Record of Decision

Sounding Rockets Program at Poker Flat Research Range

Environmental Impact Statement

National Aeronautics and Space Administration
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RECORD OF DECISION

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SOUNDING ROCKETS PROGAM AT POKER FLAT RESEARCH RANGE

A. Background

The National Aeronautics and Space Administration (NASA) has prepared this Record of Decision (ROD) for the *Sounding Rockets Program at Poker Flat Research Range (PFRR) Final Environmental Impact Statement (EIS)*. This ROD includes a summary of the Final EIS, public involvement in the decision-making process, synopses of alternatives considered, a summary of the key environmental issues evaluated, statement of the decision made (selection of an alternative), and the basis for the decision.

Purpose and Need for the Proposed Action

NASA's purpose for action is to ensure the continued safe and cost-effective sounding rocket-based scientific investigations at PFRR in Alaska. Sounding rockets launched from PFRR support the advancement of scientific knowledge of the Sun–Earth connection, the upper atmosphere, and global climate change.

The proposed action is needed to ensure that NASA and the global science community have a launch capability based in the United States (U.S.) 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 relatively slowly moving platforms. These are essential regions of the Earth's environment and must be measured to understand how the Earth and space interact.

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 U.S. where a sounding rocket can readily study the aurora borealis and the Sun–Earth connection.

B. The Environmental Impact Statement

B.1 Introduction to the EIS

The *PFRR EIS* tiers from NASA's 2000 *Final Supplemental EIS for Sounding Rocket Program* and provides a focused analysis of NASA's continued activities at PFRR. The U.S. Department of the Interior's Bureau of Land Management (BLM) and Fish and Wildlife Service (USFWS) served as Cooperating Agencies in preparing the EIS, as both agencies possess specialized environmental expertise and regulatory jurisdiction over lands within the PFRR launch corridor.

The University of Alaska Fairbanks, which owns and manages PFRR on NASA's behalf, participated as a Cooperating Agency as well.

On April 13, 2011, NASA published a Notice of Intent in the *Federal Register* (76 FR 20715) to prepare an EIS and conduct scoping for the SRP at PFRR. Paid notices were also published in three local newspapers: the *Anchorage Daily News*, *Fairbanks News-Miner*, and *Frontiersman*. Public input and comments on alternatives and potential environmental concerns were requested. NASA also held five public scoping meetings between April 28 and May 3, 2011, in Fort Yukon, Fairbanks, and Anchorage, Alaska, to solicit written and oral input. The scoping period closed on June 1, 2011. A total of 146 scoping comments were received from Federal, state, and local agencies, organizations, and individuals. Although the scoping comments involved a wide range of topics, the majority of concerns were regarding the potential impacts on specially designated lands, including Wilderness and Wild Rivers. The concerns raised were addressed in the Draft EIS.

In September 2012, the Draft EIS was mailed directly to 125 potentially interested Federal, state, and local agencies, organizations, and individuals. In addition, the Draft EIS was published electronically on NASA's website and made available at public reading rooms in Anchorage, Fairbanks, and Juneau, Alaska, as well as Washington, DC. The U.S. Environmental Protection Agency (EPA) published its Notice of Availability (NOA) for the Draft EIS in the *Federal Register* on September 28, 2012 (77 FR 59611), initiating the public review and comment period. NASA subsequently published a NOA for the Draft EIS in the *Federal Register* on October 10, 2012 (77 FR 61642).

The 60-day public review and comment period closed on November 28, 2012. NASA received 5 written comment submissions from agencies and organizations that collectively contained approximately 26 individual comments. The comments received ranged from concerns about impacts to wilderness-based recreation and subsistence, to the National Environmental Policy Act (NEPA) process in general. Upon its review of the Draft EIS, the U.S. EPA assigned a rating of "LO" to the document, indicating its lack of objections to the proposal.

In addition to soliciting comments for submittal by letter and email, NASA held meetings on October 24 and 25, 2012, in Anchorage and Fairbanks, Alaska, at which the public was invited to provide both oral and written comments on the Draft EIS. To notify members of the public of the availability of the Draft EIS and the schedule for the meetings, NASA placed paid advertisements in the *Anchorage Daily News*, the *Fairbanks News-Miner*, and the *Frontiersman*. In total, seven members of the public attended the meetings with one offering substantive oral comments on the Draft EIS. Meeting transcripts were recorded and are included in the Final EIS in Appendix K. NASA's responses to all comments received on the Draft EIS are also included in the Final EIS as Appendix K.

NASA published its NOA for the Final EIS in the *Federal Register* on July 3, 2013 (78 FR 40196) and mailed copies of the document to approximately 150 Federal, state, and local agencies, organizations, and individuals. In addition, NASA made the Final EIS available in electronic format on its website and at the same reading rooms to which copies of the Draft EIS were sent. The U.S. EPA published its NOA for the Final EIS in the *Federal Register* on July

12, 2013 (78 FR 41927), initiating the 30-day waiting period, which ended on August 12, 2013. NASA received one comment submittal during this period, the contents of which are summarized in Section E.2 of this ROD.

B.2 Alternatives Considered

The Final EIS evaluates in detail five alternatives, including the No Action Alternative. To better inform the BLM and USFWS decisionmaking process, each alternative includes two possible scenarios (both issuance and non-issuance of each agency's respective authorization) that could result in response to UAF's request for impacting within the lands under their jurisdiction. However, as the decision to issue an authorization for the use of Federal lands within the PFRR launch corridor is outside the scope of NASA's authority, it will not be discussed further in this ROD. As such, all alternatives (and impacts) described herein assume that UAF (on NASA's behalf) receives the necessary authorizations from the two Federal regulatory agencies.

Elements Common to All Alternatives

Under all five alternatives, NASA would continue to fund UAF's PFRR and conduct scientific investigations using sounding rockets. The sounding rocket configuration employed for each mission would be dependent on specific scientific objectives, and could include any of the single- or multi-stage vehicles in the SRP's "stable" of rockets. NASA forecasts that an average of four launches per year would be conducted at PFRR, but could range up to eight launches per year. This launch rate is typical of years in the recent past.

Similarly, past scientific research has mandated that most launches be conducted during the winter months, defined in the Final EIS as October through April. While this is the expected mode of future operations, new scientific needs might raise the desirability of other launch periods, and the possibility of a launch during the non-winter months cannot be discounted. Accordingly, the Final EIS provides a high-level discussion of issues that would require consideration during the planning of a non-winter launch. In the event that a future summer launch were to be proposed, a more detailed, project-specific NEPA analysis would be required before approval.

Consistent with the requirement levied by the USFWS in its recent Special Use Permits issued to UAF, NASA would not conduct launches with a planned impact site within the Mollie Beattie Wilderness Area in Arctic National Wildlife Refuge.

No Action Alternative

NASA adopted the "status quo" interpretation of "no action" in defining its No Action Alternative in the Final EIS; meaning that PFRR would continue to operate as it has in the recent past. As such, under this alternative, no significant efforts would be taken to recover spent flight hardware from downrange lands unless required for scientific reasons (e.g., instrument reuse or data collection). Thus, recovery efforts (and resultant impacts) would be focused primarily on the retrieval of parachuted payloads.

Alternative 1 (Environmentally Responsible Search and Recovery)

In the Final EIS, NASA identified Alternative 1 as its preferred alternative. Under Alternative 1, NASA and UAF would employ enhanced efforts to locate new and existing spent stages and payloads within the PFRR flight corridor. Attempts would be made to recover all newly expended stages and payloads predicted to land on Federal, state, or private lands. Spent stages and payloads that are located would be recovered if it is determined that the recovery operation can be performed safely while causing minimal environmental damage. As such, some items or parts thereof could be left in the field if the landowners agree that attempted recovery could cause more damage to the environment than leaving it in place. A key component of this alternative is the adoption of a formal rocket hardware recovery program, presented as Appendix E of the Final EIS.

For past SRP operations at PFRR, most spent rocket stages and payloads have not been recovered. Consistent with the philosophy that would be employed for new rocket motors and payloads, hardware that is located from past operations would be recovered if it could be done safely and in an environmentally responsible manner.

Alternative 2 (Maximum Cleanup Search and Recovery)

Alternative 2 is the same as Alternative 1, except maximum practicable effort would be exerted to fully recover newly expended and existing spent stages and payloads from PFRR if it is determined that they can be recovered safely, even if the efforts result in greater short- and longer-term recovery-related environmental impacts.

Alternative 3 (Environmentally Responsible Search and Recovery with Restricted Trajectories)

Alternative 3 is the same as Alternative 1, except trajectories of future sounding rocket missions would be restricted such that planned impacts would not be permitted within designated Wild and Scenic River corridors. The restriction would be an extension of the existing prohibition on having planned impacts within Mollie Beattie Wilderness Area and would become a program requirement that must be met during mission planning.

Alternative 4 (Maximum Cleanup Search and Recovery with Restricted Trajectories)

Alternative 4 would be the same as Alternative 2, except that like Alternative 3, NASA would restrict the flight trajectories of future PFRR missions such that planned impacts would not be located within designed Wild and Scenic River corridors.

B.3 Alternatives Considered But Dismissed from Detailed Study

NASA also considered additional alternatives but did not evaluate them in detail due to their inability to meet its purpose and need, largely due to an inability to achieve scientific goals, safety concerns, exorbitant cost, or a combination of the three. These alternatives included discontinuing operations at PFRR, relocating operations to other high-latitude launch sites, both

foreign and domestic, use of other scientific platforms, installing recovery systems on all future missions, assigning numerical risk criteria to sensitive environmental features, launching easterly into Canada, tracking all future stages and payloads, and use of heavy mechanized equipment for recovery.

B.4 Environmental Consequences of the Alternatives

Generally, all three action alternatives have similar environmental impacts. The primary factor dictating the intensity of effects across the alternatives is the level of recovery effort that would be associated with each alternative. A summary of impacts from the action alternatives and the No Action Alternative are presented within this section. The resource areas for which notable differences were identified among the alternatives are discussed in Section C below.

Air Quality

Emissions from PFRR routine operations (*e.g.*, facility heating, employee transportation) would be equal for all alternatives, regional in scope, and adverse, but minor and long-term in duration. Emissions from rocket launches would also be the same for all alternatives and global in scope, adverse, and minor and short-term in duration. The No Action Alternative would have the least emissions from search and recovery operations, followed by Alternatives 1 and 3. Alternatives 2 and 4 would result in the greatest possible emissions due to additional search and recovery operations. However, in absolute terms, search and recovery-related emissions for all alternatives would be regional in scope and adverse, but minor and medium-term in duration. Emissions from non-winter launches would not be expected to be measurably different from those described above under any of the five alternatives.

Global Atmosphere

For all alternatives, emissions from rocket launches would be equal and confined to the lower layers of the atmosphere. It is expected that there may be a very small, temporary, local stratospheric ozone reduction effect in the wake of upper-stage rockets, but there would be no globally noticeable effects.

The No Action Alternative would have the least greenhouse gas emissions from search and recovery operations, followed by Alternatives 1 and 3. Alternatives 2 and 4 would result in the greatest possible impacts because additional search and recovery activities would be undertaken. However, in absolute terms, search and recovery-related greenhouse gas emissions and resulting impacts on climate change would be global, adverse, minor, and long-term. Impacts from non-winter launches would not be expected to be measurably different from those described above under any of the five alternatives

Water Resources

For all alternatives, it is expected that the potential adverse impacts from launches and reentry of flight hardware on surface water quality would be equal. As compared to the No Action Alternative, additional recovery-related surface disturbance would occur under Alternatives 1 and 3 and, even more so, under Alternatives 2 and 4, potentially increasing the likelihood for

sediment-laden runoff to enter surface waters. The risk of spills from recovery equipment would also increase; however, the additional adverse impacts on surface water or groundwater resources beyond the localized, negligible, and short-term effects of the No Action Alternative would be minor. For all alternatives, impacts on groundwater or perennial spring water quality or recharge are also anticipated to be negligible.

The restricted trajectories proposed by Alternatives 3 and 4 would be the least impactful on designated Wild and Scenic Rivers in that they could lessen the already low probabilities that spent stages or payloads would land within them. Alternatives 1 and 2, respectively, would have the next greatest impacts, as they would entail the removal of items if located. Impacts would be greatest for the No Action Alternative, as no flight hardware would be removed unless required for scientific evaluation. However, for all alternatives, adverse effects on the physical and chemical integrity of designated Wild and Scenic Rivers are anticipated to be localized, negligible, and short-term. Potential effects of other Wild and Scenic River values, particularly recreation and wilderness experience, are discussed under Land Use and Recreation.

Compared to winter conditions, interaction of flight hardware with surface water or groundwater resources would be more immediate in the case of a non-winter launch. However, the principles and patterns of possible water resource impacts would follow similar trends and ultimate endpoints.

Geology and Soils

For all alternatives, impacts from launch and reentry of flight hardware are expected to be the same. Under winter snow, ice cover, and frozen soil conditions, no soil erosion impacts or degradation of permafrost is expected. No impacts on PFRR launch site or launch corridor soil chemistry are anticipated from the corrosion of metal items. Based on the relatively low number of flights, small payload quantities, relatively small ground area that would be affected, and low levels and decomposition rates of perchlorate in the soil, adverse impacts on soil chemistry would be short-term, negligible, and localized. Negligible adverse impacts on soil chemistry are anticipated, and adverse impacts on soil erosion would be minor in magnitude and medium-term in duration.

Under Alternatives 1 and 3, additional efforts to recover flight hardware could result in isolated soil disturbances from activities such as hand-digging around a landing site; however, all recovery efforts would be conducted in an environmentally sensitive manner, thereby mitigating the impact to a level that is essentially equivalent to the No Action Alternative. Although Alternatives 2 and 4 would entail the greatest recovery efforts and could result in potentially the greatest soil disturbances, the extent of impacts beyond those effects expected for the other alternatives would be minor.

Compared to winter conditions, interaction of flight hardware with soil resources would be more immediate for a non-winter launch because there would not be as much snow and ice on the surface to cushion the impact of spent stages or payloads. However, the principles and patterns of possible soil-related impacts would follow the same trends and ultimate endpoints. Indirect impacts could result from the increased likelihood of a wildfire starting as a result of a spent

stage igniting such a fire. Under such circumstances, before a summer launch was conducted, additional precautions would be necessary to minimize the risks associated with igniting such a fire, including notifying appropriate fire patrol personnel.

Noise

For all alternatives, the continued launch of sounding rockets would be equal to and consistent with existing sources of noises at PFRR. In absolute terms, the noise impact from routine PFRR activities, employee vehicles, and delivery vehicles under all alternatives would be regional, adverse, long-term, and minor in intensity. The noise impact from rocket launches and spent-stage reentry and impact would be regional, adverse, short-term, and minor in intensity.

Search and recovery-related noise would be the least under the No Action Alternative and would be considered adverse, regional in scope, medium-term, and minor. Estimates of noise levels on the ground under search and recovery aircraft would be similar for all alternatives. Sound levels generated from disassembly of rocket motors during recovery would likely be above background levels within the downrange lands; however, in either scenario, the sound generated would be short-term (*i.e.,* generally less than an hour per motor), infrequent, and depending on specific conditions, confined to a limited distance from the source. Accordingly, the noise impact from search and recovery operations under Alternatives 2 and 4 would be the greatest of the alternatives and considered regional in scope, adverse, medium-term in duration, and moderate in intensity.

The type, intensity, and duration of noise impacts would be the same for a non-winter launch; however, the likelihood of a receptor (*e.g.*, recreational user, wildlife species) hearing the sound of a rocket flight, reentry, and post-flight search would be greater. Potential impacts on these resources are discussed under Land Use and Recreation and Ecological Resources.

Visual Resources

Under all alternatives, no measurable changes would be made to the appearance of the PFRR launch site; therefore, no impacts on visual resources would be expected. The impact on visual resources from the launching of sounding rockets would be the same for all alternatives and would be minor and short-term.

The intensity of an alternative's impact from land-impacting flight hardware would be dependent upon where the impact site is located and how often users of the downrange lands see it. For example, it is expected that an item landing in a regularly used Wild and Scenic River corridor could result in greater adverse impacts on visual resources than an item that is partially buried in a remote bog. The duration of impacts on visual resources would vary depending on how long the stages and payloads were left unrecovered.

Recovery of additional payloads and spent stages under Alternatives 1 and 2 would reduce the probability of a visitor or user of the lands encountering such materials, thereby reducing the long-term visual impact. However, under these alternatives, no specific provisions would reduce the likelihood of planning an impact within a designated Wild and Scenic River corridor. The

presence of search and recovery aircraft would result in a short-term, minor adverse effect. In general, few payloads (and even fewer stages) would be recovered under the No Action Alternative. Accordingly, adverse impacts on visual resources would be the greatest under the No Action Alternative and would most likely be long-term and could range from minor to moderate, depending on location.

The restricted trajectories proposed under Alternatives 3 and 4 could result in lower probabilities that future rocket launches from PFRR would impact in these areas *(i.e.*, Wild and Scenic River corridors). Since these areas may attract a greater number of visitors due to their designations, avoidance of these areas could result in fewer search and recovery actions within the areas and less potential adverse impacts on visual resources. Coupled with the commitment to search and recovery of located items, it is expected that Alternatives 3 and 4 would have the least long-term adverse effects on visual resources. However, the presence of search and recovery aircraft would result in a short-term, minor, adverse effect. Additionally, under Alternative 4, a more aggressive cleanup policy could result in localized ground scars or ruts, which could degrade the natural appearance of an area.

No change in BLM Visual Resource Management classification would be anticipated for the lands within the PFRR launch corridor under any of the five alternatives.

As more human activities would occur within the PFRR launch corridor during non-winter months, the potential for someone to observe a rocket overflight would be greater if launches were conducted during these months. Also, due to the absence of frozen ground and ice during the summer in areas of lower elevation, there is the potential that spent stages would bury themselves in shallow bogs and sloughs (particularly in the wetland areas of the Yukon Flats), thereby lessening the likelihood of a land user encountering such materials. Additionally, there is the potential that a land user would observe a post-launch fixed-wing search operation within the PFRR launch corridor due to the larger user base during the non-winter months.

Ecological Resources

Under all alternatives, there would be no impacts on vegetation at the launch site because the surrounding area is cleared and maintained free of vegetation. Upon landing of flight hardware, impacts on vegetation would be restricted to the area immediately surrounding the item(s) and would diminish rapidly as distance from the impact point increases. Therefore, potential adverse effects on vegetation and habitat under all alternatives from launch and impact of flight hardware would be equal and local in scope, short-term in duration, and negligible in intensity. Any adverse impacts from launch operations on wildlife (*e.g.*, direct strike, startle) would be similar for all alternatives and would be local, short-term, and negligible due to the time of year that launches typically occur (winter months), the low density of species within the launch corridor, and the infrequency of launches during a launch season (average of four per year).

Impacts on vegetation from recovery operations would be the least under the No Action Alternative. The additional recovery efforts under Alternatives 1–4 would add to the areal extent of disturbance to vegetation, although the types of disturbance would be the same as those described under the No Action Alternative. Because of the low number of recovery efforts

annually, the small and isolated area of vegetation affected by recovery of a spent stage or payload, and the natural regeneration of vegetation after disturbance, adverse impacts on vegetation would also be negligible under Alternatives 1–4.

It is expected that recovery-related impacts (*e.g.*, startle) on wildlife species would be the least under the No Action Alternative. The additional search and recovery efforts under Alternatives 1 and 2 would increase the potential for disturbance of terrestrial wildlife and birds; however, any adverse impacts would be localized to the vicinity of search and recovery activities, would be short-term in duration, and would be minor in intensity.

The restricted trajectories provided under Alternatives 3 and 4 could lessen the potential impacts on wildlife within Wild and Scenic River corridors, where the probability of a stage or payload impact is already extremely low. Any adverse impacts on wildlife are already considered to be negligible, so any decrease in impacts is not expected to be substantial.

None of the five alternatives would adversely affect Essential Fish Habitat; target species, or subsistence species. There are no Endangered Species Act listed, proposed, or candidate species known to live in the vicinity of the PFRR launch site or under the launch corridor until it approaches the coast of the Beaufort Sea. Due to the presence of federally listed species within the launch corridor, NASA consulted with the USFWS and the National Oceanic and Atmospheric Administration National Marine Fisheries Service regarding potential effects of its operations at PFRR on listed, proposed, and candidate species under their respective jurisdictions. Both resource agencies concurred with NASA's determinations.

In the event of a non-winter launch, more vegetation would be exposed due to a lack of snow cover; therefore, impacts would be greater. Additionally, the risk of unintentional wildfire from hot reentering flight hardware would increase markedly. Spent stages and payloads would have greater potential to land in proximity to wildlife because of the greater number of species present, potentially causing short-term behavioral response such as flight. Responses to search and recovery activities would be negligible, since these activities would normally occur during summer under any launch scenario. The likelihood of direct impacts on fish of importance for subsistence or commerce fisheries is expected to be minimal. The potential impacts on federally listed species would need to be revisited, as more species would be located within the PFRR launch corridor during non-winter months.

Land Use and Recreation

The most recent USFWS- and BLM-issued permits for rocket impact and recovery require the recovery of flight hardware. Therefore, the No Action Alternative, which would direct recovery of payloads solely for scientific need, would not be fully consistent with the terms and conditions of the use permits, and would likely not by authorized by the land management agencies.

The No Action Alternative would not limit the ability for users to visit or take part in recreational activities within downrange lands; however, it would result in the greatest deposition of flight hardware in downrange lands. In the case that recreational users of the downrange lands were to discover a piece of flight hardware, it could negatively affect their experience, particularly those

persons intending to have a wilderness experience. Others may find it a positive experience to discover a spent stage or payload. It is expected that those persons engaged in hiking and rafting would be the most sensitive to finding sounding rocket hardware, with hunters, trappers, and snow machiners the most tolerant. The impact would be on a person-by-person basis and would be influenced by the perception of the individual. Accordingly, impacts could be beneficial or adverse, localized, minor in intensity, and short-term to long-term in duration, depending on how long the known payloads and spent stages remain within the launch corridor.

Recovery of payloads and new and existing spent stages under Alternative 1 would further assist UAF in complying with the requirements of the Special Use Permits and Memoranda of Agreement with BLM, USFWS, and landowners within the flight corridor. Additionally, it would reduce the probability that a recreational user would encounter flight hardware. However, as compared to the No Action Alternative, initial search activities could have negligible, short-term impacts on persons participating in recreational activities in areas within the PFRR launch corridor. Given the relative infrequency of flights and the very low probability that a low-flying/landing recovery action would be necessary within the most highly used river corridors within the downrange lands, adverse effects are anticipated to be localized, minor in intensity, and short-term in duration. It is expected that in most cases, the long-term impacts of leaving a piece of flight hardware within the downrange lands would be greater than the short-term disturbances (*e.g.,* noise, aircraft overflight) associated with recovery.

Land use and recreation impacts from launches under Alternative 2 would be essentially the same as Alternative 1. Recovery of the additional payloads and new and existing spent stages would further assist UAF in complying with the requirements of the Special Use Permits and Memoranda of Agreement with the landowners within the flight corridor. However, under this alternative, it is possible that some outward signs of more invasive recovery operations could be exhibited, affecting the wilderness character of the lands. Additionally, more recovery flights could result in more recreational users observing aircraft overhead.

Impacts on land use and recreation under Alternatives 3 and 4 would be identical to those identified under Alternatives 1 and 2, respectively, with the exception of NASA's restricting trajectories on future launches such that designated Wild and Scenic River segments would not be allowed to have predicted impact points for stages or payloads within them. These restricted trajectories could reduce the probability that spent stages or payloads would land within these areas and therefore reduce the need to recover spent stages or payloads from these areas.

For non-winter launches, it is expected that impacts on land use and recreation would be greater due to the larger user base in downrange lands. It is possible that more visitors would voluntarily suspend or relocate their planned activities upon reading posted launch notices; the potential duration of this could vary from days up to several weeks if optimum science conditions are not met until the end of the launch window. It is also possible that downrange "clear" zones would need to be established to ensure public safety, thereby restricting public access to these areas. However, in the event that such an operation would be proposed, early coordination with downrange landowners would be required to reduce potential impacts to the greatest extent practicable.

Cultural Resources

For all alternatives, there is an extremely low probability of impacting or damaging a specific site of cultural or religious importance. Launches during the winter would likely reduce the potential impact if a landing was to occur on a cultural resource, as snow and ice and frozen ground would reduce surface and subsurface damage. To date, no impacts on cultural resources have been documented through the existing SRP launch and limited recovery program.

Due to its limited recovery activities, the No Action Alternative would be expected to have the least recovery-related chance of impacting an area of cultural significance. Because there would be a greater number of recovery activities under Alternatives 1 through 4 compared to the No Action Alternative, there would be a greater possibility of disturbing a historic property. In relative terms, Alternatives 2 and 4, which would entail the greatest recovery effort, could present the highest risk of resource damage. However, given the low probability of a payload or spent stage landing on or adjacent to such a resource (and then becoming a recovery site), it is expected that impacts from recovery would also be negligible for all alternatives.

In accordance with Section 106 of the National Historic Preservation Act, NASA consulted with the Alaska State Historic Preservation Office (SHPO), Alaska Natives, and interested parties regarding the potential effects of the alternatives on cultural resources. The Alaska SHPO concurred with NASA's determination that there would be no historic properties affected.

For non-winter launches, the impact point could experience greater effect if the ground were thawed than during the winter, when the ground is frozen. If the impact point were to be on or very near a cultural resource, and if that resource were a historic property, this could have a greater effect than during the winter. However, the likelihood of a rocket impacting a historic property is extremely low; thus, it is unlikely that summer launches would adversely impact historic properties.

Subsistence

Under all alternatives, the chances of a direct impact on subsistence resources within the PFRR launch corridor due to a payload or spent stage striking an individual animal are negligible. Therefore, adverse effects on subsistence activities would also be negligible to minor and short-term.

The potential for recovery-related impacts on subsistence users would be the least under the No Action Alternative. The villages of Arctic Village, Beaver, Fort Yukon, Stevens Village, and Venetie have subsistence use areas within or in close proximity to the predicted impact areas for spent stages and payloads that would be removed under Alternatives 1 and 2. Noise from low-flying aircraft would have the potential to startle wildlife and could cause the wildlife to leave the area in which search and recovery operations are taking place. However, these startle effects and departures from the area are expected to be temporary and limited to the relatively short periods that these aircraft would be within earshot of or visible to wildlife. Once any disturbance from the low-flying aircraft has ceased, it is expected that wildlife would return to their normal habits and locations. Any adverse impacts on subsistence resources or the harvest of subsistence

resources are expected to be localized, minor, and short-term in duration under Alternative 1. Although Alternative 2 has the potential for the greatest disturbance to wildlife and subsistence hunting, these activities would continue to be relatively minor and infrequent across the affected areas since they would be spread over great distances. The restricted trajectories proposed under Alternatives 3 and 4 would not be expected to have measurable differences in potential impact on subsistence resources or uses and would therefore be equivalent to Alternatives 1 and 2.

For non-winter launches, greater potential impacts on subsistence activities would be expected due to the larger presence of subsistence resources in downrange lands and waters. As discussed under Ecological Resources, direct impacts on fish and game resources would be minor. However, as discussed under Health and Safety, requirements to maintain public safety could result in areas being avoided (either voluntarily or mandatorily) by subsistence users who would otherwise be hunting or fishing. It should be noted that the impacts would be launch-specific and highly dependent upon the month it would occur. Further consultation with Alaska Natives and downrange landowners would be necessary for NASA to assess the potential effects of a specific non-winter launch and appropriately mitigate its potential effects.

Transportation

Under all alternatives, the estimated number of traffic fatalities associated with truck transports would be minor, with a risk of about 1 chance in 500 years that a traffic fatality would occur. The impact on traffic volume of truck transports related to launch and search and recovery operations would be negligible.

The risk of an air transport incident under the No Action Alternative is estimated to be the least of the alternatives, with a risk of about 1 chance in 4,800 years that a fatal accident would occur. Alternatives 1 and 2 would result in greater risk, at 1 chance in 700 years and 1 chance in 450 years, respectively, due to more flight time during recovery operations. These probabilities are very low and would be considered negligible and minor impacts, respectively. The restricted trajectories proposed under Alternatives 3 and 4 would not change the potential transportation impacts, with these alternatives having the same risks as shown above for Alternatives 1 and 2, respectively.

For a non-winter launch, the transportation impacts should remain the same as those projected for launch operations in the winter because the truck transports and aircraft operations associated with recovery activities would occur during the summer under either launch scenario.

Waste Management

Under all alternatives, future launch activity would remain at a level similar to what has occurred at PFRR in the past 10 years. The continuation of launch operations would require the use of small quantities of potentially hazardous materials, some of which would unavoidably land within downrange properties. These materials typically include small pyrotechnic devices, rechargeable batteries, compressed gases, lead-containing solder and balance weights, chemical tracers, and (for some older rocket motors) asbestos-containing insulation. In comparison to the structural materials (*e.g.*, hardened steel, aluminum) of sounding rocket hardware, these

potentially hazardous components make up a very small portion of the total mass of a spent stage or payload.

A key difference among the alternatives is the amount of material that NASA estimates it would remove from downrange lands. Under the No Action Alternative, approximately 4,600 kilograms (10,000 pounds) of recoverable spent stages and payloads would be deposited in downrange lands, annually. Of this material, between approximately 2,200 kilograms (4,850 pounds) and 3,400 kilograms (7,500 pounds) would be expected to land within the Alaska Department of Natural Resources (ADNR) Poker Flat North and South Special Use Areas, thus resulting in an annual net deposition of between 1,200 kilograms (2,650 pounds) and 2,400 kilograms (5,300 pounds) elsewhere, a moderate to major long-term adverse impact.

Under Alternative 1, approximately 900 to 2,300 kilograms (2,000 to 5,100 pounds) of material would be deposited in downrange lands annually under this alternative. Excluding the materials within the designated ADNR Poker Flat North and South lands, other downrange lands could realize a net reduction of 500 kilograms (1,100 pounds) up to a 900-kilogram (2,000-pound) net increase in materials, annually, which would correspond to either a minor beneficial to minor adverse long-term impact of regional scope.

Under Alternative 2, up to a 900-kilogram (2,000-pound) overall reduction in waste could occur, however up to 400 kilograms (880 pounds) of material could be deposited in downrange lands annually under this alternative. Excluding the items within the designated ADNR Poker Flat North and South lands, other downrange lands could realize a net reduction of 1,200 kilograms (2,650 pounds) up to a 100-kilogram (220-pound) increase in materials, which would correspond to either a moderate beneficial to minor adverse long-term impact of regional scope.

The restricted trajectories proposed under Alternatives 3 and 4 would not change the potential quantities of wastes deposited in downrange lands as compared to those described for Alternative 1 and 2. They could, however, reduce the potential for such materials to land within the avoided areas (Wild and Scenic River corridors). No change in hazardous material and waste use or generation or its impact on the environment is anticipated in the event of a non-winter launch.

Health and Safety

Under all alternatives, public and worker health and safety impacts associated with the launch of NASA sounding rockets from PFRR would be equal, short-term, and negligible. Health risks to workers and recovery personnel occur principally during the short period around the launch when the rocket is being prepared and when the search and recovery activities take place. Continued adherence to the NASA safety rules should ensure that the risk to the PFRR workers and visitors would remain very low with future missions. The public is protected from the impacts of sounding rockets and their components through the safety policies and practices of the NASA SRP. All NASA SRP missions are required to prepare both Ground and Flight Safety Plans to minimize risk to human life and property. A Flight Safety Risk Assessment is also prepared for each mission. Both impact and overflight criteria are considered in the Flight Safety Plans and, while risk cannot be entirely eliminated, it is reduced to an acceptable margin. The

criteria that are imposed are a combination of NASA criteria from NASA's *Range Safety Manual* that is common across the U.S. Government rocket launch ranges, and additional criteria or guidelines adopted by UAF and PFRR. In some instances, nominally less restrictive risk estimates may be approved on a case-by-case basis with recognition of the conservatism built into the risk calculations.

Based on the assumed recovery of 1 payload per year under the No Action Alternative and normal injury and fatality rates for similar types of activities in Alaska, no annual fatal injury flight accidents, no occupational injuries during ground recovery operations, and no fatalities during ground recovery activities would be expected. Projected impacts of search and recovery of the assumed 2 payloads and 11 stages under Alternative 1 are about a factor of 6.4 to 9 times higher than the No Action Alternative, but are still small, with no lost work day injuries or fatalities expected during a year's recovery operations. Projected impacts from search and recovery of the assumed 4 payloads and 16 stages under Alternative 2 are the highest at a factor of 11 to 19 times higher than the No Action Alternative, but again are still small, with no lost work day injuries or fatalities expected. Alternatives 3 and 4 would be expected to have the same potential impacts as Alternatives 1 and 2, respectively.

The potential safety risks would be greater for non-winter launches due to higher population densities within downrange lands. Additionally, burning solid propellant and hot rocket motors could produce fires in areas of impact. This would be especially true where impacts occurred in dry areas during the summer months. The potential worker risks would be unchanged or slightly less for summer launches because workers would not be subject to the below freezing temperatures present at PFRR during the winter months. Before scheduling a summer launch, additional landowner consultation and safety analyses would need to be performed to ensure that such launches could be conducted safely in accordance with NASA, UAF, and landowner guidelines.

Socioeconomics and Environmental Justice

For all alternatives, normal operations at PFRR are estimated to result in direct employment of approximately 17 full-time equivalents annually. Direct employment at PFRR is expected to generate indirect employment of approximately 11 jobs, for a total impact of 28 jobs attributable to PFRR activities. Normal operations at PFRR are estimated to generate approximately $1.9 million of direct economic activity annually. Approximately $1.4 million of the value added would be in the form of earnings to PFRR employees, which in turn would generate an estimated $640,000 of indirect earnings, resulting in minor, medium-term, beneficial socioeconomic impacts.

Search and recovery activities under the No Action Alternative would be the least of the alternatives and would result in negligible, though beneficial, socioeconomic impacts over the medium-term. Additionally, the No Action Alternative is not expected to create any additional indirect employment opportunities. Under Alternatives 1 and 2, recovery activities are expected to result in minor, medium-term, beneficial effects, with the generation of 3 and 4 full-time jobs, respectively, with the annual value added to the local economy estimated to be approximately $166,000 and $282,000, respectively. The restricted trajectories proposed under Alternatives 3

and 4 would not change the potential socioeconomic impacts associated with Alternatives 1 and 2, respectively. Non-winter launches would not change the socioeconomic impacts projected for the different alternatives under consideration.

Regarding environmental justice, the analyses prepared for each alternative showed that the intensity of the risks to public health and safety from NASA SRP normal operations, off-normal flights, and transportation are estimated to be negligible to minor. In addition, continued SRP operations at PFRR, including search and recovery activities, are not expected to adversely affect subsistence resources or users within the PFRR launch corridor. Therefore, continued NASA SRP operations at PFRR are not expected to result in disproportionately high and adverse impacts on minority or low-income populations under any of the alternatives under consideration.

Cumulative Effects

NASA considered a number of past, present, and reasonably foreseeable future actions that could occur within or adjacent to downrange lands and contribute cumulatively to impacts on the same resource areas affected by PFRR launch and recovery. With the exception of waste, the cumulative effects analysis in this EIS indicates that the NASA SRP's operations at PFRR under any of the five alternatives would be much smaller in scope and environmental impact than other activities occurring within the analysis area; therefore, its contribution to adverse cumulative effects would be minor.

Regarding cumulative waste, more than 40 years of PFRR operation with limited focus on recovery of flight hardware from both NASA and non-NASA launches has resulted in a net deposition of approximately 125,000 kilograms (276,000 pounds) of material from NASA activities and a net deposition of approximately 55,000 kilograms (121,000 pounds) from non-NASA activities. The net deposition from both NASA and non-NASA activities is approximately 180,000 kilograms (397,000 pounds) of items within the flight corridor, with the majority of it being inert steel and aluminum. Approximately 45 percent of all items (approximately 65 percent by weight) are estimated to remain within the ADNR Poker Flat North and South Special Use Areas, which are specially designated for rocket and payload impacts.

Within other downrange lands, the No Action Alternative would result in a continued cumulative increase in the deposition of flight hardware, resulting in a major, long-term, adverse impact. Accordingly, NASA has incorporated mitigation of this long-term adverse impact in Alternatives 1–4 by establishing a formal recovery program such that over time, the quantity of flight hardware would be reduced in downrange lands. Alternatives 1 and 3 would have lesser cumulative effects than the No Action Alternative; while Alternatives 2 and 4 would likely result in the most waste removed from downrange lands over time, and would likely contribute the least to long-term adverse cumulative effects.

C. Key Environmental Issues and Assessment of the Analysis

The analyses in the Final EIS indicate that while the environmental consequences of each alternative are generally negligible to minor, there are several key issues warranting further discussion. These key issues involve special use lands within the flight corridor and differing views of flight hardware, both of which are discussed in more detail below.

C.1 Special Use Lands

Within the PFRR launch corridor are some of the most environmentally sensitive land uses provided under current U.S. law. These include designated Wilderness, four designated Wild Rivers, two wildlife refuges, a National Conservation Area, and a National Recreation Area. As such, NASA recognizes that it must conduct its operations at PFRR with the focus on doing so in the least intrusive manner possible. To implement this commitment, NASA would continue to avoid conducting missions with planned impacts within designated Wilderness. Additionally, as described in detail in the PFRR Recovery Plan (Appendix E of the Final EIS), NASA would place its highest recovery priority on flight hardware located within designated Wilderness and Wild and Scenic Rivers. Missions of opportunity (*e.g.*, combining recovery efforts with other already planned uses) would be sought to minimize the number of recovery flights needed each year. Finally, to further reduce potential recovery-related disturbances, NASA would employ the least tools necessary to effectively conduct the recovery operation. Through the experience gained during its interim recovery program employed at PFRR over the past several years, NASA has found that utilizing hand tools and small aircraft can effectively remove the majority of items found within downrange lands while minimizing environmental effects, recovery costs, and logistical challenges.

C.2 Differing Views of Flight Hardware

The primary reason for preparing the subject EIS was due to concerns raised by owners and users of downrange lands regarding the long-term deposition of PFRR-launched flight hardware. During the preparation of the EIS, users of downrange lands offered substantially different views as to the potential effects of discovering a piece of flight hardware. Some users were highly concerned about the presence of the items whereas others offered no concern at all. Downrange landowners express similar variability in response, however the responses were commensurate with specific land uses. For example, Federal land management agencies stressed the regular removal of items, whereas the managers of the Alaska DNR lands just north of the PFRR launch site have consistently requested that recovery operations not be conducted unless absolutely necessary. A similar sentiment was offered during discussions with the Native Village of Venetie Tribal Government, which expressed concern regarding potential recovery-related effects on subsistence activities within its lands. Given this variation in landowner objectives, and the situation-specific case each recovery operation presents, NASA recognizes that it must work closely with downrange landowners such that its future efforts are consistent with each area's (often season-specific and/or evolving) guiding policies.

D. Choice of Alternatives

After a thorough review of the potential environmental consequences of all alternatives evaluated in the Final EIS, consultations with and input from other Federal, state, and local agencies; organizations; and individuals, it is my intention to select Alternative 1 for the SRP at PFRR based upon the following:

For NASA to continue its operations at PFRR within an increasingly sensitive environmental context, the adoption of a funded search and recovery program is essential for mitigating the effects of both historically launched and future-launched items within downrange lands. Due to the sensitivity of downrange lands, the possibility for substantially embedded items or unsafe conditions facing the recovery team, I find it imperative that NASA have the ability to leave certain items in place should conditions warrant. All such decisions would be made in consultation with the respective landowner. Additionally, to ensure that downrange land users are aware of the recovery program, NASA would require UAF to maintain an active public outreach campaign as described in Appendix E of the Final EIS.

As compared to the more aggressive search and recovery activities envisioned for Alternatives 2 and 4, it is my position that the level of effort projected for Alternative 1 is the appropriate balance of mitigating the long-term adverse effects of flight hardware and the short- and long-term effects of recovery operations. Additionally, during the implementation of the interim recovery program, we have found that the levels of effort associated with Alternative 1 best reflect those that would occur in the future, and the level of funding that would be allocated for the recovery program.

As compared to the programmatic avoidance of designated Wild and Scenic River corridors provided under Alternative 3, given the large dispersion of descending sounding rocket hardware, the actual reduction in probability of landing within a designated resource would be negligible as compared to Alternative 1. Additionally, future missions could present instances in which flight safety considerations could preclude missions from occurring to meet this additional requirement.

Regarding future non-winter launches, while none are envisioned at the current time, their possibility cannot be discounted and will therefore remain open for consideration. However, given their only cursory analysis in the Final EIS, the decision regarding if and how to conduct such an operation would be the subject of future action-specific NEPA documentation.

Identification of the Environmentally Preferable Alternative

Alternative 3 would be the environmentally preferable alternative, as it would include both programmatic avoidance of planned impacts within designated Wild and Scenic River corridors and environmentally sensitive recovery practices. However, as discussed above, the added environmental benefit between it and Alternative 1, the selected alternative, would be negligible.

E. Additional Information

E.1 Consultation and Coordination

While preparing the EIS, NASA strived to accomplish as many related environmental review requirements as practicable to assist in the decision making process. Consultations pursuant to the Endangered Species Act and National Historic Preservation Act were accomplished concurrently with EIS preparation. Also, throughout the EIS process NASA provided multiple consultation opportunities for Alaska Native organizations. Summaries of all such consultations are included in the Final EIS; detailed consultation information is included in Appendix A.

E.2 Comments Received on the Final EIS

NASA received one agency comment submittal on the Final EIS. Provided by the U.S. EPA, the letter indicated that the agency believed NASA's identified preferred alternative (Alternative 1) to have minimal environmental impact and that appropriate mitigation had been employed. EPA suggested continued coordination with downrange land users to ensure the maximum effectiveness of NASA's proposed flight hardware recovery program. NASA agrees that public outreach would be a key contributing factor to the recovery program's success and would continue to work with downrange landowners and users to locate and remove flight hardware.

F. Mitigation and Monitoring

NASA included mitigation measures as integral components of its selected alternative. These measures, described in detail in Chapter 2, Section 2.3, and Appendix E of the Final EIS, provide consideration of all resource areas while focusing primarily on the location and removal of past and future flight hardware from downrange lands. Below is a summary of such measures that would be undertaken under the selected alternative's recovery program:

- Programmatically committing to continually improving recovery aides;
- Establishing a minimum $250,000 annual recovery budget;
- Searching for all newly launched, land-impacting stages and payloads;
- Recovering those items that can be done so in a safe and environmentally responsible manner;
- Employing the tools of least environmental impact necessary for the recovery;
- Engaging outside parties in recovery efforts through an improved, ongoing outreach campaign;
- Establishing a rewards program for persons reporting items in downrange lands;
- Prioritizing recovery efforts and funding such that items within the most sensitive areas (*e.g.*, Wilderness, Wild and Scenic Rivers) are recovered first; and
- Establishing and maintaining a database to track impact location information for future and past (as available) launches.

Adoption of All Practical Means to Minimize Environmental Harm

It is my belief that all practical measures to mitigate environmental harm have been adopted for the SRP at PFRR. Throughout the EIS preparation process, both resource agencies and conservation organizations proposed potential changes to PFRR launches that could have further reduced environmental impact; however such measures would not be practical within the context of the program. In determining if a mitigation measure is practical, a number of factors must be considered, including the ability of the agency to still meet its objectives, cost, and technical feasibility. As discussed in the Final EIS, severely restricting the available launch vehicles for use at PFRR would preclude NASA from achieving the longer duration, larger missions that are most frequently specified by its researchers. Additionally, launching in different directions than are currently approved would be either unsafe, unable to achieve scientific objectives, or both. As such, the most reasonable option moving forward would be to focus NASA's efforts on means to effectively and unobtrusively locate and remove items of flight hardware. I find that the implementation of the recovery program developed in conjunction with the Final EIS will do just that.

Decision

Based upon all of the foregoing, and in consideration of all technical, environmental, and economic factors, it is my decision to continue the SRP at PFRR with a funded flight hardware recovery program. NASA will continue to coordinate with its downrange landowners and interested parties to ensure that identified flight hardware is removed from downrange lands in an environmentally conscious manner.

Dr. John M. Grunsfeld
Associate Administrator
Science Mission Directorate

12/26/13
Date