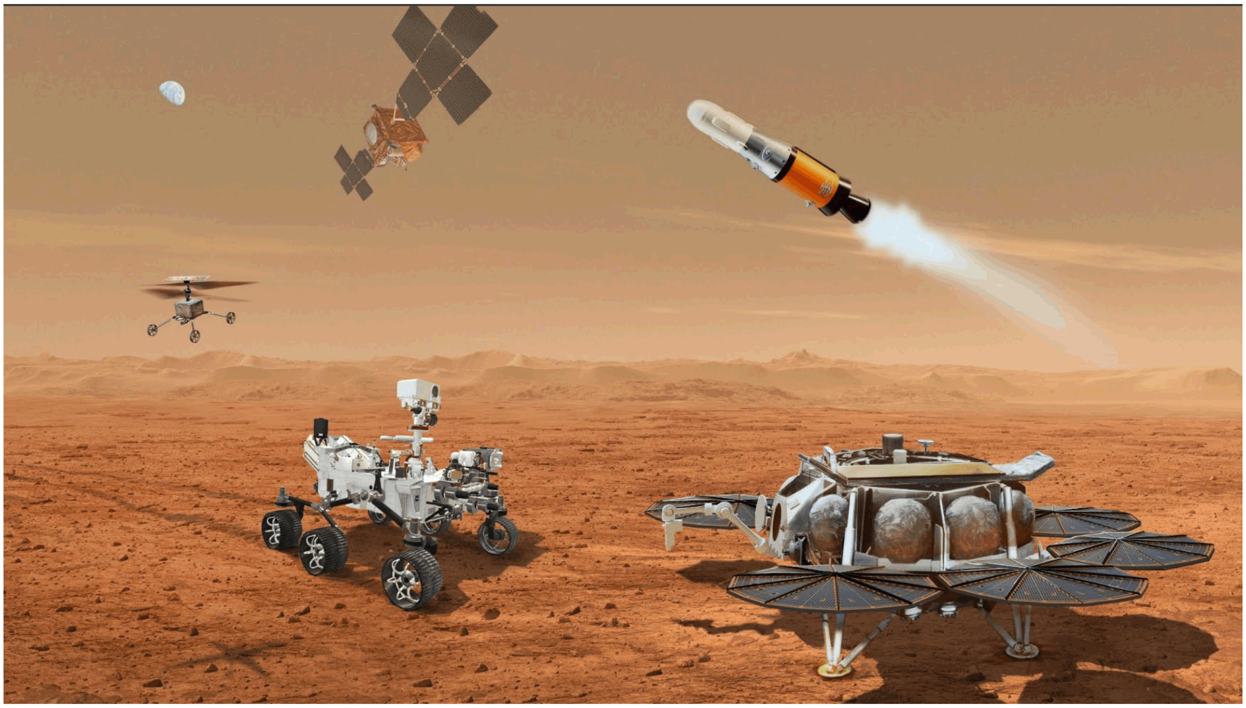

DRAFT

Mars Sample Return (MSR) Campaign Programmatic Environmental Impact Statement*

*Includes Review under Executive Order (EO) 12114, *Environmental Effects Abroad of Major Federal Actions*

November 2022

Science Mission Directorate
National Aeronautics and Space Administration
Washington, DC 20546

www.nasa.gov

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COVER SHEET

Programmatic Environmental Impact Statement for the Mars Sample Return (MSR) Campaign

Responsible Agency: National Aeronautics and Space Administration (NASA)

Cooperating Agencies: Department of the Air Force (DAF) (Hill Air Force Base, Utah, and Cape Canaveral Space Force Station [CCSFS], Florida), Department of the Army (Dugway Proving Ground [DPG]), U.S. Department of Agriculture, and Centers for Disease Control and Prevention

Affected Location: Utah Test and Training Range (UTTR), Utah

Report Designation: Draft Programmatic Environmental Impact Statement (PEIS)

Point of Contact: Mr. Steve Slaten, NASA MSR NEPA Project Manager, NASA Jet Propulsion Laboratory, 4800 Oak Grove Drive, M/S: 180-801, Pasadena, California 91109-8099

Public Comments Due: December 19, 2022

Abstract: NASA, in coordination with the European Space Agency, proposes to conduct a campaign to retrieve samples from Mars and transport them to Earth. A scientifically selected set of samples (i.e., Martian rocks, regolith, and atmosphere), acquired and cached on the surface of Mars by the Perseverance rover, would be returned to Earth for scientific analysis and research. The proposed MSR Campaign involves several flight elements associated with retrieving the samples on Mars, launching them into Mars orbit, capturing the samples in orbit, and returning them to Earth for study. The proposed sample landing location is the DAF-managed UTTR, with supporting activities proposed at U.S. Army-managed DPG. Additional Earth-based ground elements associated with sample transportation and sample management/research (otherwise referred to as “curation”) involving the development and operation of a Sample Receiving Facility (SRF) are also part of the MSR Campaign architecture.

NASA is the lead agency, with the DAF serving as a cooperating agency because the scope of NASA’s Proposed Action involves activities under DAF jurisdiction by law; other cooperating agencies listed above are serving as cooperating agencies due to special expertise. This PEIS has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, as amended (42 United States Code 4321 et seq.); Executive Order 12114, *Environmental Effects Abroad of Major Federal Actions*; the 2022 *Council on Environmental Quality Regulations for Implementing the Procedural Provisions of NEPA* (Title 40 Code of Federal Regulations [CFR] Parts 1500–1508); NASA’s procedures for implementing NEPA (14 CFR § 1216.3); and DAF procedures for implementing NEPA in the Environmental Impact Analysis Process (EIAP) (32 CFR Part 989). NASA is the agency that will sign a Record of Decision (ROD) and, depending on what activities would occur on the UTTR or CCSFS, the DAF may also sign a separate ROD or cosign the NASA ROD.

Because of the campaign’s large scope and uncertainty regarding future timing, locations, and environmental impacts associated with ground element actions, this PEIS programmatically addresses the potential impacts associated with all elements of the MSR Campaign and site-specifically addresses potential impacts at the UTTR. Future tiered analyses are planned to address site-specific impacts associated with sample transportation and development and operation of an SRF.

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SUMMARY

S.1. INTRODUCTION

NASA, in coordination with the European Space Agency (ESA), proposes to conduct a campaign to retrieve samples from Mars and transport them to Earth. A scientifically selected set of samples (i.e., Martian rocks, regolith, and atmosphere), acquired and cached on the surface of Mars by the Perseverance rover, would be returned to Earth for scientific analysis and research. The proposed Mars Sample Return (MSR) Campaign involves several flight elements associated with retrieving the samples on Mars, launching them into Mars orbit, capturing the samples in orbit, and returning them to Earth for study. The proposed sample landing location is the Department of the Air Force (DAF)-managed Utah Test and Training Range (UTTR), with supporting activities proposed at U.S. Army-managed Dugway Proving Ground (DPG). Additional Earth-based ground elements associated with sample transportation and sample management and research (otherwise referred to as "curation") involving the development and operation of a Sample Receiving Facility (SRF) are also part of the MSR Campaign architecture.

NASA is the lead agency, with the DAF serving as a cooperating agency because the scope of NASA's Proposed Action involves activities under DAF jurisdiction by law; other cooperating agencies are serving as cooperating agencies due to special expertise (i.e., the Department of the Army, U.S. Department of Agriculture, and Centers for Disease Control and Prevention). This Programmatic Environmental Impact Statement (PEIS) has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, as amended (42 United States Code [U.S.C.] 4321 et seq.); Executive Order (EO) 12114, *Environmental Effects Abroad of Major Federal Actions*; the 2022 *Council on Environmental Quality Regulations for Implementing the Procedural Provisions of NEPA* (Title 40 Code of Federal Regulations [CFR] Parts 1500–1508); NASA's procedures for implementing NEPA (14 CFR § 1216.3), and DAF procedures for implementing NEPA in the Environmental Impact Analysis Process (EIAP) (32 CFR Part 989). NASA is the agency that will sign a Record of Decision (ROD) and, depending on what activities would occur on DAF-managed properties (mission preparation, use of staging area[s], and sample return vehicle landing and recovery operations), the DAF may also sign a separate ROD or cosign the NASA ROD to accommodate these activities.

S.2. PURPOSE AND NEED

The purpose of the proposed MSR Campaign is to collect samples of Martian rocks, regolith, and atmosphere and then return those samples to Earth for detailed analysis to enable significant advances in the following:

- the search for evidence of ancient life forms on Mars;
- the understanding of the origin and evolution of Mars as a geological system and how it may relate to the origin and evolution of other terrestrial planets;
- the understanding of the processes and history of climate on Mars; and
- the preparation for human exploration.

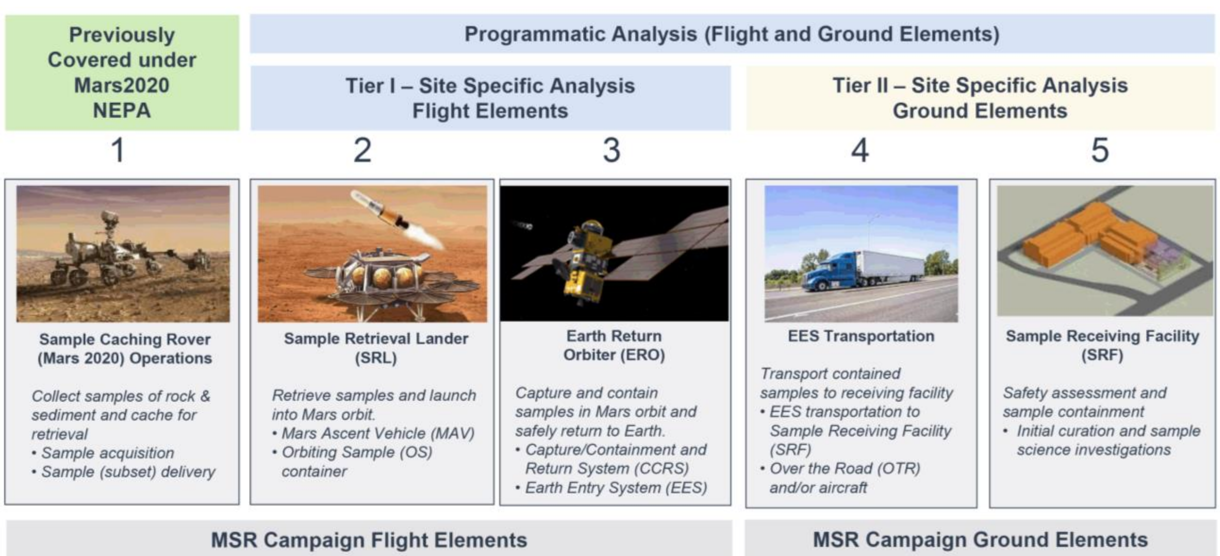
The need for the Proposed Action is to support major goals of the international planetary science community. Obtaining a scientifically selected set of samples of Mars for study on Earth has been a major goal of the international planetary science community for several decades. From the earliest Mars missions, it was recognized that the complexity and cost of sending advanced instruments to study Mars in place (*in situ*) would restrict the scope and detail of the science that could be done; many important classes of scientific instruments are not amenable to the miniaturization and ruggedization that would be necessary to operate from a spacecraft. An important aspect of this is that many critical measurements can only be done on samples that have been through intricate sample preparation processes, and most of those processes are not able to be automated. These same principles regarding the importance of using terrestrial laboratories to enable the best scientific return also apply to the care and attention to detail that would be required to conduct a proper and comprehensive sample safety assessment in a proposed SRF.

By acquiring and delivering to Earth a rigorously documented set of Mars samples for investigation in terrestrial laboratories, scientists would have access to the full breadth and depth of analytical science instruments available across the world. Similar to the lunar samples returned by NASA's Apollo missions to the Moon (1969–1972), the Mars samples would be studied for many decades and would include using future techniques that have not yet been invented.

S.3. OVERVIEW OF THE PROPOSED ACTION AND ALTERNATIVES

S.3.1 Proposed Action (Mission Overview)

The MSR Campaign includes three flight elements and two ground elements. The flight elements consist of the Perseverance rover, a Sample Retrieval Lander (the "Lander"), and the Earth Return Orbiter (the "Orbiter"), including its payload (the Earth Entry System [EES]) and payload recovery. The two ground elements are transportation of the EES from UTTR/DPG to an SRF, as well as development and operation of an SRF.



Key: EES = Earth Entry System; MSR = Mars Sample Return; NEPA = National Environmental Policy Act.

Figure S-1. MSR Campaign Elements

NASA is taking a programmatic approach to analyzing the environmental consequences of the MSR Campaign program elements because of the campaign’s large scope and uncertainty regarding future timing, locations, and environmental impacts associated with ground element actions. This programmatic approach allows for near-term focus on issues ripe for decision and establishes a foundation for follow-on tiering (sequencing) to future actions and minimizing detailed topics previously decided at the initial programmatic level. This PEIS programmatically addresses the potential impacts associated with all elements of the MSR Campaign and site-specifically addresses potential impacts at the UTTR/DPG. Depending on NASA's decision on the Proposed Action as set forth in a ROD, future tiered NEPA analysis would occur after the ROD is finalized but before additional action is taken to address specific environmental impacts related to EES transportation (e.g., over the road or via aircraft) from the UTTR/DPG complex to an SRF. The type, location, construction, and operation of an SRF would also be analyzed in specific detail after mission requirements are more robustly characterized.

Because the proposed launches are more than five years away, and the landing potentially ten years away, the mission and design requirements are still in development and subject to further refinement. As a result, the MSR Campaign and its elements are described using the most current planned mission architecture at this time. Should substantial changes relevant to environmental concerns, as described and analyzed in this PEIS, be proposed for the MSR Campaign architecture or should NASA become aware of significant new circumstances or information relevant to environmental concerns and bearing on the Proposed Action or its impacts, NASA may prepare a supplemental environmental impact statement or analyze the changes in its Tier II document for ground elements, as appropriate.

Flight Elements

Launches and Landings

Currently, the Perseverance rover (launch analysis of this aspect was previously addressed in the *Mars 2020 Supplemental EIS*) (NASA 2020a) is collecting samples and caching them on the surface of Mars. The Lander—to be launched by NASA at either Cape Canaveral Space Force Station or Kennedy Space Center—would deliver the Mars Ascent Vehicle with the Orbiting Sample container, a Sample Transfer Arm provided by ESA, and up to two Sample Recovery Helicopters to the surface of Mars. The Perseverance rover would be the primary means of transporting samples it has retained on board directly to the Lander, where the Sample Transfer Arm would load the sample tubes into the Orbiting Sample container. The Sample Recovery Helicopter, based on the design of the Ingenuity helicopter that landed on Mars with Perseverance and has operated well beyond its original planned lifetime, would provide a secondary capability to retrieve samples cached on the surface of Mars. The Mars Ascent Vehicle would launch the Orbiting Sample container loaded with sample tubes into Mars orbit. The Orbiter (also provided by ESA and launched from French Guiana) includes the Capture, Containment, and Return System (CCRS) provided by NASA, which would capture and contain the Orbiting Sample container for return to the surface of Earth. The CCRS comprises four elements: 1) the Capture Enclosure, 2) the Assembly Enclosure, 3) the Earth Entry Vehicle, and 4) the Micrometeoroid Protection System.

The CCRS captures the Orbiting Sample, contains it, and places it inside the Earth Entry Vehicle, creating the EES.

Sample Recovery

The flight element aspect of the MSR Campaign also includes the recovery of the EES once it has landed. Once the EES has landed, the notional plan is that the whole EES would be recovered and contained within a “vault” (an environmentally isolated, biocontained, safe and secure enclosure) and transported to an SRF (not on the UTTR/DPG), where the samples would be processed and analyzed. Transportation of the EES from the landing site to an SRF, as well as development and operation of an SRF, are considered ground elements of the MSR Campaign. Recovery operations specific to the UTTR/DPG are described in Section S.3.1.1 (Site-Specific Aspects [UTTR/DPG]).

Consensus opinion within the astrobiology scientific community supports a conclusion that the Martian surface is too inhospitable for life to survive there today, particularly at the location and shallow depth (6.4 centimeters [2.5 inches]) being sampled by the Perseverance rover in Jezero Crater, which was chosen as the sampling area because it could have had the right conditions to support life in the ancient past, billions of years ago (Rummel et al. 2014, Grant et al. 2018). There is no current evidence that the geologic samples collected by the Mars 2020 mission from the first few inches of the Martian surface could contain biological entities (living organisms and/or bioactive molecules capable of propagation) that would be harmful to Earth’s environment. Nevertheless, out of an abundance of caution and in accordance with NASA policy and regulations, NASA would implement measures to ensure that the Mars material is fully contained (with redundant layers of containment) so that it could not be released into Earth’s biosphere and impact humans or Earth’s environment. The material would remain contained until examined and confirmed safe or sterilized for distribution to terrestrial science laboratories. NASA and its partners would use many of the basic principles that Biosafety Level 4 (BSL-4) laboratories use today to contain, handle, and study materials that are known or suspected to be hazardous.

Although not listed or designated as such under any regulatory definition, the Mars samples would be handled in a manner consistent with guidance from protocols for Biological Select Agents and Toxins (BSAT). BSAT are specific biological agents that fall under a congressionally mandated level of control. BSAT material requires the use of additional biosafety measures (e.g., a higher level of biocontainment). For highly infectious or unknown materials, the highest level of biosafety (BSL-4) and biosecurity measures, in addition to specific measures for transport and inactivation, must be utilized. Because the samples would be treated as though potentially hazardous until demonstrated otherwise, they would be handled in a manner that provides the highest level of security and containment during the EES landing, recovery, transportation, sample storage, and receiving/curation mission phases and that is consistent with BSAT protocols in support of the planetary protection requirements. The samples would be stored and handled consistent with BSAT protocols until deemed safe for release.

Ground Elements

EES Transportation

After containment of the EES at the landing site and transfer to the vault, the EES would be transported to an SRF. The objective would be to recover the EES, place it in the vault, and begin the transport process from the vault location at the UTTR/DPG to an SRF as soon as reasonably practicable; NASA intends to move the vault from the UTTR/DPG to the SRF as soon as practicable barring specific weather and other day-of-landing operational constraints. Transport methods have yet to be determined; however, the vault would be delivered to the SRF using either over-the-road (OTR) transport or a combination of OTR and aircraft (e.g., C-130) transport. Exact transportation methods and routes would depend on the type of vault utilized and the location of an SRF. Thus, in this PEIS, potential impacts associated with possible transportation methods are analyzed from a programmatic perspective based on either OTR and/or aircraft use. This programmatic analysis identifies protocols and requirements associated with transportation of BSAT-type materials and general impacts associated with OTR and/or aircraft use (e.g., air emissions). This PEIS can be utilized to guide Tier II analysis once the vault type, location of an SRF, and transportation methods to an SRF have been identified and proposed. This PEIS does not include site-specific analysis of EES transportation from the landing site to an SRF.

Transportation of the EES would follow guidelines under U.S. Department of Transportation's Hazardous Materials Regulations (Title 49 CFR Parts 171–180) and the Federal Select Agents Program. Section 11 of the select agent regulations (42 CFR § 73.11, *Select Agents and Toxins, Security*; 7 CFR § 331.11, *Possession, Use, and Transfer of Select Agents and Toxins, Security*; and 9 CFR § 121.11, *Possession, Use, and Transfer of Select Agents and Toxins, Security*) requires development and implementation of a security plan sufficient to safeguard the select agents or toxins against unauthorized access, theft, loss, or release. Transportation of the EES would be guided by these security requirements as identified through a NASA-developed security plan (which will be prepared in coordination with appropriate cooperating and coordinating agencies), as well as the results of NEPA analyses, mitigations carried forward, and resulting RODs.

Samples (Mars and landing site soils) would remain in NASA custody from landing/retrieval through transport to an SRF; no custody transfer of samples to any other entity would occur before the material was determined to be nonhazardous or before safe methods for transfer and handling were established and reviewed by appropriate authorities.

Sample Receiving Facility

An SRF would be a temporary or permanent facility used to isolate unsterilized Mars materials from the Earth's environment. Activities anticipated at this type of facility are removal of the Mars samples from the EES; sample safety assessment; curation (including the preservation, conservation, management, preliminary examination, cataloging, allocation, and distribution) and physical security of Mars materials; and analysis, which may include scientific or planetary protection activities. Mars sample and EES elements would not be released from containment until proven safe by analysis or sterilization.

As proposed, the Mars samples will be handled in accordance with protocols that apply to BSAT materials, as described previously. These protocols include appropriate measures to store and curate the samples at an existing BSL-4 laboratory, a new-construction BSL-4 equivalent facility (including modular or mobile). The specific requirements for an SRF are currently in development; however, this PEIS applies BSL-4 equivalent facility protocols as being representative of construction and operating standards that may be adopted in the future to manage the storage and curation of Mars samples. As a result, analysis of potential impacts associated with development and operation of an SRF are identified and analyzed programmatically in this PEIS. By applying the BSL-4 framework, NASA is able to identify and analyze reasonably foreseeable environmental impacts of its Proposed Action (e.g., the air emissions from a representative existing BSL-4 facility) and evaluate, from a programmatic perspective, whether the environmental effects may be significant. This programmatic analysis can be utilized to guide SRF type and location planning, as well as analyses once these aspects have been identified and proposed.

S.3.1.1 Site-Specific Aspects (UTTR/DPG)

Currently, NASA proposes to land the EES on the UTTR (Figure S-2). The proposed landing site at the UTTR is referred to as the West Desert of the UTTR South Range. The UTTR is a military testing and training area located in Utah's West Desert in west-central Utah, primarily in Tooele County (portions of the North Range are in Box Elder County), about 129 kilometers (km) (80 miles) southwest of Salt Lake City. NASA proposes to utilize the DAF-managed Detachment 1 (Det-1) location adjacent to Michael Army Field on DPG as the primary location area for recovery team staging and the vault location (see Figure S-3). The Det-1 location is leased from the U.S. Army and managed by the DAF.

The nominal landing target area consists of an ellipse approximately 379 square kilometers (km^2) (146 square miles [mi^2]) contained within an area of the UTTR. The nominal ellipse defines the area with a 99.9999 percent probability of nominal landing. The notional area associated with an off-nominal (abnormal or unexpected) landing event is an expanded version of the nominal ellipse; in off-nominal scenarios, it is expected that the landing ellipse may shift further to the northeast but would remain within the UTTR boundary. The notional off-nominal ellipse covers an additional area of approximately 191 km^2 (74 mi^2). The entire area susceptible to a small area impact (e.g., the size of the EES, which is about the size of a semitruck tire) is approximately 570 km^2 (200 mi^2). Figure S-3 shows the nominal, off-nominal, and desired landing location (90-percent probability of landing).

Although the project would be designed to minimize the probability for an off-nominal event, the project design is still evolving. While an off-nominal event (one in which the EES or its components land outside the 99.9999 percentile ellipse) would be considered extremely unlikely, a statistical probability is currently unavailable at this time, as this information would be made available as project design is more defined.[1] This information is relevant to assessing the potential for impacts to occur outside the nominal landing ellipse. However, there is a high degree of certainty that the EES would still land on the UTTR should an off-nominal event occur.

NASA anticipates up to 6 recovery operation dress rehearsals during the 24 months prior to EES landing, with a team of up to 12 personnel, depending on required operational parameters. Dress rehearsals would likely involve the use of two to four helicopters. Additionally, NASA anticipates that a team of up to 40 personnel may be staged at the UTTR and/or DPG 6 to 12 months prior to the EES reentry date for site preparation and recovery operations setup. Support for dress rehearsals and recovery operations setup would likely involve use of equipment (e.g., helicopters, wheeled vehicles, etc.), infrastructure (facilities, utilities, etc.), and personnel support supplied by the U.S. Army and DAF. This support would be coordinated with the respective agencies once requirements have been defined.

Currently, the UTTR South Range contains debris such as aerial gunnery tow targets (referred to as “target darts”). Within the landing ellipse are many target darts, many of which (perhaps up to a few hundred) could require removal, which would be conducted by the DAF. Prior to landing, a portion of the landing area would be prepared by removing landing hazards in order to prevent inadvertent impacts with objects that would adversely affect the integrity of the EES.

After release from the Orbiter, the cone-shaped EES (about the size of a tire on a semitruck) would passively enter Earth’s atmosphere on a predictable path shaped by gravity and atmospheric drag. It is estimated that the EES will reach terminal velocity[2] (about 35 to 45 meters per second or 78 to 100 miles per hour) before landing; it is calculated that after entering the Earth’s atmosphere, it would take approximately 377 seconds (about 6 minutes) before the EES lands. During reentry, a sonic boom would be generated at a very high altitude. The EES would be tracked to its landing location using UTTR radar/tracking instrumentation. One or more recovery teams may be staged outside the landing ellipse at previously disturbed test sites with road access, with the vault located at the DAF-managed Det-1 location adjacent to the Michael Army Field runway on DPG.

Based on drop testing activity, upon landing, the EES would be expected to create an impact crater of approximately 1.2 meters (4 feet) in diameter and 0.5 meter (1.6 feet) in depth, based on soil composition, with soil ejected from the crater to a distance of approximately 15 meters (approximately 49 feet) from the EES.

Once the EES has landed, one or more recovery teams would transit to the landing site (either via helicopter or ground-based vehicles) and contain the EES. The EES would be handled under protocols similar to BSL-4 protocols; NASA intends to manage the EES, and the Mars material it carries, as potentially hazardous until demonstrated otherwise.

[1] 40 CFR § 1502.21 requires the identification of incomplete or unavailable information when that information is relevant to reasonably foreseeable significant adverse impacts.

[2] Terminal velocity is the maximum speed attainable by an object (based on its mass) as it falls through the air (i.e., when the resistance of the air has become equal to the force of gravity).

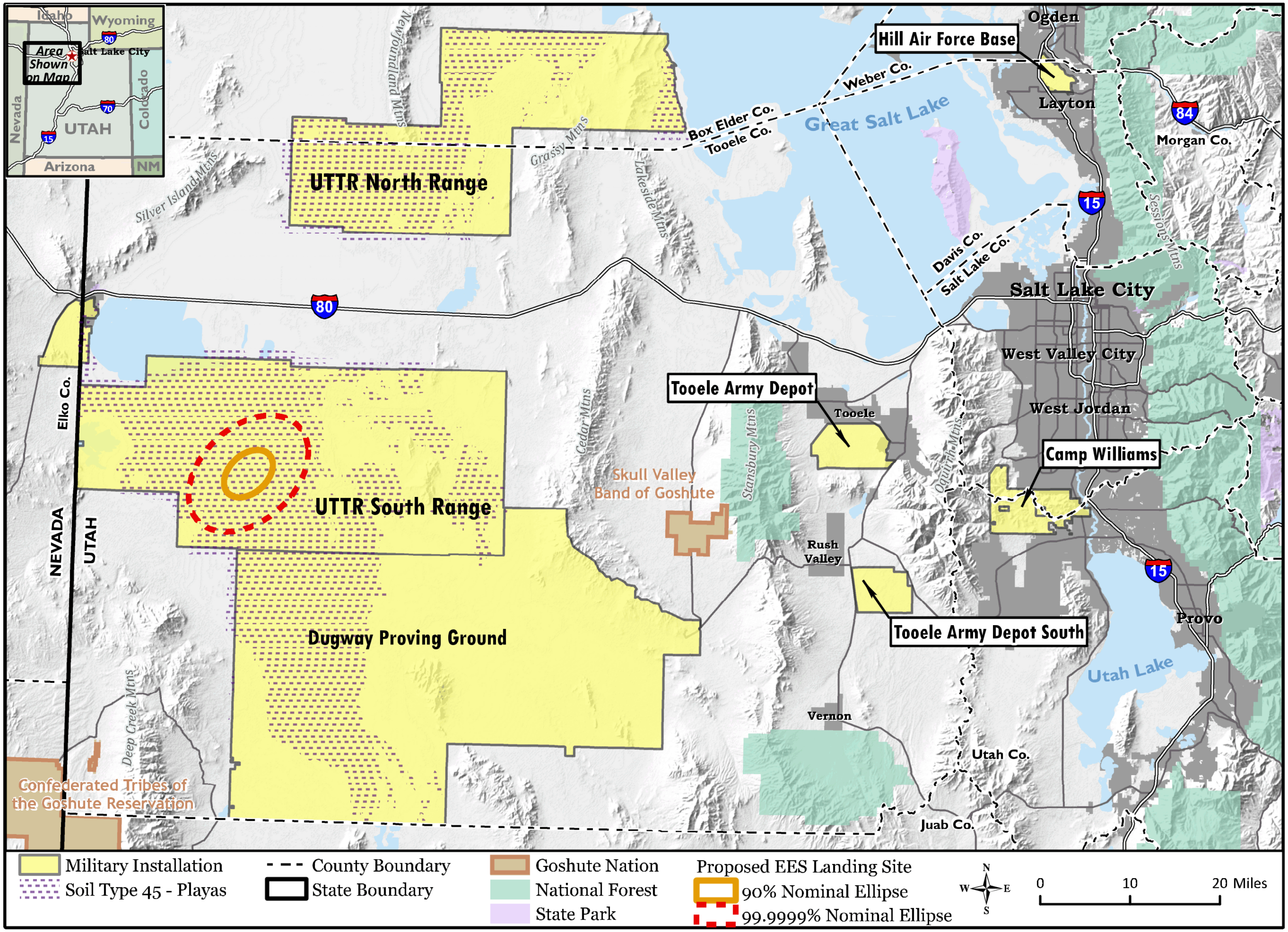


Figure S-2. Regional Location of the UTTR and DPG

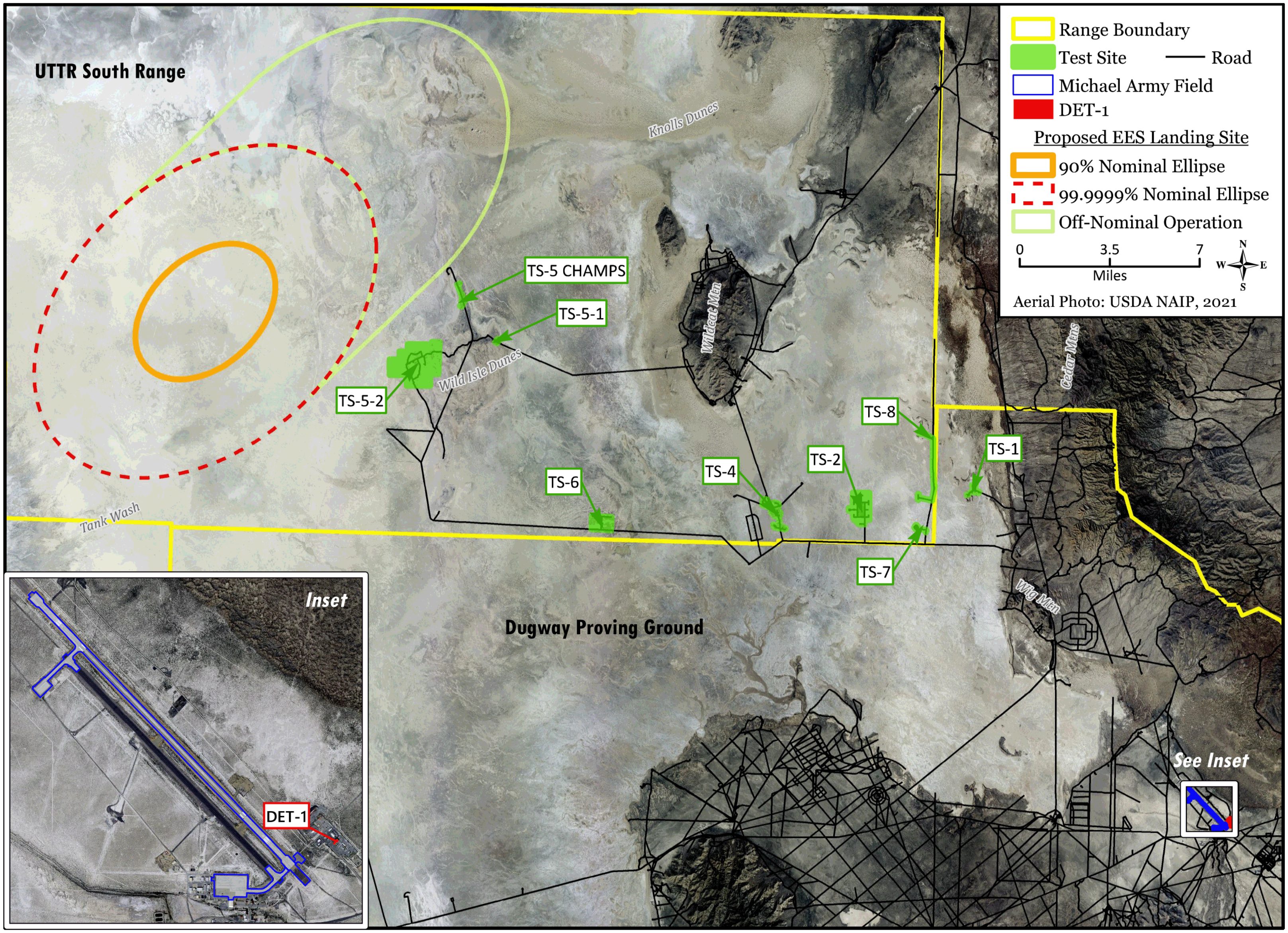


Figure S-3. Proposed EES Landing Site and Potential Staging Areas

BSL-4 reflects the highest level of containment, handling, and transportation regulatory standards (CDC 2020) (49 CFR Parts 171–180, 42 CFR § 73.11, 7 CFR § 331.11, and 9 CFR § 121.11). Therefore, to ensure proper containment of the site, recovery teams would handle the landing event as though a release has occurred. After arrival of the recovery team, the landing site around the EES would be cordoned off. The EES would be recovered, enclosed within a protective bag similar in function to a biohazard containment bag, and then inserted into a 2-meter by 2-meter (6.56-foot by 6.56-foot) sealed travel case; the case would be a lightweight, temporary container, designed to facilitate rapid transportation from the landing site to the vault. The EES travel case may be decontaminated and then would be transported to the vault for shipment to an SRF. After removal of the EES, the entire landing site (which may involve the impact area and extent of ejecta) may be decontaminated as a precautionary measure.

Although anticipated as a precautionary measure (release of any Mars materials is considered highly unlikely), at this time, the exact decontamination method(s) that may be used for the EES travel case and landing site have not been determined.[4] For purposes of this PEIS, it is assumed that any decontamination activities would be in alignment with Chemical, Biological, Radiological, Nuclear, and Explosives (CBRNE) response planning for U.S. Environmental Protection Agency (EPA) and the DAF Readiness and Emergency Management Office. The standard decontamination of biohazards in soil typically involves applying chemical sterilants as liquid or fumigants (such as chlorine dioxide or aldehyde) in place (EPA 2017). It is assumed that any decontamination would be *in situ*, using a fumigation method or “safe” liquid (e.g., the type used for groundwater decontamination) that would allow soils to remain in place with minimal residual hazards, thus eliminating the need for soil removal and minimizing any associated waste generation/disposal issues.

It is anticipated that the vault containing the EES would be transported off the UTTR to an SRF location as soon as possible barring specific weather and other day-of-landing operational constraints. However, in the event of an off-nominal landing, NASA personnel could remain on site for several weeks or months as part of contingency activities. Specific contingency activities are unknown at this time, as NASA is currently evaluating contingency planning concepts. Contingency activities may be relevant in understanding potential impacts associated with health and safety, hazardous material and waste, ground disturbance, and infrastructure-related needs. Should these contingency activities result in potential impacts outside the scope of those analyzed in this PEIS, supplemental NEPA analyses may be required.

S.3.2 No Action Alternative

Under the No Action Alternative, the MSR Campaign as described in this PEIS would not be undertaken. As a result, investigation of Mars as a planetary system would be limited due to the cost and complexity of sending instruments into space or to Mars for *in situ* analyses. By not undertaking the MSR Campaign, scientists would not have access to the full breadth and depth of analytical science instruments available in Earth laboratories.

[4] 40 CFR § 1502.21 requires the identification of incomplete or unavailable information when that information is relevant to reasonably foreseeable significant adverse impacts.

S.4. ENVIRONMENTAL CONSEQUENCES

A launch from either Kennedy Space Center or Cape Canaveral Space Force Station in Florida would consist of a routine payload and has been addressed in previous NEPA analysis; no significant adverse impacts were identified for these activities. Launch of the Orbiter from French Guiana is addressed under EO 12114, *Environmental Effects Abroad of Major Federal Actions.* The focus of this PEIS is therefore flyby of the Orbiter, to include release, entry, and landing of the EES; initial recovery; containment; and handling of the EES on Earth's surface.

This Tier I PEIS considers the overarching environmental impacts associated with the proposed MSR Campaign and near-term decisions, which NASA and cooperating agencies may then incorporate into subsequent, tiered analyses and decisions associated with future proposed MSR Campaign activities.

S.4.1 No Action Alternative

Potential impacts associated with transportation of Mars samples and development of an SRF would not be realized. The No Action Alternative would not result in any additional resource-related impacts at the UTTR, DPG, or surrounding areas outside of those associated with ongoing and potential future military operations and other activities occurring at the site.

S.4.2 Proposed Action

S.4.2.1 Health and Safety

Programmatic Analysis

Significant adverse impacts associated with EES transportation to an SRF are not anticipated. The travel and handling procedures for the EES and the security and functionality of the SRF would be based heavily on the proven techniques used for safely handling biological toxins and known infectious agents used in Earth-based research labs. Potential impacts associated with SRF development and operation would be related to the location of the facility, as well as the type and size. Tier II analyses for determination of impacts associated with health and safety would consider the location of the proposed facility and surrounding community/land use type, health and safety system requirements associated with a BSL-4 equivalent facility, and risk analysis involving failure of containment systems that results in a release within the facility.

Site-Specific Analysis (UTTR/DPG)

Significant adverse impacts at the UTTR or DPG are not anticipated. During landing site preparation, the potential for unexploded ordnance (UXO) encounters is small, and there would be a UXO technician with project personnel during all operations in the area. Personnel tasked with debris removal activities would be trained to identify potential UXO, and removal would be deferred to trained explosive ordnance disposal personnel in accordance with Air Force Manual (AFMAN) 32-3001, *Explosive Ordnance Disposal (EOD) Program*. With regard to EES release and landing, the MSR Campaign has established stringent probability targets to drive robust containment engineering. The MSR Campaign selected a target value equivalent to a 99.9999 percent probability of successful containment. These targets are applied to each of three material vectors or pathways along which Mars material may reach Earth: 1) free particle transport; 2) approach, entry, and descent; and 3) landing. Throughout MSR Campaign element design, NASA will continue to assess numerous factors that may influence Mars material containment and/or sterilization success for each vector. For EES recovery, all personnel involved in recovery operations would be required to wear personal protective equipment (PPE). After the EES has been transferred, in the travel case, from the site to the vault, soil and PPE may be decontaminated. The exact means of potential decontamination has not been determined. However, any decontamination activities would follow standard decontamination protocols for biological hazards typically involving application of chemical sterilants as liquid or fumigants at the landing site in place. All activities would be in alignment with CBRNE response planning for EPA and the DAF Readiness and Emergency Management Office.

S.4.2.2 Cultural Resources

The effect of mission preparation, landing, and retrieval of the EES is discussed under Site-Specific Analysis.

Programmatic Analysis

Transportation of the EES to an SRF would not be expected to result in any cultural resource impacts. Furthermore, operation of an SRF would not be anticipated to impact cultural resources; the main impact driver for this resource is the development of an SRF. Construction activities that may impact cultural resources are all ground-disturbing activities, including land clearing, earth moving, excavation, and vehicle and equipment operation on unpaved surfaces. These activities may result in physical disturbance of any surface or subsurface archaeological resources that may be present in the areas disturbed. Direct adverse effects would result if any of the archaeological resources are listed on or eligible for listing in the National Register of Historic Places (NRHP). Potential impacts associated with SRF development would be related to the location of the facility, as well as the type and size. Tier II analyses would initiate the NHPA Section 106 consultation process early in the planning process to identify any historic properties and/or significant traditional cultural resources that may or may not meet the NRHP criteria (as defined in 36 CFR § 60.4) but that are properties of cultural, historical, or religious significance to American Indian Tribes or other recognized traditional cultural groups within or near the APE. Additionally, the effects of the undertaking on identified properties and/or traditional resources would be assessed, and any necessary mitigations required to avoid or minimize identified adverse effects would be identified.

Site-Specific Analysis (UTTR/DPG)

NASA, with the DAF as the lead, has initiated, and is in the process of conducting, Section 106 consultation with 21 Federally recognized Native American tribes, the Utah State Historic Preservation Officer (SHPO), the Advisory Council on Historic Preservation (ACHP), and other entities regarding the effects of the Proposed Action to historic properties, in accordance with Section 106 of the NHPA; this consultation is ongoing. Any activities within this Tier I analysis that are required to be assessed for impacts to historic properties will follow protocols laid out within a program Programmatic Agreement between Hill Air Force Base (AFB) (the responsible land manager of the UTTR), the Utah SHPO, and ACHP. Ground disturbance associated with on-site mission preparation (to include testing and rehearsals and landing site preparation), EES landing, and EES recovery could result in adverse effects to historic properties if there are any that cannot be avoided during vehicular transit to/from each object location or if an object is located within an archaeological site eligible for listing in the NRHP. Any potential adverse effects would be mitigated through the Standard Mitigation Treatment Measures within the aforementioned Programmatic Agreement, which would include stipulations for range clearance activities.

S.4.2.3 Hazardous Materials and Waste

Programmatic Analysis

Transportation of the EES to an SRF would not be expected to involve the use of hazardous materials or generation of hazardous wastes. Hazardous materials may be used, and waste generated, as a part of the construction and operation of an SRF. Typical construction-related hazardous wastes consist of petroleum, oils, and lubricants, as well as paints, adhesives, and solvents. The amounts of hazardous materials used and wastes generated would depend on the size and type of facility. Types of hazardous materials and wastes associated with operation of an SRF facility would likely be consistent with operation of other similar types of facilities and could include materials/wastes such as flammable liquids; flammable, toxic liquids; corrosive liquids; oxidizing liquids; and ethidium bromide solids. The types and quantities of hazardous materials and wastes used would be particular to the size and function of an SRF. Regardless, all hazardous materials and wastes would be managed according to applicable Federal, state, and local requirements depending on hazardous waste generator status (i.e., large, small, or very small quantity generator). Exact types of hazardous materials that would be used; wastes generated; associated potential impacts; and applicable Federal, state, and local requirements will be addressed in the Tier II NEPA analyses.

Site-Specific Analysis (UTTR/DPG)

No significant adverse impacts are anticipated at the UTTR or DPG. Regarding landing site preparation, target darts are nonhazardous material (consisting of wood and metal), and the small amount of waste material generated could be disposed of as standard industrial waste or recycled. Any soil and/or debris associated with landing site preparation that would be disposed of offsite would require sampling to determine appropriate disposition (e.g., solid waste or hazardous waste fill). Although UXO encounters are unlikely (Section 2.1.3.1, Landing at Utah Test and Training Range), any potential UXO encountered would be handled in accordance with AFMAN 32-3001, *Explosive Ordnance Disposal (EOD) Program*. The EES contains *de minimis* amounts of hazardous materials consisting of standard aerospace adhesive materials; there are no fuels or other petroleum products used in the EES. The process of retrieving the EES and placing it into the vault would be assumed to generate potentially hazardous biological waste until demonstrated otherwise. All the systems used, including personnel protective gear, would be assumed to be contaminated and would either be decontaminated or simply discarded as hazardous waste. Wastes could include plastics and clothing. Any liquids used in the decontamination process would be absorbed onto solids prior to disposal. It is assumed that any soil decontamination would be *in situ* using a fumigation method or "safe" liquid (e.g., the sort used for groundwater decontamination) that would allow soils to remain in place with minimal residual hazards, thus eliminating the need for soil removal and minimizing any associated waste generation/disposal issues.

NASA would be accountable to the DAF and U.S. Army for complying with all applicable laws governing the proper handling of materials and disposal of waste on their properties. Occupational Safety and Health Administration requirements would also apply, depending upon the status of personnel (civilian, military, contractor) regarding the use of appropriate PPE, etc. This compliance must also incorporate and abide by 10 U.S.C. 2692 (*Storage, treatment, and disposal of nondefense toxic and hazardous materials*) requirements for the storage, treatment, and disposal of nondefense toxic/hazardous materials on Department of Defense property. NASA may need a waiver from the DAF and/or U.S. Army to bring any required hazardous materials onto respective properties. For hazardous waste disposal, NASA would work with the DAF and U.S. Army to determine waste management responsibilities (under the requirements of the Hill AFB Hazardous Waste Management Plan (Hill AFB 2016), any applicable U.S. Army requirements, and Federal and state regulations) and codify these in a Memorandum of Understanding/Agreement. NASA may pursue acquiring its own EPA Generator identification number for this particular project.

S.4.2.4 Soils and Geology

Programmatic Analysis

Transportation of the EES to an SRF would not be expected to interact with soils. Operation of an SRF would not be anticipated to impact soils or geology; the main impact driver for this resource is the site development associated with establishment of an SRF. The amount of soil disturbance and associated extent of adverse impacts would be dependent on the type and size of the facility, as well as the need for any additional or ancillary infrastructure (such as underground utilities and parking). The potential for any site-specific impacts to soils and geology associated with SRF development will be addressed in Tier II NEPA analyses, which would consider the soil types potentially impacted; the amount/area of soil potentially disturbed and the potential for, and scope of, soil erosion; the need for a National Pollutant Discharge Elimination System permit; geologic limitations and/or influence on-site development; and identification of any necessary mitigations required to avoid or minimize identified adverse impacts.

Site-Specific Analysis (UTTR/DPG)

There would be ground disturbance associated with on-site mission preparation (to include testing and rehearsals and landing site preparation), EES landing, and EES recovery operations; however, disturbance would be localized and would not result in loss of soil productivity or significant erosion given the flat land area and lack of substantive precipitation. Given the context of the landing site and low intensity of the action, these activities are expected to have minimal impacts on soils and geology at the UTTR. Ground disturbance for similar activities at the UTTR were found to have no significant impacts on soils or geology. During landing site preparation and EES recovery operations, standard practices for preventing soil erosion would be employed, such as minimizing the size of the disturbed area associated with landing site preparation activities (e.g., aerial target debris removal) and EES recovery operations; stockpiling of all excavated soils and protection from wind and water erosion, with replacement or removal of stockpiles when activity is complete; and, to the maximum extent practicable, restoration of the environmental condition of the affected landing area to its pre-disturbance condition.

S.4.2.5 Biological Resources

Programmatic Analysis

Transportation of the EES to an SRF would not be expected to have an interaction with biological resources. Additionally, operation of an SRF would not be anticipated to impact biological resources; the main impact driver for this resource is the development of an SRF. Construction activities that may impact biological resources include vehicle and equipment operation, land clearing, earth moving, stormwater runoff, and potential introduction of invasive species. The potential for any site-specific impacts to biological resources associated with SRF development will be addressed in Tier II NEPA analyses. Analyses would consider the habitat type and amount of habitat area potentially impacted; identification of the vegetation, wildlife, and special-status species (e.g., Federally and/or state-listed, threatened, endangered, or candidate species) potentially impacted within the context of importance (legal, commercial, ecological, or scientific) of the species, habitat function, sensitivity, and the availability of regionally similar resources and the need for associated consultation under Section 7 of the Endangered Species Act; and identification of any necessary mitigations required to avoid or minimize identified adverse impacts. Were NASA to identify a location for the SRF that would potentially impact species listed under the Endangered Species Act or associated critical habitat, NASA would be required to consult with the respective USFWS district under Section 7 of the Endangered Species Act.

Site-Specific Analysis (UTTR/DPG)

On-site mission preparation (to include testing and rehearsals and landing site preparation), EES landing, EES recovery, and EES transportation operations are expected to have minimal direct and/or indirect impacts on the biotic environment at the UTTR, given the context of the landing area (e.g., desert playa with sparse vegetation and lack of suitable wildlife habitat) and the intensity of the action (minor, temporary disturbance). Based on analysis presented in this PEIS, there are no Endangered Species Act-protected species located on the UTTR; thus, there would be no effect to Endangered Species Act-protected species, and consultation with the U.S. Fish and Wildlife Service is not required.

S.4.2.6 Water Resources

Programmatic Analysis

Transportation of the EES to an SRF would not be expected to have an interaction with water resources. Both construction and operation of an SRF may have the potential to affect water resources, each in a different manner. Depending on the type and size of the facility, operation of the SRF may involve industrial stormwater discharges to the environment, while development of the SRF may have a direct or indirect impact on water resources from sedimentation runoff during construction and may require a general stormwater construction permit. The potential for any site-specific impacts to water resources associated with SRF development and operation will be addressed in Tier II NEPA analyses, which would identify water resources within the affected environment, to include wetlands and floodplains, stormwater runoff analysis, and potential groundwater use. If site development results in direct impacts to wetlands, coordination with the U.S. Army Corps of Engineers may be required for a jurisdictional wetland determination, and a Clean Water Act Section 404 permit may be required. If site development results in direct impacts to wetlands or floodplains, NASA would be required to identify the lack of practicable alternatives to that particular site.

Site-Specific Analysis (UTTR/DPG)

Given the context of the action area (no water resources), on-site mission preparation (to include testing and rehearsals and landing site preparation), EES landing, EES recovery, and EES transportation operations are expected to have no direct or indirect impacts to water resources at the UTTR or DPG.

S.4.2.7 Air Quality/Climate

Programmatic Analysis

Transportation of the EES to an SRF would be expected to result in *de minimis* air emissions associated with either aircraft or OTR vehicles. However, both construction and operation of an SRF may have the potential to affect air quality associated with emissions from point sources and mobile sources. Construction requiring ground improvements would result in mobile air emissions from equipment use, as well as particulate matter from fugitive dust emissions. Facility operations could involve air emissions of criteria pollutants, depending on the types of operations conducted and whether there are direct air exhaust systems or roof stacks for incineration activities. The potential for any site-specific impacts to air quality associated with SRF development and operation will be addressed in Tier II NEPA analyses, which would analyze air emissions associated with construction and operation as compared to current local/regional emissions and National Ambient Air Quality Standards thresholds to determine any exceedances of certain criteria pollutant thresholds that may require general conformity analysis. Analyses would also consider whether a Prevention of Significant Deterioration, nonattainment New Source Review, or Title V permit is required.

Site-Specific Analysis (UTTR/DPG)

On-site mission preparation (to include testing and rehearsals and landing site preparation), EES landing, EES recovery, and EES transportation operations are expected to have minimal direct impacts on Tooele County air quality and climate, given the context of the landing area (remote site on an active military range with more extensive air emissions) and the intensity of the action (temporary *de minimis* emissions from mobile sources and fugitive dust).

S.4.2.8 Land Use

Programmatic Analysis

Transportation of the EES would not be expected to result in any land use impacts. Temporary impacts on land use from construction operations can affect ongoing uses in nearby areas, both on and off the SRF site. These impacts include elevated traffic, including heavier-than-usual truck traffic; dust from ground disturbance and site preparation; and noise from construction equipment. While these effects can cause inconvenience and some annoyance for local users, upon completion of construction, these effects would cease. Were NASA to propose siting the SRF in an area of incompatible land use, adverse impacts to existing uses could occur. The significance of the environmental impact of SRF siting on land use would be affected by the location and type of SRF NASA determines is best suited to carry out the purpose and need for the Proposed Action. The potential for any site-specific impacts related to land use associated with SRF development and operation will be addressed in Tier II NEPA analyses, which would determine whether the proposed site meets zoning requirements and/or is incompatible with an existing land use or reasonably foreseeable land use due to noise, safety, or other issues and mitigations that may serve to minimize or avoid these types of impacts. Additionally, analyses would include identification of potential ancillary effects to nearby properties, such as increased traffic and lighting and visual effects, and mitigations that may serve to minimize or avoid these types of impacts.

Site-Specific Analysis (UTTR/DPG)

On-site mission preparation (to include testing and rehearsals and landing site preparation), EES landing, EES recovery, and EES transportation operations are expected to have no impacts to UTTR or DPG land use, given the context of the activities (within an active military installation and roads for intended use) and the intensity of the action (occasional, discrete short-term events).

S.4.2.9 Socioeconomics

Programmatic Analysis

Transportation of the EES to an SRF would not be expected to have any socioeconomic impact. Development activities would likely result in some beneficial direct, indirect, and induced economic impacts in terms of employment and income, with the scope of benefit tied to the size and type of facility. Construction-related impacts would last for the duration of the activities. Long-term socioeconomic impacts would be directly tied to the number of new jobs created and the projected population increase associated with those jobs. Employment numbers would be dependent on the type and size of the facility. Direct impacts to housing, education, and public services (e.g., emergency services) would also be dependent on local population increases. Depending on the scope of any increase in local population, impacts can adversely affect these aspects if availability and capacity cannot adequately accommodate the increase. The potential for any site-specific socioeconomic impacts associated with SRF development and operation will be addressed in Tier II NEPA analyses. Analyses would consider the number of projected workers required and the ability of local workforce to meet demand; the local population and population trends and whether any influx of workers (temporary and permanent and estimated dependents) would result in a substantive increase in population; and, if there was a projected substantive increase in population, would determine whether housing availability and education and public services could accommodate the associated increase in demand.

Site-Specific Analysis (UTTR/DPG)

Within the context of the Proposed Action, mission preparation activities, EES landing site preparation, EES landing recovery operations, and sample transportation would be expected to have no adverse impacts to socioeconomics, because activities would be within the existing range and there are no anticipated effects outside this area. There may be *de minimis* beneficial impacts associated with NASA scientists and other recovery team members utilizing services (e.g., hotels, restaurants, etc.) within the local community during their time at the UTTR or DPG.

S.4.2.10 Environmental Justice / Protection of Children

Programmatic Analysis

Transportation of the EES to an SRF would not be expected to have any impact to environmental justice communities. Impacts to environmental justice communities from development and operation of an SRF would be based on the extent to which minority and low-income populations reside within the affected environment. Potential environmental justice impacts are directly tied to the location of the facility and would require site-specific analysis. The potential for any site-specific environmental justice-related impacts associated with SRF development and operation will be addressed in Tier II NEPA analyses. Such analyses would consider the extent to which minority and low-income populations reside within the affected environment; the extent to which children and elderly populations reside within the affected environment; and whether the site-specific effects of any identified noise, land use, and air quality impacts would have disproportionate effects on these populations and would identify any mitigations that may serve to minimize or avoid disproportionate impacts to environmental justice populations.

Site-Specific Analysis (UTTR/DPG)

Within the context of the Proposed Action, there are no environmental justice concerns associated with on-site mission preparation (to include testing and rehearsals and landing site preparation) or EES landing and recovery operations, as these activities would all occur within the confines of the UTTR South Range and DPG boundary. There are no anticipated effects outside this area; therefore, there would be no environmental justice concerns associated with activities at the UTTR or DPG.

S.4.2.11 Noise

Programmatic Analysis

Transportation of the EES to an SRF would not be expected to result in any significant adverse noise impacts. Development of an SRF would generate localized noise associated with heavy equipment and generator operation; such noise would be temporary (lasting only the duration of the construction project) and would be expected to be limited to normal working hours. Construction activities would not be expected to result in significant community noise impacts, provided the location is not within or adjacent to a residential area. Operationally, external noise may be generated by such equipment as cooling towers, laboratory ventilation fans, and emergency generators. The need and extent of this type of equipment would be dictated by facility design. Provided the facility is located within compatible land use areas, it is unlikely that operational noise would result in significant impacts. A noise assessment based on facility design would determine potential noise emissions and compatibility with local noise ordinances. The potential for any site-specific noise-related impacts associated with SRF development and operation will be addressed in Tier II NEPA analyses. Noise analysis would assess the potential noise generated by construction and operation of the facility and identify adjacent land uses and adjacent sensitive noise receptors (e.g., residences, schools, elder-care facilities, etc.). Analyses would then determine whether the noise generated from these activities would result in significant increases in noise for sensitive receptors, determine whether noise generated from these activities would exceed any state or local noise ordinances, and identify any mitigations that may serve to minimize or avoid any adverse impacts.

Site-Specific Analysis (UTTR/DPG)

Upon entering the Earth's upper atmosphere, the EES would create a sonic boom above the UTTR. UTTR airspace is currently utilized for supersonic aircraft operations, and this one-time event would be indistinguishable from regular UTTR operations. This sonic boom, while somewhat audible at this altitude, would not be expected to result in overpressures at ground level that would result in hearing or structural damage. Transport of the EES would result in negligible, transient noise associated specifically with the transportation mode selected (e.g., truck, aircraft). Based on the type of noise, context of occurrence (roadways or airfields), and single-event transient intensity, this type of noise would not be expected to result in adverse impacts.

S.4.2.12 Infrastructure

Programmatic Analysis

Transportation of the EES would utilize the national and/or local transportation infrastructure network and would not be expected to have any adverse impacts. The main impact driver for utilities is operation of an SRF; development would not be expected to result in any adverse utility impacts. The size and intended operational parameters of the facility would dictate the amount of electricity and/or natural gas and potable water required, as well as wastewater generation. The size, location, and number of employees required for a facility would also determine the extent of potential impacts to local transportation networks. The scope of the impacts would also depend on the existing level of service for surrounding transportation networks. The potential for any site-specific impacts to infrastructure associated with SRF development and operation will be addressed in Tier II NEPA analyses. Tier II analyses will address existing affected environment utility infrastructure, operational utility loads based on facility equipment types and number of employees, the extent to which these loads would burden local utility systems and providers, and whether utility system upgrades or use permits would be required. Analyses will also identify necessary transportation network level of service and whether the number of employees and associated traffic would adversely affect the level of service.

Site-Specific Analysis (UTTR/DPG)

Under the Proposed Action, on-site mission preparation (to include testing and rehearsals and landing site preparation), EES landing, and EES recovery would not require the construction of new, or modification of existing, UTTR or DPG infrastructure. Hookups to existing Det-1 utility infrastructure for temporary use (e.g., electricity for trailers, communications, etc.) may be required, a small number of wheeled vehicles may utilize UTTR and DPG roads, and recovery team members may use local roadways transiting to/from the UTTR. These activities would not be expected to impact infrastructure or utility use on UTTR, DPG, or local roadways.

S.4.2.13 Cumulative Impacts

Council on Environmental Quality regulations implementing NEPA require that the cumulative impacts of a proposed action and alternatives be assessed (40 CFR Parts 1500–1508). Cumulative effects are defined as “effects on the environment that result from the incremental effects of the action when added to the effects of other past, present, and reasonably foreseeable actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time...” (40 CFR § 1508.1(g)(3)).

Programmatic Analysis

From a programmatic perspective, EES transportation would not be expected to result in cumulative impacts; this is a discrete event that would have *de minimis* impact on the environment. Cumulative impacts associated with development of an SRF will be addressed in the subsequent Tier II analyses once alternatives have been identified. At that time, past, present and reasonably foreseeable future actions relevant to the affected environment would be identified and analyzed. Analyses would consider relationships between the alternatives and other identified actions interacting within the same affected environment(s).

Site-Specific Analysis (UTTR/DPG)

The UTTR and the Det-1 location are currently utilized for military testing and training operations; this would be expected to continue into the future. Other than debris removal as part of landing site preparation, no long-term impacts to the UTTR or the Det-1 location would be expected, due to the discrete nature of the action. Mission preparation activities and the presence of NASA personnel at the UTTR/DPG within the 24 months prior to EES landing would result in only minimal short-term impacts, as NASA personnel would leave once the mission is complete. The use of facilities at the UTTR and the Det-1 location for retrieving the Mars samples would be consistent with existing operations and would pose no new types of impacts. Existing facilities and infrastructure would be utilized, and no new facilities on site or offsite would be needed. Any impacts of the MSR Campaign at the UTTR and DPG would be negligible. The incremental impact of the mission would not add to or create any long-term cumulative effect on the local or regional environment.

S.4.2.14 Irreversible and Irretrievable Commitment of Resources

The primary irretrievable impacts of implementation of the Proposed Action would involve the use of energy, labor, and materials and funds. From a programmatic perspective, development of an SRF may involve conversion of some lands from an unimproved or semi-improved condition through the construction of buildings and facilities; however, this would depend on where the SRF is sited and would be required to be addressed under Tier II analyses. Irretrievable impacts would occur as a result of construction, facility operation, and maintenance activities. Direct losses of biological productivity and the use of natural resources from these impacts will be considered as part of Tier II analyses.

S.4.2.15 Unavoidable Adverse Impacts

For the MSR launch, landing, and recovery operations, analyses of the Proposed Action identified unavoidable adverse impacts associated with soil disturbance from landing site preparation and EES recovery activities. However, these adverse impacts have been shown to not be significant based on the context (dry, flat lakebed on a military installation) and intensity (single event) of the Proposed Action. With regard to SRF development and operations, unavoidable adverse impacts would be dependent on the scope of a particular SRF development scenario, with impacts related to the size of the facility and the location to be developed. Unavoidable adverse impacts could be associated with air emissions from ground disturbance and operations; impacts to natural resources (e.g., forested areas, wildlife, etc.) from ground disturbance, depending on location developed; and impacts to local infrastructure and utilities, depending on the ability of the locale to support SRF operations. These factors will be considered as part of Tier II NEPA analyses for development of an SRF once SRF requirements and potential locations have been identified.

S.4.2.16 Short-Term Uses and Maintenance and Enhancement of Long-Term Productivity

Analysis of short-term environmental impacts of development of an SRF and on the maintenance and enhancement of the long-term productivity would be wholly dependent on the location and scope of the SRF. Short term uses of fossil fuels and natural resources (e.g., concrete, wood, metal, etc.) during development of an SRF would occur, the quantity of use dependent on the scope of the SRF (e.g., development a mostly modular facility would likely require far fewer natural resources and fossil fuel use than would a complete, large brick-and-mortar facility). Operation of an SRF would also require use of electrical energy, potable water, and potentially natural gas. Similarly, the amount of resource use for operations would be dependent on the scope of the SRF, as well as implementation of any environmental and “green” design considerations. These factors will be considered as part of Tier II NEPA analyses for development of an SRF once SRF requirements and potential locations have been identified.

Implementation of the Proposed Action would result in impacts limited to the UTTR/DPG and has been shown to have no significant short- or long-term adverse impacts. As a result, no adverse impacts to the maintenance and enhancement of the long-term productivity of the UTTR/DPG would be expected.

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Mars Sample Return (MSR) Campaign
Programmatic Environmental Impact Statement

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ABBREVIATIONS AND ACRONYMS

°C	degrees Celsius
°F	degrees Fahrenheit
ABSL	Animal Biosafety Level
ACHP	Advisory Council on Historic Preservation
AFB	Air Force Base
AFI	Air Force Instruction
AFMAN	Air Force Manual
AGL	above ground level
APE	Area of Potential Effects
BMP	Best Management Practice
BP	before present
BSAT	Biological Select Agents and Toxins
BSC	biosafety cabinet
BSL	Biosafety Level
C&D	construction and development
CAA	Clean Air Act
CBRNE	Chemical, Biological, Radiological, Nuclear, and Explosives
CCRS	Capture, Containment, and Return System
CCSFS	Cape Canaveral Space Force Station
CDC	Centers for Disease Control and Prevention
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
COC	Community of Comparison
CWA	Clean Water Act
DAF	Department of the Air Force
dB	decibels
dBA	A-weighted decibels
Det-1	Detachment 1
DoD	Department of Defense
DPG	Dugway Proving Ground
EA	Environmental Assessment
EES	Earth Entry System
EIAP	Environmental Impact Analysis Process
EO	Executive Order
EOD	Explosive Ordnance Disposal
EPA	U.S. Environmental Protection Agency
ESA	European Space Agency
FEMA	Federal Emergency Management Agency
FONSI	Finding of No Significant Impact
FY	fiscal year
g	acceleration relative to that of the Earth's gravity
GHG	greenhouse gas
GPS	Global Positioning System
HAP	hazardous air pollutant
HQ UTTR	Headquarters Utah Test and Training Range
HSM	High Speed Mover
HWMP	Hazardous Waste Management Plan
iMOST	international MSR Samples and Objectives Team
ISS	International Space Station
IU	industrial user
JPL	Jet Propulsion Laboratory
km	kilometers
km^2	square kilometers
KSC	Kennedy Space Center
Lander	Sample Retrieval Lander
LEED	Leadership in Energy and Environmental Design
mi^2	square miles
MSPG2	MSR Science Planning Group 2

MSR	Mars Sample Return
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NEI	National Emissions Inventory
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NIOSH	National Institute for Occupational Safety and Health
NOI	Notice of Intent
NO_x	nitrogen oxide
NPD	NASA Policy Directive
NPDES	National Pollutant Discharge Elimination System
NPR	NASA Procedural Requirement
NRC	National Research Council
NRHP	National Register of Historic Places
Orbiter	Earth Return Orbiter
OSHA	Occupational Safety and Health Administration
OTR	over-the-road
PEIS	Programmatic Environmental Impact Statement
$PM_{2.5}$	particulate matter less than or equal to 2.5 micrometers
PM_{10}	particulate matter less than or equal to 10 micrometers
POTW	publicly owned treatment works
PPE	personal protective equipment
PSD	Prevention of Significant Deterioration
RCRA	Resource Conservation and Recovery Act
RER	Restricted Earth Return
ROD	Record of Decision
ROI	Region of Influence
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SO_2	sulfur dioxide
SRF	Sample Receiving Facility
SSAP	Sample Safety Assessment Protocol
SWG	Sterilization Working Group
TS	Test Site
U.S.C.	United States Code
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
UTTR	Utah Test and Training Range
UXO	unexploded ordnance
VOCs	volatile organic compounds

BRITISH VS. METRIC MEASUREMENT CONVERSION

Length

1 centimeter (cm) = 0.3937 inch	1 inch = 2.54 cm
1 centimeter = 0.0328 foot (ft)	1 foot = 30.48 cm
1 meter (m) = 3.2808 feet	1 ft = 0.3048 m
1 meter = 0.0006 mile (mi)	1 mi = 1609.3440 m
1 kilometer (km) = 0.6214 mile	1 mi = 1.6093 km
1 kilometer = 0.53996 nautical mile (nmi)	1 nmi = 1.8520 km
	1 mi = 0.87 nmi
	1 nmi = 1.15 mi

Area

1 square centimeter (cm^2) = 0.1550 square inch (in^2)	1 in^2 = 6.4516 cm^2
1 square meter (m^2) = 10.7639 square feet (ft^2)	1 ft^2 = 0.09290 m^2
1 square kilometer (km^2) = 0.3861 square mile (mi^2)	1 mi^2 = 2.5900 km^2
1 hectare (ha) = 2.4710 acres (ac)	1 ac = 0.4047 ha
1 hectare (ha) = 10,000 square meters (m^2)	1 ft^2 = 0.000022957 ac

Volume

1 cubic centimeter (cm^3) = 0.0610 cubic inch (in^3)	1 in^3 = 16.3871 cm^3
1 cubic meter (m^3) = 35.3147 cubic feet (ft^3)	1 ft^3 = 0.0283 m^3
1 cubic meter (m^3) = 1.308 cubic yards (yd^3)	1 yd^3 = 0.76455 m^3
1 liter (l) = 1.0567 quarts (qt)	1 qt = 0.9463264 l
1 liter = 0.2642 gallon (gal)	1 gal = 3.7845 l
1 kiloliter (kl) = 264.2 gal	1 gal = 0.0038 kl

Weight

1 gram (g) = 0.0353 ounce (oz)	1 oz = 28.3495 g
1 kilogram (kg) = 2.2046 pounds (lb)	1 lb = 0.4536 kg
1 metric ton (mt) = 1.1023 tons	1 ton = 0.9072 metric ton

Energy

1 joule = 0.0009 British thermal unit (BTU)	1 BTU = 1054.18 joule
1 joule = 0.2392 gram-calorie (g-cal)	1 g-cal = 4.1819 joule

Pressure

1 newton/square meter (N/m^2) = 0.0208 pound/square foot (psf)	1 psf = 48 N/m^2

Force

1 newton (N) = 0.2248 pound-force (lbf)	1 lbf = 4.4478 N

Radiation

1 becquerel (Bq) = 2.703 x 10^{-11} curies (Ci)	1 Ci = 3.70 x 10^{10} Bq
1 sievert (Sv) = 100 rem	1 rem = 0.01 Sv

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1. PURPOSE AND NEED FOR THE PROPOSED ACTION

This Programmatic Environmental Impact Statement (PEIS) identifies and analyzes potential environmental impacts of the Mars Sample Return (MSR) Campaign Proposed Action and No Action Alternative. This PEIS has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, as amended (42 United States Code 4321 et seq.); Executive Order (EO) 12114, *Environmental Effects Abroad of Major Federal Actions*; the 2022 *Council on Environmental Quality Regulations for Implementing the Procedural Provisions of NEPA* (Title 40 Code of Federal Regulations [CFR] Parts 1500–1508); NASA's procedures for implementing NEPA (14 CFR § 1216.3); and the Department of the Air Force (DAF) procedures for implementing NEPA in the *Environmental Impact Analysis Process (EIAP)* (32 CFR Part 989).

1.1 BACKGROUND

NASA, in coordination with the European Space Agency (ESA), proposes to conduct a campaign to retrieve samples from Mars and transport them to Earth. A scientifically selected set of samples (i.e., Martian rocks, regolith,[5] and atmosphere), acquired and cached on the surface of Mars by the Perseverance rover, would be returned to Earth for scientific analysis and research.

The proposed MSR Campaign involves several flight elements associated with retrieving the samples on Mars, launching them into Mars orbit, capturing the samples in orbit, and returning them to Earth for study. The proposed Earth Entry System (EES) landing location is the DAF-managed Utah Test and Training Range (UTTR), with supporting activities proposed at U.S. Army-managed Dugway Proving Ground (DPG). Additional Earth-based ground elements associated with sample transportation (utilizing over-the-road and/or aircraft to transport the EES off the UTTR) and sample management/research (otherwise referred to as "curation") involving the development and operation of a Sample Receiving Facility (SRF) are also part of the MSR Campaign architecture.

Overall, the proposed MSR Campaign spans five elements:

- three flight elements, which include (1) the Perseverance rover (previously addressed in the *Final Supplemental Environmental Impact Statement for the Mars 2020 Mission*) (NASA 2020a); (2) the Sample Retrieval Lander and its subcomponents (the "Lander"); and (3) the Earth Return Orbiter (the "Orbiter"), with its subcomponents[6] and recovery of the EES for temporary storage for preparation of ground elements; and
- two ground elements, which include (4) EES transportation off of the UTTR and (5) an SRF.

[5] Regolith is a section of loose unconsolidated rock and dust that sits atop a layer of bedrock.
[6] Subcomponents are detailed in Chapter 2 (Description of the Proposed Action and Alternatives).

The Mars 2020 mission launched the Perseverance rover in July 2020; the rover landed on Mars in February 2021 and began collecting and storing samples for potential return to Earth for study.

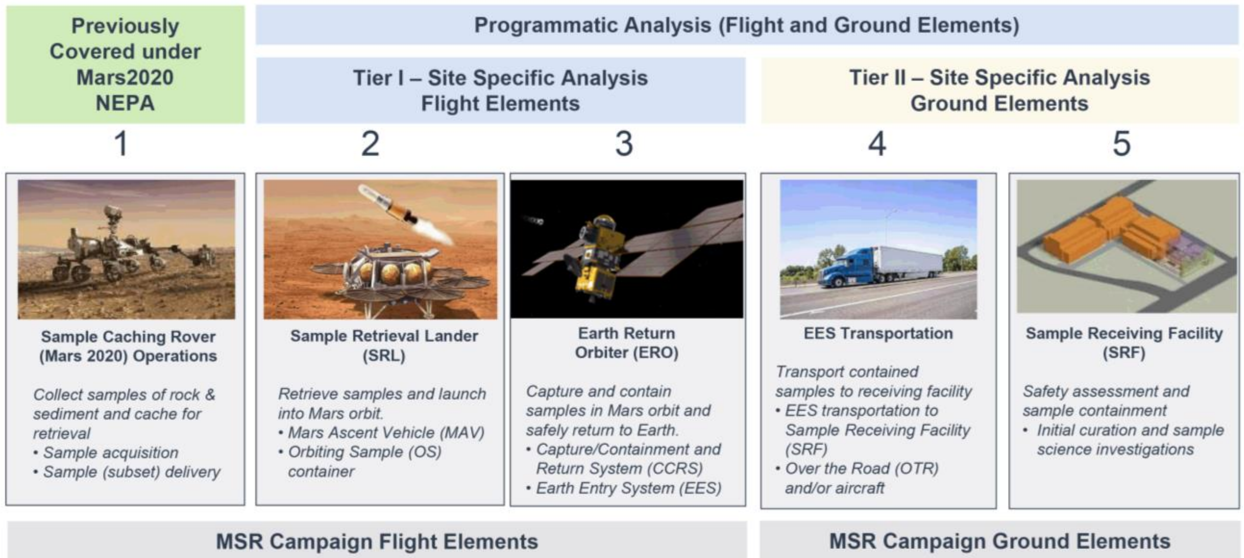

Figure 1.1-1. MSR Campaign Elements

A launch from either Kennedy Space Center or Cape Canaveral Space Force Station (CCSFS) in Florida would consist of a routine payload and has been addressed in previous NEPA analysis (see Table 1.1-1), and launch of the Orbiter from French Guiana is addressed under EO 12114, *Environmental Effects Abroad of Major Federal Actions* (see Appendix C, NASA Environmental Checklists). NASA is taking a programmatic approach to analyzing the environmental consequences of the remaining MSR Campaign program elements because of the campaign’s large scope and uncertainty regarding future timing, locations, and environmental impacts associated with ground element actions. This programmatic approach allows for near-term focus on issues ripe for decision and establishes a foundation for follow-on tiering (sequencing) to future actions and minimizing detailed topics previously decided at the initial programmatic level. This PEIS programmatically addresses the potential impacts associated with all elements of the MSR Campaign and site-specifically addresses potential impacts at the UTTR. Future tiered analyses are planned to address site-specific impacts associated with sample transportation and development and operation of an SRF.

The focus of this PEIS is therefore flyby of the Orbiter, to include release, entry, and landing of the EES; initial recovery; containment; and handling of the EES on Earth’s surface. Depending on NASA's decision on the Proposed Action as set forth in a Record of Decision (ROD), future tiered NEPA analysis would occur after the ROD is finalized but before additional action is taken regarding EES transportation planning and SRF siting and development. Future tiered NEPA analysis would address specific environmental impacts related to EES transportation (e.g., over the road or via aircraft) from the UTTR complex to an SRF. The type, location, construction, and operation of an SRF would also be analyzed in specific detail after mission requirements are more robustly characterized.

In summary, this Tier I PEIS considers the overarching environmental impacts associated with the proposed MSR Campaign and near-term decisions, which NASA and cooperating agencies may then incorporate into subsequent, tiered analyses and decisions associated with future proposed MSR Campaign activities.

The analysis in this PEIS will be used by decision makers to determine whether to proceed with the MSR Campaign and utilize the UTTR as a landing site for the EES. Decisions regarding specific methods of sample transportation from the landing site to an SRF, as well as the type and location of an SRF, will be deferred to a Tier II analysis once the requirements for such activities have been fully defined.

Applicability of Previous NEPA Analysis

The specific launch vehicle for the Lander component has not yet been determined.[7] The Lander launch would occur from either CCSFS or Kennedy Space Center (both in Brevard County, Florida), depending on the launch vehicle selected, with the launch vehicle dependent on Lander design. The launch of the Orbiter would occur from the ESA launch facility located in French Guiana.

The specific Lander design and payload are still under consideration; however, the payload is not proposed to contain any nuclear materials (e.g., radioisotope heater units). As a result, the launch flight element would be considered a "routine payload mission." Routine payload missions were previously analyzed by NASA for CCSFS and Kennedy Space Center in the *Final Environmental Assessment for Launch of NASA Routine Payloads* (NASA 2011) (the "NASA Routine Payload Environmental Assessment [EA]"), which concluded that if payload characteristics were within the scope of the EA's analysis, then the launch would not result in significant impacts to the quality of the human environment. For purposes of analysis within this PEIS, it is assumed that any Lander launch involving routine payloads would fall within the scope of the previous NEPA analysis conducted for routine payloads and is not analyzed further in this document.

Because the NEPA analysis of the launch associated with the Lander would be covered under the NASA Routine Payload EA (NASA 2011), the NEPA coverage for this element is provided using the NASA Routine Payload EA environmental checklist, which is included in Appendix C (NASA Environmental Checklists) of this PEIS. If the launch flight element for the Lander and/or the associated launch location would not fall within the scope of the previous NEPA analysis, then supplemental NEPA analysis may be required. Because the Orbiter launch occurs outside the jurisdiction of the United States, it is covered under the EO 12114 checklist (see Appendix C).

The scope of the Proposed Action was also evaluated against other previous NEPA documentation for similar actions to determine the necessary scope of analysis within this PEIS. Table 1.1-1 lists previous NEPA analyses conducted by NASA and or the DAF, the outcome/determination of the associated NEPA analysis, and the relevance to the Proposed Action.

[7] 40 CFR § 1502.21 requires the identification of incomplete or unavailable information when that information is relevant to reasonably foreseeable significant adverse impacts.

Table 1.1-1. Applicability of Previous NEPA Analysis

<table>
<tr><th>NEPA Document</th><th>Analysis Conducted</th><th>Outcome/ Determination</th><th>Relevance to Proposed Action</th></tr>
<tr><td>Final Environmental Assessment for Launch of NASA Routine Payloads – 2011 (NASA 2011)</td><td>Potential impacts were assessed from routine (non-nuclear) payload launches from CCSFS and KSC utilizing the following launch vehicles: Atlas, Delta, Taurus, Pegasus XL, Falcon, Minotaur, and Athena.</td><td>FONSI</td><td rowspan="2">The Proposed Action would involve routine payload launch activities from KSC and/or CCSFS launch complexes potentially utilizing launch vehicles addressed in these EAs. Therefore, routine payload launches from KSC and/or CCSFS are not addressed in this document. See Appendix C (NASA Environmental Checklists) of this PEIS for the routine payload criteria checklist for the MSR Campaign mission.</td></tr>
<tr><td>Final Environmental Assessment for SpaceX Falcon Launches at Kennedy Space Center and Cape Canaveral Air Force Station – 2020 (NASA 2020b)</td><td>Potential impacts were assessed from routine (non-nuclear) payload launches from CCSFS and KSC utilizing Falcon 9 and Falcon Heavy launch vehicles.</td><td>FONSI</td></tr>
<tr><td>Stardust Mission Environmental Assessment – 1998 (NASA 1998)</td><td>Potential impacts were assessed from routine payload launch from CCSFS and recovery of a sample return capsule containing interstellar dust particles at the UTTR. The capsule's deceleration was via a parachute system. Ground recovery operations at the UTTR utilizing wheeled vehicles and helicopters were also assessed.</td><td>FONSI</td><td rowspan="3">A portion of the landing ellipses for the Stardust, Genesis, and OSIRIS-Rex Mission landing ellipses overlapped with the proposed MSR Campaign EES landing ellipse. While landing and ground recovery operations were found to have no significant impact on the UTTR affected environment (similar to the proposed EES landing site), these aspects have been analyzed in this PEIS to account for site-specific conditions as well as any changes in baseline conditions since the previously conducted analyses.</td></tr>
<tr><td>Genesis Mission Environmental Assessment – 2001 (NASA 2001)</td><td>Potential impacts were assessed from routine payload launch from CCSFS and recovery of a sample return capsule containing solar wind particles at the UTTR. The capsule deceleration was via a parachute system and was to be captured midair by helicopter. The potential for ground recovery operations at the UTTR utilizing wheeled vehicles and helicopters were also assessed.</td><td>FONSI</td></tr>
<tr><td>Environmental Assessment for the Origins, Spectral Interpretation, Resource Identification, and Security-Regolith Explorer (OSIRIS-Rex) Mission – 2013 (NASA 2013)</td><td>Potential impacts were assessed from routine payload launch from CCSFS and recovery of a sample return capsule containing asteroid samples at the UTTR. The capsule's deceleration was via a parachute system. Ground recovery operations at the UTTR utilizing wheeled vehicles and helicopters were also assessed.</td><td>FONSI</td></tr>
<tr><td>DAF Environmental Impact Analysis Process (EIAP) Air Force Form 813 – Drop Tests (September 2021) (DAF 2021a)</td><td>The EIAP evaluated the potential environmental impacts from conducting drop tests of a to-scale model of the EES on UTTR soils to determine what level of NEPA analysis would be required.</td><td>Categorical Exclusion (i.e., no adverse impact or need for additional NEPA analysis)</td><td>The drop tests occurred in the TS-6 and TS-8 area of UTTR-South. Similar drop tests will be conducted over time from present until the actual mission as part of dress rehearsals, etc.</td></tr>
</table>

Table 1.1-1. Applicability of Previous NEPA Analysis

NEPA Document	Analysis Conducted	Outcome/ Determination	Relevance to Proposed Action
EO 12114 Compliance Package – James Webb Space Telescope (JWST) Launch from French Guiana (2015) *EO 12114 Compliance Package – Herschel and Planck Space Observatory Launch from French Guiana (2008)*	In coordination with ESA, NASA conducted evaluations of effects of "routine payload" operations involving European heavy-lift space launch vehicles. The reviews considered whether the missions involved the following: potential environmental effects on the global commons, potential environmental effects on foreign nations not participating with the missions, export of product or facilities producing products (or emissions) that in the U.S. are prohibited or strictly regulated because their effects on the environment create a serious public health risk, a physical project that in the United States would be prohibited or strictly regulated by Federal law to protect the environment against radioactive substances, and potential environmental effects on natural and ecological resources of global importance.	ESA confirmed concurrence for both projects that the missions would not result in any significant environmental effects abroad and that the launches would comply with French environmental laws.	The same site, using a similar launch vehicle with a routine payload, would be utilized for the MSR Campaign. The EO 12114 Compliance Package for the MSR Campaign is provided in Appendix C (NASA Environmental Checklists).

Key: CCSFS = Cape Canaveral Space Force Station; EA = Environmental Assessment; EES = Earth Entry System; EO = Executive Order; ESA = European Space Agency; FONSI = Finding of No Significant Impact; KSC = Kennedy Space Center; MSR = Mars Sample Return; UTTR = Utah Test and Training Range.

Planetary Protection and Sample Curation

"Planetary protection" is the discipline/practice of protecting solar system bodies (e.g., a planet, planetary moon, or asteroid) from contamination by Earth life and, in the case of sample return missions, protecting Earth from potential hazards posed by extraterrestrial matter.

For missions returning samples from planetary bodies that might have major and protracted effects on the physical or biological environment, NASA is required to address Presidential Directive/National Security Council-25, *Scientific or Technological Experiments with Possible Large-Scale Adverse Environmental Effects and Launch of Nuclear Systems into Space*, by presenting detailed information regarding the importance and potential environmental effects of the mission in this PEIS. NASA's planetary protection policies address missions involving samples returned from various solar system bodies as detailed in NASA Policy Directive 8700.1F, *NASA Policy for Safety and Mission Success*. The NASA policies are guided by the planetary protection policies published by the international Committee on Space Research as informed by the United Nations Outer Space Treaty. NASA Procedural Requirement 8715.24, *Planetary Protection Provisions for Robotic Extraterrestrial Missions*, provides guidelines for categorizing missions according to the destination and proposed activity. NASA Procedural Requirement 8715.24 also provides specific procedural requirements for certain mission categories. All missions returning samples from outside the Earth-

Moon system are designated as Category V. Under Category V, there are two subcategories:

- Unrestricted Earth Return – sample return missions from solar system bodies deemed by scientific consensus to have no extraterrestrial life (e.g., Earth's Moon and Venus) (NASA 2021); and
- Restricted Earth Return (RER) – sample return missions from solar system bodies deemed by scientific opinion to have a possibility of harboring indigenous life forms (e.g., Mars or Europa). RER missions have requirements to break the chain of contact with the target body as well as isolate and robustly contain restricted samples during all mission phases through safe receipt and containment on Earth (NASA 2021).

Due to the potential for ancient life forms on Mars, the sample return portion of the proposed MSR Campaign is expected to be classified as a Category V RER activity, which requires preparation of an environmental impact statement under 14 CFR § 1216.306. To provide the most conservative analysis, this PEIS assumes that a restricted return may occur.

Consensus opinion within the astrobiology scientific community supports a conclusion that the Martian surface is too inhospitable for life to survive there today, particularly at the location and shallow depth (6.4 centimeters [2.5 inches]) being sampled by the Perseverance rover in Jezero Crater, which was chosen as the sampling area because it could have had the right conditions to support life in the ancient past, billions of years ago (Rummel et al. 2014, Grant et al. 2018). Existing credible evidence suggests that conditions on Mars have not been amenable to supporting life as we know it for millions of years (iMARS Working Group 2008, National Research Council 2011, Beaty et al. 2019, National Research Council 2022). The surface of Mars, particularly for the area/region/middle latitudes being sampled by the Perseverance rover, is too cold (an average surface temperature of -55 degrees Celsius [°C] [-67 degrees Fahrenheit (°F)]) for water to exist in a liquid form in other than optimal circumstances and then often only transiently on or near the surface in isolated pockets. Scientists are interested in returning samples to understand what the Martian environment was like billions of years ago, when the planet was wetter and could have more easily supported microbial life. There is no current evidence that the geologic samples collected by the Mars 2020 mission from the first few inches of the Martian surface could contain biological entities (living organisms and/or bioactive molecules capable of propagation) that would be harmful to Earth's environment. Nevertheless, out of an abundance of caution and in accordance with NASA policy and regulations, NASA would implement measures to ensure that the Mars material is fully contained (with redundant layers of containment) so that it could not be released into Earth's biosphere and impact humans or Earth's environment. The material would remain contained until examined and confirmed safe or sterilized for distribution to terrestrial science laboratories. NASA and its partners would use many of the basic principles that Biosafety Level 4 (BSL-4) laboratories use today to contain, handle, and study materials that are known or suspected to be hazardous.

Although not listed or designated as such under any regulatory definition, the Mars samples would be handled in a manner consistent with protocols for Biological Select Agents and Toxins (BSAT). BSAT are specific biological agents that fall under a congressionally mandated level of control. BSAT material requires the use of additional biosafety measures (e.g., a higher level of biocontainment). For highly infectious or unknown materials, the highest level of biosafety (BSL-4) and biosecurity measures, in addition to specific measures for transport and inactivation, must be utilized. Because the samples would be treated as though potentially hazardous until demonstrated otherwise, they would be handled in a manner that provides the highest level of security and containment during the EES landing, recovery, transportation, sample storage, and receiving/curation mission phases and that is consistent with BSAT protocols in support of the planetary protection requirements. The samples would be stored and handled consistent with BSAT protocols until deemed safe for release and/or sterilized. Regulatory oversight of BSAT material is a joint responsibility of the Department of Health and Human Services - Centers for Disease Control and Prevention (CDC), the U.S. Department of Agriculture (USDA), the Department of Justice (USDOJ), and the Department of Defense (DoD). With the exception of the USDOJ, each of these Federal departments, or components thereof, is serving as a cooperating agency in the preparation of this PEIS. In coordination with NASA, the cooperating agencies will provide their unique experience and substantial experience during the development of appropriate safety assessment protocol(s). The DAF and U.S. Army would have some oversight responsibility for EES transport on the UTTR and DPG, respectively, to ensure regulatory requirements in this regard are being met.

This Proposed Action would combine NASA's expertise in performing planetary protection with existing curation operations that have been in place since 1969. With over 50 years of curation expertise, NASA’s current curation operations include the documentation, preservation, preparation, safe handling, and distribution of astromaterials samples collected from the Moon, asteroids, comets, meteorites (to include those from Mars), and the solar wind. Astromaterials’ unique history and primeval features must be preserved with the highest degree of care. The curation laboratories and procedures developed by NASA have proven both necessary and sufficient to serve the evolving needs of a worldwide research community. Starting with lunar rocks and soils collected by the Apollo 11 astronauts, NASA’s extensive curation operations have evolved to include the following:

- meteorites collected on National Science Foundation–funded expeditions to Antarctica;
- “cosmic dust” collected by high-altitude NASA aircraft;
- solar wind atoms collected by the Genesis spacecraft;
- comet particles collected by the Stardust spacecraft; and
- interstellar dust particles collected by the Stardust spacecraft.

Astromaterials acquisition and curation practices directly impact the contamination levels of samples and determine both the types of questions that can be answered about our solar system and the degree of precision that can be expected of those answers. Strict adherence to these practices is in NASA's and the global astromaterials research community's interest to keep the samples free from any terrestrial contamination. Three of NASA's previous missions were categorized as RER (Apollo 11, 12, and 14), and sample preservation and containment were critical mission elements. NASA has developed first-of-its-kind, advanced curation as a cross-disciplinary field to provide continuous improvement in curation and acquisition practices for existing astromaterials collections and to lay the basis for future sample return activities. These goals are accomplished through research and development of innovative facilities, technologies, and techniques for sample collection, handling, characterization, analysis, and curation of astromaterials. From the first lunar samples returned during the Apollo program to new techniques under development for future missions, lessons learned from each collection and mission, as well as advancements in science and technology, will be integrated into NASA's plan for acquiring and curating future samples.

Cooperating Agencies

Several cooperating agencies are involved in this Proposed Action due to jurisdiction by law associated with the Proposed Action areas or due to special expertise associated with development and implementation of BSAT protocols. Table 1.1-2 lists the cooperating agencies associated with this Proposed Action.

Table 1.1-2. Cooperating Agencies

Agency	Rationale
Department of Defense	
Department of the Air Force – Hill AFB, Utah / Cape Canaveral Space Force Station, Florida	The DAF is a cooperating agency because of its jurisdiction over the proposed landing site at the UTTR, with Hill AFB as the managing entity for the UTTR having special expertise with regard to the landing site. Launch activity may occur at CCSFS. The DAF is supporting NASA through consultation efforts with the Utah State Historic Preservation Officer under the National Historic Preservation Act. NASA is the agency that will sign a Record of Decision (ROD) and, depending on what activities would occur on the UTTR or CCSFS, the DAF may also sign a separate ROD or cosign the NASA ROD. The DAF decision would be associated with allowing the following mission aspects on the UTTR as described in this PEIS: mission preparation; use of staging area(s); and allowing for EES landing/recovery activities.
U.S. Department of the Army – Dugway Proving Ground	The Department of the Army is the designated DoD Executive Agent for the BSAT Program (DoD 2016). The BSAT Program is designed to protect individuals who work with DoD BSAT materials and mitigate potential risk to the general public. NASA has invited the Department of the Army to serve as a cooperating agency because of its special expertise with regard to BSAT material safety and security protocols (e.g., storage, transportation, and contingency planning protocols). The Army is a local partner with the UTTR and may be utilized to support landing and sample recovery activities.
U.S. Department of Agriculture	The USDA provides leadership on food, agriculture, natural resources, rural development, nutrition, and related issues. In the past, the agency has claimed some jurisdiction over extraterrestrial soils (NASA 2018). For example, the USDA was a member of the Interagency Committee

Table 1.1-2. Cooperating Agencies

Agency	Rationale
	on Back Contamination during the Apollo-era missions. In that capacity, USDA's involvement included guidance on the movement of organisms, plant pests, and soil (Pugel 2017). The USDA / Animal and Plant Health Inspection Service has the authority to regulate BSAT and non-BSAT infected material that may pose a severe threat to animal and plant health/products under 7 CFR Part 331, *Possession, Use, and Transfer of Select Agents and Toxins*, and 9 CFR Part 121, *Possession, Use, and Transfer of Select Agents and Toxins*. NASA has invited the USDA to serve as a cooperating agency because of its special expertise with regard to BSAT transportation and handling protocols.
U.S. Department of Health and Human Services	
Centers for Disease Control and Prevention	Under the BSAT designation, the Department of Health and Human Services was granted authority by Congress to regulate the possession, use, and transfer of BSAT material under 42 CFR Part 73, *Select Agents and Toxins*. This authority was delegated to the CDC, which has developed regulations for the possession, use, and handling of BSAT material. NASA has invited the CDC to serve as a cooperating agency because of CDC expertise with regard to BSAT management/oversight, biocontainment, decontamination, and forward/reverse contamination. Historically, the CDC has consulted on other space-oriented projects, providing technical expertise on disinfection and sterilization, biosafety, and sampling methods.

Key: AFB = Air Force Base; BSAT = Biological Select Agents and Toxins; CDC = Centers for Disease Control and Prevention; CFR = Code of Federal Regulations; DoD = Department of Defense; DAF = Department of the Air Force; EES = Earth Entry System; PEIS = Programmatic Environmental Impact Statement; USDA = U.S. Department of Agriculture; UTTR = Utah Test and Training Range.

1.2 PURPOSE OF THE ACTION

The purpose of the proposed MSR Campaign is to collect samples of Martian rocks, regolith, and atmosphere and then return those samples to Earth for detailed analysis to enable significant advances in the following:

- the search for evidence of ancient life forms on Mars;
- the understanding of the origin and evolution of Mars as a geological system and how it may relate to the origin and evolution of other terrestrial planets;
- the understanding of the processes and history of climate on Mars; and
- the preparation for human exploration.

1.3 NEED FOR THE PROPOSED ACTION

The need for the Proposed Action is to support major goals of the international planetary science community. Obtaining a scientifically selected set of samples of Mars for study on Earth has been a major goal of the international planetary science community for several decades. The two most recent U.S. national analyses of planetary science priorities, entitled *Vision and Voyages for Planetary Science in the Decade 2013-2022* (National Research Council 2011) and *Origins, Worlds, and Life: A*

Decadal Strategy for Planetary Science and Astrobiology 2023–2032 (National Research Council 2022), confirmed that the MSR Campaign remains among the very highest priorities of the science community. This formal recommendation is one of the reasons that led NASA to develop and launch the sample-collecting Perseverance rover. Perseverance landed in February 2021 and is actively collecting rock, regolith, and atmospheric samples from the Jezero Crater landing site—an ancient Martian river delta chosen because it offers rock formations that have a high chance of preserving evidence of ancient microbial life. These samples are sealed in tubes and would be retrieved and returned to Earth in a manner further described in this PEIS.

The past four decades of Mars missions have explored the planet using a multidisciplinary set of scientific instruments, from both orbit and from the Martian surface. This orbital and on-surface planetary research has confirmed that ancient Mars may have supported environmental conditions favorable to the evolution of life on the planet (National Research Council 2011, National Research Council 2022):

- Mars is now known to have had a much warmer and wetter climate in the ancient past in which habitable environments existed at its surface and prebiotic compounds could have formed and flourished.
- Early Earth and early Mars were far more similar to each other than they are now, with both hosting environments rich in liquid surface water for significant periods of time. It was during that early period that life emerged on Earth and may have emerged on Mars.
- Due to plate tectonics on Earth, older rocks are consumed by natural processes and reconstituted—this has obliterated the geologic record of the very earliest period of the Earth’s history. However, Mars never had plate tectonics, and it has a well-preserved record of the geologic time period that is missing on Earth, which may reveal biosignatures of early microbial life that existed on the Red Planet.

Because of those conditions, Mars may still contain evidence of processes that happened billions of years ago, in the same era that life was beginning on Earth. If life arose on Mars, signs of that ancient life (much like the fossil record on Earth) may have been preserved in such a manner that they could still be found today. Mars, therefore, provides the opportunity to address fundamental questions about the origin and evolution of life on Earth (and elsewhere in the solar system), such as *Did life arise elsewhere in the solar system, and if so, how and when? How did Mars evolve into the planet it is today and what can that tell us about Earth’s evolution?* and *How are the biological and geological histories of a planet related?* Progress on these important questions can be made more readily through the collection, return to Earth, and scientific analysis of Martian geologic and atmospheric samples than from any other planetary body in the solar system (National Research Council 2011, National Research Council 2022).

From the earliest Mars missions, it was recognized that the complexity and cost of sending advanced instruments to study Mars in place (*in situ*) would restrict the scope and detail of the science that could be done; many important classes of scientific instruments are not amenable to the miniaturization and ruggedization that would be necessary to operate from a spacecraft. An important aspect of this is that many critical measurements can only be done on samples that have been through intricate sample preparation processes, and most of those processes are not able to be automated. These same principles regarding the importance of using terrestrial laboratories to enable the best scientific return also apply to the care and attention to detail that would be required to conduct a proper and comprehensive sample safety assessment in the proposed SRF.

By acquiring and delivering to Earth a rigorously documented set of Mars samples for investigation in terrestrial laboratories, scientists would have access to the full breadth and depth of analytical science instruments available across the world. Similar to the lunar samples returned by NASA’s Apollo missions to the Moon (1969–1972), the Mars samples would be studied for many decades and would include using future techniques that have not yet been invented.

The science potential of samples delivered from Mars was most recently re-evaluated by the international MSR Samples and Objectives Team (iMOST), which was active from 2017 to 2018. iMOST outlined a set of seven proposed objectives for MSR science, along with the types of samples and measurements that would be needed to achieve those objectives (Beaty et al. 2019). One of the major findings of the iMOST study was that a set of diverse, scientifically selected samples collected by Perseverance and delivered to Earth by the MSR Campaign would allow for major progress to be made on all seven of the proposed objectives. The resulting investigations of these returned samples would enable scientific advances in multiple areas, including the following:

- the search for past life on Mars;
- the understanding of the origin and evolution of Mars as a geological system;
- the understanding of the processes and history of climate on Mars; and
- the closing of knowledge gaps required to prepare for future human exploration.

The missions that would conduct Mars sample return represent the knowledge gained from decades of research and investigations in planning and operating a series of progressively larger, more complex, more scientifically rewarding missions to Mars. The samples being gathered by Perseverance in and around the rover’s landing site in Jezero Crater are being carefully selected to address fundamental science questions about habitability and the history of the planet’s geology and climate. If the samples are successfully returned and analyzed, it is expected that they would ultimately revolutionize scientific understanding of the potential for the ancient Martian environment to support life, the broader evolution of the solar system, and humanity's place in all of it.

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2. DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

2.1 DESCRIPTION OF THE PROPOSED ACTION

Under the Proposed Action, NASA, in coordination with the European Space Agency (ESA), would conduct the Mars Sample Return (MSR) Campaign to retrieve a scientifically selected set of Mars samples (i.e., Martian rocks, regolith, and atmosphere). As a cooperating agency, the Department of the Air Force (DAF) would provide support and decision making for the proposed landing of the Earth Entry System (EES) at the Utah Test and Training Range (UTTR). The proposed sample landing location is the DAF-managed UTTR, with supporting activities proposed at U.S. Army-managed Dugway Proving Ground (DPG). Currently, the Perseverance rover is collecting samples and caching them on the surface of Mars. Under the Proposed Action, selected samples would be transported to Earth for scientific analysis and research. This chapter provides a mission overview from a programmatic perspective (Section 2.1.1, Mission Overview), provides a description of the programmatic elements that would occur from a site-specific perspective at the UTTR (Section 2.1.3, Site-Specific Elements), and discusses the No Action Alternative (Section 2.2, Description of the No Action Alternative).

2.1.1 Mission Overview

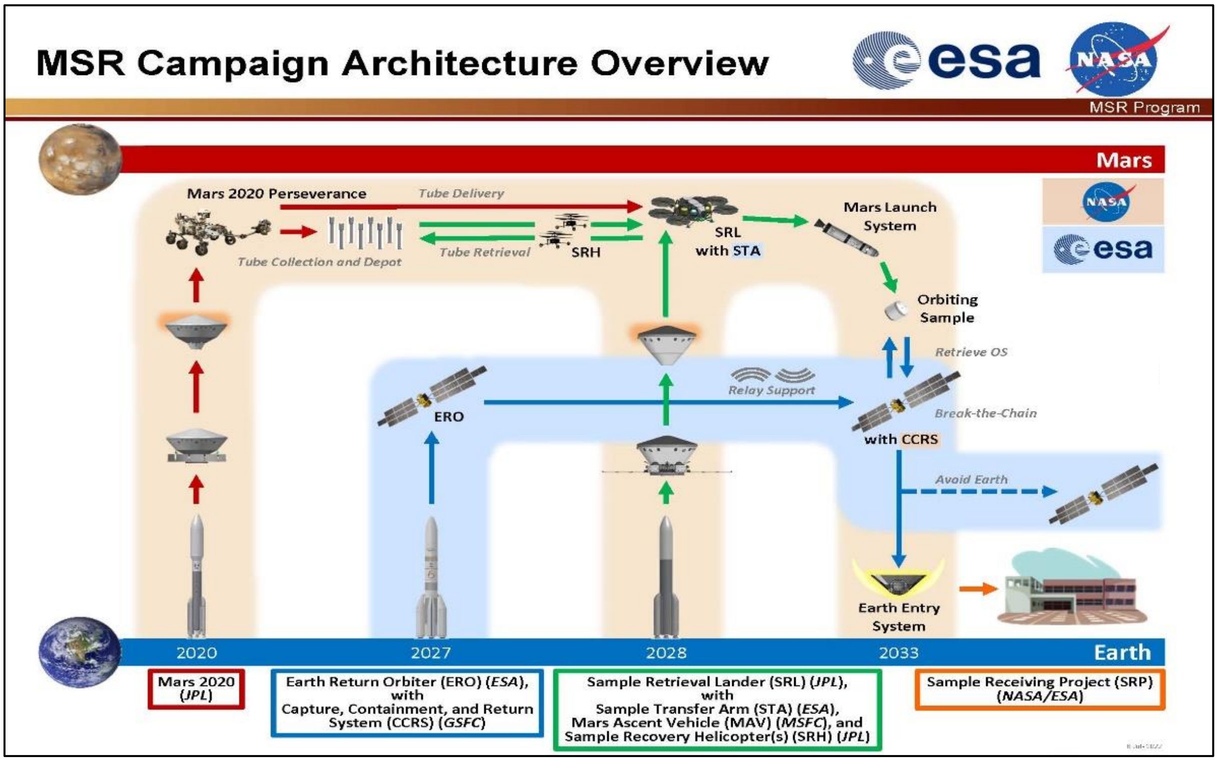
The MSR Campaign includes three flight elements and two ground elements. The flight elements consist of the Perseverance rover, a Sample Retrieval Lander (the “Lander”), and the Earth Return Orbiter (the “Orbiter”), including its payload (the EES) and payload recovery. The two ground elements are transportation of the EES from UTTR/DPG to a Sample Receiving Facility (SRF), as well as development and operation of an SRF.[8]

As previously discussed, the Perseverance rover selects, acquires, and caches Mars samples. The Lander—launched by NASA—would deliver to the planet's surface the Mars Ascent Vehicle with the Orbiting Sample container, a Sample Transfer Arm provided by ESA, and up to two Sample Recovery Helicopters. The Perseverance rover would be the primary means of transporting samples it has retained on board directly to the Lander, where the Sample Transfer Arm would load the sample tubes into the Orbiting Sample container. The Sample Recovery Helicopter, based on the design of the Ingenuity helicopter that landed on Mars with Perseverance and has operated well beyond its original planned lifetime, would provide a secondary capability to retrieve samples cached on the surface of Mars. The Mars Ascent Vehicle would launch the Orbiting Sample container loaded with sample tubes into Mars orbit. The Orbiter (also provided by ESA) includes the Capture, Containment, and Return System (CCRS) provided by NASA, which would capture and contain the Orbiting Sample container for return to the surface of Earth. The CCRS comprises four elements: 1) the Capture Enclosure, 2) the Assembly Enclosure, 3) the Earth Entry Vehicle, and 4) the Micrometeoroid Protection System. The CCRS captures the Orbiting Sample container,

[8] More detailed information regarding the MSR Campaign architecture, goals, and objectives can be found in “Mars Sample Return Campaign Concept Status” by Muirhead et al., published June 13, 2020, in *Acta Astronautica* and available at http://doi.org/10.1016/j.actaastro.2020.06.026.

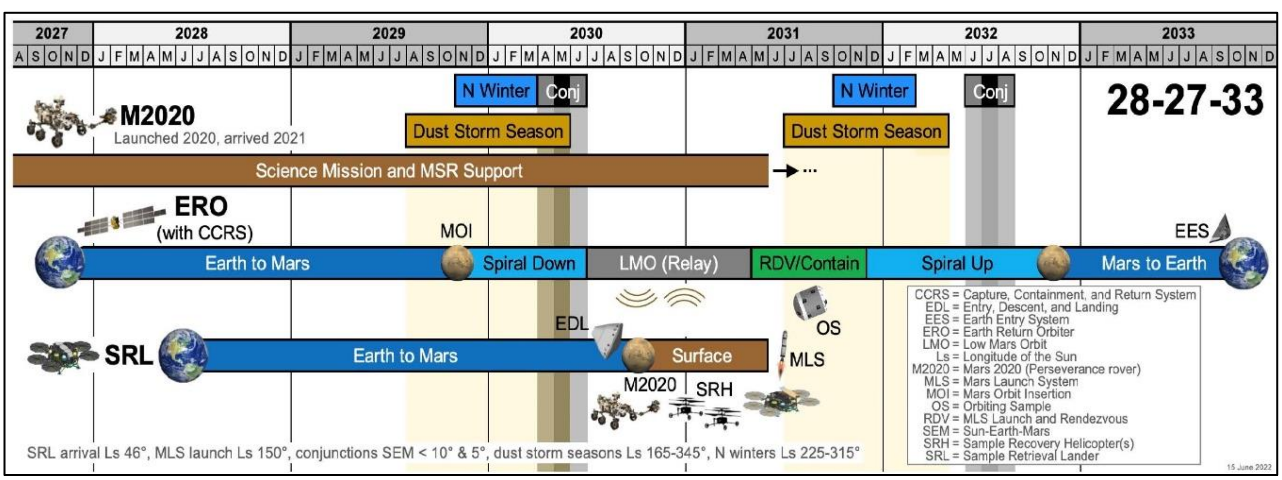
contains it, and places it inside the Earth Entry Vehicle, creating the EES. Once the EES has landed, the notional plan is that the whole EES would be contained and transported to an SRF (not on the UTTR), where the samples would be processed and analyzed.

Figure 2.1-1 presents a graphical overview of the MSR Campaign. Figure 2.1-2 provides the timeline of the MSR Campaign.



Key: ERO = Earth Return Orbiter; esa/ESA = European Space Agency; OS = Orbiting Sample; SRL = Sample Retrieval Lander.

Figure 2.1-1. Planned MSR Campaign Overview



Note: The Sample Retrieval Lander element is anticipated to launch in 2028, with backup opportunities in 2030 and 2032; the Earth Return Orbiter would arrive no earlier than 2033, with a backup opportunity in 2035.

Figure 2.1-2. Baseline MSR Campaign Timeline

As discussed in Chapter 1 (Purpose and Need for the Proposed Action), the Earth return portion of the proposed MSR Campaign is expected to be classified as a Category V mission with Restricted Earth Return (RER) to prevent release of uncontained or unsterilized material from Mars into Earth's biosphere; this is referred to as "backward planetary protection." This protection drives the design of MSR systems to return the Mars sample tubes in the Orbiting Sample container to Earth while containing and/or sterilizing any other Mars material that the MSR flight elements may have contacted. NASA currently proposes landing the EES containing the Mars samples at the UTTR.

Figure 2.1-3 shows the regional location of the UTTR and proposed EES landing site, which is in an area in the South Range with soft sandy/clay soils in the "Type 45-Playas" soil profile. The UTTR and associated MSR Campaign activities proposed at the UTTR are discussed in Section 2.1.3 (Site-Specific Elements).

Because the proposed launches are more than five years away, and the landing potentially ten years away, the mission and design requirements are still in development and subject to further refinement. As a result, the MSR Campaign and its elements are described using the most current planned mission architecture at this time. Should substantial changes to the MSR Campaign architecture (as described and analyzed in this Programmatic Environmental Impact Statement [PEIS]) that are relevant to environmental concerns be proposed, or NASA become aware of significant new circumstances or information relevant to environmental concerns and bearing on the Proposed Action or its impacts, NASA may prepare a supplemental environmental impact statement or analyze the changes in its Tier II document for ground elements as appropriate.

2.1.2 Programmatic Elements

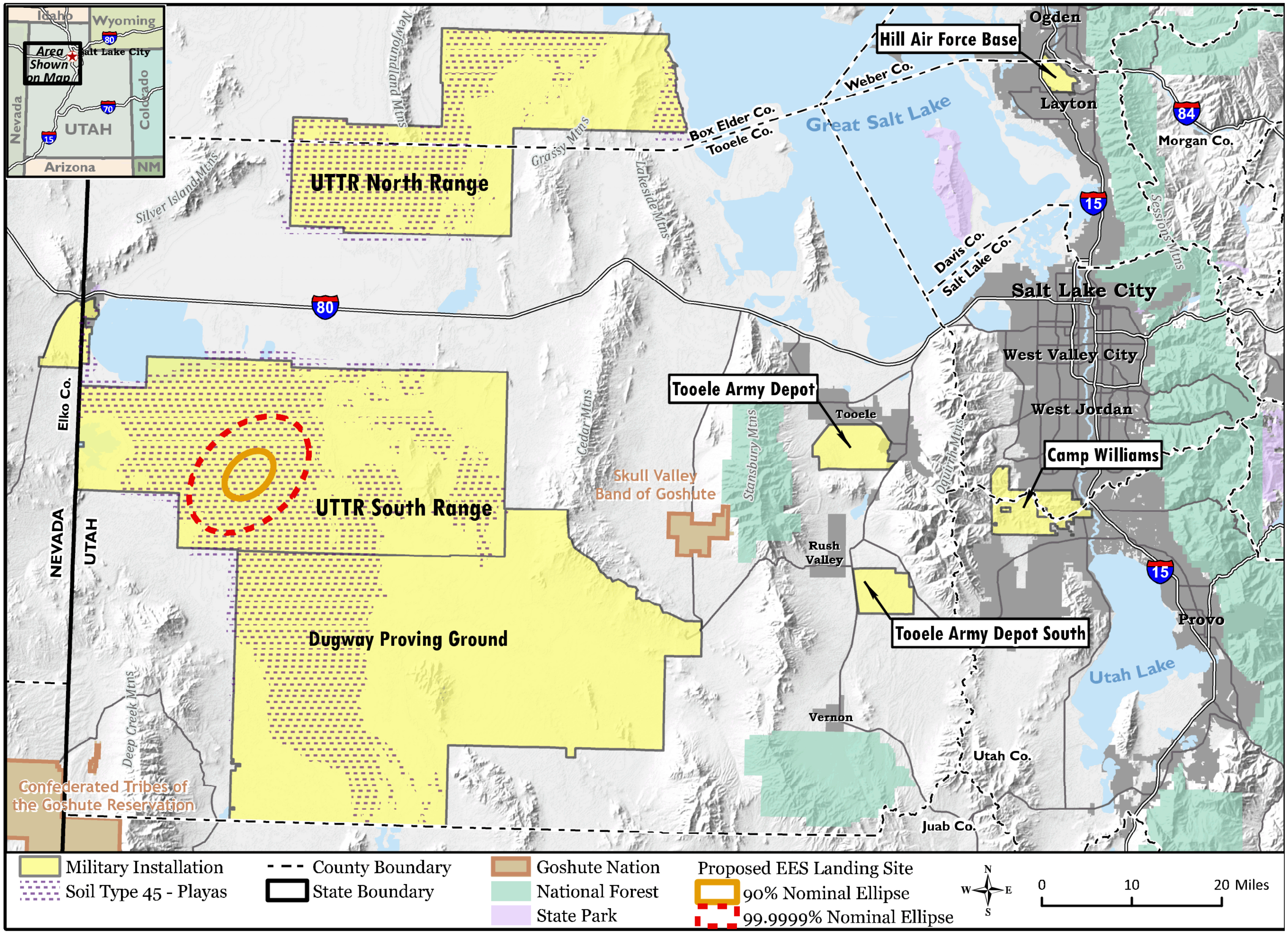
As discussed in Chapter 1 (Purpose and Need for the Proposed Action), this PEIS analyzes the potential impacts of the MSR Campaign both programmatically (flight and ground elements) and site specifically (Earth-based launch elements and landing of the EES at the UTTR). Appropriate transportation, storage, and curation protocols for the Mars samples, including transportation from the UTTR landing site, are currently under investigation, with details incomplete at this time.[9] This PEIS identifies and evaluates, from a programmatic perspective, the conceptual transportation methods and representative SRF options (i.e., new construction, existing facility, modular, or hybrid) that are most likely applicable to this future recovery and curation action; however, those elements of the Proposed Action cannot be analyzed from a site-specific perspective at this time. Subsequent Tier II National Environmental Policy Act (NEPA) analyses will address site-specific impacts associated with sample transportation off the UTTR and type, location, development and operation of an SRF.

2.1.2.1 Flight Elements

The flight elements associated with the MSR Campaign include the Perseverance rover, the Lander and its subcomponents, and the Orbiter and its subcomponents.

[9] 40 CFR § 1502.21 requires the identification of incomplete or unavailable information when that information is relevant to reasonably foreseeable significant adverse impacts.

1



2

Key: EES = Earth Entry System; UTTR = Utah Test and Training Range.

3

Figure 2.1-3. Regional Location of the UTTR

2.1.2.1.1 Perseverance Rover

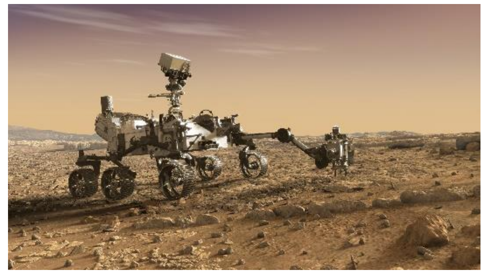


Image credit: NASA/JPL-Caltech

For mission flexibility and functional redundancy to the Lander mission, the Perseverance rover may cache part of its samples in multiple depots for subsequent retrieval and/or return sample tubes directly to the Lander. This flight element was previously analyzed in the *Final Environmental Impact Statement for the Mars 2020 Mission* (NASA 2014) and the *Final Supplemental Environmental Impact Statement for the Mars 2020 Mission* (NASA 2020a). While the NEPA process was completed for the launch of the Perseverance spacecraft, the rover is included in this PEIS to describe the enabling role that it is playing in implementing the MSR Campaign on the surface of Mars, which was to assemble a returnable cache of samples for possible future return to Earth. As a result, although discussed within the context of the overall MSR Campaign, this flight element is not analyzed further in this PEIS.

The Perseverance rover is the primary proposed method to deliver samples to the Lander / Mars Ascent Vehicle. A select subset of samples collected by Perseverance, approximately 30 samples of rock and regolith weighing about 15 grams each (0.03 pound), will be deposited directly into ultraclean and sterile sample tubes (Farley et al. 2020) for return to Earth. The total sample amount returned would be approximately 450 grams (about 1 pound).

2.1.2.1.2 Sample Retrieval Lander

The Lander would include a lander platform delivered from launch through entry, descent, and landing on Mars. An ESA-provided Sample Transfer Arm on the Lander would be used to transfer samples from the Perseverance rover to the Orbiting Sample container. The Lander would include the Mars Launch System, consisting of the Mars Ascent Vehicle and the Mars Ascent Vehicle Payload Assembly that delivers the Orbiting Sample container to Mars orbit. The Orbiting Sample container would be released to Mars orbit after Mars Ascent Vehicle burnout.

It is anticipated that the launch for the Lander would occur in 2028, arriving at Mars in 2030, with the specific launch vehicle and location of the launch (i.e., specific launch location at Cape Canaveral Space Force Station or Kennedy Space Center located in Brevard County, Florida) dependent on the launch vehicle selected. Backup launch dates are in 2030 and 2032, with the expected return of the Mars samples approximately five years after launch. As discussed previously, launches involving routine payloads were previously analyzed by NASA in the NASA Routine Payload Environmental Assessment (EA) (NASA 2011). This document concluded that if payload characteristics were within the scope of the EA's analyses, the launch would not result in significant impacts to the quality of the human environment. As a result, although discussed within the context of the overall MSR Campaign, this flight element is not analyzed further in this document. Should the selected launch vehicle for the Lander, and/or the associated launch location(s), not fall within the scope of the previous NEPA analysis, supplemental NEPA analysis may be required (NASA 2011).

The NEPA coverage for this element is provided using the NASA Routine Payload EA environmental checklist, which is included in Appendix C (NASA Environmental Checklists) of this PEIS. More detailed information regarding the engineering behind the Lander and its subcomponents is available at https://mars.nasa.gov/msr/.

2.1.2.1.3 Earth Return Orbiter

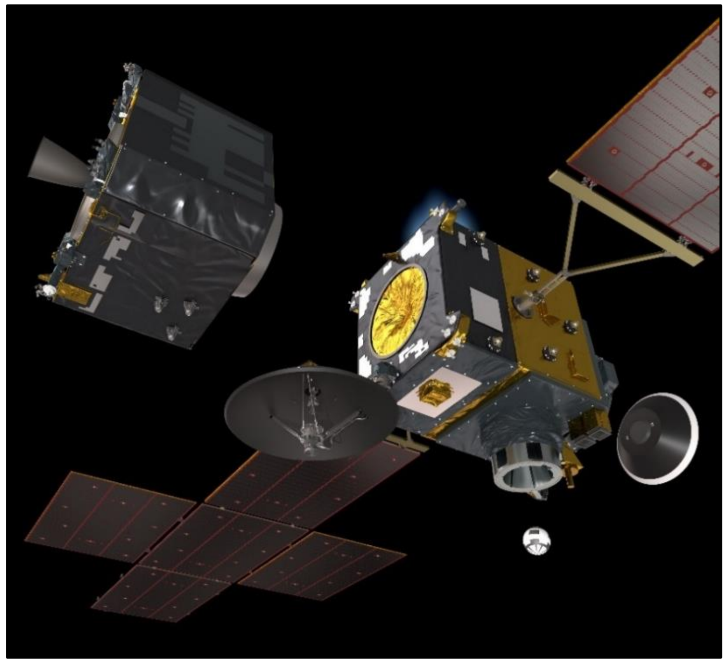
The Orbiter would be provided by ESA and launched from French Guiana in 2027 (prior to the Lander launch). A backup Orbiter launch date is 2028. The Orbiter would rendezvous with the Orbiting Sample container in space and return it for a safe entry and landing on Earth. The Orbiter would be capable of 1) providing communications relay for all MSR flight elements on the surface of Mars—the Lander, Perseverance rover, and Mars Launch System; 2) locating the Orbiting Sample container in Mars orbit; and 3) supplying power, propulsion, and navigation needed for the NASA-provided CCRS payload to function. More information regarding ESA’s role in the proposed MSR Campaign can be found at the ESA website: https://www.esa.int/Science_Exploration/Human_and_Robotic_Exploration/Exploration/Mars_sample_return.

The CCRS payload would provide the ability to capture and contain the Orbiting Sample container, transfer the Orbiting Sample container into the Earth Entry Vehicle (creating the EES), and protect it during the return flight to Earth. The EES, once released, would continue to a landing on Earth. More detailed information regarding the science behind the Orbiter and its various components can be found at http://www.jpl.nasa.gov/missions/mars-sample-return-msr.

In addition to the EES, the Orbiter is considered a potential contamination vector for the Earth-Moon system for backward planetary protection. Although highly unlikely, the Orbiter may be exposed to Mars particles from the exterior of the Orbiting Sample container prior to capture, and thus mitigation measures are being implemented as a precaution. Once the Orbiting Sample container has been captured and break-the-chain[10] has been completed, the portion of the CCRS potentially contaminated with Mars particulates is jettisoned into a stable orbit of Mars. The remaining hardware on the Orbiter, used for Earth return, conducts an Earth avoidance maneuver to ensure that the system will avoid inadvertent impact with Earth.

To avoid Earth, the Orbiter implements a dual-pronged strategy, including mission design and diversion operations. For mission design, the Orbiter leaves Mars on a path that will pass by Earth. After all critical spacecraft systems can be verified to be healthy and reliable, the Orbiter would be maneuvered onto a path that would allow the EES to land precisely in the target area. After EES release, the Orbiter would navigate to a trajectory that would avoid Earth for over 100 years, ensuring that residual Mars material, if any, associated with the Orbiter is not returned to Earth.

[10] “Break-the-chain” means that no uncontained and unsterilized hardware that contacted Mars, directly or indirectly, shall be returned to Earth.



The Orbiter is designed to ensure high reliability across all systems that are critical for EES delivery and the Earth avoidance maneuvers and is designed with redundant navigation and avionics capabilities. These procedures are expected to keep practically all uncontained Mars particles associated with the spacecraft from arriving on Earth. The system includes two, redundant containment layers designed to ensure Mars material is contained upon landing on the soil types encountered within the landing ellipse to a high degree of certainty (99.9999%). These containers work in concert with the structural characteristics of the Orbiting Sample container and the EES to ensure the integrity of the sample tubes, as well. Assessments are being conducted to determine how this low-likelihood event may proceed, to further characterize the potential that particles delivered in this manner could represent a hazard to Earth's biosphere.

The MSR Campaign has established stringent probability targets to drive robust containment engineering, with a selected a target value equivalent to a 99.9999 percent probability of successful sample containment. The MSR Campaign is performing analyses based on both designs and operational planning to meet this target. Key features of these analyses include efforts to better understand the population of Mars material transported by the wind on the planet (dust particle sizes, etc.), improved knowledge about how and how fast this material accumulates on specific exposed surfaces over time, and the rate and timing of particle emission from surfaces exposed to space, including the effects of the space environment on particle sterilization and trajectories.

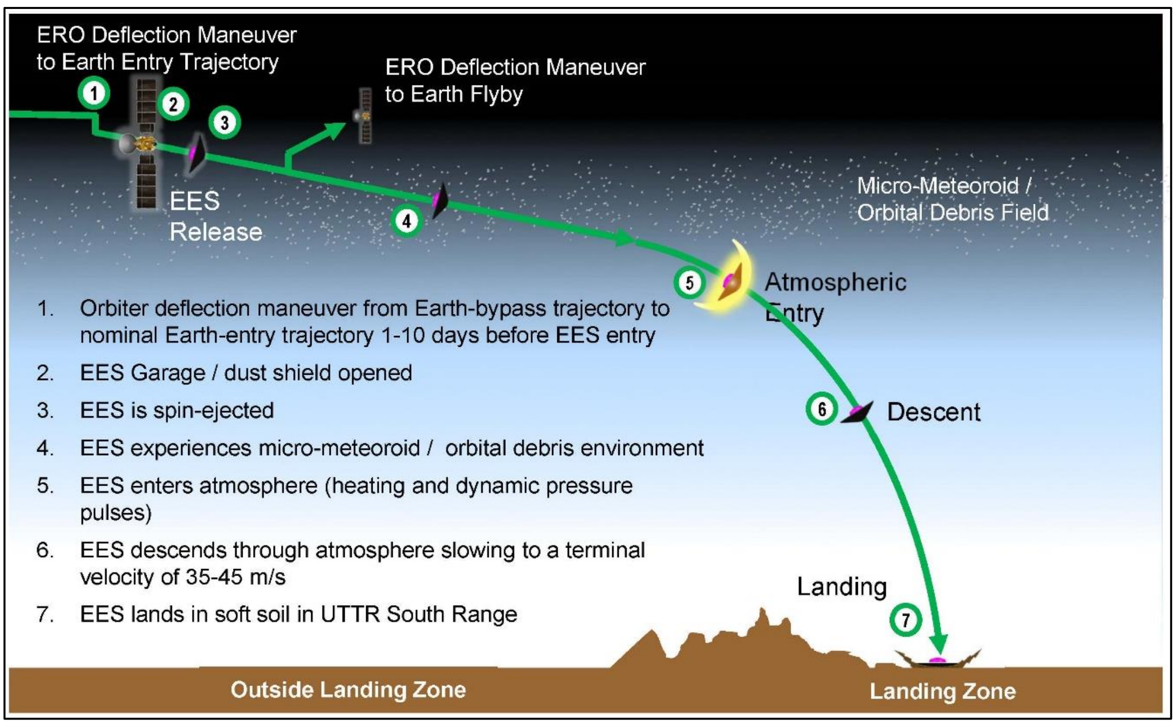
As a matter of standard practice, NASA and ESA would closely monitor spacecraft telemetry and health, including vehicle attitude, throughout flight. To the extent that any anomalous indications can be positively attributed to micrometeoroid damage, that information will be included in operational decision making. The MSR Campaign mission concept provides a micrometeoroid protection system that has multiple layers of protective materials, which provides protection throughout the entire flight from launch out to Mars and back to Earth.

Because the launch of the Orbiter from French Guiana, an area beyond the territorial jurisdiction of the United States, would be a joint effort between NASA and the ESA, it is addressed in this PEIS under Executive Order (EO) 12114, *Environmental Effects Abroad of Major Federal Actions*. While EO 12114 addresses Federal actions abroad, which are not included under NEPA, the EO furthers the purpose of NEPA by requiring Federal agencies to consider the significant effects of their actions on the environment outside the

United States, its territories, and possessions. NASA's checklist for compliance with EO 12114 requirements is provided in Appendix C (NASA Environmental Checklists).

EES Landing

After departing orbit around Mars on an Earth-bound trajectory, the Orbiter would release the EES above the Earth's atmosphere. After EES release, the Orbiter would continue past Earth while the EES performs entry, descent, and landing as it returns to Earth. The Orbiter would navigate to a trajectory that would avoid Earth for over 100 years, ensuring that residual Mars material, if any, associated with the Orbiter is not returned to Earth. NASA and ESA would not expect the Orbiter to reencounter Earth after navigating to the avoidance trajectory and have run orbital simulations to demonstrate this for at least 100 years. The expectation is that Orbiter would remain in a heliocentric orbit and not return to Earth. However, it gets increasingly difficult to demonstrate for timeframes exceeding 100 years. The cone-shaped EES, about the size of a tire on a semitruck, would passively enter Earth's atmosphere on a predictable path shaped by gravity and atmospheric drag. It is estimated that the EES will reach terminal velocity[11] (about 35 to 45 meters per second or 78 to 100 miles per hour) before landing; it is calculated that, after entering the Earth's atmosphere, it would take approximately 377 seconds (about 6 minutes) before the EES lands. During reentry, a sonic boom would be generated at a very high altitude (see Section 3.14, Noise). Figure 2.1-4 shows the Orbiter release and EES landing process.



Key: EES = Earth Entry System; ERO = Earth Return Orbiter; m/s = meters per second; UTTR = Utah Test and Training Range.

Figure 2.1-4. Orbiter EES Release Process

[11] Terminal velocity is the maximum speed attainable by an object (based on its mass) as it falls through the air (i.e., when the resistance of the air has become equal to the force of gravity).

The EES has a fully passive aerodynamic design for entry and landing without use of a parachute, which reduces potential failure modes to the minimum. This design decision eliminates major potential failure modes involving systems such as parachutes or retrorockets that have levels of reliability lower than those required for successful landing of the EES. A series of ground-based impact tests involving drop towers and the dropping of full-scale test articles from a helicopter (which reach speeds and forces equal to or greater than the expected impact of the flight vehicle) have validated this approach. The pictures in Figure 2.1-5 show the impact results of an EES drop test at the UTTR under very dry conditions; the pictures show a small dust cloud lasting for a few seconds—the actual landing would be expected to occur during the fall when soils are relatively moist and soft, thus reducing the size of any potential dust cloud.

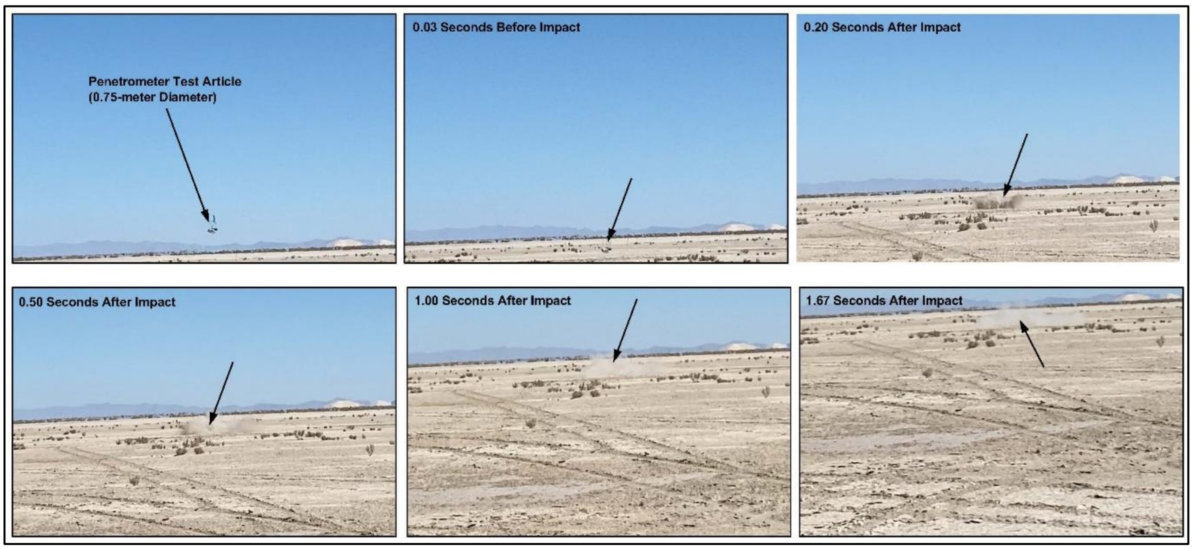


Figure 2.1-5. Impact Results of an EES Drop Test

Data from these tests are informing detailed computational models of the landing as well as future drop tests. This information, in combination with the soil properties at the baseline landing site at the UTTR, provides high confidence that the EES would survive touchdown loads within significant margins.

The system includes two levels of containment designed to sustain the integrity of the sample container and sample tubes upon landing with a nominal (“normal”) landing load (less than 1,300 acceleration relative to that of the Earth’s gravity [*g*]) to protect the EES and an off-nominal (“abnormal”) surface landing load (less than 3,000 *g*) to assure containment (see Figure 2.1-6).[12] While the EES design is still evolving, the EES is estimated to be approximately 1.25 meters (49 inches) in diameter and 0.52 meter (20.5 inches) tall. The final dimensions could be slightly different by a few inches one way or another but would not be expected to substantively change the results of impact analysis within this PEIS. The EES would be composed of titanium, aluminum, carbon-fiber, carbon-phenolic and cork-based thermal protective material, and assorted small steel components. There would also be standard aerospace adhesives and lubricants in small quantities. However, the EES would carry no fuel or propellent.

[12] *g* = acceleration relative to that of the Earth’s gravity

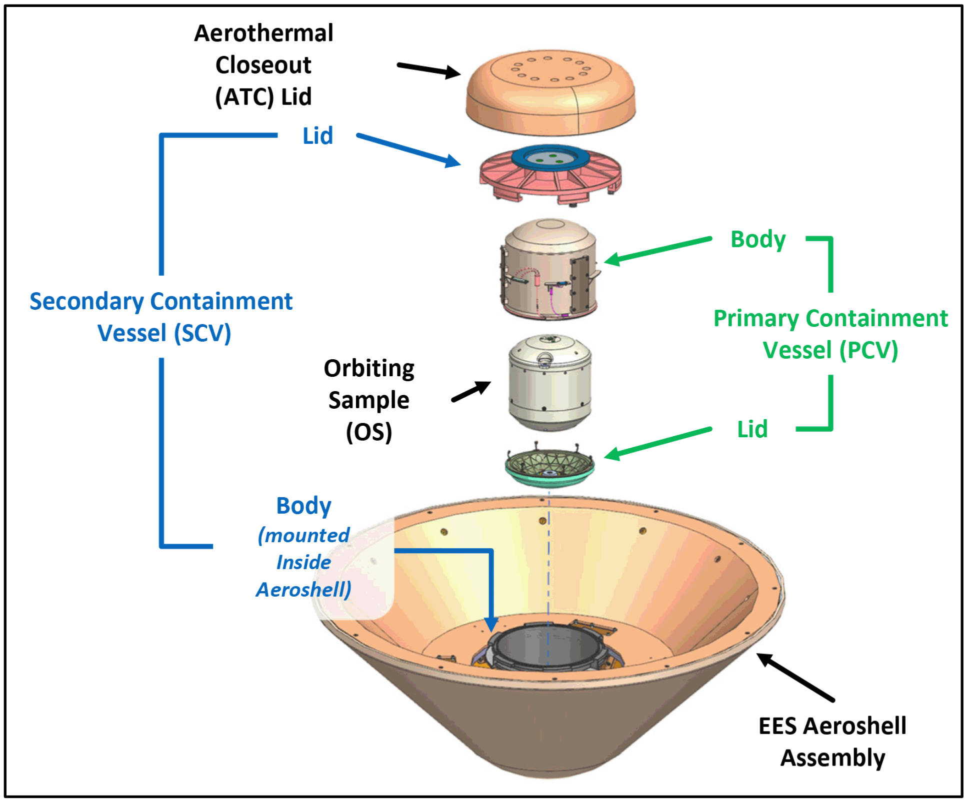


Figure 2.1-6. MSR EES Configuration

EES Recovery, Containment and "Decontamination"

It is anticipated that tracking capabilities provided by Hill Air Force Base (AFB) would provide sufficient resolution of the landing site such that a single recovery team may be utilized; however, studies of the need for multiple teams and the required capabilities are underway. Prior to EES landing, one or more recovery teams would be staged at a strategic location away from the proposed landing site, with the objective to contain and recover the EES promptly. The staging area would include communications equipment and vehicles (land and/or air) and equipment for use in transport to and from the landing site, as well as a mobile containment system (or "vault," as described in subsequent sections). The exact location of the staging area has not yet been determined; however, the most likely location for a staging area would be the DAF Detachment 1 (Det-1) location adjacent to the Michael Army Field runway located on Dugway Proving Ground (DPG); the Det-1 location is DAF managed and leased from the U.S. Army. The Det-1 location has ready access to improved roadways and utilities if needed. This would facilitate transportation of the EES to the vault once contained, as well as transportation of the vault off Department of Defense (DoD) property. Other staging areas that may be utilized would consist of previously disturbed test site areas near the proposed landing ellipse that are accessible by road or air from DPG (see Figure 2.1-9 on page 2-19). While the EES recovery team would likely access the landing site via helicopter, the use of wheeled vehicles cannot be discounted.

Once the EES has landed, the recovery team would transit to the landing site and contain the EES. The EES would be handled under protocols similar to Biosafety Level 4 (BSL-4) protocols; NASA intends to manage the EES, and the Mars material it carries, as potentially hazardous until demonstrated otherwise. BSL-4 reflects the highest level of containment, handling, and transportation regulatory standards (CDC 2020) (49 CFR Parts 171–180, 42 CFR § 73.11, 7 CFR § 331.11, and 9 CFR § 121.11). Additionally, although release of Mars sample particles is considered an off-nominal event, NASA has decided that, based on the current operations concepts, the best practice for planetary protection is to handle the encapsulation/recovery in a manner that does not assume containment has been successful. NASA does not expect that there would be Martian particles on the exterior of the EES and, in an off-nominal scenario, both containment vessels would have to be breached for a release to potentially occur, which is unlikely given the engineering parameters of the EES and the soft soils at the landing site. Nonetheless, studies regarding burnup/breakup, atmospheric release, contingency planning, and the extremely low likelihood that any Mars material will be distributed outside of the landing site radius are ongoing, and procedures to recover the EES fragments if it is damaged upon reentry and landing are still in development. As a result, this information is currently unavailable.[13] This information is relevant regarding understanding the potential for impacts associated with EES landing mishaps and sample release (see Sections 3.2, Incomplete or Unavailable Information, and 3.4, Health and Safety, for more discussion on this topic).

Therefore, to ensure proper containment, the site recovery teams would handle the landing event as though a release has occurred, which may involve the decontamination of both the landing site (impact area and extent of ejecta) and the packaged EES. This means that throughout the recovery and any decontamination process, all personnel in contact with the EES and involved in decontamination activities would be required to wear personal protective equipment appropriate for handling biohazardous material (CDC 2020). After arrival of the recovery team, the landing site around the EES would be cordoned off. The EES would be recovered, enclosed within a protective bag similar in function to a biohazard containment bag, and then inserted into a 2-meter by 2-meter (6.56-foot by 6.56-foot) sealed travel case; the case would be a lightweight, temporary container, designed to facilitate rapid transportation from the landing site to the vault. The EES travel case may be decontaminated and then would be transported via helicopter to the vault for shipment to an SRF. After removal of the EES, the entire landing site (consisting of the impact area and extent of ejecta) may be decontaminated as a precautionary measure. Samples of the landing site/impact area would also be taken for contamination/biological knowledge after the EES was removed but before decontamination of the area. These samples would be transported under containment with the EES to the SRF for analysis.

Although anticipated as a precautionary measure (release of any Mars materials is considered highly unlikely), at this time, the exact decontamination method(s) that may be used for the EES travel case and landing site have not been determined.[14] The

[13] 40 CFR § 1502.21 requires the identification of incomplete or unavailable information when that information is relevant to reasonably foreseeable significant adverse impacts.

[14] 40 CFR § 1502.21 requires the identification of incomplete or unavailable information when that information is relevant to reasonably foreseeable significant adverse impacts.

decontamination method is relevant to addressing impacts to the environment associated with effects to natural resources, use of hazardous materials, and generation and management of hazardous waste. For purposes of this PEIS, it is assumed that any decontamination process would involve standardized decontamination and/or sterilization methods, in alignment with current accepted practices by hazardous materials response teams (FEMA 2018, FEMA 2019). All decontamination activities would be in alignment with Chemical, Biological, Radiological, Nuclear, and Explosives (CBRNE) response planning for U.S. Environmental Protection Agency (EPA) and the DAF Readiness and Emergency Management Office. The standard decontamination of biohazards in soil typically involves applying chemical sterilants as liquid or fumigants (such as chlorine dioxide or aldehyde) in place (EPA 2017). It is assumed that any decontamination would be *in situ* using a fumigation method or “safe” liquid (e.g., the sort used for groundwater decontamination) that would allow soils to remain in place with minimal residual hazards, thus eliminating the need for soil removal and minimizing any associated waste generation/disposal issues. Potential impacts associated with biosafety decontamination methods would be dependent on the decontamination method used and the landing location.

The preservation of the geologic record for these samples is of paramount importance to NASA; therefore, the process for sterilization is being considered very carefully. To date, there have been several working groups considering the impact of sterilization on sample science. The most recent in 2021, ESA and NASA jointly chartered the MSR Science Planning Group 2 (MSPG2) to build upon previous findings and conclusions (Meyer et al. 2022). To determine what sample properties are sterilization-sensitive or sterilization-tolerant, the MSPG2 considered the sterilization effects of two techniques: 1) the application of dry heat under two temperature–time regimes (180 degrees Celsius [°C] [356 degrees Fahrenheit (°F)] for 3 hours and 250°C [482°F] for 30 minutes) and 2) γ-irradiation (gamma radiation) (1 Megagray [MGry]). The MSPG2 concluded that in the case where there are sample properties that would not survive sterilization intact, the sterilization effects should be measured on unsterilized samples inside a high-containment SRF; although, most aspects of MSR sample science could and should be effectively performed on samples deemed safe (either by test or by sterilization) in uncontained laboratories outside of the SRF.

Because potential decontamination methods are yet to be determined, this PEIS analyzes potential impacts associated with possible biosafety decontamination methods based on standard methods, with potential impacts analyzed for the proposed UTTR landing site. This programmatic analysis serves to identify protocols and requirements associated with standard decontamination methods and associated environmental impacts (e.g., impacts to natural resources). If the biosafety decontamination methods analyzed in this PEIS are substantially modified, or significant new information or circumstances relevant to environmental concerns and bearing on the Proposed Action or its impacts are identified, then NASA may prepare a supplement to this PEIS with the required analysis as determined to be necessary.

Mobile Containment System ("Vault")

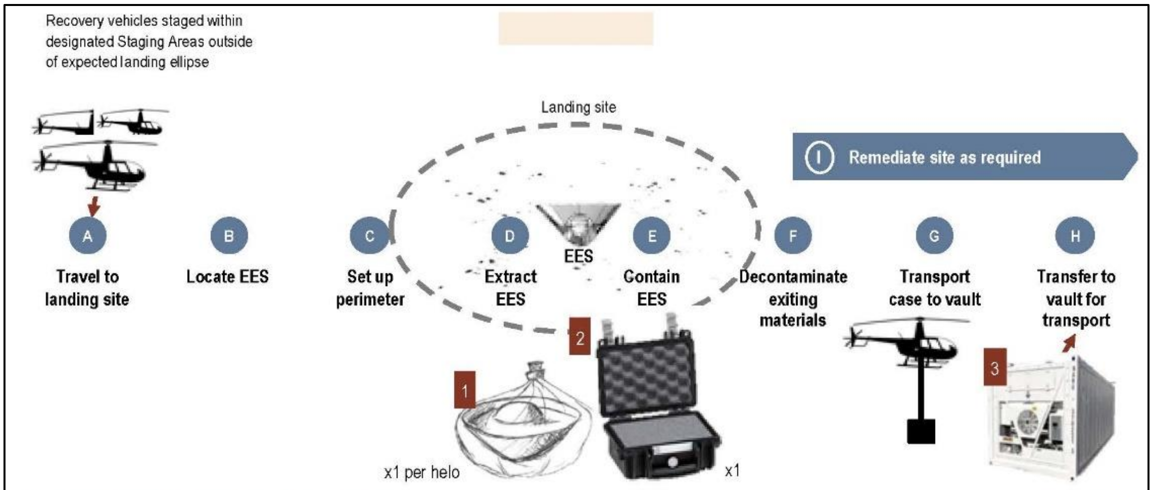
The mobile containment system, or "vault," would house the EES for transport to an SRF.[15] The vault would provide an environmentally isolated, biocontained, safe, and secure enclosure for the samples after landing and prior to and during their transport to the SRF. An example of a vault-type system for EES containment and transport includes a BSL-4-rated "trailer" or other similar high-containment transport, as depicted in Figure 2.1-7. Given the types of units that meet the environmental, containment, safety, and security requirements to ensure appropriate safeguards are met, it is reasonable to infer that the vault would be too heavy to transport to the actual EES landing site, which would be somewhere within the landing ellipse identified in Figure 2.1-8. Therefore, the recovery team would proceed to the landing site and place the EES into a smaller containment system (i.e., the travel case as described previously), the exterior of which may be decontaminated on scene at the landing site. The smaller containment system with the EES inside would then be transported, likely by helicopter but possibly via over-the-road (OTR) assets, to the vault's location. Upon arrival at the vault's location, the EES would be transferred into the vault, where it would remain until it is finally received at the SRF.

Figure 2.1-7. Example BSL-4 "Vault" Trailer

The vault would be located at a secure staging area, with the most likely location being the DAF-managed Det-1 area (leased from the U.S. Army) adjacent to the Michael Army Field runway on the Army's DPG; this is also the most likely location for pre- and post-recovery staging of the EES recovery team and associated support equipment.

In the unlikely event of an off-nominal landing, NASA is evaluating options to provide for additional containment and/or decontamination capabilities within the vault. As with specific recovery site decontamination methods, the exact type of vault and its required capabilities have yet to be precisely determined. However, as described, the most likely vault containment system will have equivalent safeguards as which may be expected for those systems used to transport, store, and handle Biological Select Agents and Toxins (BSAT) material. Should further refinement of vault design elements and capabilities result in the potential for substantive impacts outside the scope of those analyzed in this PEIS, then supplemental NEPA analysis may be required. Figure 2.1-8 provides a graphic representation of the recovery and containment operations described previously that would occur at the landing site once the EES has landed.

[15] Upon final confirmation of SRF requirements and location, a Tier II site specific NEPA document will be prepared which will analyze the environmental impacts of proposed transportation alternatives to the facility, and the construction and operation of the SRF itself and alternatives thereto.



Three-element encapsulation solution	Element	Rationale
	(1) Bag	Can carry multiple examples with limited space constraint, redundant containment with case.
	(2) Travel case	Provides shock, vibration, option for passive thermal control. Hard surface easier to sterilize than soft goods.
	(3) Vault	Required for highway transport. Can provide increased environmental capabilities. Too heavy to transport to landing site.

Key: EES = Earth Entry System.

Figure 2.1-8. Landing Site Recovery Operations

2.1.2.2 Ground Elements

As described in more detail below, the ground elements associated with the Proposed Action include the secure transportation of the EES–contained samples within the vault to an SRF. While specific transportation protocols and SRF design and operational requirements are still in development,[16] this PEIS describes, in as much detail as is practicable, the reasonably foreseeable transportation, safety, security, and storage/curation protocols for the MSR Campaign. The PEIS will be supplemented with Tier II analysis of these future actions as specific protocols and criteria are confirmed.

2.1.2.2.1 EES and Mars Sample Transportation

After containment of the EES at the landing site and transfer to the vault, the EES would be transported to an SRF. The objective would be to recover the EES, place it in the vault, and begin the transport process from the vault location off the UTTR/DPG to an SRF as soon as reasonably practicable; NASA intends to move the vault from the UTTR/DPG to the SRF as soon as possible, barring specific weather and other day-of-landing operational constraints. Transport methods have yet to be determined; however, the vault would be delivered to the SRF using either OTR transport or a combination of OTR and aircraft (e.g., C-130) transport. Exact transportation methods and routes would depend on the type of vault utilized and the location of an SRF. Thus, in this PEIS, potential impacts associated with possible transportation methods are analyzed from a programmatic perspective based on either OTR and/or aircraft use. This programmatic analysis identifies protocols and requirements associated with transportation of BSAT-

[16] 40 CFR § 1502.21 requires the identification of incomplete or unavailable information when that information is relevant to reasonably foreseeable significant adverse impacts.

type materials and general impacts associated with OTR and/or aircraft use (e.g., air emissions). This PEIS can be utilized to guide Tier II analysis once the vault type, location of an SRF, and transportation methods to an SRF have been identified and proposed. This PEIS does not include site-specific analysis of EES transportation from the landing site to an SRF.

Because the Mars samples would be treated as though potentially hazardous until demonstrated otherwise, the framework for handling of BSAT would be adopted for these samples to ensure that they have the highest biological controls in place (even though extraterrestrial materials are not considered part of the Federal BSAT program). Consequently, transportation of the EES would follow guidelines similar to the U.S. Department of Transportation's Hazardous Materials Regulations (Title 49 Code of Federal Regulations [CFR] Parts 171–180) and the Federal Select Agents Program. Section 11 of the select agent regulations (42 CFR § 73.11, *Select Agents and Toxins, Security*; 7 CFR § 331.11, *Possession, Use, and Transfer of Select Agents and Toxins, Security*; and 9 CFR § 121.11, *Possession, Use, and Transfer of Select Agents and Toxins, Security*) requires development and implementation of a security plan sufficient to safeguard the select agents or toxins against unauthorized access, theft, loss, or release. The security plan must be designed according to a site-specific risk assessment and provide for graded protection.[17] According to 7 CFR § 331.11(c)(10), the security plan must contain provisions and policies for shipping, receiving, and storage of select agents and toxins; this includes procedures for receiving, monitoring, and shipping of all select agents and toxins.[18] Transportation of the EES would be guided by these security requirements as identified through a NASA-developed security plan (which will be prepared in coordination with appropriate cooperating and coordinating agencies), as well as the results of NEPA analyses, mitigations carried forward, and resulting Records of Decision.

Samples (Mars and landing site soils) would remain in NASA custody from landing/retrieval through transport to an SRF; no custody transfer of samples to any other entity would occur before the material was determined to be nonhazardous or before safe methods for transfer and handling were established and reviewed by appropriate authorities.

2.1.2.2.2 Sample Receiving Facility

As proposed, the Mars samples will be handled with guidance from protocols that apply to BSAT materials, as described previously. This includes appropriate measures to store and curate the samples at an existing BSL-4 laboratory, a new-construction BSL-4 equivalent facility (modular or mobile). Currently, NASA does not have a BSL-4 equivalent facility. The specific requirements for an SRF are currently in development; however, this PEIS applies BSL-4 equivalent facility protocols as being representative of construction and operating standards that may be adopted in the future to manage the storage and curation of Mars samples. As a result, analysis of potential impacts associated with development and operation of an SRF are identified and analyzed

[17] https://www.selectagents.gov/compliance/guidance/security-plan/index.htm.

[18] More information on the guidance associated with the transport of BSAT materials is available at https://www.selectagents.gov/compliance/guidance/transfer/index.htm.

programmatically in this PEIS. By applying the BSL-4 framework, NASA is able to identify and analyze reasonably foreseeable environmental impacts of its Proposed Action (e.g., the air emissions from a representative existing BSL-4 facility) and evaluate, from a programmatic perspective, whether the environmental effects may be significant. This programmatic analysis can be utilized to guide SRF type and location planning, as well as analyses once these aspects have been identified and proposed.

For purposes of this PEIS, an SRF would include temporary or permanent facilities used to isolate RER unsterilized Mars materials from the Earth's environment. Activities anticipated at this type of facility are removal of the Mars samples from the EES, sample safety assessment, curation (including the preservation, conservation, management, preliminary examination, cataloging, allocation, and distribution) and physical security of Mars materials, and analysis, which may include scientific or planetary protection activities. Mars sample and EES elements would not be released from containment until proven safe by analysis or sterilization. Since BSL-4 provides the highest level of containment, the scope of any potential SRF assumes BSL-4 equivalency as a minimum requirement; however, modification or updates to other lower-level BSL facilities to achieve equivalent BSL-4 containment may be potential alternatives for consideration in the development of a proposed action and alternatives under Tier II analysis.

NASA may consider using existing BSL-4 containment facilities or building/modifying facilities, including a modular containment facility. There are currently only four operational BSL-4 laboratory suites in the United States: at the Centers for Disease Control and Prevention in Atlanta; at the United States Army Medical Research Institute for Infectious Diseases at Fort Detrick in Frederick, Maryland; at the Southwest Foundation for Biomedical Research in San Antonio, Texas; and at the University of Texas at Galveston (National Institutes of Health 2022). However, all existing BSL-4 facilities have current operating missions and limited availability. To support RER mission samples, alteration or expansion of the facility locations would likely be necessary. Existing capabilities at these locations, including laboratory equipment, relevant sample controls, and available space, as well as ability to expand, modify, or alter capabilities, would need to be researched using refined criteria. Additionally, NASA would need to coordinate directly with any potential owner/operator of an existing BSL-4 facility to fully assess the feasibility of using such a facility as an SRF while maintaining a high level of sample integrity.

NASA owns and operates a curation facility at the Johnson Space Center; currently, this facility does not support BSL-4 equivalent laboratories and containment capabilities and would need to be modified to accept any BSL-4 equivalent capabilities. As a result, in addition to potential use of existing facilities, NASA may consider construction of an SRF at a NASA location, because some existing infrastructure (e.g., curation support at the Johnson Space Center) may be able to be utilized to supplement SRF functionality. Alternatively, NASA may consider a non-Federal site for the SRF, such as a university.

Planetary Protection in the Sample Receiving Facility

Current draft planetary protection requirements state that samples returned from Mars would be placed in BSL-4-equivalent containment, until they are deemed safe to be released to outside laboratories either by analysis or by sterilization (see NASA Procedural Requirement 8715.24, *Planetary Protection Provisions for Robotic Extraterrestrial Missions*). A multidisciplinary team of scientists and experts (e.g., engineers, occupational safety and health professionals, BSL-4 facility managers, etc.) would be responsible for the development of criteria for sample release and distribution through development of recommended protocols for sample physical and chemical processing, life detection testing, biohazard testing, facility requirements (including security), environmental and health monitoring and safety, personnel management considerations in protocol implementation, and contingency planning for different protocol outcomes, while keeping the samples pristine for characterization.

As a result of these draft requirements, the Committee on Space Research established a Sample Safety Assessment Protocol (SSAP) Working Group to provide a mechanism by which the international science community could meet to:

- define a decision tree to evaluate the safety status of the material from Mars;
- define success/no-success criteria to determine the safety status of the material from Mars, taking into account the sensitivity of this determination on terrestrial contamination in the analyzed material;
- estimate the time necessary to execute the protocol; and
- ensure throughout the process the highest degree of harmonization feasible with the scientific analysis of the material from Mars (safety assessment benefiting from scientific analysis and vice versa). (Grady, M. S. and COSPAR 2019)

Ultimately, the SSAP Working Group findings, through an external independent peer-reviewed process, will evolve over time as knowledge of sample constituents evolves and scientists identify certain requirements and protocols that should be implemented to ensure sample safety throughout the sample management, handling, and curation process (Kminek et al. 2022).

2.1.3 Site-Specific Elements

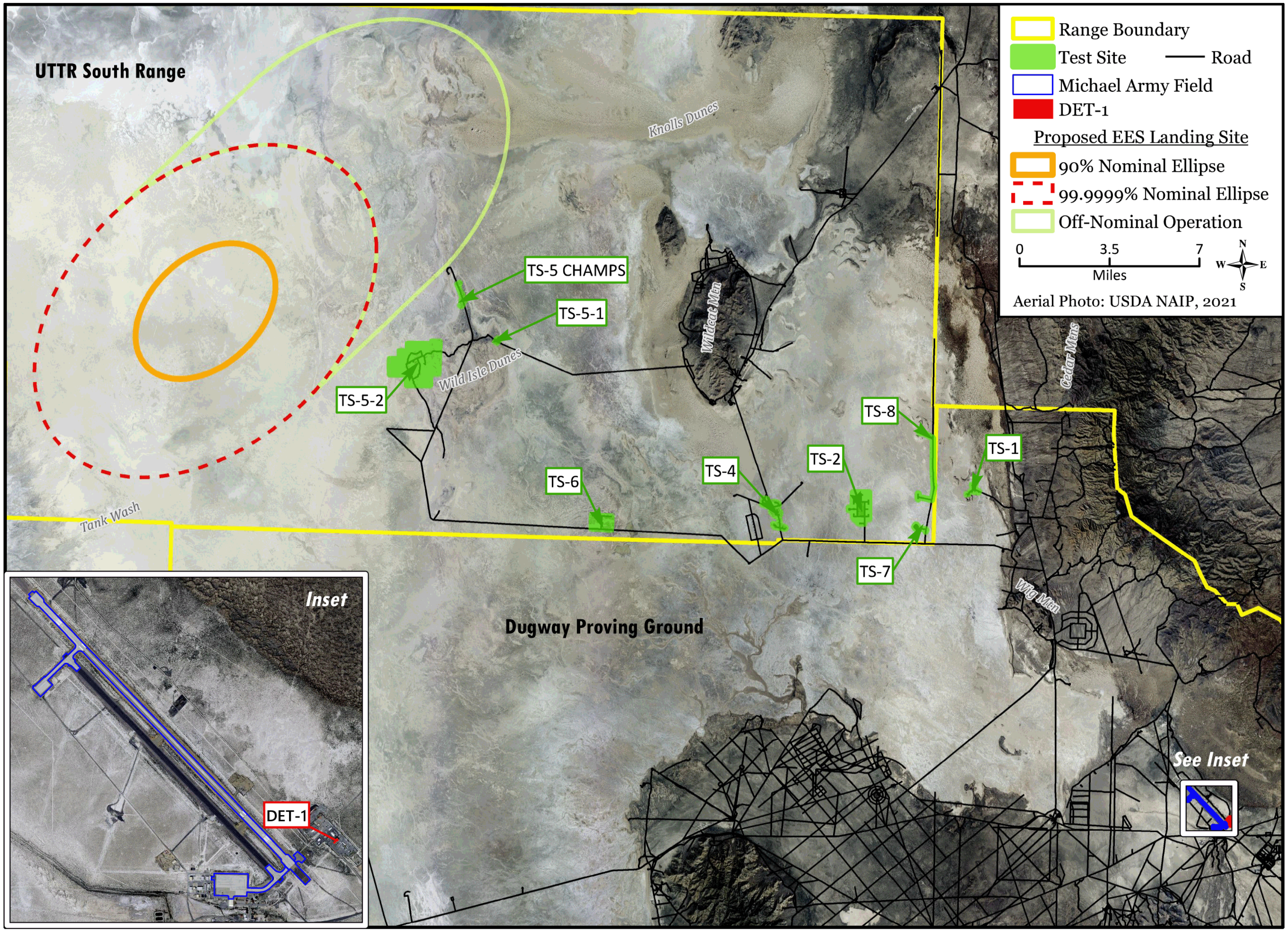
2.1.3.1 Landing at Utah Test and Training Range

Currently, NASA proposes to land the EES on the UTTR (Figure 2.1-3). The proposed landing site at the UTTR is referred to as the West Desert of the UTTR South Range. The UTTR is a military testing and training area located in Utah's West Desert in west-central Utah, primarily in Tooele County (portions of the North Range are in Box Elder County), about 129 kilometers (80 miles) southwest of Salt Lake City (Figure 2.1-3). The UTTR is currently the largest overland contiguous block of supersonic authorized restricted airspace in the continental United States. The range, which has a footprint of 6,930 square kilometers (km^2) (2,675 square miles [mi^2]) of ground space and over 49,000 km^2 (19,000 mi^2) of airspace, is divided into North and South Ranges. Interstate 80 divides the two sections of the UTTR. The site is administered and maintained by the DAF 388th Range Squadron, stationed at Hill AFB, Utah. DPG—managed by the U.S. Army—is south of, and adjacent to, the South Range and consists of a total of 3,196 km^2 (1,234 mi^2). The installation lies entirely within Tooele County. The DoD has designated the DPG installation (as well as the UTTR) as a Major Range and Test Facility Base and the primary chemical and biological defense testing center under the Chemical/Biological Defense Program. The DoD uses the airspace over U.S. Army and DAF lands (DPG and the UTTR North and South Ranges), as well as adjacent public lands, as a maneuver overflight area.

The DAF's 388th Fighter Wing, Headquarters UTTR (HQ UTTR), Air Combat Command, operates a detachment on DPG (Det-1) in support of the UTTR. As a DPG tenant, HQ UTTR is responsible for providing ground support for testing and training activities conducted on the UTTR for all DoD units and some North Atlantic Treaty Organization countries. These ground support activities include tracking and evaluating aircraft training and test missions; response to in-flight emergencies and support of grounded flight crews; and support of crews in testing and recovering aircraft, missile, and space vehicle elements. In addition to their primary DAF support responsibilities, HQ UTTR provides support to non-DAF activities that require electronic flight surveillance capabilities as well as test locations and scoring. The 388th operations at DPG include the use of office facilities at Avery Area; maintenance, storage, and lodging facilities; and command and control centers for weapons testing, radar sites, and target and telemetry locations and roads to target complexes and radar sites. In total, the 388th occupies approximately 27 km^2 (approximately 44 mi^2) on DPG land. HQ UTTR has occupied facilities on DPG land since 1978 and, with current global situations, sees an ongoing need for continued use of this land in the future. NASA proposes to utilize the DAF-managed Det-1 location adjacent to Michael Army Airfield on DPG as the primary location area for recovery team staging and the vault location (see Figure 2.1-9).

Historically, NASA has utilized the UTTR for the Stardust (NASA 1998) and Genesis (NASA 2001) missions, which returned samples of comet dust and the solar wind, respectively. The UTTR is also the planned landing site for the OSIRIS-Rex mission (NASA 2013), which would return samples of dust and rocks from the asteroid Bennu in 2023. The UTTR consists of 9,300 km^2 (2.3 million acres) and is owned by the DoD (DAF and Army [the DPG]) (Hill AFB 2012). The differences between the MSR Campaign return elements and those analyzed previously for the UTTR are the landing without the aid of a parachute and the RER classification associated with the Mars samples. Range scheduling for the MSR Campaign would be conducted in the same manner as for previous NASA missions at the UTTR.

The nominal landing target area consists of an ellipse approximately 379 km^2 (146 mi^2) contained within an area of the UTTR containing soft sandy/clay soils typically found on dried lake beds/plains that are relatively barren and subject to repeated inundation by water, with enough salt to prohibit the growth of vegetation. The nominal ellipse defines the area with a 99.9999 percent probability of nominal landing. The notional area associated with an off-nominal (abnormal or unexpected) landing event is an expanded version of the nominal ellipse; in off-nominal scenarios, it is expected that the landing ellipse may shift further to the northeast but would remain within the UTTR boundary. The notional off-nominal ellipse covers an additional area of approximately 191 km^2 (74 mi^2). The entire area susceptible to a small area impact (e.g., the size of the EES) is approximately 570 km^2 (200 mi^2). Figure 2.1-9 shows the nominal, off-nominal, and desired landing location (90 percent probability of landing).



Key: EES = Earth Entry System; UTTR = Utah Test and Training Range.

Figure 2.1-9. Proposed EES Landing Site

Although the project would be designed to minimize the probability for an off-nominal event, the project design is still evolving. While an off-nominal event (one in which the EES or its components land outside the 99.9999 percentile ellipse) would be considered extremely unlikely, a statistical probability is currently unavailable at this time, as this information would be made available as project design is more defined.[19] This information is relevant to assessing the potential for impacts to occur outside the nominal landing ellipse. However, there is a high degree of certainty that the EES would still land on the UTTR should an off-nominal event occur. This is discussed in more detail in Sections 3.2 (Incomplete or Unavailable Information) and 3.4 (Health and Safety).

These ellipses may change slightly as NASA learns more about the distribution of landing hazards, requirements continue to be refined, various Earth atmospheric models are incorporated into EES entry simulations, and NASA continues working range safety and recovery operations with the DAF. Should the landing ellipses change substantively from those analyzed in this PEIS, supplemental NEPA analyses may be required.

Preparing for the Mission

NASA anticipates up to six recovery operation dress rehearsals during the 24 months prior to EES landing, with a team of up to 12 personnel, depending on required operational parameters. Dress rehearsals would likely involve the use of two to four helicopters. Additionally, NASA anticipates that a team of up to 40 personnel may be staged at the UTTR and/or DPG 6 to 12 months prior to the EES reentry date for site preparation and recovery operations setup. Support for dress rehearsals and recovery operations setup would likely involve use of equipment (e.g., helicopters, wheeled vehicles, etc.), infrastructure (facilities, utilities, etc.), and personnel support supplied by the U.S. Army and DAF. This support would be coordinated with the respective agencies once requirements have been defined.

Landing Area Preparation

Currently, the UTTR South Range contains debris such as aerial gunnery tow targets (referred to as “target darts”). In the 1950s and 1960s, target darts were towed behind an aircraft on 457 to 610 meters (1,500 to 2,000 feet) of cable and were used for aerial target practice by other aircraft. Typically, the cable would be severed by gunfire or released, and the target would fall to the ground and become embedded in the ground surface. Figure 2.1-10 provides pictures of target darts at the UTTR. Within the landing ellipse are many target darts, many of which (perhaps up to a few hundred) could require removal and would be conducted by the DAF. Prior to landing, a portion of the landing area would be prepared by removing landing hazards in order to prevent inadvertent impacts with objects that would adversely affect the integrity of the EES.

Hazards to be removed would be prioritized for removal based on the potential hazard posed to the EES (size, location, etc.); Figure 2.1-11 shows the relationship between the number of hazards removed within the ellipse and the reduction in probability of the

[19] 40 CFR 1502.21 requires the identification of incomplete or unavailable information when that information is relevant to reasonably foreseeable significant adverse impacts

EES encountering a hazard upon landing within the landing ellipse. Hazard debris identified for removal would likely be concentrated within the 90 percent nominal ellipse, with some removal between the 90 percent and 99.9999 percent nominal ellipse (see Figure 2.1-12). Currently, the UTTR is testing different methods for object removal, which may include digging below the ground surface (potentially up to 1.2 meters [4 feet]) to remove the large portions of exposed target dart debris or removing the exposed portion of the target dart and leaving the remaining subsurface elements. In either case, debris removal would require ground disturbance in the immediate vicinity of the subject debris, as well as the use of vehicles to transport to the debris removal site and to remove the debris from the landing area. Tracked and/or wheeled vehicles may be utilized.

Figure 2.1-10. Depiction of Target Darts at the UTTR

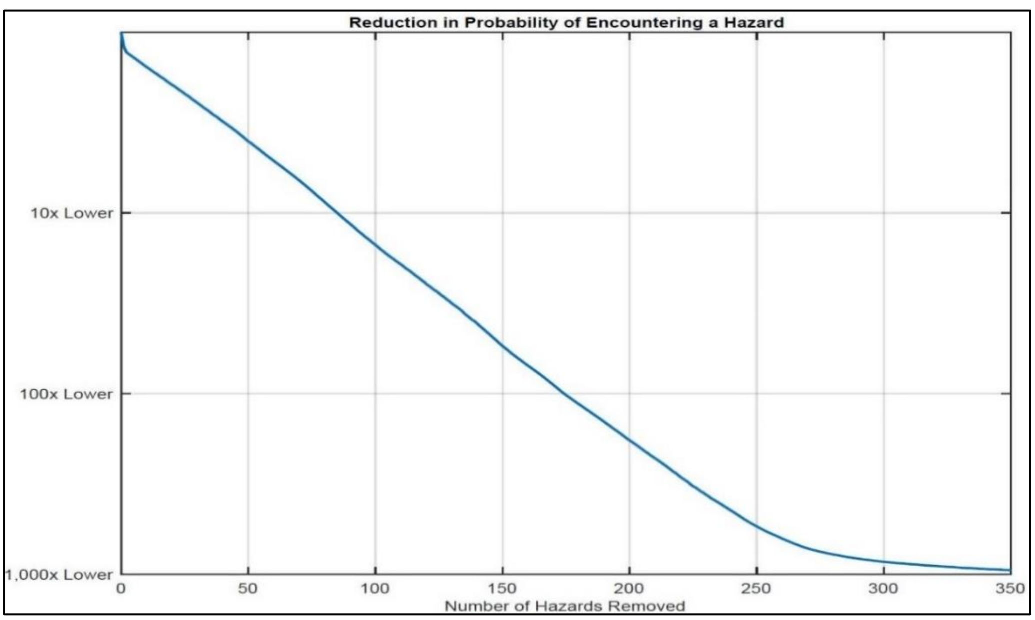
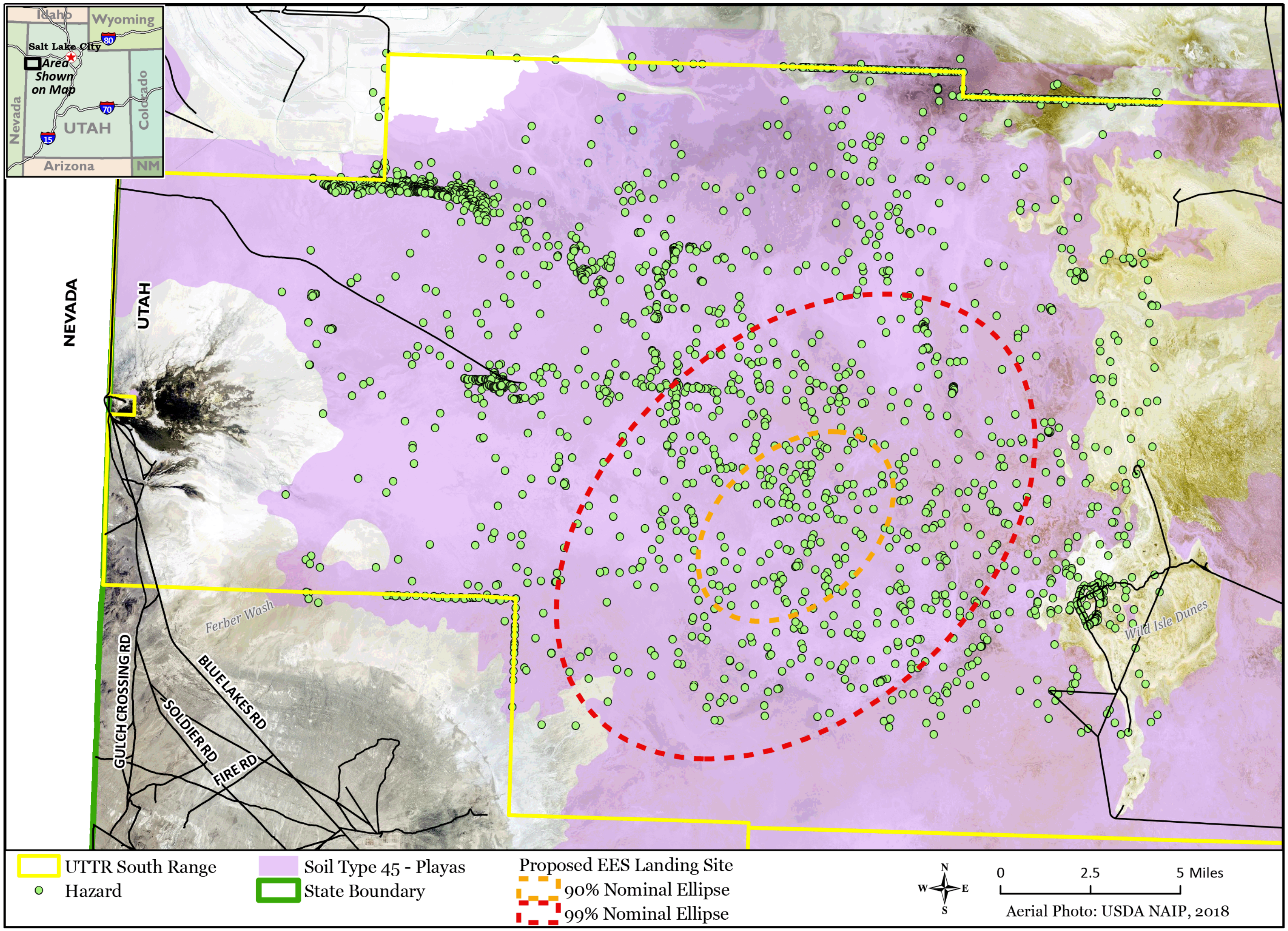


Figure 2.1-11. Reduction in Probability of Encountering a Hazard Based on Hazard Removal



Key: EES = Earth Entry System; UTTR = Utah Test and Training Range. Note: Hazards represented on map are not to scale and are smaller than represented.

Figure 2.1-12. Existing Landing Hazards to be Assessed for Removal

According to DAF personnel, the proposed landing ellipse has not previously been used as a target area and the potential for unexploded ordnance (UXO) in this area is small; DAF personnel have assessed the area during previous test operations and have not found any UXO issues of concern (Shane 2022). Regardless, there would be a UXO technician with project personnel during all operations in the area, and all personnel visiting the area would be briefed as to the potential for UXO in the area and what to look for and what to do in the event a potential UXO is discovered. Any UXO encountered would be handled in accordance with Air Force Manual (AFMAN) 32-3001, *Explosive Ordnance Disposal (EOD) Program*, which outlines the requirements for operational range clearance and UXO recovery operations. As a result, UXO within the proposed landing ellipse, and associated hazard clearance activities described above, are of minimal concern.

Flight Elements and EES Recovery Activities

All flight elements and landing site activities associated with the proposed MSR Campaign would occur as described previously under Section 2.1.2 (Programmatic Elements). The EES would be tracked to its landing location using UTTR radar/tracking instrumentation. It is unknown at this time the exact area of recovery team staging or the size of the staging area.[20] However, one or more recovery teams may be staged outside the landing ellipse at previously disturbed test sites with road access, with the vault likely located at the DAF-managed Det-1 location adjacent to the Michael Army Field runway on DPG (see Figure 2.1-9).

It is anticipated that the landing would occur while the soils are soft but before they become saturated from rain events in the fall, which would serve to lessen the force of impact for the EES. As a result, vehicles that can traverse in loose soils and that are not excessive in weight would be the best option for traversing to the landing site, and planned ingress and egress routes would also be a best practice for traveling on the playa. Helicopters (the most likely scenario) or a tracked vehicle, such as a snow cat that distributes its weight more effectively, are the most likely methods of transport. Use of wheeled vehicles off road is unlikely because they would easily become stuck in the soft soils; however, use of wheeled vehicles off road to and from staging areas cannot be discounted. Based on drop testing activity, upon landing, the EES would be expected to create an impact crater of approximately 1.2 meters (4 feet) in diameter and 0.5 meter (1.6 feet) in depth, based on soil composition, with soil ejected from the crater to a distance of approximately 15 meters (approximately 49 feet) from the EES (Corliss 2022).

Once the EES has landed, recovery teams would transit to the site and conduct landing site activities as described previously. It is anticipated that the vault containing the EES would be transported off the UTTR/DPG to an SRF location as soon as possible barring specific weather and other day-of-landing operational constraints. However, in the event of an off-nominal landing, NASA personnel could remain on site for several weeks or months as part of contingency activities. Specific contingency activities are unknown at this time, as NASA is currently evaluating contingency planning concepts. Contingency

[20] 40 CFR § 1502.21 requires the identification of incomplete or unavailable information when that information is relevant to reasonably foreseeable significant adverse impacts.

activities may be relevant in understanding potential impacts associated with health and safety, hazardous material and waste, ground disturbance, and infrastructure-related needs. Should these contingency activities result in potential impacts outside the scope of those analyzed in this PEIS, supplemental NEPA analyses may be required.

2.2 DESCRIPTION OF THE NO ACTION ALTERNATIVE

Under the No Action Alternative, the MSR Campaign as described in this PEIS would not be undertaken. As a result, investigation of Mars as a planetary system would be limited due to the cost and complexity of sending instruments into space or to Mars for *in situ* analyses. By not undertaking the MSR Campaign, scientists would not have access to the full breadth and depth of analytical science instruments available in Earth laboratories.

2.3 ALTERNATIVES CONSIDERED BUT NOT CARRIED FORWARD

This section describes the screening criteria utilized by NASA to evaluate potential programmatic and site-specific alternatives to the Proposed Action as well as alternatives considered but not carried forward for further analysis.

2.3.1 Programmatic Alternative Screening Criteria

As discussed previously, *in situ* analysis of Mars samples (i.e., while still on Mars) is limited by cost and technical feasibility and does not provide the full breadth and depth of analytical science tools needed to meet the purpose of and need for the Proposed Action. Therefore, programmatic alternatives for the MSR Campaign regarding sample management, processing, analyses, and curation were evaluated according to the following criteria:

Alternatives must be able to accommodate the equipment required to conduct the proper analysis to meet MSR Campaign objectives (which include not only science but also a properly rigorous assessment of the biological safety of the samples). The International Mars Architecture for the Return of Samples Working Group, in 2008, evaluated the overall goals and objectives of Mars exploration and determined that, given the scope of what is realistically achievable via *in situ* exploration technology, a significant fraction of these investigations could not be meaningfully advanced without returned samples for the following reasons (iMARS Working Group 2008, Meyer et al. 2022):

- **Complex sample preparation.** Several of the high-priority investigations would involve sample preparation procedures (e.g., creating very thin slices) that would be too complicated for *in situ* missions. The procedures to do this in terrestrial labs are well established, but the ability to conduct similar sample preparation procedures on Mars does not currently exist nor is likely to exist in the future.
- **Instrumentation that would not be suitable for flight to Mars.** Many types of scientific instrumentation would not be compatible with mounting on a Mars Lander because the equipment is too large, requires too much power, requires

too much maintenance, involves complex procedures, or a combination of these factors.

- **Lack of instrument diversity.** *In situ* missions to date have been limited to 5 to 10 scientific instruments. However, terrestrial labs could analyze returned samples using at least 50 to 100 instruments, including future instruments that have not yet been designed. This could significantly amplify the ability of scientists to make initial discoveries and to respond to initial or unexpected discoveries with follow-up tests that are not currently able to be envisioned. Such complementary measurements would significantly increase the degree of definitiveness to which a scientific question could be answered (which commonly is dependent on whether a preliminary result could be confirmed by a different kind of measurement).

Given the needs above, Mars sample processing and analysis cannot be sufficiently conducted *in situ*, and any alternative associated with sample analysis under the MSR Campaign must be able to accommodate the processes and associated equipment required to conduct the level of analysis required to meet MSR Campaign objectives, including a comprehensive SSAP. Additionally, given the constraints described above, there is no instrument or suite of tests that Perseverance can use on Mars or that the MSR Campaign could bring to Mars, to definitively determine if the samples collected are of sufficiently low risk so as to alter the “Restricted Earth Return” mission planetary protection designation and being treated as if they are potentially hazardous.

2.3.1.1 Programmatic Alternatives

Based on the programmatic alternative selection criteria for Mars sample management, processing, analyses, and curation, the following alternatives were considered but not carried forward for further analysis:

- **Remote and/or in-orbit SSAP.** This alternative involved conducting the primary lab work on the samples in orbit or on the lunar surface until the SSAP process is completed and then, when determined safe, the samples would be returned to Earth for further analysis and curation. This work would occur on an orbital structure such as the International Space Station (ISS). The primary issues associated with this alternative include significant uncertainties about the ability to ensure secure containment of the samples during transfer and analysis, the low likelihood that the ISS (or any other orbital structure planned for launch prior to 2033) could accommodate the required containment and sample management equipment without extensive retrofitting and ground-based testing, and the absence of any plans for a lunar base that would be available and capable of conducting effective sample analysis.

  Remote sample analysis would be exceedingly complex, especially if automated, and would include the need for destructive reopening of multiple tubes, posing a significant threat to major efforts made over more than a decade to maintain the scientific integrity of each of the samples. Designing, flight-qualifying, and launching appropriate instruments of analysis to be operated by non-expert crew members would be a major challenge. The sensitivity and accuracy of instruments operated in microgravity is much lower than similar instruments on Earth (Marks 2022); with proper procedures likely including a challenging search for microscopic biosignatures, there is a significant chance of "false negatives" if the SSAP is not done properly (i.e., declaring that the Mars samples are not hazardous when they could be). Additionally, a positive result from the SSAP represents a potential hazard to crew health within a small, enclosed system, plus a contaminated facility that will eventually need to be returned to Earth (or will fall to Earth if there is a system failure). Similarly, a failure of sample containment at a lunar base could lead to onerous requirements for decontamination protocols for future travel between the Earth-Moon system (Marks 2022).

Finally, the ISS is planned for decommissioning/deorbiting in 2031, two years before the Mars samples would return to the Earth-Moon system, meaning that using the ISS is not a reasonable alternative for the MSR Campaign. The MSR Campaign would, therefore, be dependent on other space stations or other missions involving orbital or lunar structures, which may not correspond to the timeframe of the MSR Campaign. Such other orbital or lunar structures that could potentially be used instead of the ISS are not yet constructed and may be subject to delays such that the MSR Campaign cannot reasonably plan to use them.

- **Human-assisted return.** This alternative involves the return of Mars samples to lunar orbit, recovery of the samples, and return to Earth by a crewed spacecraft. Primary issues associated with this alternative are associated with an increased risk of breaching sample containment during transfer of the sample container from one craft to the other, related potential risks to the health and safety of the crew, and the dependency on other missions that may not correspond to the MSR Campaign timeframe. In addition, there is no current or currently envisioned crew-rated vehicle capable of visiting the Lunar Gateway and landing on solid ground upon return to Earth. Crewed spacecraft capable of reaching the Lunar Gateway require water landings; as such, this option was eliminated by the requirement to land on solid ground (because spacecraft loss during or after water landing could lead to loss of sample containment with little-to-no chance of recovery or decontamination, compared to land).

2.3.2 Site-Specific Alternative Screening Criteria

Site-specific alternative screening criteria within the context of this PEIS involve identification of potential landing sites for the EES. Landing site locations are typically mission-specific and therefore dependent on a variety of factors such as the year and season of the launch and planned return. As part of a landing site evaluation study, potential landing locations were evaluated under the criteria listed in Table 2.3-1 in order of priority (Luthman 2021). A more comprehensive outline of the site selection process is provided in Appendix A (Landing Site Selection Information).

Table 2.3-1. MSR Campaign Site-Specific Landing Site Selection Criteria*

Priority	Category	Criteria	Rationale
1	U.S. vs. Foreign Site Location	Landing site must be on U.S. soil.	• As specified in the Memorandum of Understanding with the European Space Agency. • Time to transport samples to the Sample Receiving Facility, ensuring integrity, safety, and security of samples.
2	Safety	The landing site must be remote.	• Limits the possibility of damage or injury to people or property.
3		The landing site must be a controlled zone with restricted access.	• Sites that can effectively be closed to the public minimize any chance of the EES harming individuals or their possessions within the controlled site boundary and security risk to the vehicle.
4		The landing site must have controlled airspace above it.	• Provides safety to aircraft.
5		The site must accommodate a 30 km downrange x 20 km cross-range landing ellipse (major axis at 295 degrees).	• This is the maximum expected 5-sigma (σ) landing ellipse. Due to the restricted nature of the return, it is considered prudent to accommodate the 5σ ellipse and not only the 3σ ellipse.[(a)]
6	Assured Containment	The landing site must be on land, not on water.	• Salt water is highly corrosive. • There is a risk of the EES sinking in a water landing. • There is a risk of the EES being carried by currents if not promptly recovered.
7		The site must have a recovery area free of roads, structures, trees, hills, and other hazardous terrain features.[21]	• Vehicle must be easily findable and retrievable. • The sample return architecture is a passive vehicle. • The site must be free of hazards that could impose side loads on the vehicle. • The containment system must not experience a high-*g* environment (no more than 3,000 *g*) on landing to preserve containment.
8		The site must have a recovery area with slope less than 5 degrees.	• The low slope enables crushable materials in the nose of the EES to limit the acceleration experienced by the samples and the containment system. • The low slope limits the need for excessive levels of crushable materials in other areas of the vehicle.

[21] Analysis of surveyed hazards in the UTTR, described in Section 2.1.3.1 (Landing at Utah Test and Training Range), has shown that the landing ellipse can be placed strategically in a location that meets target values for the failure of containment, given in Section 3.5.1.2.2 (Hazardous Materials and Waste, Site-Specific Analysis (UTTR/DPG), Environmental Consequences), with the removal of a manageable number of these known hazards.

Table 2.3-1. MSR Campaign Site-Specific Landing Site Selection Criteria*

Priority	Category	Criteria	Rationale
9		Soil in the recovery area must have mechanical properties that aid in the dissipation of landing impact energy.	• The sample tubes must experience no more than 1,300 *g*.[(b)] • The EES makes a landing without a parachute. • Soil with suitable mechanical properties can dissipate all impact energy without exercising the crushable material in the EES.
10		The samples must experience minimum exposure to high temperature (>20°C).	• Preserve sample integrity. • Analysis shows sample tubes will be -40°C (-40°F) on landing, and maintaining samples below -20°C (-4°F) through recovery is preferable, if possible.
11	Science Return	Requires soft landing surfaces.	• The EES must experience no more than a 1,300-*g* impact acceleration.[(b)] • Limit the degradation of samples due to impact (Requirement on Capture, Containment, and Return System project as defined in Environmental Requirements Document MSR-CCRS-SYS-REQ-0002).
12		The location must allow prompt delivery of the EES to the Sample Receiving Facility.	• Preserve sample integrity. • Limit the time needed to move the EES to a stable, sterile environment.
13	Range Recovery Assets	The location should have the capability to track the EES during descent.	• The EES needs to be tracked during descent and located promptly to enable rapid encapsulation. • Facilities with their own demonstrated tracking capabilities limit the need to ensure availability of, and coordinate bringing in, mobile range assets for this purpose.

Source: (Luthman 2021)

Key: < = less than; °C = degrees Celsius; °F = degrees Fahrenheit; EES = Earth Entry System; ESA = European Space Agency; *g* = acceleration relative to that of the Earth's gravity; km = kilometers.

Notes:

* Information within this table is preliminary and may be refined as the mission concept matures. Statements about things such as design features, the landing ellipse size and major axis direction are specific to preliminary concepts and subject to change.

(a) The landing ellipse represents a standard deviation analysis, serving as a measure of certainty with regard to where the EES would land. In this case, the ellipse represents the expected area where the EES would land, and the "sigma" indicates the chances of the EES landing outside that ellipse. For a 5-sigma ellipse, there is more than a 99.9996 percent chance that the EES would land inside of the ellipse (see Figure 2.1-9); for a 3-sigma ellipse, there is more than a 98.8891 percent chance that the EES would land inside of the ellipse.

(b) The 1,300 *g* requirement is directed at maintaining the physical integrity of the EES, while the 3,000-*g* requirement is a design limit for maintaining containment of the samples.

2.3.2.1 Site-Specific Alternatives

Based on the site-specific landing site criteria identified above, the numerous alternatives for landing sites were considered but not carried forward for further analysis.

Overall, 507 DoD ranges in the United States were reviewed against these criteria. A shortlist of 18 candidate ranges was created (see Appendix A, Landing Site Selection Information), which included 13 ranges previously analyzed in the Stardust, Genesis, and OSIRIS-Rex EAs and 5 ranges from DoD Sustainable Range Reports, with potentially enough area to encompass the 5σ landing ellipse[22] (NASA 1998, NASA 2001, NASA 2013, Luthman 2021).

After further review, 11 ranges were dismissed because they were too small to accommodate the landing ellipse or had unacceptable terrain (mountainous or heavily forested). An additional five ranges were dismissed after review of Digital Elevation Model data that indicated these remaining sites were unable to accommodate the landing ellipse within a region with a slope of less than 5 degrees (Luthman 2021).

White Sands Missile Range and the UTTR were the only two sites identified as potential landing sites; however, after further study it was concluded that White Sands' terrain and soil types pose greater risks to the EES and the successful containment of the Mars samples; the White Sands terrain is less flat than at the UTTR, and the soil is much harder, which makes it much more challenging to meet the sample tube acceleration requirements (Luthman 2021). As a result, White Sands was eliminated and the UTTR was identified as the best alternative for the EES landing site.

These findings are consistent with sample return missions evaluated as part of the Stardust Mission EA (NASA 1998) and OSIRIS-Rex EA (NASA 2013). The EAs both noted that, because a water landing (as with Apollo-era returns) would most probably compromise the mission science objectives by increasing the risk of contamination of the collected samples, a recovery site on land is mandated. Within the Stardust Mission EA, several landing site alternatives were evaluated against essentially the same criteria (Yuma Marine Corps Air Station, Arizona; Luke AFB, Arizona; Edwards AFB, California; Chocolate Mountain Gunnery Range, California; Twenty-Nine Palms Marine Corps Base, California; Camp Pendleton Marine Corps Base, California; Fort Bliss Military Reserve, New Mexico; White Sands Missile Range, New Mexico; Tonopah Test Range, Nevada; Nellis Air Force Range, Nevada; China Lake/Fort Irwin, California; and the UTTR). Through this process, it was also determined that the UTTR provided the best, most feasible alternative for sample return missions.

2.4 SUMMARY OF ENVIRONMENTAL IMPACTS / COMPARISON OF ALTERNATIVES

The following table (Table 2.4-1) provides a summary of the potential impacts associated with the Proposed Action and No Action Alternative.

[22] The landing ellipse represents a standard deviation analysis, serving as a measure of certainty with regard to where the EES would land. In this case, the ellipse represents the expected area where the EES would land, and the "sigma" (σ) indicates the chances of the EES landing outside that ellipse. For a 5-sigma ellipse, there is more than a 99.9996 percent chance that the EES would land inside of the ellipse; for a 3-sigma ellipse, there is more than a 98.8891 percent chance that the EES would land inside of the ellipse.

Table 2.4-1. Summary of Environmental Impacts / Comparison of Alternatives

Resource Area	Alternative	
	Proposed Action	No Action
Health and Safety	*Programmatic*: Significant adverse impacts associated with EES transportation to an SRF are not anticipated. The travel and handling procedures for the EES and the security and functionality of the SRF would be based heavily on the proven techniques used for safely handling biological toxins and known infectious agents used in Earth-based research labs. Potential impacts associated with SRF development and operation would be related to the location of the facility, as well as the type and size. Tier II analyses for determination of impacts associated with health and safety would consider the location of the proposed facility and surrounding community/land use type, health and safety system requirements associated with a BSL-4 equivalent facility, and risk analysis involving failure of containment systems that results in a release within the facility. *Site Specific*: Significant adverse impacts at the UTTR or DPG are not anticipated. During landing site preparation, the potential for UXO encounters is small, and there would be a UXO technician with project personnel during all operations in the area. Personnel tasked with debris removal activities would be trained to identify potential UXO, and removal would be deferred to trained explosive ordnance disposal personnel in accordance with Air Force Manual (AFMAN) 32-3001, *Explosive Ordnance Disposal (EOD) Program*. With regard to EES release and landing, the MSR Campaign has established stringent probability targets to drive robust containment engineering. The MSR Campaign selected a target value equivalent to a 99.9999% probability of successful containment. These targets are applied to each of three material vectors or pathways along which Mars material may reach Earth: 1) free particle transport; 2) approach, entry, and descent; and 3) landing. Throughout the MSR Campaign element design, NASA will continue to assess numerous factors that may influence Mars material containment and/or sterilization success for each vector. For EES recovery, all personnel involved in recovery operations would be required to wear personal protective equipment (PPE). After the EES has been transferred, in the travel case, from the site to the vault, soil and PPE may be decontaminated. The exact means of potential decontamination has not been determined. However, any decontamination activities would follow standard decontamination protocols for biological hazards typically involving application of chemical sterilants as liquid or fumigants at the landing site in place. All activities would be in alignment with CBRNE response planning for EPA and the DAF Readiness and Emergency Management Office.	*Programmatic*: Potential impacts associated with transportation of Mars samples and development of an SRF would not be realized. *Site Specific*: The No Action Alternative would not result in any additional health and safety impacts at the UTTR, DPG, or surrounding areas outside of those associated with ongoing and potential future military operations and other activities occurring at the site.
Cultural Resources	*Programmatic*: Transportation of the EES to an SRF would not be expected to result in any cultural resource impacts. Furthermore, operation of an SRF would not be anticipated to impact cultural resources; the main impact driver for this resource is the development of an SRF. Construction activities that may impact cultural resources are all ground-disturbing activities, including land clearing, earth moving, excavation, and vehicle and equipment operation on unpaved surfaces. These activities may result in physical disturbance of any surface or subsurface archaeological resources that may be present in the areas disturbed. Direct adverse effects would result if any of the archaeological resources are listed on or eligible for listing in the NRHP. Potential impacts associated with SRF development would be related to the location of the facility, as well as the type and size. Tier II analyses would initiate the NHPA Section 106 consultation process early in the planning process to identify any historic properties and/or significant traditional cultural resources that may or may not meet the NRHP criteria (as defined in 36 CFR § 60.4) but that are properties of cultural, historical, or religious significance to American Indian Tribes or other recognized traditional cultural groups within or near the APE. Additionally, the effects of	*Programmatic*: Potential impacts associated with transportation of Mars samples and development of an SRF would not be realized. *Site Specific*: The No Action Alternative would not result in any additional cultural resource impacts at the UTTR or surrounding areas outside of those associated with ongoing and potential future military

Table 2.4-1. Summary of Environmental Impacts / Comparison of Alternatives

Resource Area	Alternative: Proposed Action	No Action
	the undertaking on identified properties and/or traditional resources would be assessed, and any necessary mitigations required to avoid or minimize identified adverse effects would be identified. *Site Specific*: NASA, with the DAF as the lead, has initiated and is in the process of conducting Section 106 consultation, with 21 Federally recognized Native American tribes, the Utah SHPO, the Advisory Council on Historic Preservation (ACHP), and other entities regarding the effects of the Proposed Action to historic properties, in accordance with Section 106 of the NHPA; this consultation is ongoing. Any activities within this Tier I analysis that are required to be assessed for impacts to historic properties will follow protocols laid out within a program Programmatic Agreement between Hill AFB (the responsible land manager of the UTTR), the Utah SHPO, and ACHP. Ground disturbance associated with on-site mission preparation (to include testing and rehearsals and landing site preparation), EES landing, and EES recovery could result in adverse effects to historic properties if there are any that cannot be avoided during vehicular transit to/from each object location or if an object is located within an archaeological site eligible for listing in the NRHP. Any potential adverse effects would be mitigated through the Standard Mitigation Treatment Measures within the aforementioned Programmatic Agreement, which would include stipulations for range clearance activities.	operations and other activities occurring at the site.
Hazardous Materials/Waste	*Programmatic*: Transportation of the EES to an SRF would not be expected to involve the use of hazardous materials or generation of hazardous wastes. Hazardous materials may be used, and waste generated, as a part of the construction and operation of an SRF. Typical construction-related hazardous wastes consist of petroleum, oils, and lubricants, as well as paints, adhesives, and solvents. The amounts of hazardous materials used and wastes generated would depend on the size and type of facility. Types of hazardous materials and wastes associated with operation of an SRF facility would likely be consistent with operation of other similar types of facilities and could include materials/wastes such as flammable liquids; flammable, toxic liquids; corrosive liquids; oxidizing liquids; and ethidium bromide solids. The types and quantities of hazardous materials and wastes used would be particular to the size and function of an SRF. Regardless, all hazardous materials and wastes would be managed according to applicable Federal, state, and local requirements, depending on hazardous waste generator status (i.e., large, small, or very small quantity generator). Exact types of hazardous materials that would be used; wastes generated; associated potential impacts; and applicable Federal, state, and local requirements will be addressed in the Tier II NEPA analyses. *Site Specific*: No significant adverse impacts are anticipated at the UTTR or DPG. Regarding landing site preparation, target darts are nonhazardous material (consisting of wood and metal), and the small amount of waste material generated could be disposed of as standard industrial waste or recycled. Any soil and/or debris associated with landing site preparation that would be disposed of offsite would require sampling to determine appropriate disposition (e.g., solid waste or hazardous waste fill). Although UXO encounters are unlikely, any potential UXO encountered would be handled in accordance with AFMAN 32-3001, *Explosive Ordnance Disposal (EOD) Program*. The EES contains *de minimis* amounts of hazardous materials, consisting of standard aerospace adhesive materials; there are no fuels or other petroleum products used in the EES. The process of retrieving the EES and placing it into the vault would be assumed to generate potentially hazardous biological waste until demonstrated otherwise. All	*Programmatic*: Potential impacts associated with transportation of Mars samples and development of an SRF would not be realized. *Site Specific*: The No Action Alternative would not result in any additional hazardous materials and/or waste impacts at the UTTR or surrounding areas outside of those associated with ongoing and potential future military operations and other activities occurring at the site.

Table 2.4-1. Summary of Environmental Impacts / Comparison of Alternatives

	Alternative	
Resource Area	**Proposed Action**	**No Action**
	the systems used, including personnel protective gear, would be assumed to be contaminated and would either be decontaminated or simply discarded as hazardous waste. Wastes could include plastics and clothing. Any liquids used in the decontamination process would be absorbed onto solids prior to disposal. It is assumed that any soil decontamination would be *in situ*, using a fumigation method or "safe" liquid (e.g., the sort used for groundwater decontamination) that would allow soils to remain in place with minimal residual hazards, thus eliminating the need for soil removal and minimizing any associated waste generation/disposal issues. NASA would be accountable to the DAF and U.S. Army for complying with all applicable laws governing the proper handling of materials and disposal of waste on their properties. Occupational Safety and Health Administration requirements would also apply, depending upon the status of personnel (civilian, military, contractor), regarding the use of appropriate PPE, etc. This compliance must also incorporate and abide by 10 U.S.C. 2692 (*Storage, treatment, and disposal of nondefense toxic and hazardous materials*) requirements for the storage, treatment, and disposal of nondefense toxic/hazardous materials on DoD property. NASA may need a waiver from the DAF and/or U.S. Army to bring any required hazardous materials onto respective properties. For hazardous waste disposal, NASA would work with the DAF and U.S. Army to determine waste management responsibilities (under the requirements of the Hill AFB Hazardous Waste Management Plan, any applicable U.S. Army requirements, and Federal and state regulations) and codify these in a Memorandum of Understanding/Agreement. NASA may pursue acquiring its own EPA Generator identification number for this particular project.	
Soils and Geology	*Programmatic*: Transportation of the EES to an SRF would not be expected to interact with soils. Operation of an SRF would not be anticipated to impact soils or geology; the main impact driver for this resource is the site development associated with establishment of an SRF. The amount of soil disturbance and associated extent of adverse impacts would be dependent on the type and size of the facility, as well as the need for any additional or ancillary infrastructure (such as underground utilities and parking). The potential for any site-specific impacts to soils and geology associated with SRF development will be addressed in Tier II NEPA analyses, which would consider the soil types potentially impacted; the amount/area of soil potentially disturbed and the potential for, and scope of, soil erosion; the need for a National Pollutant Discharge Elimination System permit; geologic limitations and/or influence on site development; and identification of any necessary mitigations required to avoid or minimize identified adverse impacts. *Site Specific*: There would be no ground disturbance activities at the Det-1 location. There would be ground disturbance associated with on-site mission preparation (to include testing, rehearsals and landing site preparation), EES landing, and EES recovery operations; however, disturbance would be localized and would not result in loss of soil productivity or significant erosion given the flat land area and lack of substantive precipitation. Given the context of the landing site and low intensity of the action, these activities are expected to have minimal impacts on soils and geology at the UTTR. Ground disturbance for similar activities at the UTTR were found to have no significant impacts on soils or geology. During landing site preparation and EES recovery operations, standard practices for preventing	*Programmatic*: Potential impacts associated with transportation of Mars samples and development of an SRF would not be realized. *Site Specific*: The No Action Alternative would not result in any additional impacts to soils and geology at the UTTR or surrounding area outside of those associated with ongoing and potential future military operations and other activities occurring at the site.

Table 2.4-1. Summary of Environmental Impacts / Comparison of Alternatives

	Alternative	
Resource Area	**Proposed Action**	**No Action**
	soil erosion would be employed, such as minimizing the size of the disturbed area associated with landing site preparation activities (e.g., aerial target debris removal) and EES recovery operations; stockpiling of all excavated soils and protection from wind and water erosion, with replacement or removal of stockpiles when activity is complete; and to the maximum extent practicable, restoration of the environmental condition of the affected landing area to its pre-disturbance condition.	
Biological Resources	*Programmatic*: Transportation of the EES to an SRF would not be expected to have an interaction with biological resources. Operation of an SRF would not be anticipated to impact biological resources; the main impact driver for this resource is the development of an SRF. Construction activities that may impact biological resources include vehicle and equipment operation, land clearing, earth moving, stormwater runoff, and potential introduction of invasive species. The potential for any site-specific impacts to biological resources associated with SRF development will be addressed in Tier II NEPA analyses. Analyses would consider the habitat type and amount of habitat area potentially impacted; identification of the vegetation, wildlife, and special-status species (e.g., Federally and/or state-listed, threatened, endangered, or candidate species) potentially impacted within the context of importance (legal, commercial, ecological, or scientific) of the species, habitat function, sensitivity, and the availability of regionally similar resources and the need for associated consultation under Section 7 of the Endangered Species Act; and identification of any necessary mitigations required to avoid or minimize identified adverse impacts. Were NASA to identify a location for the SRF that would potentially impact species listed under the Endangered Species Act or associated critical habitat, NASA would be required to consult with the respective U.S. Fish and Wildlife Service (USFWS) district under Section 7 of the Endangered Species Act. *Site Specific*: On-site mission preparation (to include testing and rehearsals and landing site preparation), EES landing, EES recovery, and EES transportation operations are expected to have minimal direct and/or indirect impacts on the biotic environment at the UTTR, given the context of the landing area (e.g., desert playa with sparse vegetation and lack of suitable wildlife habitat) and the intensity of the action (minor, temporary disturbance). Based on analysis presented in this PEIS, there are no Endangered Species Act-protected species located on the UTTR or the Det-1 location; thus, there would be no effect to Endangered Species Act-protected species, and consultation with the USFWS is not required.	Programmatic: Potential impacts associated with transportation of Mars samples and development of an SRF would not be realized. Site Specific: The No Action Alternative would not result in any additional impacts to biological resources at the UTTR or surrounding area outside of those associated with ongoing and potential future military operations and other activities occurring at the site.
Water Resources	*Programmatic*: Transportation of the EES to an SRF would not be expected to have an interaction with water resources. Both construction and operation of an SRF may have the potential to affect water resources, each in a different manner. Depending on the type and size of the facility, operation of the SRF may involve industrial stormwater discharges to the environment, while development of the SRF may have a direct or indirect impact on water resources from sedimentation runoff during construction and may require a general stormwater construction permit. The potential for any site-specific impacts to water resources associated with SRF development and operation will be addressed in Tier II NEPA analyses, which would identify water resources within the affected environment, to include wetlands and floodplains, stormwater runoff analysis, and potential groundwater use. If site development results in direct impacts to wetlands, coordination with the U.S. Army Corps of Engineers may be required for a jurisdictional wetland determination, and a Clean Water Act Section 404 permit may be required. If site	*Programmatic*: Potential impacts associated with transportation of Mars samples and development of an SRF would not be realized. *Site Specific*: The No Action Alternative would not result in any additional impacts to water resources at the UTTR or surrounding areas outside of

Table 2.4-1. Summary of Environmental Impacts / Comparison of Alternatives

Resource Area	Alternative: Proposed Action	No Action
	development results in direct impacts to wetlands or floodplains, NASA would be required to identify the lack of practicable alternatives to that particular site. *Site Specific*: Given the context of the action area (no water resources), on-site mission preparation (to include testing and rehearsals and landing site preparation), EES landing, EES recovery, and EES transportation, operations are expected to have no direct or indirect impacts to water resources at the UTTR or DPG.	those associated with ongoing and potential future military operations and other activities occurring at the site.
Air Quality / Climate	*Programmatic*: Transportation of the EES to an SRF would be expected to result in *de minimis* air emissions associated with either aircraft or over-the-road vehicles. However, both construction and operation of an SRF may have the potential to affect air quality associated with emissions from point sources and mobile sources. Construction requiring ground improvements would result in mobile air emissions from equipment use, as well as particulate matter from fugitive dust emissions; facility operations could involve air emissions of criteria pollutants depending on the types of operations conducted and whether there are direct air exhaust systems or roof stacks for incineration activities. The potential for any site-specific impacts to air quality associated with SRF development and operation will be addressed in Tier II NEPA analyses, which would analyze air emissions associated with construction and operation as compared to current local/regional emissions and National Ambient Air Quality Standards thresholds to determine any exceedances of certain criteria pollutant thresholds that may require general conformity analysis. Analysis will also consider whether a Prevention of Significant Deterioration, nonattainment New Source Review, or Title V permit is required. *Site Specific*: On-site mission preparation (to include testing, rehearsals and landing site preparation), EES landing, EES recovery, and EES transportation operations are expected to have minimal direct impacts on Tooele County air quality and climate, given the context of the landing area (remote site on an active military range with more extensive air emissions) and the intensity of the action (temporary *de minimis* emissions from mobile sources and fugitive dust).	*Programmatic*: Potential impacts associated with transportation of Mars samples and development of an SRF would not be realized. *Site Specific*: The No Action Alternative would not result in any additional air quality or climate-related impacts at the UTTR or surrounding areas outside of those associated with ongoing and potential future military operations and other activities occurring at the site.
Land Use	*Programmatic*: Transportation of the EES would not be expected to result in any land use impacts. Temporary impacts on land use from construction operations can affect ongoing uses in nearby areas, both on and off the SRF site. These impacts include elevated traffic, including heavier-than-usual truck traffic; dust from ground disturbance and site preparation; and noise from construction equipment. While these effects can cause inconvenience and some annoyance for local users, upon completion of construction, these effects would cease. Were NASA to propose siting the SRF in an area of incompatible land use, adverse impacts to existing uses may occur. The significance of the environmental impact of SRF siting on land use would be affected by the location and type of SRF NASA determines is best suited to carry out the purpose and need for the Proposed Action. The potential for any site-specific impacts related to land use associated with SRF development and operation will be addressed in Tier II NEPA analyses, which would determine whether the proposed site meets zoning requirements and/or is incompatible with an existing land use or reasonably foreseeable land use due to noise, safety, or other issues and mitigations that may serve to minimize or avoid these types of impacts. Additionally, analysis would include identification of potential ancillary effects to nearby properties, such as increased traffic and lighting and visual effects and mitigations that may serve to minimize or avoid these types of impacts.	*Programmatic*: Potential impacts associated with transportation of Mars samples and development of an SRF would not be realized. *Site Specific*: The No Action Alternative would not result in any additional land use impacts at the UTTR or surrounding area outside of those associated with ongoing and potential future military operations and other activities occurring at the site.

Table 2.4-1. Summary of Environmental Impacts / Comparison of Alternatives

Resource Area	Alternative: Proposed Action	No Action
	Site Specific: On-site mission preparation (to include testing, rehearsals and landing site preparation), EES landing, EES recovery, and EES transportation operations are expected to have no impacts to UTTR or DPG land use, given the context of the activities (within an active military installation and roads for intended use) and the intensity of the action (occasional, discrete short-term events).	
Socioeconomics	*Programmatic*: Transportation of the EES to an SRF would not be expected to have any socioeconomic impact. Development activities would likely result in some beneficial direct, indirect, and induced economic impacts in terms of employment and income, the scope of benefit tied to the size and type of facility. Construction-related impacts would last for the duration of the activities. Long-term socioeconomic impacts would be directly tied to the number of new jobs created and the projected population increase associated with those jobs. Employment numbers would be dependent on the type and size of the facility. Direct impacts to housing, education, and public services (e.g., emergency services) would also be dependent on local population increases. Depending on the scope of any increases in local population, this can adversely affect these aspects if availability and capacity cannot adequately accommodate the increase. The potential for any site-specific socioeconomic impacts associated with SRF development and operation will be addressed in Tier II NEPA analyses, which would consider the number of projected workers required and the ability of local workforce to meet demand; the local population and population trends and whether any influx of workers (temporary and permanent and estimated dependents would result in a substantive increase in population; and if there is a projected substantive increase in population, determine whether housing availability and education and public services can accommodate the associated increase in demand. *Site Specific*: Within the context of the Proposed Action, mission preparation activities, EES landing recovery operations, and sample transportation would be expected to have no adverse impacts to socioeconomics, because activities would be within the existing range and there are no anticipated effects outside this area. There may be *de minimis* beneficial impacts associated with NASA scientists and other recovery team members utilizing services (e.g., hotels, restaurants, etc.) within the local community during their time at the UTTR and DPG.	*Programmatic*: Potential impacts associated with transportation of Mars samples and development of an SRF would not be realized. *Site Specific*: The No Action Alternative would not result in any additional socioeconomic impacts at the UTTR or surrounding area outside of those associated with ongoing and potential future military operations and other activities occurring at the site.
Environmental Justice	*Programmatic*: Transportation of the EES to an SRF would not be expected to have any impact to environmental justice communities. Impacts to environmental justice communities from development and operation of an SRF would be based on the extent to which minority and low-income populations reside within the affected environment. Potential environmental justice impacts are directly tied to the location of the facility and would require site-specific analysis. The potential for any site-specific environmental justice-related impacts associated with SRF development and operation will be addressed in Tier II NEPA analyses. Such analysis would consider the extent to which minority and low-income populations reside within the affected environment; the extent to which children and elderly populations reside within the affected environment; whether the site-specific effects of any identified noise, land use, and air quality impacts would have disproportionate effects on these populations; and identify any mitigations that may serve to minimize or avoid disproportionate impacts to environmental justice populations. *Site Specific*: Within the context of the Proposed Action, there are no environmental justice concerns associated with on-site mission preparation (to include testing and rehearsals and landing site	*Programmatic*: Potential impacts associated with transportation of Mars samples and development of an SRF would not be realized. *Site Specific*: The No Action Alternative would not result in any additional environmental justice impacts at the UTTR or surrounding areas outside of those associated with ongoing and potential future military

Table 2.4-1. Summary of Environmental Impacts / Comparison of Alternatives

Resource Area	Alternative: Proposed Action	No Action
	preparation) or EES landing and recovery operations, as these activities would all occur within the confines of the UTTR South Range and DPG boundary. There are no anticipated effects outside this area; therefore, there would be no environmental justice concerns associated with activities at the UTTR.	operations and other activities occurring at the site.
Noise	*Programmatic*: Transportation of the EES to an SRF would not be expected to result in any significant adverse noise impacts. Development of an SRF would generate localized noise associated with heavy equipment and generator operation; such noise would be temporary (lasting only the duration of the construction project) and would be expected to be limited to normal working hours. Construction activities would not be expected to result in significant community noise impacts, provided the location is not within or adjacent to a residential area. Operationally, external noise may be generated by such equipment as cooling towers, laboratory ventilation fans, and emergency generators. The need and extent of this type of equipment would be dictated by facility design. Provided the facility is located within compatible land use areas, it is unlikely that operational noise would result in significant impacts. A noise assessment based on facility design would determine potential noise emissions and compatibility with local noise ordinances. The potential for any site-specific noise-related impacts associated with SRF development and operation will be addressed in Tier II NEPA analyses. Noise analysis would assess the potential noise generated by construction and operation of the facility and identify adjacent land uses and adjacent sensitive noise receptors (e.g., residences, schools, elder-care facilities, etc.). Analyses would then determine whether the noise generated from these activities would result in significant increases in noise for sensitive receptors, determine whether noise generated from these activities would exceed any state or local noise ordinances, and identify any mitigations that may serve to minimize or avoid any adverse impacts. *Site Specific*: Upon entering the Earth's upper atmosphere, the EES would create a sonic boom above the UTTR. The UTTR airspace is currently utilized for supersonic aircraft operations, and this one-time event would be indistinguishable from regular UTTR operations. This sonic boom, while somewhat audible at this altitude, would not be expected to result in overpressures at ground level that would result in hearing or structural damage. Transport of the EES would result in negligible, transient noise associated specifically with the transportation mode selected (e.g., truck, aircraft). Based on the type of noise, context of occurrence (roadways or airfields), and single-event transient intensity, this type of noise would not be expected to result in adverse impacts.	*Programmatic*: Potential impacts associated with transportation of Mars samples and development of an SRF would not be realized. *Site Specific*: The No Action Alternative would not result in any additional noise-related impacts at the UTTR or surrounding areas outside of those associated with ongoing and potential future military operations and other activities occurring at the site.
Infrastructure	*Programmatic*: Transportation of the EES would utilize the national and/or local transportation infrastructure network and would not be expected to have any adverse impacts. The main impact driver for utilities is operation of an SRF; development would not be expected to result in any adverse utility impacts. The size and intended operational parameters of the facility would dictate the amount of electricity and/or natural gas and potable water required, as well as wastewater generation. The size, location, and number of employees for a facility would also determine the extent of potential impacts to local transportation networks. The scope of the impact would also depend on the existing level of service for surrounding transportation networks. The potential for any site-specific impacts to infrastructure associated with SRF development and operation will be addressed in Tier II NEPA analyses. Tier II analyses will address existing affected environment utility infrastructure, operational utility loads based on facility equipment types and number of employees, the extent to which these loads would burden	*Programmatic*: Potential impacts associated with transportation of Mars samples and development of an SRF would not be realized. *Site Specific*: The No Action Alternative would not result in any additional impacts to infrastructure at the UTTR or surrounding areas outside of

Table 2.4-1. Summary of Environmental Impacts / Comparison of Alternatives

	Alternative	
Resource Area	**Proposed Action**	**No Action**
	local utility systems and providers, and whether utility system upgrades or use permits would be required. Analyses will also identify necessary transportation network level of service and whether the number of employees and associated traffic would adversely affect the level of service. *Site Specific*: Under the Proposed Action, on-site mission preparation (to include testing and rehearsals and landing site preparation), EES landing, and EES recovery would not require the construction of new, or modification of existing, UTTR or DPG infrastructure. Hookups to existing Detachment 1 (Det-1) utility infrastructure for temporary use (e.g., electricity for trailers, communications, etc.) may be required, a small number of wheeled vehicles may utilize UTTR and DPG roads, and recovery team members may use local roadways transiting to/from the UTTR. These activities would not be expected to impact infrastructure or utility use on UTTR, DPG, or local roadways.	those associated with ongoing and potential future military operations and other activities occurring at the site.

Key: ACHP = Advisory Council on Historic Preservation; AFMAN = Air Force Manual; BSL = Biosafety Level; DAF = Department of the Air Force; DPG = Dugway Proving Ground; EES = Earth Entry System; NEPA = National Environmental Policy Act; NHPA = National Historic Preservation Act; NRHP = National Register of Historic Places; PEIS = Programmatic Environmental Impact Statement; PPE = personal protective equipment; SRF = Sample Receiving Facility; SHPO = State Historic Preservation Officer; U.S.C. = United States Code; USFWS = U.S. Fish and Wildlife Service; UTTR = Utah Test and Training Range; UXO = unexploded ordnance.

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3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 INTRODUCTION

Because of the large scope and long temporal arc of the Mars Sample Return (MSR) Campaign, certain aspects of the ground element mission architecture remain in development (e.g., sample transportation requirements and logistics, specific Sample Receiving Facility [SRF] requirements and location). Therefore, as further described below, the MSR Campaign's environmental impact analysis is planned to be conducted in two "tiers" (or phases). This approach is endorsed under both Title 40 Code of Federal Regulations (CFR) § 1501.11 and 14 CFR § 1216.307.

Tier I, the focus of this Programmatic Environmental Impact Statement (PEIS), programmatically addresses the potential impacts associated with the Sample Retrieval Lander launch from either Kennedy Space Center or Cape Canaveral Space Force Station in Florida, launch of the Earth Return Orbiter (the "Orbiter") from French Guiana, and flyby of the Orbiter. The focus also includes release, entry, and landing of the Earth Entry System (EES), and initial recovery, containment, and handling of the EES on Earth's surface. From a programmatic perspective, this PEIS also addresses Tier II ground elements associated with EES transportation and establishment and operation of an SRF as information is available if requirements associated with transportation and an SRF are still under development and currently unavailable for detailed analysis within this Tier I document.[23] Additionally, this Tier I analysis addresses the site-specific proposal to prepare the Utah Test and Training Range (UTTR) landing site (involving debris removal) and to land and retrieve the EES and contain it at the UTTR.

The programmatic aspects of future actions analyzed in this PEIS are intended to familiarize the public with the totality of the mission's architecture and will be analyzed from the perspective of reasonably foreseeable actions, which, if considered, will be examined with greater specificity in the Tier II document.

3.2 INCOMPLETE OR UNAVAILABLE INFORMATION

40 CFR § 1502.21 directs that when an agency is evaluating reasonably foreseeable significant adverse effects on the human environment in an environmental impact statement, and there is incomplete or unavailable information, the agency shall make clear that such information is lacking. As noted throughout this PEIS, because of the large scope and long temporal arc of the MSR Campaign, certain aspects of the ground element mission architecture (e.g., EES transportation requirements and logistics, specific SRF requirements and location) remain in development. Wherever possible, this PEIS identifies those areas where incomplete or unavailable information exists, but which may be addressed in a future Tier II document.

[23] 40 CFR § 1502.21 requires the identification of incomplete or unavailable information when that information is relevant to reasonably foreseeable significant adverse impacts.

Further, in cases where the incomplete or unavailable information is relevant to reasonably foreseeable impacts but cannot be obtained because the means to obtain it are not known, then a Federal agency is required to affirmatively state that: 1) such information is incomplete or unavailable; 2) provide a statement of the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment; 3) provide a summary of existing credible scientific evidence that is relevant to evaluating the reasonably foreseeable significant adverse impacts on the human environment; and; 4) provide an evaluation of such impacts based on theoretical approaches or research methods generally accepted in the scientific community.

Impacts Associated with an Off-Nominal Entry or Landing

Although highly unlikely, an anomalous entry or landing may result in release of Mars material either within or outside the UTTR boundary; however, the potential distribution of Mars materials and potential impacts cannot be determined at this time. Currently, it is unknown the exact nature of the Mars sample constituents regarding biosignatures and potential biological activity.

Relevance to Impact Analysis

This is relevant in understanding the potential risks and associated impacts to the human and natural environment from exposure to Mars sample particles and limits the ability to conduct a quantitative analysis of impacts associated with health and safety, cultural resources, hazardous materials and waste, soils and geology, biological resources, water resources, air quality, land use, socioeconomics, environmental justice/protection of children, noise, and infrastructure. The main purpose of the MSR Campaign is to look for signs of past life—this is the reason for returning the Mars samples to Earth for scientific research. As a result, a comprehensive quantitative analysis of the potential impacts of a sample release in the event of an off-nominal landing and the effects of Mars samples on Earth's environment cannot be accomplished with current data; any such analysis would be theoretical at best, involving speculation and supposition.

Relevance of Existing Credible Scientific Evidence

Existing credible evidence suggest that conditions on Mars have not been amenable to supporting life as we know it for millions of years (iMARS Working Group 2008, National Research Council 2011, Beaty et al. 2019, National Research Council 2022). The surface of Mars, particularly for the area/region/middle latitudes being sampled by the Perseverance rover, is too cold (an average surface temperature of -55 degrees Celsius [°C] [-67 degrees Fahrenheit]) for water to exist in a liquid form in other than optimal circumstances and then often only transiently on or near the surface in isolated pockets. Due to the thin atmosphere of Mars, the surface is bombarded by significant amounts of ultraviolet radiation. Similarly, due to the lack of a magnetic field on Mars, galactic cosmic and solar particle radiation also affect the surface, penetrating to a depth of a few meters. Therefore, samples taken by the Perseverance rover in the first few centimeters would have been exposed to significant amounts of radiation over long (thousands to millions of years) periods. Finally, the surface of Mars has been found to be highly oxidizing, containing chemicals such as chlorates. All of these conditions are not favorable to life as we know it.

In 1997 the National Research Council (NRC) concluded that contamination of Earth by Martian microorganisms is unlikely to pose a risk of significant harmful effects. However, the risk is not zero. Recognizing the non-zero risk, the report recommended that samples returned from Mars by spacecraft should be contained and treated as though potentially hazardous until proven otherwise (National Research Council 1997). No uncontained Martian materials, including spacecraft surfaces that have been exposed to the Martian environment, should be returned to Earth unless sterilized. NASA Procedural Requirements (NPR) 8715.24, *Planetary Protection Provisions for Robotic Extraterrestrial Missions*, call for missions to “establish and implement a strategy and design concepts to break the chain of contact with the target body, isolate, and robustly contain restricted samples.” NPR 8715.24 further defines robust containment as a “strategy of utilizing dissimilar, redundant approaches to achieve an overall containment system that is minimally sensitive to engineering operations, stressful environmental conditions, and off-nominal scenarios in use from point-of-collection to containment in a receiving facility on Earth.”

In 2009 the NRC reaffirmed those conclusions, in particular the recommendation identified above (National Research Council 2009). The NRC acknowledged that since the 1997 report, additional information has been discovered regarding the environment of Mars and the existence of life in inhospitable Earth environments once thought to be incompatible to life. The NRC reaffirmed the conclusion that the potential for pathogenic effects from the release of small amounts of Mars samples is regarded as being very low. Additionally, those life forms found in extreme environments on Earth have not been found to have pathological effects on humans (National Research Council 2009).

One of the reasons that the scientific community thinks the risk of pathogenic effects from the release of small amounts (less than 1 kilogram [2.2 pounds]) of Mars samples is very low is that pieces of Mars have already traveled to Earth as meteorites. The National Academies of Sciences affirmed the consensus that Martian material travels to Earth when they developed the planetary protection guidelines for sample return from Martian moons, Phobos and Deimos (National Academies of Sciences, Engineering, and Medicine and the European Science Foundation 2019). As of 2020, 262 individual samples (approximately 211 kilograms [465 pounds] of material) of Martian meteorites have been recovered from six different continents (Udry et al. 2020). Even though this is a large amount of material compared to what NASA will return from Mars, it likely represents a small fraction of the total amount of Martian material that has landed on Earth over geologic time (Gladman 1997). The natural delivery of Mars materials can provide better protection and faster transit than the current MSR mission concept. First, potential Mars microbes would be expected to survive ejection forces and pressure (National Academies of Sciences, Engineering, and Medicine and the European Science Foundation 2019), and, within the interior portions of the rocks, would be protected from elevated radiation levels, and large temperature variations that meteorite surfaces experience during the transit from Mars to Earth (Mileikowsky 2000). Second, a significant fraction of natural transits occur on trajectories that require as little as 6 months where the material returned by the MSR mission concept would be in flight for over 18 months (Gladman 1997). Thus, if potentially harmful microbes were abundant on the Martian surface it is likely they already would have been transferred to Earth by this natural process (Fajardo-Cavazos et al. 2005, Horneck et al. 2008, Howard et al. 2013). Despite the large amount of Martian material already on Earth, it is important for NASA to bring back pristine samples collected by the Perseverance rover with known collection locations and well understood geologic context. Scientists do not understand exactly where on the surface of Mars the meteorites originated (Udry et al. 2020), and without this geologic context it is impossible to address the scientific objectives described in Section 1.3 (Need for the Proposed Action) (Beaty et al. 2019).

NASA convened a Sterilization Working Group (SWG) beginning in 2019 to assess methods for sterilization and inactivation, identify future work to verify those methods, and determine their feasibility for a mission such as the MSR Campaign. In addressing these topics, the SWG revisited the question of the hazard potential of Mars biology. In the context of sterilization, the SWG concluded that inactivation (sterilization) techniques are likely applicable to Martian life. Furthermore, the SWG reaffirmed the conclusions of the two NRC studies that any life form from Mars is unlikely to pose a hazard to Earth's biosphere, although the risk is not zero. However, due to a non-zero risk, containment and inactivation of Martian samples should be important features of a sample return mission (Craven et al. 2021).

Evaluation of Impacts

NASA does not expect that there would be Martian particles on the exterior of the EES, and, in an off-nominal scenario, both containment vessels would have to be breached for a release to potentially occur, which is unlikely given the engineering parameters of the EES and the soft soils at the landing site. Nonetheless, studies regarding burnup/breakup, atmospheric release, contingency planning, and the likelihood that sample material will be distributed outside of the landing site radius are ongoing, and procedures to recover EES fragments, if it is damaged upon reentry and landing, are still in development.

NASA recognizes that human errors are possible in mission and system designs and readily accepts the fact that knowledge of the level of hazard associated with retrieving samples from Mars is incomplete; that is why NASA is designing the mission with an abundance of caution, utilizing measures to ensure that the Mars samples are sealed within redundant layers of containment and handled consistent with protocols for Biological Select Agents and Toxins (BSAT).

To assess the risk associated with the return of samples, NASA has identified multiple vectors (specific pathways) that could result in the release of Mars material into Earth's biosphere. However, a final quantitative estimate of the likelihood of release for any one vector or group of vectors based on the MSR Campaign design and mission plans is not complete, and the assessment of each of these vectors is ongoing. Because it is currently thought the potential for pathogenic effects from the release of small amounts of Mars samples is regarded as being very low, the analysis of Health and Safety in Section 3.4 focuses on the design mitigations and protocols utilized to minimize the potential risk associated with Mars sample release during landing and recovery.

Parallel assessments are being undertaken to 1) identify mitigating measures and circumstances for protecting the spacecraft from contamination with unsterilized Mars particles; 2) understand the probability of one or more Mars particles arriving at Earth uncontained; and 3) establish the minimum rate of particle sterilization provided by the thermal, vacuum, and radiation extremes of spaceflight. This information is currently under development and unavailable because studies are ongoing.[24] Should further refinement of mission and design elements result in the potential for substantive impacts outside the scope of those analyzed in this PEIS, then supplemental National Environmental Policy Act (NEPA) analysis may be required.

Potential Impacts Associated with Decontamination Activities

Although anticipated as a precautionary measure (release of sample materials is considered highly unlikely), at this time, the exact decontamination method(s) that may be used for the EES travel case and landing site have not been determined.

Relevance to Impact Analysis

The decontamination method is relevant to addressing impacts to the environment associated with effects to natural resources (e.g., soils, water resources, biological resources), use of hazardous materials, and generation and management of hazardous waste.

Relevance of Existing Credible Scientific Evidence

For purposes of this PEIS, it is assumed that any decontamination process would involve standardized decontamination and/or sterilization methods in alignment with Chemical, Biological, Radiological, Nuclear, and Explosives (CBRNE) response planning for the U.S. Environmental Protection Agency (EPA) and the Department of the Air Force (DAF) Readiness and Emergency Management Office. The standard decontamination of biohazards in soil typically involves applying chemical sterilants as liquid or fumigants (such as chlorine dioxide or aldehyde) in place (EPA 2017).

Evaluation of Impacts

Potential impacts associated with biosafety decontamination methods would be dependent on the decontamination method and landing location. It is assumed that any decontamination would be *in situ*, using a fumigation method or “safe” liquid (e.g., the sort used for groundwater decontamination) that would allow soils to remain in place with minimal residual hazards, thus eliminating the need for soil removal and minimizing any associated waste generation/disposal issues. Impacts to soil organisms would be localized to the decontamination area (potentially up to a 30-meter [100-foot] radius around the EES impact crater]; however, the soils potentially impacted are not considered “productive” (i.e., rich in organic matter and nutrients) and the landing ellipse is not known to provide quality habitat to any sensitive species. If the biosafety decontamination methods analyzed in this PEIS are substantially modified, or significant new information or circumstances relevant to environmental concerns and bearing on

[24] 40 CFR § 1502.21 requires the identification of incomplete or unavailable information when that information is relevant to reasonably foreseeable significant adverse impacts.

the Proposed Action or its impacts are identified, then NASA may prepare a supplement to this PEIS with the required analysis as determined to be necessary.

3.3 ENVIRONMENTAL RESOURCES ANALYZED IN THIS PEIS AND RESOURCES NOT CARRIED FORWARD

The Council on Environmental Quality's (CEQ's) regulations at 40 CFR § 1501.9(f)(1) require the lead agency to identify and eliminate from detailed study the issues that are not significant or have been covered by prior environmental review(s). If not wholly eliminated from further analysis, the discussion of these issues should be narrowly tailored to a brief presentation of why they will not have a significant effect on the human environment or by providing a reference to their coverage elsewhere.

As indicated in Section 1.1 (Background), the launch elements of the Proposed Action are not addressed further in this document due to their coverage under previous NEPA and/or NASA's Executive Order (EO) 12114 Checklist. Additionally, the Orbiter return portion of the MSR Campaign has no potential interaction with Earth-based resources as all aspects of the Orbiter return occur outside the Earth's atmosphere. As a result, analysis within this document focuses on the potential impacts associated with EES landing and recovery operations, transportation of the EES from the landing site, and development and operation of an SRF.

As discussed previously, the Proposed Action is analyzed in this Tier I document from both a programmatic perspective as well as site-specifically for activities occurring at the UTTR.

NASA identified issues to be fully analyzed in this PEIS by evaluating 1) the Proposed Action's potential to interact with a particular resource area and 2) where a potential interaction is identified, the scope of the Proposed Action's anticipated effect on individual resources relative to established criteria (when available) or guidelines outlined in agency guidance documents. Specific factors used for determining resource area interactions and/or potential significance determinations are provided in each respective resource section in this PEIS for those resources/issue areas carried forward and in the subsections for those not carried forward for detailed analysis.

Significance of impacts is determined by considering how a proposed action directly and indirectly interacts with the various resources in terms of the potentially affected environment (the context) and the degree (or intensity) of the effects of the action (40 CFR § 1501.3[b]). The analysis considers the affected area (national, regional, or local) and its resources (e.g., listed species and designated critical habitat under the Endangered Species Act). The degree of the effects takes into consideration both short- and long-term effects as well as beneficial and adverse effects. It also considers the effects on public health and safety and the effects that would violate Federal, State, tribal, or local law protecting the environment. Each of these aspects are addressed as appropriate in the applicable resource area sections within this chapter. General criteria for categorizing the degree of impacts to resource/issue areas are summarized below and are presented relative to individual resource/issue areas under the Proposed Action and the No Action Alternative:

- ***Beneficial*** – These generally result in some benefit or overall improvement to the resource impacted by the action. Such impacts may include a reduction in air emissions or restoration of habitats; the scope of the impact is directly related to the potentially affected environment and the degree of effects. Restoration of large areas of disturbed wetland may be considered significant beneficial impacts, while a small reduction in baseline air emissions or restoration of a small pocket of wetlands may be considered beneficial but relatively insignificant.
- ***Adverse*** – Adverse impacts generally result in detriment or degradation of the impacted resource and the degree or level of impact. Adverse impacts can either be significant or insignificant.
    - ***Significant*** – Physical aspects are easily perceptible, and typically endure over the medium-to-long term, with a regional affected environment and a high degree of effects; however, significant impacts can occur potentially over the short term under the local or regional affected environment, given a high degree of effects. Significant adverse impacts are typically not recoverable over the short term and require long-term recovery processes with extensive mitigation or revision of a proposed action to avoid or minimize impacts. An example of a significant adverse impact would be substantive increases in noise over noise-sensitive areas that exceed established threshold criteria.
    - ***Not Significant*** – These impacts can be short- to long-term impacts under any potentially affected environment or degree of effects. Adverse but not significant impacts are typically recoverable or manageable with mitigations or via implementation of standard management actions (e.g., implementation of existing management plan requirements). The extent of mitigations or management actions is dependent on the identified affected environment and degree of the impact. Examples of adverse impacts that are not significant may be short-term impacts to soils from ground disturbance mitigated through implementation of erosion control measures. Insignificant impacts are only briefly discussed in this document per 40 CFR § 1501.9(f))1).
- ***Neutral or No Effect*** – This category is based on whether there is no interaction with the resource (i.e., no effect) or the impacts have a low degree of effect such that they are imperceptible regardless of the affected environment (i.e., neutral impact). Such neutral impact is recoverable over the short term without mitigation and results in no overall perceptible change to the resource.

Based on preliminary analysis of the Proposed Action relative to the scope of the activities within the respective affected environment, as well as consideration of previous analysis for similar actions, it was determined that the Proposed Action does not present a potential for significant environmental impact to airspace. In all respects, no potential for adverse impacts to airspace have been identified. Total time for airspace coordination requirements is 6 minutes (EES entering the atmosphere to landing). Recovery activities may involve helicopter use under 152 meters (500 feet) above ground level within the DAF-controlled airspace. The UTTR has been utilized for similar actions, such as the Stardust (NASA 1998) and Genesis (NASA 2001) missions, and is also the planned landing site for the OSIRIS-Rex (NASA 2013) mission in 2023.

The same processes and procedures for airspace coordination applicable for these missions would also apply to MSR. In these prior mission cases, no adverse impacts to airspace were identified and the same would be expected for the MSR Campaign. As a result, airspace is not addressed in this document.

Table 3.3-1 lists resource/issue area analysis categories typically analyzed as part of NEPA and indicates whether the resource area is addressed in detail with respect to each Proposed Action component. In Table 3.3-1, if a resource indicates "Yes," an interaction is indicated and further detailed analysis is provided in the respective resource subsection. If a resource indicates "No," the rationale for not providing detailed analysis is also provided in that particular resource subsection based on the context and/or intensity of the activity. Table 3.3-1 also identifies those issue areas for which a detailed environmental impact analysis will be conducted as part of the Tier II analysis discussed previously.

Table 3.3-1. Resources Addressed in the PEIS

Resource / Issue Area	Analyzed in Detail			
	Site-Specific	Programmatic		Site-Specific Tier II Deferral
	EES Landing / Recovery [(a)]	Sample Transport	SRF	
Health and Safety	Yes	Yes	Yes	Yes
Cultural Resources	Yes	No	Yes	Yes
Hazardous Materials / Waste	Yes	No	Yes	Yes
Soils / Geology	No	No	Yes	Yes
Biological Resources	No	No	Yes	Yes
Water Resources	No	No	Yes	Yes
Air Quality / Climate	No	No	Yes	Yes
Land Use	No	No	Yes	Yes
Socioeconomics	No	No	Yes	Yes
Environmental Justice / Protection of Children	No	No	Yes	Yes
Noise	No	No	Yes	Yes
Infrastructure	No	Yes	Yes	Yes

Note:
(a) Includes landing site preparation.
Key: EES = Earth Entry System; PEIS = Programmatic Environmental Impact Statement; SRF = Sample Receiving Facility.

3.4 HEALTH AND SAFETY

Health and safety refers to programs, guidelines, and procedures that protect the safety, welfare, and health of persons engaged in particular work or the public. The overall goal of any health and safety program is to create a safe working environment and to reduce the risk of accidents, injuries, and fatalities either on the job or to members of the public. NASA Policy Directive (NPD) 8700.1E, *NASA Policy for Safety and Mission Success,* codifies this commitment and states that it is NASA policy to protect the public, NASA workforce, high-value equipment and property, and the environment from potential harm as a result of NASA activities and operations by factoring safety as an integral feature of programs, projects, technologies, operations, and facilities. As discussed in Section 3.2 (Incomplete or Unavailable Information), the potential for pathogenic effects from the release of Mars sample material is regarded as being very low; therefore, within the context of this document, health and safety analyses focuses on the design mitigations and protocols utilized to minimize the potential risk associated with Mars sample release during landing and recovery.

3.4.1 Proposed Action

3.4.1.1 Programmatic Analysis

Protection of the human environment and Earth's biosphere is NASA's highest priority under the Proposed Action.[25] In developing the MSR Campaign mission architecture, NASA has relied on the best available science to reach an international astrobiology scientific community consensus that a loss of containment of Mars samples would pose an extremely low risk of an adverse effect to human health or the environment (National Research Council 1997, National Research Council 2009). However, as described in Section 3.2 (Incomplete or Unavailable Information), the consensus is not unanimous, and the risk is not zero. Therefore, NASA has approached the return of Mars samples to Earth in a manner that assumes the material could in fact pose a risk of harmful effects if released into the environment (NASA 2021). This conservative approach dictates that robust design and engineering principles be applied to all aspects of the MSR Campaign, and it emphasizes multi-layered containment (i.e., "nesting doll" principle), which can withstand the most strenuous physical stresses. As required by the Outer Space Treaty, to which the United States is a Party, NASA's Proposed Action would establish a planetary protection process that ensures any system that has been exposed to the Martian atmosphere and surface, is either not returned to Earth, or fully "breaks the chain" of connection between Mars and Earth. Of note, the EES is designed and engineered to reenter and land on Earth's surface ballistically (i.e., without a parachute). By taking this approach, the spacecraft's design can be more streamlined and simple, and it avoids possible complications associated with a parachute failure (e.g., Genesis spacecraft reentry). In brief, the EES is specifically engineered to withstand the impact of landing in the soft soil of the UTTR without a parachute affecting its descent velocity. Finally, NASA's recovery, transportation, and SRF all emphasize use of proven principles of biosafety management. (See Chapter 2, Description of the Proposed Action and Alternatives, for a discussion of the engineered and procedural provisions for the Proposed Action.)

Regulatory Requirements

Because NASA is treating the unsterilized Mars samples as if they could contain unknown pathogens, NASA would develop transportation, handling, storage, and

[25] NASA is in the process of developing a Planetary Protection Approach and Implementation (PPAI) Document. The PPAI document addresses all measures to be taken by the MSR Campaign's NASA elements to manage Earth-based biological contamination of Mars and to manage any potential threat posed by the introduction of Mars material to the Earth's biosphere.

containment protocols consistent with BSAT. Regardless of landing site, transportation method, or SRF siting location, related Federal regulations are contained within 42 CFR Part 73, *Public Health – Select Agents and Toxins*, which implements the provisions of the Public Health Security and Bioterrorism Preparedness and Response Act of 2002. These regulations set forth the requirements for possession, use, and transfer of BSAT that have the potential to pose a severe threat to public health and safety, to animal health, or to animal products.[26] Requirements for the handling of select agents and toxins include restricting access to qualified personnel, providing physical security, biosafety measures (procedures and physical containment features), training, and incident response procedures, among other requirements. Requirements for the transportation of infectious material are contained within 42 CFR. Paragraph 73.12 *Public Health – Biosafety*, identifies the Centers for Disease Control and Prevention/National Institute of Health publication *Biosafety in Microbiological and Biomedical Laboratories* as providing guidance for the development of a biosafety plan. This document provides descriptions of the features required of a Biosafety Level 4 (BSL-4) facility, which are discussed further below.

EES Landing and Recovery

The engineered features and the procedures used to ensure isolation of the Mars samples are discussed in Chapter 2 (Description of the Proposed Action and Alternatives). These discussions address engineered sample protection design features and procedures during sample transfer from the Perseverance rover to the Sample Retrieval Lander, transfer to the Orbiter, transit in the Orbiter, entry, descent, landing, and site restoration.

The potential impacts and risks to health and safety are minimized through careful design of the EES landing and recovery process. This approach includes:

- assuming that the Martian samples are biologically significant until demonstrated nonhazardous;
- providing multiple layers of protection and confinement of Martian materials to reduce the potential that unsterilized Mars material could be released, with the goal of limiting the probability of a release of any Martian sample material so that it is extremely small, on the order of one-in-a-million; and
- ensuring that the landing systems provide very high confidence that the EES lands in the designated location.

Preventing the release of uncontained or unsterilized material from Mars into Earth's biosphere (i.e., "backward planetary protection") is the basis for protecting the biosphere and addressing human health concerns. This strategy drives the MSR design to contain the Orbiting Sample container (which has contacted Mars and contains the sample tubes) within redundant containers for return to Earth while containing and/or sterilizing any other Mars material that the MSR flight elements may have contacted. Program backward planetary protection requirements are derived from and intended to meet the

[26] 9 CFR Part 121, *Animal and Animal Products – Possession, Use, and Transfer of Select Agents and Toxins*, and 7 CFR Part 331, *Agriculture – Protection, Use, and Transfer of Select Agents and Toxins*, provide similar requirements in response to the *Agricultural Bioterrorism Protection Act of 2002*.

requirements outlined in NPR 8715.24, Section 3.4, *Planetary Protection Provisions for Robotic Extraterrestrial Missions*. Among those relevant to landing and recovery activities are NPR 8715.24 Sections:

- 3.4.1. Missions conducting restricted sample return, which prevent harmful biological contamination of Earth's biosphere, are the highest priority for planetary protection oversight.
- 3.4.2. The mission and the spacecraft design shall provide a method to "break the chain of contact" with Mars material. No uncontained hardware that contacted Mars, directly or indirectly, may be returned to Earth unless sterilized.
- 3.4.4.e. Samples returned from Mars by spacecraft shall be contained and treated as though potentially hazardous until demonstrated otherwise.
- 3.4.3. NASA shall initiate and execute a process to assure the safety and containment of Earth-return samples [the MSR Campaign has adopted these guidelines]:
  - Until the sample to be returned is subjected to an accepted and approved sterilization process, the sample container must be sealed after sample acquisition and a redundant containment method shall be required, and
  - For unsterilized samples, the integrity of the flight containment system shall be maintained until the sample is transferred to containment in an appropriate receiving facility on Earth.

These provisions lead directly to steps that would be taken at every stage of the campaign—on the surface and in orbit around Mars, in flight between planets, and all the way to the surface of Earth. Each step sequentially reduces the potential that any unsterilized Mars material could be released into Earth's biosphere.

The process, according to NASA's current plans, begins on the surface of Mars, where the Orbiting Sample container is protected from Martian dust by an enclosure that is opened only to insert sample tubes, minimizing the amount of dust that is allowed to accumulate on the Orbiting Sample container. Once launched into orbit by the planned Mars Launch System, the Orbiting Sample container would be collected inside the Capture, Containment, and Return System (CCRS) on the Orbiter. As its name suggests, the CCRS first captures the Orbiting Sample container and then seals it inside the first of two containment vessels, while simultaneously heat sterilizing any Mars dust that might remain in the seam of this primary containment vessel. A heat shrinking process has been identified for sealing the primary containment vessel. Where the parts of containment vessel meet, there would be a larger (outer) part and a small (inner) part. The outer part is heated and thermally expands as it is heated. The inner and outer parts are fitted together, and, as the outer part cools, it contracts and a tight seal is formed between the inner and outer parts. Any biological material of concern in the small amount of dust that might remain in the container joint would be inactivated either prior to or during the sealing process. The planned sterilization method is high heat, but other approaches, including ultraviolet sterilization, remain under study. As noted in Section 3.2 (Incomplete or Unavailable Information), studies are ongoing to establish the minimum rate of particle sterilization provided by the thermal, vacuum, and radiation extremes of spaceflight. Parallel studies to optimize the strategy for redundant containment of unsterilized material are also being performed. This information is currently under development and unavailable because studies are ongoing. Should further refinement of mission and design elements result in the potential for substantive impacts outside the scope of those analyzed in this PEIS, then supplemental NEPA analysis may be required.

In flight between planets, the primary protective measure employed would be the Micrometeoroid Protection System. This micrometeoroid shield would be designed to protect the EES from impacts that could possibly damage the Thermal Protection System and possibly result in the release of a portion of the Mars samples during Earth reentry.

Programmatic elements intended to protect against backward contamination during Earth approach, entry, descent, landing, and site recovery have previously been described in Chapter 2, Section 2.1.2.1.3 (Earth Return Orbiter).

Sample Transportation

Transportation of the Mars samples from the landing site to the SRF would be done in two phases. Transport from the landing site to a transportation vault, which would likely be located at the DAF-managed Detachment 1 (Det-1) location adjacent to the Michael Army Field runway located on Dugway Proving Ground (DPG), and transportation in the vault from the Det-1 location to the SRF (via land transportation only or via a combination of land and air transport vehicles).

While technical trades are still being evaluated, in preparation for transfer to the transportation vault the EES would notionally be placed in a lightweight, temporary container (a travel case) designed to facilitate rapid transportation within the UTTR to a transportation vault. The travel and handling procedures for the EES beyond UTTR boundaries and the security and functionality of the receiving facility would be based heavily on the proven techniques used for safely handling biological toxins and known infectious agents used in Earth-based research labs.

The transportation vault would provide an environmentally controlled and secure containment system for the EES while being transported to the SRF. The exact type of vault has yet to be determined. An example of a representative vault-type system for EES containment and transport includes a BSL-4 equivalent “trailer” or high-containment transport. BSL-4 equivalent trailers are designed and operated in the same manner as BSL-4 facilities, including design features to physically isolate material[27] through both structures and engineered features (e.g., access control and filtered ventilation systems) and practices and procedures for the protection of workers and the public. (BSL-4 requirements are addressed in the SRF Analysis subsection below.) They can be used to transport infectious material or people who have become infected. As such, they require egress controls for staff attending a person being transported. The BSL-4 equivalent trailer could incorporate all of the features of a BSL-4 equivalent

[27] Structural design of the vault would be dependent upon the mode of transport selected—over the road or a combination of over the road and by airplane. Factors to be considered include different design parameters to provide containment of samples during an accident for the two modes of transport.

facility, but they may not all be necessary. Since the vault transporting the EES may not require personnel access other than to load the EES at the landing site and remove the EES upon receipt at the SRF, access controls may not be as vigorous as for a BSL-4 equivalent trailer.

SRF Analysis

NASA's concept for the SRF is to build a facility that can be characterized as a BSL-4 equivalent facility. The facility would nominally incorporate the designs and procedures of a BSL-4 facility (which has significant security requirements) and possibly, as yet undefined, additional cleanliness and protective measures.[28] Progressive levels of BSL requirements build upon the requirements of the lower levels (e.g., BSL-2 requirements include and augment BSL-1 requirements). Therefore, a BSL-4 equivalent facility must meet the requirements associated with BSL categories -1, -2, -3, and -4. Table 3.4-1 provides the requirements for facilities at each of these levels. These high-level requirements are augmented with more specific design requirements for the systems intended to perform the functions identified in these requirements. Centers for Disease Control and Prevention's Biosafety in Microbiological and Biomedical Laboratories provides more detailed requirements (CDC 2020).

Table 3.4-1. Summary of BSL Requirements

BSL	Special Practices [a]	Primary Barrier and Personal Protective Equipment [a]	Facilities (Secondary Barriers) [a]
1	Standard microbiological practices	No primary barriers required; protective laboratory clothing; protective face, eyewear, as needed	Laboratory doors; sink for handwashing; laboratory bench; windows fitted with screens; lighting adequate for all activities
2	Limited access; occupational medical services including medical evaluation, surveillance, and treatment, as appropriate; all procedures that may generate an aerosol or splash conducted in a BSC; decontamination process needed for laboratory equipment	BSCs or other primary containment device used for manipulations of agents that may cause splashes or aerosols; protective laboratory clothing; other PPE, including respiratory protection, as needed	Self-closing doors; sink located near exit; windows sealed or fitted with screens; autoclave available
3	Access limited to those with need to enter; viable material removed from laboratory in primary and secondary containers; opened only in BSL-3 or ABSL-3 laboratories; all procedures with infectious materials performed in a BSC	BSCs for all procedures with viable agents; solid front gowns, scrubs, or coveralls; two pairs of gloves, when appropriate; protective eyewear, respiratory protection, as needed	Physical separation from access corridors; access through two consecutive self-closing doors; hands-free sink near exit; windows are sealed; ducted air ventilation system with negative airflow into laboratory; autoclave available, preferably in laboratory
4	Clothing change before entry; daily inspections of essential	BSCs for all procedures with viable agents; solid front	Entry sequence; entry through airlock with airtight doors; walls,

[28] Operation of the SRF will include stringent cleanliness requirements in addition to the BLS safety and security requirements. Facility cleanliness would help to ensure sample integrity and safety.

Table 3.4-1. Summary of BSL Requirements

BSL	Special Practices [a]	Primary Barrier and Personal Protective Equipment [a]	Facilities (Secondary Barriers) [a]
	containment and life support systems; all wastes decontaminated prior to removal from laboratory; shower on exit	gowns, scrubs, or coveralls; gloves; full-body, air-supplied, positive pressure suit	floors, ceilings form sealed internal shell; dedicated, non-recirculating ventilation system required; double-door, pass-through autoclave required

Source: (CDC 2020) Table 1
Note:
(a) Each successive BSL contains the recommendations of the preceding level(s).
Key: ABSL = Animal Biosafety Level; BSC = biosafety cabinet; BSL = Biosafety Level; PPE = personal protective equipment.

While not completely analogous,[29] the results of previous NEPA analyses for BSL-4 facilities have concluded that the hazards associated with the operation of BSL-4 facilities are expected to be minimal. Analyses performed in support of recent NEPA documents conclude that the risk from accidental release of material from a BSL-4, even under accident conditions that include the failure of protective boundaries (e.g., reduced effectiveness of ventilation filtration systems) are minute and can be described as zero (NIH/DHHS 2005). An alternative release path resulting from the contamination of workers leading to direct contact with others (members of the public) was also analyzed. Qualitative risk assessments for this mode of transmission have shown that the risk to the public is negligible. (NIH/DHHS 2005, DHS 2008)

Should the Proposed Action be chosen, Tier II NEPA analyses of the proposed SRF would include analysis similar to those performed for existing BSL-4 facilities.

Siting and Development Considerations

Siting and development of an SRF should consider the following factors in order to minimize the potential for adverse impacts to human health and safety:

- <u>Compatible Land Use</u>: Siting the facility in close proximity to other similar facilities and/or a medical facility experienced with biohazard exposures would support emergency response capabilities. However, siting the facility in an area that is less densely populated minimizes the number of persons potentially affected should a pathogen release occur.
- <u>Facility Type and Size</u>: An addition to an existing facility (e.g., addition of BSL-4 capabilities to another BSL-type facility) would allow for the leveraging of existing health and safety systems. Also, larger facilities that might process larger sample amounts would likely require more substantial health and safety systems.

Tier II Analysis Considerations

Once a site is selected, Tier II analysis would need to consider:

- the location of the proposed facility and surrounding community/land use type;

[29] The individual health hazard associated with exposure to varying levels/concentrations of most pathogens has been established. As stated, the risk of exposure to Mars samples is expected to be very low; however, any relationship between quantity of material and impacts is not known.

- health and safety system requirements associated with a BSL-4 equivalent facility; and
- conduct analysis addressing any risk of loss of containment.

3.4.1.2 Site-Specific Analysis (UTTR/DPG)

3.4.1.2.1 Affected Environment

The UTTR is an active military range with many health and safety protocols intended to protect service members and members of the public. The UTTR is currently managed in accordance with the requirements and procedures prescribed in Air Force Instruction (AFI) 13-212 Air Combat Command Supplement 1, 388 FW Addenda A, *Range Planning and Operations*. This AFI addresses a variety of ground safety considerations, including land ownership and control, weapons use, range scheduling, range maintenance, Explosive Ordnance Disposal (EOD), range decontamination and debris disposal, and environmental stewardship of ranges. AFI 13-212 also assigns responsibilities and provides detailed processes and procedures for range scheduling, maintenance, EOD, range decontamination and debris disposal, and entry into, operations within, and exit from airspace directly supporting range operations.

Headquarters (HQ) UTTR is responsible for the safe management and operation of the UTTR. Range management involves the development and implementation of those processes and procedures required to ensure that range operations are planned, operated, and managed safely. The focus of range management is on ensuring the safe, effective, and efficient operation of the UTTR and the safe and efficient use of restricted areas. The overall purpose of range management is to balance the military need to accomplish realistic testing and training with the need to minimize potential impacts of such activities to human health, the environment, and surrounding communities.

The UTTR Fire Department, which is stationed at Oasis Range, provides fire response for activities on the UTTR, including those near Wendover Airport. HQ UTTR also has mutual aid agreements with Tooele County, the City of West Wendover, and the City of Wendover's volunteer fire department. HQ UTTR works with the local fire departments to alert citizens about the potential for injury should they handle or disturb aircraft or munitions debris associated with military operations.

3.4.1.2.2 Environmental Consequences

The MSR Campaign is the first sample return mission to be classified as Restricted Earth Return, since the term was defined. (The Apollo 11, 12, and 14 missions were subjected to quarantine upon return until lunar samples were assessed and found to pose no hazard.) Prior mission sample return missions at the UTTR (e.g., Stardust, Genesis, and the upcoming return of OSIRIS-Rex) were all classified as Unrestricted Earth Return. The human health and safety analysis focuses on the precautions taken to provide backward planetary protection. However, the probability of inadvertent or off-nominal reentry would be similarly small as those evaluated for these earlier missions (NASA 1998, NASA 2001, NASA 2013), and as stated previously, the samples are unlikely to pose a risk of significant ecological impact or other significant harmful effects should there be a sample release. The relatively low probability of an inadvertent reentry combined with the assessment that samples are unlikely to pose a risk of significant ecological impact or other significant harmful effects support the judgement that the potential environmental impacts would not be significant.

UTTR-specific activities being addressed in this PEIS include site preparation (e.g., clearing hard objects from the anticipated landing area), entry, descent, and landing, and sample recovery operations.

EES Landing and Recovery

Mission Preparation

As part of mission preparation, drop testing, dress rehearsals, and site objects and debris posing a hazard to the EES would be removed from the landing site, including any unexploded ordnance (UXO). Both drop tests and dress rehearsals could potentially occur within the ellipse and/or on test sites identified in Figure 2.1-9. Cleared test sites do not pose any UXO concerns. As discussed in Section 2.1.3.1 (Landing at Utah Test and Training Range), the proposed landing ellipse has not previously been used as a target area and the potential for UXO in this area is small; DAF personnel have assessed the area during previous test operations and have not found any UXO issues of concern (Shane 2022). During all operations in the area, a UXO technician would accompany project personnel, and all personnel visiting the area would be briefed as to the potential for UXO in the area and what to look for and what to do in the event a potential UXO is discovered. Personnel tasked with debris removal activities would be trained to identify potential UXO and removal would be deferred to trained EOD personnel (uniformed service members and/or DAF-contracted personnel) in accordance with Air Force Manual (AFMAN) 32-3001, *Explosive Ordnance Disposal (EOD) Program*.

EES Release/Landing

NASA has prescribed the use of an assurance case as a compliance path for backward planetary protection. Assurance cases take in both qualitative and quantitative information to make the case that a proposed action meets a certain standard. In the execution of Mars sample return, NASA has stated in its procedural requirements (NPR 8715.24, *Planetary Protection Provisions for Robotic Extraterrestrial Missions*) that “preventing harmful biological contamination of Earth’s biosphere is the highest priority.” Where quantitative standards can be implemented, MSR has established stringent probability targets to drive robust containment engineering. MSR selected a target value equivalent to a 99.9999 percent probability of successful containment. These targets are applied to each of three material vectors, or pathways along which Mars material may reach Earth: 1) free particle transport; 2) approach, entry, and descent; and 3) landing. Throughout MSR element design, NASA will continue to assess numerous factors that may influence Mars material containment and/or sterilization success for each vector.

For free particle transport, NASA will continue to assess the probability that non-sterile Mars material reaches and is transported to Earth on spacecraft exteriors. These analyses would then be used to refine the design and operation of MSR flight elements to minimize this risk, if necessary. For further analyses, NASA is considering assessing this vector to include the sterilizing and inactivating effects of the space environment on bioactive molecules, as has been done for the Japanese Martian Moons Exploration mission (National Academies of Sciences, Engineering, and Medicine and the European Science Foundation 2019).

Analyses of the approach, entry, and descent vector would utilize the assessed likelihood of EES anomalies that could compromise Mars material containment, such as micrometeoroid impacts in flight or unexpected entry performance. The current design addresses these possibilities with a micrometeoroid shield that the EES will remain behind for all but a few days of the mission, as well as stringent constraints on the flight performance of both the Orbiter and the EES itself. NASA currently requires that the EES design and operation achieve a 99.9985 percent likelihood of success and is assessing if the high levels of heating that would be experienced during rare entry anomalies result in sterilization-level heating to reach the 99.9999 percent containment success target.

The landing vector analyses utilize a range of inputs related to the EES final trajectory. Inputs to the trajectory include accurate determination of the Orbiter's position in space (performed by multiple ground assets), release precision (direction, speed), entry and aerodynamic performance of the EES itself, and atmospheric effects like wind. These values are combined to identify a 99.9999 percent landing ellipse, which NASA then assesses to understand the surfaces on which the EES could land within this area. That information, along with analyses of the landing state of the EES (touchdown angle, lateral and vertical speed), is used to calculate the forces experienced by the redundant containment vessels. NASA is currently designing and testing the containment vessels to these values using standard practices, which assume the loads are significantly higher than predicted. NASA is also narrowing the range of expected landing forces, in collaboration with the DAF, by assessing the number of hazards that need to be removed from the UTTR (see previous discussions regarding landing site preparation).

The predicted performance of the MSR systems against the 99.9999 percent containment success target values for each vector will be a primary input to the MSR Assurance Case. The MSR Assurance Case will also utilize qualitative information demonstrating that the mission concept and spacecraft designs are capable of containing unsterilized Mars material to NASA safety standards and, as required under its *Planetary Protection Provisions for Robotic Extraterrestrial Missions* (NPR 8715.24), prioritize preventing any harm to Earth's biosphere. This qualitative information would detail the rationale for design decisions related to a particular containment strategy and why it represents the best choice for this activity. Such engineering choices, called trade studies, are regularly documented as part of space flight mission and spacecraft design; NASA plans to use these within the scope of the MSR Assurance Case to further characterize containment capability beyond the numeric analyses of containment success. The baseline MSR Assurance Case will be developed prior to the mission's Critical Design Review and will be regularly refreshed with updated analysis thereafter, with reports created for NASA and external review throughout the development and operation of the mission.

EES Recovery

It is expected that the cone-shaped EES, roughly the size of a tire on a semitruck, would land at the UTTR with a speed of approximately 145 kilometers per hour (90 miles per hour). Simulations and ground-based testing have shown the landing would be expected to create a depression in the soil about the same as the EES, with a diameter of about 1.2 meters (4 feet) and depth of about 0.5 meter (1.6 feet), with soil being ejected from the crater to a distance of approximately 15 meters (49 feet).

As described in Chapter 2 (Description of the Proposed Action and Alternatives), all personnel involved in recovery operations would be required to wear personal protective equipment (PPE). After the EES has been transferred from the site to the vault, soil and PPE may be decontaminated. As stated in Chapter 2, the exact means of potential decontamination has not been determined (possibilities include high heat exposure, use of chemicals such as chlorine dioxide or aldehyde, or a combination of both). However, any decontamination activities would follow standard decontamination protocols for biological hazards. As discussed previously, the standard decontamination of biohazards in soil typically involves applying chemical sterilants as liquid or fumigants at the landing site in place (EPA 2017). All activities would be in alignment with CBRNE response planning for EPA and the DAF Readiness and Emergency Management Office.

Overall Health and Safety Impacts

Health and safety impacts are mitigated through the prevention of backward contamination, which is provided by the low probability of failure of the engineered containment systems intended to provide containment of the Mars sample material under all circumstances. Implementation of actions that are in line with accepted procedures used for the isolation of biohazard materials provides additional protection against the release and spread of such material. Given implementation of these precautions and given that Mars materials are not expected to have significant pathological impacts if released into the Earth’s biosphere, on-site mission preparation (to include testing, rehearsals, and landing site preparation), EES landing, and EES recovery operations are expected to have minimal direct and/or indirect impacts on human health at the UTTR, the Det-1 location, or in general.

3.4.2 No Action Alternative

Under the No Action Alternative, the MSR Campaign would not involve the landing of Mars samples at the UTTR, and an SRF would not be developed. Therefore, the No Action Alternative would not result in any additional impacts to human health or safety within or adjacent to the proposed landing site outside of those associated with ongoing and potential future military operations and other activities occurring at the site. Potential impacts associated with development of an SRF would not be realized.

3.5 CULTURAL RESOURCES

Cultural resources are historic properties as defined by the National Historic Preservation Act (NHPA), cultural items as defined by the Native American Graves Protection and Repatriation Act, archaeological resources as defined by the Archaeological Resources Protection Act (ARPA), sacred sites as defined by EO 13007, *Indian Sacred Sites*, to which access is afforded under the American Indian Religious Freedom Act, and collections and associated records as defined by 36 CFR Part 79. Both historic properties and significant traditional cultural resources that may or may not meet the National Register of Historic Places (NRHP) criteria (as defined in 36 CFR § 60.4) but are identified by American Indian Tribes or other recognized traditional cultural groups, are evaluated for potential adverse effects from an action.

Criteria applied to evaluate properties for listing in the NRHP are set forth at 36 CFR § 60.4. A historic property must possess integrity of location, design, setting, materials, workmanship, feeling, and association and meet at least one of four criteria: A) association with events that have made a significant contribution to the broad patterns of our history; B) association with the lives of persons significant in our past; C) embodiment of distinctive characteristics of a type, period, or method of construction; and D) yield, or likeliness to yield, information important in prehistory or history. Ordinarily, a historic property must be more than 50 years old, and certain types of properties are not typically considered for listing in the NRHP, such as birthplaces, graves, and cemeteries. However, under certain criteria considerations, these properties may be eligible for listing in the NRHP, assuming that they already meet the regular requirement.

3.5.1 Proposed Action

3.5.1.1 Programmatic Analysis

Regulatory Requirements

The following laws, executive orders, regulations, and other agency policy and guidance apply to the programmatic analysis, as well as the site-specific analysis.

A number of Federal statutes, regulations, or guidelines must be considered when analyzing the effects of the Proposed Action on architectural, archaeological, and cultural resources. Foremost among these is the NHPA (Public Law 89-655, as amended through 2006; 54 United States Code [U.S.C.] 300101 et seq.), of which Section 106 requires Federal agencies to take into account the effects of their undertakings on historic properties. Other laws pertinent to the Proposed Action include, but may not be limited to, the Antiquities Act of 1906; the Historic Sites Act of 1935; NEPA; the Archaeological and Historic Preservation Act of 1974; the ARPA of 1979; the Native American Graves Protection and Repatriation Act of 1990; and the American Indian Religious Freedom Act of 1978.

Federal regulations governing cultural resource activities include the following: 36 CFR Part 800, *Protection of Historic Properties* (incorporating amendments effective August 5, 2004), which implements Section 106 of the NHPA; 36 CFR Part 79 *Curation* *of Federally Owned and Administered Archaeological Collections*; 43 CFR Part 7, *Protection of Archaeological Resources*; 36 CFR Part 60, *NRHP*; 36 CFR Part 63, *Determinations of Eligibility for Inclusion in the National Register*; and 36 CFR Part 68, *Secretary of Interior's Standards for the Treatment of Historic Properties*. Cultural resource-related executive orders that may affect the NEPA process include the following: EO 11593, *Protection and Enhancement of the Cultural Environment*; EO 13007*, Indian Sacred Sites*; EO 13175, *Consultation and Coordination with Indian Tribal Governments*; and EO 13287, *Preserve America*.

In addition to the Federal statutes, regulations, guidelines, and executive orders, there are NPDs and NPRs pertaining to cultural resources management, including NPD 8500.1C, *NASA Environmental Management*, and NPR 8510.1A, *NASA Cultural Resources Management*. NPD 8500.1C (effective December 2, 2013, expires December 2, 2023) is an internal directive to NASA employees regarding environmental management policy, including compliance with historic preservation laws and cultural resources management regulations, under the authority of NEPA and the NHPA.

Analysis of potential effects to historic properties considers both direct and indirect effects, in accordance with 36 CFR § 800.5. Direct effects may be the result of physically altering, damaging, or destroying all or part of a historic property; altering characteristics of the surrounding environment that contribute to the importance of the historic property; introducing visual, atmospheric, or audible elements that are out of character for the period the historic property represents (thereby altering the setting); or neglecting the historic property to the extent that it deteriorates or is destroyed. Indirect effects include reasonably foreseeable future effects caused by the undertaking that may occur later in time, be farther removed in distance, or be cumulative (36 CFR § 800.5(a)(1)).

For the purposes of cultural resources analysis, the Region of Influence (ROI) is considered equivalent to the Area of Potential Effects (APE), as defined by 36 CFR § 800.16(d). The APE for cultural resources is the geographic area or areas within which an undertaking (project, activity, program, or practice) may cause changes in the character or use of any historic properties present. The APE is influenced by the scale and nature of the undertaking and may be different for various kinds of effects caused by the undertaking.

NHPA Section 106 Consultation

The 36 CFR Part 800 regulations, implementing NHPA Section 106, require considerable consultation with the State Historic Preservation Officer (SHPO), Indian tribes, and interested members of the public for projects that have the potential to affect historic properties. Consultation early in the planning process allows identification of properties potentially affected by the undertaking and the development of measures to avoid, minimize, and mitigate adverse effects on historic properties.

Standard Section 106 consultation is a four-step process, beginning with the initiation of the Section 106 process by establishing that a proposed action is an undertaking *type* that could affect historic properties. The next step in the process is identification of historic properties, including defining the APE. The APE is defined as "the geographic area(s) within which an undertaking may directly or indirectly cause changes in the historic character or use of historic properties, if any such properties exist” (36 CFR § 800.16(d)). Once the APE is established, the agency, through consultation, will take steps necessary to ensure a reasonable and good faith effort to carry out appropriate efforts to identify resources and evaluate them for eligibility for listing in the NRHP. The third step in the process is assessing the effects of the undertaking on historic properties in the APE by applying the criteria of adverse effect (36 CFR § 800.5) in consultation with SHPO and consulting parties. The fourth step is resolution of any adverse effects identified in step three, through consultation, by developing alternatives or modifications to the proposed undertaking that could avoid, minimize, or mitigate the adverse effects on historic properties; or by executing an agreement (either Memorandum of Agreement or Programmatic Agreement) to mitigate unavoidable adverse effects.

SRF Analysis

Because a site has not been selected for development of an SRF facility, the focus of this analysis is on potential impacts, siting considerations, and requirements associated with development of an SRF facility that would need to be considered as an SRF facility site. Site-specific analysis of potential impacts to cultural resources is deferred to Tier II analysis once a site has been selected and a design developed.

The APE for development of an SRF includes the footprint of the proposed facility construction and any associated infrastructure improvements, such as road construction, where archaeological sites could be disturbed, and an as yet undefined area around the new facility where it would be visible and potentially affect the setting of any nearby NRHP-listed or -eligible properties.

Operation of an SRF would not be anticipated to impact cultural resources; the main impact driver for this resource is the development of an SRF. Construction activities that may impact cultural resources are all ground-disturbing activities, including land clearing, earth moving, excavation, and vehicle and equipment operation on unpaved surfaces. These activities may result in physical disturbance of any surface or subsurface archaeological resources that may be present in the areas disturbed. Direct adverse effects would result if any of the archaeological resources are listed on or eligible for listing in the NRHP.

The amount of land clearance and earth moving required would be dependent on the type and size of the facility, as well as the need for any additional or ancillary infrastructure (such as parking). Generally, the amount of land clearing and total ground disturbance would be associated with the site chosen for the SRF, in conjunction with the type and size of facility. Siting an SRF in previously undeveloped locations would require more ground disturbance of previously undisturbed areas, with greater potential for intact archaeological resources, than would placement of a facility in an area that is already developed or improved (such as an industrial park). Constructing a modular facility, an addition to an existing facility, or a new brick-and-mortar type facility within a previously developed or improved area, would not be expected to result in significant impacts to archaeological resources as prior development of these areas typically has already impacted any sites that may have been present. Clearing of undeveloped areas for facility development would have a higher potential to result in adverse effects to archaeological resources; however, the degree of the impact would be dependent on the significance (NRHP eligibility) of the site(s) present.

Development of any type of facility also presents the potential for introduction of a visual intrusion into the setting of nearby NRHP-listed or -eligible properties, if there are any within the viewshed of the new facility. Construction of a new facility in proximity to NRHP-listed or -eligible properties could alter characteristics of their surrounding environment (setting), and adverse effects could result if that setting contributes to the importance of the historic property. Adverse effects would also result if the new facility, through its design or scale, introduced visual elements that are out of character for the period the historic property represents. The degree of the impact would be dependent on multiple factors, including how visible the new facility will be to any NRHP-listed or -eligible properties, which in turn is a function of how close it is and whether there are any intervening obstructions, the size and design of the new facility, and the integrity of the historic setting in which the new facility would be built.

Siting and Development Considerations

Siting and development of an SRF should consider the following factors in order to minimize the potential for adverse impacts to cultural resources:

- Developed versus Undeveloped Location: Siting the facility in a developed/improved location would minimize the amount of land clearing and disturbance of previously undisturbed ground required for construction of the facility and potentially for access roads, which would reduce the potential to impact any undisturbed significant archaeological resources. Siting within undeveloped areas should avoid areas of moderate to high probability for the presence of archaeological resources. Undeveloped locations are also less likely to have nearby NRHP-listed or -eligible properties in close proximity, thereby reducing the potential impacts to significant historical architectural resources.

- Proximity to NRHP-listed or -eligible Properties: Outside of siting within developed/undeveloped areas, both of which could have historic buildings or districts, siting should also consider proximity to NRHP-listed or -eligible properties to avoid or minimize impacts to these historic properties.

- Facility Type and Size: An addition to an existing facility (e.g., addition of BSL-4 capabilities to another BSL-type facility) would minimize the amount of land disturbance required, which, in general, would reduce the potential to impact archaeological sites. Smaller, modular facilities would also minimize the amount of land required, as well as the distance of the potential visual effect from the new facility.

- Facility Design: Whether constructing a new facility or an addition to an existing facility, if the facility is sited within the viewshed of any NRHP-listed or -eligible properties (particularly a historic district), potential adverse effects to those properties could be minimized if the facility is designed to be compatible with the appearance of the nearby historic properties and/or consistent with any existing building design covenants or executed agreements.

Tier II Analysis Considerations

Once a site is selected, Tier II analysis would need to consider:

- initiation of the NHPA Section 106 consultation process early in the planning process;
- defining the APE;
- once the APE is established, take steps necessary to ensure a reasonable and good faith effort to identify any significant cultural resources, which may include historic properties as defined by the NHPA, cultural items as defined by the Native American Graves Protection and Repatriation Act, archaeological resources as defined by the ARPA, sacred sites as defined by EO 13007, and collections and associated records as defined by 36 CFR Part 79;
- assessment of the effects of the undertaking on significant cultural resources, including properties of cultural, historical, or religious significance in the APE, and including determination of adverse effects to historic properties in accordance with 36 CFR § 800.5; and
- identification of any necessary mitigations required to avoid or minimize identified adverse effects. The action should seek to avoid or minimize adverse effects to historic properties, including archaeological resources, historic architectural resources, and traditional cultural resources.

3.5.1.2 Site-Specific Analysis (UTTR/DPG)

Tribal Consultation

On March 25, 2022, NASA sent letters initiating government-to-government consultation with 21 Federally recognized Native American Tribes with cultural and/or historic ties to the area that are potentially interested in the Proposed Action. On April 15, 2022, NASA sent a second letter initiating Section 106 consultation with the same 21 potentially interested tribes, seeking comment on NASA's definition of the APE. To date, NASA has received one response from the tribes, which did not identify any resources that may be affected by the Proposed Action or comment on the APE (see Appendix B, Section B.3, Native American Tribal Coordination). Tribal consultation is ongoing, and engagement with consulting tribes will continue throughout the life of the project as needed.

NHPA Section 106 Consultation

NASA has initiated and is in the process of conducting Section 106 consultation and government-to-government consultations with Federally recognized Native American tribes, the Utah SHPO, the Advisory Council on Historic Preservation (ACHP), and other entities regarding the effects of the Proposed Action to historic properties, in accordance with Section 106 of the NHPA. On April 15, 2022, NASA sent letters initiating Section 106 consultation with the Utah SHPO, the same 21 potentially interested tribes, the ACHP, and other parties seeking comment on NASA's definition of the APE. In a letter dated April 18, 2022, the Utah SHPO concurred with NASA's definition of the APE (see Appendix B, Section B.2, Regulatory Consultations). Hill Air Force Base (AFB), the Utah

SHPO, and the ACHP are finalizing a program Programmatic Agreement (see Appendix B, Section B.4, Cooperating Agency Agreements), which includes protocols for retrieval actions and Standard Mitigation Treatment Measures to mitigate any potential adverse effects to historic properties from the landing of objects from high in Earth's atmosphere (and above) and their retrieval, including EES landing and recovery.

3.5.1.2.1 Affected Environment

NASA has defined the APE for the EES landing and recovery as the area in which a targeted or off-target landing may occur (Figure 3.5-1). The nominal landing target area consists of an ellipse that defines the area with a 99.9999 percent probability of landing. The notional area associated with an off-nominal (abnormal or unexpected) landing is an expanded version of the ellipse. The APE also includes the addition of an approximately 45.72-meter-wide (150-foot-wide) buffer around the ellipse to accommodate recovery team staging and/or access. The total area of potential landing (both nominal and off-nominal) where ground disturbance could occur is approximately 574 square kilometers or 222 square miles. The actual area of disturbance is significantly smaller and would consist of the EES impact crater of approximately 1.2 meters (4 feet) in depth, a surrounding radius of approximately 15 meters (49 feet) where soil ejected from the impact crater may be deposited, and an unknown area around that where recovery activities would occur. Utilization of the Det-1 location would be temporary and would not involve any ground disturbance, building modifications, or permanent infrastructure; therefore, the Det-1 location on DPG is not discussed further.

The entirety of the proposed EES landing site in the UTTR South Range has not been subject to systematic archaeological survey. However, since 1994 there have been 14 surveys within the APE and 35 others within 8.05 kilometers (km) (5 miles) of the APE in the UTTR South Range (Table 3.5-1). These surveys have covered approximately 15 percent of the APE (Table 3.5-2). Within the APE, surveys have been concentrated in the northeastern portion of the off-nominal ellipse, although some survey has been conducted in the 99.999 percent and 90 percent nominal ellipse areas (Figure 3.5-2).

Surveys conducted in the APE identified 36 prehistoric archaeological sites, all within the off-nominal portion of the APE. The 36 sites span the time frame of earlier than 13,000 years before present (BP) to 650 years BP and they encompass the following archaeological time periods: Paleoindian (earlier than 13,000 BP), Paleoarchaic (13,000–10,800 BP), Early Archaic (10,800–6,800 BP), Middle Archaic (6,800–1,600 BP), and Late Archaic (1,600–650 BP). All 36 sites have been evaluated for inclusion in the NRHP and, of these, four have been determined to be eligible. Two of the eligible sites are Paleoindian, one is Paleoindian/Paleoarchaic, and one is Early Archaic.

Given the relatively low proportion of the APE that has been surveyed to date, data on archaeological sites identified within 8.05 km (5 mi) of the APE within the UTTR South Range can be used to further characterize the types of sites in the UTTR South Range. Surveys conducted there have identified 122 prehistoric sites, of which 41 have been determined to be eligible for the NRHP (Table 3.5-3). Eligible sites include 7 Paleoindian, 9 Paleoindian/Paleoarchaic, 3 Archaic, 14 Early Archaic, 3 Early/Middle Archaic, 1 Middle Archaic, and 4 sites classified as "Unknown Aboriginal" (Hill AFB 2022).

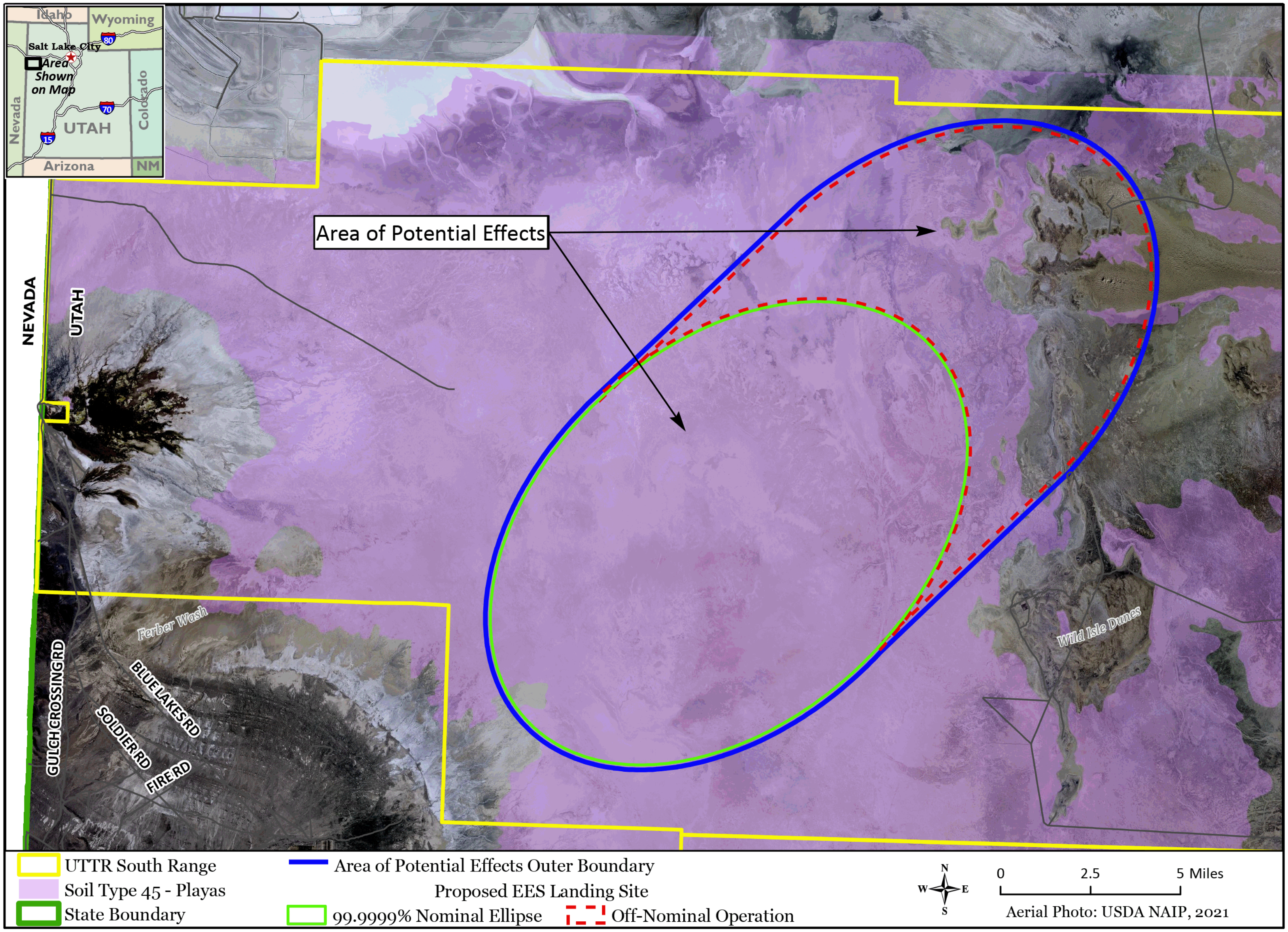

Figure 3.5-1. Map of the Area of Potential Effects for EES Landing and Recovery

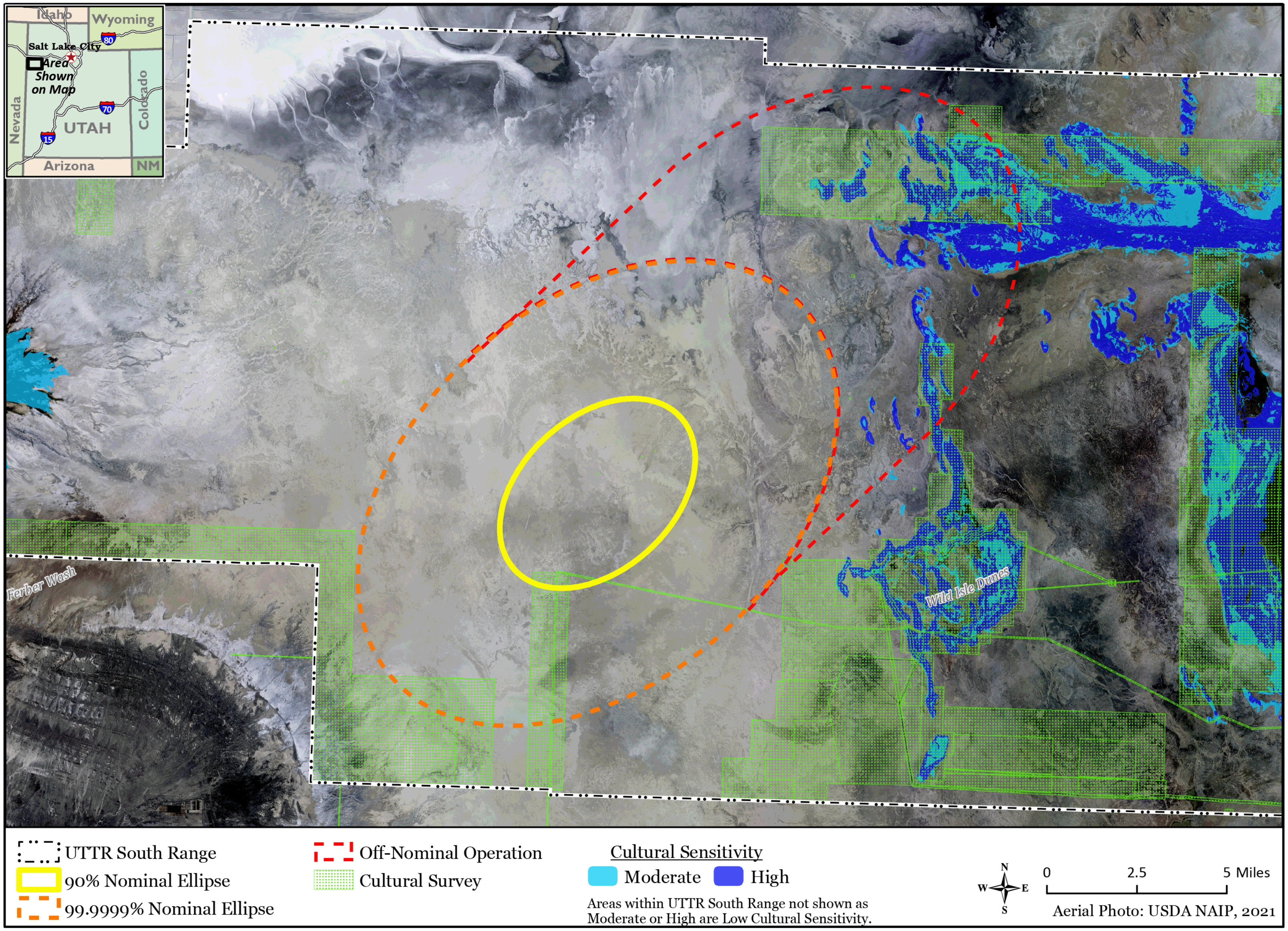

Figure 3.5-2. UTTR South Range Archaeological Survey Areas and Archaeological Sensitivity

Table 3.5-1. Archaeological Surveys in the APE and Within 5 Miles of the APE in the UTTR South Range

Survey Report Title	Description	Area Surveyed (Hectares)
Area of Potential Effects		
Off-Nominal (Faulted) Operations		
U-05-EU-0971m	XS187	1.526
U-05-EU-0971m	XS191	0.105
U-05-EU-0971m	XS233	0.369
U-12-FF-0340m	Knolls Inventory	1,593.861
U-15-FF-0213m	SUTTR Fiber Line	0.004
U-16-FF-0625m	West Delta Inventory	23.631
U-95-WC-0558m	Inventory 1995 Season	4,433.356
U-98-HD-0376m	TS-5 Access Road	458.238
99.9999% Nominal Ellipse Footprint		
U-05-EU-0971m	XS181	0.137
U-05-EU-0971m	XS182	0.139
U-05-EU-0971m	XS183	0.150
U-05-EU-0971m	XS185	0.184
U-05-EU-0971m	XS297	0.170
U-15-FF-0213m	SUTTR Fiber Line	93.657
U-16-FF-0625m	West Delta Inventory	1.641
U-94-WC-0577m	Inventory 1994 Season	5.553
U-95-WC-0558m	Inventory 1995 Season	1,730.305
90% Nominal Ellipse		
U-05-EU-0971m	XS181	0.137
U-05-EU-0971m	XS182	0.139
U-05-EU-0971m	XS183	0.150
U-15-FF-0213m	SUTTR Fiber Line	16.781
U-95-WC-0558m	Inventory 1995 Season	101.765
Area within 5 miles of the APE in the UTTR South Range		
Monitored Section	Monitored Section	44.338
U-00-HD-0482m	TS-5 Inventory 2000	1,573.440
U-01-GM-0708m	TS-5 Southern Access Rd	111.015
U-01-GM-0831m	TS-5-2 Road Monitoring	143.774
U-05-EU-0971m	XS034	0.088
U-05-EU-0971m	XS078	0.117
U-05-EU-0971m	XS172	0.078
U-05-EU-0971m	XS173	0.120
U-05-EU-0971m	XS176	0.233
U-05-EU-0971m	XS181	0.137
U-05-EU-0971m	XS182	0.139
U-05-EU-0971m	XS183	0.150
U-05-EU-0971m	XS185	0.184
U-05-EU-0971m	XS187	1.526
U-05-EU-0971m	XS188	0.008
U-05-EU-0971m	XS191	0.105
U-05-EU-0971m	XS232	0.522
U-05-EU-0971m	XS233	0.369

Table 3.5-1. Archaeological Surveys in the APE and Within 5 Miles of the APE in the UTTR South Range

Survey Report Title	Description	Area Surveyed (Hectares)
U-05-EU-0971m	XS236	0.186
U-05-EU-0971m	XS295	0.142
U-05-EU-0971m	XS297	0.170
U-12-FF-0340m	Knolls Inventory	2,428.760
U-12-FF-0788m	High Speed Mover West Delta	2.561
U-15-FF-0213m	SUTTR Fiber Line	178.999
U-15-ST-0753m	HSM Inventory - Intensive	1,278.512
U-15-ST-0753m	HSM Inventory - Recon	10.701
U-16-FF-0625m	West Delta Inventory	1,938.444
U-20-LI-0905	SUTTR FY 20 Inventory	1,944.434
U-93-WC-0546m	Inventory 1993 Season	65.878
U-94-WC-0577m	Inventory 1994 Season	4,366.700
U-95-WC-0558m	Inventory 1995 Season	9,487.825
U-96-HL-0440b	GPS Jammer Sites	117.475
U-98-HD-0376m	TS-5 Access Road	3,286.052
U-98-HL-0002m	TS-5-1 Access Rd & Gravel Pit	48.557
U-99-HL-0695m	West TS-5 Target & Access Rd	41.145

Key: % = percent; APE = Area of Potential Effects; FY = fiscal year; GPS = Global Positioning System; HSM = High Speed Mover; SUTTR = Utah Test and Training Range, South Range; TS = Test Site; UTTR = Utah Test and Training Range.

Table 3.5-2. Surveyed Area Within the APE

APE Portion Description	Area (Square Kilometers)	Surveyed Area (Square Kilometers)	Percent of Area Surveyed
Off Nominal Operations	191	65.11	34.09%
99.9999% Nominal Ellipse	325	18.32	5.64%
90% Nominal Ellipse	54	1.19	2.20%
Total	**570**	**84.61**	**14.84%**

Key: % = percent; APE = Area of Potential Effects.

Table 3.5-3. Archaeological Sites Within 5 Miles of the APE in the UTTR South Range

Archaeological Period Association	Eligible [(a)]	Not Eligible	Total
Paleoindian	7	9	16
Paleoindian/Paleoarchaic	9	22	31
Paleoindian/Middle Archaic	0	1	1
Paleoindian/Late Archaic	0	1	1
Archaic	3	2	5
Early Archaic	14	11	25
Early/Middle Archaic	3	0	3
Middle Archaic	1	0	1
Unknown Aboriginal	4 [(a)]	35	39
Total	41	81	122

Note:
(a) Includes an unevaluated site.
Key: APE = Area of Potential Effects; UTTR = Utah Test and Training Range.

The model indicates that dune settings are highly sensitive and that areas near the dune and alluvial fan margins, and at spring mounds and outflow streams have moderate sensitivity for prehistoric archaeology. The sensitivity model identified the Old River Bed distributary system within the UTTR South Range as having moderate- to high-sensitivity for archaeological resources and many of the archaeological sites recorded have been located in these areas, in particular sites with Paleoarchaic (13,000–10,800 BP) association (Hill AFB 2021). All four of the NRHP-eligible sites in the APE are in areas identified as having moderate to high cultural sensitivity. As with the sites identified within the APE, the majority of eligible sites within 8.05 km (5 mi) of the APE within the UTTR South Range are located in areas identified as having moderate to high cultural sensitivity, often associated with the Old River Bed distributary system.

The only areas of moderate- and high-sensitivity within the APE occur in the eastern part of the off-nominal portion of the ellipse (an area where much of the archaeological survey within the APE has been conducted). The entirety of the 99.9999 percent nominal ellipse lies within the playa portion of the UTTR South Range, the type of landform identified by the model as having low sensitivity for archaeological sites and where to date no archaeological sites have been identified (although not much survey has been conducted there). Based on the results of previous surveys conducted in the UTTR South Range, and the findings of the Geoarchaeological Sensitivity Model that associate archaeological sites with the landforms that do not occur in the EES landing area, it is unlikely that archaeological sites will be encountered there.

3.5.1.2.2 Environmental Consequences

EES Landing and Recovery

Mission Preparation

As part of mission preparation, drop testing, dress rehearsals, and objects and debris posing a hazard to the EES would be removed from the landing site. Both drop tests and dress rehearsals could potentially occur within the ellipse and/or on test sites identified in Figure 2.1-9. Activities on existing test sites would not be expected to result in any adverse impacts. Objects and debris removal involves the removal of old aerial gunnery tow-target debris and other objects (e.g., railroad ties) within a portion of the nominal landing area ellipse. The exact nature and scale of object removal has not been fully established, but will likely include use of tracked and/or wheeled vehicles and ground-disturbing activities. Currently, NASA is testing different methods for object removal, which may include digging below the ground surface (potentially up to 1.2 meters [4 feet]) to remove the large portions of exposed target debris.

The ground disturbance associated with object/debris removal of the area of the proposed landing could result in adverse effects to historic properties if there are any that cannot be avoided during vehicular transit to/from each object locations, or if an object is located within an archaeological site eligible for listing in the NRHP. All protocols for site preparation and range clearance activities are outlined within the Hill AFB program Programmatic Agreement, and any potential adverse effects would be mitigated through the Standard Mitigation Treatment Measures within the Programmatic Agreement (see Appendix B, Section B.4, Cooperating Agency Agreements).

EES Release/Landing

It is anticipated that the landing will occur while the soils are soft but before they become saturated from rain events in the fall, which would serve to lessen the force of impact to the EES. The EES is expected to create an impact crater of approximately 1.2 meters (4 feet) in depth and 0.5 meter (1.6 feet) in diameter, which is roughly the same size as the EES. Given the composition of the soil, it is expected that soil will be ejected from the impact crater to a distance of approximately 15 meters (49 feet).

The ground disturbance associated with the proposed EES landing could result in adverse effects to historic properties if the EES lands on an archaeological site eligible for listing in the NRHP or if there are any within the approximate 15-meter (49 feet)-radius of the impact crater. All protocols for site preparation and range clearance activities are outlined within the Hill AFB program Programmatic Agreement, and any potential adverse effects would be mitigated through the Standard Mitigation Treatment Measures within the Programmatic Agreement (see Appendix B, Section B.4, Cooperating Agency Agreements).

EES Recovery

EES Recovery would include the following activities, all of which involve some degree of ground disturbance with the potential to adversely affect historic properties, should any exist within the landing site and its immediate vicinity:

- *Transit of recovery teams to the EES landing site*. The recovery team would most likely transit to the EES landing site using helicopters. The use of wheeled vehicles is unlikely because they would easily become stuck in the soft soils; however, use of wheeled vehicles off road to or from staging areas cannot be entirely discounted. Adverse effects to historic properties could result if there are any that cannot be avoided during vehicular transit to the EES landing site.
- *EES recovery*. Once on site, the recovery teams will secure and cordon off the EES landing site. The EES would be contained in a biosafety bag, sealed in a 2-meter by 2-meter (6.5-foot by 6.5-foot) travel case, and the case exterior may be cleaned. The ground disturbance associated with the proposed EES recovery area could result in adverse effects to historic properties if there are any archaeological sites eligible for listing in the NRHP within the cordoned off EES landing site.
- *Transit of recovery teams from the EES landing site to the primary staging area*. Recovery teams would transit from the EES landing site to the primary staging area and the EES would be placed into the Vault for shipment over the road and/or via aircraft to an SRF. Transit methods for recovery teams are described above in item 1. Adverse effects to historic properties could result if there are any that cannot be avoided during vehicular transit from the EES landing site.

- *Decontamination of the landing site*. Although release of Mars sample particles is considered an off-nominal event, the entire landing site (consisting of the impact area and extent of ejecta) may be cleaned as a precautionary measure after removal of the EES. It is assumed that the cleaning process may involve standardized decontamination and/or sterilization methods, which could include high-heat exposure, use of chemicals (such as chlorine dioxide or aldehyde), or a combination of both.

All protocols for the landing of objects from high in Earth's atmosphere (and above) and their associated retrieval activities are outlined within the Hill AFB program Programmatic Agreement, and any potential adverse effects would be mitigated through the Standard Mitigation Treatment Measures within the Programmatic Agreement (see Appendix B, Section B.4, Cooperating Agency Agreements).

3.5.2 No Action Alternative

Under the No Action Alternative, the MSR Campaign would not involve the landing of Mars samples at the UTTR and an SRF would not be developed. Therefore, the No Action Alternative would not result in any additional impacts to cultural resources within or adjacent to the proposed landing site outside of those associated with ongoing and potential future military operations and other activities occurring at the site. Potential impacts associated with development of an SRF would not be realized.

3.6 HAZARDOUS MATERIALS AND WASTE

In general, hazardous wastes include substances that, because of their concentration, physical, chemical, or other characteristics, may present substantial danger to public health or welfare or to the environment when released into the environment or otherwise improperly managed.

3.6.1 Proposed Action

3.6.1.1 Programmatic Analysis

Regulatory Requirements

There are many regulations associated with the management of hazardous materials and waste, with applicability dependent on the types and amounts of hazardous materials and waste associated with the specific processes related to a proposed action. The two main regulations of focus with regards to the proposed action are the Resource Conservation and Recovery Act (RCRA) and the Emergency Planning and Community Right-to-Know Act.

RCRA is the public law that creates the framework for the proper management of hazardous and nonhazardous solid waste, and is the primary regulatory requirement associated with management of hazardous waste.

Emergency Planning and Community Right-to-Know Act imposes requirements for Federal, state, and local governments, tribes, and industry for emergency planning and "Community Right-to-Know" reporting on hazardous and toxic chemicals. The

Community Right-to-Know provisions help increase the public's knowledge and access to information on chemicals at individual facilities, their uses, and releases into the environment. States and communities, working with facilities, can use the information to improve chemical safety and protect public health and the environment. This requirement would apply specifically to an SRF should the SRF store any listed hazardous materials in quantities exceeding reportable thresholds.

The proposed activities at both the UTTR and a potential SRF would be expected to follow all local, state, and Federal regulations for use and disposal of hazardous materials and waste. Hazardous wastes generated at the UTTR are managed as specified in the Hill AFB *Hazardous Waste Management Plan* (HWMP) (Hill AFB 2016). The UTTR RCRA permit (Utah Division of Solid and Hazardous Waste 2013) prescribes responsibilities, policies, and procedures for managing hazardous waste on the installation. The objective of the HWMP is to facilitate the responsible management of hazardous waste by identifying facilities that generate hazardous waste and to summarize the hazardous waste generation processes. The HWMP provides guidance for the management of these facilities and processes in compliance with RCRA regulations and other Federal, State, and Air Force environmental protection laws.

SRF Analysis

For purposes of this PEIS, an SRF would include temporary or permanent facilities used to isolate Restricted Earth Return unsterilized Mars materials from the Earth’s environment. Mars sample and EES elements would not be released from the SRF until proven safe by analysis or sterilization. For the SRF, the affected environment would be the potential location of an SRF and the area surrounding it. The main impact driver for this resource is facility development and operation of an SRF.

Hazardous materials may be used, and waste generated, as a part of the construction of an SRF. Typical construction-related hazardous wastes consist of petroleum, oils and lubricants, as well as paints, adhesives, and solvents. The amounts of hazardous materials used and wastes generated would depend on the size and type of facility. New construction of a large facility would generate more hazardous wastes than would use of a modular facility. Management and disposal of hazardous wastes would be conducted according to Federal and applicable state and local requirements depending on the location of an SRF.

Types of hazardous materials and wastes associated with operation of an SRF facility would likely be consistent with other similar types of facilities. For example, the *National Emerging Infectious Diseases Laboratories Final Environmental Impact Statement* for a BSL-4 laboratory (NIH/DHHS 2005) identified the following waste streams: Flammable Liquids; Flammable, Toxic Liquids; Corrosive Liquids; Oxidizing Liquids; Ethidium Bromide Solids. The types and quantities of hazardous materials and wastes used would be particular to the size and function of an SRF. The waste associated with the Mars Program would be proportionally much smaller due to small-scale activities associated with sample analyses. In any case, all hazardous materials and wastes would be managed according to applicable Federal, state, and local requirements depending on hazardous waste generator status (i.e., large, small, or very small quantity generator).

Siting & Development Considerations

Siting and development of an SRF should consider the following factors to minimize impacts associated with hazardous materials and waste:

- Facility Type and Size: An addition to an existing facility (e.g., addition of BSL-4 capabilities to another BSL-type facility) would allow leveraging of existing hazardous waste management systems. However, depending on SRF functionality and waste generated, this may push the entire facility to a new more restrictive generator status. Smaller, modular facilities limited to handling just exoplanetary samples would also likely limit the amount of hazardous materials required for construction and wastes generated from operations.
- State Location: Some states have more restrictive hazardous waste management requirements. All states are required to implement Federal hazardous waste management requirements based on generator status. However, hazardous waste management requirements vary by state, and the effect of specific state rules would be assessed in a subsequent Tier II document when SRF siting is better specified.

Tier II Analysis Considerations

Once a site is selected, Tier II analysis would need to consider:

- the amounts of waste that might be generated during construction;
- the amounts of hazardous materials and wastes that might be produced during operations and potential generation status of the facility (i.e., large, small, or very small quantity generator);
- Federal, state, and local requirements for the management of hazardous wastes;
- potential disposal sites for the wastes generated; and
- identification of any necessary mitigations required to avoid or minimize identified adverse impacts.

3.6.1.2 Site-Specific Analysis (UTTR/DPG)

3.6.1.2.1 Affected Environment

All hazardous wastes generated on the UTTR South Range and the Det-1 location are managed in accordance with the Hill AFB HWMP (Hill AFB 2016). This plan describes the responsibilities, training, policies, and procedures for managing hazardous wastes on the UTTR and ensures compliance with applicable federal, state, and local laws and regulations at Hill AFB, the UTTR, the Little Mountain Test Annex, and the Det-1 location on DPG. The HWMP applies to all organizations and activities associated with, located on, or occurring at the UTTR (Hill AFB 2016).

NASA would be accountable to the DAF and U.S. Army for complying with all applicable laws governing the proper handling of materials and disposal of waste on their properties. Occupational Safety and Health Administration (OSHA) requirements would also apply depending upon the status of personnel (civilian, military, contractor) regarding the use of appropriate PPE, etc. This compliance must also incorporate and abide by 10 U.S.C. 2692 (*Storage, treatment, and disposal of nondefense toxic and hazardous materials*) requirements for the storage, treatment, and disposal of nondefense toxic/hazardous materials on Department of Defense property. NASA may need a waiver from the DAF and/or U.S. Army to bring any required hazardous materials onto respective properties.

For hazardous waste disposal, NASA would work with the DAF and U.S. Army to determine waste management responsibilities (under the requirements of the Hill AFB HWMP, any applicable U.S. Army requirements, and federal and state regulations) and codify these in a Memorandum of Understanding/Agreement. NASA may pursue acquiring its own EPA Generator identification number for this particular project.

3.6.1.2.2 Environmental Consequences

EES Landing and Recovery

Mission Preparation

As part of mission preparation, drop testing, dress rehearsals, and objects and debris posing a hazard to the EES would be removed from the landing site, including any UXO. Both drop tests and dress rehearsals could potentially occur within the ellipse and/or on test sites identified in Figure 2.1-9. Drop testing and dress rehearsals would not be anticipated to utilize hazardous materials or generate hazardous waste. Site preparation involves the removal of target darts (aerial gunnery tow targets) within the landing ellipse. As stated in Chapter 2 (Description of the Proposed Action and Alternatives), as many as a few hundred may need to be removed. The target darts are nonhazardous material (consisting of wood and metal), and the small amount of waste material generated could be disposed of as standard industrial waste or recycled. Any soil and/or debris associated with landing site preparation that would be disposed of offsite would require sampling utilizing an appropriate EPA method (e.g., toxicity characteristic leaching procedure) to determine appropriate disposition (e.g., solid waste or hazardous waste fill depending upon constituent concentration levels [40 CFR Part 261]). The UTTR may employ reuse (reclamation) for the cables/darts present or they may dispose under the RCRA scrap metal provisions. Although UXO encounters are unlikely (see Section 2.1.3.1, Landing at Utah Test and Training Range), any potential UXO encountered would be handled in accordance with AFMAN 32-3001, *Explosive Ordnance Disposal (EOD) Program*.

EES Release/Landing

The EES contains *de minimis* amounts of hazardous materials consisting of standard aerospace adhesive materials; there are no fuels or other petroleum products used in the EES. Although unlikely, should the EES break up upon impact there would be no release of materials known to be hazardous; Mars material would be the sole potentially hazardous material.

EES Recovery

As discussed in Section 2.1.2.1.3 (Earth Return Orbiter), the recovery team would transit to the landing site and contain the EES. Because the EES should be treated as though potentially hazardous until demonstrated otherwise, the EES would be handled under BSL-4 equivalent protocols and the recovery team would be wearing appropriate personnel protective equipment. The recovery team would handle the landing event as though containment has been compromised and ensure proper containment of the EES. After removal of the EES, the entire landing site (consisting of the impact area and extent of ejecta) may be decontaminated as a precautionary measure.

The process of retrieving the EES and placing it into the vault would be assumed to generate potentially hazardous biological waste until demonstrated otherwise. As described earlier, the process of placing the EES into containment and then inserting it into the vault would be conducted as in past missions. All the systems used, including personnel protective gear, would be assumed to be contaminated and would either be decontaminated or simply discarded as hazardous waste. Wastes could include plastics and clothing. Any liquids used in the decontamination process would be absorbed onto solids prior to disposal.

For purposes of this PEIS, it is assumed that any decontamination process would involve standardized decontamination and/or sterilization methods, in alignment with CBRNE response planning for EPA and the DAF Readiness and Emergency Management Office. It is assumed that any decontamination would be *in situ* using a fumigation method or “safe” liquid (e.g., the sort used for groundwater decontamination) that would allow soils to remain in place with minimal residual hazards, thus eliminating the need for soil removal and minimizing any associated waste generation/disposal issues. The standard decontamination of biohazards in soil typically involves applying chemical sterilants as liquid or fumigants (such as chlorine dioxide or aldehyde) in place (EPA 2017). NASA believes these types of decontaminates would be effective given the assumption that any putative Mars life forms would be similar to “life as we know it” with a water-mediated carbon-based biochemistry, and that there would not be any “unique” biohazards associated with the Mars samples.

Chlorine dioxide is a disinfectant. When added to drinking water, it helps destroy bacteria, viruses and some types of parasites. The EPA regulates the maximum concentration of chlorine dioxide in drinking water to be no greater than 0.8 parts per million. Chlorine dioxide can be used as an antimicrobial agent in water used in poultry processing and to wash fruits and vegetables, chemically process wood pulp for paper manufacturing, and in hospitals and other healthcare environments. Chlorine dioxide gas helps to sterilize medical and laboratory equipment, surfaces, rooms and tools. In its pure form, chlorine dioxide is a hazardous gas but rapidly breaks down in air to chlorine gas and oxygen. For workers who use chlorine dioxide, OSHA regulates the level of chlorine dioxide in workplace air for safety. OSHA has set a Permissible Exposure Limit for chlorine dioxide at 0.1 parts per million, or 0.3 milligrams per cubic meters for workers using chlorine dioxide for general industrial purposes. OSHA also has a Permissible Exposure Limit for chlorine dioxide for the construction industry. Chlorine dioxide is always made at the location where it is used (Chemicalsafetyfacts.org 2022).

Aldehydes are highly effective, broad-spectrum disinfectants, which typically achieve sterilization by damaging proteins. Aldehydes are effective against bacteria, fungi, viruses, mycobacteria and spores. Aldehydes are non-corrosive to metals, rubber, plastic and cement. They are highly irritating, toxic to humans or animals with contact or inhalation, and are potentially carcinogenic. Personal protective equipment (i.e., nitrile gloves, fluid resistant gowns, eye protection) is required for handling of aldehydes. (CleaningforHealth.org 2011). Examples of aldehydes include formaldehyde and glutaraldehyde.

Potentially hazardous waste associated with biosafety chemical decontamination methods would consist of items such as PPE and soil, the volumes of which would be dependent on the decontamination method and the area and depth of soil decontaminated. However, as stated previously, it is anticipated that any decontamination methods utilized would be *in situ*, and thus preclude the removal of any soils. Any soil or debris that would be disposed of offsite would require sampling to determine appropriate disposition.

Wastes potentially generated at the Det-1 location would be mainly associated with PPE disposal; no Mars particles would be disposed of at the Det-1 location. Management and disposal of hazardous wastes would be conducted according to the Hill AFB HWMP and would be disposed at an approved disposal site. If the biosafety decontamination methods analyzed in this PEIS are substantially modified, or significant new information or circumstances relevant to environmental concerns and bearing on the Proposed Action or its impacts are identified, then NASA may prepare a supplement to this PEIS with the required analysis as determined to be necessary or address the changes within the Tier II analysis.

3.6.2 No Action Alternative

Under the No Action Alternative, the MSR Campaign would not involve the landing of Mars samples at the UTTR and an SRF would not be developed. Therefore, the No Action Alternative would not result in any additional impacts associated with hazardous waste within or adjacent to the proposed landing site outside of those associated with ongoing and potential future military operations and other activities occurring at the site. Potential impacts associated with development of an SRF would not be realized.

3.7 SOILS AND GEOLOGY

Soils and geology refer to unconsolidated materials overlying bedrock or other parent material, as well as the materials underlying the soil, within the affected environment. Soil structure, elasticity, strength, shrink-swell potential, and erodibility all determine the ability of the ground to support man-made structures and facilities, provide a landscaped environment, and control the transport of eroded soils into nearby drainages.

3.7.1 Proposed Action

3.7.1.1 Programmatic Analysis

Regulatory Requirements

Regardless of location or soil type, ground disturbance of more than one acre would require a National Pollutant Discharge Elimination System (NPDES) permit for stormwater discharges from construction activity. The NPDES permit program addresses water pollution by regulating point sources that discharge pollutants to waters of the United States. Established in 1972 by the Clean Water Act (CWA), the authority to administer the NPDES permit program has been delegated by EPA to most states, which are then responsible for permitting, enforcement, and administrative aspects of the program. EPA retains authorization for the program components for which a state is not authorized. Any required NPDES permit application(s) would be submitted to the state agency with jurisdiction for administration of the NPDES permit program, or to the EPA in situations where NPDES permitting authority has not been delegated to the state. In states authorized to implement CWA programs, EPA retains oversight responsibilities. Currently 47 states and one territory are authorized to implement the NPDES program.

All NPDES permits for construction stormwater would be required to address the minimum Federal effluent limitation guidelines for the construction and development point source category (referred to as “the C&D rule”). The C&D rule found in 40 CFR § 450.21 establishes minimum NPDES effluent limitations, such as:

- design, install, and maintain effective erosion and sediment controls, and pollution prevention measures, to minimize the discharge of pollutants;
- stabilize disturbed areas immediately when construction has ceased and will not resume for more than 14 days;
- prohibit dewatering discharges unless managed by appropriate controls;
- prohibit the discharge of:
  - wastewater from concrete washout (unless managed by appropriate control), or washout/cleanout of stucco, paint, form release oils, other wastewater materials;
  - fuels, oils, or other pollutants used for vehicles; and
  - soaps or solvents to wash vehicles and equipment.

Typically, as part of the NPDES construction permitting requirements, the proponent is required to develop a construction Sediment and Erosion Control Plan or something similar that identifies Best Management Practices (BMPs) to address these effluent limitations.

SRF Analysis

For the SRF, the affected environment would be the potential location of an SRF and the area surrounding it. Operation of an SRF would not be anticipated to impact soils or geology; the main impact driver for this resource is the site development associated with establishment of an SRF. Construction activities typically involve soil disturbance associated with site leveling, grading, and other earth moving activities such as excavation to support foundation development and infrastructure installation. This results in direct impact to the soil profile. The amount of soil disturbance would be dependent on the type and size of the facility, as well as the need for any additional or ancillary infrastructure (such as underground utilities and parking). Generally, modular facilities or additions to existing facilities would result in less soil disturbance than construction of a new brick-and-mortar type facility. Development of other infrastructure such as stormwater conveyances and retention basins would also require soil disturbance. Whether the location of the facility is in a developed or undeveloped area may affect the amount of soil disturbance required, because location of a facility in an already developed or improved area may reduce the construction footprint through the use of existing infrastructure, therefore minimizing the necessary scope of soil disturbance.

Soil suitability factors for development may also affect the scope of soil disturbance, and soil type may factor into the scope of potential impact. For example, soil types such as soft, sandy soils are less suitable for development because they require more stabilization efforts, and over time can erode and adversely affect foundations; however, these soils are less productive in terms of biology due to low organic content. Loam is the best soil type for construction due to its ideal combination of silt, sand, and clay. Loam generally does not shift, expand, or shrink drastically and handles the presence of water very well. However, loamy soils with good organic content are productive soils from a biological or agricultural perspective, and development of a facility in an area consisting or organic, loamy soils would result in a loss of localized soil productivity.

As a geologic element, seismic activity (i.e., earthquakes) can adversely affect the structural integrity of any facility not properly designed to withstand such stressors. In the case of a BSL-4 type facility intended to provide containment and control of hazardous or potentially hazardous materials, seismic activity can be a potential hazard that should be accounted for during planning and design.

Siting & Development Considerations

Siting and development of an SRF should consider the following factors to minimize the potential for adverse impacts to soils and geology:

- Developed vs. Undeveloped Location: siting the facility in a developed/improved location may reduce the construction footprint through the use of existing infrastructure and may minimize the scope of required soil disturbance.
- Facility Type and Size: An addition to an existing facility (e.g., addition of BSL-4 capabilities to another BSL-type facility) would minimize the amount of ground disturbance required. New construction (and associated infrastructure) would likely result in the largest scope of soil disturbance. Regardless of the size of the facility and associated infrastructure, a Construction General Permit for stormwater discharges would need to be obtained if the construction would disturb one acre or more of land, and from smaller sites that are part of a larger, common plan of development that collectively would disturb 0.4 hectare (1 acre)

or more. Smaller, modular facilities would minimize the amount of ground disturbance and potential need for a NPDES permit.

- Soil Type: Selection of an SRF location with a soil type suitable for the type of facility planned (e.g., loamy soil for new permanent fixed above and below ground infrastructure), or co-location of the SRF with an existing facility, may reduce the amount of soil disturbance or backfill required during facility construction. Avoidance of soils suitable for agricultural purposes would help maintain localized soil productivity.
- Geologic Hazards: Siting considerations should account for the potential for seismic activity and the potential for such occurrences to affect structural integrity. Structures should be designed accordingly.

Tier II Analysis Considerations

Once a site is selected, Tier II analysis would need to consider:

- the soil types potentially impacted;
- the amount/area of soil potentially disturbed and the potential for, and scope of, soil erosion;
- the need for a NPDES permit;
- geologic limitations and/or influence on-site development; and
- identification of any necessary mitigations required to avoid or minimize identified adverse impacts.

3.7.1.2 Site-Specific (UTTR/DPG)

The affected environment for the Proposed Action within the context of soils is the UTTR South Range. There would be no ground disturbance associated with use of the Det-1 location. The UTTR is part of the Great Basin Region and Range Physiographic Province, which is characterized by fault-block mountain ranges trending north and south, separated by alluvium-filled valleys and closed desert basins. During the late Pleistocene Epoch, Lake Bonneville covered the UTTR area. Lake Bonneville was a freshwater lake that at its maximum extent covered an area of approximately 50,000 km^2 (19,305 mi^2) and had a depth of more than 330 meters (984 feet) (Hill AFB 2019).

The two most common soils on the UTTR are the Playas and Playas-Saltair Complex soils. The Playas soil type covers 62 percent of the South Range and is found primarily in the low-lying, flat portions of the range, which is the location of the proposed landing site. The next most common soil type in the South Range is the Saltair-Playas Complex, which covers 4.5 percent of the area. These soil types are not suitable for rangeland, wildlife, cropland, roads, or building site development (Hill AFB 2019). Therefore, while there would be ground disturbance associated with landing site preparation, EES landing, and EES recovery operations, disturbance would be localized and would not result in loss of soil productivity or significant erosion given the flat land area and lack of substantive precipitation (annual precipitation for the UTTR is 0.13 to 0.20 meters (5 to 8 inches), most of which falls as snow in the winter months) (Hill AFB 2019).

Given the context of the landing site, and low intensity of the action, on-site mission preparation (to include testing, rehearsals, and landing site preparation), EES landing, EES recovery, and EES transportation operations are expected to have minimal impacts on soils and geology at the UTTR. Ground disturbance for similar activities at the UTTR were found to have no significant impacts on soils or geology (see Table 1.1-1). During landing site preparation and EES recovery operations, standard practices for preventing soil erosion would be employed:

- minimize the size of the disturbed area associated with landing site preparation activities (e.g., aerial target debris removal) and EES recovery operations;
- stockpile all excavated soils and protect them from wind and water erosion and replace or remove stockpiles when activity is complete; and
- to the maximum extent practicable, restore the environmental condition of the affected landing area to its pre-disturbance condition.

3.7.2 No Action Alternative

Under the No Action Alternative, the MSR Campaign would not involve the landing of Mars samples at the UTTR and an SRF would not be developed. Therefore, the No Action Alternative would not result in any additional impacts to soils or geology within or adjacent to the proposed landing site outside of those associated with ongoing and potential future military operations and other activities occurring at the site. Potential impacts associated with development of an SRF would not be realized.

3.8 BIOLOGICAL RESOURCES

Biological resources are defined as the native and introduced terrestrial and aquatic vegetation and wildlife found in the affected environment. For the purposes of this analysis, biological resources are organized into three categories: vegetation, wildlife, and special-status species. Vegetation includes existing plant communities, within an area that generally determines ecological function and quality of available habitats, which in turn influences the composition, diversity, and abundance of animals. Wildlife includes all animals, including large and small mammals, birds, waterfowl, reptiles, amphibians, and invertebrates. Special status plant and wildlife species are those species subject to regulations under the authority of Federal and state agencies.

3.8.1 Proposed Action

3.8.1.1 Programmatic Analysis

Regulatory Requirements

Regardless of siting location NASA must comply with the Endangered Species Act (16 U.S.C. 531–1543). The purpose of the Endangered Species Act is to provide a means to conserve the ecosystems upon which endangered and threatened species depend and provide a program for the conservation of such species.

The Endangered Species Act directs all Federal agencies to participate in conserving these species. Specifically, Section 7(a)(1) of the Endangered Species Act charges Federal agencies to aid in the conservation of listed species, and Section 7(a)(2) requires the agencies to ensure their activities are not likely to jeopardize the continued existence of Federally-listed species or destroy or adversely modify designated critical habitat. The provision under Section 7 that is most often associated with the Service and other Federal agencies is Section 7(a)(2). It requires Federal agencies to consult with the Service(s) to ensure that actions they fund, authorize, permit, or otherwise carry out will not jeopardize the continued existence of any listed species or adversely modify designated critical habitats. The consultation process can vary depending on the complexity of the project or action. The consultation process usually begins as informal consultation. The Federal agency must initiate consultation when any action they authorize, fund, or carry out (such as through a permit) may affect a listed endangered or threatened species or designated critical habitat. If the Federal agency determines, through a biological assessment or other review, that its action is likely to adversely affect a listed species, the agency submits to the Service a request for formal consultation. During formal consultation, the Service and the agency share information about the proposed project and the species or critical habitat likely to be affected. Formal consultation may last up to 90 days, after which the Service will prepare a biological opinion.

The intent of a biological opinion is to analyze the effects of the proposed action to the listed species or designated critical habitat. The conclusion of the biological opinion will state whether the federal agency has ensured that its action is not likely to jeopardize the continued existence of a listed species and/or result in the destruction or adverse modification of critical habitat. A biological opinion usually includes conservation recommendations to further the recovery of listed species, and it also may include reasonable and prudent measures, as needed, to minimize any "take" of listed species. If a proposed action is reasonably certain to cause incidental take of a listed species, the Services, under 50 CFR § 402.14(i), issue along with the biological opinion an incidental take statement that specifies, among other requirements: The impact of such incidental taking on the listed species; measures considered necessary or appropriate to minimize the impact of such take; terms and conditions (including reporting requirements) that implement the specified measures; and procedures to be used for handling or disposing of individuals that are taken.

Were NASA to identify a location for the SRF that would potentially impact species listed under the Endangered Species Act or associated critical habitat, NASA would be required to consult with the respective U.S. Fish and Wildlife Service (USFWS) district under Section 7 of the Endangered Species Act. Based on analysis presented in Section 3.8.1.2 (Site-Specific Analysis [UTTR/DPG]), there are no Endangered Species Act-protected species located on the UTTR; thus, there would be no effect to Endangered Species Act-protected species and consultation with the USFWS is not required.

All states also have sensitive species lists, and some states require consultation and/or coordination with respective fish and wildlife services/departments regarding potential impacts to state-listed species. Depending on proposed SRF site location, NASA may need to coordinate with state fish and wildlife services in this regard.

EO 13112, *Invasive Species*, states that no Federal agency shall authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive nonnative species in the United States or elsewhere. The chosen location should be evaluated for the presence of nonnative invasive species and BMPs should be implemented during construction and landscaping efforts to ensure that nonnative invasive species are not spread or introduced to the locale. In keeping with EO 13112 and to reduce introduction of potential invasive species, equipment should be inspected and cleaned prior to first-time use at the site and only weed-free landscaping materials should be used. If areas of invasive species infestations were to be discovered, they should be treated with approved herbicides in accordance with guidance provided on the label.

SRF Analysis

For the SRF, the affected environment would be the potential location of an SRF and the area surrounding it. Operation of an SRF would not be anticipated to impact biological resources; the main impact driver for this resource is the development of an SRF. Construction activities that may impact biological resources include vehicle and equipment operation, land clearing, earth moving, stormwater runoff, and potential introduction of invasive species. These activities may result in injury, mortality, alterations to behavior and reproduction, water quality alterations causing physiological impacts, removal or adverse effects to co-located or adjacent wetlands (addressed in Section 3.9, Water Resources) and increased competition from invasive species.

Depending on the location chosen for the SRF, construction activities may involve land clearing and the use of heavy equipment, which could result in the removal of wildlife habitats and inadvertent mortality of small animals, both of which would be considered direct adverse impacts. Soil erosion and sediment transport as a result of ground disturbance may also indirectly impact any aquatic species within nearby surface waters or wetlands.

The amount of land clearance and earth moving required would be dependent on the type and size of the facility, as well as the need for any additional or ancillary infrastructure (such as utility installation, access road construction, parking, etc.). Generally, the amount of land clearing and need for habitat removal would be associated with the site chosen for the SRF, in conjunction with the type and size of facility. Siting an SRF in previously undeveloped locations with heavy ground cover would require more habitat removal than would placement of a facility in an area that is already developed or improved (such as an industrial park). Constructing a modular facility, an addition to an existing facility, or a new brick-and-mortar type facility within a previously developed or improved area would not be expected to result in significant impacts to biological resources as these areas typically have minimal vegetation and do not provide suitable or high-quality habitat for protected or sensitive wildlife or plant species. Clearing of undeveloped areas for facility development would likely result in adverse impacts; however, the significance of the impact would be dependent on the type and quality of the habitat and the type and abundance of species present.

Development of any type of facility also presents the potential for introduction of invasive nonnative species to the location from construction vehicles and equipment (if previously used in other locations and not cleaned prior to project site use), and supplies, and poor post-construction landscaping practices, which would have the potential to alter native plant communities through increased competition.

Siting & Development Considerations

Siting and development of an SRF should consider the following factors to minimize the potential for adverse impacts to biological resources:

- <u>Developed vs. Undeveloped Location</u>: siting the facility in a developed/improved location may reduce the amount of land clearing and habitat disturbance required. Siting within undeveloped areas should avoid quality wildlife habitat and should not include critical habitat for sensitive species. Developed/improved locations are also less likely to include sensitive species.
- <u>Facility Type and Size</u>: An addition to an existing facility (e.g., addition of BSL-4 capabilities to another BSL-type facility) may reduce the amount of land disturbance required. Smaller, modular facilities would likely reduce the amount of land required.
- <u>Proximity to Sensitive Habitats</u>: Outside of siting within developed/undeveloped areas, siting should also consider proximity to sensitive habitats such as wetlands and protected areas such as wildlife preserves to avoid direct and indirect impacts to these habitats and associated species.

Tier II Analysis Considerations

Once a site is selected, Tier II analysis would need to consider:

- the habitat type and amount of habitat area potentially impacted;
- identification of the vegetation, wildlife, and special-status species (e.g., Federally and/or state listed, threatened, endangered or candidate species) potentially impacted within the context of importance (legal, commercial, ecological, or scientific) of the species, habitat function, sensitivity, and the availability of regionally similar resources and the need for associated consultation under Section 7 of the Endangered Species Act; and
- identification of any necessary mitigations required to avoid or minimize identified adverse impacts. The action should seek to avoid or minimize: adverse impacts to state-listed species, migratory birds, eagles, and species proposed for listing and their habitats; long-term or permanent loss of unlisted species; substantial reduction, disturbance, degradation, fragmentation, or loss of native species' habitat or their populations; and adverse impacts on a species' natural mortality rates, non-natural mortality, reproductive success rates, or ability to sustain the minimum population levels necessary for population maintenance.

3.8.1.2 Site-Specific Analysis (UTTR/DPG)

The affected environment accounts for areas that could potentially be directly or indirectly affected by ground disturbance associated with landing site preparation, EES landing, and EES recovery. There would be no ground disturbance or other activities affecting biological resources at the Det-1 location. Therefore, the biological resource affected environment for the Proposed Action is defined as species and habitats within and adjacent to the landing ellipse on the UTTR South Range. The area of the landing ellipse on the UTTR South Range consists mainly of hard and soft playa soils. There is little-to-no vegetation associated with the landing ellipse area. Several desert wildlife species are known to occur on the UTTR South Range, and potentially within the landing area ellipse, and are identified within the *Hill AFB Integrated Natural Resources Management Plan*; there are no known threatened or endangered species or habitat documented to occur within the area of the landing ellipse (Hill AFB 2019, USFWS 2022). Vegetation and small wildlife species may be directly impacted by wheeled vehicle movement during landing site preparation and EES recovery operations. However, it is expected that mobile wildlife species would move from the area as vehicles approach. Some less-mobile species may be directly impacted; however, personnel would be trained to recognize and avoid wildlife.

On-site mission preparation (to include testing, rehearsals and landing site preparation), EES landing, EES recovery, and EES transportation operations are expected to have minimal direct and/or indirect impacts on the biotic environment at the UTTR and DPG given the context of the landing area (e.g., desert playa with sparse vegetation and lack of suitable wildlife habitat) and Det-1 location (improved, paved area) and the intensity of the action (temporary disturbance). Analysis of similar activities at the UTTR were found to have no significant impacts on biological resources (see Table 1.1-1). To prevent the introduction of invasive plant species, all vehicles not native to the UTTR would be inspected and cleaned prior to entry onto the UTTR.

3.8.2 No Action Alternative

Under the No Action Alternative, the MSR Campaign would not involve the landing of Mars samples at the UTTR and an SRF would not be developed. Therefore, the No Action Alternative would not result in any additional impacts to biological resources within or adjacent to the proposed landing site outside of those associated with ongoing and potential future military operations and other activities occurring at the site. Potential impacts associated with development of an SRF would not be realized.

3.9 WATER RESOURCES

Water resources include wetlands, floodplains, surface waters, and groundwater. Wetlands are areas of transition between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water (Mitsch and Gosselink 2000).

Wetlands

The U.S. Army Corps of Engineers (USACE) defines wetlands (33 CFR § 238.3(b)) as “those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.” The definition excludes non-vegetated areas such as streams, ponds, and mudflats.

AFMAN 32-7003, *Environmental Conservation*, requires early public notice for any actions occurring in wetlands, as well as issuance of a Finding of No Practicable Alternative indicating that all practicable alternatives were considered to try and avoid and/or minimize potential impacts to wetlands.

Floodplains

AFMAN 32-7003, *Environmental Conservation*, defines “floodplains” as “Lowland and relatively flat areas adjoining inland and coastal waters including flood prone areas of offshore islands, including at a minimum, that area subject to a one percent or greater chance of flooding in any given year [EO 11988].” Floodplains provide value by serving as natural flood and erosion control, maintaining surface water quality by filtering nutrients and impurities, increasing biological productivity, and providing societal benefits such as open space for recreational opportunities and enhanced agricultural lands. Floodplains are often discussed in terms of the 100-year flood and 500-year flood. The 100-year flood (or base flood) is a flood having a 1-percent chance of occurring in a given year in areas where Federal floodplain development regulations are enforced. The 500-year flood is a flood that has a 0.2-percent chance of occurring in any given year.

Similar to wetlands, AFMAN 32-7003 requires early public notice for any actions occurring in floodplains, as well as issuance of a Finding of No Practicable Alternative indicating that all practicable alternatives were considered to try and avoid and/or minimize potential impacts to floodplains.

Surface Water

Surface-water resources include streams, rivers, lakes, ponds, estuaries, and oceans and are important for a variety of reasons, including economic, ecological, recreational, and human health factors.

Groundwater

Groundwater is subsurface water that occupies the space between sand, clay, and rock formations. The term *aquifer* is used to describe the geologic layers that store or transmit groundwater, such as to wells, springs, and other water sources.

3.9.1 Proposed Action

3.9.1.1 Programmatic Analysis

Regulatory Requirements

Federal regulations in 40 CFR § 122.26(b)(14)(i)-(xi) require stormwater discharges associated with specific categories of industrial activity to be covered under NPDES permits (unless otherwise excluded). One of the categories – construction sites that disturb 2.023 hectares (5 acres) or more – is generally permitted separately because of the significant differences between those activities and the others. It is unlikely that this industrial stormwater requirement would apply, as it mostly covers types of industrial activities that are exposed to the environment. NASA would need to coordinate with the particular state and EPA to determine NPDES Industrial Stormwater Permit applicability.

The Federal Water Pollution Control Act (commonly known as the CWA) (33 U.S.C. 1251 et seq.) was established to regulate discharges of pollutants to surface waters, including wetlands. There are a variety of permits which may be required for potential development actions that may affect jurisdictional waters or wetlands. Section 402 of the CWA prohibits the discharge of a pollutant into waters of the U.S. without a permit (including construction general permits as discussed above). Section 404 of the CWA requires a permit before "dredged or fill material" is discharged into waters of the U.S. including wetlands. As part of the permitting process, Section 401 of the CWA requires permit applicants to include a state water quality certification that the activity will not result in an exceedance of any applicable effluent limitation/state water quality standard.

EO 11990, *Protection of Wetlands*, states that Federal actions must avoid to the extent possible the long- and short-term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative. Potential development actions that may affect streams and/or wetlands require a permit from USACE for dredging and filling in wetlands. Section 401 of the CWA includes requirements that a project does not violate State water quality standards. NASA would be required to comply with requirements of EO 11990 and any applicable state water quality requirements.

Section 438 of the *Energy Independence and Security Act* (42 U.S.C. 17094) directs that the sponsor of any development or redevelopment project involving a Federal facility with a footprint that exceeds 464 square meters (5,000 square feet) shall use site planning, design, construction, and maintenance strategies for the property to maintain or restore, to the maximum extent technically feasible, the predevelopment hydrology of the property with regard to the temperature, rate, volume, and duration of flow.

EO 11988, *Floodplain Management*, requires Federal agencies to take action to reduce the risk of flood damage; minimize the impacts of floods on human safety, health, and welfare; and restore and preserve the natural and beneficial values served by floodplains. Federal agencies are directed to consider the proximity of their actions to or location within floodplains. The National Flood Insurance Act established the National Flood Insurance Program, which is a voluntary floodplain management program for local communities. The National Flood Insurance Program is based on a mutual agreement between the Federal government and communities. Communities that participate in the National Flood Insurance Program agree to regulate floodplain development according to certain criteria and standards. Placement of a facility within a floodplain would require design considerations to ensure no adverse impacts to floodplain utility (or the facility itself from flooding) and may require that NASA coordinate with the local municipality or state for any local floodplain requirements.

Other Federal or state water resource regulations may apply to the action depending on alternatives under consideration; NASA would be required to coordinate with associated state and local agencies to identify specific applicable requirements.

SRF Analysis

For the SRF, the affected environment would be the potential location of an SRF and the area surrounding it. Both construction and operation of an SRF may have the potential to affect water resources, each in a different manner. Depending on the type and size of the facility, operation of the SRF may involve industrial stormwater discharges to the environment, while development of the SRF may have a direct or indirect impact on water resources from sedimentation runoff during construction (addressed under Section 3.7, Soils and Geology) and may require a general stormwater construction permit. Siting an SRF within or in close proximity to a wetland or floodplain can directly or indirectly affect resource productivity and/or utility. It is assumed that an SRF would utilize municipal potable water both during construction and operation; therefore, use of groundwater is not addressed.

The amount of impervious surface (i.e., the building itself and any pavement) associated with the facility would directly correlate to the amount of stormwater runoff associated with the site after construction and during operation of the facility. Runoff from rainfall or snowmelt that comes in contact with impervious surfaces can pick up pollutants and transport them directly to a nearby river, lake, wetland, or coastal water or indirectly via a storm sewer and degrade water quality. Depending on the amount of impervious surface area associated with the facility, stormwater conveyance and retention systems may be required to reduce or minimize stormwater discharges to the environment.

Direct and indirect impacts to wetlands and floodplains would be associated with soil runoff during construction, which is addressed under Section 3.7 (Soils and Geology). BMPs related to construction (e.g., a Sediment and Erosion Control Plan) would serve to minimize potential adverse impacts. Direct impacts would be associated with siting an SRF within a wetland or floodplain. Siting within wetlands would require dredging and/or filling of a wetland, thus resulting in the direct loss of the wetland (or a portion thereof). Siting the facility within a floodplain would require ground elevation to avoid flooding of the facility, which would in turn negatively impact the utility of the floodplain.

SRF site development may be subject to Energy Independence and Security Act Section 438. Low impact development practices such as bioretention areas, permeable pavements, or cisterns/recycling would be implemented to maintain predevelopment site hydrology to the maximum extent practicable.

Siting and Development Considerations

Siting and development of an SRF should consider the following factors to minimize the potential for adverse impacts to water resources:

- <u>Proximity to Water Resources</u>: Siting should avoid close proximity to wetland areas and floodplains. Siting should also consider proximity to other surface waters such as rivers, lakes, wetlands, and streams due to the effect of stormwater runoff from impervious surfaces.
- <u>Developed vs. Undeveloped Location</u>: A developed location may allow for use of existing stormwater infrastructure and may reduce the amount of impervious surface necessary for ancillary infrastructure such as parking, access roads, and sidewalks, etc. However, addition of more impervious surface area to an already developed location may place additional stress on existing stormwater systems. An undeveloped location may provide more options for stormwater management,

but would likely result in more impervious surface area (depending on facility type and design) and more ground disturbance.

- Facility Type and Size: An addition to an existing facility (e.g., addition of BSL-4 capabilities to another BSL-type facility) or use of smaller modular facilities may reduce the amount of additional impervious surface required. New construction of a larger facility may require construction of stormwater conveyance infrastructure.

Tier II Analysis Considerations

Once a site is selected, Tier II analysis would need to consider:

- The identification of water resources within the affected environment.
  - National Wetland Inventory, 100- and 500-year Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps, and Geographic Information System data should be utilized to identify water resources.
- If site development results in direct impacts to wetlands, coordination with the USACE may be required for a jurisdictional wetland determination and a CWA Section 404 permit may be required.
- If site development results in direct impacts to wetlands or floodplains, NASA would be required to identify the lack of practicable alternatives to that particular site.
- The amount of impervious surface area required at the end state and the need for stormwater conveyance to accommodate any additional stormwater runoff.
- If the facility does not use municipal potable water, groundwater drawdown impacts should be assessed by comparing the authorized use rates of groundwater extraction wells on the property with the anticipated usage rate for the proposed facilities and operations.

3.9.1.2 Site-Specific Analysis (UTTR/DPG)

The affected environment accounts for areas that could potentially be affected either directly or indirectly by activities associated with on-site mission preparation (to include testing and rehearsals and landing site preparation), EES landing, and EES recovery. There would be no ground-disturbing activities at the Det 1 location and, therefore, no direct or indirect impacts to water resources. The water resource affected environment for the Proposed Action is defined as water resources within and adjacent to the landing ellipse on the UTTR South Range. The UTTR has no permanent streams (Hill AFB 2019), and there are no identified intermittent or ephemeral surface waters within the proposed landing site. The area of the landing ellipse does not contain any wetlands, floodplains, or surface waters. The closest surface water area is Blue Lake, which is comprised of 6,070 hectares (15,000 acres) of wetlands near the Nevada border of the UTTR South Range, more than 32 km (20 mi) west of the proposed landing site.

The major groundwater reservoir beneath the UTTR is an unconsolidated to partially consolidated basin fill, which is more than 305 meters (1,000 feet) thick and supplies three major aquifers in the region. The basin fill aquifer consists of older alluvial sediments that probably underlie most of the UTTR and the proposed landing site (Hill AFB 2019).

Given the context of the action area (no water resources), on-site mission preparation (to include testing and rehearsals and landing site preparation), EES landing, EES recovery, and EES transportation, operations are expected to have no direct or indirect impacts to water resources at the UTTR or DPG. Analysis of similar activities at the UTTR and DPG were found to have no significant impacts on water resources (see Table 1.1-1).

3.9.2 No Action Alternative

Under the No Action Alternative, the MSR Campaign would not involve the landing of Mars samples at the UTTR and an SRF would not be developed. Therefore, the No Action Alternative would not result in any additional impacts to water resources within or adjacent to the proposed landing site outside of those associated with ongoing and potential future military operations and other activities occurring at the site. Potential impacts associated with development of an SRF would not be realized.

3.10 AIR QUALITY/CLIMATE

Air quality is determined by the type and amount of pollutants emitted into the atmosphere, the size and topography of the air basin, and the prevailing meteorological conditions. The levels of pollutants are generally expressed on a concentration basis in units of parts per million or micrograms per cubic meter.

The baseline standards for pollutant concentrations are the National Ambient Air Quality Standards (NAAQS) and state air quality standards established under the Clean Air Act (CAA) and amendments of 1990. These standards represent the maximum allowable atmospheric concentration that could occur and still protect public health and welfare. The NAAQS provide both short- and long-term standards for the following criteria pollutants: carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter less than or equal to 10 micrometers in diameter, particulate matter less than or equal to 2.5 micrometers in diameter, ozone, and lead.

Under the CAA, the EPA may delegate (i.e., transfer) primary implementation and enforcement authority for most of the Federal standards to state, local, or tribal regulatory agencies. Prior to such delegation, EPA must determine that the state, local, or tribal entity has adequate legal authorities and resources to enforce the CAA's requirements. To accomplish this, states develop, and receive approval from the EPA to implement, a State Implementation Plan (SIP). A SIP identifies goals, strategies, schedules, and enforcement actions designed to reduce the level of pollutants in the air and bring the state into compliance with the NAAQS.

All areas of the United States are designated as having air quality better than (attainment) or worse than (nonattainment) the NAAQS. Areas for which the air quality data are insufficient for the EPA to form a basis for attainment status are unclassifiable. Such areas are treated as attainment areas until proven otherwise. Nonattainment areas in which air pollution concentrations have been successfully reduced to levels below the standard are designated as “maintenance areas.” Maintenance areas are subject to special maintenance plans to ensure compliance with the NAAQS.

Hazardous air pollutants (HAPs) are chemicals known to or suspected of causing cancer or other serious health effects for which occupational exposure limits have been established. Some volatile organic compounds are classified as HAPs. Volatile organic compounds are also precursors to ozone depletion. Any organic compound involved in atmospheric photochemical reactions, except those designated by EPA as having negligible photochemical reactions, are contributors to ozone depletion. HAPs are not covered by the NAAQS, but could present a threat of adverse human health or environmental effects under certain conditions.

Greenhouse Gases

Greenhouse gases (GHGs) are gases that trap heat in the atmosphere; the accumulation of these gases in the atmosphere has been attributed to increases in global temperature with associated changes to Earth’s biosphere. Human influence on the climate system is clear, and recent anthropogenic emissions of GHGs are the highest in history. Recent climate changes have had widespread impacts on human and natural systems (IPCC 2021).

3.10.1 Proposed Action

3.10.1.1 Programmatic Analysis

Regulatory Requirements

For any site under consideration within a “nonattainment” or “maintenance” area, NASA may be required to comply with the EPA General Conformity Rule. This rule applies to Federal actions occurring in nonattainment or maintenance areas when the total direct and indirect emissions of nonattainment pollutants (or their precursors) exceed specified thresholds called *de minimis* thresholds. A conformity applicability analysis is the first step of a conformity evaluation and assesses whether a Federal action must be supported by a conformity determination. This is typically done by quantifying applicable direct and indirect emissions that are projected to result due to implementation of the Federal action. If the results of the applicability analysis indicate that the total emissions would not exceed the *de minimis* emissions thresholds, then the conformity evaluation process is completed. If *de minimis* thresholds would be exceeded, the agency is required to complete a conformity determination in which the action must be shown to conform with the applicable SIP(s).

New major stationary sources and major modifications at existing major stationary sources are required by the CAA to obtain an air pollution permit before commencing construction. This permitting process for major stationary sources is called a New Source Review and is required whether the major source or major modification is planned for nonattainment areas or attainment and unclassifiable areas. In general, permits for sources in attainment areas and for other pollutants regulated under the major source program are referred to as Prevention of Significant Deterioration (PSD) permits, while permits for major sources emitting nonattainment pollutants and located in nonattainment areas are referred to as nonattainment New Source Review permits. In addition, a proposed project may have to meet the requirements of nonattainment New Source Review for the pollutants for which the area is designated as nonattainment and PSD for the pollutants for which the area is designated as attainment. Additional PSD permitting thresholds apply to increases in stationary source GHG emissions. PSD permitting can also apply to a new major stationary source (or any net emissions increase associated with a modification to an existing major stationary source) that is constructed within 9.9 km (6.2 mi) of a Class I area and that would increase the 24-hour average concentration of any regulated pollutant in the Class I area by 1 microgram per cubic meter or more. Class I Federal lands include areas such as national parks, national wilderness areas, and national monuments. These areas are granted special air quality protections under Section 162(a) of the Federal CAA (EPA 2020a).

The Title V Operating Permit Program consolidates all CAA requirements applicable to the operation of a source, including requirements from the SIP, preconstruction permits, and the air toxics program. It applies to stationary sources of air pollution that exceed the major stationary source emission thresholds, as well as other non-major sources specified in a particular regulation. The program includes a requirement for payment of permit fees to finance the operating permit program whether implemented by EPA or a state or local regulator. Installations subject to Title V permitting shall comply with the requirements of the Title V Operating Permit Program, which are detailed in 40 CFR Part 70 and all specific requirements contained in their individual permits.

Other state air quality regulations may apply to the action depending on alternatives under consideration; NASA would be required to coordinate with associated state and local agencies to identify specific applicable requirements.

Analyses should be commensurate with projected GHG emissions and climate impacts and should employ appropriate quantitative or qualitative analytical methods to ensure useful information is available to inform the public and the decision-making process in distinguishing between alternatives and mitigations. The six primary GHGs, as defined by the EPA under Section 202(a) of the CAA by rulemaking (see Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the CAA, 74 Federal Register 66495–66546, 15 December 2009) are carbon dioxide (CO_2), methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride.

SRF Analysis

For the SRF, the affected environment would be the potential location of an SRF and the area surrounding it, typically the Air Quality Control Region associated with the location(s) being considered. Both construction and operation of an SRF may have the potential to affect air quality associated with emissions from point sources and mobile sources. Point sources are stationary sources that can be identified by name and location. Mobile sources are any kind of vehicle or equipment with a gasoline- or diesel-powered engine, an airplane, or a boat. Two types of mobile sources are considered: on-road and non-road. On-road sources include vehicles such as cars, light trucks, heavy trucks, buses, engines, and motorcycles. Non-road sources include aircraft, locomotives, diesel- and gasoline-powered boats, personal watercraft, lawn and garden equipment, agricultural and construction equipment, and recreational vehicles.

Construction requiring ground improvements would result in mobile air emissions from equipment use, as well as particulate matter from fugitive dust emissions; facility operations could involve air emissions of criteria pollutants depending on the types of operations conducted and whether there are direct air exhaust systems or roof stacks for incineration activities.

Air emission analyses from construction activities typically include construction equipment and operations, as well as emissions from worker vehicles commuting to and from the area during construction. There are several models that can be used for estimating air emissions, such as EPA's Motor Vehicle Emission Simulator, which is a state-of-the-science emission modeling system that estimates emissions for mobile sources at the national, county, and project level for criteria air pollutants, GHGs, and air toxics. To evaluate the potential impacts of air emissions, the estimated emissions from project construction activities are compared with the total affected environment emissions on a pollutant-by-pollutant basis for the region's available National Emissions Inventory (NEI) data. If the proposed activities would result in emissions representing a large portion of affected environment emissions for any of the NAAQS pollutants, the impacts on air quality could be significant. The analysis also determines whether any exceedance of the NAAQS or State standards could be anticipated. Emissions from construction activities are mostly related to fuel consumption and are typically not significant within this context given the short-term temporary nature of the emissions, although fugitive dust from ground disturbance can be an annoyance if the site is large.

Once operational, the SRF may be considered a point source and the facility itself would need to be evaluated to determine whether the facility would qualify as a new major stationary source with regard to New Source Review (if constructed as part of an addition to an existing facility) and the need for a PSD permit. Although it is likely that no major stationary sources (e.g., an incinerator) would be required at the facility, the aggregate of many smaller sources may have the potential to emit more than the major source threshold of 90.7 metric tons (100 tons) of any pollutant per year.[30] Once the final construction plan is determined and facilities are constructed, an emissions inventory should be prepared to accurately determine if the facility will be required to obtain a SIP Construction and Operating Permit (depending on the locale and need for SIP compliance) and/or a Title V operating permit.

The Intergovernmental Panel on Climate Change asserts that human-induced climate change will continue to contribute to more frequent and intense extreme events, such as hurricanes and that continued and accelerating sea level rise will encroach on coastal settlements and infrastructure (IPCC 2022). NASA should consider and strategically plan for these long-term impacts of climate change on their mission and infrastructure; such considerations include avoiding coastal areas and other low-lying areas that may be prone to flooding or extreme weather events. Several best management practices for air quality, such as limiting idling time of vehicles during construction, would also limit overall fossil fuel combustion and help to minimize greenhouse gas emissions. During operation, greenhouse gas emissions may be lowered by use of alternative and renewable energy sources (e.g., solar, wind, geothermal) and implementation of

[30] Lower thresholds may apply in non-attainment areas and do apply to emissions of hazardous air pollutants

Leadership in Energy and Environmental Design (LEED) sustainability concepts in facility design and operation.

Siting & Development Considerations

Siting and development of an SRF should consider the following factors to minimize the potential for adverse impacts to air quality:

- <u>Attainment vs. Non-Attainment Area</u>: siting should consider the attainment status of proposed siting locations; depending on the size of the facility and scope of operations facility operation may require General Conformity analysis or could result in pushing an area to non-attainment if the area is already close to non-attainment.
- <u>Facility Location</u>: siting location should consider proximity to coastal and low-lying areas to avoid potential impacts from flooding and extreme weather events.
- <u>Facility Type and Size</u>: facility design should consider implementation of LEED standards and utilization of alternative/renewable energy sources (solar, wind, geothermal, etc.) to the extent practicable, and any required generators, boilers, and laboratory vents should provide for minimal amounts of air emissions.

Tier II Analysis Considerations

Once a site is selected, Tier II analysis would need to consider:

- depending on the scope of activity, calculation of air emissions associated with construction and operation and comparison of emissions to current local/regional emissions and NAAQS thresholds;
- depending on the locale, exceedances of certain criteria pollutant thresholds that may require general conformity analysis;
- determination of whether a PSD, nonattainment New Source Review, or Title V permit is required;
- identification of BMPs that may be implemented to minimize or avoid mobile source, fugitive dust, and particulate emissions such as reduced vehicle idling and use of dust suppression techniques such as wet-down of exposed soils; and
- presence of climate elements that may influence design such as sea level rise or severe weather.

3.10.1.2 Site-Specific Analysis (UTTR/DPG)

Both the Det-1 location and the proposed UTTR landing site are located in Tooele County, Utah. On-site mission preparation (to include testing, rehearsals, and landing site preparation), EES landing, and EES recovery activities would occur exclusively in this area. Therefore, for the purposes of this air quality analysis, the affected environment for the Proposed Action and No Action Alternative includes Tooele County. The affected environment accounts for air quality that could potentially be affected either directly or indirectly by activities associated with on-site mission preparation, EES landing, and EES recovery.

The UTTR and the Det-1 location are located in the interior climate region of central/western Utah, which is in the transition zone between a humid, subtropical climate and a hot-summer humid continental climate. The average temperature is 10.8°C (51.5°F). The warmest month is July, with an average high temperature of 34.3°C (93.7°F). The coolest month is January, with an average low temperature of -7.7°C (18.1°F). Average annual precipitation at the UTTR is 263.1 millimeters (10.4 inches). April is the wettest month, with an average of 33.0 millimeters (1.3 inches) precipitation. August is the driest month, with an average of 8.9 millimeters (0.35 inch) of precipitation. Average annual snowfall at the UTTR is 46.5 centimeters (18.3 inches). The most snow falls in January, with an average of 19.6 centimeters (7.7 inches) (DAF 2021b).

According to the EPA, portions of Tooele County are in serious nonattainment for particulate matter less than or equal to 2.5 micrometers (2006 standard) and nonattainment for sulfur dioxide (1971 standard). However, because the proposed landing site is not included in the nonattainment areas, a conformity determination is not required (DAF 2021b).

Tooele County emissions data are identified in the *Final Environmental Assessment for Sub-Scale Aerial Target Launch, Control, and Recovery at the Utah Test and Training Range, Wendover, Utah* (DAF 2021b), which were obtained from EPA's 2017 NEI (EPA 2020b) (the latest data available); these are shown in (Table 3.10-1). The county data include emission amounts from point sources, area sources, and mobile sources.

Table 3.10-1. Tooele County Emissions

County	Criteria Pollutant (tons/year)					
	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOCs
Tooele	26,195	6,083	7,214	2,554	193	19,535

Source: (DAF 2021b)

Key: CO = carbon monoxide; NO_x = nitrogen oxide; PM_{10} = particulate matter less than or equal to 10 micrometers; $PM_{2.5}$ = particulate matter less than or equal to 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.

The GHGs applicable to this project are CO_2, nitrous oxide, and methane. Each GHG has an estimated global warming potential, which is a function of its atmospheric lifetime and its ability to absorb and radiate infrared energy emitted from the Earth's surface. The global warming potential allows for the comparison of GHGs by converting the GHG quantity into the common unit CO_2 equivalent. The latest available GHG emissions for Tooele County, obtained from the *Final Environmental Assessment for Sub-Scale Aerial Target Launch, Control, and Recovery at the Utah Test and Training Range, Wendover, Utah* (DAF 2021b) and based on EPA's 2017 NEI (EPA 2020b), are summarized in Table 3.10-2.

Table 3.10-2. Current Greenhouse Gas Emissions Inventory for Tooele County, Utah

County	Greenhouse Gases (tons/year)			
	CO_2	N_2O	CH_4	CO_2e
Tooele	26,195	6,083	7,214	2,554

Source: (DAF 2021b)

Key: CO_2 = carbon dioxide; CO_2e = carbon dioxide equivalent; CH_4 = methane; N_2O = nitrous oxide.

The EES itself does not involve the use of any fuels and is a completely passive system; therefore, there would be no air emissions associated with the EES itself. Landing site preparation would result in mobile emissions associated with the use of helicopters and wheeled vehicles. Mission preparation activities and EES recovery may involve the use of some ground vehicles and helicopters. Given the unknown nature of the amount of transit required and area disturbed for mission preparation, site preparation and recovery operations, specific air emissions calculations are not available. However, it is reasonable to conclude that given the limited duration of mission and site preparation and EES recovery operations, emissions from mobile sources (e.g., vehicles, helicopter support) would be temporary, *de minimis* in the context of the overall UTTR emissions inventory, and would not result in any exceedances of NAAQS or emission of substantive quantities of GHGs. Fugitive dust emissions from vehicles and helicopters associated with landing site preparation and EES recovery operations may exceed 20% opacity in the immediate vicinity of these activities. However, because of the distance to facility boundaries, the low number of vehicles utilized, and the short-term nature of the activities, these emissions are not expected to result in adverse air quality impacts to the UTTR/Det-1 location, the surrounding community, or to air quality generally in the Tooele County region.

Overall, mission and landing site preparation, EES landing, EES recovery, and EES transportation operations are expected to have minimal direct impacts on Tooele County air quality and climate given the context of the landing area (remote site on an active military range with more extensive air emissions) and the intensity of the action (temporary *de minimis* emissions from mobile sources and fugitive dust). Analysis of similar activities at the UTTR and DPG were found to have no significant impacts on air quality either discretely or cumulatively (see Table 1.1-1).

3.10.2 No Action Alternative

Under the No Action Alternative, the MSR Campaign would not involve the landing of Mars samples at the UTTR and an SRF would not be developed. Therefore, the No Action Alternative would not result in any additional impacts to air quality or climate within or adjacent to the proposed landing site outside of those associated with ongoing and potential future military operations and other activities occurring at the site. Potential impacts associated with development of an SRF would not be realized.

3.11 LAND USE

Land use describes the way the natural landscape has been modified or managed to provide for human needs. In developed and urbanized areas, land uses typically include residential, commercial, industrial, utilities and transportation, recreation, open space, and mixes of these basic types. Other uses such as mining, agriculture, forestry, and specially protected areas (e.g., monuments, parks, and preserves) are usually found on the fringes of or outside of urbanized areas. Plans and policies guide how land resources are allocated and managed to best serve multiple needs and interests. Local zoning ordinances and regulations frequently prescribe what land uses are appropriate and may occur in specific areas.

3.11.1 Proposed Action

3.11.1.1 Programmatic Analysis

Regulatory Requirements

While the Federal government does not exercise direct land use oversight of activities that may occur on non-Federally managed lands, it does exercise considerable influence over land use planning, primarily through the enactment of environmental legislation and implementing regulations that directly affect state and local land-use decision making. There may be state or local land use and/or planning regulations that may apply to the action depending on alternatives under consideration; NASA would be required to coordinate with associated state and local agencies to identify specific applicable requirements.

SRF Analysis

For the SRF, the affected environment would be the potential location of an SRF and the area surrounding it. Impacts on land use from construction operations can affect ongoing uses in nearby areas, both on and off the SRF site. These include elevated traffic, including heavier-than-usual truck traffic; dust from ground disturbance and site preparation; and noise from construction equipment. While these effects can cause inconvenience and some annoyance for local users, upon completion of construction, these effects would cease. From a land use perspective, adverse impacts to land use in the affected environmental are frequently caused by the incompatibility of a proposed action with existing or future planned land uses (e.g., siting an industrial facility in an area zoned residential). Typically, impacts to land use involve changes in the land use designation and the manner in which the land may be utilized by people. Adverse impacts may result in land use conflicts or preclude specific uses (e.g., recreation) of certain areas either temporarily or permanently. Adverse impacts on landowners can include incompatibilities with current landowner uses or have negative effects on adjacent property values. In certain circumstances, incompatibilities in land use may arise that require further planning or consultations between landowners until an agreeable designation is issued.

Were NASA to propose siting the SRF in an area of incompatible land use, adverse impacts to existing uses may occur (e.g., encroachment of the SRF on other approved uses [recreational or residential]). To avoid these potential adverse impacts, NASA would seek to site the SRF in an area of compatible activities (e.g., industrial, research park, public access–limited areas), on a NASA Center, or in a more remote and undeveloped area of land outside of metropolitan, suburban or exurban environments. Such compatible siting would minimize the environmental impact of incompatible uses and potentially allow for use of existing security, utility, and transportation infrastructure.

The significance of the environmental impact of SRF siting on land use may also be affected by the type of SRF NASA determines is best suited to carry out the purpose and need for the Proposed Action. As described in Chapter 2 (Description of the Proposed Action and Alternatives), a number of SRF concepts are under consideration from new construction, use of an existing facility, or a modular hybrid design approach.

In cases where the SRF were proposed to be co-located with an existing facility, land use impacts would likely be *de minimis*, as traffic, lighting, and security would likely remain the same or similar as that which is currently in place. Were NASA to propose to build a new SRF, greater impacts to land use, in both developed and undeveloped areas, would be reasonably expected.

Siting & Development Considerations

Siting and development of an SRF should consider the following factors to minimize the potential for adverse impacts associated with land use compatibility:

- <u>Compatible Land Use</u>: siting should seek to identify locations that are compatible with the intended use. Co-location with similar research facilities may minimize potential land use impacts associated with encroachment and increased traffic, lighting, and security. Co-location may also result in benefits with respect to scientific collaboration with nearby research facilities. Siting should consider local master plans and zoning ordinances to identify locations suitable or a BSL-4 type facility.

Tier II Analysis Considerations

Once a site is selected, Tier II analysis would need to consider:

- identification of adjacent land uses;
- determine whether the proposed site meets zoning requirements and/or is incompatible with an existing land use or reasonably foreseeable land use due to noise, safety, or other issues and mitigations that may serve to minimize or avoid these types of impacts; and
- identification of potential ancillary effects to nearby properties, such as increased traffic and lighting and visual effects, and mitigations that may serve to minimize or avoid these types of impacts.

3.11.1.2 Site-Specific Analysis (UTTR/DPG)

The attributes of land use addressed in this analysis include general land use patterns and regulatory setting within and surrounding the UTTR South Range and the Det 1 location. Both the Det 1 location and the UTTR South Range are primarily used for military personnel and weapon systems training and testing exercises. Testing and training include air-to-air operations, air-to-surface operations, visual and radar bombing, and tactical maneuvers. Landing site preparation, EES landing, EES recovery, and sample transportation would not result in any changes to land use patterns or designations, and land areas would be utilized as intended. All activities, except for sample transportation and SRF development and operation, would occur within the UTTR South Range and the Det 1 location.

On-site mission preparation (to include testing and rehearsals and landing site preparation), EES landing, EES recovery, and EES transportation operations are expected to have no impacts to the UTTR or DPG land use given the context of the activities (within an active military installation and roads for intended use) and the intensity of the action (occasional, discrete short-term events). Analysis of similar activities at the UTTR and DPG were found to have no significant impacts on land use (see Table 1.1-1).

3.11.2 No Action Alternative

Under the No Action Alternative, the MSR Campaign would not involve the landing of Mars samples at the UTTR and an SRF would not be developed. Therefore, the No Action Alternative would not result in any additional impacts to land use within or adjacent to the proposed landing site outside of those associated with ongoing and potential future military operations and other activities occurring at the site. Potential impacts associated with development of an SRF would not be realized.

3.12 SOCIOECONOMICS

Socioeconomics refers to features or characteristics of the social and economic environment (e.g., population, employment, earnings, housing, and public services). Socioeconomic impacts are assessed in terms of direct effects to the local economy and population and related indirect effects on other socioeconomic resources within the ROI. Although economic or social effects are not intended by themselves to require preparation of an EIS (40 CFR § 1502.16(b)), socioeconomic impacts would be considered significant if the Proposed Action resulted in a substantial shift in population trends or notably affected regional employment, earnings, or community resources such as schools.

3.12.1 Proposed Action

3.12.1.1 Programmatic Analysis

Regulatory Requirements

There are no Federal regulatory requirements associated with socioeconomics applicable to the Proposed Action. There may be state or local requirements that may apply to the action depending on alternatives under consideration; NASA would be required to coordinate with associated state and local agencies to identify specific applicable requirements.

SRF Analysis

For the SRF, the affected environment would be the potential location of an SRF and the area surrounding it. Socioeconomic impacts associated with development of an SRF would be associated with economic impacts from construction and operation, with consideration given to effects on population, employment, earnings, housing, and public services.

Development activities would likely result in beneficial direct, indirect, and induced economic impacts in terms of employment and income in the affected environment, the scope of benefit tied to the size and type of facility (i.e., development of a small modular facility would provide less economic benefit in this regard than would a large new construction facility or campus). Cost details regarding the facilities and infrastructure are not available at this time. However, it would be anticipated that development of the

SRF and associated infrastructure would result in near-term economic benefits driven by an increase in construction spending. Construction-related impacts would last for the duration of the activities. Under the assumption that the local construction workforce would be expected to meet the labor demand, there would be no additional permanent population increase associated with development activities.

Long-term socioeconomic impacts would be directly tied to the number of new jobs created and the projected population increase associated with those jobs. Employment numbers would be dependent on the type and size of the facility, which is unknown at this time. In most cases, jobs would likely be filled within the local/regional population (assuming the SRF would be located in a more urban locale) and would not be expected to significantly impact local population numbers or have significant effects on housing. In more rural locales, placement of a specialized facility like an SRF would likely require an influx of personnel resulting in local population increases and subsequent increase in demand on housing, education, and local services. Specialized jobs associated with an SRF would provide for increased earnings within the locale, and thus realized economic benefits to local businesses associated with discretionary spending. Visiting scientists may provide short-term economic benefits through localized spending during their stays.

Direct impacts to housing, education, and public services (e.g., emergency services) would also be dependent on local population increases. Depending on the scope of any increases in local population, this can adversely affect these aspects if availability and capacity cannot adequately accommodate the increase.

Siting & Development Considerations

Siting and development of an SRF should consider the following factors to minimize the potential for adverse socioeconomic impacts:

- Locale: siting should seek to identify locations that can provide the necessary workforce without requiring a substantive increase in local population. Siting within urban areas would increase the likelihood of a local workforce and the potential for housing availability and educational and local services capacity for any in-migration of workers.

Tier II Analysis Considerations

Once a site is selected, Tier II analysis would need to consider:

- the number of projected workers required and ability of local workforce to meet demand;
- local population and population trends and whether any influx of workers (temporary and permanent) (and estimated dependents) would result in a substantive increase in population; and
- if there is a projected substantive increase in population, determine whether housing availability and education and public services can accommodate the associated increase in demand.

3.12.1.2 Site-Specific Analysis (UTTR/DPG)

The socioeconomic affected environment for the Proposed Action is defined as the area surrounding the UTTR South Range and DPG. Within the context of the Proposed Action, mission preparation activities (to include testing, rehearsals, and landing site preparation), EES landing recovery operations, and sample transportation would be expected to have no adverse impacts to socioeconomics because activities would be within the existing range and there are no anticipated effects outside this area. There may be *de minimis* beneficial impacts associated with NASA scientists and other recovery team members utilizing services (e.g., hotels, restaurants, etc.) within the local community during their time at the UTTR. Analysis of similar activities at the UTTR and DPG were found to have no significant socioeconomic impacts (see Table 1.1-1).

3.12.2 No Action Alternative

Under the No Action Alternative, the MSR Campaign would not involve the landing of Mars samples at the UTTR and an SRF would not be developed. Therefore, the No Action Alternative would not result in any additional socioeconomic impacts at the UTTR or surrounding area outside of those associated with ongoing and potential future military operations and other activities occurring at the site. Potential impacts associated with development of an SRF would not be realized.

3.13 ENVIRONMENTAL JUSTICE / PROTECTION OF CHILDREN

EPA defines "environmental justice" as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation and enforcement of environmental laws, regulations and policies" (EPA 2021). Fair treatment means that no population bears a disproportionate share of negative environmental consequences resulting from industrial, municipal, and commercial operations or from the execution of Federal, state, and local laws; regulations; and policies. Meaningful involvement requires effective access to decision makers for all, and the ability in all communities to make informed decisions and take positive actions to produce environmental justice for themselves. EPA defines minority and low-income populations as follows:

- **Minority** – populations of people who are not single-race white and not Hispanic but who are members of the following population groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic
- **Low-income** – populations characterized by limited economic resources (EPA 2021).

The DAF also evaluates impacts to other sensitive populations including the children and elderly and defines children, ROI, and Community of Comparison (COC) (DAF 2020).

- **Children and Elderly** – In this analysis, children refers to any person(s) under the age of 17 years old and elderly are considered 65 years of age or older.

- **ROI** – ROI is the administrative area containing the best available and most appropriate units that underlie the affected area. Data collected for any given ROI is used to quantitatively characterize the demographic composition of the Affected Area and is used to determine whether Environmental Justice populations are present in the area affected by the Proposed Action, and if so whether there may be disproportionate effects to these communities. In this case, the ROI includes the U.S. Census Bureau Block Groups.
- **COC** – is the smallest set of U.S. Census Bureau data encompassing the ROI and is used to establish thresholds of comparison. In other words, the COC is data representing comparison data to which the demographic data in the ROI will be compared to identify if there are "meaningfully greater" percentages. It is through the establishment of COC threshold data that it is determined whether environmental impacts would disproportionately affect Environmental Justice communities and populations.

3.13.1 Proposed Action

3.13.1.1 Programmatic Analysis

Regulatory Requirements

EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, requires Federal agencies to evaluate human health and environmental conditions in minority and low-income communities and to identify and address the potential disproportionately high and adverse human health or environmental effects on these communities.

EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, was introduced on April 21, 1997 to address environmental health or safety risks that may disproportionately affect children. EO 13045 was intended to: 1) prioritize the identification and assessment of environmental health and safety risks that may affect children, and 2) to ensure that Federal agency policies, programs, activities, and standards address environmental and safety risks to children.

SRF Analysis

For the SRF, the affected environment would be the potential location of an SRF and the area surrounding it. For minority and low-income populations, determination of impacts is based on the extent to which minority and low-income populations reside within the affected environment. If the percentage of minority and low-income populations in the affected environment (U.S. Census Block Groups) is higher compared to the COC (county specific), it is considered to have a disproportionately higher minority or low-income population. For children and elderly, the same methodology is typically used to determine if effects are considered disproportionate. Potential environmental justice impacts are directly tied to the location of the facility and would require site-specific analysis. Environmental justice impacts should also consider the site-specific effects of any identified noise, land use, and air quality impacts on these populations.

Siting and Development Considerations

Siting and development of an SRF should consider the following factors to minimize the potential for environmental justice impacts:

- <u>Avoidance of Environmental Justice Populations</u>: siting should seek to identify locations that do not result in disproportionate impacts to minority and low-income populations. If such alternatives are considered, meaningful engagement with potentially affected minority and low-income populations is required to ensure effective access to decision makers and the ability to make informed decisions. Consideration would also be given for disproportionate impacts to populations including children and the elderly.

Tier II Analysis Considerations

Once a site is selected, Tier II analysis would need to consider the following:

- Determine the extent to which minority and low-income populations reside within the affected environment. If the percentage of minority and low-income populations in the affected environment (U.S. Census Block Groups) is higher compared to the COC (county specific), it is considered to have a disproportionately higher minority or low-income population.
- Determine the extent to which children and elderly populations reside within the affected environment. If the percentage of these populations in the affected environment (U.S. Census Block Groups) is higher compared to the COC (county specific), it is considered to have a disproportionately higher population.
- Identification of mitigations that may serve to minimize or avoid disproportionate impacts to environmental justice populations. These are typically tied directly to mitigations associated with other resource areas such as noise, land use, and air quality.

3.13.1.2 Site-Specific Analysis (UTTR/DPG)

Within the context of the Proposed Action, there are no environmental justice concerns associated with mission preparation or EES landing and recovery operations as these activities would all occur within the confines of the UTTR South Range and DPG boundary. There are no anticipated effects outside this area; therefore, there would be no environmental justice concerns associated with activities at the UTTR or DPG. Analysis of similar activities at the UTTR and DPG were found to have no significant impacts on environmental justice communities (see Table 1.1-1).

3.13.2 <u>No Action Alternative</u>

Under the No Action Alternative, the MSR Campaign would not involve the landing of Mars samples at the UTTR and an SRF would not be developed. Therefore, the No Action Alternative would not result in any additional environmental justice impacts at the UTTR or surrounding area outside of those associated with ongoing and potential future military operations and other activities occurring at the site. Potential impacts associated with development of an SRF would not be realized.

3.14 NOISE

Noise is commonly defined as unwanted sound. Sound is defined as pressure variations in air that can be detected by the human ear. A sound can be characterized by its pitch and its loudness. Pitch depends on the rapidity (frequency) of the vibrations that comprise a sound. The human ear is specialized and best suited for the detection of sounds with vibrational frequencies between 1,000 and 6,000 cycles per second. Extremely high-pitched sounds (e.g., dog whistles) and extremely low-pitched sounds (e.g., distant rumbles) are not heard as well as sounds in mid-range frequencies. Sound levels are typically described in decibels (dB), a logarithmic scale used to simplify communication of a very wide range of audile sound pressure levels. Loudness describes the amplitude of sound waves as perceived by a listener. A system known as A-weighting (measured in A-weighted decibels [dBA]) is often applied to sounds to mathematically deemphasize sound energy at frequencies not easily detected by the human ear. Zero on the dBA scale is based on the lowest sound pressure that a healthy, unimpaired, human ear can detect. Sound levels higher than 120 dBA can cause discomfort. Normal conversation at a distance of 0.91 meters (3 feet) typically generates sound levels of approximately 60 dBA. Common A-weighted sound levels are shown on Figure 3.14-1.

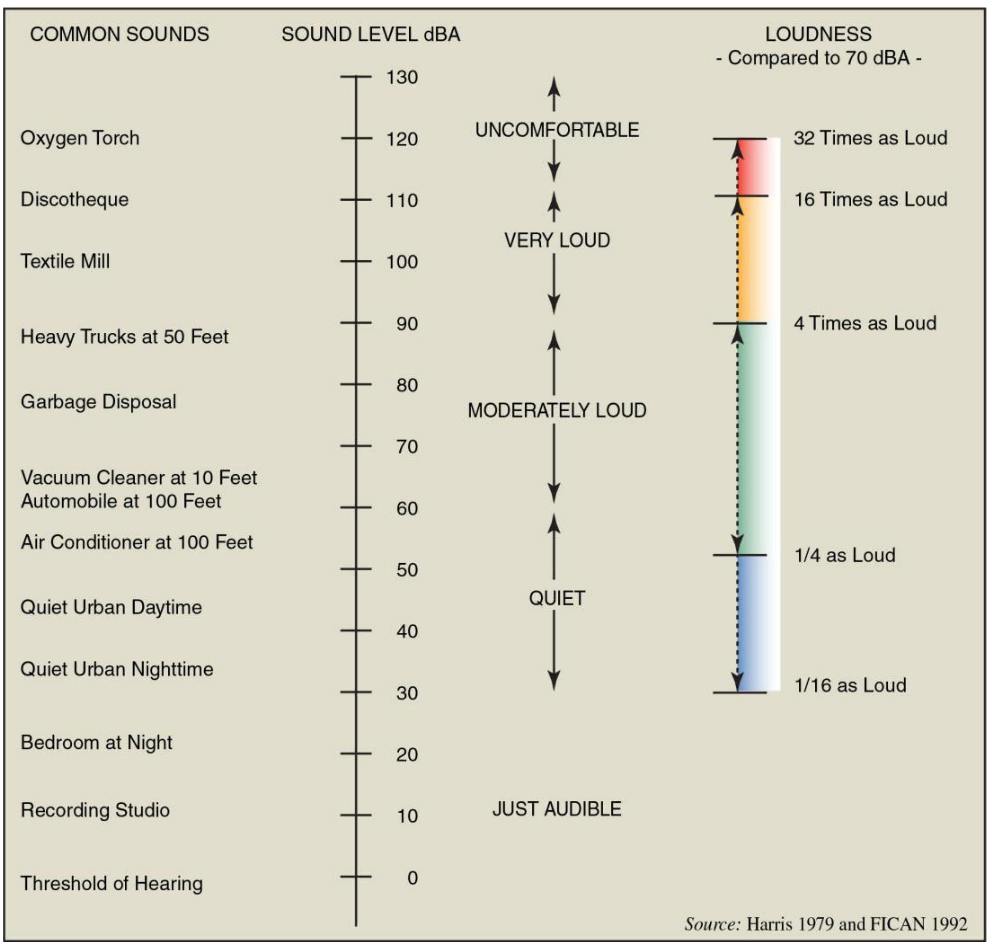

Figure 3.14-1. Typical A-Weighted Levels of Common Sounds

The variability of sound levels across time is also important in determining impacts. The highest sound level measured during a noise event (e.g., a vehicle pass-by) is referred to as the maximum sound level; the overall noise energy of a noise event normalized to a single second is the sound exposure level; and the decibel-averaged sound level over a period of time is the equivalent sound level. The day-night average sound level is a dB-averaged noise level for a 24-hour time period with a 10-dB "penalty" applied to noise levels generated between 10:00 p.m. and 7:00 a.m.

3.14.1 Proposed Action

3.14.1.1 Programmatic Analysis

Regulatory Requirements

There are no specific Federal regulations related to noise. There may be state or local noise ordinances that may apply to the action depending on alternatives under consideration; NASA would be required to coordinate with associated state and local agencies to identify specific applicable requirements.

Multiple Federal government agencies have provided guidelines on permissible noise exposure limits to protect human hearing. The most conservative workplace noise level limit has been set by the OSHA at 115 dBA for non-impulsive noise over an allowable exposure duration of 15 minutes (OSHA 2008). The National Institute for Occupational Safety and Health (NIOSH) limits for non-impulsive noise are less conservative (NIOSH 1998). For impulsive noise, such as sonic booms, OSHA and NIOSH have both established maximum allowable peak noise levels of 140 dB, which equates to an overpressure of about 19.5 kilograms per square meter (4 pounds per square foot). Workplace noise level recommendations are designed such that, even with steady near-daily exposures over the course of an entire career, the excess risk of developing occupational noise–induced hearing loss is minimized.

SRF Analysis

For the SRF, the affected environment would be the potential location of an SRF and the area surrounding it. The main noise impact drivers for the SRF are development activities and operations.

Development of an SRF would generate localized noise, the scope of which would be determined by the type and size of the facility (development of modular or facility additions would generate less noise than would new construction of a large facility or campus). Construction noise would be associated with heavy equipment and generator operation, would be temporary (lasting only the duration of the construction project), and would be expected to be limited to normal working hours. Construction activities would not be expected to result in significant community noise impacts provided the location is not within or adjacent to a residential area.

Operationally, external noise may be generated by such equipment as cooling towers, laboratory ventilation fans, and emergency generators. The need and extent of this type of equipment would be dictated by facility design. Provided the facility is located within compatible land use areas it is unlikely that operational noise would result in significant impacts. A noise assessment based on facility design would determine potential noise emissions and compatibility with local noise ordinances.

Siting and Development Considerations

Siting and development of an SRF should consider the following factors to minimize the potential for adverse noise impacts:

- Compatible Land Use: Siting should seek to identify locations that are compatible with the intended use, thus ensuring that operational noise is consistent with the affected environment.
- Use of Low-Noise Equipment: Design should consider use of low-noise equipment and implementation of noise control measures to ensure compliance with local and state noise regulations at all nearby sensitive locations.

Tier II Analysis Considerations

Once a site is selected, Tier II analysis would need to consider:

- potential noise generated by construction and operation of the facility;
- identification of adjacent land uses and adjacent sensitive noise receptors (e.g., residences, schools, elder-care facilities, etc.);
- determination of whether the noise generated from these activities would result in significant increases in noise for sensitive receptors;
- determination of whether noise generated from these activities would exceed any state or local noise ordinances; and
- identification of mitigations that may serve to minimize or avoid any identified impacts.

3.14.1.2 Site-Specific Analysis (UTTR/DPG)

For the purposes of this noise analysis, the affected environment for mission preparation, EES landing, and EES recovery operations includes areas in which the component actions of the Proposed Action (i.e., operation of ground vehicles, equipment, helicopters, and atmospheric entry of the EES) would be audible. Existing UTTR airspace is currently used by a wide variety of military aircraft, and the land area is remote and experiences ground vehicle use. Therefore, the noise resulting from operation of ground vehicles, equipment, and helicopters in existing airspace and on the land surface under the airspace would not constitute a new noise source.

Upon entering the Earth’s upper atmosphere, the EES would create a sonic boom above the UTTR. UTTR airspace is currently utilized for supersonic aircraft operations, and this one-time event would be indistinguishable from regular UTTR operations. This sonic boom, while somewhat audible at this altitude, would not be expected to result in overpressures at ground level that would result in hearing or structural damage. Transport of the EES would result in negligible, transient noise associated specifically with the transportation mode selected (e.g., truck, aircraft). Based on the type of noise, context of occurrence (roadways or airfields), and single event transient intensity this type of noise would not be expected to result in adverse impacts.

Within the context of the Proposed Action, mission preparation, EES landing recovery operations, and EES transportation would be expected to have no significant adverse noise impacts. Analysis of similar activities at the UTTR were found to have no significant noise impacts (see Table 1.1-1).

3.14.2 No Action Alternative

Under the No Action Alternative, the MSR Campaign would not involve the landing of Mars samples at the UTTR and an SRF would not be developed. Therefore, the No Action Alternative would not result in any additional noise impacts at the UTTR or surrounding area outside of those associated with ongoing and potential future military operations and other activities occurring at the site. Potential impacts associated with development of an SRF would not be realized.

3.15 INFRASTRUCTURE

Infrastructure within the context of this document is associated with utilities (potable water, electricity, wastewater, and solid waste) and transportation.

3.15.1 Proposed Action

3.15.1.1 Programmatic Analysis

Impacts to utility and transportation networks are assessed with respect to the potential for either the disruption, degradation, or improvement of existing levels of service or potential change in demand for energy or water resources. Impacts may result from physical changes to utility corridors, construction activity, and/or the introduction of additional construction-related traffic and utility use. Impacts to infrastructure would be considered significant if they create substantial and continuous changes to any utility or transportation circulation network, resulting in measurable delays or disruption of normal conditions.

Regulatory Requirements

EO 14057, *Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability*, was signed by President Biden on December 8, 2021. EO 14057 directs the Federal government to align its procurement and operations efforts with the following principles and goals: achieving climate resilient infrastructure and operations; building a climate- and sustainability-focused workforce; advancing environmental justice and equity; and prioritizing the purchase of sustainable products, such as products without added perfluoroalkyl or polyfluoroalkyl substances.

The National Pretreatment Program is a component of the NPDES program. It is a cooperative effort of Federal, state, and local environmental regulatory agencies established to protect water quality. Similar to how EPA delegates the authority to administer the NPDES permit program to state, tribal, and territorial governments to perform permitting, administrative, and enforcement tasks for discharges to waters of the United States (or jurisdictional waters) (NPDES program). EPA and authorized NPDES state pretreatment programs approve local municipalities to perform permitting, administrative, and enforcement tasks for discharges into the municipalities publicly owned treatment works (POTWs). The National Pretreatment Program requires industrial and commercial dischargers, called industrial users (IUs), to obtain permits or other control mechanisms to discharge wastewater to the POTW. Such a permit may specify the effluent quality that necessitates that an IU pretreat or otherwise control pollutants in its wastewater before discharging it to a POTW. The General Pretreatment Regulations of the National Pretreatment Program require all large POTWs (those designed to treat flows of more than 19 million liters [5 million gallons] per day) and smaller POTWs (that accept wastewater from IUs that could affect the treatment plant or its discharges) to establish local pretreatment programs. These local programs must enforce all national pretreatment standards and requirements in addition to any more stringent local requirements necessary to protect site-specific conditions at the POTW.

State and/or local transportation restrictions may be present along the transportation route(s) necessary for movement of the EES. NASA would be required to coordinate with state and local governments to identify any such restrictions or limitations.

Sample Transportation

Transportation of the EES would likely occur over the road on a semitruck or large truck, or via air using an aircraft large enough to accommodate the vault. Utilization of these two methods would not be expected to result in any impacts to transportation circulation networks or result in measurable delays or disruption of normal conditions.

Requirements for transportation with respect to health and safety are addressed in Section 3.4 (Health and Safety).

SRF Analysis

The main impact driver for utilities is operation of an SRF; development would not be expected to result in any adverse utility impacts. The size and intended operational parameters of the facility would dictate the amount of electricity and/or natural gas and potable water required, as well as wastewater generation. Larger facilities would draw more power or natural gas and generate more wastewater. As an example, the *National Emerging Infectious Diseases Laboratories Final Environmental Impact Statement* for the Boston National Biocontainment Laboratory estimated that for its 18,023-gross square meter (194,000-gross square foot) BLS-4 facility natural gas consumption would equate to 46.7 cubic meter per hour (1,650 cubic feet per hour) and electric demand would be approximately 7,120 kilowatts (kW). There were no estimates of potential wastewater effluents (NIH/DHHS 2005). By contrast, in an environmental assessment conducted by the Department of Energy for construction for a 139-square meter (1,500-square-foot) BSL-3 facility, electrical demand was estimated at 60 kW and wastewater was estimated at 37,854 liters (10,000 gallons) per year; there was no estimate of natural gas usage (Department of Energy 2002). The proposed SRF would likely fall somewhere between these two sizes of facility, and depending on the capacity of local utility distribution systems larger facilities could place a burden on local utility providers and/or POTWs.

Wastewater from the SRF would need to comply with treatment standards relevant for BSL-facilities as set forth by local requirements. Certain industrial discharge practices can interfere with the operation of POTWs, leading to the discharge of untreated or inadequately treated wastewater into rivers, lakes, and other waters of the United States. A discharge can cause interference, inhibit, or disrupt the POTW, its treatment processes or operations, or its sludge processes, use, or disposal and therefore cause a violation of any requirement of the POTW's NPDES permit. Some pollutants are not amenable to biological wastewater treatment at POTWs and can pass through the treatment plant untreated. This pass through of pollutants affects the receiving water and might cause fish kills or other adverse effects. Even when a POTW has the capability to remove toxic pollutants from wastewater, the pollutants can end up in the POTW’s sewage sludge, which might then be processed into a fertilizer or soil conditioner that is land-applied to food crops, parks, or golf courses or elsewhere.

The size, location, and number of employees for a facility would also determine the extent of potential impacts to local transportation networks. The scope of the impact would also depend on the existing level of service for surrounding transportation networks. Large numbers of employees transiting to the facility during normal working hours on roads with already degraded levels of service could result in further traffic slow-downs or stoppages and increase accident potential. Additionally, large amounts of traffic could degrade levels of service from adequate to inadequate depending on road conditions and time of day. Surrounding land use and associated road types may also dictate the potential for transportation impacts; residential roads are typically not equipped to accommodate significant amounts of traffic, whereas multi-lane roads in commercial or industrial areas are intended for such use.

Siting and Development Considerations

Siting and development of an SRF should consider the following factors to minimize the potential for adverse impacts to associated infrastructure:

- <u>Compatible Land Use</u>: Siting should seek to identify locations that are compatible with the intended use. This may reduce the construction footprint through the use of existing infrastructure and minimize the need for extensive infrastructure improvements.
- <u>Size and Type of Facility</u>: Larger facilities would require more power and generate more wastewater than would smaller, modular facilities. Additions to existing facilities may reduce the construction footprint through the use of existing infrastructure via tie-ins. Use of energy-efficient equipment and renewable/alternative energy sources (wind, solar, geothermal, etc.) should also be considered to minimize utility requirements.
- <u>Local Transportation Networks</u>: Location should consider capacity and level of service of roadways necessary to support access. Close proximity to interstate highways and airfields would be beneficial for air and vehicle transport of samples, and close proximity to commercial airports would facilitate collaboration with scientists from a variety of locations. Any limitations or restrictions regarding

secure transport of samples should be identified and considered with alternative facility locations.

Tier II Analysis Considerations

Once a site is selected, Tier II analysis would need to consider:

- Existing affected environment utility infrastructure, operational utility loads based on facility equipment types and number of employees, the extent to which these loads would burden local utility systems and providers, and whether utility system upgrades would be required.
- Identification of necessary transportation network level of service and whether the number of employees and associated traffic would adversely affect the level of service. Depending on the size, location, and number of employees associated with the facility, a separate traffic study and mitigations (such as roadway improvements, installation of traffic lights, etc.) may be required.
- Determination of the need for a local POTW industrial pretreatment permit and pretreatment requirements. As part of internal wastewater pretreatment design, and depending on intended use, a segregated plumbing system that would carry laboratory wastewater from every non-BSL area to mixing tanks prior to discharge to the sanitary system may be implemented. In addition, BSL areas of the SRF may require a sterilization system designed to kill any biological agents that might exist in the wastewater from BSL areas; the sterilized effluent would likely then need to be cooled before it can be discharged.
- Identification of any state or local limitations or restrictions regarding secure transport of samples.
- Identification of any mitigations required to avoid or minimize identified adverse impacts.

3.15.1.2 Site-Specific Analysis (UTTR/DPG)

Under the Proposed Action, on-site mission preparation (to include testing and rehearsals and landing site preparation), EES landing, and EES recovery would not require the construction of new, or modification of existing, UTTR or DPG infrastructure. Hookups to existing Det-1 utility infrastructure for temporary use (e.g., electricity for trailers, communications, etc.) may be required; a small number of wheeled vehicles may utilize UTTR and DPG roads, and recovery team members may use local roadways transiting to/from the UTTR. These activities would not be expected to impact infrastructure or utility use on UTTR, DPG, or local roadways. Analysis of similar activities at the UTTR were found to have no significant impacts on infrastructure (see Table 1.1-1).

3.15.2 No Action Alternative

Under the No Action Alternative, the MSR Campaign would not involve the landing of Mars samples at the UTTR and an SRF would not be developed. Therefore, the No Action Alternative would not result in any additional impacts to the UTTR or surrounding area infrastructure outside of those associated with ongoing and potential future military operations and other activities occurring at the site. Potential impacts associated with development of an SRF would not be realized.

3.16 CUMULATIVE IMPACTS

CEQ regulations implementing NEPA require that the cumulative impacts of a proposed action and alternatives be assessed (40 CFR Parts 1500–1508). Cumulative effects are defined as "effects on the environment that result from the incremental effects of the action when added to the effects of other past, present, and reasonably foreseeable actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time..." (40 CFR § 1508.1(g)(3)).

Cumulative effects may occur when there is a relationship between a proposed action or alternative and other actions expected to occur in a similar location or during a similar time period. This relationship may or may not be obvious. The effects may then be incremental (increasing) in nature and result in cumulative impacts. Actions overlapping with or in proximity to a proposed action or alternative can reasonably be expected to have more potential for cumulative effects on "shared resources" than actions that may be geographically separated. Similarly, actions that coincide temporally will tend to offer a higher potential for cumulative effects.

3.16.1 Past, Present, and Reasonably Foreseeable Actions and Environmental Trends

Past and present actions inform the current condition of the affected environment, while reasonably foreseeable future actions inform the projected affected environment for the planned EES landing and recovery operations, expected to occur in early 2033. Mission preparation is expected to occur within a two- to three-year timeframe prior to EES landing. Reasonably foreseeable future actions are considered in this PEIS if they are: 1) included in a Federal, state, or local planning document, 2) likely to occur based on the recommendations of Federal, state, or local planning agencies, 3) identified in an existing permit application, or 4) part of fiscal appropriations that are likely (or reasonably certain) to occur. For purposes of this analysis, foreseeable actions were considered.

Predictable environmental trends considered in this PEIS are those that could result from foreseeable actions.

3.16.2 Programmatic Analysis

From a programmatic perspective EES transportation would not be expected to result in cumulative impacts. This is a discrete event that would have *de minimis* impact on the environment.

Cumulative impacts associated with development of an SRF will be addressed in the subsequent Tier II analysis once alternatives have been identified. At that time past, present, and reasonably foreseeable future actions relevant to the affected environment would be identified and analyzed. Analysis would consider relationships between the alternatives and other identified actions interacting within the same affected environment(s).

3.16.3 Site-Specific Analysis (UTTR/DPG)

The UTTR and the Det-1 locations are currently utilized for military testing and training operations. This would be expected to continue into the future. Other than debris removal as part of landing site preparation, no long-term impacts to the UTTR or the Det-1 location would be expected due to the discrete nature of the action. NASA anticipates up to six recovery operation dress rehearsals during the 24 months prior to EES landing, with a team of up to 12 personnel depending on required operational parameters. Dress rehearsals would likely involve the use of two to four helicopters. Additionally, NASA anticipates that a team of up to 40 personnel may be staged at the UTTR and/or DPG 6 to 12 months prior to the EES reentry date for site preparation and recovery operations set up. The use of facilities at the UTTR and the Det-1 location for retrieving the Mars samples would be consistent with existing operations and would pose no new types of impacts. Existing facilities and infrastructure would be utilized and no new facilities on site or offsite would be needed. Any impacts of the MSR Campaign at the UTTR and DPG would be negligible. The incremental impact of the mission would not add to or create any long-term cumulative effect on the local or regional environment.

3.17 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

NEPA CEQ regulations require environmental analyses under an EIS to identify "...any irreversible and irretrievable commitments of resources that would be involved in the proposal should it be implemented" (40 CFR § 1502.16). Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects the uses of these resources have on future generations. Irreversible effects primarily result from the use or destruction of a specific resource (e.g., energy and minerals) that cannot be replaced within a reasonable time frame. Building construction material, such as gravel and gasoline usage for construction equipment, would constitute the consumption of nonrenewable resources.

Irretrievable resource commitments also involve the loss in value of an affected resource that cannot be restored as a result of the action. Overall, the MSR Campaign would involve consumption of nonrenewable resources, such as metals used in component construction, fuels used in launch and ground vehicles and aircraft, etc. None of these activities would be expected to substantially affect environmental resources, because the relative consumption of these materials is expected to change negligibly.

The primary irretrievable impacts of implementation of the Proposed Action would involve the use of energy, labor, materials, and funds. From a programmatic perspective, development of an SRF may involve conversion of some lands from an unimproved or semi-improved condition through the construction of buildings and facilities; however, this would depend on where the SRF is sited and would be required to be addressed under Tier II analysis. Irretrievable impacts would occur as a result of construction, facility operation, and maintenance activities. Direct losses of biological productivity and the use of natural resources from these impacts will be considered as part of Tier II analysis.

3.18 UNAVOIDABLE ADVERSE IMPACTS

NEPA requires identification of any unavoidable adverse impacts (40 CFR § 1502.16(a)(2)). For the MSR launch, landing, and recovery operations, analyses of the Proposed Action identified unavoidable adverse impacts associated with soil disturbance from with landing site preparation and EES recovery activities. However, these adverse impacts have been shown to not be significant based on the context (dry, flat lakebed on a military installation) and intensity (single event) of the Proposed Action. With regards to SRF development and operations, unavoidable adverse impacts would be dependent on the scope of a particular SRF development scenario, with impacts related to the size of the facility and the location to be developed. Unavoidable adverse impacts could be associated with air emissions from ground disturbance and operations, impacts to natural resources (e.g., forested areas, wildlife, etc.) from ground disturbance depending on location developed, and impacts to local infrastructure and utilities depending on the ability of the locale to support SRF operations. These factors will be considered as part of Tier II NEPA analyses for development of an SRF once SRF requirements and potential locations have been identified.

3.19 SHORT-TERM USES, MAINTENANCE, AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

NEPA requires an analysis of the relationship between a project's short-term impacts on the environment and the effects that these impacts may have on the maintenance and enhancement of the long-term productivity of the affected environment (40 CFR § 1502.16(a)(3)). Impacts that narrow the range of beneficial uses of the environment are of particular concern. Choosing one option may reduce future flexibility in pursuing other options or committing a resource to a certain use may eliminate the possibility for other uses of that resource.

From a programmatic perspective, analysis of short-term environmental impacts of development of an SRF, and the effects that these impacts may have on the maintenance and enhancement of the long-term productivity of the associated affected environment, would be wholly dependent on the location and scope of the SRF. Short term uses of fossil fuels and natural resources (e.g., concrete, wood, metal, etc.) during development of an SRF would occur, the quantity of use dependent on the scope of the SRF (e.g., development a mostly modular facility would likely require far fewer natural resources and fossil fuel use than would a complete, large brick-and-mortar facility). Operation of an SRF would also require use of electrical energy, potable water, and potentially natural gas. Similarly, the amount of resource use for operations would be dependent on the scope of the SRF, as well as implementation of any environmental and "green" design considerations (e.g., LEED). Larger facilities with minimal LEED design considerations would require more resources for operation than would a smaller modular-type facility. These factors will be considered as part of Tier II NEPA analyses for development of an SRF once SRF requirements and potential locations have been identified.

From a site-specific perspective, implementation of the Proposed Action would result in impacts limited to the UTTR/DPG and has been shown to have no significant short- or long-term adverse impacts. As a result, no adverse impacts to the maintenance and enhancement of the long-term productivity of the UTTR/DPG would be expected. In fact, removal of range debris as part of landing site preparation may have a long-term benefit on the maintenance of the UTTR South Range and provide some enhancement to environment.

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4. SUBMITTED ALTERNATIVES, INFORMATION, AND ANALYSES

4.1 PUBLIC INVOLVEMENT SUMMARY

- **Notice of Intent (NOI)** – A notice that announced NASA’s intent to prepare an Environmental Impact Statement (EIS) was published in the Federal Register on April 15, 2022. The NOI formally initiated the public scoping process. The NOI included descriptions of the alternatives and the scoping process, and the dates, times, and locations of the scoping meetings. The NOI also invited potentially affected Federal, state, and local agencies; potentially affected Indian tribe(s); and interested persons (e.g., public) to participate in the scoping process. A copy of the NOI is provided in Appendix B (Public/Agency Involvement).
- **Scoping** – Council on Environmental Quality regulations at Title 40 Code of Federal Regulations 1501.9 requires a process called “scoping” to involve the public early in the assessment process. The scoping process is designed to solicit input from the public and interested agencies on the nature and extent of issues and impacts to be addressed and the methods by which potential impacts are evaluated. NASA published advertisements in local newspapers near the Utah Test and Training Range and Kennedy Space Center two weeks prior to the scoping meetings. Each advertisement provided scoping meeting dates and meeting access information. The 30-day scoping comment period began on April 15, 2022, and officially ended on May 16, 2022. NASA held two virtual public scoping meetings to inform the public and solicit comments and concerns about the proposal.

Comments and stakeholder input received during the scoping comment period were considered during the development of the alternatives and the analysis presented in the Draft Programmatic EIS (PEIS). Comments received after the official end of the scoping comment period were also considered in determining the range of actions, alternatives, and environmental analysis of significant issues in the Draft PEIS, to the maximum extent practicable, prior to its publication.

4.2 SUBMITTED ALTERNATIVES

Alternatives submitted via scoping comments are identified in Table 4.2-1.

Table 4.2-1. Alternatives Submitted via Scoping Comments

Submitted Alternative	Carried Forward	Rationale
Conducting sample analysis on the surface of Mars to determine the samples are safe prior to return to Earth.	No	See Section 2.3 (Alternatives Considered But Not Carried Forward).
Conducting sample analysis on the lunar surface to determine the samples are safe prior to return to Earth.	No	See Section 2.3 (Alternatives Considered But Not Carried Forward).
Conducting sample analysis in orbit on the International Space Station to determine the samples are safe prior to return to Earth.	No	See Section 2.3 (Alternatives Considered But Not Carried Forward).

Table 4.2-1. Alternatives Submitted via Scoping Comments

Submitted Alternative	Carried Forward	Rationale
Consideration of partnerships with commercial space entities.	No	The United States, like all other Parties to the 1967 Outer Space Treaty, bears international responsibility for both governmental and non-governmental activities in space. Furthermore, Parties to the Outer Space Treaty are to conduct space exploration activities so as to avoid “adverse changes in the environment of the Earth” as a result of extraterrestrial matter. Private space flight companies launching from the United States would have to obtain the relevant approvals and authorizations for returning samples from Mars. NASA and its partners have decades of proven experience engineering systems for transit to, and operation on, Mars. Planning for MSR applies that engineering and scientific experience in a logical follow-on to the Mars 2020 – Perseverance Rover mission.
Consideration of techniques to assess samples and for sterilization prior to returning to Earth: • Two-color technique to study the evolution of the organic pigments instead of direct sampling • Using plasma sterilization technology • Nanoscale X-ray emitters for sterilization	No	Sterilizing the entirety of the material returned from Mars would compromise specific scientific goals, as outlined in the discussion of sterilization-sensitive science by Meyer et al. (2022) in the “Final Report of the Mars Sample Return Science Planning Group 2 (MSPG2)” (Meyer et al. 2022). Note that the Meyer paper considers only gamma radiation and heat sterilization methods, but the same principles apply to any sterilization method: to be successful, such methods must damage the molecule types that represent key targets for Mars science investigations. The MSPG2 report notes that the process of successfully completing the MSR Sample Safety Assessment Protocol involves a variety of complex operations that would not be feasible on Mars, including examining the samples on very small scales (5 to 20 microns), high-resolution spectrographic analysis, and culturing in conditions suitable for propagating terrestrial biology. The design and feasibility of the SRF is currently under consideration by several architecture and design firms. The SRF

Table 4.2-1. Alternatives Submitted via Scoping Comments

Submitted Alternative	Carried Forward	Rationale
		will employ a combination of the best in industry standards and innovative tested technology concepts for air filtration to meet the stringent planetary protection requirements.
Consideration of propulsive landing and redundant systems (e.g., parachute) for sample return to Earth.	No	NASA's approach to achieving extremely high reliability throughout entry, descent, and landing is through simplicity of design. By minimizing the number of systems that could have failure modes, the entire Earth Entry System is made more reliable. Propulsion systems and parachutes could improve performance, but add significant mass, complexity, cost, and additional risk.
Consideration of sample tube configurations that resist corrosion and have multilayer tube walls to ensure containment.	No	The MSR mission concept does not depend on sample tube integrity to ensure containment of Mars material. See Section 2.1.2.1.3 (Earth Return Orbiter) in the PEIS regarding sample containment.

Key: MSPG2 = "Final Report of the Mars Sample Return Science Planning Group 2"; MSR = Mars Sample Return; PEIS = Programmatic Environmental Impact Assessment; SRF = Sample Receiving Facility.

4.3 INFORMATION AND ANALYSES

Table 4.3-1 provides a summary of the substantive comments (information) received during scoping and how NASA addressed those comments in this PEIS (analyses). This table does not provide a summary of the individual comments verbatim. Some comments were provided by multiple commenters. The substantive comments in the table have been organized into broad categories. Substantive comments generally include, but are not limited to, comments that identify potential environmental impacts for analysis, identify reasonable alternatives for analysis, identify feasible mitigations for consideration, or otherwise recommend relevant information that should be considered in the development of the Draft PEIS. Non-substantive comments generally include, but are not limited to, comments that express a conclusion, an opinion, or a vote for or against the proposal itself, or some aspect of it; that state a position for or against a particular alternative; or that otherwise state a personal preference or opinion. All comments received on this proposal will be included in the Administrative Record regardless of when they were received and regardless of their substantive or non-substantive nature.

Table 4.3-1. Summary of Scoping Issues/Concerns

Issue/Concern Identified	Addressed in PEIS	If Yes, Location in EIS If No, Rationale
Purpose and Need, Alternatives		
Questions concerning whether sterilization processes would change the quality of samples.	Yes	See Section 2.1.2.1.3 (Earth Return Orbiter). The preservation of the geologic record for these samples is of paramount importance to NASA, therefore the process for sterilization is being considered very carefully.
Concern that sample handling involves military organizations, U.S. Air Force and U.S. Army, which may obstruct the scientific process.	No	Involvement of DoD is limited to support for EES landing and recovery operations.
The cost of the MSR Campaign when money should be spent on other efforts (e.g., climate change, carbon reduction).	No	The cost of the MSR Campaign is not within the scope of PEIS analysis.
Availability of the SRF to others.	No	The Mars returned samples will be available to the world-wide scientific community through competitive processes enabling selected scientists' access to the samples. NASA does not plan for the SRF to house samples returned through agencies/corporations not included in the NASA-ESA Mars Sample Return Campaign.
Monitoring for sudden disturbances to the Orbiter's attitude for micrometeoroid damage to the EES.	Yes	See Section 3.4.1.1 (Programmatic Analysis). The MSR mission concept provides a Micrometeoroid Protection System that has multiple layers of protective materials which provides protection throughout the entire flight from launch, out to Mars and back to Earth.
Concern over the "race" with China regarding sample returns and whether the timetable for the MSR Campaign could change based on China or other considerations (e.g., budget) constraints.	No	China is a Party to the Outer Space Treaty, which requires that Parties pursuing the exploration of outer space conduct exploration "so as to avoid adverse changes in the environment of the Earth resulting from the introduction of extraterrestrial matter" that could result from sample return missions. NASA is focused on its plans to remain on the cutting edge of space science, technology, and exploration, including plans to return humans to the Moon, explore Mars and the solar system, as well as to launch the next great observatories. Our ambitious plans involve engagement with global partners.

Table 4.3-1. Summary of Scoping Issues/Concerns

Issue/Concern Identified	Addressed in PEIS	If Yes, Location in EIS If No, Rationale
		We've always worked to use space and science as a unifying force.
Landing site assessment and use of ground penetrating radar at the landing site.	Yes	Section 2.3.2 (Site-Specific Alternative Screening Criteria) discusses the landing site selection process. Ground penetrating radar was not utilized as part of the evaluation of landing site alternatives.
Whether any crewed missions are being considered at any point under this proposal or any future tiered phases of the MSR Campaign.	Yes	See Section 2.3.1.1 (Programmatic Alternatives). A role for human exploration is not included in the initial phase of returning samples from Mars.
NEPA/Public Involvement		
Concerns over public meetings using commercial closed-source software (Webex) requiring consenting to unspecified analytics.	No	This is not within the scope of NEPA analysis.
NASA perpetuating misinformed scientific data showing that Mars has no conditions and indications of microbial life today.	Yes	See Section 1.1 (Background).
Safety/Mission Safety/Planetary Protection		
General concern about safety of bringing Mars samples to Earth (potential for contamination of Earth by microbes, pathogens, prions, viruses, bacteria, or other organisms).	Yes	Section 3.4 (Health and Safety) discusses the health and safety aspects of the Proposed Action.
Ensure the safety/sterilization of samples before they are returned to Earth, whether there be full certainty that sterilization techniques would neutralize any biological material from Mars, and concern over extremophiles or organisms unlike any terrestrial biology.	Yes	Section 3.4 (Health and Safety) discusses the health and safety aspects of the Proposed Action.
Consideration of the presence of bacteriological/microbial content from the Viking lander tests. The organic analyses results from the Curiosity and Perseverance rovers should now call into question the negative organics findings by the Viking Lander Gas Chromatograph Mass Spectrometer from 1976 and reinvigorate renewed interest in the Viking Labeled Release experiment.	No	The general consensus in the scientific community continues to be that the Viking lander experiments did not detect signs of biological activity in Mars material. NASA's Curiosity and Perseverance Mars rovers have found habitable conditions at their landing sites and have detected organic compounds; this does not equate to finding current biological activity.
Concern about mission failure/failure rates, or loss of containment of EES during reentry or impact (using Solar Wind/Genesis project as examples).	Yes	Section 3.4 (Health and Safety) discusses the health and safety aspects of the Proposed Action.

Table 4.3-1. Summary of Scoping Issues/Concerns

Issue/Concern Identified	Addressed in PEIS	If Yes, Location in EIS If No, Rationale
Control of hazards resulting from human error in the overall MSR programmatic process. Human errors may be introduced via 1) mission design: lack of proper specification of the mission processes and procedures; 2) environmental factors: overlooking or misjudging the environments that will be imposed during the mission; 3) system design: lack of properly designed hardware and software features to control contamination potential; and 4. human factors: overlooking or misjudging aspects of human behavior during the MSR mission that could result in contamination potential.	Yes	Section 3.4 (Health and Safety) discusses the health and safety aspects of the Proposed Action.
EPA recommends decontamination as another prevention approach as part of the ground recovery operation. The following aspects of decontamination would be appropriate for consideration: • how mobile decontamination techniques and techniques used for decontamination at the eventual stationary facility could be complementary; and • how the decontamination technologies and procedures would account for the extreme environment from which the potential life has come.	Yes	Section 3.5.1.2.1 (Cultural Resources, Site-Specific Analysis [UTTR/DPG]), Affected Environment) and Section 3.6 (Hazardous Materials and Waste) discuss the standard decontamination methods proposed and potential effects associated with the Proposed Action.
EPA supports the assessment of the integrity of the EES upon ground retrieval. It is well-known that microbes on Earth are capable of taking up material from their environment, incorporating it into their cellular machinery, and passing it down through generations. For this reason, EPA recommends that NASA identify the most likely and most hazardous scenarios of loss of integrity and evaluate what ground operations would do in the eventuality of those events. With respect to unplanned release of material, EPA recommends that NASA consider if the risk of release of viable Martian life (which includes quiescent/dormant life that could animate if exposed to the right environmental conditions) is equivalent to risk of release of building blocks of Martian life.	Yes	Section 3.4 (Health and Safety) discusses the health and safety aspects of the Proposed Action. Within the context of this NEPA analysis, there is no functional difference between dormant Martian life and "building blocks" of Martian life - both are considered the same from a risk and health and safety perspective (i.e., response) when considered in context of unplanned release of sample material.
Early detection-rapid response (EDRR) planning to the programmatic EIS.	Yes	Section 3.4 (Health and Safety) discusses the health and safety aspects of the Proposed Action.

Table 4.3-1. Summary of Scoping Issues/Concerns

Issue/Concern Identified	Addressed in PEIS	If Yes, Location in EIS If No, Rationale
What is the smallest Mars particle that is forbidden to be on the capsule carried to Earth? Dust level, bacteria level, virus level, prion level?	No	MSR engineering requirements are based on managing unsterilized particles 50 nm in size and larger. MSR selected this size limit because particle size distribution data indicate that the fraction of particles below 50 nm is small (less than 0.06%) and also because the physics of particle transport are such that measures taken to control or exclude particles of 50 nm are also effective for particles of smaller sizes. A number of studies (National Research Council 1999, Heim et al. 2017) have estimated the minimum sizes for life forms from fundamental inputs such as the genetic material required to permit a cell to perform basic functions [e.g., (Glass et al. 2006)], observations in extreme environments [e.g., (Comoli et al. 2009)] or theoretical constraints that would apply to astrobiology investigations (Lingam 2021). Values from such studies have been used to inform findings on best practices for sample return missions and MSR has considered those findings in selecting 50 nm for engineering requirements.
When the consequences of a failure are so great, a 100% guarantee should be required. The NASA factsheet "The Safety of Mars Sample Return" does address this issue. "Panels have found an extremely low likelihood that samples collected from areas on Mars like those being explored by Perseverance could possibly contain a biological hazard to our biosphere." Just how low is "low likelihood"? Is NASA's goal specification to prevent accidental release of the Mars samples 1 in a thousand? 1 in a million? 1 in a billion?	Yes	See Sections 2.1.2.1.3 (Earth Return Orbiter) and 3.4.1.2.2 (Health and Safety, Site-Specific Analysis [UTTR/DPG]), Environmental Consequences). No outcome in science and engineering processes can be predicted with 100% certainty. The safety case for MSR safety is based on redundant containment supported by rigorous testing and analysis, the extensive experience of NASA and ESA with very similar activities over the past three decades, as well as independent reviews of program plans by external experts.
NASA has not set forth a specific containment requirement necessary to protect the Earth's biosphere from accidental, mistaken, or even intentional release of the sample into Earth's biosphere.	Yes	See Section 2.1.2.1.3 (Earth Return Orbiter). NASA's requirements for backward planetary protection (i.e., containment requirements) are set forth in NPR 8715.24: Section 3.4.
How will NASA assure that the Mars Sample handlers are qualified and of sound mind?	No	Because the SRF will be a high-containment laboratory, the requirements for sample handlers will follow similar proven processes developed by the NIH and CDC's Biological Surety Program,

Table 4.3-1. Summary of Scoping Issues/Concerns

Issue/Concern Identified	Addressed in PEIS	If Yes, Location in EIS If No, Rationale
		which includes the Personnel Reliability Program. These programs include: 1) a comprehensive background investigation, 2) Maximum biocontainment MSR SRF-specific training, 3) Medical examinations to assure physical fitness for duty, and 4) a behavioral health screen, designed to help assess the worker's psychological resilience and individual attitudes toward laboratory safety and personal responsibility. Additionally, NASA's workplace policies encourage all employees to be open and forthcoming about any concerns related to their personal health and safety or that of their co-workers. The processes for major mission events are rehearsed extensively in advance to clearly establish norms of expected performance. Key operational positions will have well-identified back-ups who are capable of recognizing unexpected performance and stepping in to assist, if necessary.
NASA has claimed (and has placed into print in the Notice for these comments) that "It (Mars) is a freezing landscape" without telling the reader the temperature on Mars reaches 70 degrees F seasonally in places. NASA claims Mars has "…no liquid water" which misleads the reader into thinking there is zero water available for microbial life, when sufficient water vapor exists to support some species of microbial life. NASA claims that Mars is "continually bombarded with harsh radiation", when studies have shown some species of Earth microbe could survive the ionizing radiation on Mars for half a million years, even in the dormant state. As to ultraviolet light, a thin layer of Mars regolith or shade in crevices or under the numerous rocks on Mars provides adequate protection from UV light.	Yes	See Section 1.1 (Background).
International space law and policy on planetary protection appears inadequate to meet the challenges of a Mars sample return as envisioned by NASA.	No	Article IX of the 1967 Outer Space Treaty is very clear regarding the duty to avoid adverse changes in the environment of the Earth resulting from the introduction of extraterrestrial matter. Moreover, NASA and ESA have agreed to apply biological planetary protection measures consistent

Table 4.3-1. Summary of Scoping Issues/Concerns

Issue/Concern Identified	Addressed in PEIS	If Yes, Location in EIS If No, Rationale
		with the guidelines contained in the Committee on Space Research (COSPAR) Planetary Protection Policy and Implementation Guidelines. In addition, both space agencies committed (under international law) to draw up a Joint Biological Planetary Protection Management Plan for the avoidance of harmful contamination of Mars and adverse changes in the environment of the Earth resulting from the introduction of Martian material, as part of the campaign and missions planning process. NASA observes additional internal guidelines and policies regarding planetary protection in its NPR 8715.24 (Planetary Protection Provisions for Robotic Extraterrestrial Missions).
Hazardous Materials		
The proposed Campaign may involve a number of hazardous materials that may require disclosure, avoidance, and mitigation to ensure public health and environmental protection. Public disclosure of the presence of these elements at different points of the proposed Campaign that can interact with the public and our environment can enhance public understanding of the decision.	Yes	Section 3.6 (Hazardous Materials and Waste) discusses the potential impacts associated with hazardous materials and waste related to the Proposed Action.
Hydrazine is a common fuel for spacecraft and is corrosive with acute health risks to humans and animals and is a probable human carcinogen. It is unclear if a significant quantity of this or other toxic fuel will survive a launch accident and whether there could be human or animal exposure down range from a launch site before ground crews respond. It is also unclear if NASA anticipates using any fuel on the Earth Entry System through the atmosphere back to the Earth's surface. The twenty radioisotope heating units (RHUs) that NASA is considering for this mission may use Plutonium-238 or another radioisotope. It is unclear if NASA anticipates any of the RHUs being integrated with any mission element returning to Earth. EPA encourages NASA to disclose if it anticipates any hydrazine fuel or RHUs being part of the mission elements returning to the Earth's	No	Launches and potential impacts (including launch accidents) are addressed in the *Final Environmental Assessment for Launch of NASA Routine Payloads* (NASA 2011), which found no significant impacts from routine launches using rocket fuels (see Appendix C, NASA Environmental Checklists). There are no fuels being utilized in the EES; it is a passive system. RHUs are no longer proposed as part of the actions. None of the mission elements returning to the Earth's surface would contain hydrazine fuel.

Table 4.3-1. Summary of Scoping Issues/Concerns

Issue/Concern Identified	Addressed in PEIS	If Yes, Location in EIS If No, Rationale
surface, and any public safety messaging plans it has in case of landing outside the anticipated target zone.		
The UTTR has a history of cruise missile testing and may have unexploded munitions within or near the proposed landing site. EPA recommends that NASA continue to cooperate closely with the US Air Force to map out known hazard areas for UXO, both inside the anticipated landing areas and beyond it within the larger UTTR.	Yes	UXO and safety clearance is addressed in Section 3.4 (Health and Safety).
It is unclear what the decontamination methods involve, including chemical, radiological, or pressurized sterilization (autoclave) treatment, and whether that includes sterilization of the estimated 100-square-meter landing site. It is also unclear how any decontamination supplies (chemicals, wipes, etc.) will be managed. In addition, please describe the decontamination methods, including chemical, radiological, incineration, or pressurized sterilization. Also describe what impact is anticipated from that decontamination on the landing site itself, including any excavation of Earth sediment, and to what depth, and what the waste management solution of decontamination supplies and materials will be.	Yes	Section 3.6 (Hazardous Materials and Waste) discusses the potential impacts associated with hazardous materials and waste related to the Proposed Action.
Cultural Resources		
EPA notes that at either end of the UTTR site are the Skull Valley Indian Reservation and the Goshute Indian Reservation. Either tribe may have ancestral cultural resources within the UTTR area. EPA encourages NASA to work with the Department of Defense, the Bureau of Indian Affairs, and the Skull Valley and Goshute Indian Reservation governments to identify cultural resources in the anticipated landing area, to avoid and minimize impact to those cultural resources, and consult with the tribes to identify adequate mitigation measures where impacts are unavoidable. EPA strongly encourages that consultation inform sample recovery teams planning and operations.	Yes	Section 3.5 (Cultural Resources) discusses potential impacts to cultural resources and coordination with interested tribal entities.

Table 4.3-1. Summary of Scoping Issues/Concerns

Issue/Concern Identified	Addressed in PEIS	If Yes, Location in EIS If No, Rationale
Biological Resources		
The document should identify all petitioned and listed threatened and endangered species and critical habitat that might occur within the landing area. EPA notes that NASA may decontaminate the estimated 100-square meter landing area. The Draft EIS should also quantify which species or critical habitat might be directly, indirectly, or cumulatively affected by the proposed Campaign.	Yes	Section 3.8 (Biological Resources) discusses potential impacts to sensitive species. A USFWS IPaC report as well as the DAF INRMP identifies no sensitive species or critical habitat present at the proposed landing site.
The EPA recommends that NASA engage with the U.S. Fish and Wildlife Service and US Air Force biologists early to account for any sensitive, threatened, or endangered species in the anticipated landing area, and incorporate their input to avoid, minimize, and mitigate any impact to these species and their habitat. NASA should also account for the following in the programmatic document: 1) Hydrologic function, flow and channel modifications, wetlands, and habitat fragmentation regarding species' habitat requirements; and 2) Migratory Bird Treaty Act compliance.	Yes	Section 3.8 (Biological Resources) discusses potential impacts to sensitive species. A USFWS IPaC report as well as the DAF INRMP identifies no sensitive species or critical habitat, to include gold or bald eagles, present at the proposed landing site. The landing site activities would not be expected to have any adverse effects to migratory birds given the context of the location (active military training site with minimal migratory bird presence) and intensity of the action (one time).
In order to illustrate effects to wetlands in the area, EPA recommends that the Programmatic Draft EIS specifically include the following analyses or descriptions: • Description of impacts under individual or nationwide permits authorizing the discharge of fill or dredge materials to waters of the U.S.; • Maps, identifying wetlands and regional water features; • Identification of the direct, indirect, and cumulative impacts to wetlands in the geographic scope, including impacts from changes in hydrology even if these wetlands are spatially removed from the construction footprint. Include the indirect impacts to wetlands from loss of hydrology from water diversion/transfers, as well as the cumulative impacts to wetlands from future development scenarios based on population and growth estimates; and	Yes	Section 3.9 (Water Resources) discusses water resources. The are no identified surface waters, wetlands, or floodplains identified for the proposed landing site. A site location for the SRF has yet to be identified and is therefore addressed programmatically. Potential site-specific impacts associated with development of an SRF would be addressed in a follow-on Tier II analysis.

Table 4.3-1. Summary of Scoping Issues/Concerns

Issue/Concern Identified	Addressed in PEIS	If Yes, Location in EIS If No, Rationale
• Wetland delineations and functional analysis for wetlands potentially impacted by project alternatives.		
The UTTR site is located in a region prone to increased wildfire risk, with vegetation concentrations east and south of Salt Lake presenting the likeliest sources of wildfire fuels. Other forms of extreme weather may also affect alternate landing and the various launch sites under consideration. High wind speed could affect the accuracy of the sample return, and poor visibility could impair the sample recovery and decontamination mission elements. An erroneous landing by spacecraft or ground recovery elements in forest or residential areas may even accidentally start a fire. EPA encourages NASA to disclose their plans to deal with extreme weather events during mission operations, from launch to recovery and clean up, and to outline a coordination plan with fire responders in wildlands and residential areas if needed.	No	An erroneous landing outside the identified ellipses is highly unlikely. The sample capsule does not involve the use of any fuels. Use of recovery vehicles would follow the DAF wildland fire guidelines. The proposed landing site, on the playas of the South UTTR do not provide wildfire fuel loads. Risk of wildfire as a result of the Proposed Action is expected to be de-minimis.
Orbital Debris		
Orbital Debris According to NASA's website (https://www.nasa.gov/mission_pages/station/news/orbital_debris.html) the National Aeronautics and Space Administration and the Department of Defense's global Space Surveillance Network is of aware of at least 27,000 individual pieces of debris in orbit, presenting an ongoing threat to human spaceflight and robotic missions. The proposed Mars Sample Return Campaign would add debris from at least three additional flight elements and set the Earth Return Orbiter on a centennial avoidance trajectory following the release of the Martian samples to Earth for recovery. EPA recommends that NASA disclose the potential quantity, mass, and near-Earth orbital residency time it anticipates may be produced by the proposed Campaign. EPA further recommends that NASA disclose what measures it will commit to in the Campaign mission packages to minimize and mitigate the accumulation of orbital debris. For example, the rocket launches could avoid using as much paint and could use component separation methods other than explosive bolts or minimal shearing	No	Nominal launch operations for interplanetary missions do not leave anything in Earth orbit; all material left behind (payload fairings, debris from stage separation) returns to Earth and all material placed on an Earth-Mars transfer trajectory leaves Earth orbit. Orbital debris is possible in an off-nominal launch situation; potential impacts (including off-nominal events) are addressed in the *Final Environmental Assessment for Launch of NASA Routine Payloads* (NASA 2011), which found no significant impacts from routine launches in this regard (see Appendix C, NASA Environmental Checklists).

Table 4.3-1. Summary of Scoping Issues/Concerns

Issue/Concern Identified	Addressed in PEIS	If Yes, Location in EIS If No, Rationale
explosive bolt use to avoid debris multiplication. Finally, EPA recommends NASA consider reusable rockets for Earth launches at a programmatic level from the perspective of orbital debris avoidance.		

Key: AGL = above ground level; ANG = Air National Guard; CDC = Centers for Disease Control and Prevention; DAF = Department of the Air Force; dBA = A-weighted decibels; DNL = day-night average sound level; DoD = Department of Defense; EES = Earth Entry System; EPA = U.S. Environmental Protection Agency; ESA = European Space Agency; FAA = Federal Aviation Administration; INRMP = Integrated Natural Resources Management Plan; IPaC = Information for Planning and Consultation; MSR = Mars Sample Return; NEPA = National Environmental Policy Act; NIH = The National Institutes of Health; nm = nanometers; NPR = NASA Procedural Requirement; PEIS = Programmatic Environmental Impact Statement; PFAS = perfluoroalkyl and polyfluoroalkyl substances; SIL = Speech Interference Level; SRF = Sample Receiving Facility; USFWS = U.S. Fish and Wildlife Service; UTTR = Utah Test and Training Range; UXO = unexploded ordnance.

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5. AGENCIES, ORGANIZATIONS, AND INDIVIDUALS CONSULTED

5.1 COOPERATING AND CONSULTING AGENCIES

Several cooperating agencies are involved in this action due to jurisdiction by law associated with the action areas or due to special expertise associated with Biological Select Agents and Toxins protocols.

- Department of the Air Force
- U.S. Department of the Army
- U.S. Department of Agriculture
- U.S. Department of Health and Human Services
  - Centers for Disease Control and Prevention

Consulting agencies include:

- Utah State Historic Preservation Office
- Advisory Council on Historic Preservation
- Interested tribal governments

Appendix B (Public/Agency Involvement) provides relevant information and correspondence regarding cooperating and consulting agency correspondence.

5.2 DISTRIBUTION LIST

The Distribution List for the Draft Programmatic Environmental Impact Statement (PEIS) will be provided as part of the Final PEIS.

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8. INDEX

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APPENDIX A
LANDING SITE SELECTION INFORMATION

Jet Propulsion Laboratory
California Institute of Technology

Landing site options

Mars Sample Return landing site selection criteria and evaluation

Liz Luthman

07/20/2021

The decision to implement Mars Sample Return will not be finalized until NASA's completion of the National Environmental Policy Act (NEPA) process. This document is being made available for information purposes only.

Introduction

- NASA will engage in the NEPA process as part of MSR planning
- Most likely product is a Campaign Environmental Impact Statement (EIS)
- The EIS will contain a section addressing landing site selection for returned samples and will aim to
  - Outline our criteria for assessing landing sites and rationale for our baseline selection
  - Demonstrate due diligence in reviewing alternative sites
- This document is an overview of the content that will contribute to the landing site selection and alternatives section of the EIS

Summary: UTTR is the best landing site option for several reasons

Note: all data used in this document is from publicly available sources (Stardust / Genesis / OSIRIS-Rex Environmental Assessments; Strategic Ranges Reports; USGIS DEM data; FAA airspace data; Bureau of Land Management land usage data)

Overview

- Landing site requirements
- Scope of landing sites considered and initial down select
- Detailed shortlist review

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Landing site criteria

Landing site selection criteria

#	Category	Criteria	Rationale
1	US vs foreign site	The landing site must be on US soil	• As specified in the MOU with ESA • Time and uncertainty associated with obtaining the necessary agreements with foreign governments • Cost associated with forging complex agreements • Time to transport samples to the sample receiving facility, ensuring integrity, safety, and security of samples
2	Safety	The landing site must be remote	Limits the possibility of damage or injury to people or property
3		The landing site must be a controlled zone with restricted access	• Sites that can effectively be closed to the public minimize any chance of the Earth Entry System (EES) harming individuals or their possessions within the controlled site boundary
4		The landing site must have controlled airspace above it	• Provides separation from commercial or private air traffic
5		The site must accommodate a 30 km [TBD] downrange x 20 km [TBD] cross range landing ellipse (major axis at 295° [TBD])	• This is the maximum expected 5σ landing ellipse • Due to the restricted nature of the return it is considered prudent to accommodate the 5σ ellipse and not only the 3σ ellipse

7/20/2021

Landing site selection criteria

#	Category	Criteria	Rationale
6	Assured containment	The landing site must be on land, not on water	• Salt water is highly corrosive • There is a risk of the EES sinking in a water landing • There is a risk of the EES being carried by currents if not promptly recovered
7		The site must have a recovery area free of roads, structures, trees, hills and other hazardous terrain features	• The sample return architecture is a passive vehicle • The site must be free of hazards that could impose side loads on the vehicle • The sample tubes must experience no more than 3000 g on landing to preserve containment
8		The site must have a recovery area with slope less than 5 degrees	• The low slope enables crushable materials in the nose of the EES to limit the acceleration experienced by the samples and the containment system • The low slope limits the need for excessive levels of crushable materials in other areas of the vehicle
9		Soil in the recovery area must have mechanical properties that aid in the dissipation of landing impact energy	• The sample tubes must experience no more than 3000 g • The EES makes a hard landing • Soil with suitable mechanical properties can dissipate all impact energy without exercising the crushable material in the EES

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Landing site selection criteria

#	Category	Criteria	Rationale
10	Science return	The samples must experience minimum exposure to high temperature (<20°C)	• To preserve sample integrity • Analysis shows samples tubes will be -40° on landing and would like to like to maintain samples below -20°C through recovery if possible
11		The samples must experience no more than a 1300g impact acceleration	• To limit the degradation of samples due to impact (Requirement on Capture Containment and Return System project as defined in Environmental Requirements Document MSR-CCRS-SYS-REQ-0002 [TBD])
12		The location must allow prompt delivery of the EES to the sample receiving facility	• To preserve sample integrity • To limit the time needed to move the samples to a stable, sterile environment
13	Range recovery assets	The location should have the capability to track the EES during descent	• The EES needs to be tracked during descent and located promptly to enable rapid encapsulation • Facilities with their own tracking capabilities limits the need to assure availability of and coordinate bringing in mobile range assets for this purpose

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Scope and initial down select

So where do we start looking for sites?

Stardust and Genesis Environmental Assessments

- Concluded that UTTR was the best option
- Include a list of 12 potential alternative recovery sites

Sustainable Range Reports

- Submitted annually to Congress by Sec. of Defense
- Includes inventory of all active DoD ranges worldwide, across all branches of military (576 sites)

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Creating a shortlist

- Consider all ranges in EAs — **13**
- Add any ranges from SRR that meet the following criteria:
  - In the US — 507
  - Has special use airspace — 87
  - Not by the sea — 73
  - Has a large enough land area to accommodate the EES landing ellipse — **11**

→ **18** unique potential alternative landing sites

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Alternative site shortlist

Location name	Source	Location name	Source
Camp Pendleton Marine Corps Base, CA	EA	Nevada Test and Training Range (NTTR), NV	EA
China Lake, CA	EA	Poker Flats, AK	EA
Chocolate Mountain Gunnery Range, CA	EA	Tonopah Test Range, NV	EA
Edwards Air Force Base, CA	EA	Utah Test and Training Range (UTTR), UT	EA
Fort Bliss, TX	EA	White Sands Missile Range, NV	EA
Fort Irwin, CA	EA	Barry M. Goldwater Range (BMGR), AZ	SRR
Luke Air Force Base, AZ	EA	Eglin Test and Training Complex, FL	SRR
MCAGCC Twentynine Palms, CA	EA	Fallon, NV	SRR
MCAS Yuma/Bob Stump, AZ	EA	Fort Stewart, GA	SRR

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Short list review

Staged review and analysis process for down select

1. Inspection of Google Earth or similar to discount sites
   - Too small to accommodate landing ellipse
   - With unacceptable terrain features (e.g., trees, mountains)
   - Next to the sea
2. Inspection of DEM data to find sites with suitable slope (i.e., a recovery area with slope <5°
3. Review available geology data to find sites with suitable soil mechanical properties
4. Site visits to inspect facilities and take geology samples

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Alternative site shortlist

Location name	Source	Comment	Location name	Source	Comment
~~Camp Pendleton Marine Corps Base, CA~~	~~EA~~	By the sea, mountainous, covered in trees	Nevada Test and Training Range (NTTR), NV	EA	
China Lake, CA	EA		~~Poker Flats, AK~~	~~EA~~	Not a base, covered in trees
~~Chocolate Mountain Gunnery Range, CA~~	EA	Entirely mountainous	~~Tonopah Test Range, NV~~	~~EA~~	Part of NTTR
Edwards Air Force Base, CA	EA		Utah Test and Training Range (UTTR), UT	EA	
~~Fort Bliss, TX~~	~~EA~~	Mountainous, by Mexico border	White Sands Missile Range, NV	EA	
Fort Irwin, CA	EA		Barry M. Goldwater Range (BMGR), AZ	SRR	
~~Luke Air Force Base, AZ~~	~~EA~~	Tiny land area	~~Eglin Test and Training Complex, FL~~	~~SRR~~	By the sea
~~MCAGCC Twentynine Palms, CA~~	~~EA~~	Mountainous	~~Fallon, NV~~	~~SRR~~	Part of NTTR
~~MCAS Yuma/Bob Stump, AZ~~	~~EA~~	Wrong orientation for ellipse	~~Fort Stewart, GA~~	~~SRR~~	Covered in trees

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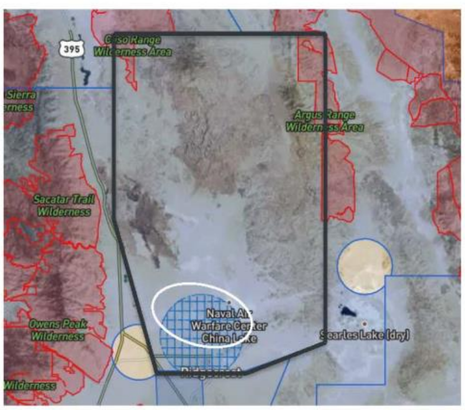
DEM slope data

Military Operations Area | Restricted airspace | Wilderness areas airspace | Restricted land

China Lake



Left: Airspace map
Center: Land usage map
Right: Terrain satellite image representative of area within notional ellipse

- Large land area
- Limited extent of flat, smooth terrain
- Flat areas contain many roads
- Majority of range is mountainous, as is surrounding area

Landing ellipse location notional

?

SOURCE: FAA (via http://knowbeforeyoufly.org/air-space-map/, accessed 5/11/20); Land Management Bureau (via https://navigator.blm.gov/map, accessed 05/11/20; Google Maps, accessed 5/11/20)

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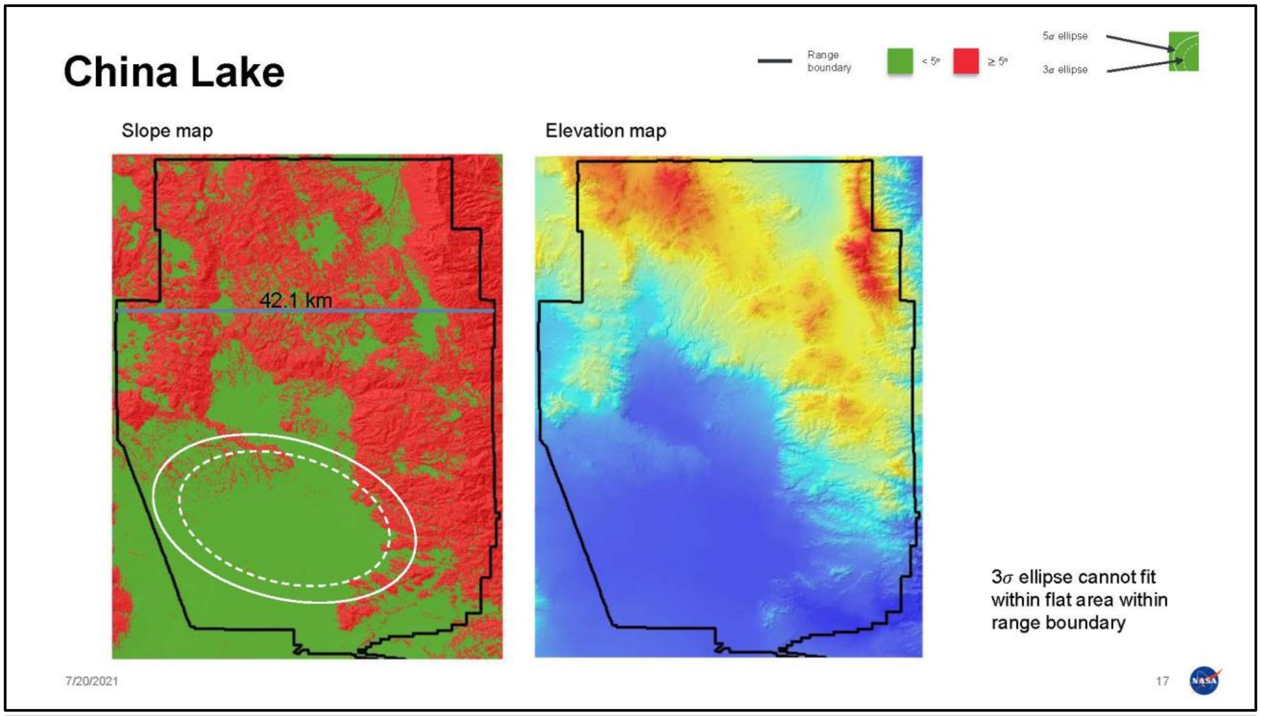
China Lake
Range boundary
< 5°
≥ 5°
5σ ellipse
3σ ellipse
Slope map
Elevation map
42.1 km
3σ ellipse cannot fit within flat area within range boundary
7/20/2021
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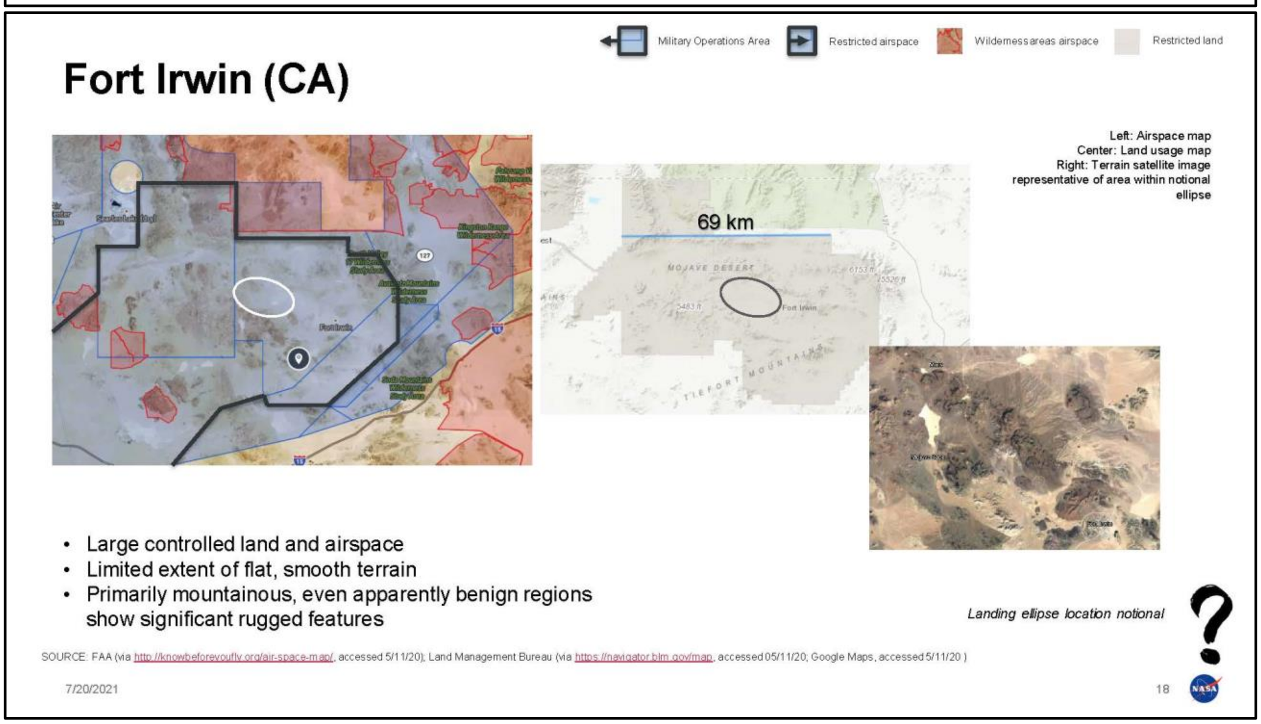
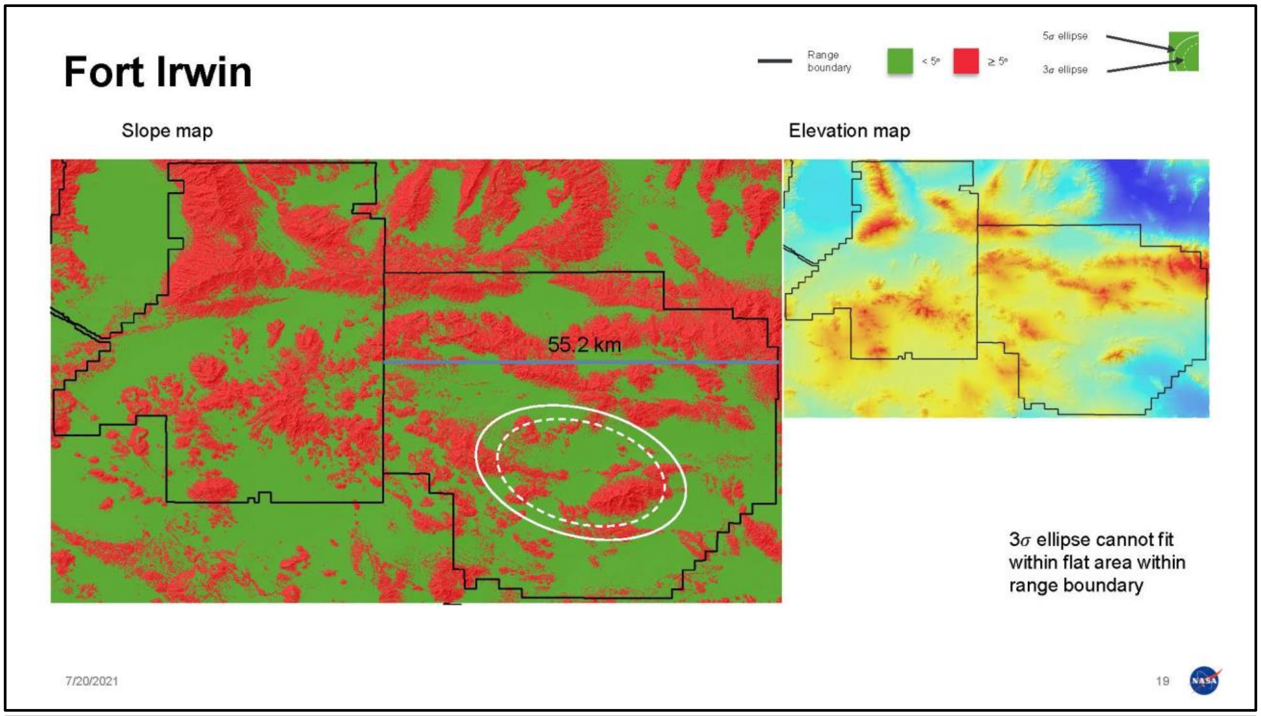

Fort Irwin (CA)
Military Operations Area
Restricted airspace
Wilderness areas airspace
Restricted land
Left: Airspace map
Center: Land usage map
Right: Terrain satellite image representative of area within notional ellipse
69 km
MOJAVE DESERT
TIEFORT MOUNTAINS
Fort Irwin
• Large controlled land and airspace
• Limited extent of flat, smooth terrain
• Primarily mountainous, even apparently benign regions show significant rugged features
Landing ellipse location notional
?
SOURCE: FAA (via http://knowbeforeyoufly.org/air-space-map/, accessed 5/11/20); Land Management Bureau (via https://navigator.blm.gov/map, accessed 05/11/20; Google Maps, accessed 5/11/20)
7/20/2021
18


Fort Irwin
Range boundary
< 5°
≥ 5°
5σ ellipse
3σ ellipse
Slope map
Elevation map
55.2 km
3σ ellipse cannot fit within flat area within range boundary
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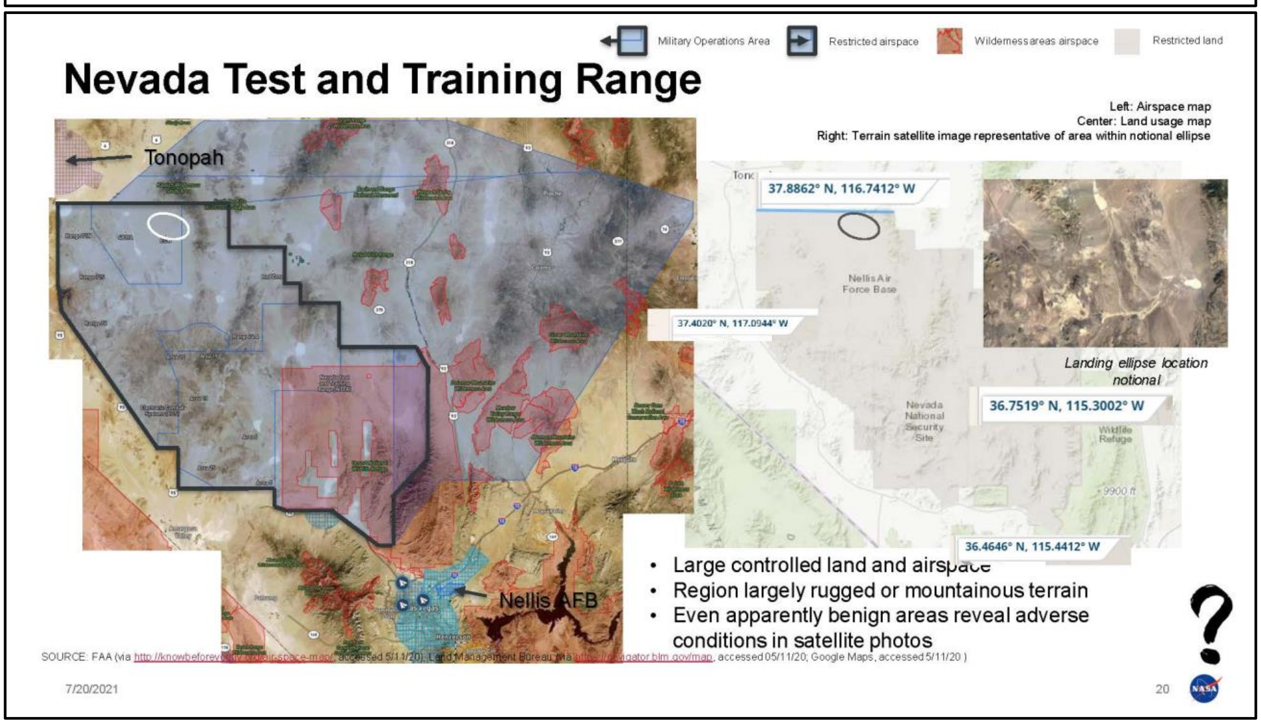
19


Military Operations Area
Restricted airspace
Wilderness areas airspace
Restricted land
Nevada Test and Training Range
Left: Airspace map
Center: Land usage map
Right: Terrain satellite image representative of area within notional ellipse
Tonopah
37.8862° N, 116.7412° W
37.4020° N, 117.0944° W
Nellis Air Force Base
Landing ellipse location notional
36.7519° N, 115.3002° W
Nevada National Security Site
36.4646° N, 115.4412° W
Nellis AFB
• Large controlled land and airspace
• Region largely rugged or mountainous terrain
• Even apparently benign areas reveal adverse conditions in satellite photos
?
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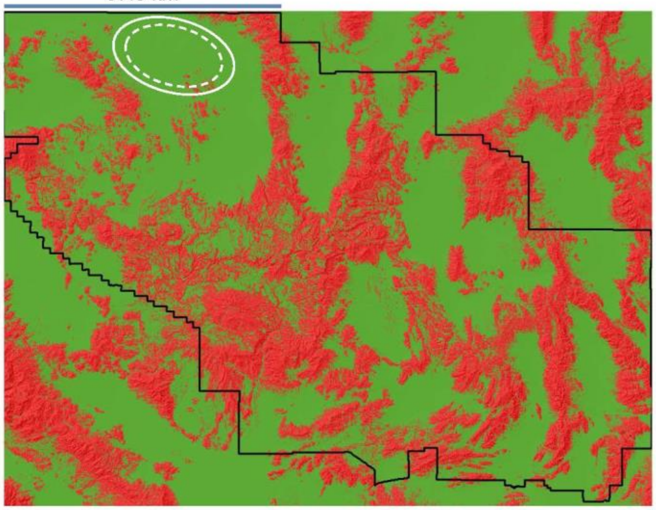
20

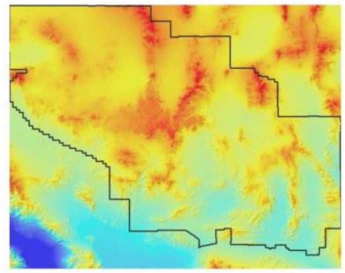
NTTR

Range boundary | < 5° | ≥ 5° | 5σ ellipse | 3σ ellipse

Slope map



Elevation map



3σ ellipse cannot fit within flat area within range boundary

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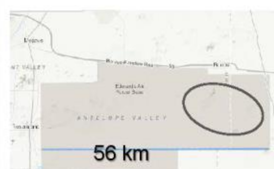
Edwards Air Force Base (CA)

Military Operations Area | Restricted airspace | Wilderness areas airspace | Restricted land



Left: Airspace map
Right: Land usage map
Bottom: Terrain satellite image representative of area within notional ellipse

- Medium land area, large controlled airspace
- Limited extent of flat, smooth terrain
- Immediate area contains airbase (buildings in center of area), tarmacked roads, mining operations
- Largely mountainous
- ~40km from Palmdale-Lancaster (pop. 300k)
- ~100 km from Los Angeles (pop. 4M)

Landing ellipse location notional

?

SOURCE: FAA (via http://knowbeforeyoufly.org/air-space-map/, accessed 5/11/20); Land Management Bureau (via https://navigator.blm.gov/map, accessed 05/11/20; Google Maps, accessed 5/11/20)

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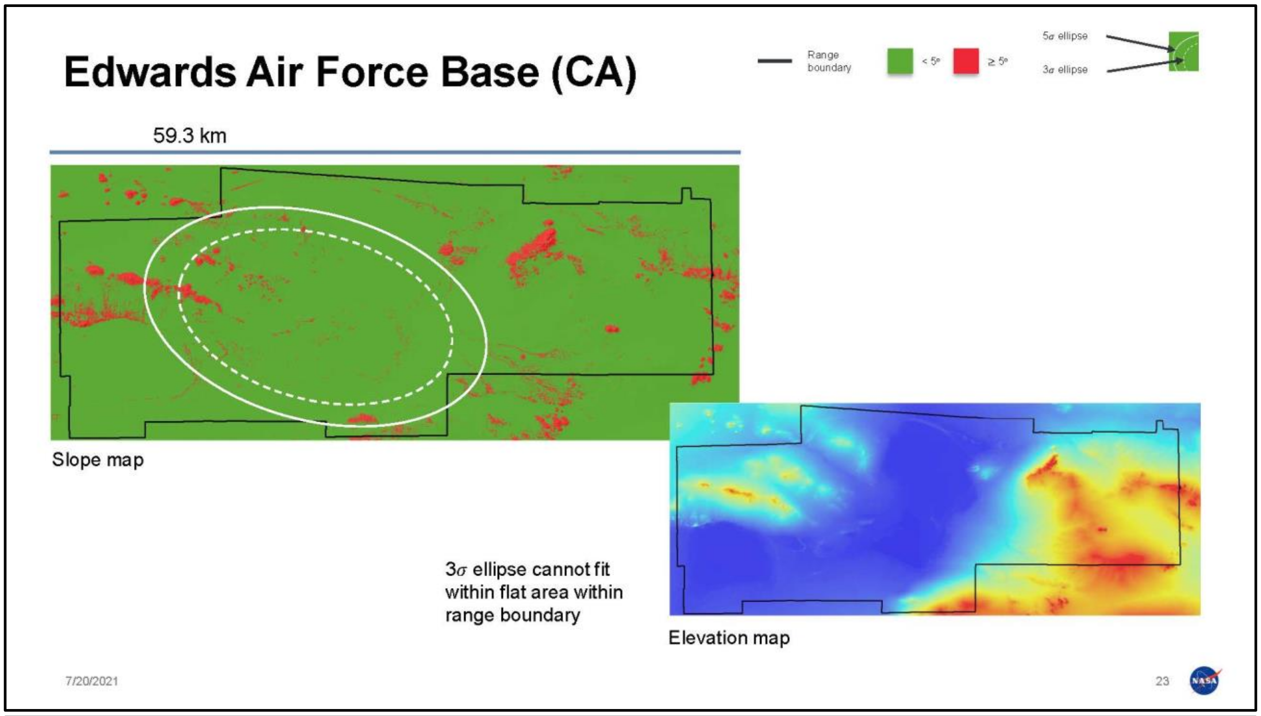
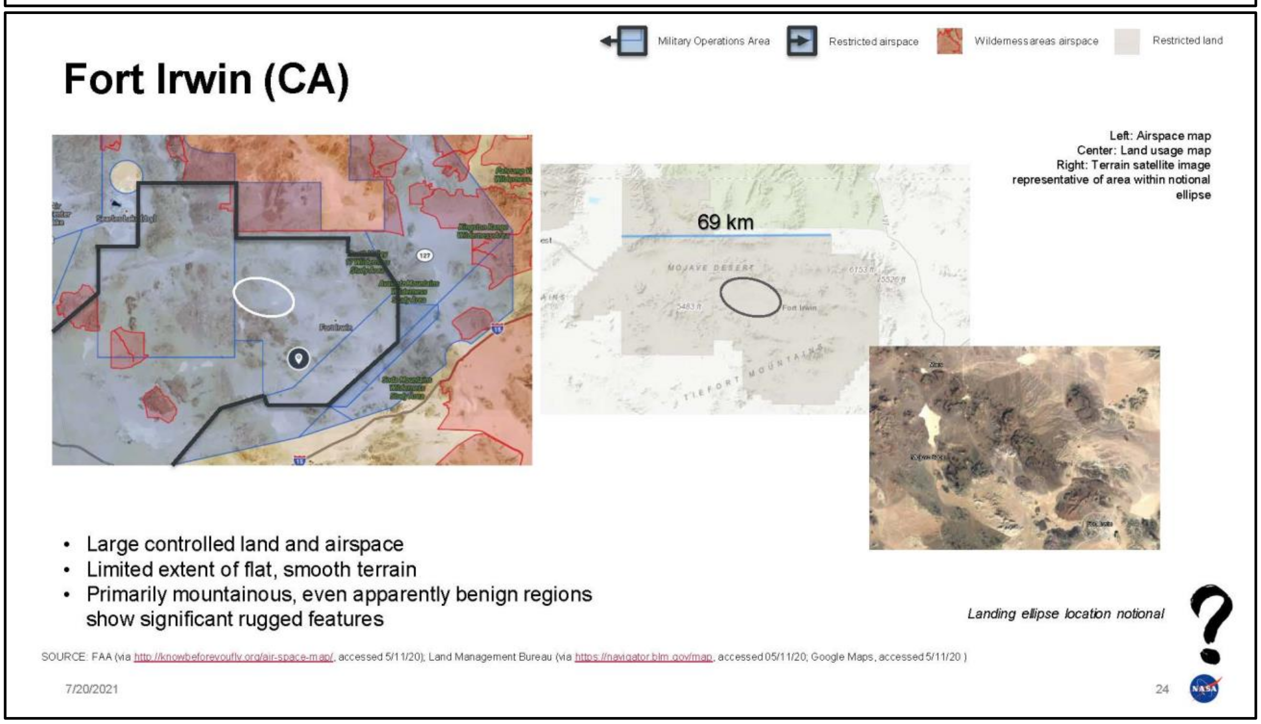

Edwards Air Force Base (CA)
Range boundary
< 5°
≥ 5°
5σ ellipse
3σ ellipse
59.3 km
Slope map
3σ ellipse cannot fit within flat area within range boundary
Elevation map
7/20/2021
23


Fort Irwin (CA)
Military Operations Area
Restricted airspace
Wilderness areas airspace
Restricted land
Left: Airspace map
Center: Land usage map
Right: Terrain satellite image representative of area within notional ellipse
69 km
MOJAVE DESERT
TIEFORT MOUNTAINS
Fort Irwin
• Large controlled land and airspace
• Limited extent of flat, smooth terrain
• Primarily mountainous, even apparently benign regions show significant rugged features
Landing ellipse location notional
?
SOURCE: FAA (via http://knowbeforeyoufly.org/air-space-map/, accessed 5/11/20); Land Management Bureau (via https://navigator.blm.gov/map, accessed 05/11/20; Google Maps, accessed 5/11/20)
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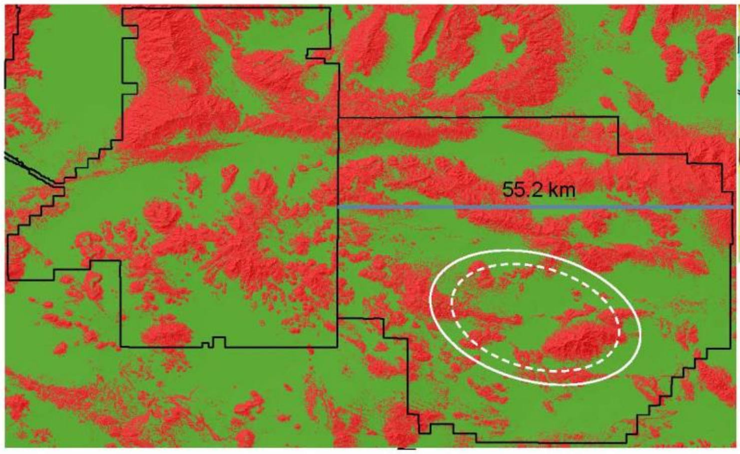
Fort Irwin

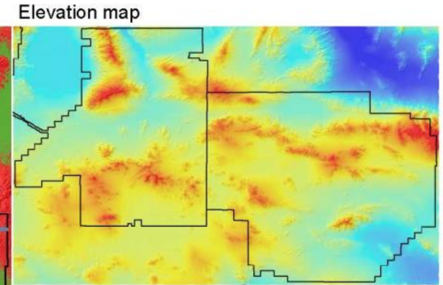
Range boundary | < 5° | ≥ 5°

5σ ellipse
3σ ellipse

Slope map



Elevation map



3σ ellipse cannot fit within flat area within range boundary

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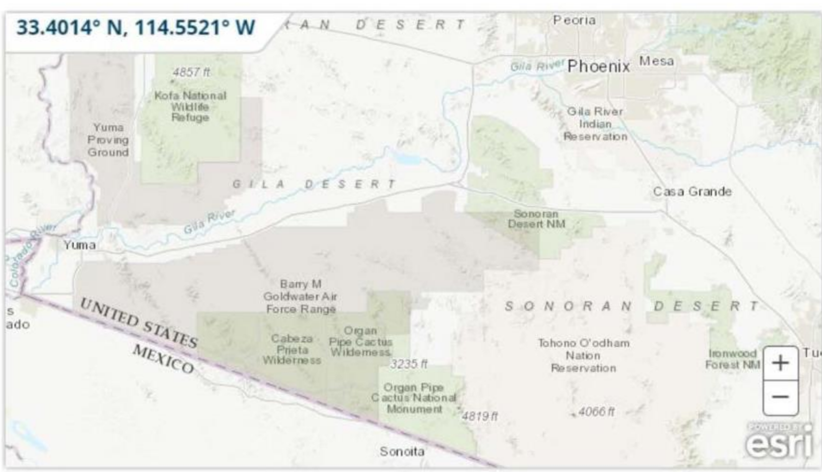
Barry M. Goldwater Range (BMGR) (AZ)



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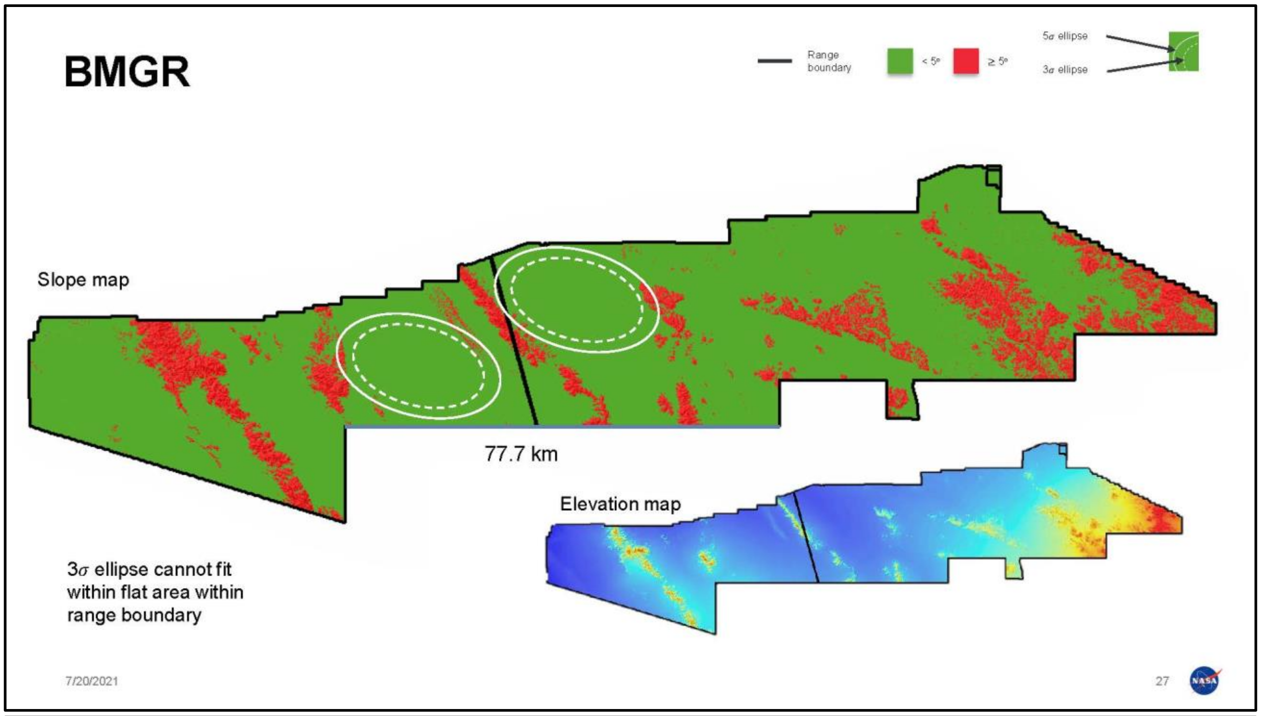
BMGR
Range boundary
< 5°
≥ 5°
5σ ellipse
3σ ellipse
Slope map
77.7 km
Elevation map
3σ ellipse cannot fit within flat area within range boundary
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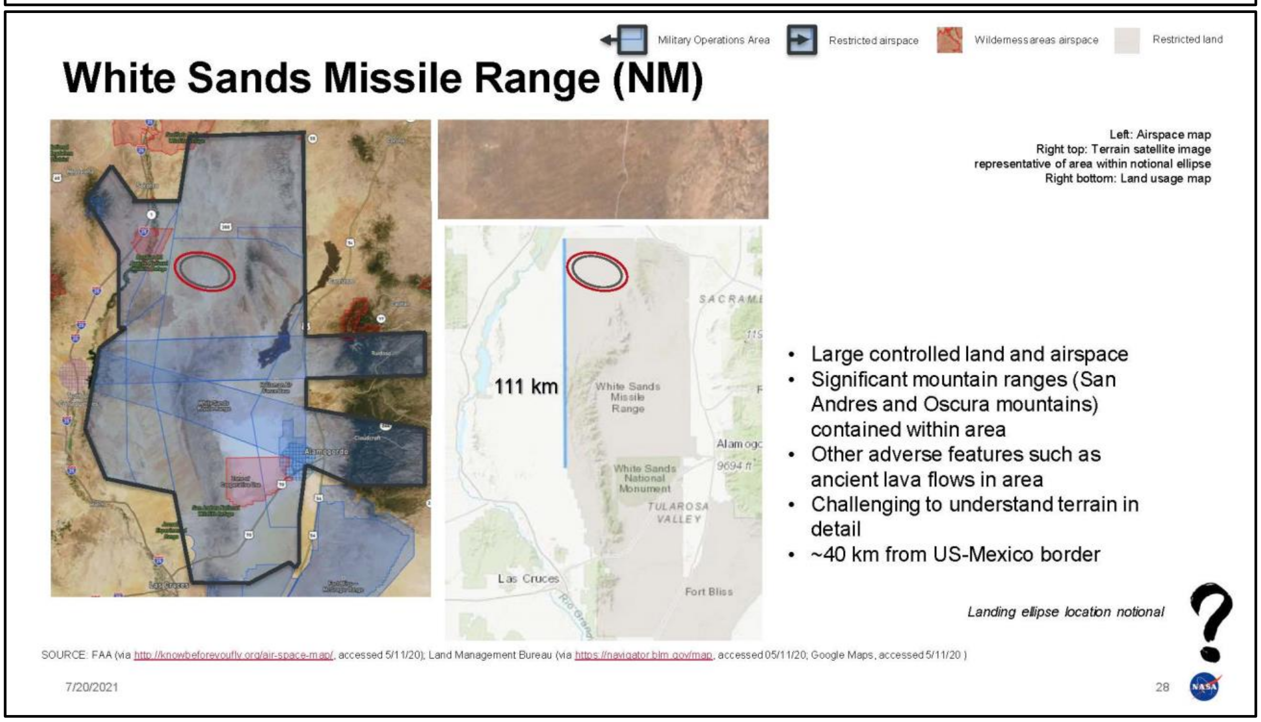
White Sands Missile Range (NM)
Military Operations Area
Restricted airspace
Wilderness areas airspace
Restricted land
Left: Airspace map
Right top: Terrain satellite image representative of area within notional ellipse
Right bottom: Land usage map
111 km
White Sands Missile Range
White Sands National Monument
TULAROSA VALLEY
Las Cruces
Fort Bliss
Alamogordo
• Large controlled land and airspace
• Significant mountain ranges (San Andres and Oscura mountains) contained within area
• Other adverse features such as ancient lava flows in area
• Challenging to understand terrain in detail
• ~40 km from US-Mexico border
Landing ellipse location notional
SOURCE: FAA (via http://knowbeforeyoufly.org/air-space-map/, accessed 5/11/20); Land Management Bureau (via https://navigator.blm.gov/map, accessed 05/11/20; Google Maps, accessed 5/11/20)
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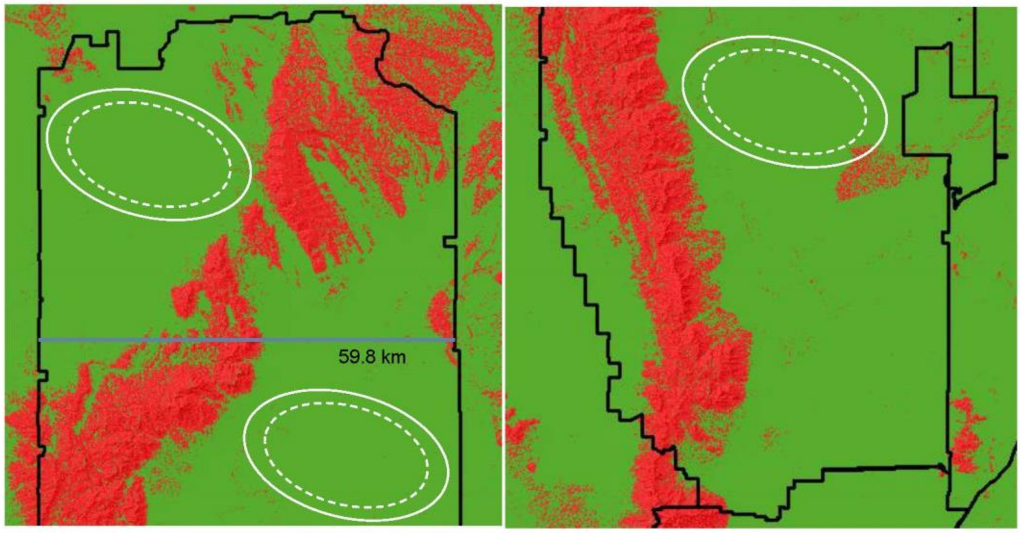
White Sands



Potentially possible to site the 3σ ellipse within flat area within range boundary, but not 5σ ellipse, and no room for flexibility

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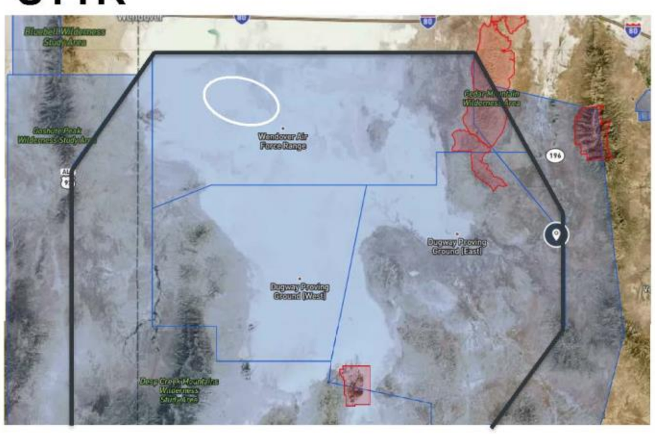
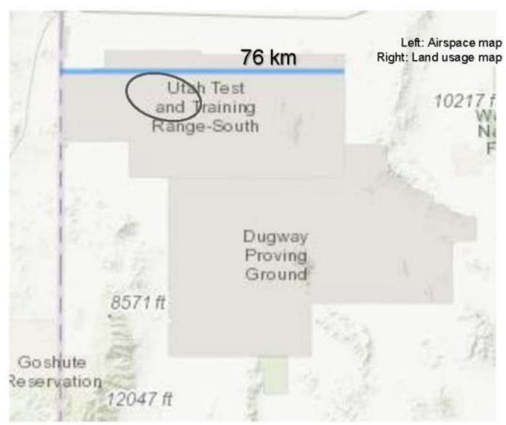
Military Operations Area | Restricted airspace | Wilderness areas airspace | Restricted land

UTTR





- Large land area comfortably accommodates 3σ landing ellipse
- Flat, smooth terrain
- Limited vegetation
- Mountains on outer edges of controlled zone
- Extensive controlled airspace

Potential ellipse derived from ELEET tool output, credit Alan Didion

SOURCE: FAA (via http://knowbeforeyoufly.org/air-space-map/, accessed 5/11/20); Land Management Bureau (via https://navigator.blm.gov/map, accessed 05/11/20; Google Maps, accessed 5/11/20)

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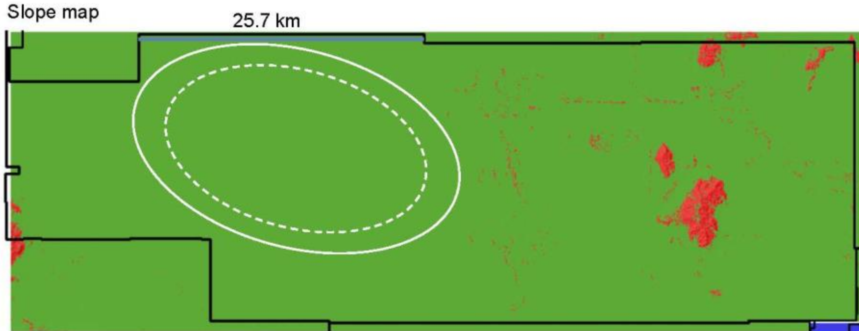
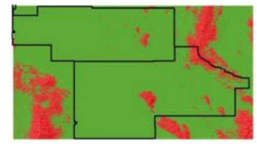
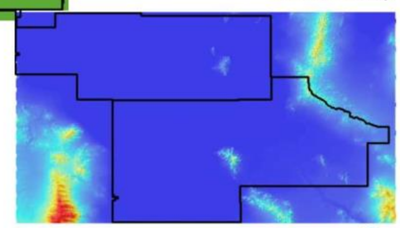
UTTR

Slope map





Elevation map



Can comfortably accommodate 3σ landing ellipse and 5σ ellipse also has flexibility to shift within UTTR bounds on flat ground

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Alternative site shortlist

Location name	Source	Comment	Location name	Source	Comment
~~Camp Pendleton Marine Corps Base, CA~~	~~EA~~	By the sea, mountainous, covered in trees	~~Nevada Test and Training Range (NTTR), NV~~	~~EA~~	Mountainous
~~China Lake, CA~~	~~EA~~	Mountainous	~~Poker Flats, AK~~	~~EA~~	Not a base, covered in trees
~~Chocolate Mountain Gunnery Range, CA~~	EA	Entirely mountainous	~~Tonopah Test Range, NV~~	~~EA~~	Part of NTTR
~~Edwards Air Force Base, CA~~	~~EA~~	Mountainous	Utah Test and Training Range (UTTR), UT	EA	
~~Fort Bliss, TX~~	~~EA~~	Mountainous, by Mexico border	White Sands Missile Range, NV	EA	
~~Fort Irwin, CA~~	~~EA~~	Mountainous	~~Barry M. Goldwater Range (BMGR), AZ~~	~~SRR~~	Mountainous, on Mexican border
~~Luke Air Force Base, AZ~~	~~EA~~	Tiny land area	~~Eglin Test and Training Complex, FL~~	~~SRR~~	By the sea
~~MCAGCC Twentynine Palms, CA~~	~~EA~~	Mountainous	~~Fallon, NV~~	~~SRR~~	Part of NTTR
~~MCAS Yuma/Bob Stump, AZ~~	~~EA~~	Wrong orientation for ellipse	~~Fort Stewart, GA~~	~~SRR~~	Covered in trees

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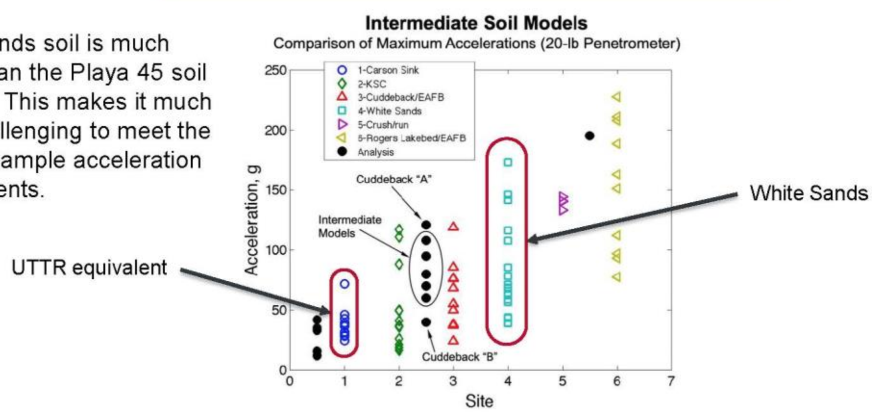
Geology

Existing soil properties tests

Soil Modeling Progress

White Sands soil is much harder than the Playa 45 soil of UTTR. This makes it much more challenging to meet the science sample acceleration requirements.



Orion soil penetration tests, credit: Jim Corliss

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Conclusions

- 507 DoD ranges in the US were reviewed
- A shortlist with 18 ranges was created
  - 13 ranges from the Stardust / Genesis /OSIRIS-Rex EAs
  - An additional 5 from the Sustainable Range Reports with enough area to encompass the 5σ landing ellipse
- After reviewing all DoD restricted ranges, UTTR represents the best landing site location on multiple dimensions
  - 11 ranges dismissed from Google Earth data: too small to accommodate the landing ellipse or unacceptable terrain (mountainous or heavily forested)
  - 5 ranges dismissed from DEM data: unable to accommodate landing ellipse within a region with slope <5°
- White Sands is a potential secondary option, but has less flat terrain and substantially harder soil

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Jet Propulsion Laboratory
California Institute of Technology

APPENDIX B
PUBLIC/AGENCY INVOLVEMENT

B.1 PUBLIC SCOPING SUMMARY

The National Environmental Policy Act (NEPA) process is intended to enable federal agencies to make decisions based on an understanding of the environmental consequences of a proposed action and alternatives. Public involvement is an essential part of this process and facilitates the development of a NEPA document—a Programmatic Environmental Impact Statement (PEIS) in this case—and informs the scope of issues to be addressed in the final analysis. In compliance with NEPA and 40 Code of Federal Regulations Section 1506.6, NASA notified relevant agencies, stakeholders, and Federally recognized tribes about the Proposed Action. The notification process provided relevant agencies and groups the opportunity to comment on the Proposed Action and informed them of potential impacts that could occur. The public scoping process included the following aspects:

- **Notice of Intent (NOI)** – A notice that announced NASA's intent to prepare an EIS was published in the Federal Register on April 15, 2022. The NOI formally initiated the public scoping process. The NOI included descriptions of the alternatives and the scoping process, and the dates, times, and locations of the scoping meetings. The NOI also invited affected federal, state, and local agencies; affected Indian tribe(s); and interested persons (e.g., public) to participate in the scoping process. A copy of the NOI is provided in Appendix B, Section B.1.1.
- **Scoping** – Council on Environmental Quality regulations at 40 Code of Federal Regulations 1501.9 requires a process called "scoping" to involve the public early in the assessment process. The scoping process is designed to solicit input from the public and interested agencies on the nature and extent of issues and impacts to be addressed and the methods by which potential impacts are evaluated. In addition to announcing scoping in the NOI, NASA published advertisements in local newspapers near the Utah Test and Training Range (UTTR) and Kennedy Space Center a week prior to the scoping meetings. Each advertisement provided scoping meeting dates and meeting access information. Table B-1 identifies the newspapers of record in which notices of public scoping were published, while Table B-2 provides information regarding the public scoping meetings.

NASA held two virtual public scoping meetings to inform the public and solicit comments and concerns about the proposal. The meetings began with a brief welcome message followed by a 10-minute NASA presentation describing the purpose of the scoping meetings, project schedule, opportunities for public involvement, Proposed Action and alternatives summary, and programmatic approach. A 30-minute technical presentation regarding the Mars Sample Return (MSR) Campaign was then provided. After the formal presentations was a 30-minute virtual "Open House" and question and answer session where meeting participants could ask questions of the panel presenters. After the technical presentations and question and answer session, the official scoping comment submission portion of the meetings began. The scoping comment submission session lasted 45 minutes, where members of the public were able to provide up to a three-minute comment.

Table B-1. Public Scoping Notices

Newspaper	City/Location	Publication Date(s)
Daytona Beach News-Journal	Daytona Beach, FL	Friday, April 15, and Sunday, April 24, 2022
Brevard Florida Today	Brevard County, FL	Friday, April 15, and Sunday, April 24, 2022
Orlando Sentinel	Orlando, FL	Friday, April 15, and Sunday, April 24, 2022
Indian River Press Journal/TCPalm	Vero Beach, FL	Friday, April 15, and Sunday, April 24, 2022
High Desert Advocate	West Wendover, NV	Friday, April 22 and Friday, April 29, 2022
Tooele Transcript Bulletin	Tooele, UT	Thursday, April 21 and Thursday, April 28, 2022
Standard Examiner	Ogden, UT	Friday, April 15, and Saturday, April 23, 2022
Salt Lake Tribune	Salt Lake City, UT	Sunday, April 17, Wednesday, May 4, 2022
Deseret News	Salt Lake City, UT	Friday, April 15, Friday, April 22, and Friday, April 29,2022

Table B-2. Public Scoping Meetings

Location	Date / Time	No. of Participants
Virtual	May 4, 2022 – 3:00 p.m. to 5:00 p.m. Eastern	64
Virtual	May 5, 2022 – 8:00 p.m. to 10:00 p.m. Eastern	18

The 30-day scoping comment period began on April 15, 2022, and officially ended on May 16, 2022. Commenters were encouraged to submit comments via the Federal Docket Management System or via U.S. Postal Service. All comments received are available for review on the Federal Docket as indicated in the NOI. Comments and stakeholder input received within the scoping comment period were considered during the development of the alternatives and the analysis presented in the Draft PEIS. Comments received after the official end of the scoping comment period were also considered in determining the range of actions, alternatives, and environmental analysis of significant issues in the Draft PEIS, to the maximum extent practicable, prior to its publication. Table B-3 provides a summary of the number and format of comment submittals received.

Table B-3. Public Scoping Comment Submittal Summary

Submittal Format	Number of Submittals
Standard Mail	3
Docket	162
Virtual Public Scoping Meetings (Oral Comments)	5
Total	170

A summary of the substantive comments received during scoping and how NASA addressed those comments in this PEIS is included in Chapter 4 (Submitted Alternatives, Information, and Analyses) of the PEIS. Substantive comments generally include, but are not limited to, comments that identify potential environmental impacts for analysis, identify reasonable alternatives for analysis, identify feasible mitigations for consideration, or otherwise recommend relevant information that should be considered in the development of the Draft PEIS. Non-substantive comments generally include, but are not limited to, comments that express a conclusion, an opinion, or a vote for or against the proposal itself, or some aspect of it; that state a position for or against a particular alternative; or that otherwise state a personal preference or opinion. All comments received on this proposal will be included in the Administrative Record regardless of when they were received and regardless of their substantive or non-substantive nature.

B.1.1 Notice of Intent

22578 Federal Register / Vol. 87, No. 73 / Friday, April 15, 2022 / Notices

FR 68275, December 1, 2021) of the subject five-year review was adequate and that the respondent interested party group response was inadequate. The Commission did not find any other circumstances that would warrant conducting a full review.[1] Accordingly, the Commission determined that it would conduct an expedited review pursuant to section 751(c)(3) of the Tariff Act of 1930 (19 U.S.C. 1675(c)(3)).

For further information concerning the conduct of this review and rules of general application, consult the Commission's Rules of Practice and Procedure, part 201, subparts A and B (19 CFR part 201), and part 207, subparts A, D, E, and F (19 CFR part 207).

Please note the Secretary's Office will accept only electronic filings at this time. Filings must be made through the Commission's Electronic Document Information System (EDIS, *https://edis.usitc.gov*). No in-person paper-based filings or paper copies of any electronic filings will be accepted until further notice.

Staff report.—A staff report containing information concerning the subject matter of the review has been placed in the nonpublic record, and will be made available to persons on the Administrative Protective Order service list for this review on April 15, 2022. A public version will be issued thereafter, pursuant to section 207.62(d)(4) of the Commission's rules.

Written submissions.—As provided in section 207.62(d) of the Commission's rules, interested parties that are parties to the review and that have provided individually adequate responses to the notice of institution,[2] and any party other than an interested party to the review may file written comments with the Secretary on what determinations the Commission should reach in the review. Comments are due on or before April 22, 2022 and may not contain new factual information. Any person that is neither a party to the five-year review nor an interested party may submit a brief written statement (which shall not contain any new factual information) pertinent to the reviews by April 22, 2022. However, should the Department of Commerce ("Commerce") extend the time limit for its completion of the final results of its review, the deadline for comments (which may not contain new factual information) on Commerce's final results is three business days after the issuance of Commerce's results. If comments contain business proprietary information (BPI), they must conform with the requirements of sections 201.6, 207.3, and 207.7 of the Commission's rules. The Commission's *Handbook on Filing Procedures,* available on the Commission's website at *https://www.usitc.gov/documents/handbook_on_filing_procedures.pdf,* elaborates upon the Commission's procedures with respect to filings.

In accordance with sections 201.16(c) and 207.3 of the rules, each document filed by a party to the review must be served on all other parties to the review (as identified by either the public or BPI service list), and a certificate of service must be timely filed. The Secretary will not accept a document for filing without a certificate of service.

Determination.—The Commission has determined this review is extraordinarily complicated and therefore has determined to exercise its authority to extend the review period by up to 90 days pursuant to 19 U.S.C. 1675(c)(5)(B).

Authority: This review is being conducted under authority of title VII of the Tariff Act of 1930; this notice is published pursuant to section 207.62 of the Commission's rules.

By order of the Commission.

Issued: April 11, 2022.

Lisa Barton,

Secretary to the Commission.

[FR Doc. 2022–08075 Filed 4–14–22; 8:45 am]

BILLING CODE 7020–02–P

[1] A record of the Commissioners' votes is available from the Office of the Secretary and at the Commission's website.

[2] The Commission has found the response to its notice of institution filed on behalf of Estwing Manufacturing Company, Inc., a domestic producer of each of the four heavy forged hand tools ("HFHT") domestic like products: Axes and adzes, bars and wedges, hammers and sledges, and picks and mattocks, to be individually adequate for each HFHT domestic product. Comments from other interested parties will not be accepted (*see* 19 CFR 207.62(d)(2)).

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

[Document Number NASA–22–024; Docket Number–NASA–2022–0002]

National Environmental Policy Act; Mars Sample Return Campaign

AGENCY: National Aeronautics and Space Administration.

ACTION: Notice of intent; notice of meetings; request for comments.

SUMMARY: Pursuant to the National Environmental Policy Act of 1969 (NEPA), as amended, the Council on Environmental Quality Regulations for Implementing the Procedural Provisions of NEPA, and NASA's procedures for implementing NEPA, NASA will prepare a Programmatic Environmental Impact Statement (PEIS) for the Mars Sample Return (MSR) Campaign; cooperating agencies for this effort include the U.S. Air Force (in accordance with, *Environmental Impact Analysis Process*), U.S. Army, U.S. Department of Agriculture, and U.S. Department of Health and Human Services—Centers for Disease Control and Prevention. The PEIS will provide information related to the potential environmental impacts associated with the proposed return of Mars samples to Earth for scientific analysis. Potential impacts to be analyzed in the PEIS include those associated with ground disturbance from landing site preparation, and sample vehicle landing and recovery efforts with respect to natural, biological and cultural resources. NASA will also assess potential impacts to the human and natural environment associated with loss of containment of Mars sample materials. Additional information about the MSR Campaign may be found on the internet at: *http://www.jpl.nasa.gov/missions/mars-sample-return-msr.*

DATES: The public scoping period for this PEIS is for a period of 30 days from publication of this notice. Fact sheets and other information regarding the NEPA and scoping process for the MSR Campaign will be made available at the following website beginning on April 15, 2022: *www.nasa.gov/feature/nepa-mars-sample-return-campaign.*

NASA will hold two VIRTUAL public scoping meetings to solicit comments regarding the Proposed Action and the environmental issues which NASA should consider in the PEIS. The virtual meetings will be held on May 4, 2022; 1 p.m.–3 p.m. (Mountain) and May 5; 6 p.m.–8 p.m. (Mountain) at the following URL: *https://jpl.webex.com/meet/msr.* The call-in number for audio-only users is: +1–510–210–8882.

The meetings will begin with a brief welcome message followed by a 10-minute NASA presentation describing the purpose of the scoping meetings, project schedule, opportunities for public involvement, proposed action and alternatives summary, and programmatic approach. A 20-minute technical presentation regarding the MSR Campaign will then be provided. After the formal presentations will be a 30-minute virtual "Open House" and question and answer session where meeting participants can ask questions of the panel presenters. After the technical presentations and question and answer session, the official scoping comment submission portion of the meetings will begin. The scoping comment submission session will be 55-

minutes, where members of the public may provide up to a three-minute comment. The virtual public meetings may end later than the stated time depending on the number of persons who wish to submit a comment. At this time, NASA does not intend to provide English-language translation unless specifically requested at least one week prior to the meetings.

NASA expects to release a Draft PEIS for public and agency review and comment in Fall 2022, and a Record of Decision in Spring/Summer 2023.

ADDRESSES: Advance registration to attend or provide a comment at either of the virtual public meetings is not required. As noted above in **DATES**, public meeting attendees may submit comments during the public meeting, or by other means described below throughout the 30-day comment period. Please provide your comments no later than May15, 2022 to ensure consideration in the Draft PEIS.

Comments must be identified with Docket No. NASA–2022–0002 and may be sent to NASA as follows:

- *Federal E-Rulemaking Portal: http://www.regulations.gov.* Follow the online instructions for submitting comments. Please note that NASA will post all comments on the internet without changes, including any personal information provided.
- By mail to Steve Slaten, NASA Jet Propulsion Laboratory, 4800 Oak Grove Drive, M/S: 200–119, Pasadena, California 91109–8099.

We encourage you to submit comments electronically through the Federal eRulemaking Portal at *http://www.regulations.gov.* If you submit your comments electronically, it is not necessary to also submit a hard copy. All comments received will be posted without change to *http://www.regulations.gov.* Before including your address, phone number, email address, or other personal identifying information in your comment, be advised that your entire comment—including any personal identifying information you provide—may be publicly available at any time. While you can ask us in your comment to withhold from public review your personal identifying information, we cannot guarantee that we will be able to do so.

FOR FURTHER INFORMATION CONTACT: Mr. Steve Slaten, National Aeronautics and Space Administration, by electronic mail at *Mars-sample-return-nepa@lists.nasa.gov* or by telephone at 202–358–0016. For questions regarding viewing the Docket, please call Docket Operations, telephone: 202–366–9317 or 202–366–9826.

SUPPLEMENTARY INFORMATION: NASA, in coordination with the European Space Agency (ESA), proposes to conduct a campaign to retrieve a scientifically selected set of samples (*i.e.,* Martian rocks, regolith, and atmosphere), acquired and cached on the surface of Mars by the Perseverance rover, and return them to Earth for scientific analysis and research. The proposed landing and recovery location for the Mars samples is the Utah Test and Training Range (UTTR), which is under the jurisdictional control of the United States Air Force. Additional Earth-based ground elements associated with sample transportation (utilizing over-the-road and/or aircraft to transport the samples off the UTTR) and sample management/research (otherwise referred to as ''curation'') involving the development and operation of a Sample Return Facility (SRF) are also part of the MSR Campaign mission architecture.

Virtual Public Meetings and Virtual Open House and Q&A

We encourage you to visit the informational website at *www.nasa.gov/feature/nepa-mars-sample-return-campaign* and attend one or both of the virtual public scoping meetings to learn about, and comment on, the proposed MSR Campaign. You will have the opportunity to verbally submit comments during the virtual public meetings on the scope and significance of the issues related to the proposed MSR Campaign that should be addressed in the PEIS.

In order to allow everyone a chance to speak at the virtual public meetings, we may limit speaker time, extend the meeting hours, or both. You must identify yourself, and any organization you represent, by name. Your remarks will be recorded and/or transcribed for inclusion in the public docket.

Public docket materials will be made available to the public on the Federal Docket Management System website (*www.regulations.gov*).

If you plan to attend one of the virtual public meetings and need special assistance such as sign language interpretation or closed captioning, non-English language translator services, or other reasonable accommodation, please notify the NASA representative identified above in the **FOR FURTHER INFORMATION CONTACT** section at least seven business days in advance of the virtual public meeting. Please include your contact information as well as information about your specific needs.

Request for Comments

We request public comment on this proposal. The comments may relate to, but are not limited to, the environmental impact of the proposed action. All comments will be accepted. The virtual public meetings are not the only opportunity you have to comment on the MSR Campaign proposed action. In addition to, or in place of, attending one of the virtual meetings, you may submit comments directly to the Federal Docket Management System during the public comment period (30 days from this notice). We will consider all comments and material received during the 30-day scoping period.

The material presented at the public meetings, received comments, and associated documentation, as well as the draft and Final PEISs (when published) are available for viewing at *www.nasa.gov/feature/nepa-mars-sample-return-campaign.*

Regardless of the method used for submitting comments, all submissions will be posted without change to the Federal Docket Management System website (*http://www.regulations.gov*) and may include any personal information you provide. Therefore, submitting this information to the docket makes it public. You may wish to read the Privacy and Use Notice that is available on the Federal Docket Management System website (*Regulations.gov—https://www.regulations.gov/user-notice*). You may view docket submissions at the Federal Docket Management System or electronically on the Federal Docket Management System website.

Background

Information about the MSR Campaign is available at: *http://www.jpl.nasa.gov/missions/mars-sample-return-msr.* Consideration of the proposed MSR Campaign includes review of the proposed action on the natural and human environment. For the proposed MSR Campaign, NASA is coordinating its review with a number of Cooperating Agencies that have jurisdiction by law over part of the proposed action or have special expertise with respect to environmental issues related to the proposed action. NASA is the lead Federal agency for determining the scope of this review, and in this case, it has been determined that review will include preparation of a PEIS. This NOI is required by 40 CFR 1501.9. It briefly describes the proposed action, possible alternatives, and our proposed scoping process. You can address any questions about the proposed action, the scoping process, or the PEIS to the NASA project manager identified in the notice (see FOR FURTHER INFORMATION CONTACT).

Proposed Action and Alternatives

The proposed action requiring environmental review is NASA's proposed MSR Campaign (see below: Summary of the MSR Campaign). The alternative to undertaking the MSR Campaign is to not undertake the campaign, which for purposes of environmental review under NEPA, is the "no-action" alternative.

Scoping Process

Public scoping is an early and open process for identifying and determining the scope of issues to be addressed in the PEIS. Scoping begins with this notice and continues through the conclusion of the public comment period (see DATES). Once the scoping process is complete, NASA will prepare a draft PEIS. When complete, NASA will publish a **Federal Register** notice announcing public availability of the Draft PEIS. (If you want that notice to be sent to you, please contact the NASA project manager identified in FOR FURTHER INFORMATION CONTACT.) You will have an opportunity to review and comment on the Draft PEIS. NASA and other appropriate Cooperating Agencies will consider the received comments and prepare the Final PEIS. As with the Draft PEIS, we will announce the availability of the Final PEIS and give you an opportunity for review and comment before a Record of Decision is announced.

Summary of the MSR Campaign

Overall, the MSR Campaign spans six elements: Four flight elements, which include the Perseverance Rover, two Sample Retrieval Landers ("Landers"—a Sample Fetch Rover Lander and Mars Ascent Vehicle Lander) and their subcomponents, and the Earth Return Orbiter (the "Orbiter"), its subcomponents and recovery of the samples; and two ground elements, which include sample transportation and an SRF. The following is an overall summary of the MSR Campaign.

The Perseverance Rover (previously addressed in the *Final Supplemental Environmental Impact Statement for the Mars 2020 Mission*) (see *https://www.nasa.gov/sites/default/files/atoms/files/20200115_mars_2020_seis_final_tagged.pdf*) is currently collecting Mars samples in environmentally sealed and rigorously engineered tubes and will eventually deposit select sets of tubes on the planet surface for later recovery. Specific Lander designs are still under consideration. NASA anticipates that the Lander payload mass and volume may result in the need for the equipment to be divided into two payloads, therefore requiring two separate Landers and launches. At this time, NASA has not confirmed if the use of Radioisotope Heater Units (RHUs) will be necessary to ensure that mission needs are met; the RHUs would generate heat, but no electricity, to support Lander function on the surface of Mars. If RHUs will be necessary, a payload of up to 20 RHUs may be included in the Lander designs.

The Landers are proposed for launch from either Cape Canaveral Space Force Station or Kennedy Space Center (depending on the launch vehicle yet to be selected). NASA anticipates launch of the Landers in of either 2026, 2028, or 2030 depending on the status of mission architecture and launch period availability. NASA anticipates Mars sample return to Earth approximately five years from launch of the Landers. The ESA Orbiter launch from French Guiana would then coincide with the NASA launch(es). All vehicles would transit to Mars. The Orbiter would enter Mars orbit, and the Landers would land directly on the Martian surface, similar to the recent Perseverance rover landing, in the vicinity of one or more sample tube sets. The samples would consist of approximately 35 tubes weighing about 25 grams each, for a total sample amount of approximately 525 grams (about 1 pound). Once on Mars, the Sample Fetch Rover would be deployed. The Sample Fetch Rover would then retrieve sample tubes left on the surface by Perseverance and deliver them to the Lander with the Mars Ascent Vehicle (MAV). If still operational, the Perseverance rover could also deliver sample tubes it retained on board directly to the Lander. A Sample Transfer Arm on the lander would be used to transfer samples from the Sample Fetch Rover and/or Perseverance rover into the Orbiting Sample container within the MAV.

The Mars Ascent Vehicle would be launched from the Martian surface into Mars orbit. Once in orbit, the Mars Ascent Vehicle would deploy the Orbiting Sample container to rendezvous with the Orbiter. Once at the Orbiter, the Orbiting Sample container would be captured by the Capture, Containment, and Return System module. When retrieved by the Capture, Containment, and Return System module, the Orbiting Sample container would be stored in redundant containment vessels and placed in the Earth Entry Vehicle, creating the Earth Entry System (EES). The Orbiter would then leave Mars orbit and navigate to a trajectory that would bring it close to Earth without placing itself on an impact trajectory. After a series of system health and navigation checks, the Orbiter would then fire its thrusters to achieve a short-lived Earth return trajectory. Once this trajectory is confirmed and the proper point is reached, the Capture, Containment, and Return System module would release the EES on a path to enter the Earth's atmosphere. The EES would then enter Earth's atmosphere and descend, reaching a velocity of approximately 35 to 45 meters per second (around 78 to 100 miles per hour) before landing at the UTTR. After EES release, the Orbiter would navigate to a trajectory that would avoid Earth for over 100 years, ensuring that residual Mars material, if any, associated with the Orbiter is not returned to Earth.

Prior to EES landing, recovery teams would be staged at strategic locations surrounding the proposed landing site; the objective being to contain and recover the EES as quickly as possible. Staging areas would include communications equipment and vehicles (land and/or air) and equipment for use in transport to and from the landing site. The primary staging area would have a mobile containment system (or "vault"). Once the EES has landed, the recovery team would transit to the landing site and contain the EES. Because the samples should be treated as though potentially hazardous until demonstrated otherwise, the EES would be handled under the highest level of containment, handling, and transportation regulatory standards. Additionally, although release of Mars sample particles is considered an off-nominal event, recovery teams would handle the landing event as though a release has occurred, thereby ensuring proper containment and decontamination of the EES and landing site. After arrival of the recovery team, the landing site would be cordoned off, and a 100-square-meter (1,076-square-foot) tent would be erected over the EES. As a precautionary measure, the EES would then be decontaminated, placed in a protective biohazard plastic bag, and then inserted into a 2-meter by 2-meter (6.56-foot by 6.56-foot) sealed travel case. The exterior of the EES travel case would be decontaminated before leaving the tent, and the EES travel case would be placed on a vehicle and transported to the roadside staging area and into the vault for shipment to an SRF. After removal of the EES, the entire contents of the tent and the landing site would be decontaminated as a precautionary measure. Samples of the landing site/

impact area would also be taken for contamination knowledge/biological knowledge after the EES is removed but before decontamination of the area. These samples would be transported under containment with the EES to the SRF for analysis. Prior to, and in support of, EES landing the proposed landing area would be cleared of old target objects and other debris (*e.g.,* railroad ties) that pose an impact risk to the EES.

"Planetary protection" is the discipline/practice of protecting solar system bodies (*e.g.,* a planet, planetary moon, or asteroid) from contamination by Earth life and, in the case of sample return missions, protecting Earth from potential hazards posed by extraterrestrial matter. For missions returning samples from planetary bodies considered to potentially harbor life, NASA is required to address Presidential Directive (PD)/National Security Council (NSC)–25, *Scientific or Technological Experiments with Possible Large-Scale Adverse Environmental Effects and Launch of Nuclear Systems into Space,* by presenting detailed information regarding the importance and potential environmental effects of the mission in the MSR Campaign's PEIS. NASA's planetary protection policies address missions involving samples returned from various solar system bodies as detailed in NASA Policy Directive 8020.7G. The NASA policies are guided by the planetary protection policies published by the international Committee on Space Research (COSPAR) in response to the United Nations Outer Space Treaty. NASA Procedural Requirement (NPR) 8715.24, *Planetary Protection Provisions for Robotic Extraterrestrial Missions,* provides guidelines for categorizing missions according to the destination and proposed activity. NPR 8715.24 also provides specific procedural requirements for certain mission categories. All missions returning samples from outside the Earth-Moon system are designated as Category V. Under Category V, there are two subcategories: Unrestricted Earth Return—sample return missions from solar system bodies deemed by scientific consensus to have no extraterrestrial life (*e.g.,* Earth's Moon and Venus); and Restricted Earth Return (RER)—sample return missions from solar system bodies deemed by scientific opinion to have a possibility of harboring indigenous life forms (*e.g.,* Mars or Europa). RER missions have requirements to break the chain of contact with the target body as well as isolate and robustly contain restricted samples during all mission phases through safe receipt and containment on Earth.

Due to the potential for past or present indigenous life forms on Mars, the sample return portion of the MSR Campaign is expected to be classified as a Category V Restricted Earth Return activity, which requires an environmental impact statement under 14 CFR 1216.306. The PEIS anticipates that this categorization will be established, and the PEIS' analysis provides for the most conservative approach. The general scientific consensus is that the Martian surface is too inhospitable for life to survive there today. It is a freezing landscape with no liquid water that is continually bombarded with harsh radiation. Scientists are interested in returning samples that may reveal what the Martian environment was like billions of years ago, when the planet was wetter and may have supported microbial life. There is no current evidence that the samples collected by the Mars 2020 mission from the first few inches of the Martian surface could contain microorganisms that would be harmful to Earth's environment. Nevertheless, out of an abundance of caution and in accordance with NASA policy and regulations, NASA would implement measures to ensure that the Mars samples are contained (with redundant layers of containment) so that they could not impact humans or Earth's environment, and the samples would remain contained until they are examined and confirmed safe for distribution to terrestrial science laboratories. NASA and its partners would use many of the basic principles that biological laboratories use today to contain, handle, and study materials that are known or suspected to be dangerous.

Due to the large scope of the MSR Campaign and uncertainty regarding the timing, location, and environmental impacts of actions associated with the ground elements, the NEPA analysis will be conducted in two "tiers" (or phases). This approach is endorsed under both 40 CFR 1501.11 and 14 CFR 1216.307. Tier I, the focus of the PEIS, will programmatically address the potential impacts associated with the potential for multiple Lander launches (with the potential for RHUs to be incorporated into the Landers' design architecture) from either Kennedy Space Center or Cape Canaveral Space Force Station in Florida, launch of the Orbiter from French Guiana, and return of the Orbiter and EES to include initial recovery, containment, and handling of the samples once they reach the Earth's surface (*i.e.,* at the UTTR landing site). Currently, definitive mission-related requirements associated with MSR Campaign ground elements for sample transportation and a SRF are still in the early planning stages of development, but each will be described to the maximum extent practicable in the PEIS. These aspects will be addressed programmatically in the Tier I PEIS, to the extent that information is available, and will be analyzed in more specific detail in subsequent Tier II NEPA analysis once this information is available. The Tier I analysis will also address the site-specific proposal to land the vehicle containing the samples (the EES) at the UTTR.

Joel Carney,

Assistant Administrator, Office of Strategic Infrastructure.

[FR Doc. 2022–08088 Filed 4–14–22; 8:45 am]

BILLING CODE 7510–13–P

NUCLEAR REGULATORY COMMISSION

695th Meeting of the Advisory Committee on Reactor Safeguards (ACRS)

In accordance with the purposes of Sections 29 and 182b of the Atomic Energy Act (42 U.S.C. 2039, 2232(b)), the Advisory Committee on Reactor Safeguards (ACRS) will hold meetings on May 4–5, 2022. The Committee will be conducting meetings that will include some Members being physically present at the NRC while other Members participating remotely. Interested members of the public are encouraged to participate remotely in any open sessions via MSTeams or via phone at 301–576–2978, passcode 22229828#. A more detailed agenda including the MSTeams link may be found at the ACRS public website at *https://www.nrc.gov/reading-rm/doc-collections/acrs/agenda/index.html.* If you would like the MSTeams link forwarded to you, please contact the Designated Federal Officer as follows: *Quynh.Nguyen@nrc.gov* or *Lawrence.Burkhart@nrc.gov.*

Wednesday, May 4, 2022

8:30 a.m.–8:35 a.m.: Opening Remarks by the ACRS Chairman (Open)—The ACRS Chairman will make opening remarks regarding the conduct of the meeting.

8:35 a.m.–11:30 a.m.: Point Beach Subsequent License Renewal Application Committee Deliberation/ Commission Meeting Preparation

25052 **Federal Register** / Vol. 87, No. 81 / Wednesday, April 27, 2022 / Notices

(a) What role could a rulemaking play in identifying STMs for adoption under 512(i)?

(b) What entity or entities would be best positioned to administer such a rulemaking?

(c) What factors should be considered when conducting such a rulemaking, and how should they be weighted?

(d) What should be the frequency of such a rulemaking?

(e) What would be the benefits of such a rulemaking? What would be the drawbacks of such a rulemaking?

12. *Alternatives:* Are there alternative approaches that could better achieve Congress's original goals in enacting section 512(i)?

Other Issues

13. Please identify and describe any pertinent issues not referenced above that the Copyright Office should consider.

Shira Perlmutter,

Register of Copyrights and Director of the U.S. Copyright Office.

[FR Doc. 2022–08946 Filed 4–26–22; 8:45 am]

BILLING CODE 1410–30–P

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

[Document Number: NASA–22–033; Docket Number: NASA–2022–0002]

National Environmental Policy Act; Mars Sample Return Campaign; Correction

AGENCY: National Aeronautics and Space Administration.

ACTION: Notice of intent; notice of meetings; request for comments; correction.

SUMMARY: The National Aeronautics and Space Administration (NASA) published a document in the **Federal Register** of April 15, 2022, concerning a notice of intent; notice of meetings; and request for comments. The document inadvertently omits the meeting number (access code) for the virtual public scoping meetings which is required for audio-only users to gain access to the meeting.

FOR FURTHER INFORMATION CONTACT: Mr. Steve Slaten, National Aeronautics and Space Administration, by electronic mail at *Mars-sample-return-nepa@lists.nasa.gov* or by telephone at 202–258–0016.

SUPPLEMENTARY INFORMATION: In the **Federal Register** of April 15, 2022, in FR Doc. 2022–08088, on page 22578, in the third column, correct the third sentence in the second paragraph of the **DATES** section from "The call-in number for audio-only users is: +1–510–210–8882" to read "The call-in number for audio-only users is: 1–510–210–8882 and the Meeting Number (access code) is 901–525–785."

Nanette Smith,

Team Lead, NASA Directives and Regulations.

[FR Doc. 2022–08937 Filed 4–26–22; 8:45 am]

BILLING CODE 7510–13–P

NATIONAL SCIENCE FOUNDATION

Sunshine Act Meetings

The National Science Board hereby gives notice of the scheduling of a teleconference of the Committee on Strategy for the transaction of National Science Board business pursuant to the NSF Act and the Government in the Sunshine Act.

TIME AND DATE: Friday, April 29, 2022, from 10:00–10:30 a.m. EDT.

PLACE: This meeting will be held by teleconference organized through the National Science Foundation.

STATUS: Closed.

MATTERS TO BE CONSIDERED: The agenda is: Committee Chair's Opening Remarks; Approval of Prior Meeting Minutes; Update on NSF's FY 2022 Current Plan.

CONTACT PERSON FOR MORE INFORMATION: Point of contact for this meeting is: Chris Blair, *cblair@nsf.gov,* 703/292–7000. Meeting information and updates are available from the NSB website at *https://www.nsf.gov/nsb/meetings/index.jsp#up.*

Chris Blair,

Executive Assistant to the National Science Board Office.

[FR Doc. 2022–09041 Filed 4–25–22; 8:45 am]

BILLING CODE 7555–01–P

NATIONAL SCIENCE FOUNDATION

Sunshine Act Meetings

The National Science Board's (NSB) Committee on External Engagement hereby gives notice of the scheduling of a teleconference for the transaction of National Science Board business pursuant to the National Science Foundation Act and the Government in the Sunshine Act.

TIME AND DATE: Thursday, April 28, 2022, from 2:00–3:00 p.m. EST.

PLACE: This meeting will be held by teleconference through the National Science Foundation.

STATUS: Open.

MATTERS TO BE CONSIDERED: The agenda of the teleconference is: Approve February 2022 minutes; Discuss NSB survey feedback and draft recommendations to update NSB honorary awards; Recent and upcoming engagement; and Discuss the next iteration of the Committee, what should it aim to do?

CONTACT PERSON FOR MORE INFORMATION: Point of contact for this meeting is: Nadine Lymn, *nlymn@nsf.gov,* 703/292–7000. Members of the public can observe this meeting through a YouTube livestream. Meeting information including a YouTube link is available from the NSB website at *https://www.nsf.gov/nsb/meetings/index.jsp#up.*

Chris Blair,

Executive Assistant to the National Science Board Office.

[FR Doc. 2022–09037 Filed 4–25–22; 8:45 am]

BILLING CODE 7555–01–P

NATIONAL SCIENCE FOUNDATION

Sunshine Act Meeting

The National Science Board's Awards and Facilities Committee hereby gives notice of the scheduling of a teleconference for the transaction of National Science Board business pursuant to the National Science Foundation Act and the Government in the Sunshine Act.

TIME AND DATE: Friday, April 29, 2022, from 12:00–2:30 p.m. EDT.

PLACE: This meeting will be held by teleconference through the National Science Foundation.

STATUS: Closed.

MATTERS TO BE CONSIDERED: The agenda of the teleconference is: Committee Chair's Opening Remarks; Schedule of Future Information, Context, and Action Items; Approval of Prior Minutes; Context Item: Inclusion of Leadership-Class Computing Facility in a Future MREFC Budget; Context Item: NOIRLab Operations & Maintenance Award; Context Item: Mag Lab Operations & Maintenance Award; Written Context Item: Regional Class Research Vessel Management Reserve.

CONTACT PERSON FOR MORE INFORMATION: Point of contact for this meeting is: Michelle McCrackin, *mmccrack@nsf.gov,* (703) 292–7000. Meeting

B.1.2 Agency Coordination

National Aeronautics and
Space Administration

**NASA Office of JPL
Management and Oversight**
4800 Oak Grove Drive
Pasadena, CA 91109-8099

April 15, 2022

Reply to Attn of: NASA Office of JPL
Management and Oversight

Memorandum for: Federal, State, and Local Public Agencies
Interested Parties
Members of the Public

Subject: NASA Mars Sample Return Campaign – Notice of Intent to Prepare a Programmatic Environmental Impact Statement and Notice of Public Meetings

Pursuant to the *National Environmental Policy Act* of 1969 (NEPA), as amended, the *Council on Environmental Quality Regulations for Implementing the Procedural Provisions of NEPA*, and NASA's procedures for implementing NEPA, NASA will prepare a Programmatic Environmental Impact Statement (PEIS) for the Mars Sample Return (MSR) Campaign. NASA, in coordination with the European Space Agency (ESA), proposes to conduct a campaign to retrieve a scientifically selected set of samples (i.e., Martian rocks, regolith, and atmosphere), acquired and cached on the surface of Mars by the Perseverance rover, and return them to Earth for scientific analysis and research. Cooperating agencies for this effort include the U.S. Air Force (in accordance with their Environmental Impact Analysis Process), U.S. Army, U.S. Department of Agriculture, and U.S. Department of Health and Human Services – Centers for Disease Control and Prevention. The proposed landing and recovery location for the Mars samples is the Utah Test and Training Range (UTTR), which is under the jurisdictional control of the U.S. Air Force. Additional Earth-based ground elements associated with sample transportation (utilizing over-the-road and/or aircraft to transport the samples off the UTTR) and sample management/research (otherwise referred to as "curation") involving the development and operation of a Sample Receiving Facility (SRF) are also part of the MSR Campaign mission architecture.

The PEIS will provide information related to the potential environmental impacts associated with the proposed return of Mars samples to Earth for scientific analysis. Potential impacts to be analyzed in the PEIS include those associated with ground disturbance from landing site preparation and sample vehicle landing and recovery efforts with respect to natural, biological, and cultural resources. NASA will also assess potential impacts to the human and natural environment associated with loss of containment of Mars sample materials. Additional information about the MSR Campaign may be found on the Internet at: https://www.jpl.nasa.gov/missions/mars-sample-return-msr.

Overall, the MSR Campaign spans six elements: four flight elements, which include the Perseverance rover, two Sample Retrieval Landers ("Landers" – a Sample Fetch Rover Lander and Mars Ascent Vehicle Lander) and their subcomponents, and the Earth Return Orbiter (the

"Orbiter"), its subcomponents and recovery of the samples; and two ground elements, which include sample transportation and an SRF. The following is an overall summary of the MSR Campaign.

The Perseverance rover is currently collecting Mars samples in environmentally sealed, rigorously engineered tubes and will eventually deposit select sets of tubes on the planet surface for later recovery (see *Final Supplemental Environmental Impact Statement for the Mars 2020 Mission*, at https://www.nasa.gov/sites/default/files/atoms/files/20200115_mars_2020_seis_final_tagged.pdf).

Specific Lander designs are still under consideration. NASA anticipates that the Lander payload mass and volume may result in the need for the equipment to be divided into two payloads, therefore requiring two separate Landers and launches. At this time, NASA has not confirmed if the use of Radioisotope Heater Units (RHUs) will be necessary to ensure that mission needs are met; the RHUs would generate heat, but no electricity, to support Lander function on the surface of Mars. If RHUs will be necessary, a payload of up to 20 RHUs may be included in the Lander designs.

The Landers are proposed for launch from either Cape Canaveral Space Force Station or Kennedy Space Center (depending on the launch vehicle yet to be selected). NASA anticipates launch of the Landers in late summer of either 2026, 2028, or 2030 depending on the status of mission architecture and launch window availability. The ESA Orbiter launch from French Guiana would then coincide with the NASA launch(es). All vehicles would transit to Mars. The Orbiter would enter Mars orbit, and the Landers would land directly on the Martian surface, similar to the recent Perseverance rover landing, in the vicinity of one or more sample tube sets. The samples to be returned to Earth would consist of approximately 30 tubes weighing about 15 grams each, for a total sample amount of approximately 450 grams (about 1 pound). Once on Mars, the Sample Fetch Rover would be deployed. The Sample Fetch Rover would then collect the sample tubes into an Orbiting Sample container within the Mars Ascent Vehicle. If still operational, the Perseverance rover could also deliver sample tubes it retained on board directly to the Lander. A Sample Transfer Arm on the Lander would be used to transfer samples from the Sample Fetch Rover and/or Perseverance rover into the Orbiting Sample container within the Mars Ascent Vehicle.

The Mars Ascent Vehicle would be launched from the Martian surface into Mars orbit. Once in orbit, the Mars Ascent Vehicle would deploy the Orbiting Sample container to rendezvous with the Orbiter. Once at the Orbiter, the Orbiting Sample container would be captured by the Capture, Containment, and Return System module. When retrieved by the Capture, Containment, and Return System module, the Orbiting Sample container would be stored in redundant vessels and placed in the Earth Entry Vehicle, creating the Earth Entry System (EES). The Orbiter would then leave Mars orbit and navigate to a trajectory that would bring it close to Earth without placing itself on an impact trajectory. After a series of system health and navigation checks, the Orbiter would then fire its thrusters to achieve a short-lived Earth return trajectory. Once this trajectory is confirmed and the proper point is reached, the Capture, Containment, and Return System module would release the EES on a path to enter the Earth's atmosphere. The EES would then enter Earth's atmosphere and descend, reaching a velocity of approximately 35 to 45 meters per second (around 78 to 100 miles per hour) before landing at the UTTR. After EES release, the Orbiter would navigate to a trajectory that would avoid Earth for over 100 years, ensuring that residual Mars material, if any, associated with the Orbiter is not returned to Earth.

Prior to EES landing, several recovery teams would be staged at strategic locations surrounding the proposed landing site; the objective being to contain and recover the EES as quickly as possible. Staging areas would include communications equipment and vehicles (land and/or air) and equipment for use in transport to and from the landing site. The primary staging area would have a mobile containment system (or "vault"). Once the EES has landed, the recovery team would transit to the landing site and contain the EES. Because the samples should be treated as though potentially hazardous until demonstrated otherwise, the EES would be handled under the highest level of containment, handling, and transportation regulatory standards. Additionally, although release of Mars sample particles is considered an off-nominal (abnormal) event, recovery teams would handle the landing event as though a release has occurred, thereby ensuring proper containment and decontamination of the EES and landing site. After arrival of the recovery team, the landing site would be cordoned off, and a 100-square-meter (1,076-square-foot) tent would be erected over the EES. As a precautionary measure, the EES would then be decontaminated, placed in a protective biohazard plastic bag, and then inserted into a 2-meter by 2-meter (6.56-foot by 6.56-foot) sealed travel case. The exterior of the EES travel case would be decontaminated before leaving the tent, and the EES travel case would be placed on a vehicle and transported to the roadside staging area and into the vault for shipment to an SRF. After removal of the EES, the entire contents of the tent and the landing site would be decontaminated as a precautionary measure. Samples of the landing site/impact area would also be taken for contamination knowledge/biological knowledge after the EES is removed but before decontamination of the area. These samples would be transported under containment with the EES to the SRF for analysis. Prior to, and in support of, EES landing the proposed landing area would be cleared of old target objects and other debris (e.g., railroad ties) that pose an impact risk to the EES.

"Planetary protection" is the discipline/practice of protecting solar system bodies (e.g., a planet, planetary moon, or asteroid) from contamination by Earth life and, in the case of sample return missions, protecting Earth from potential hazards posed by extraterrestrial matter. For missions that are returning samples from planetary bodies that are considered to potentially harbor life, NASA is required to address Presidential Directive (PD)/National Security Council (NSC)-25, *Scientific or Technological Experiments with Possible Large-Scale Adverse Environmental Effects and Launch of Nuclear Systems into Space*, by presenting detailed information regarding the importance and potential environmental effects of the mission in the MSR Campaign's PEIS. NASA's planetary protection policies address missions involving samples returned from various solar system bodies as detailed in NASA Policy Directive 8020.7G. The NASA policies are guided by the planetary protection policies published by the international Committee on Space Research (COSPAR) in response to the United Nations Outer Space Treaty. NASA Procedural Requirement (NPR) 8715.24, *Planetary Protection Provisions for Robotic Extraterrestrial Missions*, provides guidelines for classifying missions according to the destination and proposed activity. NPR 8715.24 also provides specific procedural requirements for certain mission categories. All missions returning samples from outside the Earth-Moon system are designated as Category V. Under Category V, there are two subcategories: Unrestricted Earth Return—sample return missions from solar system bodies deemed by scientific consensus to have no extraterrestrial life (e.g., Earth's Moon and Venus); and Restricted Earth Return (RER)—sample return missions from solar system bodies deemed by scientific opinion to have a possibility of harboring indigenous life forms (e.g., Mars or Europa). RER missions have requirements to break the chain of contact with the target body as well as isolate and robustly contain restricted samples during all mission phases through safe receipt and containment on Earth.

Due to the potential for past or present indigenous life forms on Mars, the sample return portion of the MSR Campaign is expected to be classified as a Category V RER activity, which requires an environmental impact statement under Title 14 Code of Federal Regulations (CFR) Section 1216.306. This PEIS anticipates that this categorization will be established and the PEIS's analysis provides for the most conservative approach. The general scientific consensus is that the Martian surface is too inhospitable for life to survive there today. It is a freezing landscape with no liquid water that is continually bombarded with harsh radiation. Scientists are interested in returning samples that may reveal what the Martian environment was like billions of years ago, when the planet was wetter and may have supported microbial life. There is no current evidence that the samples collected by the Mars 2020 mission from the first few inches of the Martian surface could contain microorganisms that would be harmful to Earth's environment. Nevertheless, out of an abundance of caution and in accordance with NASA policy and regulations, NASA would implement measures to ensure that the Mars samples are contained (with redundant layers of containment) so that they could not impact humans or Earth's environment, and the samples would remain contained until they are examined and confirmed safe for distribution to terrestrial science laboratories. NASA and its partners would use many of the basic principles that biological laboratories use today to contain, handle, and study materials that are known or suspected to be dangerous.

Due to the large scope of the MSR Campaign and uncertainty regarding the timing, location, and environmental impacts of actions associated with the ground elements, the NEPA analysis will be conducted in two "tiers" (or phases). This approach is endorsed under both 40 CFR 1501.11 and 14 CFR 1216.307. Tier I, the focus of this PEIS, will programmatically address the potential impacts associated with the potential for multiple Lander launches (with the potential for RHUs to be incorporated into the Landers' design architecture) from either Kennedy Space Center or Cape Canaveral Space Force Station in Florida, launch of the Orbiter from French Guiana, and return of the Orbiter to include initial recovery, containment, and handling of the samples once they reach the Earth's surface (i.e., at the UTTR landing site). Currently, definitive mission-related requirements associated with MSR Campaign ground elements for sample transportation and an SRF are still in the early planning stages of development, but each will be described to the maximum extent practicable in the PEIS. These aspects will be addressed programmatically in the Tier I PEIS, to the extent that information is available, and will be analyzed in more specific detail in subsequent Tier II NEPA analysis once this information is available. The Tier I analysis will also address the site-specific proposal to land the vehicle containing the samples (the EES) at the UTTR.

Scoping Process

NASA published a Notice of Intent to prepare a PEIS in the *Federal Register* on April 15, 2022, initiating the public involvement process. The public scoping period for this PEIS is from April 15 through May 15, 2022. Fact sheets and other information regarding the NEPA and scoping processes for the MSR Campaign will be made available at the following website beginning on April 15, 2022: https://www.nasa.gov/feature/nepa-mars-sample-return-campaign.

Public scoping is an early and open process for identifying and determining the scope of issues to be addressed in the PEIS. Scoping begins with this notice and continues through the conclusion of the public comment period. Once the scoping process is complete, NASA will prepare a Draft PEIS. When complete, NASA will publish a *Federal Register* notice announcing public availability of the Draft PEIS (if you want that notice to be sent to you, please contact the NASA project manager identified below). You will have an opportunity to review and comment on the Draft PEIS. NASA and other appropriate Cooperating Agencies will consider the received comments and prepare the Final PEIS. As with the Draft PEIS, we will announce the availability of the Final PEIS and give you an opportunity for review and comment before a Record of Decision is issued. NASA expects to release a Draft PEIS for public and agency review and comment in Fall 2022, and a Record of Decision in Spring/Summer 2023.

Virtual Public Meetings and Virtual Open House and Q&A

NASA will hold two VIRTUAL public meetings to solicit comments regarding the Proposed Action and the environmental issues that NASA should consider in the PEIS:

May 4, 2022, 1 p.m. to 3 p.m. (Mountain), and May 5, 2022, 6 p.m. to 8 p.m. (Mountain), at the following URL: https://jpl.webex.com/meet/msr. The call-in number for audio-only users is: +1-510-210-8882.

The meetings will begin with a brief welcome message followed by a 10-minute NASA presentation describing the purpose of the scoping meetings, project schedule, opportunities for public involvement, proposed action and alternatives summary, and programmatic approach. A 30-minute technical presentation regarding the MSR Campaign will then be provided. After the formal presentations will be a 30-minute virtual "Open House" and question and answer session where meeting participants can ask questions of the panel presenters. After the technical presentations and question and answer session, the official scoping comment submission portion of the meetings will begin. The scoping comment submission session will be 45-minutes, where members of the public may provide up to a three-minute comment. The virtual public meetings may end later than the stated time depending on the number of persons who wish to submit a comment. At this time, NASA does not intend to provide English-language translation unless specifically requested at least one week prior to the meetings.

We encourage you to visit the informational website at https://www.nasa.gov/feature/nepa-mars-sample-return-campaign and attend one or both of the virtual public scoping meetings to learn about, and comment on, the proposed MSR Campaign. You will have the opportunity to verbally submit comments during the virtual public meetings on the scope and significance of the issues related to the proposed MSR Campaign that should be addressed in the PEIS. In order to allow everyone a chance to speak at the virtual public meetings, we may limit speaker time, extend the meeting hours, or both. You must identify yourself, and any organization you represent, by name. Your remarks will be recorded and/or transcribed for inclusion in the public docket. Public docket materials will be made available to the public on the Federal Docket Management System website (https://www.regulations.gov). If you plan to attend one of the virtual public meetings and need special assistance such as sign language interpretation or closed captioning, non-English language translator services, or other reasonable accommodation, please notify the NASA representative identified at the end of this letter at least seven business days in advance of the virtual public meeting. Please include your contact information as well as information about your specific needs.

Request for Comments

We request public comment on this proposal. The comments may relate to, but are not limited to, the environmental impact of the proposed action. All comments will be accepted. The virtual public meetings are not the only opportunity you have to comment on the MSR Campaign proposed action. In addition to, or in place of, attending one of the virtual meetings, you may submit comments directly to the Federal Docket Management System during the public comment period. Though comments will be accepted at different times throughout the NEPA process, please provide your scoping comments no later than May 15, 2022, to ensure consideration in the Draft PEIS. We will consider all comments and material received during the 30-day scoping period.

Comments must be identified with **NASA-2022-0002** and may be sent to NASA as follows:

- Federal E-Rulemaking Portal: https://www.regulations.gov. Follow the online instructions for submitting comments. Please note that NASA will post all comments on the Internet without changes, including any personal information provided.
- By mail to Steve Slaten, NASA Jet Propulsion Laboratory, 4800 Oak Grove Drive, M/S: 200-119, Pasadena, California 91109-8099.

We encourage you to submit comments electronically through the Federal eRulemaking Portal at https://www.regulations.gov. If you submit your comments electronically, it is not necessary to also submit a hard copy. All comments received will be posted without change to https://www.regulations.gov. Before including your address, phone number, e-mail address, or other personal identifying information in your comment, be advised that your entire comment —including any personal identifying information you provide—may be publicly available at any time. While you can ask us in your comment to withhold from public review your personal identifying information, we cannot guarantee that we will be able to do so. You may wish to read the Privacy and Use Notice that is available on the Federal Docket Management System website (Regulations.gov – https://www.regulations.gov/user-notice). You may view docket submissions electronically on the Federal Docket Management System website.

For further information please contact Mr. Steve Slaten by electronic mail at Mars-sample-return-nepa@lists.nasa.gov or by telephone at 202-358-0016. For questions regarding viewing the Docket, please call Docket Operations, telephone: 877-378-5457 or 703-454-9859.

Sincerely,

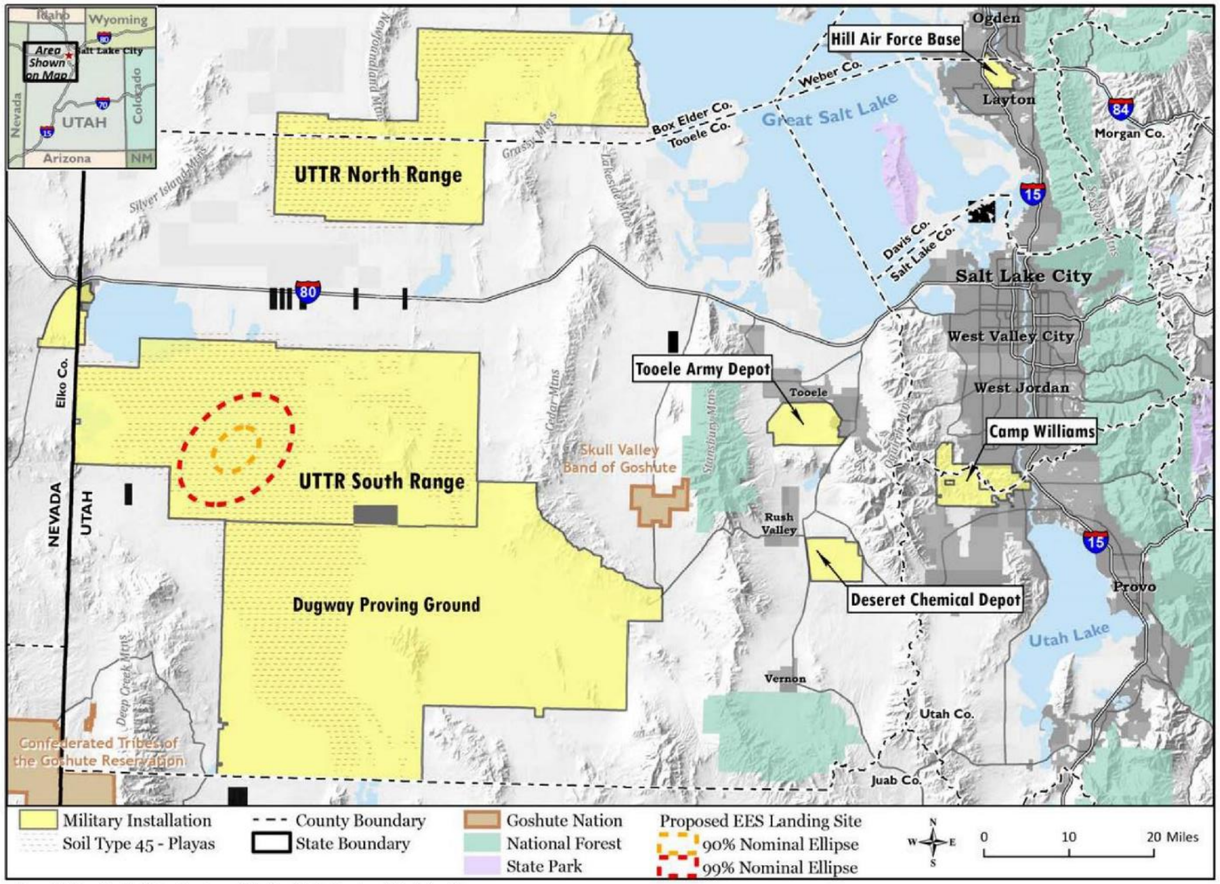
Steve Slaten

Steve Slaten, NASA MSR PEIS Project Manager
NASA Office of JPL Management and Oversight

Enclosure
1 – Location of Proposed Landing Site

7

ENCLOSURE 1
Location of Proposed Landing Site



Key: EES = Earth Entry System; UTTR = Utah Test and Training Range.

Enclosure 1

B.2 REGULATORY CONSULTATIONS

B.2.1 National Historic Preservation Act

Letter from Utah Division of State History to NASA, dated April 18, 2022

Utah Division of State History

Spencer J. Cox
Governor

Deidre M. Henderson
Lieutenant Governor

Jill Remington Love
Executive Director
Utah Department of Cultural and Community Engagement

Jennifer Ortiz
Director

Christopher Merritt
State Historic Preservation Officer

April 18, 2022

Dr. Rebecca Klein
Federal Preservation Officer
NASA Office of JPL, Management and Oversight

RE: UTTR South Range; request for APE concurrence via attached Initiation of Consultation under the National Historic Preservation Act and National Environmental Policy Act; NASA Mars Sample Return Campaign

For future correspondence, please reference Case No. 22-0651

Dear Dr. Klein,

The Utah State Historic Preservation Office received your submission and request for our comment on the above-referenced undertaking consultation initiation on April 15, 2022.

We concur with your preliminary determination of Area of Potential Effects and planned use of a Programmatic Agreement to address the undertaking's potential effects to historic properties. Additionally, we have reviewed your list of consulting parties, and recommend adding the Utah Professional Archaeological Council (UPAC). We appreciate your early consultation initiation and look forward to continuing consultation with your office, including developing a Programmatic Agreement, for the above-referenced undertaking.

This letter serves as our comment on the determinations you have made within the consultation process specified in §36CFR800.4. If you have questions, please contact me at 801-245-7246 or by email at sagardy@utah.gov.

Sincerely,

Savanna Agardy
Compliance Archaeologist

Utah Department of Cultural & Community Engagement

3760 South Highland Drive • Salt Lake City, Utah 84106 • history.utah.gov

Letter to Advisory Council on Historic Preservation from NASA, dated April 15, 2022

National Aeronautics and
Space Administration

Mary W. Jackson NASA Headquarters
Washington, DC 20546-0001

April 15, 2022

Reply to Attn of: NASA Office of JPL
Management and Oversight

Alexis Clark, Historic Preservation Specialist
Advisory Council on Historic Preservation
401 F Street NW, Suite 308
Washington, DC 20001

Re: Initiation of Consultation under the National Historic Preservation Act and National Environmental Policy Act for the NASA Mars Sample Return Campaign

Dear Mr. Daniel:

NASA, in cooperation with the European Space Agency (ESA), the United States Air Force (USAF), United States Army, United States Department of Agriculture, and the Centers for Disease Control and Prevention, proposes to conduct a campaign to retrieve a scientifically selected set of samples (i.e., Martian rocks, regolith, and atmosphere), acquired and cached on the surface of Mars by the Perseverance rover, and return them to Earth for scientific analysis and research. The proposed Mars Sample Return (MSR) Campaign involves several flight elements associated with retrieving the samples on Mars, launching them into Mars orbit, capturing the samples in orbit, and returning them to Earth for study. The proposed landing and recovery location for the Mars samples is the Utah Test and Training Range (UTTR), which is under the jurisdictional control of the USAF. Additional Earth-based ground elements associated with sample transportation (utilizing over-the-road and/or aircraft to transport the samples off the UTTR) and sample management/research (otherwise referred to as "curation") involving the development and operation of a Sample Receiving Facility (SRF) are also part of the MSR Campaign mission architecture.

As lead agency, NASA invites you to consult on this project pursuant to Section 106 of the National Historic Preservation Act (NHPA) (Title 54 United States Code [U.S.C.] Section 306108) and its implementing regulations (Title 36 Code of Federal Regulations [CFR] Part 800, Protection of Historic Properties), and the National Environmental Policy Act (NEPA) (42 U.S.C. 4321–4347) and the Council on Environmental Quality Regulations for Implementing the Procedural Provisions of NEPA (40 CFR 1500–1508).

Description of the Undertaking

NASA defines the undertaking as the entire MSR Campaign, which spans five elements: three flight elements, which include the Perseverance rover, the Sample Retrieval Landers (the "Landers") and their subcomponents, and the Earth Return Orbiter (the "Orbiter"), its subcomponents and recovery of the samples; and two ground elements, which include sample transportation and an SRF. Additional information about the MSR Campaign may be found at: http://www.jpl.nasa.gov/missions/mars-sample-return-msr.

The Perseverance rover is currently collecting Mars samples in environmentally sealed, rigorously engineered tubes and will eventually deposit select sets of tubes on the planet surface for later recovery (see *Final Supplemental Environmental Impact Statement for the Mars 2020 Mission* at https://www.nasa.gov/sites/default/files/atoms/files/20200115_mars_2020_seis_final_tagged.pdf). Specific Lander design(s) are still under consideration. NASA anticipates that the Lander payload mass and volume may result in the need for the equipment to be divided into two payloads, therefore requiring two separate Landers and launches.

The Landers are proposed for launch from either Cape Canaveral Space Force Station or Kennedy Space Center (depending on the launch vehicle yet to be selected). NASA anticipates launch of the Landers in late summer of either 2026, 2028, or 2031 depending on the status of mission architecture and launch window availability. NASA anticipates Mars sample return to Earth approximately five years from launch of the Landers. The ESA Orbiter launch from French Guiana would then coincide with the NASA launch(es). All vehicles would transit to Mars. The Orbiter would enter Mars orbit, and the Landers would land directly on the Martian surface, similar to the recent Perseverance rover landing, in the vicinity of one or more sample tube sets. The samples would consist of approximately 30 tubes weighing about 15 grams (0.03 pounds) each, for a total sample amount of approximately 450 grams (about 1 pound). Once on Mars, the Sample Fetch Rover would be deployed. The Sample Fetch Rover would then retrieve the sample tubes and deliver them to the Lander for loading into an Orbiting Sample container within the Mars Ascent Vehicle. If still operational, the Perseverance rover could also deliver sample tubes directly to the Lander.

The Mars Ascent Vehicle would be launched from the Martian surface into Mars orbit. Once in orbit, the Mars Ascent Vehicle would deploy the Orbiting Sample container to rendezvous with the Orbiter. Once at the Orbiter, the Orbiting Sample container would be captured by the Capture, Containment, and Return System module. When retrieved by the Capture, Containment, and Return System module, the Orbiting Sample container would be stored in redundant vessels and placed in the Earth Entry Vehicle, creating the Earth Entry System (EES). The Orbiter would then leave Mars orbit and navigate to a trajectory that would bring it close to Earth without placing itself on an impact trajectory. After a series of system health and navigation checks, the Orbiter would then fire its thrusters to achieve a short-lived Earth return trajectory. Once this trajectory is confirmed and the proper point is reached, the Capture, Containment, and Return System module would release the EES on a path to enter the Earth's atmosphere. The EES would then enter Earth's atmosphere and descend, reaching a velocity of approximately 35 to 45 meters per second (around 78 to 100 miles per hour) before landing at the UTTR. After EES release, the Orbiter would navigate to a trajectory that would avoid Earth for over 100 years, ensuring that residual Mars material, if any, associated with the Orbiter is not returned to Earth.

Prior to EES landing, several recovery teams would be staged at strategic locations surrounding the proposed landing site; the objective being to contain and recover the EES as quickly as possible. Staging areas would include communications equipment and vehicles (land and/or air) and equipment for use in transport to and from the landing site. The primary staging area would have a mobile containment system (or "vault"). Once the EES has landed, the recovery team would transit to the landing site and contain the EES. Because the samples should be treated as though potentially hazardous until demonstrated otherwise, the EES would be handled under the highest level of containment, handling, and transportation regulatory standards. Additionally, although release of Mars sample particles is considered an off-nominal event, recovery teams would handle the landing event as though a release has occurred, thereby ensuring proper containment and decontamination of the EES and landing site. After arrival of the recovery team, the landing site would be cordoned off, and a 100-square-meter (1,076-square-foot) tent would be erected over the EES. As a precautionary measure, the EES would then be decontaminated, placed in a protective biohazard plastic bag, and then inserted into a 2-meter by 2-meter (6.56-foot by 6.56-foot) sealed travel case. The exterior of the EES travel case would be decontaminated before leaving the tent, and the EES travel case would be placed on a vehicle and transported to the roadside staging area and into the vault for shipment to an SRF. After removal of the EES, the entire contents of the tent and the landing site would be decontaminated as a precautionary measure. Samples of the landing site/impact area would also be taken for contamination knowledge/biological knowledge after the EES is removed but before decontamination of the area. These samples would be transported under containment with the EES to the SRF for analysis. Prior to, and in support of, EES landing, the proposed landing area would be cleared of old target objects and other debris (e.g., railroad ties) that pose an impact risk to the EES.

NASA, as the lead agency, has determined that the only project element of the proposed MSR Campaign with the potential to introduce effects to historic properties and resources or places of traditional or religious importance is the third and final flight element—the reentry and landing of the EES, containing the Mars samples. The EES is proposed to land on Earth in an area at the UTTR South Range, on lands administered by the USAF in Tooele County (Enclosure 1).

The final flight element of the project involves the following:

1. *Landing site preparation.* Objects and debris within the proposed landing area will be removed to minimize the potential for the sample return vehicle (i.e., the EES) to impact an object upon landing. This involves the removal of old aerial gunnery tow-target debris and other objects (e.g., railroad ties) within a portion of the nominal landing area ellipse. The exact nature and scale of object removal has not been fully evaluated but will likely include use of tracked and/or wheeled vehicles and ground-disturbing activities. Currently, NASA is testing different methods for object removal, which may include digging below the ground surface (potentially up to 4 feet) to remove the large portions of exposed target debris. More information regarding this aspect of the project will be made available to you as the project planning develops.
2. *EES descent.* It is calculated that once entering the Earth's atmosphere, the EES would take approximately 377 seconds (about six minutes) before it lands. The EES reentry will generate a sonic boom high above the Earth at a yet to be determined altitude. It is estimated that the EES will slow to a velocity of approximately 126 to 161 kilometers per hour (78 to 100 miles per hour) before landing/impact.

3. *Recovery team staging*. Staging of up to four recovery teams (consisting of personnel, helicopters, and/or hovercraft, and/or tracked vehicles) would occur along the east/west and north/south axes just outside the landing ellipse approximately 30 minutes ahead of EES landing.
4. *Establishment of a primary recovery staging area*. A primary recovery staging area will be established, where the samples, once retrieved, will be returned. The primary staging area will include a protective storage enclosure (i.e., "the vault") for sample containment. This primary staging area will likely be placed along the road leading into the landing area ellipse.
5. *Landing of the EES in the targeted area*. It is anticipated that the landing will occur while the soils are soft but before they become saturated from rain events in the fall, which would serve to lessen the force of impact to the EES. The EES is expected to create an impact crater of approximately 1.2 meters (4 feet) in depth and diameter which is roughly the same size as the EES. Given the composition of the soil, it is expected that soil will be ejected from the impact crater to a distance of approximately 15 meters (49 feet).
6. *Transit of recovery teams to the EES landing site*. The recovery teams would transit to the EES landing site using helicopters, and/or hovercraft, and/or tracked vehicles (such as a snow cat). The use of wheeled vehicles is unlikely because they would easily become stuck in the soft soils; however, use of wheeled vehicles off road to or from staging areas cannot be entirely discounted.
7. *EES recovery*. Once on site, the recovery teams will secure and cordon off the EES landing site, and a tent containment structure will be erected (approximately 100 square meters or 1,076 square feet) over the EES. The EES will be contained in a biosafety bag, sealed in a 2-meter by 2-meter (6.5-foot by 6.5-foot) travel case, and the case exterior cleaned.
8. *Transit of recovery teams from the EES landing site to the primary staging area*. Recovery teams would transit from the EES landing site to the primary staging area and the EES would be placed into the Vault for shipment over the road and/or via aircraft to an SRF. Transit methods for recovery teams are described above in paragraph 6.
9. *Decontamination of the landing site*. Although release of Mars sample particles is considered an off-nominal event, after removal of the EES, the entire landing site will be cleaned as a precautionary measure. It is assumed that the cleaning process may involve standardized decontamination and/or sterilization methods, which could include high heat exposure, use of chemicals (such as chlorine dioxide or aldehyde), or a combination of both.

Area of Potential Effects

The area of potential effects (APE) is in the process of being more narrowly defined, but it is expected to include an area in which a targeted or off-target landing may occur. The nominal landing target area consists of an ellipse that defines the area with a 99.9999 percent probability of landing. The notional area associated with an off-nominal (abnormal or unexpected) landing is an expanded version of the ellipse. The APE also includes the addition of an approximately 150-foot wide buffer around the ellipse to accommodate recovery team staging. The total area of potential landing and ground disturbance (both nominal and off-nominal) is approximately 574 square kilometers or 222 square miles. Enclosure 2 graphically depicts the target and off-target areas where the EES may land.

NEPA Process

Due to the potential for past or present indigenous life forms on Mars, the sample return portion of the MSR mission is expected to be classified as a Category V Restricted Earth Return activity, which requires an environmental impact statement under 14 CFR 1216.306. NASA will prepare a Programmatic Environmental Impact Statement (PEIS) for the MSR Campaign. The PEIS anticipates that this categorization will be established and the PEIS's analysis provides for the most conservative approach to the potential environmental impacts associated with the proposed return of Mars samples to Earth for scientific analysis.

Due to the large scope of the MSR Campaign and uncertainty regarding the timing, location, and environmental impacts of actions associated with the ground elements, the NEPA analysis will be conducted in two "tiers" (or phases). This approach is endorsed under both 40 CFR 1501.11 and 14 CFR 1216.307. Tier I, the focus of the PEIS, will programmatically address the potential impacts associated with the potential for multiple Lander launches from either Kennedy Space Center or Cape Canaveral Space Force Station in Florida, launch of the Orbiter from French Guiana, and return of the Orbiter and EES to include initial recovery, containment, and handling of the samples once they reach the Earth's surface (i.e., at the UTTR landing site). Currently, definitive mission-related requirements associated with MSR Campaign ground elements for sample transportation and a SRF are still in the early planning stages of development, but each will be described to the maximum extent practicable in the PEIS. These aspects will be addressed programmatically in the Tier I PEIS, to the extent that information is available, and will be analyzed in more specific detail in subsequent Tier II NEPA analysis once this information is available. The Tier I analysis will also address the site-specific proposal to land the vehicle containing the samples (the EES) at the UTTR.

NASA published a Notice of Intent to prepare a PEIS in the Federal Register on April 15, 2022, initiating the public involvement process. The public scoping period for this PEIS is from April 15, 2022, to May 16, 2022.

Please visit www.nasa.gov/feature/nepa-mars-sample-return-campaign for fact sheets and other information regarding the NEPA scoping and public involvement processes for the MSR Campaign and how to participate.

The NEPA process for this action described above will be performed separately but will be aligned with the NHPA Section 106 process.

NHPA Section 106 Consultation

With this letter, NASA is initiating the NHPA Section 106 consultation process with the parties identified in Enclosure 3 and invites the ACHP to participate in this consultation, pursuant to 36 CFR 800.2(b) and 36 CFR 800 Appendix A. NASA intends to conduct Section

106 review to identify and consider adverse effects to historic properties in the APE in consultation with the SHPO, tribes, and other identified consulting parties (including the Army and the USAF). However, due to the large scope of the MSR Campaign and uncertainty regarding the timing, location, and environmental impacts of actions associated with the ground elements (described above), it will not be possible to fully assess the potential effects to historic properties in the timeframe established to complete the PEIS. Therefore, NASA proposes to fulfill its NHPA Section 106 process obligations to identify and determine potential effects to historic properties in a phased approach by developing a programmatic agreement stipulating the actions that it will take subsequent to completion of the NEPA process but before project implementation.

In accordance with 36 CFR 800.2, NASA has identified, in consultation with UTTR/USAF, 21 tribes with historical/cultural ties to the area (Enclosure 3) and has initiated government-to-government consultation with them on March 25, 2022. Also in accordance with 36 CFR 800.2, NASA will utilize the NEPA public involvement process to seek and include input from the public. This process includes notifying concerned Federal, state, and local agencies, and the general public allowing them sufficient time to evaluate potential environmental impacts (including cultural resources) of the proposed MSR Campaign.

If you have any questions regarding the proposed MSR Campaign or the Section 106 process outlined above, please contact Mr. Steve Slaten electronically at Mars-sample-return-nepa@lists.nasa.gov, by phone at 202-368-0491, or by mail at Mr. Steve Slaten, NASA Jet Propulsion Laboratory, 4800 Oak Grove Drive, M/S: 180-801, Pasadena, CA 91109-8099. We look forward to hearing from you at your earliest convenience.

Sincerely,

Dr. Rebecca Klein
FPO NASA Headquarters
300 E Street SW
Washington, DC 20546
Telephone: (202) 358-0082
E-mail: rebecca.a.klein@nasa.gov

3 Enclosures:
1. Map of Regional Location of the UTTR
2. Map of the Preliminary Area of Potential Effects
3. List of Consulting Parties

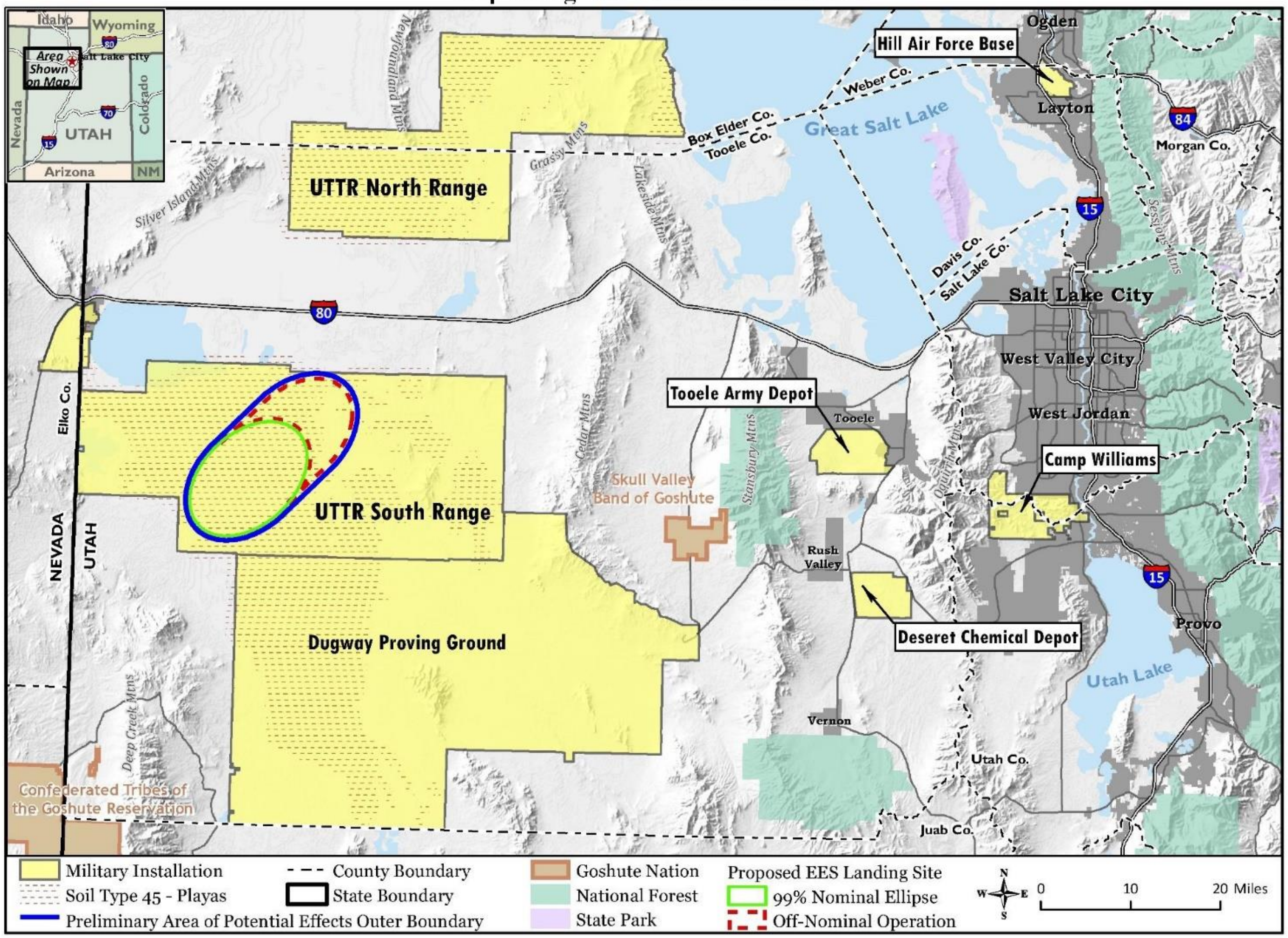
cc:

ACHP/Ms. K. Kerr
Utah SHPO/Dr. C. Merritt
USAF/Ms. A. Kitterman
U.S. Army Garrison/Ms. R. Quist

7

ENCLOSURE 1

Map of Regional Location of the UTTR



Enclosure 1

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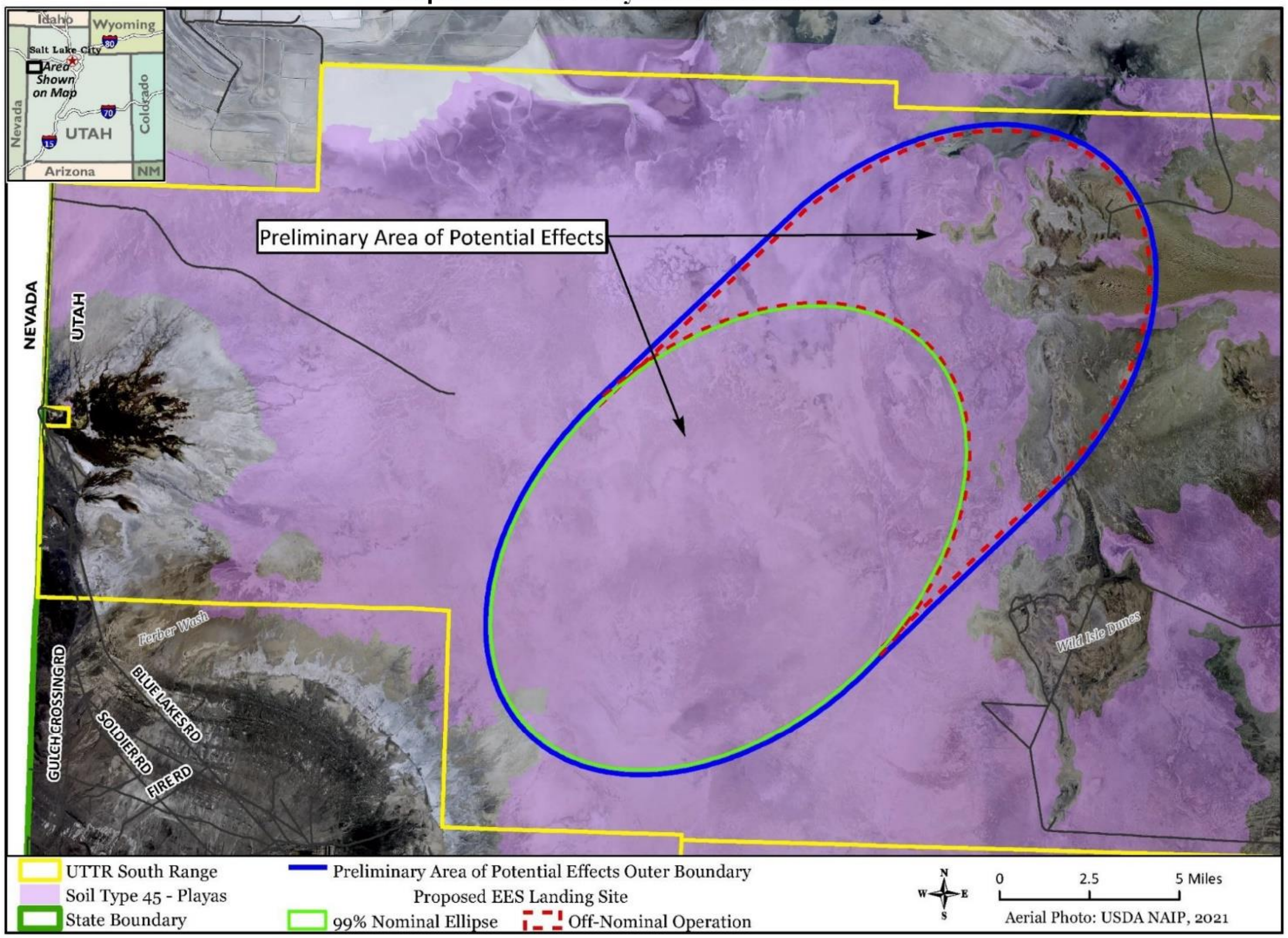
ENCLOSURE 2

Map of the Preliminary Area of Potential Effects



Enclosure 2

ENCLOSURE 3

Consulting Party List

Native American Tribes	
Tribe	**Contact Person**
Northern Arapaho Tribe of the Wind River Reservation, Wyoming	Mr. Ben Ridgley, THPO Director
Blackfeet Tribe of the Blackfeet Indian Reservation of Montana	Mr. John Murray, THPO
Confederated Salish and Kootenai Tribes of the Flathead Reservation	Mr. Kyle Felsman, THPO
Crow Tribe of Montana	Mr. Aaron Brien. Director, Tribal Historic Preservation Office
Shoshone-Paiute Tribes of the Duck Valley Indian Reservation	Ms. Lynneil Brady, Acting Cultural Resource Director
Duckwater Shoshone Tribe of the Duckwater Reservation, Nevada	Mr. Warren Graham, THPO
Eastern Shoshone Tribe of the Wind River Reservation, Wyoming	Mr. Joshua Mann, THPO
Ely Shoshone Tribe of Nevada	Ms. Shania Marques, Cultural Resources
Shoshone-Bannock Tribes of the Fort Hall Reservation	Ms. Carolyn Smith, Cultural Resource Coordinator
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Northwestern Band of the Shoshone Nation	Ms. Patty Timbimboo-Madsen, Cultural Resource Director
Paiute Indian Tribe of Utah	Ms. Dorena Martineau, Cultural Resource Director
Zuni Tribe of the Zuni Reservation, New Mexico	Mr. Kurt Dongoske, THPO
San Juan Southern Paiute Tribe of Arizona	Ms. Candelora Lehi, Vice President
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Organization	**Contact Person**
Bureau of Indian Affairs - Eastern Nevada Agency	-
Utah Division of Indian Affairs	Mr. Dustin Jansen, Division Director
Other Interested Parties (Local Groups)	
Organization	**Contact Person**
Historic Wendover Airfield	James Peterson, Director
Preservation Utah	David Amott, Executive Director
West Jordan Historical Society and Library	-

Enclosure 3

Letter to Historic Wendover Airfield from NASA, dated April 15, 2022

1

National Aeronautics and
Space Administration

Mary W. Jackson NASA Headquarters
Washington, DC 20546-0001

April 15, 2022

Reply to Attn of: NASA Office of JPL
Management and Oversight

Mr. James Peterson
Director
Historic Wendover Airfield
1940 East 10980
Sandy, UT 84092

Re: Initiation of Consultation under the National Historic Preservation Act and National Environmental Policy Act for the NASA Mars Sample Return Campaign

Dear Mr. Peterson:

NASA, in cooperation with the European Space Agency (ESA), the United States Air Force (USAF), United States Army, United States Department of Agriculture, and the Centers for Disease Control and Prevention, proposes to conduct a campaign to retrieve a scientifically selected set of samples (i.e., Martian rocks, regolith, and atmosphere), acquired and cached on the surface of Mars by the Perseverance rover, and return them to Earth for scientific analysis and research. The proposed Mars Sample Return (MSR) Campaign involves several flight elements associated with retrieving the samples on Mars, launching them into Mars orbit, capturing the samples in orbit, and returning them to Earth for study. The proposed landing and recovery location for the Mars samples is the Utah Test and Training Range (UTTR), which is under the jurisdictional control of the USAF. Additional Earth-based ground elements associated with sample transportation (utilizing over-the-road and/or aircraft to transport the samples off the UTTR) and sample management/research (otherwise referred to as “curation”) involving the development and operation of a Sample Receiving Facility (SRF) are also part of the MSR Campaign mission architecture.

As lead agency, NASA invites you to consult on this project pursuant to Section 106 of the National Historic Preservation Act (NHPA) (Title 54 United States Code [U.S.C.] Section 306108) and its implementing regulations (Title 36 Code of Federal Regulations [CFR] Part 800, Protection of Historic Properties), and the National Environmental Policy Act (NEPA) (42 U.S.C. 4321–4347) and the Council on Environmental Quality Regulations for Implementing the Procedural Provisions of NEPA (40 CFR 1500–1508).

Description of the Undertaking

NASA defines the undertaking as the entire MSR Campaign, which spans five elements: three flight elements, which include the Perseverance rover, the Sample Retrieval Landers (the “Landers”) and their subcomponents, and the Earth Return Orbiter (the “Orbiter”), its

Enclosure 3

subcomponents and recovery of the samples; and two ground elements, which include sample transportation and an SRF. Additional information about the MSR Campaign may be found at: http://www.jpl.nasa.gov/missions/mars-sample-return-msr.

The Perseverance rover is currently collecting Mars samples in environmentally sealed, rigorously engineered tubes and will eventually deposit select sets of tubes on the planet surface for later recovery (see *Final Supplemental Environmental Impact Statement for the Mars 2020 Mission*, at https://www.nasa.gov/sites/default/files/atoms/files/20200115_mars_2020_seis_final_tagged.pdf). Specific Lander design(s) are still under consideration. NASA anticipates that the Lander payload mass and volume may result in the need for the equipment to be divided into two payloads, therefore requiring two separate Landers and launches.

The Landers are proposed for launch from either Cape Canaveral Space Force Station or Kennedy Space Center (depending on the launch vehicle yet to be selected). NASA anticipates launch of the Landers in late summer of either 2026, 2028, or 2031 depending on the status of mission architecture and launch window availability. NASA anticipates Mars sample return to Earth approximately five years from launch of the Landers. The ESA Orbiter launch from French Guiana would then coincide with the NASA launch(es). All vehicles would transit to Mars. The Orbiter would enter Mars orbit, and the Landers would land directly on the Martian surface, similar to the recent Perseverance rover landing, in the vicinity of one or more sample tube sets. The samples would consist of approximately 30 tubes weighing about 15 grams (0.03 pounds) each, for a total sample amount of approximately 450 grams (about 1 pound). Once on Mars, the Sample Fetch Rover would be deployed. The Sample Fetch Rover would then retrieve the sample tubes and deliver them to the Lander for loading into an Orbiting Sample container within the Mars Ascent Vehicle. If still operational, the Perseverance rover could also deliver sample tubes directly to the Lander.

The Mars Ascent Vehicle would be launched from the Martian surface into Mars orbit. Once in orbit, the Mars Ascent Vehicle would deploy the Orbiting Sample container to rendezvous with the Orbiter. Once at the Orbiter, the Orbiting Sample container would be captured by the Capture, Containment, and Return System module. When retrieved by the Capture, Containment, and Return System module, the Orbiting Sample container would be stored in redundant vessels and placed in the Earth Entry Vehicle, creating the Earth Entry System (EES). The Orbiter would then leave Mars orbit and navigate to a trajectory that would bring it close to Earth without placing itself on an impact trajectory. After a series of system health and navigation checks, the Orbiter would then fire its thrusters to achieve a short-lived Earth return trajectory. Once this trajectory is confirmed and the proper point is reached, the Capture, Containment, and Return System module would release the EES on a path to enter the Earth's atmosphere. The EES would then enter Earth's atmosphere and descend, reaching a velocity of approximately 35 to 45 meters per second (around 78 to 100 miles per hour) before landing at the UTTR. After EES release, the Orbiter would navigate to a trajectory that would avoid Earth for over 100 years, ensuring that residual Mars material, if any, associated with the Orbiter is not returned to Earth.

Prior to EES landing, several recovery teams would be staged at strategic locations surrounding the proposed landing site; the objective being to contain and recover the EES as quickly as possible. Staging areas would include communications equipment and vehicles

(land and/or air) and equipment for use in transport to and from the landing site. The primary staging area would have a mobile containment system (or "vault"). Once the EES has landed, the recovery team would transit to the landing site and contain the EES. Because the samples should be treated as though potentially hazardous until demonstrated otherwise, the EES would be handled under the highest level of containment, handling, and transportation regulatory standards. Additionally, although release of Mars sample particles is considered an off-nominal event, recovery teams would handle the landing event as though a release has occurred, thereby ensuring proper containment and decontamination of the EES and landing site. After arrival of the recovery team, the landing site would be cordoned off, and a 100-square-meter (1,076-square-foot) tent would be erected over the EES. As a precautionary measure, the EES would then be decontaminated, placed in a protective biohazard plastic bag, and then inserted into a 2-meter by 2-meter (6.56-foot by 6.56-foot) sealed travel case. The exterior of the EES travel case would be decontaminated before leaving the tent, and the EES travel case would be placed on a vehicle and transported to the roadside staging area and into the vault for shipment to an SRF. After removal of the EES, the entire contents of the tent and the landing site would be decontaminated as a precautionary measure. Samples of the landing site/impact area would also be taken for contamination knowledge/biological knowledge after the EES is removed but before decontamination of the area. These samples would be transported under containment with the EES to the SRF for analysis. Prior to, and in support of, EES landing, the proposed landing area would be cleared of old target objects and other debris (e.g., railroad ties) that pose an impact risk to the EES.

NASA, as the lead agency, has determined that the only project element of the proposed MSR Campaign with the potential to introduce effects to historic properties and resources or places of traditional or religious importance is the third and final flight element—the reentry and landing of the EES, containing the Mars samples. The EES is proposed to land on Earth in an area at the UTTR South Range, on lands administered by the USAF in Tooele County (Enclosure 1).

The final flight element of the project involves the following:

1. *Landing site preparation.* Objects and debris within the proposed landing area will be removed to minimize the potential for the sample return vehicle (i.e., the EES) to impact an object upon landing. This involves the removal of old aerial gunnery tow-target debris and other objects (e.g., railroad ties) within a portion of the nominal landing area ellipse. The exact nature and scale of object removal has not been fully evaluated but will likely include use of tracked and/or wheeled vehicles and ground-disturbing activities. Currently, NASA is testing different methods for object removal, which may include digging below the ground surface (potentially up to 4 feet) to remove the large portions of exposed target debris. More information regarding this aspect of the project will be made available to you as the project planning develops.
2. *EES descent.* It is calculated that once entering the Earth's atmosphere, the EES would take approximately 377 seconds (about six minutes) before it lands. The EES reentry will generate a sonic boom high above the Earth at a yet to be determined altitude. It is estimated that the EES will slow to a velocity of approximately 126 to 161 kilometers per hour (78 to 100 miles per hour) before landing/impact.

3. *Recovery team staging.* Staging of up to four recovery teams (consisting of personnel, helicopters, and/or hovercraft, and/or tracked vehicles) would occur along the east/west and north/south axes just outside the landing ellipse approximately 30 minutes ahead of EES landing.
4. *Establishment of a primary recovery staging area.* A primary recovery staging area will be established, where the samples, once retrieved, will be returned. The primary staging area will include a protective storage enclosure (i.e., "the vault") for sample containment. This primary staging area will likely be placed along the road leading into the landing area ellipse.
5. *Landing of the EES in the targeted area.* It is anticipated that the landing will occur while the soils are soft but before they become saturated from rain events in the fall, which would serve to lessen the force of impact to the EES. The EES is expected to create an impact crater of approximately 1.2 meters (4 feet) in depth and diameter which is roughly the same size as the EES. Given the composition of the soil, it is expected that soil will be ejected from the impact crater to a distance of approximately 15 meters (49 feet).
6. *Transit of recovery teams to the EES landing site.* The recovery teams would transit to the EES landing site using helicopters, and/or hovercraft, and/or tracked vehicles (such as a snow cat). The use of wheeled vehicles is unlikely because they would easily become stuck in the soft soils; however, use of wheeled vehicles off road to or from staging areas cannot be entirely discounted.
7. *EES recovery.* Once on site, the recovery teams will secure and cordon off the EES landing site, and a tent containment structure will be erected (approximately 100 square meters or 1,076 square feet) over the EES. The EES will be contained in a biosafety bag, sealed in a 2-meter by 2-meter (6.5-foot by 6.5-foot) travel case, and the case exterior cleaned.
8. *Transit of recovery teams from the EES landing site to the primary staging area.* Recovery teams would transit from the EES landing site to the primary staging area and the EES would be placed into the Vault for shipment over the road and/or via aircraft to an SRF. Transit methods for recovery teams are described above in paragraph 6.
9. *Decontamination of the landing site.* Although release of Mars sample particles is considered an off-nominal event, after removal of the EES, the entire landing site will be cleaned as a precautionary measure. It is assumed that the cleaning process may involve standardized decontamination and/or sterilization methods, which could include high heat exposure, use of chemicals (such as chlorine dioxide or aldehyde), or a combination of both.

Area of Potential Effects

The area of potential effects (APE) is in the process of being more narrowly defined, but it is expected to include an area in which a targeted or off-target landing may occur. The nominal landing target area consists of an ellipse that defines the area with a 99.9999 percent probability of landing. The notional area associated with an off-nominal (abnormal or unexpected) landing is an expanded version of the ellipse. The APE also includes the addition

of an approximately 150-foot wide buffer around the ellipse to accommodate recovery team staging. The total area of potential landing and ground disturbance (both nominal and off-nominal) is approximately 574 square kilometers or 222 square miles. Enclosure 2 graphically depicts the target and off-target areas where the EES may land.

NEPA Process

Due to the potential for past or present indigenous life forms on Mars, the sample return portion of the MSR mission is expected to be classified as a Category V Restricted Earth Return activity, which requires an environmental impact statement under 14 CFR 1216.306. NASA will prepare a Programmatic Environmental Impact Statement (PEIS) for the MSR Campaign. The PEIS anticipates that this categorization will be established and the PEIS's analysis provides for the most conservative approach to the potential environmental impacts associated with the proposed return of Mars samples to Earth for scientific analysis.

Due to the large scope of the MSR Campaign and uncertainty regarding the timing, location, and environmental impacts of actions associated with the ground elements, the NEPA analysis will be conducted in two "tiers" (or phases). This approach is endorsed under both 40 CFR 1501.11 and 14 CFR 1216.307. Tier I, the focus of the PEIS, will programmatically address the potential impacts associated with the potential for multiple Lander launches from either Kennedy Space Center or Cape Canaveral Space Force Station in Florida, launch of the Orbiter from French Guiana, and return of the Orbiter and EES to include initial recovery, containment, and handling of the samples once they reach the Earth's surface (i.e., at the UTTR landing site). Currently, definitive mission-related requirements associated with MSR Campaign ground elements for sample transportation and a SRF are still in the early planning stages of development, but each will be described to the maximum extent practicable in the PEIS. These aspects will be addressed programmatically in the Tier I PEIS, to the extent that information is available, and will be analyzed in more specific detail in subsequent Tier II NEPA analysis once this information is available. The Tier I analysis will also address the site-specific proposal to land the vehicle containing the samples (the EES) at the UTTR.

NASA published a Notice of Intent to prepare a PEIS in the Federal Register on April 15, 2022, initiating the public involvement process. The public scoping period for this PEIS is from April 15, 2022, to May 16, 2022.

Please visit www.nasa.gov/feature/nepa-mars-sample-return-campaign for fact sheets and other information regarding the NEPA scoping and public involvement processes for the MSR Campaign and how to participate.

The NEPA process for this action described above will be performed separately but will be aligned with the NHPA Section 106 process.

NHPA Section 106 Consultation

With this letter, NASA is initiating the NHPA Section 106 consultation process, and requests SHPO and THPO concurrence on the APE, pursuant to 36 CFR 800.4(a)(1), within 30 days of receipt of this letter. NASA intends to conduct Section 106 review to identify and consider adverse effects to historic properties in the APE in consultation with the SHPO, tribes, and other identified consulting parties (including the Army and the USAF). However, due to the

large scope of the MSR Campaign and uncertainty regarding the timing, location, and environmental impacts of actions associated with the ground elements (described above), it will not be possible to fully assess the potential effects to historic properties in the timeframe established to complete the PEIS. Therefore, NASA proposes to fulfill its NHPA Section 106 process obligations to identify and determine potential effects to historic properties in a phased approach by developing a programmatic agreement stipulating the actions that it will take subsequent to completion of the NEPA process but before project implementation.

In accordance with 36 CFR 800.2, NASA has identified, in consultation with UTTR/USAF, 21 tribes with historical/cultural ties to the area (Enclosure 3) and has initiated government-to-government consultation with them on March 25, 2022. Also in accordance with 36 CFR 800.2, NASA will utilize the NEPA public involvement process to seek and include input from the public. This process includes notifying concerned Federal, state, and local agencies, and the general public allowing them sufficient time to evaluate potential environmental impacts (including cultural resources) of the proposed MSR Campaign.

If you have any questions regarding the proposed MSR Campaign, please contact Mr. Steve Slaten electronically at mars-sample-return-nepa@lists.nasa.gov, by phone at 202-368-0491, or by mail at Mr. Steve Slaten, NASA Office of Jet Propulsion Laboratory Management and Oversight, 4800 Oak Grove Drive, M/S: 180-801, Pasadena, CA 91109-8099. Mr. Slaten will also be the primary point of contact for this Section 106 consultation. Copies of this letter are being sent to the local tribes that NASA contacted to participate in the consultation (Enclosure 3). We look forward to hearing from you and receiving concurrence on the APE at your earliest convenience.

Sincerely,

Dr. Rebecca Klein
FPO NASA Headquarters
300 E Street SW
Washington, DC 20546
Telephone: (202) 358-0082
E-mail: rebecca.a.klein@nasa.gov

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cc:

USAF/Ms. A. Kitterman
U.S. Army Garrison/Ms. R. Quist

7

ENCLOSURE 1

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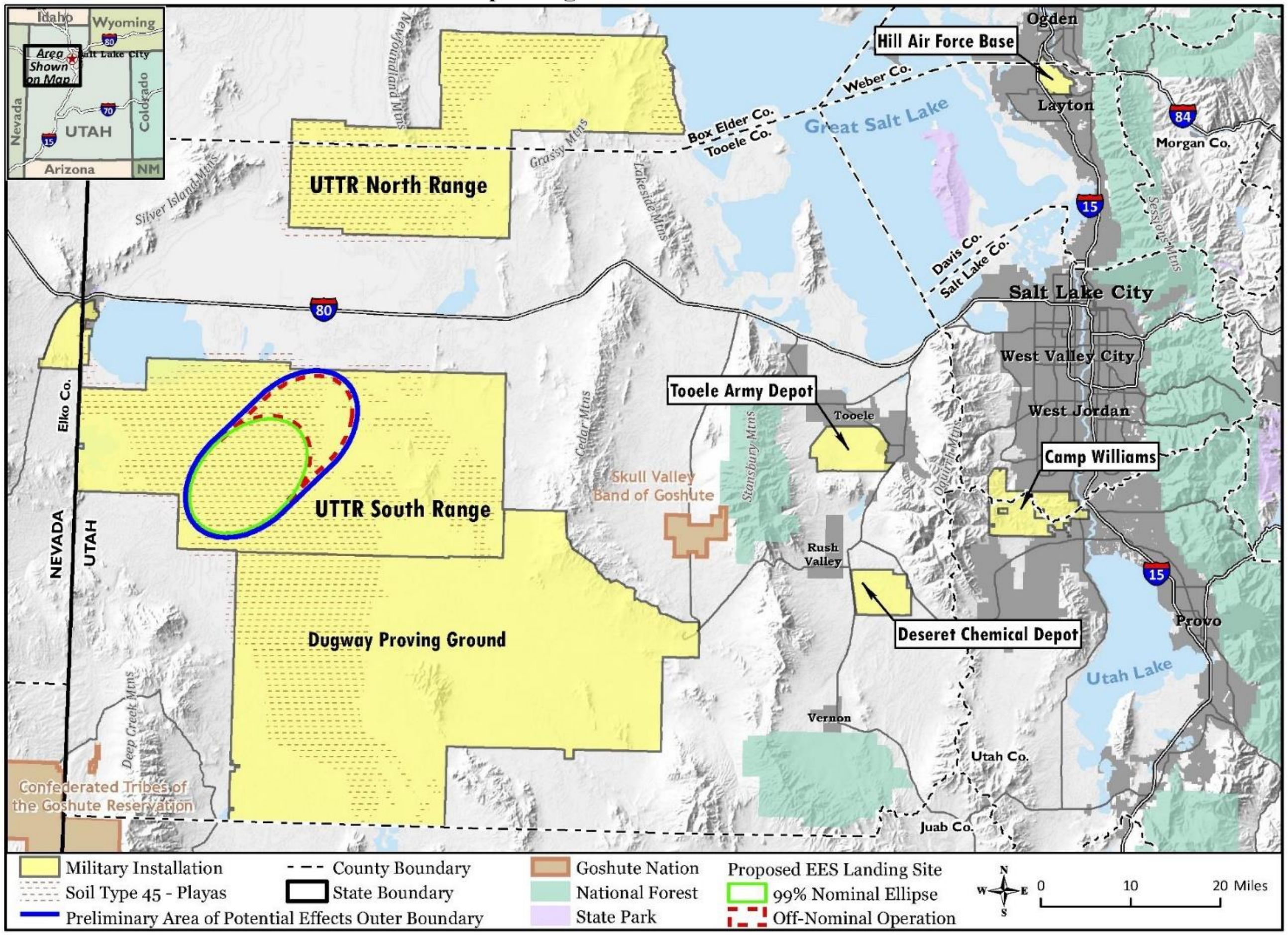

Enclosure 1

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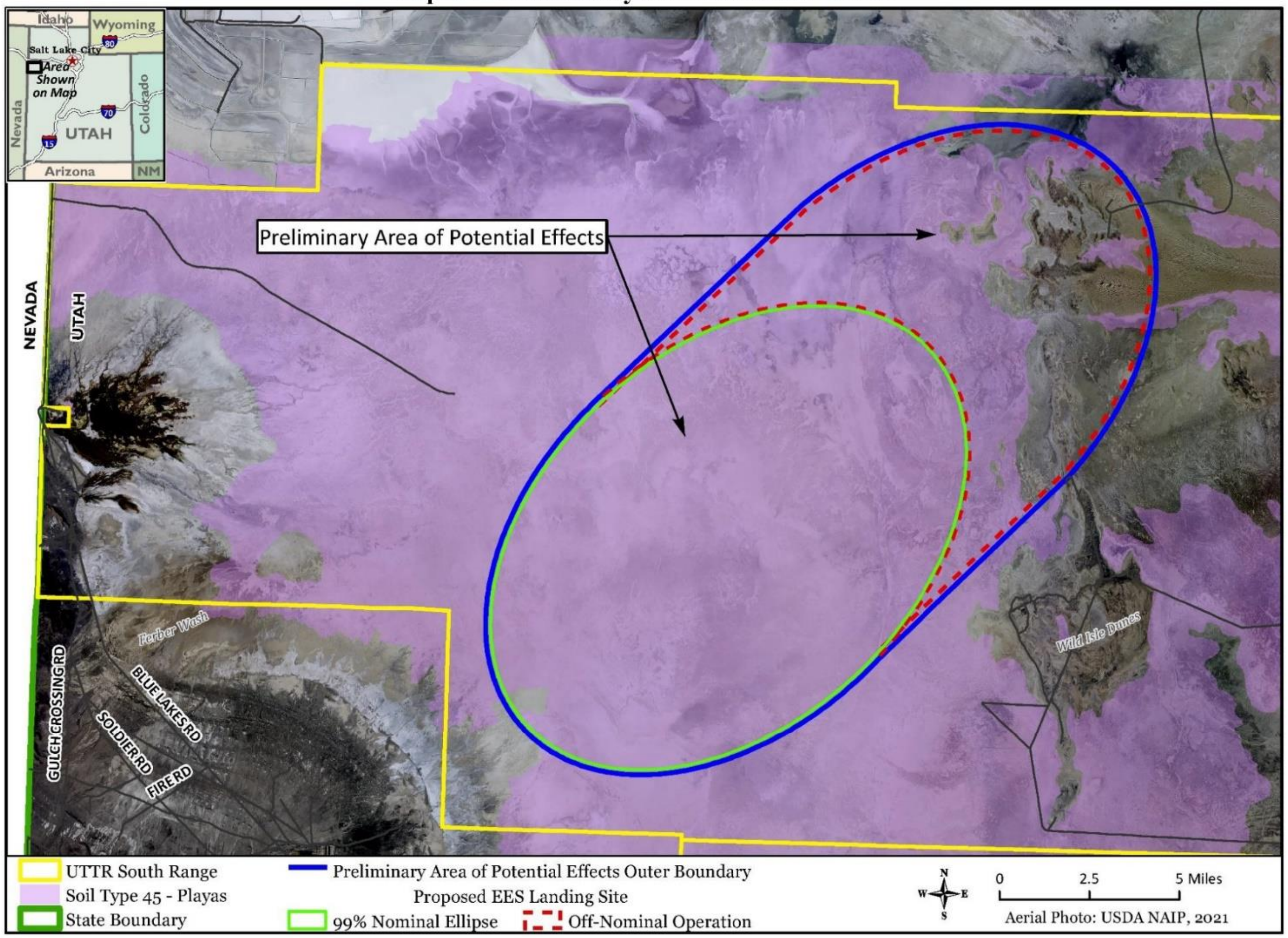

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Letter to Preservation Utah from NASA, dated April 15, 2022

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National Aeronautics and
Space Administration

Mary W. Jackson NASA Headquarters
Washington, DC 20546-0001

April 15, 2022

Reply to Attn of: NASA Office of JPL
Management and Oversight

Mr. David Amott
Executive Director
Preservation Utah
375 N. Canyon Road
Salt Lake City, Utah 84103

Re: Initiation of Consultation under the National Historic Preservation Act and National Environmental Policy Act for the NASA Mars Sample Return Campaign

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(land and/or air) and equipment for use in transport to and from the landing site. The primary staging area would have a mobile containment system (or "vault"). Once the EES has landed, the recovery team would transit to the landing site and contain the EES. Because the samples should be treated as though potentially hazardous until demonstrated otherwise, the EES would be handled under the highest level of containment, handling, and transportation regulatory standards. Additionally, although release of Mars sample particles is considered an off-nominal event, recovery teams would handle the landing event as though a release has occurred, thereby ensuring proper containment and decontamination of the EES and landing site. After arrival of the recovery team, the landing site would be cordoned off, and a 100-square-meter (1,076-square-foot) tent would be erected over the EES. As a precautionary measure, the EES would then be decontaminated, placed in a protective biohazard plastic bag, and then inserted into a 2-meter by 2-meter (6.56-foot by 6.56-foot) sealed travel case. The exterior of the EES travel case would be decontaminated before leaving the tent, and the EES travel case would be placed on a vehicle and transported to the roadside staging area and into the vault for shipment to an SRF. After removal of the EES, the entire contents of the tent and the landing site would be decontaminated as a precautionary measure. Samples of the landing site/impact area would also be taken for contamination knowledge/biological knowledge after the EES is removed but before decontamination of the area. These samples would be transported under containment with the EES to the SRF for analysis. Prior to, and in support of, EES landing, the proposed landing area would be cleared of old target objects and other debris (e.g., railroad ties) that pose an impact risk to the EES.

NASA, as the lead agency, has determined that the only project element of the proposed MSR Campaign with the potential to introduce effects to historic properties and resources or places of traditional or religious importance is the third and final flight element—the reentry and landing of the EES, containing the Mars samples. The EES is proposed to land on Earth in an area at the UTTR South Range, on lands administered by the USAF in Tooele County (Enclosure 1).

The final flight element of the project involves the following:

1. *Landing site preparation.* Objects and debris within the proposed landing area will be removed to minimize the potential for the sample return vehicle (i.e., the EES) to impact an object upon landing. This involves the removal of old aerial gunnery tow-target debris and other objects (e.g., railroad ties) within a portion of the nominal landing area ellipse. The exact nature and scale of object removal has not been fully evaluated but will likely include use of tracked and/or wheeled vehicles and ground-disturbing activities. Currently, NASA is testing different methods for object removal, which may include digging below the ground surface (potentially up to 4 feet) to remove the large portions of exposed target debris. More information regarding this aspect of the project will be made available to you as the project planning develops.
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3. *Recovery team staging*. Staging of up to four recovery teams (consisting of personnel, helicopters, and/or hovercraft, and/or tracked vehicles) would occur along the east/west and north/south axes just outside the landing ellipse approximately 30 minutes ahead of EES landing.
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6. *Transit of recovery teams to the EES landing site*. The recovery teams would transit to the EES landing site using helicopters, and/or hovercraft, and/or tracked vehicles (such as a snow cat). The use of wheeled vehicles is unlikely because they would easily become stuck in the soft soils; however, use of wheeled vehicles off road to or from staging areas cannot be entirely discounted.
7. *EES recovery*. Once on site, the recovery teams will secure and cordon off the EES landing site, and a tent containment structure will be erected (approximately 100 square meters or 1,076 square feet) over the EES. The EES will be contained in a biosafety bag, sealed in a 2-meter by 2-meter (6.5-foot by 6.5-foot) travel case, and the case exterior cleaned.
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of an approximately 150-foot wide buffer around the ellipse to accommodate recovery team staging. The total area of potential landing and ground disturbance (both nominal and off-nominal) is approximately 574 square kilometers or 222 square miles. Enclosure 2 graphically depicts the target and off-target areas where the EES may land.

NEPA Process

Due to the potential for past or present indigenous life forms on Mars, the sample return portion of the MSR mission is expected to be classified as a Category V Restricted Earth Return activity, which requires an environmental impact statement under 14 CFR 1216.306. NASA will prepare a Programmatic Environmental Impact Statement (PEIS) for the MSR Campaign. The PEIS anticipates that this categorization will be established and the PEIS's analysis provides for the most conservative approach to the potential environmental impacts associated with the proposed return of Mars samples to Earth for scientific analysis.

Due to the large scope of the MSR Campaign and uncertainty regarding the timing, location, and environmental impacts of actions associated with the ground elements, the NEPA analysis will be conducted in two "tiers" (or phases). This approach is endorsed under both 40 CFR 1501.11 and 14 CFR 1216.307. Tier I, the focus of the PEIS, will programmatically address the potential impacts associated with the potential for multiple Lander launches from either Kennedy Space Center or Cape Canaveral Space Force Station in Florida, launch of the Orbiter from French Guiana, and return of the Orbiter and EES to include initial recovery, containment, and handling of the samples once they reach the Earth's surface (i.e., at the UTTR landing site). Currently, definitive mission-related requirements associated with MSR Campaign ground elements for sample transportation and a SRF are still in the early planning stages of development, but each will be described to the maximum extent practicable in the PEIS. These aspects will be addressed programmatically in the Tier I PEIS, to the extent that information is available, and will be analyzed in more specific detail in subsequent Tier II NEPA analysis once this information is available. The Tier I analysis will also address the site-specific proposal to land the vehicle containing the samples (the EES) at the UTTR.

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Please visit www.nasa.gov/feature/nepa-mars-sample-return-campaign for fact sheets and other information regarding the NEPA scoping and public involvement processes for the MSR Campaign and how to participate.

The NEPA process for this action described above will be performed separately but will be aligned with the NHPA Section 106 process.

NHPA Section 106 Consultation

With this letter, NASA is initiating the NHPA Section 106 consultation process, and requests SHPO and THPO concurrence on the APE, pursuant to 36 CFR 800.4(a)(1), within 30 days of receipt of this letter. NASA intends to conduct Section 106 review to identify and consider adverse effects to historic properties in the APE in consultation with the SHPO, tribes, and other identified consulting parties (including the Army and the USAF). However, due to the

large scope of the MSR Campaign and uncertainty regarding the timing, location, and environmental impacts of actions associated with the ground elements (described above), it will not be possible to fully assess the potential effects to historic properties in the timeframe established to complete the PEIS. Therefore, NASA proposes to fulfill its NHPA Section 106 process obligations to identify and determine potential effects to historic properties in a phased approach by developing a programmatic agreement stipulating the actions that it will take subsequent to completion of the NEPA process but before project implementation.

In accordance with 36 CFR 800.2, NASA has identified, in consultation with UTTR/USAF, 21 tribes with historical/cultural ties to the area (Enclosure 3) and has initiated government-to-government consultation with them on March 25, 2022. Also in accordance with 36 CFR 800.2, NASA will utilize the NEPA public involvement process to seek and include input from the public. This process includes notifying concerned Federal, state, and local agencies, and the general public allowing them sufficient time to evaluate potential environmental impacts (including cultural resources) of the proposed MSR Campaign.

If you have any questions regarding the proposed MSR Campaign, please contact Mr. Steve Slaten electronically at mars-sample-return-nepa@lists.nasa.gov, by phone at 202-368-0491, or by mail at Mr. Steve Slaten, NASA Office of Jet Propulsion Laboratory Management and Oversight, 4800 Oak Grove Drive, M/S: 180-801, Pasadena, CA 91109-8099. Mr. Slaten will also be the primary point of contact for this Section 106 consultation. Copies of this letter are being sent to the local tribes that NASA contacted to participate in the consultation (Enclosure 3). We look forward to hearing from you and receiving concurrence on the APE at your earliest convenience.

Sincerely,

Rebecca Klein

Dr. Rebecca Klein
FPO NASA Headquarters
300 E Street SW
Washington, DC 20546
Telephone: (202) 358-0082
E-mail: rebecca.a.klein@nasa.gov

3 Enclosures:
1. Map of Regional Location of the UTTR
2. Map of the Preliminary Area of Potential Effects
3. List of Consulting Parties

cc:

USAF/Ms. A. Kitterman
U.S. Army Garrison/Ms. R. Quist

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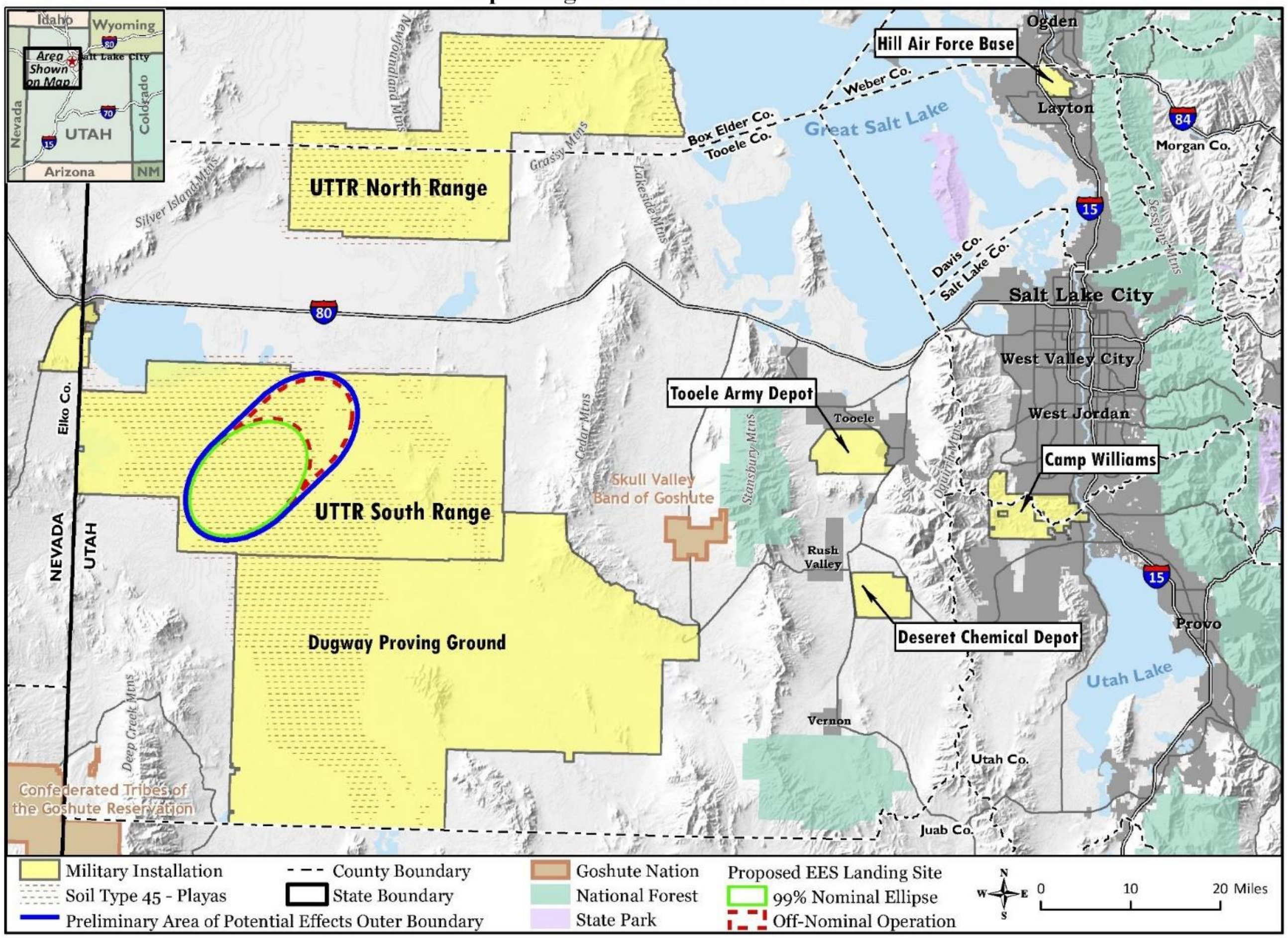
ENCLOSURE 1

Map of Regional Location of the UTTR



Enclosure 1

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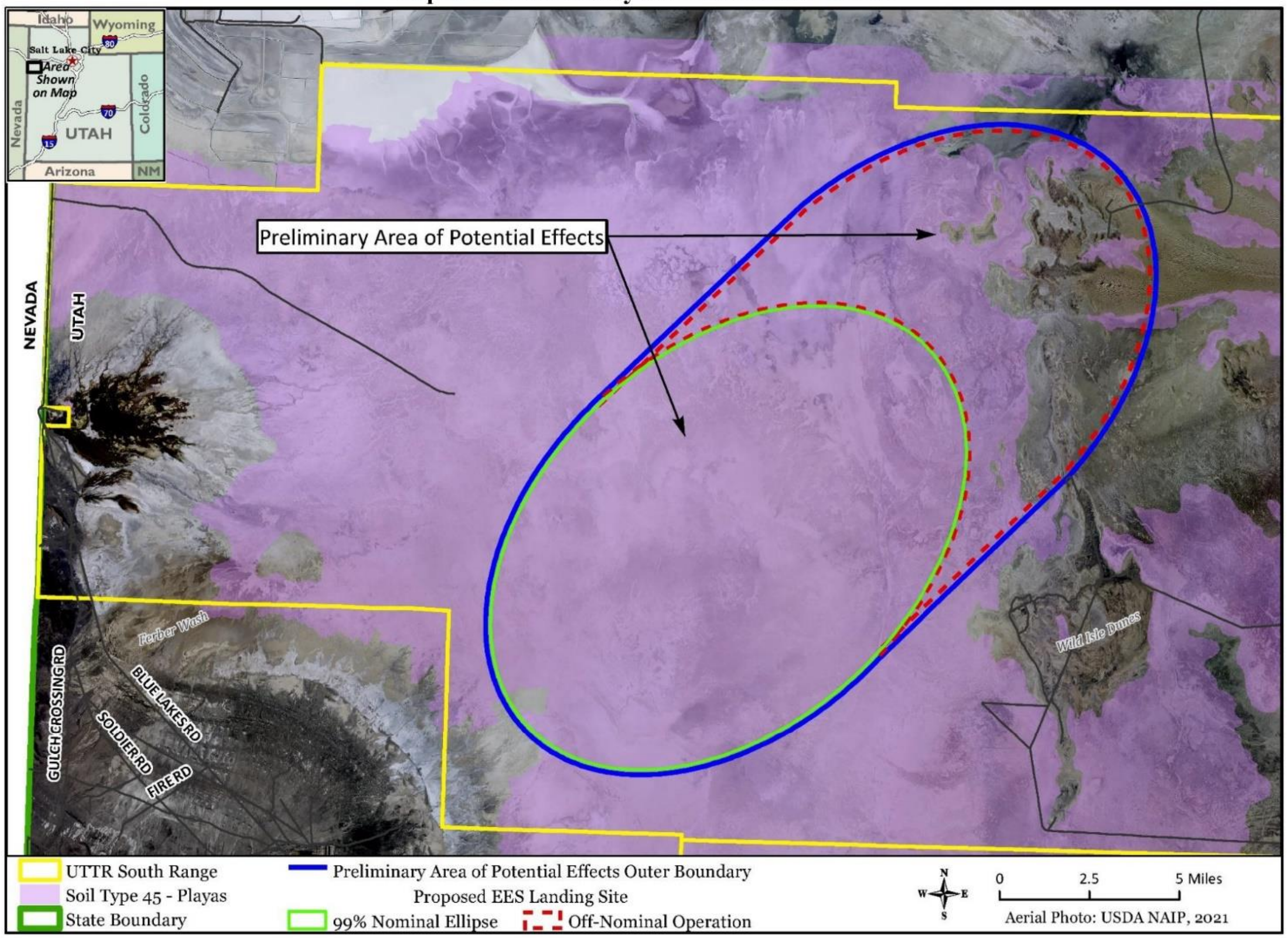
ENCLOSURE 2

Map of the Preliminary Area of Potential Effects



Enclosure 2

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ENCLOSURE 3

Consulting Party List

Native American Tribes	
Tribe	**Contact Person**
Northern Arapaho Tribe of the Wind River Reservation, Wyoming	Mr. Ben Ridgley, THPO Director
Blackfeet Tribe of the Blackfeet Indian Reservation of Montana	Mr. John Murray, THPO
Confederated Salish and Kootenai Tribes of the Flathead Reservation	Mr. Kyle Felsman, THPO
Crow Tribe of Montana	Mr. Aaron Brien. Director, Tribal Historic Preservation Office
Shoshone-Paiute Tribes of the Duck Valley Indian Reservation	Ms. Lynneil Brady, Acting Cultural Resource Director
Duckwater Shoshone Tribe of the Duckwater Reservation, Nevada	Mr. Warren Graham, THPO
Eastern Shoshone Tribe of the Wind River Reservation, Wyoming	Mr. Joshua Mann, THPO
Ely Shoshone Tribe of Nevada	Ms. Shania Marques, Cultural Resources
Shoshone-Bannock Tribes of the Fort Hall Reservation	Ms. Carolyn Smith, Cultural Resource Coordinator
Confederated Tribes of the Goshute Reservation, Nevada and Utah	Ms. Genevieve Fields, THPO
Hopi Tribe of Arizona	Mr. Stewart B. Koyiyumptewa, THPO
Navajo Nation, Arizona, New Mexico, & Utah	Mr. Richard Begay, THPO
Northwestern Band of the Shoshone Nation	Ms. Patty Timbimboo-Madsen, Cultural Resource Director
Paiute Indian Tribe of Utah	Ms. Dorena Martineau, Cultural Resource Director
Zuni Tribe of the Zuni Reservation, New Mexico	Mr. Kurt Dongoske, THPO
San Juan Southern Paiute Tribe of Arizona	Ms. Candelora Lehi, Vice President
Skull Valley Band of Goshute Indians of Utah	Ms. Candace Bear, Chairperson
Te-Moak Tribal Council of the Te-Moak Tribe of Western Shoshone Indians of Nevada (includes the Battle Mountain, Elko, and South Fork Bands)	Mr. Joseph Holley, Chairman
Ute Indian Tribe of the Uintah and Ouray Reservation, Utah	Ms. Betsy Chapoose, THPO
Ute Mountain Ute Tribe	Mr. Terry Knight, THPO
Wells Band of the Te-Moak Tribe of Western Shoshone Indians of Nevada	Ms. Andrea Woods, Chairwoman
Other Native American Entities	
Organization	**Contact Person**
Utah Division of Indian Affairs	Mr. Dustin Jansen, Division Director
Other Interested Parties (Local Groups)	
Organization	**Contact Person**
Historic Wendover Airfield	James Peterson, Director
Preservation Utah	David Amott, Executive Director

Enclosure 3

Letter to Utah Division of Indian Affairs from NASA, dated April 15, 2022

1

National Aeronautics and
Space Administration

Mary W. Jackson NASA Headquarters
Washington, DC 20546-0001

April 15, 2022

Reply to Attn of: NASA Office of JPL
Management and Oversight

Mr. Dustin Jansen
Division Director
Utah Division of Indian Affairs
250 N. 1950 W.
Elko, NV 89801

Re: Initiation of Consultation under the National Historic Preservation Act and National Environmental Policy Act for the NASA Mars Sample Return Campaign

Dear Mr. Jansen:

NASA, in cooperation with the European Space Agency (ESA), the United States Air Force (USAF), United States Army, United States Department of Agriculture, and the Centers for Disease Control and Prevention, proposes to conduct a campaign to retrieve a scientifically selected set of samples (i.e., Martian rocks, regolith, and atmosphere), acquired and cached on the surface of Mars by the Perseverance rover, and return them to Earth for scientific analysis and research. The proposed Mars Sample Return (MSR) Campaign involves several flight elements associated with retrieving the samples on Mars, launching them into Mars orbit, capturing the samples in orbit, and returning them to Earth for study. The proposed landing and recovery location for the Mars samples is the Utah Test and Training Range (UTTR), which is under the jurisdictional control of the USAF. Additional Earth-based ground elements associated with sample transportation (utilizing over-the-road and/or aircraft to transport the samples off the UTTR) and sample management/research (otherwise referred to as “curation”) involving the development and operation of a Sample Receiving Facility (SRF) are also part of the MSR Campaign mission architecture.

As lead agency, NASA invites you to consult on this project pursuant to Section 106 of the National Historic Preservation Act (NHPA) (Title 54 United States Code [U.S.C.] Section 306108) and its implementing regulations (Title 36 Code of Federal Regulations [CFR] Part 800, Protection of Historic Properties), and the National Environmental Policy Act (NEPA) (42 U.S.C. 4321–4347) and the Council on Environmental Quality Regulations for Implementing the Procedural Provisions of NEPA (40 CFR 1500–1508).

Description of the Undertaking

NASA defines the undertaking as the entire MSR Campaign, which spans five elements: three flight elements, which include the Perseverance rover, the Sample Retrieval Landers (the “Landers”) and their subcomponents, and the Earth Return Orbiter (the “Orbiter”), its

Enclosure 3

subcomponents and recovery of the samples; and two ground elements, which include sample transportation and an SRF. Additional information about the MSR Campaign may be found at: http://www.jpl.nasa.gov/missions/mars-sample-return-msr.

The Perseverance rover is currently collecting Mars samples in environmentally sealed, rigorously engineered tubes and will eventually deposit select sets of tubes on the planet surface for later recovery (see *Final Supplemental Environmental Impact Statement for the Mars 2020 Mission*, at https://www.nasa.gov/sites/default/files/atoms/files/20200115_mars_2020_seis_final_tagged.pdf). Specific Lander design(s) are still under consideration. NASA anticipates that the Lander payload mass and volume may result in the need for the equipment to be divided into two payloads, therefore requiring two separate Landers and launches.

The Landers are proposed for launch from either Cape Canaveral Space Force Station or Kennedy Space Center (depending on the launch vehicle yet to be selected). NASA anticipates launch of the Landers in late summer of either 2026, 2028, or 2031 depending on the status of mission architecture and launch window availability. NASA anticipates Mars sample return to Earth approximately five years from launch of the Landers. The ESA Orbiter launch from French Guiana would then coincide with the NASA launch(es). All vehicles would transit to Mars. The Orbiter would enter Mars orbit, and the Landers would land directly on the Martian surface, similar to the recent Perseverance rover landing, in the vicinity of one or more sample tube sets. The samples would consist of approximately 30 tubes weighing about 15 grams (0.03 pounds) each, for a total sample amount of approximately 450 grams (about 1 pound). Once on Mars, the Sample Fetch Rover would be deployed. The Sample Fetch Rover would then retrieve the sample tubes and deliver them to the Lander for loading into an Orbiting Sample container within the Mars Ascent Vehicle. If still operational, the Perseverance rover could also deliver sample tubes directly to the Lander.

The Mars Ascent Vehicle would be launched from the Martian surface into Mars orbit. Once in orbit, the Mars Ascent Vehicle would deploy the Orbiting Sample container to rendezvous with the Orbiter. Once at the Orbiter, the Orbiting Sample container would be captured by the Capture, Containment, and Return System module. When retrieved by the Capture, Containment, and Return System module, the Orbiting Sample container would be stored in redundant vessels and placed in the Earth Entry Vehicle, creating the Earth Entry System (EES). The Orbiter would then leave Mars orbit and navigate to a trajectory that would bring it close to Earth without placing itself on an impact trajectory. After a series of system health and navigation checks, the Orbiter would then fire its thrusters to achieve a short-lived Earth return trajectory. Once this trajectory is confirmed and the proper point is reached, the Capture, Containment, and Return System module would release the EES on a path to enter the Earth's atmosphere. The EES would then enter Earth's atmosphere and descend, reaching a velocity of approximately 35 to 45 meters per second (around 78 to 100 miles per hour) before landing at the UTTR. After EES release, the Orbiter would navigate to a trajectory that would avoid Earth for over 100 years, ensuring that residual Mars material, if any, associated with the Orbiter is not returned to Earth.

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Sincerely,

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Washington, DC 20546
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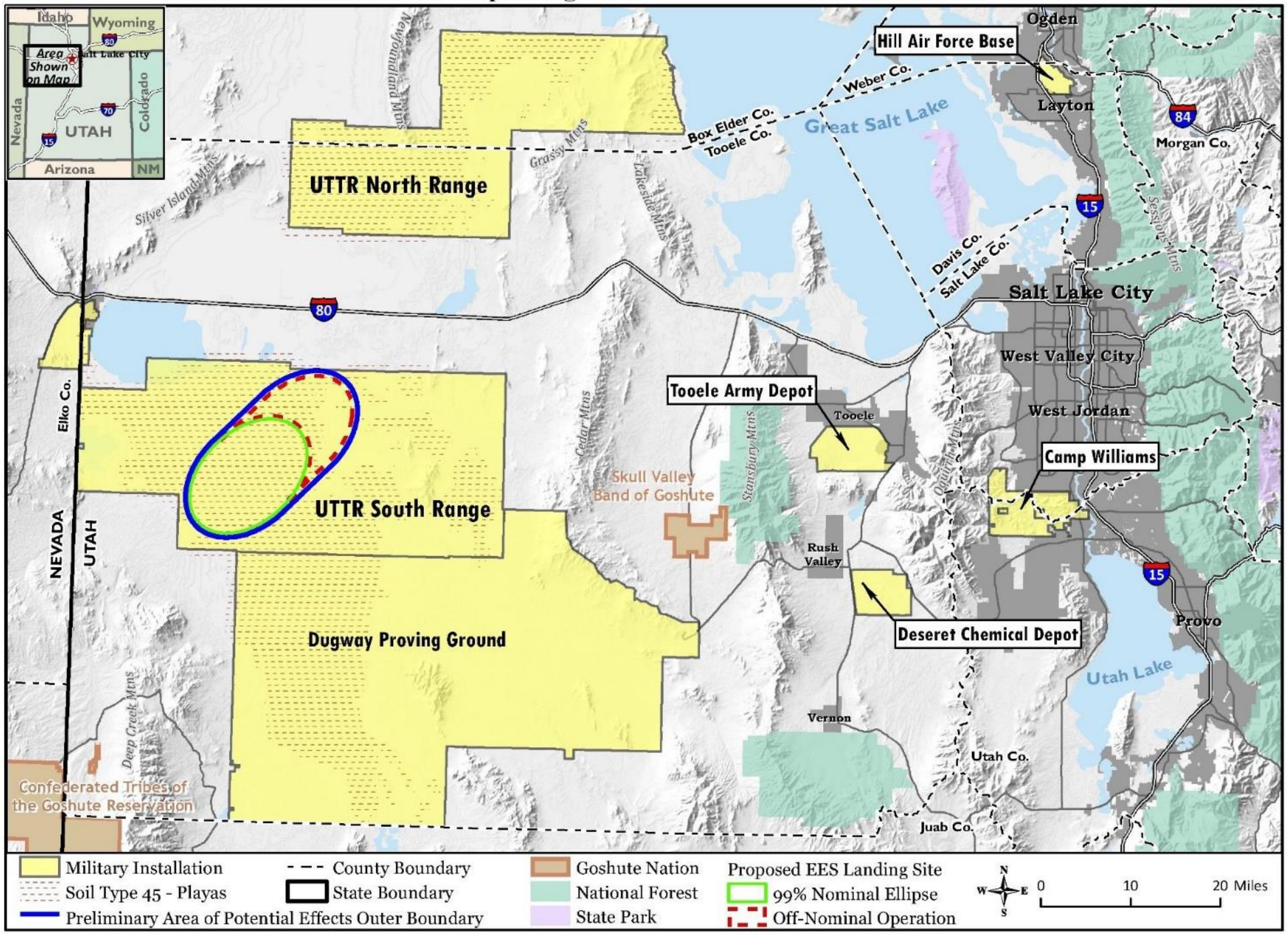
7

ENCLOSURE 1

Map of Regional Location of the UTTR

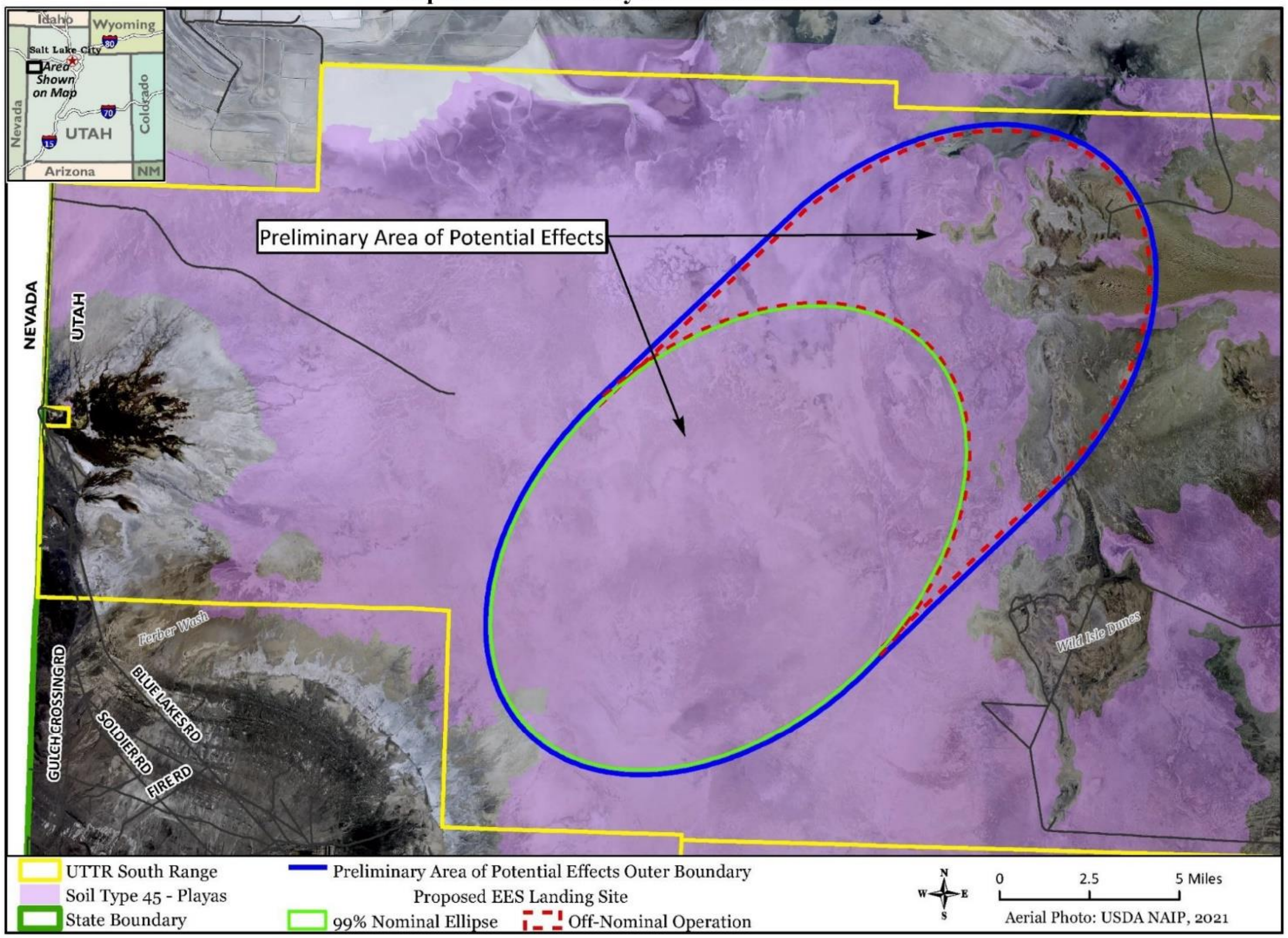


Enclosure 1

8

ENCLOSURE 2

Map of the Preliminary Area of Potential Effects



Enclosure 2

ENCLOSURE 3

Consulting Party List

Native American Tribes	
Tribe	**Contact Person**
Northern Arapaho Tribe of the Wind River Reservation, Wyoming	Mr. Ben Ridgley, THPO Director
Blackfeet Tribe of the Blackfeet Indian Reservation of Montana	Mr. John Murray, THPO
Confederated Salish and Kootenai Tribes of the Flathead Reservation	Mr. Kyle Felsman, THPO
Crow Tribe of Montana	Mr. Aaron Brien. Director, Tribal Historic Preservation Office
Shoshone-Paiute Tribes of the Duck Valley Indian Reservation	Ms. Lynneil Brady, Acting Cultural Resource Director
Duckwater Shoshone Tribe of the Duckwater Reservation, Nevada	Mr. Warren Graham, THPO
Eastern Shoshone Tribe of the Wind River Reservation, Wyoming	Mr. Joshua Mann, THPO
Ely Shoshone Tribe of Nevada	Ms. Shania Marques, Cultural Resources
Shoshone-Bannock Tribes of the Fort Hall Reservation	Ms. Carolyn Smith, Cultural Resource Coordinator
Confederated Tribes of the Goshute Reservation, Nevada and Utah	Ms. Genevieve Fields, THPO
Hopi Tribe of Arizona	Mr. Stewart B. Koyiyumptewa, THPO
Navajo Nation, Arizona, New Mexico, & Utah	Mr. Richard Begay, THPO
Northwestern Band of the Shoshone Nation	Ms. Patty Timbimboo-Madsen, Cultural Resource Director
Paiute Indian Tribe of Utah	Ms. Dorena Martineau, Cultural Resource Director
Zuni Tribe of the Zuni Reservation, New Mexico	Mr. Kurt Dongoske, THPO
San Juan Southern Paiute Tribe of Arizona	Ms. Candelora Lehi, Vice President
Skull Valley Band of Goshute Indians of Utah	Ms. Candace Bear, Chairperson
Te-Moak Tribal Council of the Te-Moak Tribe of Western Shoshone Indians of Nevada (includes the Battle Mountain, Elko, and South Fork Bands)	Mr. Joseph Holley, Chairman
Ute Indian Tribe of the Uintah and Ouray Reservation, Utah	Ms. Betsy Chapoose, THPO
Ute Mountain Ute Tribe	Mr. Terry Knight, THPO
Wells Band of the Te-Moak Tribe of Western Shoshone Indians of Nevada	Ms. Andrea Woods, Chairwoman
Other Native American Entities	
Organization	**Contact Person**
Utah Division of Indian Affairs	Mr. Dustin Jansen, Division Director
Other Interested Parties (Local Groups)	
Organization	**Contact Person**
Historic Wendover Airfield	James Peterson, Director
Preservation Utah	David Amott, Executive Director

Letter to Utah Professional Archaeological Council from NASA, dated April 20, 2022

National Aeronautics and
Space Administration

Mary W. Jackson NASA Headquarters
Washington, DC 20546-0001

April 20, 2022

Reply to Attn of: NASA Office of JPL
Management and Oversight

Ms. Suzanne Eskenazi, President
Utah Professional Archaeological Council
300 S. Rio Grande St.
Salt Lake City, Utah 84101

Re: Initiation of Consultation under the National Historic Preservation Act and National Environmental Policy Act for the NASA Mars Sample Return Campaign

Dear Ms. Eskenazi:

NASA, in cooperation with the European Space Agency (ESA), the United States Air Force (USAF), United States Army, United States Department of Agriculture, and the Centers for Disease Control and Prevention, proposes to conduct a campaign to retrieve a scientifically selected set of samples (i.e., Martian rocks, regolith, and atmosphere), acquired and cached on the surface of Mars by the Perseverance rover, and return them to Earth for scientific analysis and research. The proposed Mars Sample Return (MSR) Campaign involves several flight elements associated with retrieving the samples on Mars, launching them into Mars orbit, capturing the samples in orbit, and returning them to Earth for study. The proposed landing and recovery location for the Mars samples is the Utah Test and Training Range (UTTR), which is under the jurisdictional control of the USAF. Additional Earth-based ground elements associated with sample transportation (utilizing over-the-road and/or aircraft to transport the samples off the UTTR) and sample management/research (otherwise referred to as "curation") involving the development and operation of a Sample Receiving Facility (SRF) are also part of the MSR Campaign mission architecture.

As lead agency, NASA invites you to consult on this project pursuant to Section 106 of the National Historic Preservation Act (NHPA) (Title 54 United States Code [U.S.C.] Section 306108) and its implementing regulations (Title 36 Code of Federal Regulations [CFR] Part 800, Protection of Historic Properties), and the National Environmental Policy Act (NEPA) (42 U.S.C. 4321–4347) and the Council on Environmental Quality Regulations for Implementing the Procedural Provisions of NEPA (40 CFR 1500–1508).

Description of the Undertaking

NASA defines the undertaking as the entire MSR Campaign, which spans five elements: three flight elements, which include the Perseverance rover, the Sample Retrieval Landers (the "Landers") and their subcomponents, and the Earth Return Orbiter (the "Orbiter"), its subcomponents and recovery of the samples; and two ground elements, which include sample transportation and an SRF. Additional information about the MSR Campaign may be found at: http://www.jpl.nasa.gov/missions/mars-sample-return-msr.

The Perseverance rover is currently collecting Mars samples in environmentally sealed, rigorously engineered tubes and will eventually deposit select sets of tubes on the planet surface for later recovery (see *Final Supplemental Environmental Impact Statement for the Mars 2020 Mission*, at https://www.nasa.gov/sites/default/files/atoms/files/20200115_mars_2020_seis_final_tagged.pdf). Specific Lander design(s) are still under consideration. NASA anticipates that the Lander payload mass and volume may result in the need for the equipment to be divided into two payloads, therefore requiring two separate Landers and launches.

The Landers are proposed for launch from either Cape Canaveral Space Force Station or Kennedy Space Center (depending on the launch vehicle yet to be selected). NASA anticipates launch of the Landers in late summer of either 2026, 2028, or 2031 depending on the status of mission architecture and launch window availability. NASA anticipates Mars sample return to Earth approximately five years from launch of the Landers. The ESA Orbiter launch from French Guiana would then coincide with the NASA launch(es). All vehicles would transit to Mars. The Orbiter would enter Mars orbit, and the Landers would land directly on the Martian surface, similar to the recent Perseverance rover landing, in the vicinity of one or more sample tube sets. The samples would consist of approximately 30 tubes weighing about 15 grams (0.03 pounds) each, for a total sample amount of approximately 450 grams (about 1 pound). Once on Mars, the Sample Fetch Rover would be deployed. The Sample Fetch Rover would then retrieve the sample tubes and deliver them to the Lander for loading into an Orbiting Sample container within the Mars Ascent Vehicle. If still operational, the Perseverance rover could also deliver sample tubes directly to the Lander.

The Mars Ascent Vehicle would be launched from the Martian surface into Mars orbit. Once in orbit, the Mars Ascent Vehicle would deploy the Orbiting Sample container to rendezvous with the Orbiter. Once at the Orbiter, the Orbiting Sample container would be captured by the Capture, Containment, and Return System module. When retrieved by the Capture, Containment, and Return System module, the Orbiting Sample container would be stored in redundant vessels and placed in the Earth Entry Vehicle, creating the Earth Entry System (EES). The Orbiter would then leave Mars orbit and navigate to a trajectory that would bring it close to Earth without placing itself on an impact trajectory. After a series of system health and navigation checks, the Orbiter would then fire its thrusters to achieve a short-lived Earth return trajectory. Once this trajectory is confirmed and the proper point is reached, the Capture, Containment, and Return System module would release the EES on a path to enter the Earth's atmosphere. The EES would then enter Earth's atmosphere and descend, reaching a velocity of approximately 35 to 45 meters per second (around 78 to 100 miles per hour) before landing at the UTTR. After EES release, the Orbiter would navigate to a trajectory that would avoid Earth for over 100 years, ensuring that residual Mars material, if any, associated with the Orbiter is not returned to Earth.

Prior to EES landing, several recovery teams would be staged at strategic locations surrounding the proposed landing site; the objective being to contain and recover the EES as quickly as possible. Staging areas would include communications equipment and vehicles (land and/or air) and equipment for use in transport to and from the landing site. The primary staging area would have a mobile containment system (or "vault"). Once the EES has landed, the recovery team would transit to the landing site and contain the EES. Because the samples should be treated as though potentially hazardous until demonstrated otherwise, the EES would be handled under the highest level of containment, handling, and transportation regulatory standards. Additionally, although release of Mars sample particles is considered an off-nominal event, recovery teams would handle the landing event as though a release has occurred, thereby ensuring proper containment and decontamination of the EES and landing site. After arrival of the recovery team, the landing site would be cordoned off, and a 100-square-meter (1,076-square-foot) tent would be erected over the EES. As a precautionary measure, the EES would then be decontaminated, placed in a protective biohazard plastic bag, and then inserted into a 2-meter by 2-meter (6.56-foot by 6.56-foot) sealed travel case. The exterior of the EES travel case would be decontaminated before leaving the tent, and the EES travel case would be placed on a vehicle and transported to the roadside staging area and into the vault for shipment to an SRF. After removal of the EES, the entire contents of the tent and the landing site would be decontaminated as a precautionary measure. Samples of the landing site/impact area would also be taken for contamination knowledge/biological knowledge after the EES is removed but before decontamination of the area. These samples would be transported under containment with the EES to the SRF for analysis. Prior to, and in support of, EES landing, the proposed landing area would be cleared of old target objects and other debris (e.g., railroad ties) that pose an impact risk to the EES.

NASA, as the lead agency, has determined that the only project element of the proposed MSR Campaign with the potential to introduce effects to historic properties and resources or places of traditional or religious importance is the third and final flight element—the reentry and landing of the EES, containing the Mars samples. The EES is proposed to land on Earth in an area at the UTTR South Range, on lands administered by the USAF in Tooele County (Enclosure 1).

The final flight element of the project involves the following:

1. *Landing site preparation.* Objects and debris within the proposed landing area will be removed to minimize the potential for the sample return vehicle (i.e., the EES) to impact an object upon landing. This involves the removal of old aerial gunnery tow-target debris and other objects (e.g., railroad ties) within a portion of the nominal landing area ellipse. The exact nature and scale of object removal has not been fully evaluated but will likely include use of tracked and/or wheeled vehicles and ground-disturbing activities. Currently, NASA is testing different methods for object removal, which may include digging below the ground surface (potentially up to 4 feet) to remove the large portions of exposed target debris. More information regarding this aspect of the project will be made available to you as the project planning develops.
2. *EES descent.* It is calculated that once entering the Earth's atmosphere, the EES would take approximately 377 seconds (about six minutes) before it lands. The EES reentry will generate a sonic boom high above the Earth at a yet to be determined altitude. It is estimated that the EES will slow to a velocity of approximately 126 to 161 kilometers per hour (78 to 100 miles per hour) before landing/impact.

3. *Recovery team staging*. Staging of up to four recovery teams (consisting of personnel, helicopters, and/or hovercraft, and/or tracked vehicles) would occur along the east/west and north/south axes just outside the landing ellipse approximately 30 minutes ahead of EES landing.
4. *Establishment of a primary recovery staging area.* A primary recovery staging area will be established, where the samples, once retrieved, will be returned. The primary staging area will include a protective storage enclosure (i.e., “the vault”) for sample containment. This primary staging area will likely be placed along the road leading into the landing area ellipse.
5. *Landing of the EES in the targeted area.* It is anticipated that the landing will occur while the soils are soft but before they become saturated from rain events in the fall, which would serve to lessen the force of impact to the EES. The EES is expected to create an impact crater of approximately 1.2 meters (4 feet) in depth and diameter which is roughly the same size as the EES. Given the composition of the soil, it is expected that soil will be ejected from the impact crater to a distance of approximately 15 meters (49 feet).
6. *Transit of recovery teams to the EES landing site*. The recovery teams would transit to the EES landing site using helicopters, and/or hovercraft, and/or tracked vehicles (such as a snow cat). The use of wheeled vehicles is unlikely because they would easily become stuck in the soft soils; however, use of wheeled vehicles off road to or from staging areas cannot be entirely discounted.
7. *EES recovery.* Once on site, the recovery teams will secure and cordon off the EES landing site, and a tent containment structure will be erected (approximately 100 square meters or 1,076 square feet) over the EES. The EES will be contained in a biosafety bag, sealed in a 2-meter by 2-meter (6.5-foot by 6.5-foot) travel case, and the case exterior cleaned.
8. *Transit of recovery teams from the EES landing site to the primary staging area.* Recovery teams would transit from the EES landing site to the primary staging area and the EES would be placed into the Vault for shipment over the road and/or via aircraft to an SRF. Transit methods for recovery teams are described above in paragraph 6.
9. *Decontamination of the landing site*. Although release of Mars sample particles is considered an off-nominal event, after removal of the EES, the entire landing site will be cleaned as a precautionary measure. It is assumed that the cleaning process may involve standardized decontamination and/or sterilization methods, which could include high heat exposure, use of chemicals (such as chlorine dioxide or aldehyde), or a combination of both.

Area of Potential Effects

The area of potential effects (APE) is in the process of being more narrowly defined, but it is expected to include an area in which a targeted or off-target landing may occur. The nominal landing target area consists of an ellipse that defines the area with a 99.9999 percent probability of landing. The notional area associated with an off-nominal (abnormal or unexpected) landing is an expanded version of the ellipse. The APE also includes the addition of an approximately 150-foot wide buffer around the ellipse to accommodate recovery team staging. The total area of potential landing and ground disturbance (both nominal and off-nominal) is approximately 574 square kilometers or 222 square miles. Enclosure 2 graphically depicts the target and off-target areas where the EES may land.

NEPA Process

Due to the potential for past or present indigenous life forms on Mars, the sample return portion of the MSR mission is expected to be classified as a Category V Restricted Earth Return activity, which requires an environmental impact statement under 14 CFR 1216.306. NASA will prepare a Programmatic Environmental Impact Statement (PEIS) for the MSR Campaign. The PEIS anticipates that this categorization will be established and the PEIS's analysis provides for the most conservative approach to the potential environmental impacts associated with the proposed return of Mars samples to Earth for scientific analysis.

Due to the large scope of the MSR Campaign and uncertainty regarding the timing, location, and environmental impacts of actions associated with the ground elements, the NEPA analysis will be conducted in two "tiers" (or phases). This approach is endorsed under both 40 CFR 1501.11 and 14 CFR 1216.307. Tier I, the focus of the PEIS, will programmatically address the potential impacts associated with the potential for multiple Lander launches from either Kennedy Space Center or Cape Canaveral Space Force Station in Florida, launch of the Orbiter from French Guiana, and return of the Orbiter and EES to include initial recovery, containment, and handling of the samples once they reach the Earth's surface (i.e., at the UTTR landing site). Currently, definitive mission-related requirements associated with MSR Campaign ground elements for sample transportation and a SRF are still in the early planning stages of development, but each will be described to the maximum extent practicable in the PEIS. These aspects will be addressed programmatically in the Tier I PEIS, to the extent that information is available, and will be analyzed in more specific detail in subsequent Tier II NEPA analysis once this information is available. The Tier I analysis will also address the site-specific proposal to land the vehicle containing the samples (the EES) at the UTTR.

NASA published a Notice of Intent to prepare a PEIS in the Federal Register on April 15, 2022, initiating the public involvement process. The public scoping period for this PEIS is from April 15, 2022, to May 16, 2022.

Please visit www.nasa.gov/feature/nepa-mars-sample-return-campaign for fact sheets and other information regarding the NEPA scoping and public involvement processes for the MSR Campaign and how to participate.

The NEPA process for this action described above will be performed separately but will be aligned with the NHPA Section 106 process.

NHPA Section 106 Consultation

With this letter, NASA is initiating the NHPA Section 106 consultation process, and requests SHPO and THPO concurrence on the APE, pursuant to 36 CFR 800.4(a)(1), within 30 days of receipt of this letter. NASA intends to conduct Section 106 review to identify and consider adverse effects to historic properties in the APE in consultation with the SHPO, tribes, and other identified consulting parties (including the Army and the USAF). However, due to the large scope of the MSR Campaign and uncertainty regarding the timing, location, and environmental impacts of actions associated with the ground elements (described above), it will not be possible to fully assess the potential effects to historic properties in the timeframe established to complete the PEIS. Therefore, NASA proposes to fulfill its NHPA Section 106 process obligations to identify and determine potential effects to historic properties in a phased approach by developing a programmatic agreement stipulating the actions that it will take subsequent to completion of the NEPA process but before project implementation.

In accordance with 36 CFR 800.2, NASA has identified, in consultation with UTTR/USAF, 21 tribes with historical/cultural ties to the area (Enclosure 3) and has initiated government-to-government consultation with them on March 25, 2022. Also in accordance with 36 CFR 800.2, NASA will utilize the NEPA public involvement process to seek and include input from the public. This process includes notifying concerned Federal, state, and local agencies, and the general public allowing them sufficient time to evaluate potential environmental impacts (including cultural resources) of the proposed MSR Campaign.

If you have any questions regarding the proposed MSR Campaign, please contact Mr. Steve Slaten electronically at mars-sample-return-nepa@lists.nasa.gov, by phone at 202-368-0491, or by mail at Mr. Steve Slaten, NASA Office of Jet Propulsion Laboratory Management and Oversight, 4800 Oak Grove Drive, M/S: 180-801, Pasadena, CA 91109-8099. Mr. Slaten will also be the primary point of contact for this Section 106 consultation. Copies of this letter are being sent to the local tribes that NASA contacted to participate in the consultation (Enclosure 3). We look forward to hearing from you and receiving concurrence on the APE at your earliest convenience.

Sincerely,

Dr. Rebecca Klein
FPO NASA Headquarters
300 E Street SW
Washington, DC 20546
Telephone: (202) 358-0082
E-mail: rebecca.a.klein@nasa.gov

3 Enclosures:
1. Map of Regional Location of the UTTR
2. Map of the Preliminary Area of Potential Effects
3. List of Consulting Parties

cc:

USAF/Ms. A. Kitterman
U.S. Army Garrison/Ms. R. Quist

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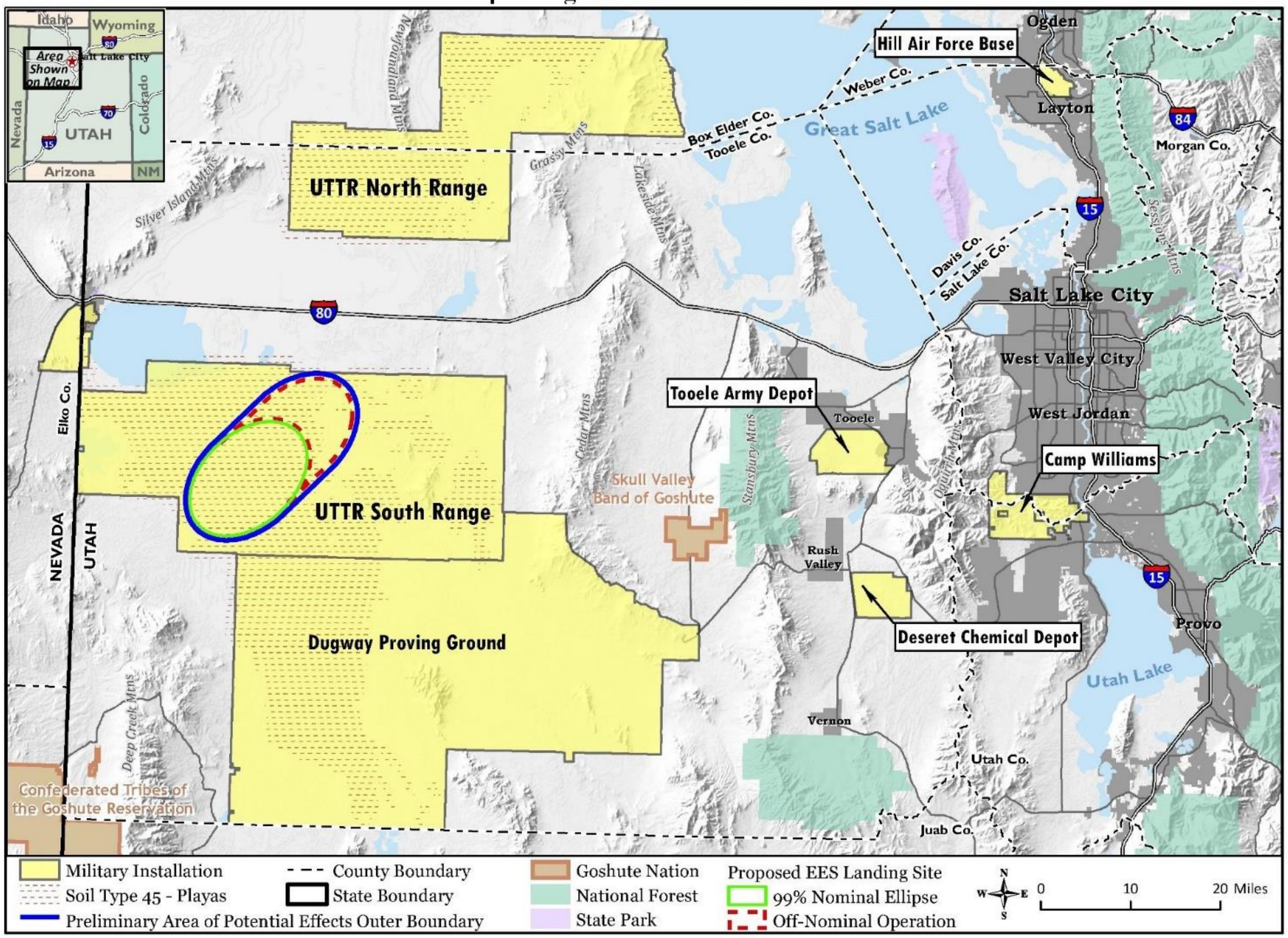
ENCLOSURE 1

Map of Regional Location of the UTTR



Enclosure 1

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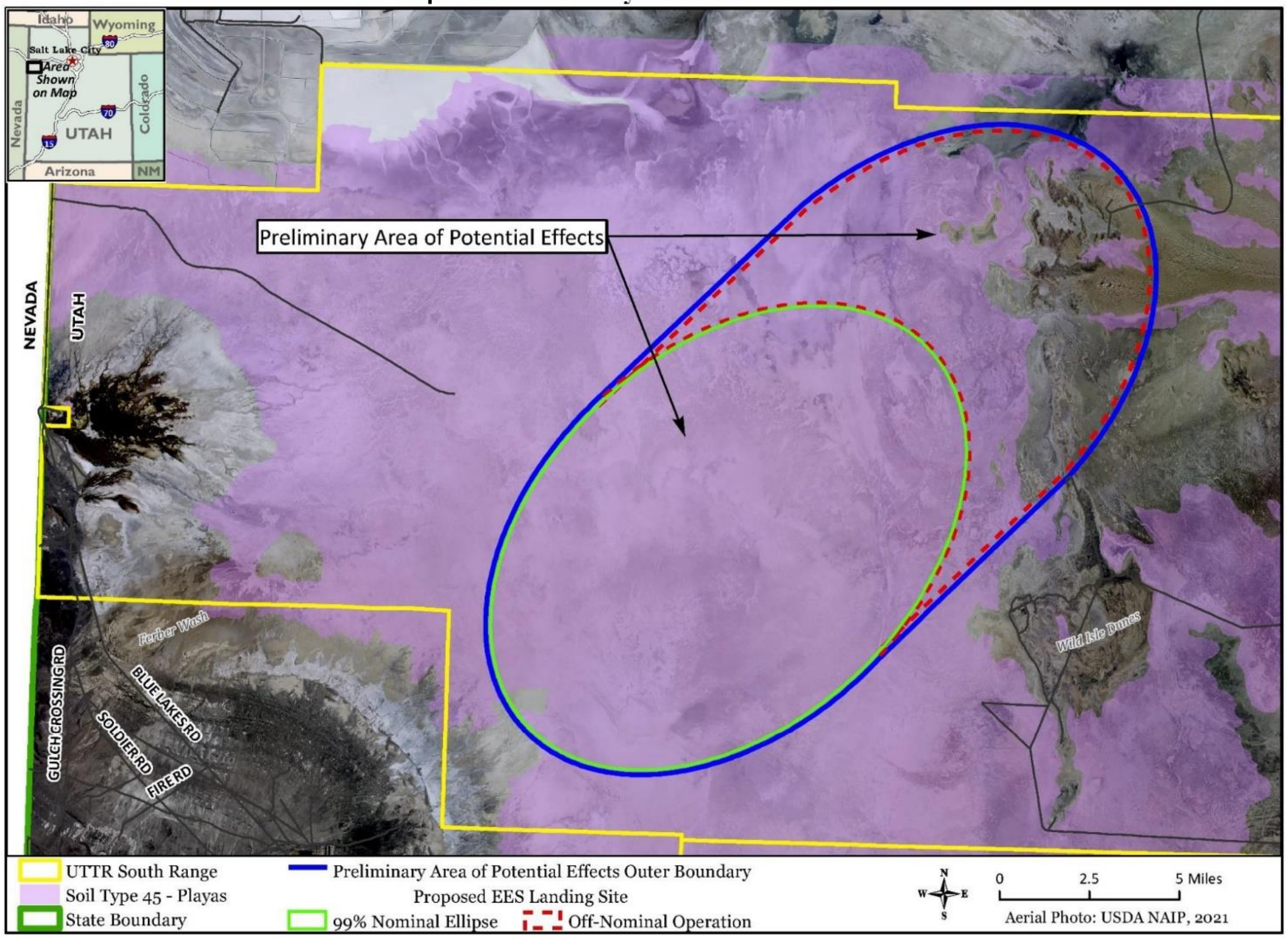
ENCLOSURE 2

Map of the Preliminary Area of Potential Effects



Enclosure 2

ENCLOSURE 3

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Wells Band of the Te-Moak Tribe of Western Shoshone Indians of Nevada	Ms. Andrea Woods, Chairwoman
Other Native American Entities	
Organization	**Contact Person**
Bureau of Indian Affairs - Eastern Nevada Agency	-
Utah Division of Indian Affairs	Mr. Dustin Jansen, Division Director
Other Interested Parties (Local Groups)	
Organization	**Contact Person**
Historic Wendover Airfield	James Peterson, Director
Preservation Utah	David Amott, Executive Director
West Jordan Historical Society and Library	-

B.2.2 Endangered Species Act

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Utah Ecological Services Field Office
2369 West Orton Circle, Suite 50
West Valley City, UT 84119-7603
Phone: (801) 975-3330 Fax: (801) 975-3331
https://fws.gov/office/utah-ecological-services

In Reply Refer To: June 03, 2022
Project Code: 2022-0049969
Project Name: Mars Sample Return

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2) (c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts see https://www.fws.gov/birds/policies-and-regulations.php.

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures see https://www.fws.gov/birds/bird-enthusiasts/threats-to-birds.php.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/birds/policies-and-regulations/executive-orders/e0-13186.php.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries
- Migratory Birds

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Utah Ecological Services Field Office
2369 West Orton Circle, Suite 50
West Valley City, UT 84119-7603
(801) 975-3330

Project Summary

Project Code: 2022-0049969
Event Code: None
Project Name: Mars Sample Return
Project Type: Military Operations
Project Description: Under the Proposed Action, NASA, in coordination with the European Space Agency (ESA), would conduct the Mars Sample Return (MSR) Campaign to retrieve a scientifically selected set of Mars samples (i.e., Martian rocks, regolith, and atmosphere). As a cooperating agency, the U.S. Air Force (USAF) would provide support for the proposed landing of the samples at the Utah Test and Training Range (UTTR). Under the Proposed Action, selected samples would be transported to Earth for scientific analysis and research. Prior to the sample container (referred to as the Earth Entry System, or "EES") landing at UTTR, several recovery teams would be staged at strategic locations surrounding the proposed landing site. It is anticipated that there would be up to four teams located at various locations just outside of the landing ellipse. Staging areas would include communications equipment and vehicles (land and/or air) and equipment for use in transport to and from the landing site. The primary staging area would have a mobile containment system (or “vault”) and be located at or near a roadway to facilitate transportation of the EES to the vault once contained; the objective is to contain and recover the EES promptly. Once the EES has landed, the recovery team would transit to the landing site and contain the EES.

After arrival of the recovery team, the landing site would be cordoned off, and a 100-square-meter (1,076-square-foot) tent would be erected over the EES. The EES would then be placed in a protective biohazard plastic bag, and then inserted into a 2-meter by 2-meter (6.56-foot by 6.56-foot) sealed travel case. The exterior of the EES travel case would be decontaminated before leaving the tent, and the EES travel case would be placed on a vehicle and transported to the roadside staging area and into the vault for shipment to a receiving facility. After removal of the EES, the entire contents of the tent and the landing site would be decontaminated as a precautionary measure. Samples of the landing site/ impact area would also be taken for contamination knowledge/biological knowledge after the EES is removed but before decontamination of the area. These samples would be transported under containment with the EES to the receiving facility for analysis.

Although anticipated as a precautionary measure (release of sample materials is considered highly unlikely), at this time, the exact decontamination method (s) to be used for the EES travel case, tent contents, and landing site have not been determined. For purposes of this

PEIS, it is assumed that the decontamination process may involve standardized decontamination and/or sterilization methods, in alignment with current accepted practices by hazardous materials response teams. These could include high heat exposure, use of chemicals (such as chlorine dioxide or aldehyde), or a combination of both.

Prior to landing, a portion of the landing area would be prepared by removing landing hazards in order to prevent inadvertent impacts with objects that would adversely affect the integrity of the EES. Currently, the UTTR South Range contains debris such as aerial gunnery tow-targets (referred to as "target darts"). Currently, NASA is testing different methods for object removal, which may include digging below the ground surface (potentially up to 4 feet) to remove the large portions of exposed target dart debris or removing the exposed portion of the target dart and leaving the remaining subsurface elements. In either case, debris removal would require ground disturbance in the immediate vicinity of the subject debris, as well as the use of vehicles to transport to the debris removal site and to remove the debris from the landing area. Tracked and/or wheeled vehicles may be utilized.

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@40.48422275,-113.60151046159447,14z

Counties: Tooele County, Utah

Endangered Species Act Species

There is a total of 1 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Insects

NAME	STATUS
Monarch Butterfly *Danaus plexippus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

USFWS National Wildlife Refuge Lands And Fish Hatcheries

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS OR FISH HATCHERIES WITHIN YOUR PROJECT AREA.

Migratory Birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

THERE ARE NO FWS MIGRATORY BIRDS OF CONCERN WITHIN THE VICINITY OF YOUR PROJECT AREA.

Migratory Birds FAQ

Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the migratory birds potentially occurring in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the AKN Phenology Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?
The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets .

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, migrating or present year-round in my project area?
To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may refer to the following resources: The Cornell Lab of Ornithology All About Birds Bird Guide, or (if you are unsuccessful in locating the bird of interest there), the Cornell Lab of Ornithology Neotropical Birds guide. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?
Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects
For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical

Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?
If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report
The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

IPaC User Contact Information

Agency: National Aeronautics and Space Admin
Name: Kevin Akstulewicz
Address: 7808 Beckett Ridge Ct
City: Powell
State: TN
Zip: 37849
Email akstulewiczk@leidos.com
Phone: 8652555654

B.3 NATIVE AMERICAN TRIBAL COORDINATION

In compliance with the National Historic Preservation Act of 1966, as amended, NASA has endeavored to identify historic properties, sacred sites, and traditional cultural properties that may be affected by the Proposed Action. NASA has consulted Native American tribes with cultural affinity to the Proposed Action, in keeping with the Presidential Memorandum on Government-to-Government Relations with Native American Tribal Governments; Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments*; NASA Policy Directives (NPD) and NASA Procedural Requirements (NPR) pertaining to cultural resources management, including NPD 8500.1C, *NASA Environmental Management*, and NPR 8510.1A, *NASA Cultural Resources Management*; Department of Air Force Instruction (DAFI) 90-2002, *Interactions with Federally Recognized Tribes*, and Air Force Manual 32-7003, *Environmental Conservation*; and Department of Defense's Policy on Native American and Native Alaskan Consultation. On March 25, 2022, NASA sent letters initiating Government-to-Government Consultation to Federally recognized tribes with potential interest in the Proposed Action. The letters requested any concerns or additional information for incorporation into the EIS. On April 15, 2022, NASA sent letters initiating NHPA Section 106 consultation to the same Federally recognized tribes. The following provides a summary of the tribes contacted and any responses received at the time of this publication.

Tribe	Response
Duckwater Shoshone Tribe of the Duckwater Reservation, Nevada	No Response
Eastern Shoshone Tribe of the Wind River Reservation, Wyoming	No Response
Ely Shoshone Tribe of Nevada	No Response
Shoshone-Bannock Tribes of the Fort Hall Reservation	No Response
Confederated Tribes of the Goshute Reservation, Nevada and Utah	No Response
Hopi Tribe of Arizona	No Response
Navajo Nation, Arizona, New Mexico, & Utah	Requested an extension on review of the MSR March 25, 2022 Government-to-Government Consultation. The letter was forwarded to the Navajo Nation Headquarters in Washington D.C.
Northwestern Band of the Shoshone Nation	No Response
Paiute Indian Tribe of Utah	No Response
Zuni Tribe of the Zuni Reservation, New Mexico	No Response
San Juan Southern Paiute Tribe of Arizona	No Response
Skull Valley Band of Goshute Indians of Utah	No Response
Te-Moak Tribal Council of the Te-Moak Tribe of Western Shoshone Indians of Nevada	No Response
Ute Indian Tribe of the Uintah and Ouray Reservation, Utah	No Response

Tribe	Response
Ute Mountain Ute Tribe	No Response
Wells Band of the Te-Moak Tribe of Western Shoshone Indians of Nevada	No Response

MSR PEIS - Tier I

Personal Communication Reference Form

Party 1 Information

Name: **Slaten** (*Last*) **Steve** (*First*) (*M.I.*)

Title: **MSR PEIS Project Manager**

Company/Agency: **NASA NOJMO**

Party 2 Information

Name: **Mike**

Title: **Tribal Congressional liason** Phone: **( )**

Company/Agency: **Navajo Nation**

Reference Comments

Method of Communication: Telephone ☒ In Person ☐

Date: **04/14/22**

Summary of the subject matter and relevant discussion:
Navajo Nation requested an extension on thier review of the MSR PEIS gov't to gov't consultation. The consultation was forwarded to Mike who works at Navajo Nation Headquarters in Washington D.C.

B.4 COOPERATING AGENCY AGREEMENTS

B.4.1 Memorandum of Understanding (with Programmatic Agreement)

MEMORANDUM OF UNDERSTANDING BETWEEN
THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)
AND
THE UNITED STATES DEPARTMENT OF THE AIR FORCE (DAF)
FOR
LEAD AGENCY FOR SECTION 106 CONSULTATION
FOR SELECT MARS SAMPLE RETURN CAMPAIGN ACTIVITIES

This is a Memorandum of Understanding (MOU) between NASA and the DAF. When referred to collectively, NASA and the DAF are referred to as the "Parties."

1. BACKGROUND: NASA, in cooperation with the European Space Agency, the United States Department of the Air Force (DAF), the United States Army, the United States Department of Agriculture, and the United States Department of Health and Human Services - Centers for Disease Control and Prevention, proposes to conduct a campaign to retrieve a scientifically selected set of samples (i.e., Martian rocks, regolith, and atmosphere), acquired and cached on the surface of Mars by the Perseverance rover, and return them to Earth for scientific analysis and research. The proposed Mars Sample Return (MSR) Campaign spans five elements: three flight elements, which include the Perseverance rover, a Sample Retrieval Lander (the "Lander"), and the Earth Return Orbiter (the "Orbiter"), including its payload (the Earth Entry System [EES]) and payload recovery; and two ground elements, which include transportation of the EES from the Utah Test and Training Range (UTTR)/Dugway Proving Ground (DPG) to a Sample Receiving Facility, as well as development and operation of a Sample Receiving Facility. These five project elements are divided into two Tiers (I and II) for the purposes of National Environmental Protection Act process purposes, with only Tier I elements ready for effects analysis and consultation in a site-specific manner at this time and Tier II project elements to be addressed in the future.

The MSR Campaign Tier I project elements include several flight elements associated with retrieving the samples on Mars, launching them into Mars orbit, capturing the samples in orbit, and returning them to Earth for study. The subject of this MOU is the proposed landing location for the Mars samples (the UTTR), which is under the jurisdictional control of the DAF and managed by Hill Air Force Base (AFB). Additional Earth-based ground elements associated with sample transportation (utilizing over-the-road and/or aircraft to transport the samples off the UTTR) and sample management/research (otherwise referred to as "curation"), involving the development and operation of a Sample Receiving Facility, are part of the Tier II MSR Campaign mission architecture, but are not included in the activities covered by this MOU.

The National Historic Preservation Act (NHPA) Section 106 consultation was initiated on 25 April 2022 by NASA as the lead Agency. NASA determined that the only Tier I project element of the proposed MSR Campaign with the potential to introduce effects to historic properties and resources or places of traditional or religious importance is the third and final flight element—the reentry and landing of the Earth Entry Vehicle, hereafter referred to as the EES, containing the Mars samples, including mission preparation (e.g., drop tests, dress rehearsals, and ground-based hazard removal), the recovery of the samples and decontamination of the landing site. Therefore, this MOU applies only to these Tier I project element activities.

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In response to the initial NHPA Section 106 consultation, the Advisory Council for Historic Preservation suggested that the Programmatic Agreement being developed by Hill AFB to streamline NHPA Section 106 compliance be expanded to accommodate for the EES landing and recovery elements of NASA's MSR Campaign undertaking. NASA and the DAF explored the feasibility of the Advisory Council for Historic Preservation's suggestion and determined it to be beneficial to both Parties, which would require that the DAF assume the lead Agency status for NHPA Section 106 consultation from NASA.

2. AUTHORITIES: Title 36 Code of Federal Regulations Part 800, Subpart A, § 800.2(a)(2).

3. PURPOSE: Establish the DAF as the lead Agency for NHPA Section 106 consultation for the EES landing and recovery elements of NASA's MSR Campaign undertaking.

4. UNDERSTANDINGS OF THE PARTIES:

4.1. NASA will—

4.1.1. Pursuant to the terms of this MOU, transfer lead Agency responsibility for NHPA Section 106 consultation for the EES landing and recovery elements of NASA's MSR Campaign Undertaking to the DAF.

4.1.2. In coordination with the DAF in its capacity as the lead Agency responsible for NHPA Section 106 compliance, assume responsibility to perform all necessary Section 106 compliance functions for the EES landing and recovery elements of NASA's MSR Campaign Undertaking as stipulated by the Programmatic Agreement and the processes described therein.

4.1.3 Continue to maintain public communication regarding the undertaking and NHPA Section 106 consultation efforts via NASA's project website (https://www.nasa.gov/feature/nepa-mars-sample-return-campaign), including receipt of public comments and input regarding the undertaking through the website, the points of contact identified on the website, and the initial NHPA Section 106 consultation correspondence.

4.2. The DAF will—

4.2.1. Pursuant to the terms of this MOU, assume the lead Agency responsibility for NHPA Section 106 consultation for the EES landing and recovery elements of NASA's MSR Campaign Undertaking.

4.2.2. Incorporate into its Programmatic Agreement stipulations providing for space vehicle landing and recovery activities at the UTTR, which would establish the process under which NASA can satisfy its NHPA Section 106 obligations for the EES landing and recovery elements of the MSR Campaign Undertaking.

5. PERSONNEL: Each Party is responsible for all costs of its personnel, including pay and benefits, support, and travel. Each Party is responsible for supervision and management of its personnel.

6. GENERAL PROVISIONS:

6.1. POINTS OF CONTACT: The following points of contact will be used by the Parties to communicate in the implementation of this MOU. Each Party may change its point of contact upon reasonable notice to the other Party.

6.1.1. For NASA—

6.1.1.1 Primary: Ms. Irene Romero CRM, NASA Goddard Space Flight Center, (301) 286-8644

6.1.1.2. Alternate: Mr. Steve Slaten, NASA MSR PEIS Project Manager, NASA Office of Jet Propulsion Laboratory Management and Oversight, (202) 368-0491

6.1.2. For the DAF—

6.1.2.1. Primary: Ms. Anya Kitterman, Cultural Resource Manager, Hill AFB/UTTR, (801) 586-2464

6.1.2.2. Alternate: Ms. Michelle Cottle, Environmental Chief/Installation Tribal Liaison Officer, Hill AFB/UTTR, (801) 777-5041

6.2. CORRESPONDENCE: All correspondence to be sent and notices to be given pursuant to this MOU will be addressed, if to NASA, to—

6.2.1. NASA Primary: Ms. Irene Romero, CRM
NASA Goddard Space Flight Center
Building 18 Room 250
8800 Greenbelt Rd, MD 20771
Telephone: (301) 286-8644
Email: irene.j.romero@nasa.gov

6.2.2. NASA Alternate: Mr. Steve Slaten
NASA Office of Jet Propulsion Laboratory Management and Oversight
4800 Oak Grove Drive
M/S: 180-801
Pasadena, CA 91109-8099
Telephone: (202) 368-0491
Email: sslaten@nasa.gov

and, if to the DAF, to—

6.2.3. DAF Primary: Ms. Anya Kitterman, CRM
75 CEG/CEIE
7290 Weiner Street, Bldg. 383
Hill AFB, UT 84056
Telephone: (801) 586-2464
Email: anya.kitterman@us.af.mil

6.2.4. DAF Alternate: Ms. Michelle Cottle
75 CEG/CEIE
7290 Weiner Street, Bldg. 383
Hill AFB, UT 84056
Telephone: (801) 777-5041
Email: michelle.cottle.1@us.af.mil

6.3. FUNDS AND MANPOWER: This MOU does not support an obligation of funds, does not document or otherwise provide for an exchange of funds or manpower, does not constitute a binding commitment upon either Party, and does not create any legal rights or obligations for either Party.

6.4. MODIFICATION OF MOU: This MOU may only be modified by the written agreement of the Parties, duly signed by their authorized representatives. This MOU will be reviewed annually on or around the anniversary of its effective date, and triennially in its entirety.

6.5. DISPUTES: Any disputes relating to this MOU will, subject to any applicable law, Executive Order, directive, or instruction, be resolved by consultation between the Parties or through both Parties' chains of command.

6.6. TERMINATION OF UNDERSTANDING: This MOU may be terminated by the mutual agreement of the NASA Administrator and the DAF, or by either Party, upon thirty (30) calendar days written notice to the other Party.

6.7. TRANSFERABILITY: This MOU is not transferable except with the written consent of the Parties.

6.8. ENTIRE UNDERSTANDING: It is expressly understood and agreed that this MOU embodies the entire understanding between the Parties regarding the MOU's subject matter.

6.9. EFFECTIVE DATE: This MOU becomes effective upon the date of the last signature below ("Effective Date").

6.10. EXPIRATION DATE: This MOU shall remain in effect until either (a) a Party decides to terminate its participation according to Section 6.6 of this MOU, or (b) the completion of the EES landing and recovery elements of NASA's MSR Campaign Undertaking and the associated NHPA Section 106 compliance activities stipulated in the Programmatic Agreement (MOU Section 4.2.2).

6.12. LIMITATIONS: It is expressly understood and agreed that this MOU embodies the entire understanding between the Parties regarding the MOU's subject matter.

AGREED:

For NASA—	For the DAF—
__________________________	__________________________
JOEL CARNEY Assistant Administrator Office of Strategic Infrastructure	JEFFREY G. HOLLAND, Colonel, USAF Commander, 75th Air Base Wing
____________	____________
(Date)	(Date)

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Attachment - Programmatic Agreement regarding NHPA Section 106 Compliance for NASA's MSR Campaign Undertaking

PROGRAMMATIC AGREEMENT AMONG
THE UNITED STATES AIR FORCE 75TH AIR BASE WING,
THE UTAH STATE HISTORIC PRESERVATION OFFICE,
AND
THE ADVISORY COUNCIL ON HISTORIC PRESERVATION
REGARDING OPERATIONS, MAINTENANCE, AND DEVELOPMENT ACTIVITIES AT
HILL AIR FORCE BASE, UTAH TEST AND TRAINING RANGE,
AND LITTLE MOUNTAIN TEST FACILITY, UTAH

WHEREAS, the United States Air Force 75th Air Base Wing (75th ABW), or future command, proposes to continue to coordinate and administer an ongoing program of operation, maintenance and development (Program); and

WHEREAS, the 75th ABW has authority over federally owned lands on Hill Air Force Base (HAFB), the Utah Test and Training Range (UTTR), and Little Mountain Test Facility (Little Mountain) to carry out the Program pursuant to Air Force Regulation, thereby making the Program an undertaking subject to review under Section 106 of the National Historic Preservation Act (NHPA) 54 U.S.C. § 306108, and its implementing regulations, 36 CFR Part 800; and

WHEREAS, the 75th ABW has defined the Area of Potential Effects (APE) to include federally owned lands in Utah administered by the 75th ABW including HAFB (6,611 acres), the UTTR (943,374 acres), and Little Mountain (692 acres) as described in Appendix D; and

WHEREAS, the 75th ABW, the Utah State Historic Preservation Office (SHPO), and the Advisory Council on Historic Preservation (ACHP) have determined pursuant to 36 CFR Part 800 that undertakings under this Program have the potential to affect the Ogden Air Material Area Historic District, the Hill Field Historic Housing District, the Strategic Air Command (SAC) Alert Historic District, the proposed Little Mountain Historic District, and properties eligible for or listed in the National Register of Historic Place (NRHP), and that certain exclusions and streamlining measures outlined in this PA are warranted to accommodate both military and preservation goals; and

WHEREAS, the 75th ABW has consulted with the Blackfeet Tribe, Confederated Tribes of the Goshute Indian Reservation, Crow Nation, Duckwater Shoshone Tribe of the Duckwater Reservation, Eastern Shoshone Tribe, Ely Shoshone Tribe, Hopi Indian Tribe, Navajo Nation, Northern Arapaho Tribe, Northwestern Band of Shoshone Nation, Paiute Indian Tribe of Utah, Pueblo of Zuni, San Juan Southern Paiute Tribe, Shoshone-Bannock Tribes of the Fort Hall Business Council, Shoshone-Paiute Tribes of the Duck Valley Reservation, Skull Valley Band of Goshute Indians, Te-Moak Tribe of Western Shoshone, Ute Indian Tribe, Ute Mountain Ute Tribe, Wells Band of Western Shoshone, and the Confederate Salish & Kootenai Tribes of the Flathead Nation, all federally recognized Indian tribes (Tribes) and has invited these tribes to consult, recognizing the potential concerns for properties of traditional religious and cultural importance; and

WHEREAS, the 75th ABW acknowledges that this Programmatic Agreement (PA) will not affect consultation with the Tribes; and

WHEREAS, pursuant to Air Force Manual 32-7003 § 1.14.2., *Environmental Conservation*, the Department of the Air Force has designated the Wing Commander (75th ABW/CC) to serve as the agency official with approving authority for the implementation of the PA as a requirement of Section 106 of the NHPA; and

Attachment - Programmatic Agreement regarding NHPA Section 106 Compliance for NASA's MSR Campaign Undertaking

WHEREAS, the 75th ABW's Civil Engineering Group (75th CEG) manages the built and natural infrastructure for the day-to-day operations and long-range planning, design, construction, environmental protection, and real property functions, with the Commander designating the 75th CEG Base Civil Engineer (BCE) to be a key point of contact regarding Section 106; and

WHEREAS, the BCE finds that many of the maintenance and repair activities are of a scale, scope, and routine nature that case-by-case review under the Section 106 process (36 CFR §§ 800.3 through 800.7) often results in no historic properties affected, or findings of no adverse effect, in a manner of predictive redundancy; and

WHEREAS, the BCE finds that a programmatic approach, employing the present Programmatic Agreement (PA), is an appropriate and improved way (in accordance with 36 CFR § 800.14(b)(2)) for the BCE to address the circumstances of such routine and redundant maintenance and repair activities, and will produce equivalent appropriate consideration of historic properties at HAFB, the UTTR, and Little Mountain when such activities are planned, including recognition that there will remain potential for historic properties to be affected by such undertakings, and this approach will allow the BCE and consulting parties to give attention to a number of other important Section 106-related undertakings within HAFB, the UTTR, and Little Mountain; and

WHEREAS, the management of certain buildings and landscape features located within the Hill Field Historic Housing District, are governed by the 2002 *Memorandum of Agreement Between the United States Air Force and the Utah State Historic Preservation Officer, Regarding the Privatization of Family Housing Hill Air Force Base, Utah*, and those specific buildings and landscape features are therefore not part of this PA; and

WHEREAS, districts, sites, buildings, structures, and objects that are 50 years of age or older that have not yet been evaluated for eligibility to the NRHP will be considered eligible to the NRHP for this PA, and

WHEREAS, areas identified as containing unexploded ordinance (UXO) and have been listed as impact and or No-Go areas (described in Appendix C) will not be surveyed for archaeological sites because of human health and safety issues; and

NOW, THEREFORE, the 75th ABW/CC, the SHPO, and the ACHP agree that the Program activities shall be implemented in accordance with the following stipulations in order to take into account potential effects of the undertaking on historic properties.

STIPULATIONS

The 75th ABW/CC shall ensure that the following stipulations are carried out.

I. RESPONSIBILITIES

Attachment - Programmatic Agreement regarding NHPA Section 106 Compliance for NASA's MSR Campaign Undertaking

A. The 75th ABW/CC is responsible for ensuring that historic properties on federally owned lands administered by the 75th ABW, and properties not federally owned but potentially affected by 75th ABW undertakings, are managed and maintained in accordance with NHPA requirements. The 75th ABW/CC shall designate the 75 CEG Cultural Resource Manager (CRM) with the authority to implement the stipulations identified in this PA. All actions performed by the 75th ABW, or on behalf of the 75th ABW, in compliance with the terms of this PA shall be conducted by, or under the supervision of, a qualified professional meeting the Secretary of Interior's (SOI) Professional Qualifications Standards in Archaeology, History, Architectural History, or Historic Architecture, as applicable.

B. The 75th ABW/CC shall ensure that all individuals designated to perform cultural resource management duties are qualified under the SOI Professional Qualifications Standards for the tasks appointed to them.

II. **SECTION 106 REVIEW PROCESS**

A. Determine the Undertaking

1. The CRM shall determine if the proposed project is an undertaking as defined in 36 CFR § 800.16(y).

   a) If the CRM determines the proposed project is not an undertaking as defined in 36 CFR § 800.16(i), the CRM the 75th ABW has no further obligations under this Stipulation.

   b) If the CRM determines that the proposed project is listed in Appendix A, Excluded Actions, the CRM shall document this determination for inclusion in the Annual Report, and the 75th ABW has no further obligations under this Stipulation.

   c) If the CRM determines the proposed project is an undertaking not listed in Appendix A, the CRM will continue on in the Section 106 Project Review Process as defined in this document.

B. Define the APE and Identify Historic Properties

1. The CRM shall determine and document the project APE for each specific undertaking, appropriate to the scope and scale of the undertaking, and considering direct, indirect, and cumulative effects.

2. The CRM shall determine if cultural resource surveys are required for the APE using the following parameters:

   a) The CRM shall conduct a literature review for the APE, including its cultural resource inventory list and records of previous surveys, evaluations, and project reviews.

Attachment - Programmatic Agreement regarding NHPA Section 106 Compliance for NASA's MSR Campaign Undertaking

b) The CRM shall visually inspect the APE and update the inventory list, site/building forms and photographic records if necessary. New cultural resource survey is not required in disturbed or previously surveyed areas provided the previous surveys were conducted within the last 10 years. New survey in areas where survey is greater than 10 years will be reviewed by the CRM to determine if additional survey is warranted. If the CRM determines additional survey is not warranted the CRM shall discuss the request with the SHPO via email prior to an official notification letter.

c) If the CRM identifies no historic properties (as defined in 36 CFR § 800.16(1)) within the APE, then the CRM shall document a determination of "No Historic Properties Affected" for inclusion in the Annual Report, and the 75^{th} ABW has no further obligations under this Stipulation.

d) If archaeological or architectural survey is determined necessary, the CRM shall not consult with the SHPO regarding the methodology of the survey as long as the survey is conducted according to the methodology outlined in the most recent installation Integrated Cultural Resources Management Plan (ICRMP) and adheres to the most recent SHPO guidance.

e) If the CRM identifies a historic property that may be directly, indirectly, or cumulatively affected within the APE, then the CRM shall continue with the Section 106 review process.

3. Evaluation of Surveyed Cultural Resources

a) Surveys with no archaeological sites, isolated features or artifacts, or other cultural resources will be defined as negative surveys.

(1) The CRM shall provide reports of negative surveys to Tribes before finalizing the report. If Tribes identify properties of traditional religious and cultural significance, the CRM shall proceed to Stipulation II(B)(3)(b) in the Section 106 Project Review Process.

(2) A list of finalized negative survey reports will be part of the Annual Report, the CRM shall proceed to Stipulation III in the Section 106 Project Review Process.

b) All newly identified cultural resources, and any previously identified but unevaluated cultural resources that could be affected by an undertaking, shall be evaluated by the CRM in accordance with 36 CFR Part 63 and bulletins, guidance, and documents produced by the National Park Service (NPS), in consultation with SHPO, and Tribes, to determine if they are historic properties.

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(1) SHPO shall provide a response to the 75th ABW eligibility determinations within 30 calendar days of receipt of all pertinent documentation. If no comments are received within that time, the CRM shall make a second attempt to contact the SHPO for comments. If SHPO does not respond after 14 calendar days, the CRM will assume SHPO concurrence with the 75th ABW determinations.

(2) If SHPO responds that it does not concur with determinations made by the 75th ABW, the parties will attempt to resolve the dispute through additional consultation. If the 75th ABW and SHPO cannot resolve the issue within 30 calendar days, then the 75th ABW shall forward the dispute to the Keeper of the NRHP for resolution at the conclusion of the 30 calendar day period.

(3) The 75th ABW shall consult with Tribes to identify properties of traditional religious and cultural significance (54 U.S.C. 302706) and determine if they are historic properties, in accordance with NPS Bulletin 38.

(4) The CRM does not identify any historic properties within the APE the CRM shall document this determination of "No Historic Properties Present" for those undertakings for inclusion in the Annual Report, and the 75th ABW has no further obligations under this Stipulation.

(5) If the CRM identifies a historic property that may be directly, indirectly, or cumulatively affected within the APE, the CRM shall continue on in the Section 106 Project Review Process.

C. Evaluate Effects of the Undertaking

1. The CRM shall assess the effects of the proposed undertaking on historic properties, including direct, indirect, and cumulative effects, using the criteria of adverse effects (36 CFR. § 800.5(a)(1)) and will make one of the following determinations:

a) "No Historic Properties Affected:" if the CRM determines that historic properties present in the APE will not be affected by the undertaking, the CRM shall document this determination for those undertakings for inclusions in the official record, and the 75th ABW has no further obligations under this Stipulation.

b) "No Adverse Effect to Historic Properties:" if the CRM determines that historic properties present in the APE will not be adversely affected by the undertaking, and the undertaking is not included in Appendix A, the CRM shall proceed to Stipulation II(C)(2).

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c) "Adverse Effect to Historic Properties:" if the CRM determines that historic properties present in the APE will be adversely affected by the undertaking, the CRM shall proceed to Stipulation II(C)(3).

2. No Adverse Effect to Historic Properties

a) For those undertakings with a finding of "No Adverse Effect to Historic Properties" aside from "Excluded Actions" (Appendix A) noted in this PA, the CRM shall provide the SHPO with a packet of information including, but not limited to, the following:

(1) project description, approximate square footage, and if available the depth and amount of ground disturbance anticipated;

(2) APE map showing the location of the project and of any identified historic properties;

(3) description of the historic properties affected;

(4) any current photos as when available, unless security restrictions prevent sharing of photographs; and

(5) finding of effect and request for concurrence on "No Adverse Effect to Historic Properties" finding from SHPO.

b) SHPO shall provide a response to the 75th ABW effect determination within 30 calendar days of receipt of all pertinent documentation. If no comments are received within that time, the CRM shall make a second attempt to contact the SHPO for comments. If SHPO does not respond after 14 calendar days the 75th ABW will assume SHPO concurrence with the 75th ABW determinations.

(1) If the SHPO concurs with the "No Adverse Effect to Historic Properties" finding, the CRM shall document this concurrence for inclusion in the official record, and the 75th ABW has no further obligations under this Stipulation.

(2) If the SHPO does not concur with the finding of "No Adverse Effect to Historic Properties," the CRM shall consult with the SHPO for no more than a total of 30 calendar days, or other time period as agreed to between SHPO and the CRM, upon receipt of SHPO notification of non-concurrence to attempt to resolve concerns as identified by the SHPO.

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(a) If at the end of the 30 calendar days, or agreed to specified time, the SHPO concurs with the finding of "No Adverse Effect to Historic Properties," the CRM shall document this concurrence for inclusion in the Annual Report, and the 75th ABW has no further obligations under this PA.

(b) If at the end of the 30 calendar days, or agreed to specified time, the SHPO does not concur with the finding of "No Adverse Effect to Historic Properties," the CRM shall notify the ACHP in accordance with Stipulation IV, *Dispute Resolution*.

3. Adverse Effect to Historic Properties

a) For those undertakings with a finding of "Adverse Effect to Historic Properties" the CRM shall provide the SHPO and with a packet of information including, but not limited to, the following:

(1) project description, approximate square footage, and if available the depth and amount of ground disturbance anticipated;

(2) APE map showing the location of the project and of any identified historic properties;

(3) description of the historic properties affected;

(4) any photos as necessary, when available, unless security restrictions prevent sharing of photographs; and

(5) finding of effect and request for concurrence on "Adverse Effect to Historic Properties" finding from SHPO.

b) SHPO shall provide a response to 75th ABW effect determination within 30 calendar days of receipt of all pertinent documentation. If no comments are received within that time, the CRM shall make a second attempt to contact the SHPO for comments. If SHPO does not respond after 14 calendar days the 75th ABW will assume SHPO concurrence with the 75th ABW determinations.

(1) If the SHPO concurs with the adverse effects finding, the CRM shall proceed to Stipulation II(D).

(2) If the SHPO does not concur with the finding of adverse effects, the CRM shall consult with the SHPO for no more than a total of 30 days, or other time period as agreed to between SHPO and the CRM, upon receipt of SHPO notification of non-concurrence to attempt to resolve concerns as identified by the SHPO.

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(a) If at the end of the 30 days, or agreed to specified time, the SHPO concurs with the finding of adverse effects, the CRM shall proceed to Stipulation II(D).

(b) If at the end of the 30 days, or agreed to specified time, the SHPO does not concur with the finding of "Adverse Effect to Historic Properties", the CRM shall notify the ACHP in accordance with Stipulation IV, *Dispute Resolution*.

D. Resolution of Adverse Effects

1. The CRM shall notify Consulting Parties and public within 30 calendar days of receiving the SHPO's concurrence of an adverse effect finding for an undertaking using the following process:

a) The CRM shall prepare and send a notification package for the Consulting Parties including a description of the undertaking, an illustration of the APE, a list of identified historic properties within the APE, the explanation for the finding of adverse effects, steps taken or considered by 75th ABW to avoid or minimize the adverse effects, any SHPO comments received by 75th ABW regarding the undertaking, an invitation to participate in a consultation to resolve adverse effects, and the proposed date for a Consulting Parties meeting.

b) Consulting Parties are under no obligation to provide comments on the effect determination; however, if they wish 75th ABW to consider their comments regarding the effect determination, Consulting Parties must submit comments in writing within 30 calendar days of receipt. If no comments are received within that time, the CRM shall make a second attempt to contact the Consulting Parties for comments and if they wish to participate in the resolution of adverse effects. 75th ABW shall take any comments received into consideration before concluding the consultation and will notify the SHPO of any concerns and the 75th ABW response to those concerns.

2. The CRM shall organize a consultation meeting, if necessary, to include the SHPO, 45 calendar days after notifying Consulting Parties, to discuss alternatives to avoid, minimize, or mitigate the adverse effects. Additional meetings shall be scheduled as needed.

3. If through consultation with the SHPO and Consulting Parties alternatives are identified which will avoid adverse effects resulting from the undertaking, the CRM will document the alternatives to be utilized in order to reach a no adverse effects and seek concurrence with all participating Consulting Parties. The CRM will include this documentation in the official record, and 75th ABW has no further obligations under this Stipulation.

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4. If through consultation with the SHPO and Consulting Parties the adverse effects are minimized or mitigated, then the measures agreed to by 75th ABW the SHPO, and Consulting Parties can be specified in a Memorandum of Agreement (MOA) in accordance with 36 CFR § 800.6(c) and filed with the ACHP upon execution.

5. If the 75th ABW, in consultation with the SHPO, agrees that no prudent or feasible alternatives exist to implementing the undertaking, the 75th ABW and the SHPO may decide to utilize one or more of the Standard Mitigation Treatment Measures as outlined in Appendix B in lieu of a MOA.

6. The ACHP will only participate in the resolution of adverse effects for individual undertakings if a written request is received from 75th ABW, the SHPO, or a Tribe.

III. ANNUAL REPORT

A. The Annual Report by the BCE submitted to the SHPO annually will include all undertakings not otherwise previously consulted on and include those that utilized Excluded Actions (Appendix A), determinations of "No Historic Properties Affected," the use of Standard Mitigation Treatment Measures (Appendix B), and a list of negative reports.

1. The Annual Report shall be due on the 30 January of each year after the signing of the PA unless an alternative date is agreed upon by the CRM and the SHPO.

2. If either the BCE or the SHPO determine a meeting is required to discuss the Annual Report, a date and time shall be scheduled within 30 calendar days of the report being submitted to the SHPO.

B. The following are required features of the Annual Report.

1. A heading noting critical report data, including but not limited to the Spreadsheet Title, AF Region, Installation, and time period reported.

2. A spreadsheet of all agreed upon activities (noted in Section III.A) with relevant information falling into the following categories:

a) Installation

b) Historic Building Number/ID or Archaeological Site Number

c) Project Title

d) CRM

e) Review Date

f) Assessment of Effect

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g) Applied Stipulation/Excluded Action

h) Documentation Method

i) Records Location

IV. DISPUTE RESOLUTION

A. Should any signatory to this PA object at any time to any actions proposed or the manner in which the terms of the PA are implemented, the BCE shall consult with such party, and other consulting parties as appropriate, to resolve the objection. If the BCE determines that such objection cannot be resolved, the 75th ABW/CC shall:

1. Forward all documentation relevant to the dispute, including the 75th ABW's proposed resolution, to the ACHP. The ACHP shall provide the 75th ABW/CC with its advice on the resolution of the objection within 30 calendar days of receiving adequate documentation. Prior to reaching a final decision on the dispute, the 75th ABW/CC shall prepare a written response that takes into account any timely advice or comments regarding the dispute from the ACHP, signatories and concurring parties, and provide them with a copy of this written response. The 75th ABW/CC will then proceed according to its final decision.

2. If the ACHP does not provide its advice regarding the dispute within the 30 calendar-day period, the 75th ABW/CC may make a final decision on the dispute and proceed accordingly. Prior to reaching such a final decision, the 75th ABWCC shall prepare a written response that takes into account any timely comments regarding the dispute from signatories to the PA, and provide them and the ACHP with a copy of such written response.

B. The 75th ABW's responsibility to carry out all other actions subject to the terms of this PA that are not the subject of the dispute remain unchanged.

C. Should any member of the public raise a timely and substantive objection pertaining to the manner in which the terms of this PA are carried out, at any time during its implementation, the BCE shall consider objection by consulting with the objector to resolve the matter. When the BCE responds to an objection, it shall notify the consulting parties of the objection, and the manner in which it was resolved. The BCE may request assistance from consulting parties to resolve such an objection.

V. AMENDMENTS

This PA may be amended when such an amendment is agreed to in writing by all Signatories. The amendment will be effective on the date a copy signed by all Signatories is filed with the ACHP.

VI. TERMINATION

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A. If any Signatory to this PA determines that its terms will not or cannot be carried out, the Signatory shall immediately consult with the other parties to attempt to develop an amendment per Stipulation V, *Amendments*. If within 30 calendar days, or another time period agreed to by all signatories, an amendment cannot be reached, any signatory may terminate the PA upon written notification to other signatories.

B. Once the PA is terminated, the 75th ABW must review all undertakings identified post termination in accordance with 36 CFR §§ 800.3 through 7.

VII. SUNSET PROVISIONS

This PA will remain in full force and effect until December 31, 2032. The 75th ABW, the SHPO, and the ACHP shall review the PA at least 180 calendar days prior to the date this PA would otherwise expire for possible modifications, termination, or extension.

VIII. ANTI-DEFICIENCY ACT

Nothing in this PA shall be interpreted to require any obligation or payment of funds in violation of the Anti-Deficiency Act (31 U.S.C. 1341). If for that reason the 75th ABW/CC is unable to carry out the terms of this PA, the 75th ABW/CC shall advise the ACHP and SHPO and comply with all requirements of 36 CFR §§ 800.3 through 7.

Execution of this PA by the 75th ABW/CC, the SHPO, and the ACHP, and implementation of its terms, is evidence that the 75th ABW/CC has taken into account the effects of its actions on historic properties and has satisfied its NHPA Section 106 responsibilities for all individual undertakings of the program addressed herein.

This PA may be executed in counterparts, each of which shall constitute execution of the overall agreement.

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**PROGRAMMATIC AGREEMENT AMONG
THE UNITED STATES AIR FORCE 75TH AIR BASE WING,
THE UTAH STATE HISTORIC PRESERVATION OFFICE,
AND
THE ADVISORY COUNCIL ON HISTORIC PRESERVATION
REGARDING OPERATIONS, MAINTENANCE, AND DEVELOPMENT ACTIVITIES AT
HILL AIR FORCE BASE, UTAH TEST AND TRAINING RANGE,
AND LITTLE MOUNTAIN TEST FACILITY, UTAH**

75TH AIR BASE WING

By: ______________________________ Date: ______________________________
Jeffery G. Holland, Colonel, USAF
Commander, 75th Air Base Wing

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HILL AIR FORCE BASE, UTAH TEST AND TRAINING RANGE,
AND LITTLE MOUNTAIN TEST FACILITY, UTAH**

UTAH STATE HISTORIC PRESERVATION OFFICER

By: ______________________________ Date: ______________________________
Chris Merritt
Utah State Historic Preservation Officer

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PROGRAMMATIC AGREEMENT AMONG
THE UNITED STATES AIR FORCE 75TH AIR BASE WING,
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ADVISORY COUNCIL ON HISTORIC PRESERVATION

By: ______________________________ Date: ______________________________
Jordan E. Tennenbaum
Vice Chairman

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APPENDIX A
Excluded Actions

The 75th ABW, in consultation with the SHPO and the ACHP, has determined the following activities meet the criteria for exemption so long as they have no adverse effect on character defining features. The SHPO concurs that these activities will not require project review by the SHPO pursuant to Stipulation II but will be documented by the 75th ABW as part of the Annual Report. For the purposes of this agreement, the terms "in-kind repair" or "in-kind replacement" are defined as installation of a new element that duplicates the material (historic or modern equivalent), dimensions, design, texture, configuration, and detailing of the original or historic element or feature.

a. Non-Physical/Administrative Activities [Stipulation II(A)]

a. Grants or loans to participants for working capital, equipment, furniture, fixtures, debt refinancing, and acquisition of building for reuse.

b. Projects consisting of grants or loans to be applied to the purchase (down payment, mortgage prepayment, and/or closing costs) of buildings.

c. Acquisition of real property (including air rights, water rights, and other interests therein), which is limited to the legal transfer of ownership with no physical improvements proposed.

d. Relinquishment of real property (including air rights, water rights, and other interests therein) to another federal agency.

e. Planning-related studies and administrative/engineering/design costs.

f. Energy audits and feasibility studies.

g. Architectural and engineering fees.

b. Ineligible Properties

a. Demolition, rehabilitation, or new construction on a property that has been determined not eligible for listing in the National Register and that eligibility determination concurred on by the SHPO, except when proposed work to an existing property or new construction may impact a surrounding historic building, archaeological site, or district.

c. No-Go Areas

a. If the APE is located within or contains parts identified as No-Go areas, Appendix C, these actions are exempt from cultural resource inventory for health and safety reasons.

d. Improvements and Maintenance

a. Runway upgrades and construction: Upgrading, resurfacing, repairing existing runways, recognizing the constant need to maintain and modify these features to meet current and future Air Force Missions so long as it does not affect attributes to historic properties

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(including eligible and listed, sites or districts) and occurs in areas that have been previously surveyed (within the last 10 years), or areas with previous ground disturbance.

b. Road Improvement/Maintenance: Upgrading, resurfacing, or rehabilitation of existing roads, streets, alleyways, driveways, curbs, sidewalks, hike/bike trails, park improvements, parking areas, steps not attached to buildings, or other public improvements, except where historic materials, i.e., features which are at least fifty (50) years old, retain their integrity from the historic period, and exhibit distinctive materials, methods of construction, or elements of design that do/would contribute to the character of a historic property (including eligible or listed districts), and are being replaced or resurfaced with other materials, or where new (or extensions of existing) streets or alleyways encroach on properties, park strips, or landscaped medians fifty (50) years of age or older.

c. Utilities: Repair or replacement of existing water, gas, electrical, telephone, storm, and sewer lines, or installation of new lines in areas where no new ground disturbance will occur or where it is completely contained within previous disturbance.

d. Landscaping: Planting, removal, or trimming of trees, sod installation, and other landscaping except on historic properties where landscaping or setting is a contributing element to the property's listing or eligibility on the National Register of Historic Places, or where a sprinkling system will spray onto the historic building.

e. Fencing and Walls: Repair or replacement of fencing and walls when work is done in-kind to match existing historic material and form.

f. Temporary Barriers: Installation of temporary and /or reversible barriers as a result of another independent project or short term security feature.

g. Signs: installation of signs in accordance with state and federal regulations.

h. Security and safety upgrades: Installation of roadway security and safety features such as bollards, speedbumps, and ramps in areas of existing disturbance. Painting, sign installation, and security marking in paved areas for safety purposes such as crosswalks, fire zones, and parking spots. Installation of security features on buildings or structures such as cameras, vindicator access points, lighting, and lightning protection systems on historic properties. Upgrades to internal modern rooms within historic properties to meet Safety and Security requirements. Installation of blast resistant windows and security doors does not fall within this exemption.

i. Soil boring/well testing in established areas: Installation of new soil boring holes or wells in areas of previous survey or existing disturbance. New survey in areas where survey is greater than 10 years will be reviewed by the CRM for determination on if additional survey is warranted.

j. Guzzler Maintenance: in areas that have been previously surveyed (within the last 10 years), or in areas of previous ground disturbance. New survey in areas where survey is greater than 10 years will be reviewed by the CRM for determination on if additional survey is warranted.

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k. Wildland Firebreak Maintenance: in areas that have been previously surveyed (within the last 10 years), or in areas of previous ground disturbance. New survey in areas where survey is greater than 10 years will be reviewed by the CRM for determination on if additional survey is warranted.

l. Reseeding in established areas: in areas that have been previously surveyed (within the last 10 years), or areas with previous ground disturbance. New survey in areas where survey is greater than 10 years will be reviewed by the CRM for determination on if additional survey is warranted.

m. Environmental clean-up/soil removal in areas of previous disturbance or existing landfills.

e. **Exterior Rehabilitation**

a. Temporary Features: Installation of scaffolding. Temporary stabilization that causes no permanent damage to the building or site, including installation of temporary bracing, shoring, and tarps.

b. Replacement of Storm Windows & Doors: Installation of storm windows and doors provided they are anodized or painted to match the trim and windows with horizontal and vertical divisions that align with the existing window divisions.

c. Replacement of Existing Mechanical Systems: Placement and installation of exterior heating, ventilating or air conditioning (HVAC) mechanical units and vents, provided any exterior HVAC mechanical units at the front of the building are screened from public view. Placement and installation of power meters or generators.

d. Replacement of Existing Bulkhead Doors: Installation, replacement, or repair of basement bulkhead doors.

e. Pest Control: Control of insects, rodents, or other pests when the method does not visibly impact the historic fabric of the building.

f. Window Covering: Installation of removable film on windows (if the film is transparent), solar screens, or window louvers, in a manner that does not harm or obscure historic windows or trim. Replacement of window tinting on buildings where such tinting already exists.

g. Replacement of Existing Foundation Vents: Installation of foundation vents, if painted or finished to match the existing foundation material.

h. Exterior maintenance and repair made with in-kind materials and that do not affect the external appearance and building fabric, including but not limited to the following:

i. Structural: Repair and in-kind replacement of foundations and structural members such as floor joists, ceiling joists, roof rafters, and walls.

ii. Exterior Paint: Application of exterior paint, other than on previously unpainted masonry. Removal of exterior paint by non-destructive means, limited to hand scraping, low-pressure water wash of less than 400 psi, heat plates or hot air guns, chemical paint removal.

iii. Lead Paint Treatment: Exterior lead paint treatment that includes scraping and repainting of exterior wood and masonry surfaces in accordance with the National Park Service's Preservation Brief 3 7, *Appropriate Methods for Reducing Lead-Paint Hazards in Historic Housing.*

iv. Caulking & Glazing: Installation of caulking that matches the color of adjacent surfaces of the building; weather-stripping, re-glazing and repainting of windows.

v. Masonry Cleaning: Cleaning of masonry surfaces with low-pressure water and detergent (less than 400 psi) after a test patch has been done on an inconspicuous location to ensure the masonry will not be damaged. Sandblasting will never be used on masonry.

vi. Repointing: Repointing of masonry and stone if the old mortar is removed by hand, i.e., no power saws and the new mortar is the same color, tooling and strength as the historic mortar, as per the guidelines in Preservation Brief #2.

vii. Siding & Trim: Repair or replacement in-kind of existing exterior siding and trim.

viii. Porches: Repair or replacement in-kind of existing porch elements such as columns, flooring, floor joists, ceilings, railing, balusters and balustrades, and lattice.

ix. Roofs: Repair or replacement in-kind of historic roofing, with material which closely matches the existing material and form. In-kind replacement is recommended, but compatible substitute materials, including architectural composition shingles, can be used with the goal to match the historic material in design, color, texture, and other visual qualities.

x. Windows and Doors: Repair or replacement in-kind of existing historic windows and doors, or replacement of non-historic windows and doors with windows and doors that match the size, color, profile and configuration of the historic windows and doors and are compatible with the visual qualities and historic character of the building. Replacement of historic windows, historic doors, and door frames that closely resemble the existing on elevations not visible from the public right-of-way.

xi. Accessibility: Maintenance, repair, or in-kind replacement of accessibility improvements such as wheelchair ramps, but not including exterior elevators.

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xii. Awnings: Repair or replacement in-kind of historic awnings. Removal of metal awnings, except where the awnings have been deemed to be a contributing element of the historic property.

xiii. Gutters: Repair, replacement, or installation of gutters and downspouts. Replacing existing profiles with a more historic profile (i.e., replacing K-style with half round or square where appropriate). Installation of heat tape.

f. Interior Rehabilitation

a. Interior Finishes: Refinishing and repair in-kind of interior finishes. Replacement of non-historic interior finishes.

b. Plaster and Drywall: Repair and replacement in-kind of plaster walls and ceilings. Installation of drywall where original plaster wall surfaces are missing and where the installation of drywall will not appreciably change the trim profile.

c. Floors and Floor Coverings: Repair and refinishing of interior floors. Replacement of damaged material in-kind. Installation of carpeting and other floor coverings provided that installation does not damage underlying wood or masonry floor surfaces.

d. Doors and Trim: Refinishing, repair, or replacement of interior doors and trim in-kind. Replacement of non-significant flat stock trim with material to match historic pattern if known or to be compatible with the property's historic character.

e. Cabinetry, Countertops and Appliances: Refinishing, repair, replacement, or installation of cabinetry and countertops as long as it does not affect the properties character. Repair, replacement, or installation of appliances as long as it does not alter character-defining features.

f. Structural: Repair, replacement, or installation of new interior structural elements which do not intersect windows.

g. Plumbing: Repair, replacement, or installation of new plumbing lines and fixtures.

h. Electrical: Repair, replacement, or installation of new electrical lines, equipment, and fixtures.

i. Mechanical Systems: Repair, replacement, or installation of new HVAC systems and their components, including ventilation, provided that such work does not alter character-defining features.

j. Insulation: Replacement or installation of insulation provided it can be accomplished without permanent visual changes in the decorative interior (e.g., plaster, woodwork) and/or exterior finish materials (e.g., siding, masonry) and that it is installed with appropriate vapor barriers. The proposed use of urea-formaldehyde insulation and exterior "blow-in" insulation are not exempt from review.

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k. Security Features and Building Controls: Installation or replacement of security devices. Installation of building control devices such as photo/card controls, occupancy sensors, fire-smoke-carbon monoxide detectors, thermostats, humidity, light meters and other building control sensors.

l. Lead Paint Treatment: Treatment methods of lead paint hazards as required by local, state, and/or federal law; not to include removal/replacement of historic features.

m. Asbestos Abatement: Treatment methods of asbestos hazards as required by local, state, and/or federal law; not to include removal/replacement of historic features. Updates to previously modified/modern interiors that do not impact the historic character, and updates to non-permanent internal layouts (e.g., cubicles/etc.)

g. Demolition

a. Removal and disposal of collapsed building debris and rubble not attached to any structure, except where the building debris is determined to be a contributing element of a historic property.

b. Cleanup and removal of modern materials less than 50 years of age trash, refuse, debris, targets, and vehicles.

c. Grading and seeding sites where demolition has already taken place.

h. Operational Retrieval of Objects

a. Standard Object Retrieval Actions: This exclusion applies to all mission and/or proponent retrieval activities of objects which are initiated within 62 miles (100 kilometers) of the earth's surface (the Kármán line at which outer space begins) at the time the retrieval is initiated. Due to the nature of these activities, exact landing areas are often unknown until impact.

i. Retrieval of standard objects which land within active target complexes will require no further consultation.

ii. If a standard object lands in an area previously surveyed for archaeological resources, the project proponent will record the location of the retrieval activities via current GPS technology and will forward the information to the HAFB CRM who will assess effects of the retrieval action. If the HAFB CRM determines that the retrieval action did not adversely affect historic properties no further consultation is required. If the HAFB CRM finds that a historic property has been adversely affected, the HAFB CRM will document the adverse effect and coordinate with SHPO, consulting parties, and the proponent to implement mitigation through the Standard Mitigation Treatment Measures found in Appendix B.

iii. If a standard object lands in an area that has not been surveyed for historic properties will record the location of the retrieval activities via current GPS technology and forward the information to the HAFB CRM. The HAFB CRM

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will determine the APE in consultation with the SHPO, ensure an after-action survey is conducted and documented in an inventory report which meets current SHPO standards. If the HAFB CRM determines that the retrieval action did not adversely affect historic properties, no further consultation is required, and the inventory report will be submitted in accordance with Stipulation III. If the HAFB CRM finds that a historic property has been adversely affected, the HAFB CRM will coordinate with SHPO, consulting parties, and the proponent to implement mitigation through the Standard Mitigation Treatment Measures found in Appendix B.

iv. If a standard object is unique or significant in nature, the HAFB CRM may determine that it's retrieval should be addressed using the procedure for Earth Return Retrieval Actions described in Section h(b) below.

v. All ground disturbing activities will fall under and meet the HAFB Unanticipated Discovery of Archaeological Deposits protocol.

b. <u>Earth Return Retrieval Actions</u>: This exclusion applies to all retrieval activities for objects which are initiated beyond 62 miles (100 kilometers) from the earth's surface or standard objects that the HAFB CRM determines to be unique or significant in nature to warrant further evaluation.

i. Retrieval of earth return objects which land within active target complexes will require no further consultation.

ii. An archaeological monitor must be present on site for all retrieval actions and preparatory groundwork for earth return objects landing outside active target complexes. The APE will be determined by the Hill CRM in consultation with the SHPO. The archaeological monitor will record the location of the retrieval activities and assess effects to historic properties. If the HAFB CRM determines that the retrieval action did not adversely affect historic properties, no further consultation is required, and the inventory report will be submitted in accordance with Stipulation III. If the HAFB CRM determines that there has been an adverse effect the HAFB CRM will coordinate with SHPO, consulting parties, and the proponent to implement mitigation through the Standard Mitigation Treatment Measures found in Appendix B. In addition, the HAFB CRM, in consultation with SHPO and other consulting parties (as applicable), will determine if the landing site meets National Register eligibility criteria. If so, the site will be fully recorded as such during retrieval and clean-up activities in coordination with the proponent to ensure that all security and safety measures are met. The HAFB CRM will provide a monitoring and recordation report (as applicable) to SHPO and other consulting parties.

iii. The HAFB CRM will review action associated with retrieval activities to determine if any action is an Excluded Action described in the Appendix. If so, the action will not require any further consultation. If the activity is not an Excluded Action, the HAFB CRM will consult with the SHPO, consulting parties, and the proponent to determine the best course of action to meet Section 106 requirements.

Attachment - Programmatic Agreement regarding NHPA Section 106
Compliance for NASA's MSR Campaign Undertaking

iv. Post review discoveries will be handled in accordance with the HAFB Unanticipated Discovery of Archaeological Deposits protocol.

Attachment - Programmatic Agreement regarding NHPA Section 106 Compliance for NASA's MSR Campaign Undertaking

APPENDIX B
Standard Mitigation Treatment Measures

When avoidance or minimization of adverse effects is not appropriate or feasible, the following standard mitigation treatment measures may be implemented, if agreed upon by all parties, for the resolution of adverse effects. If an undertaking will result in an adverse effect, the 75th ABW, the SHPO, and other participating/coordinating parties may develop a standard mitigation treatment plan that includes one or more of the following measures, depending on the nature of historic properties affected and the severity of the adverse effect. For example, demolition will likely result in multiple mitigation measures while alteration of a minor character-defining feature may be addressed with a single measure. If standard mitigation treatment measures outlined in this appendix cannot be agreed upon or it is found the treatment plan cannot be completed for any reason, a MOA, following the procedures in 36 CFR § 800.6(c), will be executed to resolve the adverse effect.

The 75th ABW shall make a determination that Standard Mitigation Treatment Measures are applicable to a specific undertaking, and notify the SHPO. The ACHP will not be notified when Standard Mitigation Treatment Measures are going to be used to mitigate adverse effects under this PA. If the SHPO and the 75th ABW agree in consultation in accordance with Stipulation II(D)(5), the 75th ABW shall send the SHPO and other consulting parties an official letter notifying them that Standard Mitigation Treatment Measures will be used to mitigate adverse effects. The SHPO and other participating parties shall notify the 75th ABW whether they concur or object to the 75th ABW's determination and plan to use Standard Mitigation Treatment Measures within 30 calendar days following receipt of documentation. If the SHPO and other participating parties fail to respond within 30 calendar days, the SHPO and other participating parties will be deemed to concur with the 75th ABW's determination.

1. Recordation, Digital Photograph Package
Prior to project implementation, the 75th ABW's shall oversee the successful delivery of a digital photography package. The digital photography package shall include a comprehensive collection of photographs of both interior and exterior views showing representative spaces and details of significant architectural features and typical building materials. Exterior photographs shall include overall images and images of each elevation. Exterior views shall be keyed to a site plan while interior views shall be keyed to a floor plan of the building/structure. The photographs shall be saved on an archival compact disc and include the date photographed, address, subject matter, photographer's name, and elevation or direction of image. The 75th ABW will distribute a digital copy of the photograph package to SHPO and other participating parties.

2. Reconnaissance Survey
The 75th ABW, in consultation with the SHPO, shall develop a non-intensive inventory strategy to identify historic properties and identify an area to conduct the study. Study areas may include high probability areas never before surveyed or any areas of interest to the 75th ABW or the SHPO. The report will include a literature review and may include building or site forms completed according to Utah State History standards. A digital copy of the report and associated forms will be submitted to the SHPO and other participating parties.

3. Intensive Level Survey
An intensive level historic site form providing a historical narrative and physical property description will be completed for the property, including information on outbuildings, if one has not been previously completed. For the detailed description of the physical appearance of the building and its significant architectural features, a brief description is required of any additions or alterations that have been made to

the building; a list and brief description of the materials, estimated dates, and condition; a description of and a note of contributory/non-contributory status of any outbuildings on the property; and a description of any features not adequately shown in the photos. For the historical narrative, write a chronological history of the property, focusing on the original or principal owner and significant events. This must include internal and external elements of the building as well as meet all Utah State ILS standards. In consultation with the SHPO, the survey may or may not include level I or II documentation standards of the Historic American Building Survey/Historic American Engineering Record/Historic American Landscape Survey.

4. Drawings
For architecturally significant or unique buildings, or buildings that can provide important data, the 75th ABW shall prepare two exterior elevation drawings (primary elevation, plus one other that best captures the property) for the primary building. The 75th ABW shall prepare a site plan, drawn to an appropriate scale, showing the primary building and associated outbuildings, fences, and structures. The 75th ABW shall prepare a basic floor plan drawing (for each building level). The drawings may be done electronically or by hand (if done by hand, they must be scanned and submitted electronically).

5. Oral History Documentation
Prior to project implementation, the 75th ABW shall work with the SHPO and other consulting parties to identify oral history, or ethnography, documentation needs and agree upon a topic and list of interview candidates. Once the parameters of the oral history project have been agreed upon, the 75th ABW shall continue to coordinate the project through data collection, drafting of the document (recordings may be allowed), and delivery of a final product.

6. Public Interpretation
Prior to project implementation, the 75th ABW and other consulting parties shall work with the SHPO to design an educational or other public interpretive plan. The plan may include signs, displays, educational pamphlets, websites, workshops, museum displays, and other similar mechanisms to educate and raise awareness with the public on historic properties within the local community or region. Once an interpretive plan has been agreed to by the parties, consultation shall continue throughout implementation of the plan until the 75th ABW has completed all agreed-upon actions. All such projects will go through security screening prior to release to ensure no sensitive material is released.

7. Maps/ Story Maps (Current and Historical)
The 75th ABW shall work with the SHPO and other participating parties to identify historic maps and/or aerial photographs for scanning and geo-referencing. Once a list of maps and/or aerial photographs has been agreed upon, the 75th ABW shall continue the project by scanning and geo-referencing them and shall submit drafts of electronic files to the SHPO and other parties for review. The 75th ABW shall submit final electronic files that include scanned documents (if not created electronically) and the metadata relating to the creation of the maps. A story map detailing aspects of the installation's history or prehistory may also be developed to be utilized for defined purposes (including but not limited to project planning, public outreach, installation training). All such projects will go through security screening prior to release to ensure no sensitive material is released.

8. NRHP Nomination or Historic Context
The 75th ABW shall work with the SHPO and other participating parties to identify individual properties that would benefit from a completed NRHP Nomination, either close in proximity to the project or historically-related to the properties being affected, to be listed in the NRHP; or, the 75th ABW shall identify properties that may be related to existing historic themes associated with the property to develop

Attachment - Programmatic Agreement regarding NHPA Section 106 Compliance for NASA's MSR Campaign Undertaking

into a formal historic context statement. Once the parties have agreed to a property, the 75th ABW shall continue to work the SHPO through the drafting of the nomination form. The SHPO shall provide guidance during the preparation of the form and shall submit the nomination to the Keeper for inclusion in the NRHP. The 75th ABW shall use staff or contractors that meet the Secretary's Professional Qualifications.

9. Multiple Property Submission

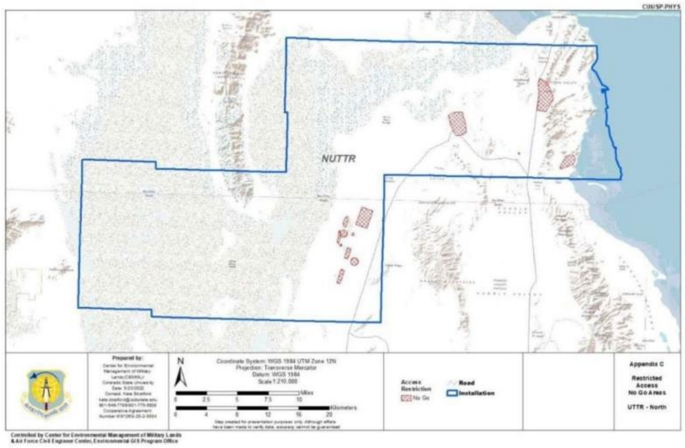
The 75th ABW shall seek to identify properties that are associated with significant historic themes to develop a Multiple Property nomination (the organization and nomination of a group of related significant properties based on themes, trends, and/or patterns of history shared by the properties). Once the parties have agreed to a property, the 75th ABW shall continue to work the SHPO through the drafting of the nomination form. The SHPO shall provide guidance during the preparation of the form and shall submit the nomination to the Keeper for inclusion in the National Register. The 75th ABW shall use staff or contractors that meet the Secretary's Professional Qualifications.

10. Historic Preservation Workshops

The 75th ABW shall, in consultation with the SHPO and other consulting parties, offer or sponsor a public or internal workshop to raise awareness and understanding of historic preservation standards and practices. Ideally, the workshop will be related to the project activity resulting in the adverse effect. For example, the decision to replace historic windows with incompatible windows may result in offering a window restoration workshop.

Attachment - Programmatic Agreement regarding NHPA Section 106
Compliance for NASA's MSR Campaign Undertaking

APPENDIX C
No-Go Areas



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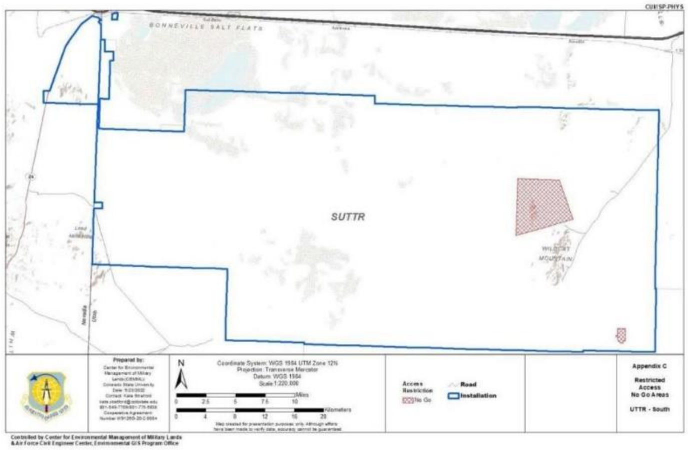
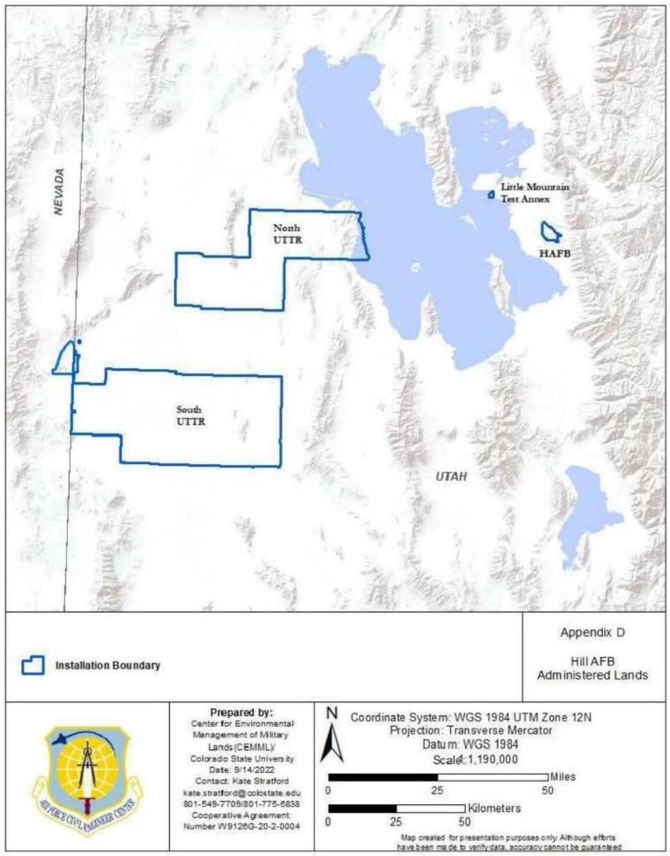
Compliance for NASA's MSR Campaign Undertaking



Attachment - Programmatic Agreement regarding NHPA Section 106 Compliance for NASA's MSR Campaign Undertaking

APPENDIX D
Area of Potential Effect

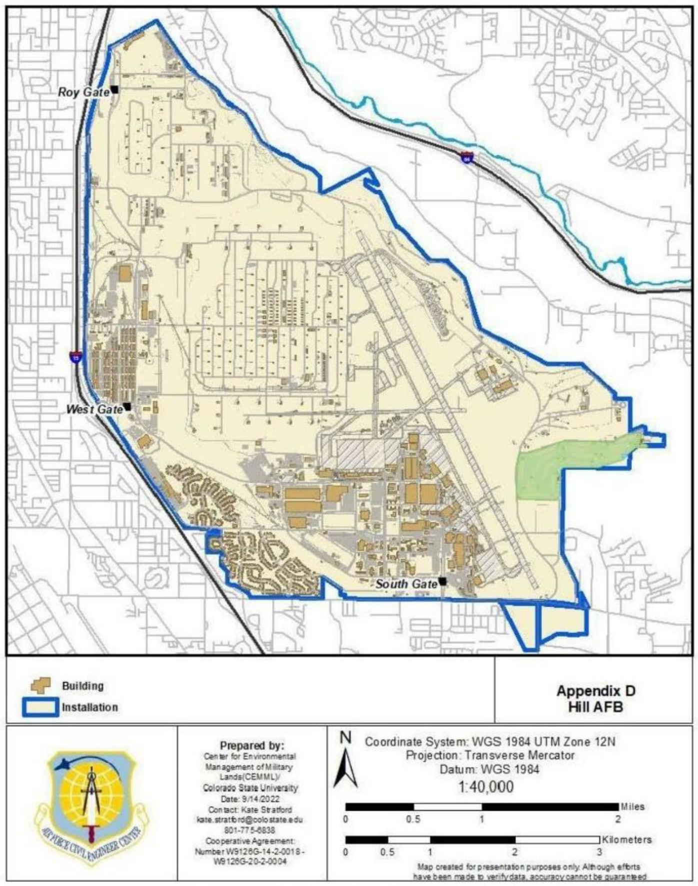


Page **28** of **31**

Programmatic Agreement Regarding Section 106 Compliance
Hill Air Force Base, Utah Test and Training Range, Little Mountain Test Facility

Attachment Page 28 of 31

Attachment - Programmatic Agreement regarding NHPA Section 106
Compliance for NASA's MSR Campaign Undertaking



CONTROLLED BY CENTER FOR ENVIRONMENTAL MANAGEMENT OF MILITARY LANDS & AIR FORCE CIVIL ENGINEERING CENTER, ENVIRONMENTAL GIS PROGRAM OFFICE

Page **29** of **31**

Programmatic Agreement Regarding Section 106 Compliance
Hill Air Force Base, Utah Test and Training Range, Little Mountain Test Facility

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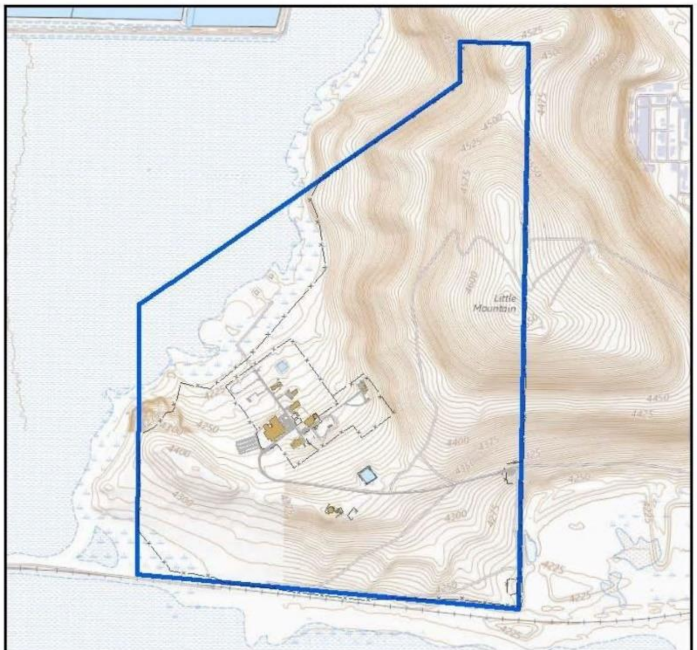
Attachment - Programmatic Agreement regarding NHPA Section 106
Compliance for NASA's MSR Campaign Undertaking



Building
Installation

Appendix D
Little Mountain
Text Annex

Prepared by:
Center for Environmental Management of Military Lands(CEMML)/
Colorado State University
Date: 9/14/2022
Contact: Kate Stratford
kate.stratford@colostate.edu
801-775-6838
Cooperative Agreement: Number W9126G-14-2-0018 - W9126G-20-2-0004

N
Coordinate System: WGS 1984 UTM Zone 12N
Projection: Transverse Mercator
Datum: WGS 1984
1:14,000

0 0.2 0.4 0.8 Miles
0 0.25 0.5 1 Kilometers

Map created for presentation purposes only. Although efforts have been made to verify data, accuracy cannot be guaranteed

CONTROLLED BY CENTER FOR ENVIRONMENTAL MANAGEMENT OF MILITARY LANDS & AIR FORCE CIVIL ENGINEERING CENTER, ENVIRONMENTAL GIS PROGRAM OFFICE

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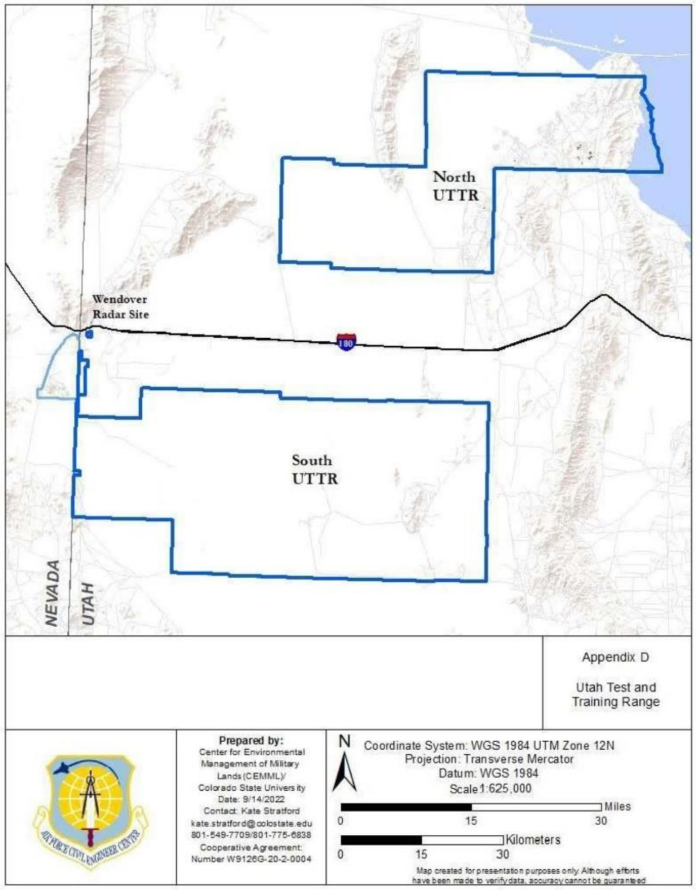
Compliance for NASA's MSR Campaign Undertaking



Page **31** of **31**

Programmatic Agreement Regarding Section 106 Compliance
Hill Air Force Base, Utah Test and Training Range, Little Mountain Test Facility

Attachment Page 31 of 31

B.4.2 Correspondence Among Cooperating Agencies

DEPARTMENT OF THE AIR FORCE
WASHINGTON DC

OFFICE OF THE ASSISTANT SECRETARY

SAF/IEI
1665 Air Force Pentagon
Washington, DC 20330-1665

NASA Office of JPL
Management and Oversight
4800 Oak Grove Drive
Pasadena, CA 91109-8099

Dear Mr. Slaten:

The Department of the Air Force (DAF) accepts the National Aeronautics and Space Administration (NASA) 22 September 2021 invitation to be a Cooperating Agency in preparation of a Programmatic Environmental Impact Statement (PEIS) to evaluate the potential environmental impacts of the proposed Mars Sample Return (MSR) Campaign and related tiered analyses.

The DAF will participate as generally prescribed at 40 C.F.R. § 1501.8, Cooperating Agencies. It is appropriate for the DAF to participate in the preparation of this PEIS due to its jurisdiction by law and its special expertise associated with Utah Test and Training Range (UTTR), the proposed landing site. The DAF may specify the mitigation measures considered necessary for permitting use of UTTR. As the lead agency, NASA would be responsible for ensuring timely completion of all regulatory consultations in coordination with the DAF.

As a Cooperating Agency, the DAF will participate in the PEIS in support of NASA's MSR Campaign and to support DAF required NEPA analyses and decision-making per 32 C.F.R § 989 and per 40 C.F.R. § 1503.2 and 1505.3. Should you or your staff have further questions regarding this letter, our points of contact are Mr. Jack Bush at (703) 867-1082 or jack.bush@us.af.mil, and Mr. Jay Nash at (703) 622-8357 or john.nash.4.ctr@us.af.mil. A local UTTR POC will be determined in the future as needed for day-to-day coordination.

Sincerely,

ROBERT E. MORIARTY, P.E., SES
Deputy Assistant Secretary of the Air Force
(Installations)

cc: 2

SAF/GCN
AF/A3T/A4C
AF/JAO
AFCEC/CZ
AFMC/A4C
AFIMSC Det 6/CEB
75 CEG/CEIE
ACC/A5/8/9/A8BG
AFIMSC Det 8/CEO
ACC/A3A

Dr. Edwin,

Following up on my email last month.

Please let me know if CDC will be a cooperating agency.

Thanks,

Steve Slaten
NASA MSR PEIS Project Manager
NASA Office of JPL Management and Oversight
202-368-0491

From: Slaten, Steven W. (HQ-RA000)
Sent: Wednesday, August 25, 2021 1:43 PM
To: mhq2@cdc.gov
Cc: Montgomery, Lizabeth R. {Beth} (GSFC-2500) <lizabeth.r.montgomery@nasa.gov>; Akstulewicz, Kevin D. <KEVIN.D.AKSTULEWICZ@leidos.com>
Subject: MSR PEIS: Cooperating Agency request

Please see attached letter.

Steve Slaten
NASA MSR PEIS Project Manager
NASA Office of JPL Management and Oversight
202-368-0491

2

Akstulewicz, Kevin D. [US-US]

From: Edwin, Samuel (CDC/DDPHSIS/CPR/DSAT) <mhq2@cdc.gov>
Sent: Monday, September 27, 2021 8:39 AM
To: Slaten, Steven W. (HQ-RA000)
Cc: Montgomery, Lizabeth R. {Beth} (GSFC-2500); Akstulewicz, Kevin D. [US-US]; McQuiston, Jennifer H. (CDC/DDID/NCEZID/DHCPP)
Subject: EXTERNAL: RE: MSR PEIS: Cooperating Agency request

Good morning Dr. Staten,

My apologies for the delay in getting back to you. Dr. Jack Taniewski, my counterpart at APHIS/USDA has kept me updated regarding the conversations you had regarding the specifics of your ask to the Federal Select Agent Program (FSAP) Directors. I am fully onboard for supporting NASA setting up a non-regulatory oversight program (for samples arriving from Mars and other planets) similar to the Federal Select Agent Program which oversees the possession, use and transfer of select agents and toxins. We are also open for sharing all the guidance documents, forms and other materials we have available so that NASA can use these with minor, specific modifications. As Directors of FSAP, Jack and I are regulators and have the regulatory perspective.

I think NASA would benefit immensely from also engaging non-regulatory subject matter experts (SMEs) from CDC (copied the lead on this message) for guidance on various other matters outlined in your Cooperating Agency Agreement that are outside the expertise of the FSAP. Thank you.

Respectfully,
Sam

Samuel S. Edwin, Ph.D.

Director
Division of Select Agents and Toxins
Center for Preparedness and Response

Centers for Disease Control and Prevention (CDC)
1600 Clifton Road, NE MS H21-7, Atlanta, GA 30329
404-718-2001 Office | 470-747-9879 Cell
E-mail: mhq2@cdc.gov
https://www.selectagents.gov/

CDC 24/7 Saving Lives. Protecting People. Saving Money Through Prevention. cdc.gov/24-7

From: Slaten, Steven W. (HQ-RA000) <sslaten@nasa.gov>
Sent: Thursday, September 23, 2021 3:22 PM
To: Edwin, Samuel (CDC/DDPHSIS/CPR/DSAT) <mhq2@cdc.gov>
Cc: Montgomery, Lizabeth R. {Beth} (GSFC-2500) <lizabeth.r.montgomery@nasa.gov>; Akstulewicz, Kevin D. <KEVIN.D.AKSTULEWICZ@leidos.com>
Subject: FW: MSR PEIS: Cooperating Agency request

1

Akstulewicz, Kevin D. [US-US]

From:	Hoffman, Brian T COL USARMY ATEC (USA) <brian.t.hoffman.mil@mail.mil>
Sent:	Wednesday, August 25, 2021 7:00 PM
To:	Slaten, Steven W. (HQ-RA000)
Cc:	Montgomery, Lizabeth R. {Beth} (GSFC-2500); Johnson, Christopher M CIV USARMY ATEC (USA); Damour, Christopher D CIV USARMY USAG (USA); Liddiard, Vincent M CIV USARMY ATEC (USA); Akstulewicz, Kevin D. [US-US]; Reed, Randolph Jason CIV USARMY USAG (USA); Harris, Ryan W CIV USARMY ATEC (USA); Gritton, Kenneth Scott (Ken) CIV USARMY ATEC (USA)
Subject:	EXTERNAL: RE: [Non-DoD Source] Cooperating Agency Request under NEPA
Attachments:	(20210822)_MSR_CA_Army Letter_FINAL_v2.pdf
Follow Up Flag:	Follow up
Flag Status:	Flagged

Steven,

Received. DPG will support and looks forward to being a Teammate with NASA. Our Special Programs Division is the lead for DPG, POC is Mr. Chris Johnson, Cc'd.

V/r,
Colonel Brian T. Hoffman
Commander
Dugway Proving Ground, Utah 84022
(435) 831-3314 office
(435) 830-0470 mobile
brian.t.hoffman.mil@mail.mil

From: Slaten, Steven W. (HQ-RA000) <sslaten@nasa.gov>
Sent: Wednesday, August 25, 2021 1:36 PM
To: Hoffman, Brian T COL USARMY ATEC (USA) <brian.t.hoffman.mil@mail.mil>; Damour, Christopher D CIV USARMY USAG (USA) <christopher.d.damour.civ@mail.mil>
Cc: Montgomery, Lizabeth R. {Beth} (GSFC-2500) <lizabeth.r.montgomery@nasa.gov>; Akstulewicz, Kevin D. <KEVIN.D.AKSTULEWICZ@leidos.com>
Subject: [Non-DoD Source] Cooperating Agency Request under NEPA

All active links contained in this email were disabled. Please verify the identity of the sender, and confirm the authenticity of all links contained within the message prior to copying and pasting the address to a Web browser.

Please see attached letter.

Steve Slaten
NASA MSR PEIS Project Manager
NASA Office of JPL Management and Oversight
202-368-0491

1

Akstulewicz, Kevin D. [US-US]

From: Taniewski, Jacek - APHIS <jacek.taniewski@usda.gov>
Sent: Thursday, September 30, 2021 4:08 PM
To: Slaten, Steven W. (HQ-RA000)
Cc: Montgomery, Lizabeth R. {Beth} (GSFC-2500); Akstulewicz, Kevin D. [US-US]; Capsel, Randal T - APHIS; Hudson, Paul - MRP-APHIS, Riverdale, MD
Subject: EXTERNAL: RE: MSR PEIS: Cooperating Agency Request

Follow Up Flag: Follow up
Flag Status: Completed

Steve,

Drs. Randy Capsel and Paul Hudson will represent DASAT in the project.

Thanks

Jack Taniewski, DVM
Director
Division of Agricultural Select Agents and Toxins
ERCS, APHIS, USDA
4700 River Road,
Riverdale, Maryland 20737
jacek.taniewski@usda.gov
Phone: 301-851-3352

From: Slaten, Steven W. (HQ-RA000) <sslaten@nasa.gov>
Sent: Wednesday, August 25, 2021 3:40 PM
To: Taniewski, Jacek - APHIS <jacek.taniewski@usda.gov>
Cc: Montgomery, Lizabeth R. {Beth} (GSFC-2500) <lizabeth.r.montgomery@nasa.gov>; Akstulewicz, Kevin D. <KEVIN.D.AKSTULEWICZ@leidos.com>
Subject: MSR PEIS: Cooperating Agency Request

Please see attached letter.

Steve Slaten
NASA MSR PEIS Project Manager
NASA Office of JPL Management and Oversight
202-368-0491

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APPENDIX C
NASA ENVIRONMENTAL CHECKLISTS

C.1 ENVIRONMENTAL CHECKLIST FOR EXECUTIVE ORDER 12114

Page 1

NASA EO12114 Checklist

Proposed Action: Launch of MSR Earth Return Orbiter (ERO)	Center/Office Code: NASA SMD
Location of Foreign Proposed Action: Kourou, French Guiana	Tracking Number:

Description of Proposed Action:
The Earth Return Orbiter (referred to as the "Orbiter") is one of the flight elements of the Mars Sample Return (MSR) Campaign. The Orbiter would be provided by European Space Agency (ESA) and would be launched from Kourou, French Guiana in 2027. The Orbiter would include the Capture, Containment, and Return System (CCRS), which would capture and contain the Orbiting Sample container for return to the surface of Earth. NASA is preparing a Programmatic Environmental Impact Statement (PEIS) to analyze the potential environmental impacts of the MSR Campaign from a programmatic perspective and a site specific perspective for the landing site. Because the launch of the Orbiter from French Guiana, an area beyond the territorial jurisdiction of the United States, is a joint effort between NASA and the ESA, it is addressed in the PEIS under Executive Order (EO) 12114, Environmental Effects Abroad of Major Federal Actions as documented in this EO12114 checklist and review.
See Notes Section below.

PI/Proponent: George Tahu	Phone: 202-358-0000	e-mail: hq-msr-nepa@mail.nasa.gov
Applicable Permits/ Agreements *(Please attach to this checklist)*:		Start Date/ Duration: September 2027
Other NASA Centers Involved: NASA HQ, JPL, GSFC		

Note: Actions outside the U.S. may also require compliance with NHPA, ESA, MMPA, ASTCA & Antarctic Protocol	YES	NO
1. Would all or part of the activity occur outside the boundaries of the United States or its territories (e.g., in another country or in the ocean beyond 12 nautical miles from the U.S. shoreline)? *(If "YES" proceed with checklist. If "NO", the provisions of EO12114 do not apply to this action and do not proceed with checklist.)* **NOTE: NEPA, not EO 12114, applies in the Antarctica land mass**	☑	☐
2. Actions interpreted (from EO paragraph 2-3) as not included under EO12114		
a. Is this an action potentially affecting or taking place only in the environment of a participating foreign nation? (note: this includes territorial seas within 12 nautical miles from coastlines) *(If "YES" be sure to reference applicable agreements above and proceed to 2b. If "NO", proceed to Section 3 page 2.)*	☐	☑
b. Does this action involve a product, or physical project producing a principal product or an emission or effluent, which is prohibited or strictly regulated by Federal law in the United States because its toxic effects on the environment create a serious public health risk? *(If "YES" proceed to Section 3, page 2. If "NO", proceed to 2c.)*	☐	☑
c. Does this action involve a physical project which in the United States is prohibited or strictly regulated by Federal law to protect the environment against radioactive substances? *(If "YES" proceed to Section 3 page 2. If "NO", proceed to 2d.)*	☐	☑
d. Could this action significantly affect natural or ecological resources of global importance (i.e., red-list species or world heritage sites) of a participating foreign nation? *(If "YES" proceed to Section 3 page 2. If "NO" proceed to Proposed Action Assessment below, line I and sign – process is complete.)*	☐	☑

Proposed Action Assessment	YES
I. This is an action interpreted (from EO paragraph 2-3) as not included under EO12114.	☐
II. The proposed action qualifies as an Exemption as described by EO12114, paragraph 2-5.a (**Select** paragraph number from line in **Section** 3) and does NOT require a REC. No further action is required.	☐
III. The proposed action qualifies as an EO12114 Categorical Exclusion (EO12114 CatEx) Not Requiring a REC, as described by NASA procedure described in NASA NEPA Desk Guide. No further action is required.	☐
IV. The proposed action qualifies as an EO12114 Categorical Exclusion (EO12114 CatEx) Requiring a REC, as described by NASA procedure described in NASA NEPA Desk Guide. Please attach REC to this checklist.	☐
V. The proposed action is adequately addressed in existing environmental review documentation (**as described in this PEIS**).	☑
VI. The proposed action will require a REC and **an** environmental summary document, as described by NASA **procedure** in **the** NASA NEPA Desk Guide.	☐
VII. Per NASA HQ coordination, documentation required for this proposed action is as described below.	
a. The proposed action will require preparation of an environmental impact statement (including generic, program and specific statements) as described by EO12114, paragraph 2-4.(a)(i).	☐
b. The proposed action will require preparation of bilateral or multilateral environmental studies, relevant or related to the proposed action, by the United States and one or more foreign nations, or by an international body or organization in which the United States is a member or participant, as described by EO12114, paragraph 2-4.(a)(ii).	☐
c. The proposed action will require preparation of a concise review of the environmental issues involved, including environmental assessments, summary environmental analyses or other appropriate documents as described by EO12114, paragraph 2-4.(a)(iii).	☐

GEORGE TAHU Digitally signed by GEORGETAHU Date: 2022.09.12 20:29:46 -04'00'	STEVEN SLATEN Digitally signed by STEVEN SLATEN Date: 2022.09.15 13:09:02 -06'00'	
Project Proponent	**Center NEPA Manager**	**Other Signature, if required**

Page 2

NASA EO12114 Checklist			
Proposed Action: Launch of MSR Earth Return Orbiter	Center/Office Code: NASA SMD	YES	NO
3. Actions Exempted From EO12114			
Would the Proposed Action qualify as:			
a. An action taken by the President? [EO12114, 2-5(a)(ii)] *(If "YES" proceed to Proposed Action Assessment page 1, line II. If "NO", proceed to 3b.)*		☐	☑
b. An action by or pursuant to the direction of the President or Cabinet officer when the national security or interest is involved or when action occurs in the course of an armed conflict? [EO12114, 2-5(a)(iii)] *(If "YES" proceed to Proposed Action Assessment page 1, line II. If "NO", proceed to 3c.)*		☐	☑
c. Intelligence activities and arms transfers? [EO12114, 2-5(a)(iv)] *(If "YES" proceed to Proposed Action Assessment page 1, line II. If "NO", proceed to 3d.)*		☐	☑
d. Exports licenses or permits or export approvals, and actions relating to nuclear activities except actions providing to a foreign nation a nuclear production or utilization facility as defined in the Atomic Energy Act of 1954, as amended or a nuclear waste management facility? [EO12114, 2-5(a)(v)] *(If "YES" proceed to Proposed Action Assessment page 1, line II. If "NO", proceed to 3e.)*		☐	☑
e. Votes and other actions in international conferences and organizations? [EO12114, 2-5(a)(vi)] *(If "YES" proceed to Proposed Action Assessment page 1, line II. If "NO", proceed to 3f.)*		☐	☑
f. Disaster and emergency relief action? [EO12114, 2-5(a)(vii)] *(If "YES" proceed to Proposed Action Assessment, page 1, line II. If "NO", proceed to Section 4.)*		☐	☑
4. EO12114 CatEx Not Requiring a REC			
Would the Proposed Action qualify as Administrative Activities outside the United States including:			
a. Personnel actions, organizational changes, and procurement of routine goods and services?		☐	☑
b. Issuance of procedural rules, manuals, directives, and requirements?		☐	☑
c. Program budget proposals, disbursements, and transfer or reprogramming of funds?		☐	☑
d. Preparation of documents, including design and feasibility studies, analytical supply and demand studies, reports and recommendations, master and strategic plans, and other advisory documents?		☐	☑
e. Information-gathering exercises, such as inventories, audits, studies, and field studies, including water sampling, cultural resources surveys, biological surveys, geologic surveys, modeling or simulations, and routine data collection and analysis activities?		☐	☑
f. Preparation and dissemination of information, including document mailings, publications, classroom materials, conferences, speaking engagements, Web sites, and other educational/informational activities?		☐	☑
g. Software development, data analysis, and/or testing, including computer modeling?		☐	☑
h. Interpretations, amendments, and modifications to contracts, grants, or other awards?		☐	☑
Would the Proposed Action qualify as Operations and Management Activities outside the United States including:			
i. Routine maintenance, minor construction or rehabilitation, minor demolition, minor modification, minor repair, and continuing or altered operations at, or of, existing US or US-funded or -approved facilities and equipment, such as buildings, roads, grounds, utilities, communication systems, and ground support systems, such as space tracking and data systems?		☐	☑
j. Installation or removal of equipment, including component parts, at existing US or private facilities?		☐	☑
k. Contribution of equipment, software, technical advice, exchange of data, and consultations, where such assistance does not control a receiving entity's program, project, or activity?		☐	☑
l. Ceremonies, commemorative events, and memorial services?		☐	☑
m. Routine packaging, labeling, storage, and transportation of hazardous materials and wastes, in accordance with applicable laws and requirements? *(Proceed to Section 5.)*		☐	☑
5. EO12114 CatEx Requiring a REC			
Would the Proposed Action qualify as Research and Development Activities outside the United States including:			
a. Research, development, and testing in compliance with applicable laws and requirements?		☐	☑

NASA EO12114 Checklist		
Proposed Action: Launch of MSR Earth Return Orbiter — Center/Office Code: NASA SMD	YES	NO
b. Use of small quantities of radioactive materials in a laboratory or in the field. Uses include material for instrument detectors, calibration, and other purposes. Materials must be licensed, as required, and properly contained and shielded?	☐	☑
c. Use of lasers for research and development, scientific instruments and measurements, and distance and ranging, where such use meets all applicable laws and requirements. This applies to lasers used in spacecraft, aircraft, laboratories, watercraft, or outdoor activities?	☐	☑
Would the Proposed Action qualify as Aircraft and Airfield Activities outside the United States including:		
d. Periodic aircraft flight activities, including training and research and development, which are routine and comply with applicable laws and requirements?	☐	☑
e. Relocation of similar aircraft not resulting in a substantial increase in total flying hours, number of aircraft operations, operational parameters (e.g., noise), or permanent personnel or logistics support requirements at the receiving installation? *(If any "YES" in Section 4 and all "NO" in Section 5 proceed to Proposed Action Assessment, page 1, line III. If any "YES" in Section 5 proceed to Proposed Action Assessment, page 1, line IV. If all "NO" in Sections 4 AND 5 proceed to Section 6.)*	☐	☑
6. REC using Existing Environmental Review Documentation		
a. Is the proposed action a mission for which the payload meets the Envelope Payload Characteristics in the NASA Routine Payload EA and previous EO12114 documentation for the launch vehicle/launch site resulted in a "no significant effects" determination?	☐	☐
b. Is the proposed action an action similar to previous actions with environmental impacts evaluated in existing documentation (e.g., other NEPA/EO12114 documents, foreign nation's environmental assessment, etc.), for the same location with a "no significant effects" determination? *(If any "YES" in Section 6 proceed to Proposed Action Assessment, page 1, line V. If any "NO", proceed to 7.)*	☑	☐
7. Are impacts from the Action expected to be significant? *(If "YES" in Section 7 proceed to Section 8. If "NO", proceed to Proposed Action Assessment, page 1, line VI.)*	☐	☐
8. Actions requiring documentation beyond a REC:		
a. Major Federal action significantly affecting the environment of the global commons outside the jurisdiction of any nation (e.g., the oceans or Antarctica)? (EO 12114, para 2-3.a.)	☐	☑
b. Major Federal action significantly affecting the environment of a foreign nation not participating with the United States and not otherwise involved in the action? (EO 12114, para 2-3.b.)	☐	☑
c. Major Federal action significantly affecting the environment of a foreign nation which provide to that nation a product, or physical project producing a principal product or an emission or effluent, which is prohibited or strictly regulated by Federal law in the United States because its toxic effects on the environment create a serious public health risk? (EO 12114, para 2-3.c.1.)	☐	☑
d. Major Federal action significantly affecting the environment of a foreign nation which provide to that nation a physical project which in the United States is prohibited or strictly regulated by Federal law to protect the environment against radioactive substances? (EO 12114, para 2-3.c.2.)	☐	☑
e. Major Federal action outside the United States, its territories and possessions which significantly affect natural or ecological resources of global importance designated for protection under this subsection by the President, or, in the case of such a resource protected by international agreement binding on the United States by the Secretary of State? (EO 12114, para 2-3.d.) *(If any "YES" in Section 8 proceed to Proposed Action Assessment, page 1, line VII.)*	☐	☑

Notes:

Launch Vehicle being considered out of Kourou is Ariane 64. Ariane 64 uses about 568,000 kg of solid propellant (mix of ammonium perchlorate (69%) and aluminium fuel (19%) and HTPB (12%)), which compares to Ariane 5 that uses about 480,000 kg of same kind of solid propellant. Ariane 64 uses about 170,000kg of LH2/LOX liquid propellant, compared to Ariane 5 that uses up to about 185,000kg LH2/LOX.
The ERO Payload would carry propellants with approximately 1500kg MON3 and 900 kg MMH (Note: JWST evaluation did not have any of these propellants but is under the Routine Payload Envelope), and 1350kg Xenon (an inert gas).
The proposed action is similar to previous actions launched on Ariane 5 in which the environmental impacts were evaluated in existing NASA EO12114 documentation for the French Guiana with a "no significant effects" determination (James Webb Space Telescope Mission EO 12114 Review, dated March 27, 2015).

This checklist is only for assessing EO12114 compliance requirements. Actions outside the U.S. may also require compliance with:

- **Section 402 of the National Historic Preservation Act (NHPA) Amendments (16 U.S.C. § 470a-2)**
- **Section 7 of the Endangered Species Act (ESA) (16 U.S.C. § 1531–1544)**
- **Section 112 of the Marine Mammal Protection Act (MMPA) (16 U.S.C. § 1361–1407)**
- **Antarctica Science, Tourism, and Conservation Act (ASTCA) of 1996 (16 U.S.C. § 2401) and Antarctic Protocol.**

C.2 NASA ROUTINE PAYLOAD EVALUATION AND DETERMINATION PROCESS AND CHECKLIST

NASA ROUTINE PAYLOAD EVALUATION AND DETERMINATION PROCESS AND CHECKLIST

After a proposed spacecraft mission is sufficiently well formulated (usually the Phase B design study), the Sponsoring Entity, in coordination with the local Environmental Management Office (EMO), will prepare an environmental evaluation. An environmental evaluation is a preliminary review that determines what aspects of the proposal are of potential environmental concern. The environmental evaluation also assists in determining the appropriate level of National Environmental Policy Act (NEPA) documentation (i.e., environmental assessment [EA], or environmental impact statement [EIS]) for the proposal. The local EMO uses a comprehensive checklist to provide a level of rigor to this early evaluation of the proposal, helping to ensure that pertinent considerations are not overlooked. Local EMO review of the Routine Payload Checklist (RPC, below) forms the basis for evaluating the applicability of a NASA Routine Payload (NRP) spacecraft classification for a proposed mission.

The local EMO uses the completed RPC (and required attachments) to evaluate the proposed mission against the NRP EA criteria. If the EMO evaluation of the RPC indicates that a NRP categorization may be appropriate, the Sponsoring Entity documents this in an Evaluation Recommendation Package (ERP). The ERP is then processed for review and approval in accordance with established National Aeronautics and Space Administration (NASA) procedures and guidelines. If approved, the ERP would be attached to a Record of Environmental Consideration (REC).

The Sponsoring Entity can then proceed with the proposal while monitoring the project activities, for changes or circumstances during implementation that could affect classification of the proposed mission as a NRP spacecraft. If a NRP spacecraft categorization is determined to be inappropriate, the local EMO will initiate plans for preparation of additional NEPA documentation.

NASA ROUTINE PAYLOAD CHECKLIST

Project Name: **Mars Sample Return (MSR) Sample Retrieval Lander (SRL) Launch Only**			Date of Launch: **June 2028**
Project Contact: **George Tahu**		Phone Number: **202-358-0000**	Mailstop: **3V71**
Project Start Date: **MSR KDP A December 2020**	Project Location: **Multiple - Jet Propulsion Laboratory and Kennedy Space Center**		

Project Description:
SRL plans to launch a landing platform with a Mars Ascent Vehicle (MAV), Orbiting Sample (OS) container, and helicopters, from CCSFS on a Falcon or Vulcan ELV. This evaluation is only being applied to the launch since the sample return is being evaluated in the MSR Tier 1 EIS.

A. Sample Return:	Yes	No
1. Would the candidate mission return a sample from an extraterrestrial body?	☐	☑

B. Radioactive Materials:	Yes	No
1. Would the candidate spacecraft carry radioactive materials in quantities that produce an A2 mission multiple value of 10 or more?	☐	☑

Provide a copy of the Radioactive Materials On Board Report as per NPR 8715.3 with the ERP submittal.

C. Launch and Launch Vehicles:	Yes	No
1. Would the candidate spacecraft be launched on a vehicle and launch site combination other than those listed in Table C-1 below?	☑	☐
2. Would the proposed mission exceed the approved or permitted annual launch rate for the particular launch vehicle or launch site?	☐	☑

Comments:
B1: If the Project decides to use RHUs, the RHU PEA checklist would be completed.
C1: Vulcan launch vehicle has NEPA coverage per June 2019 EA by USAF (now USSF) with NASA as a cooperating agency.

D. Facilities:	Yes	No
1. Would the candidate mission require the construction of any new facilities or substantial modification of existing facilities?	☐	☑

Provide a brief description of the construction or modification required, including whether ground disturbance and/or excavation would occur.

E. Health and Safety:	Yes	No
1. Would the candidate spacecraft utilize batteries, ordnance, hazardous propellant, radiofrequency transmitter power, or other subsystem components in quantities or levels exceeding the EPC's in Table C-2 below?	☐	☑
2. Would the expected risk of human casualty from spacecraft planned orbital reentry exceed the criteria specified by NASA Standard 8719.14?	☐	☑
3. Would the candidate spacecraft utilize any potentially hazardous material as part of a flight system whose type or amount precludes acquisition of the necessary permits prior to its use or is not included within the definition of the Envelope Payload Characteristics?	☐	☑
4. Would the candidate mission, under nominal conditions, release material other than propulsion system exhaust or inert gases into the Earth's atmosphere or space?	☐	☑
5. Are there changes in the preparation, launch or operation of the candidate spacecraft from the standard practices described in Chapter 3 of this EA?	☐	☑
6. Would the candidate spacecraft utilize an Earth-pointing laser system that does not meet the requirements for safe operation (ANSI Z136.1-2007 and ANSI Z136.6-2005)?	☐	☑
7. Would the candidate spacecraft contain, by design (e.g., a scientific payload) pathogenic microorganisms (including bacteria, protozoa, and viruses) which can produce disease or toxins hazardous to human health or the environment beyond Biosafety Level 1 (BSL 1)[1]?	☐	☑

Comments:

Continued on next page

[1] The use of biological agents on payloads is limited to materials with a safety rating of "Biosafety Level 1." This classification includes defined and characterized strains of viable microorganisms not known to consistently cause disease in healthy human adults. Personnel working with Biosafety Level 1 agents follow standard microbiological practices including the use of mechanical pipetting devices, no eating, drinking, or smoking in the laboratory, and required hand-washing after working with agents or leaving a lab where agents are stored. Personal protective equipment such as gloves and eye protection is also recommended when working with biological agents.

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NASA ROUTINE PAYLOAD CHECKLIST

Project Name: **Mars Sample Return (MSR) Sample Retrieval Lander (SRL) Launch Only**		Date of Launch: **June 2028**
Project Contact: **George Tahu**	Phone Number: **202-358-0000**	Mailstop: **3V71**
Project Start Date: **MSR KDP A December 2020**	Project Location: **Multiple - Jet Propulsion Laboratory and Kennedy Space Center**	

Project Description:
SRL plans to launch a landing platform with a Mars Ascent Vehicle (MAV), Orbiting Sample (OS) container, and helicopters, from CCSFS on a Falcon or Vulcan ELV. This evaluation is only being applied to the launch since the sample return is being evaluated in the MSR Tier 1 EIS.

F. Other Environmental Issues:	Yes	No
1. Would the candidate spacecraft have the potential for substantial effects on the environment outside the United States?	☐	☑
2. Would launch and operation of the candidate spacecraft have the potential to create substantial public controversy related to environmental issues?	☐	☑
3. Would any aspect of the candidate spacecraft that is not addressed by the EPCs have the potential for substantial effects on the environment (i.e., previously unused materials, configurations or material not included in the checklist)?	☐	☑

Comments:
F2: Significant public controversy could be expected for the overall MSR Program, the launch of the SRL is not expected to garner any public controversy.

Table C-1. Launch Vehicles and Launch Sites

Launch Vehicle and Launch Vehicle Family	Space Launch Complexes and Pads				
	Eastern Range (CCAFS)	Western Range (VAFB)	USAKA/RTS	WFF	KLC
Athena I, IIc, III[a]	LC-46	CA Spaceport (SLC-8)	NA	Pad 0	LP-1[a]
Atlas V Family	LC-41	SLC-3	NA	NA	NA
Delta II Family	LC-17	SLC-2	NA	NA	NA
Delta IV Family	LC-37	SLC-6	NA	NA	NA
Falcon I/Ie	LC-36	SLC-4W	Omelek Island	Pad 0	LP-3[b]
Falcon 9	LC-40	SLC-4E	Omelek	Pad 0	LP-1
Minotaur I	LC-20 and/or LC-46	SLC-8	NA	Pad 0	LP-1
Minotaur II-III	LC-20 and/or LC-46	SLC-8	NA	Pad 0	LP-1
Minotaur IV[c]	LC-20 and/or LC-46	SLC-8	NA	Pad 0	LP-1
Minotaur V	LC-20 and/or LC-46	SLC-8	NA	Pad 0	NA
Pegasus XL	CCAFS skidstrip KSC SLF	VAFB Airfield	Kwajalein Island	WFF Airfield	NA
Taurus	LC-20 and/or LC-46	SLC-576E	NA	Pad 0	LP-1
Taurus II	NA	NA	NA	Pad 0	LP-3[b]
Any other launch vehicle/launch site combination for which NASA has completed or cooperated on the NEPA compliance.					

[a] Athena III is currently under design.

[b] LP-3 is currently under design.

[c] While not explicitly listed in this table, the Minotaur IV includes all configurations of this launch vehicle, including the Minotaur IV+, which is a Minotaur IV with a Star 48V 4th stage.

Key: CA = California; CCAFS = Cape Canaveral Air Force Station; KSC = Kennedy Space Center; LC = Launch Complex; LP = Launch Pad; MARS = Mid-Atlantic Regional Spaceport; SLC = Space Launch Complex; SLF = Shuttle Landing Facility; USAKA/RTS = United States Army Kwajalein Atoll/Reagan Test Site; VAFB = Vandenberg Air Force Base; WFF = Wallops Flight Facility.

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NASA ROUTINE PAYLOAD CHECKLIST

Table C-2. Summary of Envelope Payload Characteristics by Spacecraft Subsystems

Structure	• Unlimited: aluminum, beryllium, carbon resin composites, magnesium, titanium, and other materials unless specified as limited.
Propulsion[a]	• Liquid propellant(s); 3,200 kg (7,055 lb) combined hydrazine, monomethyhydrazine and/or nitrogen tetroxide. • Solid Rocket Motor (SRM) propellant; 3,000 kg (6,614 lb) Ammonium Perchlorate (AP)-based solid propellant (examples of SRM propellant that might be on a spacecraft are a Star-48 kick stage, descent engines, an extra-terrestrial ascent vehicle, etc.)
Communications	• Various 10-100 Watt (RF) transmitters
Power	• Unlimited Solar cells; 5 kilowatt-Hour (kW-hr) Nickel-Hydrogen (NiH_2) or Lithium ion (Li-ion) battery, 300 Ampere-hour (A-hr) Lithium-Thionyl Chloride (LiSOCl), or 150 A-hr Hydrogen, Nickel-Cadmium (NiCd), or Nickel-hydrogen ($Ni\text{-}H_2$) battery.
Science Instruments	• 10 kilowatt radar • American National Standards Institute safe lasers (see Section 4.1.2.1)
Other	• U. S. Department of Transportation (DoT) Class 1.4 Electro-Explosive Devices (EEDs) for mechanical systems deployment • Radioactive materials in quantities that produce an A2 mission multiple value of less than 10 • Propulsion system exhaust and inert gas venting • Sample returns are considered outside of the scope of this environmental assessment

[a] Propellant limits are subject to range safety requirements.

Key: kg=kilograms; lb=pounds.

GEORGE TAHU
Digitally signed by GEORGE TAHU
Date: 2022.09.08 18:09:18 -04'00'

Program Executive or Center Project Manager

STEVEN SLATEN
Digitally signed by STEVEN SLATEN
Date: 2022.09.13 20:08:45 -06'00'

NASA NEPA Manager or Center NEPA Manager

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C.3 RECORD OF ENVIRONMENTAL CONSIDERATION (REC) FOR MSR EES DROP TESTS AT THE UTTR

National Aeronautics and
Space Administration
Science Mission Directorate

NASA Management Office
180-801
Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, CA 91109-8099

DATE: September 17, 2021

MEMORANDUM FOR THE RECORD

SUBJECT: Record of Environmental Consideration (REC) for Mars Sample Return (MSR) Earth Entry System (EES) Drop Tests at the Utah Test and Training Range (UTTR)

INTRODUCTION
The National Environmental Policy Act (NEPA) of 1969 as amended (42 U.S.C. 4321, et seq.), requires federal agencies (e.g.:NASA) to consider potential environmental impacts during program and project decision-making. NASA must comply with the Council on Environmental Quality (CEQ) regulations for implementing the Procedural Provisions of NEPA (40 CFR Parts 1500-1508), NASA's NEPA regulations (14 CFR, Part 1216, Subpart 1216.3], as well as NASA's NEPA policy (NPR 8580.1).

The purpose of this Record of Environmental Consideration (REC) is to establish NASA NEPA compliance for proposed drop testing at UTTR in support of the development of the EES. NASA has coordinated the drop testing with the USAF, who in turn have completed their NEPA review.

ENVIRONMENTAL DETERMINATION
Impacts from the proposed actions have been evaluated by the USAF in accordance with their NEPA requirements.

Based on their review, impacts from the proposed action would be less than significant and short-term. NASA accepts the USAF's NEPA evaluation and determines the proposed testing qualifies for coverage under NASA Catex *(3)(i) Research, development, and testing in compliance with all applicable Federal, Federally recognized Indian tribe, State, and/or local law or requirements and Executive Orders*. Moreover, NASA concludes that no additional environmental analysis is required at this time.

My signature on this document constitutes a written record of this decision.

Steve Slaten (signature)

9-17-2021
Date

Steve Slaten
NASA MSR PEIS Project Manager
NASA Office of JPL Management and Oversight
Jet Propulsion Laboratory

REQUEST FOR ENVIRONMENTAL IMPACT ANALYSIS

Report Control Symbol *RCS:***35222**

INSTRUCTIONS: *Section I to be completed by Proponent; Section II and III to be completed by Environmental Planning Function. Continue on seperate sheets as necessary. Reference appropriate item number(s).*

SECTION I - PROPONENT INFORMATION

1. TO (*Environmental Planning Function*)	2. FROM (*Proponent organization and functional address symbo*	2a. TELEPHONE NO.
1*) ENVIRONMENTAL MGT	**ACC UTTR (Michael Shane)**	**586-2551**

3. TITLE OF PROPOSED ACTION
Mars Sample Return Earth Entry Vehicle

4. PURPOSE AND NEED FOR ACTION *(Identify decision to be made and need date)*
See Page 2

5. DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES *(DOPAA) (Provide sufficient details for evaluation of the total action.)*
See Page 2

6. PROPONENT APPROVAL *(Name and Grade)*	6a. SIGNATURE	6b. DATE
Michael Shane	**michael.shane.2**	**11-Oct-2019**

SECTION II - PRELIMINARY ENVIRONMENTAL SURVEY.

(Check appropriate box and describe potential environmental effects Including cumulative effects.) (+ = positive effect; 0 = no effect; - = adverse effect; U = unknown

	+	0	-	U
7. AIR INSTALLATION COMPATIBLE USE ZONE/LAND USE *(Noise, accident potential, encroachment, etc.)*	☐	☒	☐	☐
8. AIR QUALITY *(Emissions, attainment status, state implementation plan, etc.)*	☐	☒	☐	☐
9. WATER RESOURCES *(Quality, quantity, source, etc.)*	☐	☒	☐	☐
10. SAFETY AND OCCUPATIONAL HEALTH *(Asbestos/radiation/chemical exposure, explosives safety quantity-distance, bird/wildlife aircraft hazard, etc.)*	☐	☒	☐	☐
11. HAZARDOUS MATERIALS/WASTE *(Use/storage/generation, solid waste, etc.)*	☐	☒	☐	☐
12. BIOLOGICAL RESOURCES *(Wetlands/floodplains, threatened or endangered species, etc.)*	☐	☒	☐	☐
13. CULTURAL RESOURCES *(Native American burial sites, archeological, historical, etc.)*	☐	☒	☐	☐
14. GEOLOGY AND SOILS *(Topography, minerals, geothermal, Installation Restoration Program, seismicity, etc.)*	☐	☒	☐	☐
15. SOCIOECONOMIC *(Employment/population projections, school and local fiscal impacts, etc.)*	☐	☒	☐	☐
16. OTHER *(Potential impacts not addressed above.)*	☐	☒	☐	☐

SECTION III - ENVIRONMENTAL ANALYSIS DETERMINATION

17. ☒ PROPOSED ACTION QUALIFIES FOR CATEGORICAL EXCLUSION *(CATEX)* (see below for list of CATEXs); OR
☐ PROPOSED ACTION DOES NOT QUALIFY FOR A CATEX; FURTHER ENVIRONMENTAL ANALYSIS IS REQUIRED.

18. REMARKS

Note: These CATEX's are contingent on compliance with all reviewer comments.A2.3.7. Continuation or resumption of pre-existing actions, where there is no substantial change in existing conditions or existing land uses and where the actions were originally evaluated in accordance with applicable law and regulations, and surrounding circumstances have not changed.32 CFR 989 CATEX A2.3.11 Actions similar to other actions which have been determined to have an insignificant impact in a similar setting as established in an EIS or an EA resulting in a FONSI. Reference: OSIRIS-REx EA/FONSI March 2013

19. ENVIRONMENTAL PLANNING FUNCTION CERTIFICATION *(Name and Grade)*	19a. SIGNATURE	19b. DATE
Samuel Johnson	**//E-SIGNED 11- 4-19//** **Johnson, Samuel**	**04-Nov-2019**

AF IMT 813, 19990901, V1 THIS FORM CONSOLIDATES AF FORM 813 and 814. PREVIOUS EDITIONS OF BOTH FORMS ARE OBSOLETE. Page 1 of 3

AF IMT 813, SEP 99, CONTINUATION SHEET

4. PURPOSE AND NEED FOR ACTION *(Identify decision to be made and need date)*

4.1 Objective:

1.1 The Mars Sample Return Earth Entry Vehicle (MSR-EEV) is a passive entry capsule being developed by NASA to return Mars soil and rock samples back to Earth. The MSR-EEV is planned to land without a parachute at the Utah Test and Training Range (UTTR). Because the EEV does not rely on a parachute, it will impact the ground at UTTR with a velocity as high as 50 m/s (112 mph). It is critical that the capsule structure survives the soil impact and that the impact loads imparted on the Mars samples do not exceed acceptable limits. Meeting these requirements is highly dependent on the soil properties in the intended landing area. The test operations will happen over the next few years with the actual satellite returning to earth in 2032.

4.2 Need Back:

10/25/2019 12:00:00AM

4.3 Who Wants the Project:

NASA with the support of the UTTR

4.4 Why is the action required:

The UTTR provides a perfect landing site for this project.

5. DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES *(DOPAA) (Provide sufficient details for evaluation of the total action.)*

5.1 What is the proposed Action:

To allow NASA to return a safe landing site for a returning satellite.

5.2 Where is the proposed work to be done:

UTTR South Range

5.3 How will the proposed work be done:

The preliminary test will be dropping a simulated platform on the range from different heights. This will be accomplished in the TS-6 and TS-8 area of the south range. the actual impact site for the real mission will take place approximately 10 miles NW of the TS-5 area. the specific site has not been established due to weather and future plans but this will be the general vicinity.

5.4 Alternatives:

Alternative A - No Action:

The no action alternative is for NASA to not perform this operation. with the data they hope to bring back this is not an option.

Alternative A - No Action:

Other locations on Dugway and further east on the UTTR were considered along with doing this operation in Australia. With the operation the areas did not meet the need of the NASA with a clear area of no vegetation and limited hard surfaces. The West Desert provides NASA the surface and the soil composition that meets their requirements.

Alternative A - No Action:

All other alternatives were looked at and set aside as the site that has been considered provides NASA with a secure landing area and one with quick access to the equipment during both test and actual operations.

V1 Page 2 of 3

Electronic 813 Comments:

Remarks:

Comments:	Provided By:	Provided:
75 CEG/CEIEA-AC-Air Conformity Coordination Offices	Jensen Sarah 75 CEG/CEIE	15-Oct-2019
No conformity concerns. Conformity analysis attached.		
75 CEG/CEIEA-AQ-Air Quality Coordination Offices	Kaschmitter Mark 1*) ENVIF	15-Oct-2019
no concerns		
75 CEG/CEIEA-NR-Natural Resources Coordination Offices	Lawrence Russ 75 CEG/CE	28-Oct-2019
Good to go if the TS-6 and TS-8 sites for testing do not include vegetated sites. NR OK on the proposed real drop site.		
75 CEG/CEIE-CR-Cultural Resources Coordination Offices	Kitterman Anya 75 CEG/CE	23-Oct-2019
Cultural Resources - The majority of the proposed areas has not been surveyed for cultural resources. The area will need to have an intensive level survey prior to an work being completed and then further assessed for potential to impact cultural resources. Should eligible historic properties be identified, further mitigation may be necessary. Section 106 is not complete until both SHPO and tribal consultation happens and SHPO concurrence received. See attached full comments and unanticipated discovery protocol.		
75 CEG/CEIE-ST/WQ-Storage Tanks/Water Quality Coordination Offices	Hall Barbara 1*) ENVIRONI	17-Oct-2019
Water Quality and StorTanks – no concerns		
75 CEG/CEU-Range Support Division Coordination Offices	Byrk Michael UTTR MANAC	15-Oct-2019
No concerns.		
8a) SITE APPROVAL-Community Planner Coordination Offices	Powell Thomas 8c) UTILITII	16-Oct-2019
No concerns		
AFCEC/CZOM-UTTR-Range Restoration Coordination Offices	Tevault Elizabeth AFCEC/C.	15-Oct-2019
See attached IRP comments		
OO-ALC/JACE-Legal-JACE Coordination Offices	Linford Joseph 75 ABW	01-Nov-2019
CONDITIONALLY legally sufficient – see attached legal review. FOR OFFICIAL USE ONLY - NOT FOR PUBLIC RELEASE. The attached legal review contains information EXEMPT FROM MANDATORY DISCLOSURE under the Freedom of Information Act (FOIA) (5 USC 552(b)). This is a draft review document which includes pre-decisional information to which Exemption 5, the deliberative process privilege, applies. This document may also contain attorney work-product or information protected under the attorney-client privilege, both of which are protected from disclosure under FOIA.		

Page 3 of 3

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 75TH AIR BASE WING (AFMC)
HILL AIR FORCE BASE UTAH

1 November 2019

MEMORANDUM FOR 75 CEG/CEIEA

FROM: 75 ABW/JACE

SUBJECT: NEPA/EIAP Legal Review, 813 no. 35222,
Mars Sample Return Earth Entry Vehicle Landing Testing

1. This electronic AF Form 813 and application of Categorical Exclusion (CATEX) A2.3.11 are conditionally legally sufficient, IAW the National Environmental Policy Act/AF Environmental Impact Analysis Process (NEPA/EIAP) (42 U.S.C. §§4321-4370d; 40 C.F.R. 1508.4, 32 C.F.R. 989.13 and Appendix B to Part 989), provided the requirements and concerns of all other reviewers are met. I have reviewed the OSIRIS-REx EA/FONSI, dated March 2013, and find it applicable to the CATEX for the proposed action in this 813.

2. As mentioned above, this finding of legal sufficiency is conditioned upon the requirements and concerns of all other reviewers being met. I note particularly there are concerns from Anya Kitterman, the Hill AFB Cultural Resources Manager. She states:

> The majority of the proposed project area has not been surveyed. The entirety of the project area will need to be surveyed prior to any work being undertaken. At that time a letter determining eligibility of any sites will be drafted and forwarded to SHPO. If eligible sites are found, a course of action must be determined in order to meet regulations in regards to these sites. The testing area will take place on established roads and previous disturbance and has minimal potential for impacts to cultural resources.
>
> If any historic properties are found during the undertaking, activities in the immediate vicinity will cease, the Hill AFB Cultural Resources Program will be notified, and the unanticipated discovery procedures shall be implemented with direction from the Hill AFB Cultural Resources Program, and in accordance with the Hill AFB Integrated Cultural Resources Management Plan.

All of these requirements must be accomplished before any work on the proposed action can begin.

3. The OSIRIS-REx FONSI states, "The landing and recovery operations for this mission would be similar to those associated with prior NASA sample return missions that also utilized UTTR and would be within the bounds of activities currently being performed at UTTR." This appears to be true for this proposed action as well. Accordingly, in addition to CATEX A2.3.11, I suggest you also consider applying CATEX A2.3.7, "Continuation or resumption of pre-existing actions, where there is no substantial change in existing conditions or existing land uses and where the actions were originally evaluated in accordance with applicable law and regulations, and surrounding circumstances have not changed." Application of CATEX A2.3.7 is secondary to application of CATEX A2.3.11. In my opinion, CATEX A2.3.11 is the stronger of the two CATEXs as applied to this proposal. However, because CATEX A2.3.7 can also apply, I recommend its inclusion as well as CATEX A2.3.11.

4. **Recommendation**: Once the conditions mentioned above in paragraph 2 are met, I recommend application of CATEXs A2.3.11 and A2.3.7, and approval of this 813.

//Signed 1 Nov 19//
JOSEPH G. LINFORD, DAFC
Environmental Attorney

813 REVIEW - ID #35222
MARS ROVER LANDING SITE
SUTTR
CULTURAL RESOURCES REVIEW

The majority of the proposed project area has not been surveyed. The entirety of the project area will need to be surveyed prior to any work being undertaken. At that time a letter determining eligibility of any sites will be drafted and forwarded to SHPO. If eligible sites are found, a course of action must be determined in order to meet regulations in regards to these sites. The testing area will take place on established roads and previous disturbance and has minimal potential for impacts to cultural resources.

If any historic properties are found during the undertaking, activities in the immediate vicinity will cease, the Hill AFB Cultural Resources Program will be notified, and the unanticipated discovery procedures shall be implemented with direction from the Hill AFB Cultural Resources Program, and in accordance with the Hill AFB Integrated Cultural Resources Management Plan. Please contact Anya Kitterman (586-2464) if there are any questions.

23 October 2019 Anya Kitterman

Standard Operating Procedure

UNANTICIPATED DISCOVERY OF ARCHAEOLOGICAL DEPOSITS

APPLICABLE LAWS AND REGULATIONS

- National Historic Preservation Act
- National Environmental Policy Act
- Native American Graves Protection and Repatriation Act
- AFI 32–7065 (June 2004), *Cultural Resources Management Program*

OVERVIEW

All undertakings that disturb the ground surface have the potential to discover buried and previously unknown archaeological deposits. The accidental discoveries of archaeological deposits during an undertaking can include but are not limited to:

- Undiscovered/undocumented structural and engineering features; and
- Undiscovered/undocumented archaeological resources such as foundation remains, burials, artifacts, or other evidence of human occupation.

POLICY

When cultural resources are discovered during the construction of any undertaking or ground-disturbing activities, Hill AFB shall:

- Evaluate such deposits for NRHP eligibility.
- Treat the site as potentially eligible and avoid the site insofar as possible until an NRHP eligibility determination is made.
- Make reasonable efforts to minimize harm to the property until the Section 106 process is completed.
- **The BHPO will ensure that the provisions of NAGPRA are implemented first if any unanticipated discovery includes human remains, funerary objects, or American Indian sacred objects (see SOP #6).**

PROCEDURE

Step 1: Work shall cease in the area of the discovery (Figure 5-5). Work may continue in other areas.

- The property is to be treated as eligible and avoided until an eligibility determination is made. Hill AFB will continue to make reasonable efforts to avoid or minimize harm to

> Further construction activities in the vicinity of the site will be suspended until an agreed-upon testing strategy has been carried out and sufficient data have been gathered to allow a determination of eligibility. The size of the area in which work should be stopped shall be determined in consultation with the **BHPO**.

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the property until the Section 106 process is completed.

Step 2: Immediately following the discovery, the **Project Manager** shall notify the installation **BHPO**.

Step 3: The **BHPO** or a professional archaeologist shall make a field evaluation of the context of the deposit and its probable age and significance, record the findings in writing, and document with appropriate photographs and drawings.

- If disturbance of the deposits is minimal and the excavation can be relocated to avoid the site, the **BHPO** will file appropriate site forms in a routine manner.
- If the excavation cannot be relocated, the **BHPO** shall notify the office of the **SHPO** to report the discovery and to initiate an expedited consultation.

The Section 106 review process is initiated at this point.

- If the deposits are determined to be ineligible for inclusion in the NRHP, then Hill AFB **BHPO** will prepare a memorandum for record and the construction may proceed.
- If the existing information is inadequate for an NRHP eligibility determination, Hill AFB **BHPO** shall develop an emergency testing plan in coordination with the SHPO.

Step 4: Hill AFB shall have qualified personnel conduct test excavations of the deposits to determine NRHP eligibility.

- Hill AFB BHPO, in consultation with the SHPO, will determine appropriate methodology for NRHP eligibility determination.
- If the SHPO and Hill AFB agree that the deposits are ineligible for inclusion in the NRHP, then work on the undertaking may proceed.
- If the deposits appear to be eligible, or Hill AFB and the SHPO cannot agree on the question of eligibility, then Hill AFB shall implement alternative actions, depending on the urgency of the proposed action.
  - Hill AFB may relocate the project to avoid the adverse effect.
  - Hill AFB may request the Keeper of the National Register to provide a determination.
  - Hill AFB may proceed with a data recovery plan under a MOA developed in coordination with the SHPO and possibly the ACHP and interested parties.
  - **Hill AFB may request comments from the ACHP and may develop and implement actions that take into account the effects of the undertaking on the property to the extent feasible and the comments of the SHPO, ACHP, and interested parties. Interim comments must be provided to Hill AFB within 48 hours; final comments must be provided within 30 days.**

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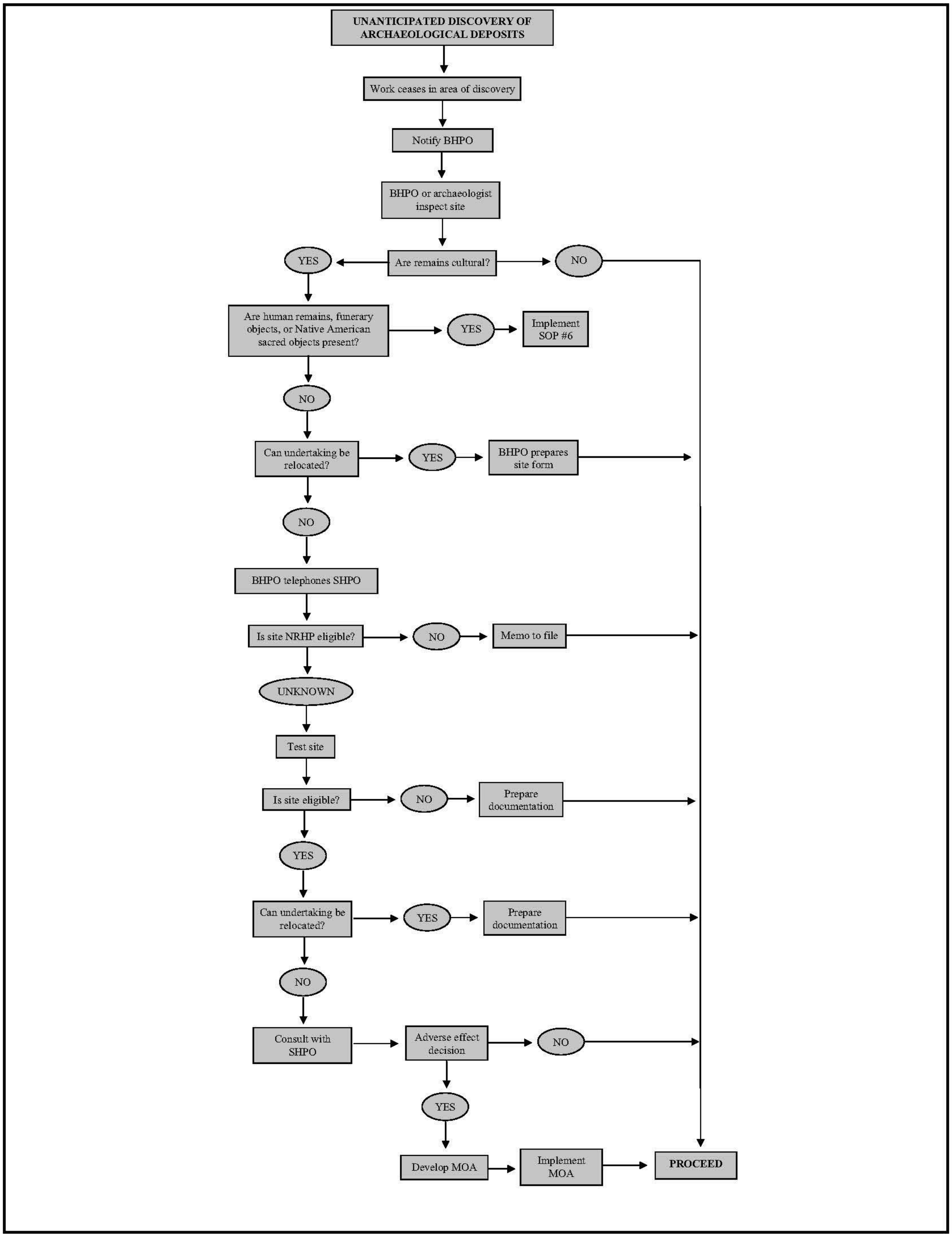
UNANTICIPATED DISCOVERY OF ARCHAEOLOGICAL DEPOSITS
Work ceases in area of discovery
Notify BHPO
BHPO or archaeologist inspect site
Are remains cultural?
YES
NO
Are human remains, funerary objects, or Native American sacred objects present?
YES
Implement SOP #6
NO
Can undertaking be relocated?
YES
BHPO prepares site form
NO
BHPO telephones SHPO
Is site NRHP eligible?
NO
Memo to file
UNKNOWN
Test site
Is site eligible?
NO
Prepare documentation
YES
Can undertaking be relocated?
YES
Prepare documentation
NO
Consult with SHPO
Adverse effect decision
NO
YES
Develop MOA
Implement MOA
PROCEED

UNANTICIPATED DISCOVERY OF ARCHAEOLOGICAL DEPOSITS ACRONYMS

ACHP – Advisory Council on Historic Preservation
BHPO – Base Historic Preservation Officer
MOA – Memorandum of Agreement
NAGPRA – Native American Graves Protection and Repatriation Act
NRHP – National Register of Historic Places
SHPO – State Historic Preservation Office

PROJECT CONFORMITY ANALYSIS DOCUMENTATION

Project Title: Mars Sample Return Earth Entry Vehicle
Project Number: 35222
DOPAA: The Mars Sample Return Earth Entry Vehicle (MSR-EEV) is a passive entry capsule being developed by NASA to return Mars soil and rock samples back to Earth. The MSR-EEV is planned to land without a parachute at the Utah Test and Training Range (UTTR). Because the EEV does not rely on a parachute, it will impact the ground at UTTR with a velocity as high as 50 m/s (112 mph). It is critical that the capsule structure survives the soil impact and that the impact loads imparted on the Mars samples do not exceed acceptable limits. Meeting these requirements is highly dependent on the soil properties in the intended landing area. The test operations will happen over the next few years with the actual satellite returning to earth in 2032.

Level I - Exempt Action Screening

The project is exempt if one of the following exemptions applies;

☒Action does not take place in a maintenance or nonattainment area (applies to UTTR).

☐Action specifically excluded in 40 CFR 93 Subpart B, exemptions applicable to Hill AFB are listed below.

☐ Routine maintenance and repair activities, including repair and maintenance of administrative sites, road, trails, and facilities

☐ Routine movement of mobile assets, such as ships and aircraft, in home port reassignments and stations (when no new support facilities or personnel are required) to perform as operation groups and/or for repair or overhaul.

☐ Actions, such as the following, with respect to existing structures, properties, facilities and lands where future activities conducted will be similar in scope and operation to activities currently being conducted at the existing structures, properties, and facilities, and lands; for example, relocation of personnel, disposition of federally-own existing structures, properties, facilities, and land, rent subsidies, operation and maintenance cost subsidies, the exercise of receivership or conservatorship authority, assistance in purchasing structures, and the production of coins and currency.

☐ Routine operation of facilities, mobile assets, and equipment.

☐Action does not result in any air emissions of NAAQS, HAPS or GHG as defined by 40 CFR 93 Subpart B, 32 CFR 989, AFI 32-7040 and R307-101.

☐Action is part of the New Source Review process and will require permitting.

☐Action has already been evaluated on a pervious environmental assessment. Please list title of environmental assessment.

Title: ____

Level II - Quantitative Assessment

Information necessary to complete formal quantitative analysis;

☐ACAM model results below federal indicators defined in 40 CFR 93 Subpart B

Level III - Quantitative Assessment

☐ACAM model result above federal indicators- **ADDITIONAL ANALYSIS REQUIRED**

Reviewed by: Sarah Jensen

ENVIRONMENTAL RESTORATION BRANCH (AFCEC/CZOM-IRP)

AF Form 813 Review
Requestor: Mike Shane
Work Request: 35222 – UTTR Mars Sample Return Earth Entry Vehicle

IRP Concerns:

There are no known restoration sites affected by this activity. However, any excavation in an area of industrial activity presents the potential to encounter contamination. In the event that explosives or ordnance contamination is encountered OR if unusual odors or soil discoloration are observed during any excavation or trenching necessary to complete this project and/or if any monitoring points are encountered, please contact EOD, Todd Hanson, 777-5502, and the Environmental Restoration POC, Ms. Elizabeth Tevault, 777-3804.

Environmental Restoration funds cannot be used to address contamination discovered during a construction project or any damaged incurred to monitoring points as a result of the project (MILCON or non-MILCON) per Section 6.4 of AFI 32-7020 (7 Nov 2014). If a construction project generates actions that result in the need to address contamination, repair damaged environmental infrastructure, or a need to change Environmental Restoration Program timelines to address known contamination, the costs of such actions are not eligible for the use of Environmental Restoration funds and shall be funded as part of the construction project. This includes the handling, mitigation, and disposal or other disposition of contaminated media discovered before or during the construction activity.

Excavations that result in the need for soil disposal will either dispose of clean soil at a permitted landfill or use as fill for another on-base project. If excavated soil is to be taken to a permitted landfill a tipping receipt must be provided to the project proponent. Please note, that each landfill may have its own requirements for certification on the material they receive; therefore, prior to excavated soil leaving HAFB it is advisable to understand and comply with those requirements.

Environmental Restoration Reviewer: Elizabeth Tevault, AFCEC (elizabeth.tevault@us.af.mil, 777-3804)

Reviewed on: 9/16/2021

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