

CHAPTER 1

INTRODUCTION AND PURPOSE AND NEED FOR THE ACTION

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1. INTRODUCTION AND PURPOSE AND NEED FOR THE ACTION

Chapter 1 of this Environmental Impact Statement (EIS) provides an overview of the activities of the National Aeronautics and Space Administration (NASA) Sounding Rockets Program (SRP) at Poker Flat Research Range (PFRR) and a brief history of the events leading to the development of this document. Chapter 1 also includes the purpose and need for agency action, the scope of the EIS and decisions to be made, the relationship of this EIS to other National Environmental Policy Act (NEPA) documentation, and a summary of the process used to obtain public input on the issues addressed in this EIS.

The National Aeronautics and Space Administration (NASA) has prepared this *Final Environmental Impact Statement for the Sounding Rockets Program at Poker Flat Research Range (PFRR EIS)* pursuant to the National Environmental Policy Act (NEPA), as amended (**42 U.S.C. 4321 et seq.**); the Council on Environmental Quality's NEPA implementing regulations (**40 CFR 1500–1508**); and NASA's procedures for implementing NEPA (**14 CFR 1216.3**) to analyze the environmental impacts of its continued use of the Poker Flat Research Range (PFRR). PFRR, located outside of Fairbanks, Alaska, is owned and managed by the University of Alaska Fairbanks (UAF). The U.S. Fish and Wildlife Service (USFWS), U.S. Bureau of Land Management (BLM), and UAF have served as cooperating agencies because they possess regulatory authority and specialized expertise regarding the proposed action analyzed in this *PFRR EIS*.

1.1 BACKGROUND

UAF is seeking authorizations from USFWS and BLM to allow for continued impact on and recovery from their lands of sounding rockets launched from PFRR as a part of the NASA Sounding Rockets Program (SRP). These authorizations are required because both agencies administer lands downrange from PFRR: USFWS administers the Arctic and Yukon Flats National Wildlife Refuges (NWRs), and BLM administers the White Mountains National Recreation Area (NRA) and Steese National Conservation Area. As such, NASA has prepared this *PFRR EIS* to fulfill the two Federal agencies' NEPA obligations as well as its own.

The purpose of this *PFRR EIS* is to evaluate the potential environmental impacts associated with the proposed action and reasonable alternatives, including a No Action Alternative.

1.1.1 NASA Sounding Rockets Program Background

The NASA SRP, based at the Goddard Space Flight Center's Wallops Flight Facility (WFF), supports NASA's strategic vision and goals for understanding the phenomena affecting the past, present, and future of Earth and the solar system and NASA's educational mission. The suborbital missions enabled by NASA SRP provide researchers with opportunities to build, test, and fly new instrument concepts while simultaneously conducting world-class scientific research. With its hands-on approach to mission formulation and execution, NASA SRP also helps ensure that the next generation of space scientists receives the training and experience necessary to move on to NASA's larger, more complex missions.

1.1.2 NASA Sounding Rockets Program Launch Sites

Sounding rockets can be launched from permanently established ranges or from temporary launch sites using NASA's mobile range assets. Permanent ranges include WFF in Wallops Island, Virginia; PFRR near Fairbanks, Alaska; White Sands Missile Range (WSMR) in White Sands, New Mexico; Kwajalein Island in the Marshall Islands Republic; Esrange Space Center near Kiruna, Sweden; and the Norwegian Sounding Rocket Ranges in Andøya, Norway and Ny-Alesund, Svalbard (Norway). In the past, there have been temporary launch sites in Australia, Brazil, Greenland, and Puerto Rico. The majority of sounding rocket launches occur at WFF, PFRR, and WSMR.

Where NASA SRP conducts its work is highly dependent on the scientific goals of each mission. For example, if equatorial phenomena must be observed, a site such as Brazil is used. For middle latitudes, WFF or WSMR is selected. If the aurora borealis must be observed, a site at very high latitudes is required, such as at PFRR.

1.1.3 PFRR Background

PFRR, located northeast of the unincorporated village of Chatanika, Alaska, consists of approximately 2,100 hectares (5,200 acres) of land that house rocket and payload support facilities, launch pads, and tracking infrastructure. Since the late 1960s, NASA, other government agencies, and educational institutions have supported suborbital rocket launches from PFRR. PFRR is owned and managed by the Geophysical Institute of UAF; however, NASA SRP has exclusively funded and managed the support contract with PFRR for more than 25 years.

The location of PFRR is strategic for launching sounding rockets for scientific research in auroral space physics and earth science. PFRR is the only high-latitude, auroral-zone rocket launching facility in the United States (U.S.) where a sounding rocket can readily study the aurora borealis and the Sun–Earth connection (discussed in more detail below). The information collected further assists the Nation's scientists in understanding the interactions between the Sun and Earth, as well as the origin and evolution of the solar system. Technology development and validation enabled by NASA SRP at PFRR is critical in furthering the development of earth and space science instruments at a fraction of the size and cost that would result from using other launch methods. PFRR also supports educational outreach programs in which students and scientists from various universities conduct aeronautics and space research.

1.1.4 Existing NASA SRP NEPA Documents and Context

In 2000, NASA published the *Final Supplemental Environmental Impact Statement for Sounding Rocket Program (SRP SEIS) (NASA 2000a)*. The 2000 *SRP SEIS* considered NASA SRP operations at a programmatic level and expanded upon the original *Final Environmental Impact Statement for Sounding Rocket Program (SRP EIS)* prepared in 1973 to include multiple launch sites, new launch vehicles, and updated environmental conditions. In its Record of Decision (ROD) for the 2000 *SRP SEIS*, NASA decided to continue NASA SRP operations at its current level of effort at all launch sites, including PFRR. Since then, NASA has launched

approximately four sounding rockets annually from PFRR primarily during the winter months (defined as October through April for the purposes of analysis).

Since issuing its ROD in June 2000, NASA has performed an annual NEPA review of all of its proposed sounding rockets missions, including those at PFRR. In each instance, NASA has found that all proposed missions have been within the scope of those analyzed in the 2000 *SRP SEIS*.

NASA most recently reviewed its 2000 *SRP SEIS* and determined that the overall environmental analysis in the document remains sufficient to support NASA's broad programmatic decision to continue NASA SRP; however, potential changes in both PFRR operations and the environmental context of the launch corridor north of PFRR warranted preparation of additional PFRR-specific environmental analysis to better inform NASA's decisionmaking regarding PFRR. For example, PFRR is now considering a more rigorous rocket spent stage and payload recovery process. Additionally, a large portion of downrange lands are undergoing Wilderness review, which could ultimately affect how rocket launches and payload recoveries are handled.

Accordingly, NASA began preparing an Environmental Assessment (EA) to determine if those changes potentially presented a significant impact necessitating an EIS. During the scoping process for the EA in the fall of 2010, NASA solicited input from over 75 potentially interested agencies and organizations. A number of conservation organizations expressed concern regarding NASA's continued operations at PFRR and requested that a more detailed assessment be performed. Considering this input, NASA decided that an EIS would be the most appropriate level of NEPA documentation for the proposal. This *PFRR EIS* tiers from the programmatic 2000 *SRP SEIS* and provides a focused analysis of NASA SRP operations at PFRR.

1.1.5 Science Conducted by NASA SRP at PFRR

To best understand the types of science enabled by the PFRR, one must first have a basic comprehension of the phenomena that are typically the subject of the research. The following section is intended to provide the reader with an overview of the natural forces that are most often studied and why they are of interest to the Nation's scientists.

NASA SRP facilitates research at PFRR primarily in support of a scientific discipline known as heliophysics; its name is derived from the Greek words *helios* for the Sun and *physika*, the science of the natural world. Heliophysics is the exploration of the Sun, its effects on Earth and the planets of the solar system, and space environmental conditions and their evolution. The study of heliophysics, also known as solar and space physics, is part of the national goal to maintain U.S. leadership in space science (White House 2012), and NASA follows the research priorities laid out by the National Research Council in its Decadal Survey (NAS 2012).

The Earth's upper atmosphere and magnetic field form a coupled system with the Sun and geospace (the space inside the protective cavity of Earth's magnetic field); therefore, a main scientific objective is to understand how the Sun, geospace, and Earth's upper atmosphere are connected in a single system.

A term commonly used in the heliophysical sciences is the “Sun–Earth connection,” which refers to the transfer of electromagnetic radiation and high-energy particles from the Sun to the Earth. This radiation consists of ultraviolet (UV), extreme UV, x-ray, and gamma rays that would be harmful to life on Earth if it were not protected by its upper atmosphere. The charged particles, referred to as the “solar wind,” would also be very harmful if Earth were not protected by its magnetic field, or magnetosphere, which excludes most of these energetic particles. However, the magnetosphere can also trap, store, and energize charged particles, with these upper-atmospheric electric currents forming what are known as aurorae. **Figure 1–1** shows a picture of an aurora borealis over PFRR.

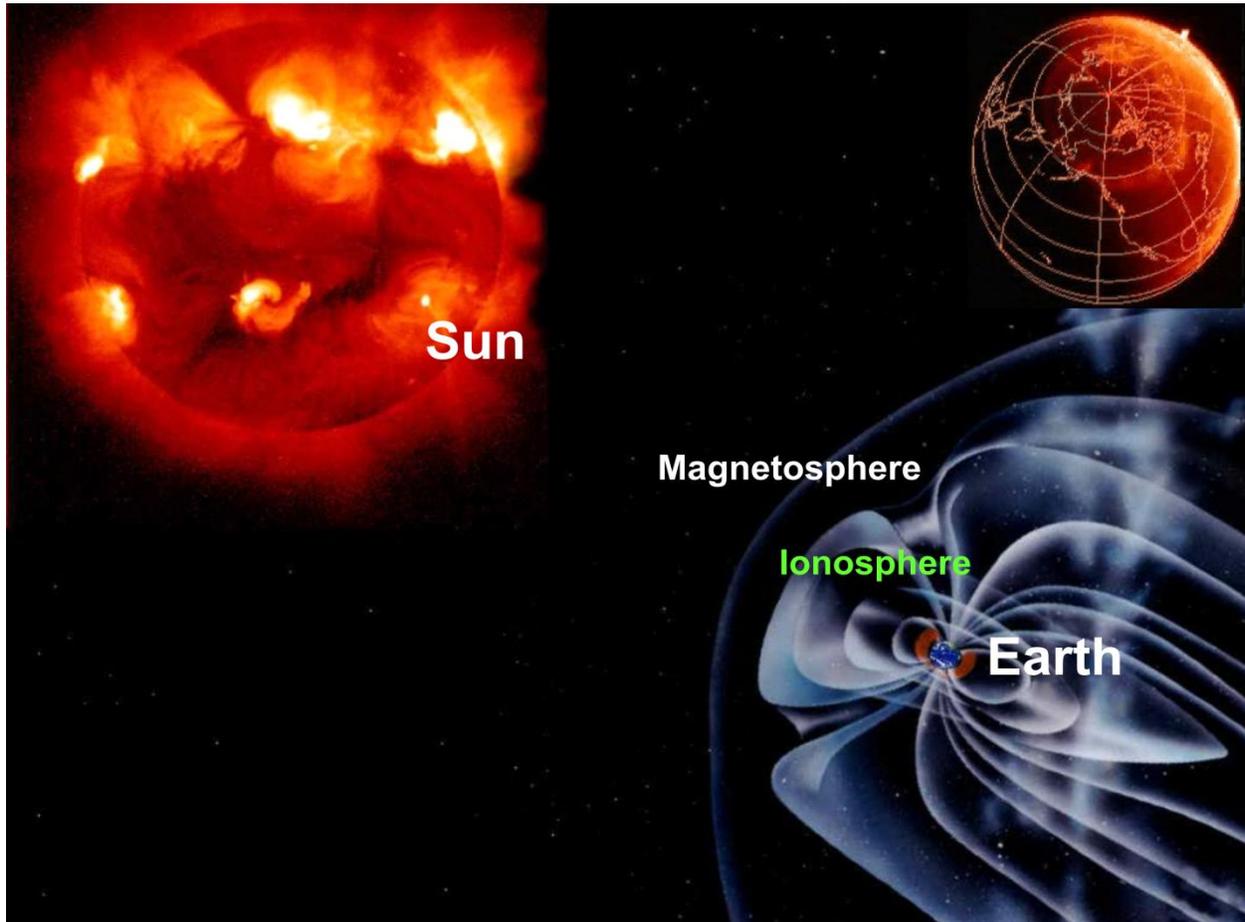


Source: GI 2010.

Figure 1–1. Aurora Borealis over Poker Flat Research Range

An aurora is a natural light display in the sky particularly in the high-latitude (Arctic and Antarctic) regions, caused by the collision of energetic charged particles with atoms in the upper atmosphere, which glow as they release the energy. The Earth’s magnetic field looks like that of a dipole magnet where the field lines are coming out and going into the Earth near the poles. The energized particles travel along the Earth’s magnetic field lines and are thus guided to the high-latitude atmosphere. Most aurorae occur at an altitude of 90–130 kilometers (56–81 miles) above Earth in a band known as the auroral zone, which is typically 3 to 6 degrees in latitudinal extent and at all local times or longitudes. The auroral zone is typically 10 to 20 degrees from the magnetic pole defined by the axis of the Earth’s magnetic dipole. **Figure 1–2** shows the

Sun–Earth connection with magnetic field lines coming into the magnetic poles. To see aurora, the sky must be dark and clear.



Source: UNH 2006.

Figure 1–2. Sun with Earth Protective Magnetic Field

As the presence of aurorae in the sky indicates disturbance in the upper atmosphere, their formation can also be associated with the disruption of a host of technologies upon which modern society heavily depends. Strong electrical currents driven into the Earth’s surface during auroral events can disrupt and damage modern electric power grids and may contribute to the corrosion of oil and gas pipelines. Changes in the ionosphere during geomagnetic storms interfere with high-frequency radio communications and global positioning system navigation. During polar cap absorption events caused by solar protons, radio communications can be severely compromised for commercial airliners on transpolar crossing routes. Exposure of spacecraft to energetic particles during solar energetic particle events and radiation belt enhancements can cause temporary operational anomalies, damage critical electronics, degrade solar arrays, and blind optical systems such as imagers and star trackers used on commercial and government satellites.

Therefore, to better understand and predict “space weather” and the effect of solar activity on the Earth, the U.S. government (represented not only by NASA, but other agencies such as the

National Science Foundation and National Oceanic and Atmospheric Administration) pursues a broad program of research that encompasses theory, modeling, and—particularly in NASA’s case—data collection from a variety of tools, including orbiting, satellites, ground-based observation stations, and in situ probes such as sounding rockets. Such investigations undertaken by NASA are selected based on community peer review, beginning with scientific priorities as indicated in the Decadal Survey from the National Research Council and ending with individual experiments selected by a panel of recognized experts. All missions recently flown by NASA at PFRR, and all missions scheduled for the foreseeable future, have been selected following a rigorous review for scientific merit (**NASA 2013a, 2013b**).

Most of the investigations selected for sounding rocket missions at PFRR address questions that can only be addressed with in situ probes on sounding rockets. For example, the aurora contains a large range of unexplained, critical phenomena that can only be explored with in situ probes on sounding rockets, which gather vertical profiles of measured parameters, which are essential for the study of the upper atmosphere and ionosphere. In some cases, Earth-orbiting satellites cannot gather adequate measurements as the satellites are traveling too fast or are too high.

Accordingly, to fill these scientific requirements, researchers develop experiments that fly aboard sounding rockets at high-latitude launch sites such as PFRR. A majority of the science enabled by PFRR can be considered fundamental science (or pure science), the goal of which is to understand the most basic forces of a phenomenon, relationships between them, and laws governing them. The knowledge gained by the research at PFRR can then be applied practically by scientists and engineers in related disciplines, such as in the design of a more resilient communications system or a more corrosion-resistant pipeline.

The data collected at PFRR also benefit meteorological research, though mainly indirectly. For example, science conducted at PFRR provides high-latitude data that support the understanding of the Earth’s global electric circuit, which is maintained by the flow of electricity from thunderstorms in the troposphere into the ionosphere and magnetosphere, eventually returning to the ground through the fair-weather atmosphere and closing via lightning (**Bering et al. 1998**). Researchers have identified at least three processes in which variations in solar wind parameters can be coupled into the stratosphere and troposphere, and each of these modulate the flow of current density in the global electric circuit (**Tinsley 2000**).

Climate change research also benefits from the data collected at PFRR. In fact, solar variability is now becoming accepted as a serious potential contributor to global-scale climate variability during the pre-industrial period, and as possibly a significant contributor even today (**Reid 2000**). **Ney (1959)** first suggested that the solar wind has the potential for causing climate change through an indirect mechanism of affecting the flux of high-energy cosmic-ray particles that can penetrate to the upper troposphere. The author suggested that the resultant ionization could affect lightning in the troposphere, and give rise to an 11-year cycle in thunderstorm activity.

Dickinson (1975) suggested that there could be a relationship between solar activity and cloudiness by way of cosmic-ray ionization. **Tinsley (2000)** suggests that there could be a number of cloud microphysical processes affected by charge distributions in the atmosphere

responding to solar wind inputs. Solar-wind and cosmic-ray effects on cloud formation remain a controversial aspect of Sun–climate relationships, and there is still much to be learned about the topic. Despite the controversy, all researchers agree on one point: more data and more basic research in the upper atmosphere and ionosphere are needed to make progress in understanding this critical aspect of the future of the planet Earth.

More recently, climate change research has expanded to include the upper atmosphere, where greenhouse gases produce a cooling effect, instead of a warming effect (**Lastovicka et al. 2008**). Increases in greenhouse gas concentrations are expected to induce substantial changes in the mesosphere, thermosphere, and ionosphere, including a thermal contraction of these layers. The observed “lowering” of the ionosphere (**Qian et al. 2008**) could also be a proxy for climate change.

Data collected by sounding rockets (*e.g.*, ionospheric density, neutral density and temperature, electric fields) in these upper-atmospheric regions can also be utilized to develop and calibrate atmospheric models to assess change (*e.g.*, **Qian et al. 2008**). Of particular note are those “whole atmosphere” models that can consistently simulate the dynamic processes of the Sun–Earth system, which will enable a quantification of the interactions of the lower and upper atmosphere, as well as the atmospheric impacts from the solar output and ionosphere/magnetosphere (**Liu et al. 2010**). These models require data to perform realistic predictions. The only way to gather the necessary direct measurements in the upper atmosphere (altitudes between 30 and 160 kilometers [20 and 100 miles]) is with probes on sounding rockets.

In addition to the majority of PFRR missions, which study the aurora and its associated physical processes, some missions’ objectives are directly related to weather and climate change. For example, a February 2011 mission investigated a technique to measure the nighttime distribution of nitric oxide, a compound produced by aurora and thought to descend to lower altitudes during long polar nights, where it is a destroyer of ozone. If this process occurs, it is likely to impact the wind patterns of the stratosphere, which would then affect the Earth’s climate.

Table 1–1 provides a summary of recent sounding rockets science missions. Additionally, Appendix J contains a bibliography of scientific papers detailing results of sounding rocket science missions from PFRR, including those published in peer-reviewed scientific journals.

Table 1–1. Science Provided by Selected PFRR Sounding Rocket Missions

Science	Mission	Date	Scientific Purpose
Space Weather	30.058UE and 30.059UE Lynch	January – February 2005	To make multiple measurements of the structure of mesospheric dust layers under varying conditions using identical instrumentation. Data obtained from these missions will be utilized to study the effects of mesospheric meteoric dust layers on mesospheric and atmospheric processes such as sudden atom layers, noctilucent clouds, and polar mesospheric summer echoes.
Magnetospheric, Ionospheric, Thermospheric, and Mesospheric Physics	<p>JOULE II: Multiple Scale Study of High-Latitude Joule Heating During a Substorm Event</p> <p>ROPA: Rocket Observations of Pulsating Aurora</p> <p>HEX 2: Investigations of Mesoscale Drivers for Vertical and Horizontal Winds in the High-Latitude Lower Thermosphere</p> <p>CHARM: Correlations of High Frequencies and Auroral Roar Measurements</p>	January – February 2007	2007 campaign of 10 launches to investigate disturbances in the ionosphere near the magnetic field. Four separate scientific missions were conducted, with each mission consisting of ground-based observations of the ionosphere followed by a series of sounding rocket launches once specific phenomena were observed. A series of 10 sounding rockets were launched carrying a variety of payloads into the ionosphere to make in situ measurements of the observed phenomena.
Ionospheric Physics, Student Mentoring	30.073UO Thorsen	January 10, 2009	To measure plasma and geomagnetic structure of the high-latitude D-region.

Table 1–1. Science Provided by Selected PFRR Sounding Rocket Missions (continued)

Science	Mission	Date	Scientific Purpose
Auroral Science	21.139 and 36.242UE Bounds	January 29, 2009	To study electric fields and current structure within an aurora.
Earth's Ionosphere Thermosphere System and the Sun–Earth Interface	41.077, 41.078, 41.079UE Lehmacher	February 18, 2009	To determine the uppermost levels of neutral air turbulence in the Earth's atmosphere.
Auroral Science	40.023UE Lynch	March 20, 2009	To investigate motions and structure of electron precipitation in a pre-midnight poleward edge discrete aurora.
Atmospheric Science and Climate	Polar NOx 36.256UE Bailey	February 4, 2011	To investigate a technique where the attenuation of star light was used to measure the nighttime altitude distribution of nitric oxide, a compound produced by aurora and thought to descend to lower altitudes during long polar nights, where it is a destroyer of ozone. If this process occurs, it is likely to impact the wind patterns of the stratosphere which would then affect the Earth's climate.

1.1.6 Cooperating Agency Decisionmaking

This *PFRR EIS* serves as a decisionmaking tool not only for NASA but also for its two Federal cooperating agencies, USFWS and BLM. Directly north of PFRR is its downrange launch corridor, over which rockets are launched and within which spent stages and payloads impact the ground. Within the launch corridor are landmasses owned or managed by several Federal, state, and Alaska Native organizations, including USFWS, BLM, Alaska Department of Natural Resources, Doyon Limited (an Alaska Native regional corporation created by the Alaska Native Claims Settlement Act), and the Native Village of Venetie Tribal Government (see **Figure 1–3**).

1.1.6.1 BLM

Regulatory Authority

BLM manages and administers the use of Federal public lands and resources on behalf of the U.S. Department of the Interior in accordance with the Federal Land Policy and Management Act of 1976, as amended (FLPMA) (**43 U.S.C. 1701 et seq.**).

FLPMA prescribes a land management approach by which public lands are managed under principles of multiple use and sustained yield as defined by the respective land use plans prepared for the area under consideration.

BLM's Eastern Interior Field Office in Alaska manages approximately 3.2 million hectares (8 million acres) of public lands in east-central Alaska, including the north and south units of the Steese National Conservation Area and the White Mountains NRA. More detail regarding these lands, including the purposes for which they were established, is provided in Chapter 3, Sections 3.8.2.1 and 3.8.2.2, of this EIS.

Background with PFRR

Prior to 2006, BLM considered the deposition and removal of rocket parts to be *casual use* as defined by 43 *Code of Federal Regulations* (CFR) 2801.5(b). Due to the need to coordinate the use of Crowberry Cabin during some rocket launches, a letter of agreement was developed to outline responsibilities and procedures for both parties.

Since 2006, BLM has authorized the deposition and removal of rocket parts by permits under 43 CFR 2920 in 2007, 2010, and 2012. BLM prepared an EA (EA-AK 024-07-003) and a Categorical Exclusion (DOI-BLM-AK-02000-2010-0011-CX) for these actions in accordance with NEPA.

1.1.6.2 USFWS

Regulatory Authority

USFWS administers NWRs on behalf of the U.S. Department of the Interior in accordance with the National Wildlife Refuge System Administration Act of 1966, as amended (NWRSA) (**16 U.S.C. 668dd-668ee**). These lands are administered for the conservation, management, and, where appropriate, restoration of the fish, wildlife, and plant resources and their habitats. The Alaska Region (Region 7) of USFWS administers 16 NWRs within the state of Alaska. The purpose of Arctic and Yukon Flats NWRs is to conserve fish and wildlife populations and habitats in their natural diversity; to fulfill international treaty obligations of the United States; to provide opportunities for continued subsistence; and to ensure adequate water quality and quantity for fish, wildlife, and their habitats. More detail regarding these lands, including the purposes for which they were established, is provided in Chapter 3, Sections 3.8.2.3 and 3.8.2.4, of this EIS.

USFWS is authorized to permit by regulations the use of any area within the NWR system provided "such uses are compatible with the major purposes for which such areas were established." When a use by the public is proposed on an NWR, the refuge will first determine if the use is compatible. A compatible use is a proposed or existing wildlife-dependent recreation use *or any other use* of an NWR that, based on sound professional judgment, would not materially interfere with or detract from the fulfillment of the NWR system mission or the purposes for which an NWR was established. A refuge compatibility determination, with associated protective stipulations to ensure compatibility, is then prepared by USFWS and

subject to public review and comment. If found compatible, the NWR may then authorize the use pursuant to the NWRSA and the Refuge Recreation Act (**16 U.S.C. 460 K-460K-4**). The authorization will stipulate the conditions that are necessary to ensure compatibility of the use. Compatibility determinations are re-evaluated at least every 10 years, except for wildlife-dependent public uses, which are re-evaluated every 15 years. In the case of an existing activity or use already authorized, as is the situation with PFRR, the Refuge Manager will work with the permit holder to modify the activity or use to make it compatible or will terminate the permit.

Background with PFRR

Since 1983, USFWS Refuge Managers have issued annual Special Use Permits to UAF authorizing deposition and removal of rocket parts from PFRR on Arctic and Yukon Flats NWRs. Prior to issuing these permits, compatibility analyses were conducted with all determinations to date authorizing UAF to operate on NWR lands based on the following justification: (1) Rocket deposition and removal from NWR lands has been ongoing, and past experiences over the long-term have shown that minimal impacts on NWR resources have occurred; (2) Research conducted from PFRR contributes to the greater understanding of the natural world, including issues like global climate change; and (3) As a science-based agency, USFWS encourages scientific research that benefits the American public and does not detract from the purposes for which an NWR was established. Stipulations in the permits issued since 2009 have become more restrictive and require a viable Recovery Program to ensure minimal impact on NWR resources over the long-term.

It should be noted that previous compatibility determinations conducted in 1994 and 2005 by Arctic and Yukon Flats NWRs have authorized PFRR to operate on Federal lands classified as minimally managed. Minimally managed lands are managed to maintain natural environmental conditions with very little evidence of human-caused change and to minimize disturbance to habitats and resources. Ground-disturbing activities are to be avoided wherever possible. As a cooperating agency in preparing this *PFRR EIS*, it is the intention of USFWS to ensure that proposed actions by PFRR are compatible with refuge purposes for both the Arctic and Yukon Flats NWRs.

1.1.6.3 *Decisionmaking Context*

This *PFRR EIS* is largely the result of a deficiency of PFRR in meeting the Yukon Flats and Arctic NWRs Special Use Permit stipulation of maintaining a viable Recovery Program for rocket components. As such, in cooperation with NASA and UAF, BLM and USFWS are currently considering if and how future authorizations for sounding rocket impact and recovery would be issued for the lands under their management. Additionally, both agencies are currently preparing long-term management plans for their respective landholdings. BLM is currently updating its Eastern Interior Resource Management Plan; Arctic NWR is updating its Comprehensive Conservation Plan; and the process for updating the Yukon Flats NWR Comprehensive Conservation Plan is expected to begin within the next several years. The results of these planning processes will play a significant role in how future launches from PFRR would occur. As such, this *PFRR EIS* considers the effects of each agency's respective permitting actions within the context of their long-term management objectives.

All current landowner-issued authorizations (*e.g.*, compatibility determinations, Special Use Permits) for PFRR operations are included in Appendix C. Additionally, prior to issuing its respective authorization, each Federal land management agency must also ensure that the proposed use would not adversely affect subsistence use resources. These impacts are analyzed by a Subsistence Specialist in a Section 810(a) evaluation pursuant to the Alaska National Interest Lands Conservation Act. Appendix D provides both a detailed description of the Section 810(a) process and a specific evaluation of future NASA sounding rocket operations at PFRR.

1.2 PURPOSE

1.2.1 NASA (Lead Agency) Purpose Statement

NASA's purpose for action is to ensure the continued safe and cost-effective sounding-rocket-based scientific investigations at PFRR. NASA launches sounding rockets at PFRR to support advancement of scientific knowledge of the Sun–Earth connection, the upper atmosphere, and global climate change. NASA intends to maintain a high-latitude launch site in the U.S. to support this research, as it is critical to the understanding of the aforementioned science. To meet this purpose, NASA needs UAF to secure authorizations on its behalf from USFWS and BLM to continue use of PFRR.

1.2.2 BLM (Cooperating Agency) Purpose Statement

BLM has received a permit application (**USDOI 2010**) from PFRR. The purpose of BLM's action is to respond to the request for use of public lands under the authority granted to the U.S. Department of the Interior by the FLPMA. If approved, the authorization would allow rocket impacts and recovery of rocket hardware from the White Mountains NRA and Steese National Conservation Area.

1.2.3 USFWS (Cooperating Agency) Purpose Statement

Similar to BLM, USFWS has received a permit application from PFRR. The purpose of the USFWS's action is to: (1) respond to the request for use of public lands; and (2) assist NASA in modification of the PFRR program to allow for an effective Recovery Program for rocket hardware, both of which support the authorities granted to USFWS by the NWRSA. If approved, the authorization would allow rocket impacts and recovery of rocket hardware from non-wilderness areas within Arctic and Yukon Flats NWRs.

1.3 NEED

1.3.1 NASA Need Statement

The proposed action is needed to ensure that NASA and the global science community have a U.S.-based launch capability to conduct experiments to aid in the understanding of the phenomena affecting the past, present, and future of the Earth and the Sun–Earth connection. Sounding rockets permit the only means to study the lower atmosphere (40–80 kilometers [25–50 miles]) and the middle ionosphere (80–150 kilometers [50–93 miles]) with direct

measurements, and the only means to explore the upper ionosphere (150–1,500 kilometers [93–930 miles]) with vertical trajectories on slowly moving platforms. These are essential regions of the Earth's environment and must be measured to understand how the Earth and space interact and phenomena such as the aurora. The northern location of PFRR is strategic for launching NASA sounding rockets for scientific research in auroral space physics and earth science. PFRR is the only high-latitude, auroral-zone rocket launching facility in the United States where a sounding rocket can readily study the aurora borealis and the Sun–Earth connection as described in Section 1.1.6.

PFRR offers a number of operational and scientific features that enhance its usefulness to the NASA SRP scientific mission, including the following:

- The launch pads are directly within the Earth's auroral zone, a key region where energy is transferred between the atmosphere and the magnetosphere and solar wind. The range is also well located for studies of other Arctic atmospheric phenomena, such as polar mesospheric summer echoes and noctilucent clouds.
- The available flight corridor enables high-altitude, long-range rockets to be launched safely toward the north.
- The range permits up to five nearly simultaneous launches, including ones along different azimuths (for low-altitude trajectories).
- The range includes an unprecedented array of established, ground-based research instruments (*e.g.*, magnetometers, all-sky cameras, and lidars) that are part of the infrastructure and are broadcast to the science operations center to permit launches into optimum scientific conditions. The data from decades of observations from these ground-based instruments constitute an essential knowledge base that provides the environmental context for interpreting rocket measurements.
- The range includes a world-class, state-of-the-art, National Science Foundation incoherent scatter radar that allows correlative measurements to be obtained with the rocket launches, therefore enhancing the overall scientific return. This radar enables observations of the upper atmosphere through its advanced capabilities, notably its ability to measure variations in the ionosphere continuously over extended time scales and with high resolution (**NSF 2005**).
- The range allows sounding rockets to be launched over accessible sites on land, permitting observers to be located downrange with optical and other instruments and including autonomous instrument observations from downrange stations (*e.g.*, Fort Yukon and Kaktovik) over which the sounding rockets fly. Only optical observations nearly along the magnetic field direction allow assessment of the spatial distribution of the aurora. This is especially important when small-scale auroral structures are critical to the science. If the optical observations are made at too low of elevation angle (*i.e.*, away from the magnetic field direction), auroral structures cannot be resolved and will blend together.

- Directly north (downrange) of the launch site are vast areas of open, very sparsely populated lands. Having the ability to launch sounding rockets safely over such a vast area with very low population density is critical to ensuring public safety.
- The range enables the recovery of rocket payloads.
- The range offers the unique advantages of being located near a permanent staff of university space physics scientists (at UAF) dedicated to studying the aurora, and of being located at a site at the southern edge of the zone where most aurorae occur.
- The range has good road access. Its proximity to Fairbanks means NASA scientists and others are able to travel to the project site on regular commercial flights. Fairbanks also provides good accommodation for campaign personnel and extensive local businesses from which goods and services can be obtained as needed to support launch operations.
- Because of its affiliation with UAF, there are many opportunities for student groups to experience a sounding rocket launch or to see a mission in preparation, *e.g.*, as a class excursion. Furthermore, the lack of restrictions on foreign national access to the range enhances the opportunities for missions involving international collaboration.

Technology development and validation enabled by NASA SRP at PFRR are critical in furthering the development of earth and space science instruments at a fraction of the size and cost that would result from using other launch methods.

Additionally, as discussed in Sections 1.1.7.3 and 1.2.3, NASA needs to modify its operations at PFRR to ensure future authorizations for use of Federal lands are provided to UAF by both USFWS and BLM.

1.3.2 BLM and USFWS Need Statement

The two Federal cooperating agencies' proposed actions are needed because the Secretary of the Interior delegated the authorities granted in the FLPMA and NWRSA to BLM and USFWS, respectively, to authorize the use of public lands in accordance with their guiding policies for management.

1.4 PUBLIC INVOLVEMENT IN DEVELOPING THE SCOPE OF THIS EIS

NASA has pursued multiple avenues to notify the public of opportunities for involvement and methods to comment on NASA's intent to prepare an EIS, as outlined below.

1.4.1 Pre-EIS Scoping

NASA began the preparation of an EA in 2010 to determine if changes in both PFRR operations and the environmental context of the launch corridor north of PFRR potentially presented a significant impact necessitating an EIS. During the scoping process for the EA in the fall of 2010, NASA solicited input from over 75 potentially interested agencies and organizations. The scoping comments received as a part of the 2010 EA effort led to NASA's decision to prepare this *PFRR EIS* and were therefore considered for establishing the scope of the document.

A summary of the comments received during the NASA 2010 EA scoping process, along with where the comment is addressed in this EIS, as applicable, is presented by topic area in **Table 1–2**.

Table 1–2. NASA 2010 Environmental Assessment Scoping Comments Summary

Comment	Addressed in EIS?	If yes, location; if no, rationale
Level of Environmental Analysis		
The NEPA documentation should be changed from an EA to an EIS.	Yes	1.4.1
Concerns that there was a gap in a compatibility finding to the 2000 <i>SRP SEIS</i> to cover 2000–2005.	No	Outside the scope of this EIS.
The environmental analysis should include: <ul style="list-style-type: none"> ○ Designated trails occurring on Federal public lands on the maps, notably the White Mountains National Recreation Area. 	Yes	4.8.2.1
<ul style="list-style-type: none"> ○ All landings, including rockets, missiles, balloons, and any other vehicles or objects that have been launched and landed since 1969. 	Yes	4.15.12
<ul style="list-style-type: none"> ○ The percentage of the fallout materials that return to Earth that has been recovered. 	Yes	2.1.7.2
<ul style="list-style-type: none"> ○ Technical information regarding why some stages can be tracked and recovered and others cannot, including if the limitation is a cost limitation. 	Yes	2.5.5 and 2.5.8
<ul style="list-style-type: none"> ○ Methods for recovering all stages of the types of rockets that land on public lands. 	Yes	2.1.7.2
<ul style="list-style-type: none"> ○ The types and utility of the experiments in SRP. 	Yes	1.1.6
<ul style="list-style-type: none"> ○ The duration of the authorizations sought from USFWS and other Federal land managers, as well as any renewal procedures or procedures to make changes to the authorizations. 	Yes	1.1.7.3
<ul style="list-style-type: none"> ○ Definition of a mission (<i>i.e.</i>, one research vessel/rocket being launched during a “mission” or several). 	Yes	2.1.1
<ul style="list-style-type: none"> ○ A layperson’s version of NASA’s methods for estimating where debris will land and if winds and climate parameters in the layers of the atmosphere the rockets are passing through on launch and reentry are taken into consideration; request for how values are acquired/derived. 	Yes	2.1.6.1 and 2.1.6.2

Table 1–2. NASA 2010 Environmental Assessment Scoping Comments Summary (continued)

Comment	Addressed in EIS?	If yes, location; if no, rationale
Alternatives		
Request for analysis of alternatives to PFRR research conducted at altitudes of 50 to 90 kilometers (31 to 56 miles).	Yes	2.5.4
Request for analysis of alternative launch locations.	Yes	2.5.2, 2.5.3, and Appendix B
Request for analysis of other areas that could be used for this program that are alternatives to the current location.	Yes	2.5.2, 2.5.3, 2.5.8, and Appendix B
Support for EA Alternative 3, Complete Recovery, to reduce the amount of manmade debris strewn about the state, subject to the affected property owner’s concurrence.	Yes	2.3.5
Cooperating Agencies		
NASA should involve USFWS and BLM as principal agencies, rather than cooperating agencies.	No	NASA is the Federal action proponent and, therefore, the lead agency.
NASA should involve USFWS in this EIS with greater examination of compatibility between Wilderness Areas and launch program.	Yes	4.8
Concern about impacts on the Arctic Refuge Comprehensive Conservation Plan.	Yes	4.15.1.6 and 4.15.5.4
Public Awareness		
Concerns that public, community, and native villages are unaware of the EA.	Yes	1.4
Suggestion to include public meetings at places such as the Chatanika Lodge on the Steese and Hilltop Café on the Elliott, given that impacts occur within the borough and near the settled areas of the Steese and Elliott Highways.	No	NASA mailed meeting notices to Chatanika Lodge.

Table 1–2. NASA 2010 Environmental Assessment Scoping Comments Summary (continued)

Comment	Addressed in EIS?	If yes, location; if no, rationale
Wilderness Areas and Minimal Management Areas		
Concerns about impacts on lands undergoing Wilderness Review and the non-wilderness character of rocket launches and debris.	Yes	4.15.5.4
Comment that the Arctic National Wildlife Refuge provides unparalleled wilderness experience and is of extraordinarily high cultural, subsistence, recreation, wilderness, and wildlife value.	Yes	3.8.2.3
Comment that sending rocket debris into the Arctic Refuge is a gross violation of the wild character of the Arctic Refuge.	No	Does not request analysis of a specific environmental resource area or alternative.
Comment to treat minimal management areas as though they are fully designated Wilderness Area.	No	This decision is outside of the scope of this EIS.
The environmental analysis should identify potential impacts on wilderness/remote experience users.	Yes	4.8
Concerns about impacts on designated Wilderness Areas and Wilderness Study Areas. The probability should be stated and represented by showing the different levels of uncertainty (one- to X-sigma) around each predicted landing for each stage of each rocket. The boundaries of designated Wilderness Areas and Wilderness Study Areas should be included on the maps. Stages recovered from designated wilderness in the past should be identified, including stage, predicted landing coordinates, actual landing coordinates, and means of recovery.	Yes	4.8 and 4.15.5
Biology		
Concerns about wildlife mortality and habitat disturbance from direct strikes and shrapnel.	Yes	4.7.4 and 4.7.6
Soils		
Concerns about soil contamination from hazardous materials and ground disturbance from direct strikes and shrapnel.	Yes	4.4 and 4.12

Table 1–2. NASA 2010 Environmental Assessment Scoping Comments Summary (continued)

Comment	Addressed in EIS?	If yes, location; if no, rationale
Water		
Concerns about water contamination from hazardous materials and ground disturbance from direct strikes and shrapnel.	Yes	4.3 and 4.12
Concern regarding the batteries/radioactive material/debris impacting the waterways.	Yes	4.3 and 4.12
The location of the proposed project is not within the coastal zone boundaries of the Alaska Coastal Management Program. Therefore, a state review for consistency is not required.	Yes	4.3.1
There may be waters of the United States under U.S. Army Corps of Engineers regulatory jurisdiction impacted by the PFRR activities.	Yes	3.3.1
Concerns about large debris landing in the riverways, and potentially impeding traffic or becoming a hazard to navigation. (The U.S. Coast Guard will be conducting outreach and research into the types and volume of vessel traffic the rivers located in the various impact zones [there are a few barges that are known to operate out of the Nenana and other immediate areas, but the extent of their operations on the identified river impact zones is unknown]).	Yes	4.3.2.1
Concerns from the Coast Guard that if a rocket impact zone is within a waterway, the Coast Guard has a duty to create a safety or security zone to provide public awareness.	Yes	2.1.6.1
Hazardous/Solid Waste		
Concerns about hazardous material impacts on persons or wildlife.	Yes	4.7.4, 4.7.6, 4.12, and 4.13
Concerns about recovery of existing debris.	Yes	2.1.7.2 and 4.15.9
Request to know types of hazardous substances involved in the program and impacts on Federal lands; the risk of releasing these hazardous materials to the environment; whether or not hazardous materials have been released, and if so, what quantities in each particular site; and what the methods and success rate for cleanup have been and/or will be in the future.	Yes	4.12 and 4.13

Table 1–2. NASA 2010 Environmental Assessment Scoping Comments Summary (continued)

Comment	Addressed in EIS?	If yes, location; if no, rationale
Recreation and Subsistence Hunting		
Concerns about impact on recreation, specifically the Arctic National Wildlife Refuge, including its designated wilderness lands and designated Wild River corridors, and Yukon Flats National Wildlife Refuge, including its Wild River corridor and agency-recommended Wilderness Area, as well as other Federal lands in the area in question, such as Beaver Creek National Wild and Scenic River and White Mountains National Recreation Area.	Yes	4.3 and 4.8
The environmental analysis should include designated trails occurring on Federal public lands on maps (<i>i.e.</i> , White Mountains National Recreation Area).	Yes	4.8.2.1
Concerns about impacts on subsistence value of all Federal lands involved.	Yes	4.7.5, 4.10, and Appendix D
Socioeconomics		
The environmental analysis should include a cost/benefit analysis addressing: <ul style="list-style-type: none"> ○ Annual program budget. 	Yes	4.14.1
<ul style="list-style-type: none"> ○ Rocket recovery budget under each alternative. 	Yes	2.3.4
<ul style="list-style-type: none"> ○ Costs of alternatives. 	Yes	4.14.1
<ul style="list-style-type: none"> ○ Whether more cost-effective alternatives exist to obtain the results/information provided by the NASA SRP. 	Yes	2.5.4
Miscellaneous Concerns		
Concerns about other agencies being able to obtain launch permits at PFRR.	No	Outside the scope of this EIS.
Concerns about violations of Alaska National Interest Lands Conservation Act, National Wildlife Refuge System Improvement Act, Federal Land Policy and Management Act, Wilderness Act, and NEPA.	Yes	4.8

Key: BLM=U.S. Bureau of Land Management; EA=Environmental Assessment; EIS=Environmental Impact Statement; NASA=National Aeronautics and Space Administration; NEPA=National Environmental Policy Act; PFRR=Poker Flat Research Range; SRP=Sounding Rockets Program; *SRP SEIS*=Final Supplemental Environmental Impact Statement for Sounding Rocket Program; USFWS=U.S. Fish and Wildlife Service.

1.4.2 EIS Scoping

Notice of Intent

The scoping process began with the publication of a Notice of Intent (NOI) in the *Federal Register* on April 13, 2011, announcing NASA's intent to prepare an EIS to analyze the environmental and socioeconomic impacts associated with continuing sounding rocket operations at PFRR. The publication of the NOI officially marked the beginning of the scoping period, during which time NASA accepted public comments on the proposed action. The NOI also provided background information; the proposed alternatives, including a No Action Alternative; a request for comments; a point-of-contact; and an announcement of the public scoping meeting times and locations. A copy of the NOI is included in Appendix A.

Correspondence

Pursuant to American Indian/Alaska Native Policy and Implementation Guidance, NASA mailed and faxed official government-to-government consultation letters inviting Alaska Native leadership and members to participate in the scoping process for the preparation of this EIS. The letter provided information similar to that contained in the NOI. A copy of this letter and the enclosures describing the proposed action are included in Appendix A. Alaska Native consultation responses to the letter are also contained in Appendix A.

On April 14, 2011, NASA distributed a scoping letter to government representatives, the general public, and agencies having jurisdiction over resources within the PFRR region of influence. The purpose of this letter was to share details regarding the proposed actions and alternatives, advertise the scoping meetings, and receive feedback from various agencies regarding the potential issues of concern.

Media

NASA distributed newspaper and radio advertisements to announce the NOI and the scoping meetings. In addition, NASA distributed a public scoping press release to newspaper, television, and radio channels covering the locations where public scoping meetings were being held. NASA representatives interacted with media during the scoping period. Media interactions included a radio interview with the Fort Yukon public radio station, KZPA; an interview with the Fairbanks local television station, radio station KTVF; and an interview with UAF Geophysical Institute Science Writer, Ned Rozell.

Meetings

NASA held five scoping meetings from April 28 through May 3, 2011, in Fort Yukon, Fairbanks, and Anchorage, Alaska to gather community-specific issues and concerns on which to focus this EIS analysis. The public scoping meetings provided an opportunity for the public to receive information about the proposed action and alternatives and assist NASA in identifying potential environmental impacts and key issues of concern. At the meetings, NASA provided comment forms; an email address; a recorder who could enter oral comments by attendees either

in private or during the comment portion of the meetings; and contact information for standard mail, phone, and fax. Twenty-eight people, including governmental and PFRR representatives, signed in as attending the public scoping meetings.

Identification of Issues

NASA solicited input from approximately 140 potentially interested citizens, tribes, agencies, and organizations. Overall, local citizens, tribes, and agencies were mostly concerned about the rocket spent stages landing in the Wilderness Areas, including concerns about physical and chemical impacts, as well as impacts on the wilderness aesthetic values. Commenters also had concerns about the lack of awareness that these rocket launches are ongoing. During the NASA 2010 EA scoping, the public and government agencies raised similar issues, emphasizing concerns about impacts on Wilderness Areas and Wilderness Study Areas.

A summary of the comments received during the *PFRR EIS* scoping process, along with where the comment is addressed in this EIS, as applicable, is presented by topic area in **Table 1–3**.

In the spring of 2011, in response to the public comments expressed during the EA and EIS scoping meetings, NASA modified the proposed actions and alternatives. These modifications were presented in the *Draft PFRR EIS*.

Table 1–3. PFRR EIS Scoping Comments Summary

Comment	Addressed in EIS?	If yes, location; if no, rationale
Level of Environmental Analysis		
This EIS should provide more information about targeted areas in the future.	Yes	Chapter 4 and Appendix G
This EIS should show a range diagram with areas to be avoided.	Yes	1.1.7
This EIS should state the probability of a rocket landing and show the different levels of uncertainty around each predicted landing for each stage of each rocket.	Yes	2.1.6.2
This EIS should indicate the success rates for launches.	Yes	3.13.4.2
This EIS should account for all the stages when predicting the number of spent stages.	Yes	4.15.9
This EIS should provide more clarity about the quantity and location of past launch debris.	Yes	4.15.9
This EIS should assess risks of wildlife for launches during non-winter months.	Yes	4.7.8

Table 1–3. PFRR EIS Scoping Comments Summary (continued)

Comment	Addressed in EIS?	If yes, location; if no, rationale
Alternatives		
NASA needs to establish the ability to control or predict the impact sites.	Yes	2.1.6.2
This EIS should consider timing flights to avoid migratory bird or other terrestrial mammal breeding times.	Yes	2.1.2.4, 4.7.4, and 4.7.8
This EIS should address cumulative impacts.	Yes	4.15
Wilderness Areas and Minimal Management Areas		
This EIS should consider impacts on wilderness quality lands, Wild and Scenic Rivers, and national recreational land values and the impacts on the experience of those using such lands for wilderness or remote experiences.	Yes	4.8
NASA should clean up the messes in the Arctic Refuge.	Yes	2.1.7.2 and 2.3.4
The public has concerns about impacts on Federal lands.	Yes	4.8
Safety		
This EIS needs to consider a spent stage hitting the Trans-Alaska Pipeline.	Yes	4.13.2.2
Hazardous/Solid Waste		
NASA should not be using public lands as dumping grounds.	No	Does not request analysis of a specific environmental resource area or alternative.
Recreation and Subsistence Hunting		
Concerns about impacts on subsistence value of all Federal lands involved.	Yes	4.10 and Appendix D
This EIS should address the impacts on subsistence hunting needs from recovery operations during the summer.	Yes	4.10 and Appendix D
Socioeconomics		
NASA should place a value on recovery of stages.	Yes	2.3.4
This EIS should clearly show what efforts were made to fulfill environmental justice requirements.	Yes	4.13.3
Funding should be set aside to promote scientific and engineering education within the Native Villages that may be affected by launch operations.	No	Outside the scope of this EIS decisionmaking.

Table 1–3. PFRR EIS Scoping Comments Summary (continued)

Comment	Addressed in EIS?	If yes, location; if no, rationale
Recovery of Rocket Hardware		
This EIS should describe methods for recovering all stages of the types of rockets that are landing on public lands.	Yes	2.1.7.2 and 2.3.4
This EIS should include a discussion of technologies that could improve location and recovery.	Yes	2.3.4
NASA should describe the Recovery Award Program.	Yes	2.3.4
NASA should enlist assistance from Native Village residents in location and recovery efforts.	Yes	2.3.4
Stronger outreach efforts and timely notification of launches to Native Villages may result in more items being located.	Yes	2.3.4

1.5 PUBLIC INVOLVEMENT DURING THE DRAFT EIS COMMENT PERIOD

NASA released the *Draft PFRR EIS* in September 2012 (**77 FR 59611**) for review and comment by Federal, state, and local agencies, tribal governments, organizations; and the public. NASA distributed copies to those agencies, organizations, and individuals who were known or expected to have an interest in the EIS, as well as to those who specifically requested a copy. Copies were also made available on the project website and in public libraries.

The formal public comment period was 60 days (longer than the NEPA-required minimum of 45 days), from September 28, 2012, through November 28, 2012. Public meetings were held to encourage public comments on the *Draft PFRR EIS* and to provide members of the public with information about the NEPA process and the proposed action. Public meetings were held on the following dates and in the following locations:

- October 24, 2012, Anchorage, Alaska
- October 25, 2012, Fairbanks, Alaska

NASA also held a meeting with representatives from Arctic Village and Venetie on October 26, 2012, in Fairbanks, Alaska. The purpose of the meeting was to discuss any comments the Villages had regarding the *Draft PFRR EIS* and to begin discussions regarding updating the land use Memorandum of Agreement with UAF.

In addition to comments received during the public meeting process, the public was invited to submit comments on the *Draft PFRR EIS* to NASA via (1) the *PFRR EIS* website (http://sites.wff.nasa.gov/code250/pfrr_eis.html), (2) a toll-free telephone number, (3) e-mail (Joshua.A.Bundick@nasa.gov) and (4) the U.S. mail. NASA received six comment documents, containing approximately 40 comments. NASA considered all comments to determine whether corrections, clarifications, or other revisions were required before publishing this *Final*

PFRR EIS. All comments were considered equally, whether written, spoken, mailed, or submitted electronically. The comments received and NASA's responses to these comments are presented in Appendix K.

1.6 CHANGES MADE TO THE DRAFT EIS

The *Draft PFRR EIS* was revised to provide additional information, include additional environmental impact analyses, correct inaccuracies and editorial errors, and clarify text. These revisions resulted from both public comments and internal review of the *Draft PFRR EIS* by NASA and cooperating agencies (USFWS, BLM, and UAF). The EIS was also updated to reflect events that occurred or documents that were published after the *Draft PFRR EIS* was issued for public comment in September 2012. These revisions are indicated in the text.

The organization of this *Final PFRR EIS* reflects changes made to the *Draft PFRR EIS* in the following ways: (1) the addition of impact analyses in the event that USFWS and/or BLM decided not to provide future authorizations to UAF for the impact of sounding rockets on their lands; (2) the addition of Appendix I, "Basis for Dismissing from Further Evaluation the Use of Heavy Mechanized Equipment for Recovery," which provides additional information about an alternative considered but dismissed from further evaluation in the EIS; (3) the addition of Appendix J, "Recent Publications Enabled by Science Conducted at Poker Flat Research Range," which provides a bibliography of studies developed from the sounding rocket launches conducted at PFRR; and (4) the addition of Appendix K, "Comment-Response Document," which includes all public comments and NASA's responses to comments on the *Draft PFRR EIS*. Sidebars in this *Final PFRR EIS* identify substantive revisions made to the *Draft PFRR EIS* in response to comments, revised information, or updates. Sidebars are not used to identify minor editorial changes.

1.7 NASA'S FUTURE USE OF THIS EIS

As this EIS evaluates an ongoing (*e.g.*, annual) range of activities, it is possible that either the proposed action or the environmental context could change in the future from what is considered in this document. Accordingly, NASA has an ongoing duty to evaluate the environmental aspects of its SRP at PFRR. To satisfy this obligation, and consistent with current practice, NASA would perform an annual evaluation of its proposed future actions at PFRR. If both the proposed action and environmental conditions are within the scope of this EIS, the analysis and final determination would be documented in a Memorandum for the Record to be kept in the official project files. If the analysis finds that differences could result in potential impacts that are outside the scope of this EIS, further NEPA documentation would be prepared before taking the action.

This approach is especially relevant to proposals for non-winter launches. Given that the probability and potential consequences of wildfire resulting from non-winter launches are, for the most part, not analyzed in detail in this EIS, any future proposals for such launches would require the preparation of a more focused, mission-specific NEPA document in consultation with land managers prior to approval.

1.8 ORGANIZATION OF THIS *FINAL PFRR EIS*

This *Final PFRR EIS* consists of two volumes. The first volume contains the Executive Summary and main text of this *Final PFRR EIS*. Volume 2 contains the technical appendices that support the analyses or provide background documentation.

This *Final PFRR EIS* contains Chapters 1 through 9 and Appendices A through K, as described below.

- Chapter 1—“Introduction and Purpose and Need for the Action,” provides an overview of the activities of the NASA SRP at PFRR and a brief history of the events leading to the development of this document. This chapter also provides background information on the purpose and need for the proposed action, describes the scope of this EIS, and summarizes the public involvement in developing the scope of this EIS.
- Chapter 2—“Description and Comparison of Alternatives,” describes NASA’s SRP, the proposed action, and the alternatives for PFRR. This chapter also provides a summary of impacts of the alternatives.
- Chapter 3—“Description of the Affected Environment,” describes the potentially affected resources within the PFRR launch site and launch corridor and the approach taken in describing them. The level of detail presented for each resource (*e.g.*, air quality, water resources) depends on the likelihood that the resource would be affected by the proposed action.
- Chapter 4—“Environmental Consequences,” describes the potential direct, indirect, and cumulative impacts on the environmental resources of the proposed alternatives. It also discusses the irreversible and irretrievable commitments of resources, the relationship between short-term uses of the environment and long-term productivity, and proposed mitigation measures.
- Chapters 5, 6, 7, 8, and 9, are the “Agencies, Organizations, and Persons Consulted,” “List of Preparers,” “Index,” “Glossary,” and “References,” respectively.

The appendices include descriptions of methods used to estimate environmental impacts of the alternatives and the detailed information to support the impact analyses. The appendices are as follows:

- Appendix A—“Coordination and Consultation”
- Appendix B—“Siting Analysis”
- Appendix C—“Land Use Permits and Memoranda of Understanding”
- Appendix D—“Alaska National Interest Lands Conservation Act Section 810(A) Summary of Evaluations and Findings”

- Appendix E—“Final Launch Vehicle and Payload Recovery Plan NASA Sounding Rockets Program at Poker Flat Research Range”
- Appendix F—“Search and Recovery Assumptions”
- Appendix G—“Impact Probabilities”
- Appendix H—“Biological Assessment”
- Appendix I—“Basis for Dismissing from Further Evaluation the Use of Heavy Mechanized Equipment for Recovery”
- Appendix J—“Recent Publications Enabled by Science Conducted at Poker Flat Research Range”
- Appendix K—“Comment-Response Document”

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