NO SIGNIFICANT IMPACT

### MODERNIZATION OF MAUI SPACE SURVEILLANCE COMPLEX FACILITIES/EQUIPMENT Haleakalā, Maui, Hawaii

Pursuant to Section 102(2)(c) of the National Environmental Policy Act (NEPA) of 1969 and the implementing regulations of the Council on Environmental Quality (CEQ) (40 Code of Federal Regulations, Parts 1500-1508), the Air Force Research Laboratory (AFRL) gives notice that a Draft Environmental Assessment (EA) has been prepared to address the potential environmental consequences of the Modernization of Maui Space Surveillance Complex Facilities and Equipment in Haleakalā, Maui, Hawaii. The Proposed Action is to repair, maintain and update current buildings and equipment within their existing footprint over the next five - ten years. Additionally, AFRL/DET 15 proposes the installation and operation of new sensors and equipment which includes a sodium laser known as Frequency Addition Source of Optical Radiation (FASOR) for enhanced research and development activities associated with space observation, illumination, and ranging capability by spring of 2015.

This Finding of No Significant Impact (FONSI) summarizes the Proposed Action and alternatives and the results of the environmental analysis.

#### **Site Location**

The modernization of research equipment and facilities will occur at the Maui Space Surveillance Complex located at the Haleakalā Observatory at the summit of Mount Haleakalā in Maui.

#### **Purpose of and Need for the Proposed Action**

The purpose of this action is for AFRL/DET 15 to modernize research equipment and facilities in order to continue meeting its DoD operational requirements and research objectives. The MSSC mission is required for the space monitoring network of the U.S. Air Force serving a dual role: facilities for the collection of electro-optical data from suborbital, near earth, and deep-space objects and as a test site for sensor/laser research.

#### **Description of the Proposed Action and Alternatives**

##### Proposed Action.

The Air Force is committed to maintaining state-of-the-art integrated electro-optical systems and to expanding its current capabilities for the transition of Research and Development (R&D) products for Air Force and National use. Upgrades and modernization of electronics, sensors

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(FASOR), instrumentation, and data collection systems are needed to improve MSSC's ability to provide high-quality, timely products that enable US Space Superiority. The goal of this modernization is to enable net-centric communications and improve the site's ability to maintain awareness of deep space objects; to characterize objects and search for closely spaced objects in proximity to objects of interest; to discover dim objects; to improve fast-search capabilities; to perform tactical indications and warnings; and continue to provide space object identification (SOI) data products on Low Earth Orbit (LEO) and Geosynchronous Earth Orbit (GEO) objects.

Mount Haleakalā, located at 3,050 meters (10,010 feet) in altitude, is above one third of the Earth's atmosphere and provides excellent conditions for astronomical observation. This combined with its remoteness from light pollution sources and high number of non-cloudy days makes it one of the best locations in the world for ground-based telescope observations. Haleakalā is an optimal location for obtaining the highest quality space object imagery required by the Air Force mission.

Modernization activities would include repairing, renovating, maintaining and updating existing facilities to maintain a state of the art facility. Repair and renovation activities would include building modifications within the existing footprint, dome replacements, concrete repair and painting the building exterior. These activities would include connections to utilities, lightning protection, and other site improvements. Dome replacement includes the inspection of supporting hardware; removal of defective components; and installation of replacement parts in their original attachment points. Facility and dome renovation activities may require the removal of lead based paint in accordance with 40 CFR 745. Dome replacements would require the use of a crane on-site to assist with the removal and installation of dome equipment. When the removed hardware, concrete grouting, and dome base ring(s) are determined to be non-hazardous they would either be disposed of at the land fill or recycled through the Defense Reutilization and Marketing Office (DRMO). Any hazardous waste generated from these efforts would be disposed of IAW Federal, State and Local regulations.

## Site Alternatives.

Alternative sites considered for the research activities performed at Maui would require the use of a large telescope similar to the Advanced Electro-Optical System (AEOS) 3.6 m telescope located at Maui. Alternative sites would also need state-of-the-art instrumentation and equipment or would require upgrades as is currently required at the AFRL/MSSC site. Modernization includes installation of new sensors; lasers, cameras and instrumentation and repair replacement of domes, and beam directors. The Starfire Optical Range (SOR) at Kirtland AFB could be a potential location to perform the AFRL/DET 15 MSSC research activities. Operations at SOR consist of optical research and advanced imaging R&D experiments. These research efforts and associated experiments utilize similar equipment in the form of 3.5 m and 1.5 m telescopes and various lasers to obtain optical images. The facility is operated primarily

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from dusk to dawn including infrequent daylight operational experiments that do not require totally dark conditions.

The SOR was eliminated as an alternative to the proposed action due to its current and projected future operations tempo, which is heavily programmed and scheduled for its current the R&D mission. SOR operates 5 days a week for 42 weeks out of the year. A typical night of testing encompasses approximately 10-12 hours per night with 6-8 hours being scheduled test hours. The SOR facility is shut down for approximately 8 weeks for engineering/maintenance and there is a 2 week shutdown during the holidays. Additionally, SOR does not have the same climate and seeing conditions that MSSC has, nor can SOR provide the AF Space Command operational data and information for the on-going DoD operational mission due to its current and future workload. No other existing government facilities with atmospheric seeing conditions similar to Maui are available for consideration to accommodate the MSSC research mission.

## No-Action Alternative.

The No-Action Alternative, modernization of the facility would not occur, domes within MSSC would not be replaced and equipment/sensors to include the FASOR sodium guide star laser would not be installed or operated at MSSC. The objective to modernization of current facilities (within existing footprint) and equipment at MSSC to maintain state-of-the-art space observation, illumination, and ranging capabilities would not be met. Critical operational mission data collection, and research and development pertaining to improving image resolution would not occur. Operations and experiments involving the AEOS telescope would decrease. The MSSC capabilities would fall behind in its ability to provide relevant, high quality data to support Air Force mission needs and eventually become obsolete.

## **SUMMARY OF ANTICIPATED ENVIRONMENTAL EFFECTS**

The following resources or issues of concern were evaluated: Land Use/Noise, Air Quality, Infrastructure, Traffic and roads, Hazardous Materials/Waste, Biological Resources, Cultural Resources, Public Safety, and Cumulative Impacts. A summary of potential impacts from the Proposed Action and alternatives follows.

### **Proposed Action**

*Land Use/Noise.* Renovations proposed at MSSC would involve noise associated with typical building construction activities. Appropriate noise-reducing measures, such as limiting unnecessary idling of equipment, or using quiet equipment where possible, would be considered as needed. Additionally, construction would be kept at least 91 meters (300 feet) away from ‘ua’u burrows during the nesting season (February to November), when the ‘ua’u are at Haleakalā to mitigate noise disturbance.

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The Proposed Action would have no significant impact on land use. It would support and be consistent with activities currently performed on the 18 acres known as Haleakalā Observatories. The AF would follow state, county, community, and University of Hawaii, Institute for Astronomy (UH IfA) requirements for the modernization of existing facilities and upgrade of research equipment. Implementation of the Proposed Action would not restrict access to current public areas.

*Air Quality.* AFRL, Det 15 manages activities to ensure compliance with federal and state regulations for air emissions. A slight increase in criteria and hazardous air emissions and fugitive dust would occur with the construction and renovation efforts associated with modernization of MSSC facilities; however, these emissions would not exceed regulatory action levels and would be temporary. To minimize fugitive dust emissions, the construction staging areas will be limited to areas that currently possess concrete pavement or previously disturbed areas. No significant impacts on air quality would occur from the modernization of facilities, equipment or operation of the FASOR laser.

*Infrastructure, Traffic and Roads.* There would be no significant impact to roads or traffic from the Proposed Action. Prior to construction activities, vehicle routes would be identified and scheduled with the National Park Service for transporting equipment and supplies to the summit. Construction-related vehicles would temporarily increase the number of vehicles to the summit during renovation activities, which would be for a short duration. Once at the construction site, the vehicles and equipment would be operated within the Haleakalā Observatories boundary and specifically within the MSSC Property in a designated construction staging area.

Only minor infrastructure changes would occur with the modernization of the equipment and facilities. Any electrical changes required for equipment and facilities would meet National Electric Code requirements. No changes to the MSSC water or wastewater systems are expected. Minor modifications to heating and cooling systems may occur to accommodate research hardware requirements. No significant impacts to the environment are anticipated from these minor infrastructure activities.

*Biological Resources.* The proposed modernization of the MSSC facilities and equipment would have no significant impact biological resources. No silverswords are located in the project areas for modernization efforts; however, specific care would be taken to protect any nearby silverswords during construction efforts. Heavy equipment would not be operated near ‘ua’u burrows during the nesting season to mitigate noise and ground vibrations that could potentially affect ‘ua’u fledging success. Noise levels at the nearest burrow are not anticipated to reach or exceed 84 dBA. Additional measures described in the UH IfA, Long Range Development Plan (LRDP) would be followed to minimize the potential adverse effects of construction activities on

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the ‘ua’u. Although the summit area is outside the known feeding range of the nēnē, additional traffic from construction vehicles ascending and descending the mountain could slightly increase the risk of traffic collisions with nēnē.

Our analysis has determined that the operation of the FASOR sodium guide star laser at MSSC is highly unlikely to adversely affect the wellbeing or flying behavior of any threatened or endangered species. Analysis shows the proposed equipment/sensor installation and operation of the sodium guide star laser, “FASOR”, poses no surface or skin hazard due to the beam size, power, and notional exposure duration. While possible, it is extremely unlikely that a bird in flight near the laser projection (beam diameter 20 cm (7.874 in.) would intersect resulting in retinal injury or surface injury, due to: tracking and slewing of the laser beam, short exposure time to the beam; relative low bird activity over the MSSC; 30 degree laser elevation pointing limitation; and typical flight altitude (15m) of the petrel – below normal beam height above the ground. The AFRL's MSSC has been performing outdoor laser and optical system testing since 2000 with negligible impact on environmental resources and no recorded impacts on any u'au or any other wildlife.

Consultation under the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*) was completed with the U.S. Fish and Wildlife Service on 3 Jan 2015. Based on AFRL’s avoidance and minimizing measures, USFWS has concurred with our determination that the proposed project may affect, but is not likely to adversely affect the Hawaiian petrel, Haleakala silversword, Hawaiian goose, and Hawaiian hoary bat.

*Cultural Resources.* There are no cultural resources, identified on the State Inventory of Historic Places or the State or National Register of Historic Places, within the project site. Cultural resources located outside of the project site would not be disturbed and would be protected per HAR Title 13, Sub-Title 13, Chapter 277 “Rules Governing Requirements for Archaeological Site Preservation Development” by implementing the management provisions identified in the UH IfA’s LRDP summarized in this EA. A slight change on visual resources and view planes would result from installation and operation of the FASOR laser would occur from the visible light (589 nm orange color vice blue or green previously seen) propagated from the AFRL MSSC AEOS telescope on the summit of Haleakalā. Cultural resources would be protected by establishing clearly marked buffer zones and periodic monitoring by both the project Archaeologist and the Cultural Specialist throughout construction . AFRL requires all construction crew members and permanent employees working at Haleakalā Observatories to attend UH-approved “Sense of Place” training prior to working at the project site. Access to cultural areas southwest of AEOS would remain open, for the sole use of the kanaka maoli for religious and cultural purposes, and would not be impacted by AFRL/MSSC activities. .

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Safety. No adverse or significant safety impacts are anticipated from the implementation of the proposed action to modernize and upgrade the MSSC facilities and equipment. Established site safety policies and procedures will be continued for outdoor laser operations.

Hazardous Materials/Waste. There would be no significant impacts to public health, safety or environmental resources associated with hazardous materials used or hazardous waste generated at MSSC. Materials would be properly stored, used, and disposed of to prevent releases and to protect the ground from contamination. The volume and types of hazardous materials stored at the MSSC is not anticipated to change under the proposed action.

Cumulative Impacts. Implementation of the Proposed Action would have no significant cumulative impacts associated with environmental resources. Cumulative impacts from construction activities related to renovations of the MSSC buildings and domes would include minor temporary increases in noise, air quality, biological resources, and roads and traffic. The MSSC modernization activities would be de-conflicted with other HO activities and would be managed to minimize impacts on environmental resources. The cumulative analysis for roadways and traffic, visitor use and experience at HO and the Park are affected by other construction and maintenance activities that occur at the same time visitors require use of the Park road. The potential contribution of the proposed actions, specifically as a result of additional slower moving wide and extra-wide construction vehicles, would have a noticeable but temporary and infrequent impact on visitor access and travel delays. Measures would be taken to reduce this impact as summarized in this EA.

The addition of the FASOR laser is a visible laser and would be seen by visitors to the summit during nighttime hours on a regular basis. The proposed visible FASOR laser is an addition to existing and previously used lasers in the HO. Visible lasers in the green spectrum are currently used by the AF and the University of Hawaii. The only difference is that the FASOR laser will be a different color (orange) than is currently being used. Overall, AFRL/Det 15 has significantly reduced the number of lasers used at the MSSC, adding the FASOR does not increase the operations tempo but does create a new visual image that visitors to the summit would potentially see. Cumulative operations of lasers, in addition to the FASOR laser, at MSSC are highly unlikely to adversely affect the well-being of the public or the flying behavior of any biological resources.

## **No-Action Alternative**

Under this alternative, there would be no significant impact on existing environmental resources, since the proposed MSSC modernization would not be accomplished. However, the *purpose* of the Proposed Action – to modernize and upgrade the equipment, instrumentation and facilities at

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MSSC to provide relevant, high quality data to support Air Force mission needs would not be met.

## CONCLUSION

After careful review of the EA, I have concluded that the Proposed Action would not have a significant impact either by itself or cumulatively (with other nearby projects) on the quality of the natural or human environment. Therefore, issuance of a FONSI is warranted, and an Environmental Impact Statement is not required. This analysis fulfills the requirements of NEPA and implementing regulations promulgated by the CEQ. Accordingly, the requirements of the National Environmental Policy Act of 1969 and the Council on Environmental Quality, and the Code of Federal Regulations, Title 32, Part 989, Environmental Impact Assessment Process, have been fulfilled, and an Environmental Impact Statement is not necessary and will not be prepared.

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Accepted by: MICHELLE L. HEDRICK  
Lead Test & Environmental Engineer  
AFRL Directed Energy Directorate

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Date:

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Approved by: JAMES D. PHILLIPS, LtCol, USAF  
Commander, AFRL Detachment 15

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Date: