RECORD OF DECISION

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

NEW HORIZONS MISSION

A. Background (Purpose and Need for the Proposed Mission)

The purpose of the New Horizons mission is to further our knowledge of the planet Pluto, its moon, Charon, and the Kuiper Belt. The goal of the mission is to measure the fundamental physical and chemical properties of Pluto and Charon. Specifically, the New Horizons mission would acquire data to address the following primary scientific objectives.

- Characterize the global geology and morphology of Pluto and Charon.
- Map the surface compositions of Pluto and Charon.
- Characterize the neutral (uncharged) atmosphere of Pluto and its rate of escape.

After the Pluto-Charon flyby and data playback is complete, the spacecraft could continue on an extended mission to encounter and study one or more objects within the Kuiper Belt.

Of the nine planets closest to the Sun, Pluto is the only one that has not yet been visited by spacecraft. Many of the questions posed about Pluto and Charon can only be addressed by a spacecraft mission that brings advanced instruments close to these two bodies. Scientific knowledge of all other planets and their moons, and thus understanding of the nature of the solar system, has been increased enormously through visits by spacecraft.

The science to be performed at Pluto and Charon is time-critical because of long-term seasonal changes in the surfaces and atmospheres of both bodies as the Pluto-Charon system continues to cool as it retreats from its 1989 closest approach to the Sun. Pluto takes 248 years to orbit the Sun and will not return to its closest approach (perihelion) again until 2237. The objectives of surface mapping and surface composition mapping would be significantly compromised as Pluto and Charon recede from the Sun and their polar regions become increasingly hidden in shadow. Furthermore, as Pluto recedes from the Sun, substantial decline, if not complete collapse, of its atmosphere is widely anticipated. Some of the planned atmospheric science would be lost if a spacecraft arrives after any such decline or collapse.

The recent discovery of many objects in the Kuiper Belt beyond Neptune has opened another dimension for a mission of exploration. Kuiper Belt Objects (KBOs), in stable and well-defined orbits that have never taken them close to the Sun, are likely to be remnants of solar system formation and may hold clues to the birth of the planets. Knowledge gained from close examination of objects in the Kuiper Belt would be of great value in developing theoretical models of the evolution and destiny of the solar system.

B. The Environmental Impact Statement

B.1 Introduction to the EIS

NASA prepared an environmental impact statement (EIS) to analyze the potential environmental impacts of the proposed New Horizons mission. The U.S. Department of Energy (DOE) was a cooperating agency in the EIS because the Proposed Action includes use of a DOE-developed and owned radioisotope thermoelectric generator (RTG) to provide electrical power for the New Horizons spacecraft.

On October 7, 1998, NASA published a Notice of Intent in the *Federal Register* (63 FR 53938) to prepare an EIS and conduct scoping for the then-called Pluto-Kuiper Express mission. The scoping period closed on November 23, 1998 but was reopened and extended until December 18, 1998. Comments were solicited from Federal, State and local organizations, and interested parties on the scope of the EIS. Scoping comments were received from one Federal Agency, one Florida County Agency, one private organization, and ten individuals.

An Information Update was published in the *Federal Register* on June 10, 2002 (67 FR 39748) to keep the public informed of the evolving plan for a science mission to Pluto and the Kuiper Belt. The Information Update also reopened the scoping period, which subsequently closed on July 25, 2002. Comments were again solicited from Federal, State and local organizations, and interested parties on the scope of the EIS. Scoping comments were received from 12 private organizations and 67 individuals. One of these organizations and three of these individuals had submitted comments in response to the original scoping period.

Issues raised in the scoping comments included: (1) concern with the use of radioactive material for the spacecraft's electrical power source; (2) use of alternative (radioactive and non-radioactive) sources for electrical power; (3) impacts to air quality due to launch vehicle exhaust; (4) global impacts in the event of a launch accident; and (5) concerns with the manufacturing and handling of the RTG proposed for use on the mission. Issues 1, 2, 3, and 4 were considered in developing the Draft EIS (DEIS). Issue 5 has been addressed in existing environmental documentation prepared by the DOE, which is responsible for the manufacturing and handling of RTGs. Consequently, Issue 5 was deemed to be out of scope and was not addressed in this EIS.

NASA published a Notice of Availability (NOA) of the DEIS for the New Horizons mission in the *Federal Register* on February 25, 2005 (70 FR 9387). The U.S. Environmental Protection Agency (EPA) published its NOA for the DEIS in the *Federal Register* on February 25, 2005 (70 FR 9306). The DEIS was mailed by NASA to 102 potentially interested Federal, State and local agencies, organizations and individuals. In addition, the DEIS was publicly available in electronic format on NASA's web site. NASA sent electronic mail (e-mail) notifications to 34 potentially interested individuals who had submitted scoping comments via e-mail but who had not provided a mailing address. The public review and comment period closed on April 11, 2005. Six comment submissions (letters and e-mails) were received from Federal, State and local agencies. No comment letters were received from private organizations, and three comment letters were received from private individuals. A total of 956 comment submissions were received via e-mail from individuals, and two comment submissions were received via e-mail from private organizations. Of these e-mailed comment submissions, 867 consisted of three nearly identical form submissions, differing only in the text of the e-mail's Subject line.

Comments received on the DEIS included: (1) “no comment”; (2) requests for clarification of specific sections of text; (3) objections to the use of nuclear material for space missions; (4) a suggested alternative launch system and launch site for the New Horizons mission; and (5) general support for the New Horizons mission. These comments were considered in developing the Final EIS (FEIS), and responses to these comments were prepared and included in the FEIS at Appendix D.

Numerous comments were received on topics deemed out-of-scope for the EIS. These included, but were not necessarily limited to:

- the production of plutonium at DOE facilities and associated worker safety;
- the “militarization” of NASA and the use of nuclear weapons in space;
- NASA’s budget in relation to other federal funding needs;
- the purpose of the Price-Anderson Act; and,
- contamination caused during the production of chemical rocket propellants.

In addition to soliciting comments for submittal by letter and e-mail, NASA held two meetings during which the public was invited to provide both oral and written comments on the New Horizons DEIS. The meetings were held on March 29 and 30, 2005, at the Florida Solar Energy Center in Cocoa, Florida. NASA placed paid advertisements announcing the dates, times, and purpose of the public meetings in local and regional newspapers together with the full text of NASA’s NOA in the legal notices section of each newspaper. Members of the public attending each meeting were asked to register their attendance at the meeting. However, registration was not a requirement for anyone wishing to present either oral or written comments. Three members of the public registered for the March 29 meeting and five registered for the March 30 meeting. No questions were raised and no oral comments were offered during the March 29 meeting. Some questions were raised and comments offered during the March 30 meeting, but these neither raised new issues nor provided any additional data or information relevant to the adequacy of the DEIS. An excerpt of the official transcript taken by a court reporter during the March 30 meeting is included in the FEIS at Appendix E.

The EPA published a finding of no objection (*i.e.*, LO – Lack of Objection) to the Proposed Action regarding NASA’s DEIS on April 8, 2005 (70 FR 17994).

NASA published its NOA for the FEIS in the *Federal Register* on August 3, 2005 (70 FR 44697) and mailed copies to 111 Federal, State and local agencies, organizations, and individuals. In addition, NASA made the FEIS available in electronic format on its web site. NASA sent e-mail notifications to 980 individuals who had submitted comments on the DEIS via e-mail or had previously expressed interest in the New Horizons mission. The EPA published its NOA in the *Federal Register* on August 5, 2005 (70 FR 45389), initiating the 30-day waiting period, which ended on September 5, 2005. Two pieces of correspondence, in the form of one letter and one e-mail, were received by NASA from State and local agencies during this period. This correspondence neither raised new issues nor provided any additional data or information relevant to the adequacy of the FEIS.

B.2 Alternatives Considered

The reasonable alternatives considered in the FEIS are:

1. The Proposed Action, which would consist of continuing preparations for and implementing the New Horizons mission to Pluto, its moon Charon, and possibly one or more objects within the Kuiper Belt. The New Horizons spacecraft would be launched on board an Atlas V 551 expendable launch vehicle from Cape Canaveral Air Force Station (CCAFS), Florida, during January – February 2006, and would be inserted into a trajectory toward Pluto. The spacecraft would arrive at the Pluto-Charon system as early as 2015, depending on the exact launch date, and would remotely gather scientific data during the flyby encounter of Pluto and Charon. The spacecraft may then be directed on an extended mission to one or more KBOs.

   The time period of the primary launch opportunity is January 11 through February 14, 2006. During this period, a launch between January 11 and February 2 would allow the use of a Jupiter Gravity Assist (JGA) maneuver to minimize the flight time to Pluto. After February 2, 2006, Jupiter would no longer be in a position to provide a gravity assist, and only direct trajectories to Pluto would be available. A launch between January 11 and January 27 would yield an arrival at Pluto in 2015. Launch dates later in January and the first two days of February yield arrival dates in 2016 and 2017, respectively. For direct trajectories (*i.e.*, without the use of a JGA maneuver), arrival at Pluto would range from 2018 through 2020, depending on the exact launch date in February 2006.

   In the event NASA is unable to launch the New Horizons spacecraft during the primary January – February 2006 opportunity, a backup opportunity could occur during February 2007. For this backup opportunity, arrival at Pluto would occur in either 2019 or 2020 depending on the exact launch date.

   While launch opportunities to Pluto occur after 2007, the arrival dates at Pluto would also be progressively later than 2020.

   The Proposed Action is the alternative that would best accomplish the scientific goals and objectives established for the New Horizons mission. The Proposed Action was designated NASA's preferred alternative in the FEIS.

2. The No Action Alternative, in which NASA would discontinue preparations for the New Horizons mission and the spacecraft would not be launched. There would be no close reconnaissance of Pluto, Charon, or any KBO within the timeframe of the Proposed Action. Potential advancements in science resulting from this mission would not be realized. Continuing observations of Pluto, Charon, and the KBOs would be limited to those obtained only from existing ground-based and Earth-orbiting resources.

B.3 Alternatives Considered But Not Evaluated Further

Alternatives to the Proposed Action that were considered but were not evaluated further include alternative power systems and alternative trajectories for the mission.

A key component of the New Horizons mission is the system for providing the spacecraft's electrical power. The New Horizons spacecraft's lengthy mission (nearly ten years or more to reach Pluto and at least another three to six years to reach one or more KBOs) imposes stringent

performance criteria for its systems and components. The spacecraft would be subject to the radiation environment of Jupiter during the planned gravity-assist flyby in February 2007. The Pluto encounter would occur at a distance of about 33 astronomical units[1] (AU) from the Sun, where solar illumination would be less than one-thousandth of that encountered in Earth orbit. The flyby of the KBOs would occur at distances up to 50 AU from the Sun. Therefore, the electrical power system must satisfy a variety of performance and operational requirements, including but not limited to the following:

- operation during passage through Jupiter's radiation fields;
- provision of sufficient power at great distances from the Sun;
- a low mass-to-power ratio (high specific power); and,
- provision of a long-term source of electrical power with high reliability.

To fulfill these requirements, an analysis of available electrical power systems was done to find a power source sufficiently capable of meeting the performance and operational requirements for the proposed New Horizons mission. The General Purpose Heat Source RTG, using plutonium dioxide (PuO_2) as the heat source, was identified as the only feasible power system with the physical and operational characteristics capable of providing the necessary power to complete the mission. Previous performance and implementation criteria for other deep space missions have also identified the RTG as the only suitable power system, as was the case for the Galileo, Ulysses, and Cassini missions.

Alternative power systems considered but not evaluated further include solar energy power systems and radioisotope power systems that would require either less PuO_2 or use a radioisotope other than plutonium. All of the alternative power systems that would require either less PuO_2 or use a radioisotope other than plutonium have technology maturity or availability issues that cannot be resolved in a timeframe consistent with the proposed New Horizons mission requirements. The solar energy power systems have technology capability issues, including extremely large mass and volume requirements, that make them infeasible for the proposed mission. Since none of these alternative power systems can provide an adequate power source for the New Horizons mission, they were not evaluated further for the proposed mission.

Alternative trajectories to Pluto were also examined that could reduce launch energy requirements for the proposed New Horizons mission, and thereby possibly eliminate the need for the solid rocket third stage. These alternative trajectories included a variety of gravity assist trajectories and low thrust trajectories using either solar-electric or nuclear-electric propulsion. None of the alternative gravity assist trajectories would be as efficient as the proposed mission's baseline trajectory, and therefore were not feasible and were not evaluated further. A solar-electric low thrust trajectory alternative would offer no advantages to the proposed New Horizons mission since the spacecraft would still require independent systems for chemical propulsion and electrical power, and was therefore not evaluated further. A nuclear-electric propulsion systems has technology maturity and availability issues that cannot be resolved in a

[1] One astronomical unit is the average radius of Earth's nearly circular orbit around the Sun, about 149.6 million kilometers (93 million miles).

timeframe consistent with the proposed New Horizons mission requirements and was therefore not feasible and was not evaluated further.

B.4 Key Environmental Issues Evaluated

The key environmental issues of implementing the Proposed Action are those associated with the air emissions which would accompany normal launch of the New Horizons spacecraft aboard the Atlas V launch vehicle, and the environmental consequences (both radiological and nonradiological) associated with potential launch accidents.

Consideration of launch accidents involving radiological consequences was a principal focus of the New Horizons EIS. The New Horizons spacecraft would have one RTG which uses PuO_2 (consisting of mostly plutonium-238) to provide electrical power. The total PuO_2 inventory would be 10.9 kilograms (24.0 pounds), with up to about 124,000 curies at the time of launch. Depending upon the sequence of events, some launch accidents could result in release of some of the PuO_2, which could have adverse impacts on human health and the environment.

There would be no environmental impacts associated with the No Action Alternative.

B.5 Environmental Consequences of the Alternatives

B.5.1 Normal Launch

The environmental impacts of a normal launch of the New Horizons spacecraft under the Proposed Action would consist principally of short-term impacts associated with the exhaust emissions from the Atlas V expendable launch vehicle.

The primary environmental impacts of a normal mission launch would be associated with airborne emissions from the strap-on solid rocket boosters that would be used on the New Horizons Atlas V launch vehicle. Air emissions from the liquid propellant engines on the core vehicle, although large in magnitude, would be relatively inconsequential in terms of environmental effects. The effects of a normal launch would include short-term adverse impacts on air quality within the exhaust cloud at and near the launch pad, and the potential for acidic deposition from the solid booster exhaust on the vegetation and surface water bodies at and near the launch complex. Shortly after lift-off, the exhaust cloud would be transported downwind and upward, eventually dissipating to background concentrations. However, because launches from CCAFS are relatively infrequent events and winds rapidly disperse and dilute the launch emissions to background concentrations, no long-term adverse impacts to air quality in offsite areas would be anticipated. Surface waters in the immediate area of the exhaust cloud would temporarily acidify from deposition of hydrogen chloride, but no prolonged acidification or other long-term adverse effects would be anticipated. Biota in the immediate vicinity of the launch pad could be damaged or killed by intense heat following ignition and hydrogen chloride deposition from the exhaust cloud, but no long-term adverse effects to biota would be anticipated. Neither short-term nor long-term adverse impacts to threatened or endangered species would be expected. No significant socioeconomic impacts would be expected on nearby communities, and no impacts would be expected to cultural, historical, or archeological resources as a result of the New Horizons mission launch.

Some short-term ozone degradation would occur along the flight path as the Atlas V launch vehicle passes through the stratosphere and deposits ozone-depleting chemicals from the exhaust

products of the solid rocket boosters. However, the depletion trail from a launch vehicle has been estimated to be largely temporary, and is self-healing within a few hours of the vehicle's passage. The total contribution to the average annual depletion of ozone from the launch of large expendable launch vehicles with solid rocket boosters in a given year has been estimated to be small (approximately 0.014 percent per year). Because launches at CCAFS are always separated by at least a few days, combined impacts in the sense of holes in the ozone layer combining or reinforcing one another cannot occur.

Launch of the Atlas V for the New Horizons mission would produce a very small fraction (less than 0.00001 percent) of the annual net greenhouse gases emitted by the United States. Therefore, launch of the mission would not be anticipated to substantially contribute to the accumulation of greenhouse gases.

Under the No Action Alternative, NASA would discontinue preparations for the New Horizons mission to Pluto, and the spacecraft would not be launched. Spacecraft and launch vehicle components would be recycled. Thus, none of the anticipated impacts associated with a normal launch would occur.

B.5.2 Potential Accidents

Nonradiological accidents could occur during preparation for and launch of the New Horizons spacecraft at CCAFS. The two nonradiological accidents of greatest concern would be a liquid propellant spill during fueling operations and a launch vehicle failure. Under the No Action Alternative a launch would not occur, therefore there would be no potential for any accident to occur.

A liquid propellant spill during fueling operations would not be expected to result in any public health impacts or any long-term environmental consequences. Fueling operations for the Atlas V involve rocket propellant-1 (a form of kerosene), liquid hydrogen, liquid oxygen, and hydrazine. Launch preparation activities at CCAFS are subject to environmental regulations, including spill prevention and response requirements, and U.S. Air Force (USAF) safety requirements specify detailed policies and procedures to be followed to ensure worker and public safety during all liquid propellant fueling operations. Workers performing propellant loading are equipped with protective clothing and breathing apparatus and uninvolved workers would be excluded from the area during propellant loading. Propellant loading would occur only shortly before launch, further minimizing the potential for accidents. Any propellant spills or releases that did occur would be minimized and contained by remotely operated actions that close applicable valves and make safe the propellant loading system. Spill containment would be in place prior to any propellant transfer to capture any potential release.

A launch vehicle failure on or near the launch area during the first few seconds of flight could result in the release of the propellants (solid and liquid) onboard the Atlas V and the spacecraft. The resulting emissions would resemble those from a normal launch, consisting principally of carbon monoxide, carbon dioxide, hydrogen chloride, oxides of nitrogen, and aluminum oxide from the combusted propellants. A launch vehicle failure would result in the prompt combustion of a portion of the released liquid propellants, depending on the degree of mixing and ignition sources associated with the accident, and somewhat slower burning of the solid propellant fragments. Falling debris would be expected to land on or near the launch pad resulting in potential secondary ground-level explosions and localized fires. After the launch vehicle clears

land, debris from an accident would be expected to fall over the Atlantic Ocean. Modeling of accident consequences with meteorological parameters that would result in the greatest concentrations of emissions over land areas indicates that the emissions would not reach levels threatening public health. Some burning solid and liquid propellants could enter surface water bodies and the ocean resulting in short-term, localized degradation of water quality and conditions toxic to aquatic life. Such chemicals entering the ocean would be rapidly dispersed and buffered, resulting in little long-term adverse impact on water quality and resident biota.

One of the primary issues addressed in the New Horizons EIS was the possible radiological consequences of mission accidents. DOE prepared a nuclear risk assessment to support the EIS. The risk assessment is based on a combination of scaling the results of risk assessments for past missions (*e.g.*, the Cassini and Mars Exploration Rover missions) on a per-curie inventory basis for specific accident configurations and environments, coupled with additional analyses where considered appropriate. The nuclear risk assessment for the New Horizons mission considers: (1) potential accidents associated with the launch, and their probabilities and accident environments; (2) the response of the RTG to such accidents in terms of the estimated amounts of radioactive material released and the release probabilities; and (3) the radiological consequences and risks associated with such releases.

The radiological impacts or consequences for each postulated accident were calculated in terms of (1) impacts to individuals in terms of the maximum individual dose (the largest expected dose that any person could receive for a particular accident); (2) impacts to the exposed portion of the population in terms of the potential for additional latent cancer fatalities due to a radioactive release (*i.e.*, cancer fatalities that are in excess of those latent cancer fatalities which the general population would normally experience from all causes over a long-term period following the release); and (3) impacts to the environment in terms of land area contaminated at or above specified levels.

Results of the DOE risk assessment show that the most likely outcome of implementing the Proposed Action would be a successful launch with no release of radioactive materials. For most launch-related problems that could occur prior to launch, the most likely result would be a safe hold or termination of the launch countdown.

The risk assessment did, however, identify potential launch accidents that could result in a release of PuO_2 in the launch area, southern Africa following suborbital reentry, and other global locations following orbital reentry. However, in each of these regions an accident resulting in a release of PuO_2 is unlikely (*i.e.*, the estimated probability of such an accident in each region ranges from 1 in 100 to 1 in 10 thousand, with the data and analysis of the risk assessment indicating mean probabilities on the order of 1 in several hundred for each region). Accidents which could occur either during ascent over the Atlantic Ocean or after the spacecraft escapes the Earth's gravity field would not result in a release of PuO_2.

A major vehicle malfunction after lift-off would lead to activation of safety systems that would result in destruction of the launch vehicle. This would also include activation of the breakup system on the third stage solid rocket motor, which is designed to preclude the intact motor and attached spacecraft falling to the ground together. Destruction of the launch vehicle by these safety systems would minimize potential damage to the RTG. The RTG or its components would fall to the ground where they could, however, be subject to mechanical damage and exposure to solid propellant fires. This unlikely situation, with an estimated mean probability of

approximately 1 in 620, could result in a release of about 0.01 percent of the PuO_2 in the RTG (about 1 gram (0.035 ounce)).

For the unlikely accidents with a release which could occur in and near the launch area or prior to and after the spacecraft achieves orbit, the predicted mean radiological dose to the maximally exposed individual is about 0.3 rem, which is the equivalent of about 80 percent of the normal annual background dose received by each member of the U.S. population during a year. No short-term radiological effects would be expected from any of these exposures. Each exposure would, however, increase the statistical likelihood of a cancer fatality over the long term. Additional latent cancer fatalities are predicted to be small (*i.e.*, a mean of 0.4 additional latent cancer fatalities among the potentially exposed members of the local population near the launch area, and a mean of 0.2 additional latent cancer fatalities among potentially exposed members of the global population). This assumes no mitigation actions, such as sheltering and exclusion of people from contaminated land areas.

Potential environmental contamination was evaluated in terms of areas exceeding various screening levels and dose-rate related criteria. Land areas estimated to be contaminated above a screening level of 0.2 microcuries per square meter ($\mu Ci/m^2$) (used by NASA in the evaluations of previous missions) have been identified for the purpose of evaluating the need for potential characterization and cleanup. Costs associated with these efforts, should decontamination be required, could vary widely ($93 million to $520 million per square kilometer or about $241 million to $1.3 billion per square mile) depending upon the characteristics and size of the contaminated area.

Results of the risk assessment indicate that the unlikely launch area accident, involving the intentional destruction of all launch vehicle stages freeing the RTG to fall to the ground, could result in less than two square kilometers (less than one square mile) potentially contaminated above the 0.2 $\mu Ci/m^2$ screening level.

Very unlikely launch accidents (*i.e.*, the estimated probability of an accident ranges from 1 in 10 thousand to 1 in 1 million) and extremely unlikely launch accidents (*i.e.*, the estimated probability of an accident is less than 1 in 1 million) were also assessed. These events were postulated for cases in which an accident occurs in the launch area and the safety systems fail to destroy the launch vehicle. The mean probabilities of these events are estimated to range from 1 in 1.4 million to 1 in 18 million or less. These extremely unlikely accidents could, however, expose the RTG to severe accident environments, including mechanical damage, fragments, and solid propellant fires, and could result in higher releases of PuO_2 (up to 2 percent of the RTG inventory) with the potential for higher consequences.

The maximally exposed individual could receive a mean dose of 10 to 55 rem following the more severe types of extremely unlikely accidents, such as ground impact of the entire launch vehicle. It should be noted that there are very large variations and uncertainties in the prediction of close-in doses due to the large variations and uncertainties in dispersion modeling for such complicated accident situations. Assuming no mitigation actions, such as sheltering and exclusion of people from contaminated land areas, the potentially exposed members of the population could inhale enough material to result in about 100 additional cancer fatalities over the long term.

For the extremely unlikely accident that involves ground impact of the entire launch vehicle, nearly 300 square kilometers (about 115 square miles) of land area could be contaminated above the 0.2 $\mu Ci/m^2$ screening level. Contamination at this level could necessitate radiological surveys and potential mitigation and cleanup actions.

Considering both the unlikely and the extremely unlikely launch accidents assessed in this EIS, both the maximally exposed member of the exposed population and the average individual within the exposed population face a less than 1 in 1 million chance of incurring a latent cancer due to a catastrophic failure of the New Horizons mission.

Under the No Action Alternative, NASA would not complete preparations for and implement the New Horizons mission. The No Action Alternative would, therefore, not involve any of the radiological risks associated with potential launch accidents.

C. Assessment of the Analysis

The environmental impacts of a normal launch of the New Horizons spacecraft under the Proposed Action would consist principally of short-term impacts associated with the exhaust emissions from the Atlas V expendable launch vehicle. Such impacts of Atlas launches from CCAFS have been previously addressed and fully characterized in USAF and NASA environmental documentation. A normal launch of the New Horizons mission is within the scope of operations analyzed in that previous documentation and would not be expected to cause any environmental impacts beyond those of routine CCAFS launch operations.

The DOE's risk assessment shows that in most launch accidents there would be no release of nuclear material. The environmental impacts of a launch accident with no release of nuclear material would consist principally of emissions from burning propellants and from falling debris. Emissions from a launch accident would resemble the emissions from a normal launch and would not be anticipated to reach levels threatening public health. Debris from a launch accident would be expected to fall in the launch site area or over the Atlantic Ocean.

In the unlikely event of an accident resulting in release of nuclear material, the risk assessment indicates that, in the mean, no additional latent cancer fatalities would be expected among potentially exposed members of the population. For certain potential launch accidents in which the launch vehicle safety systems fail to operate, there could be, in the mean, about 100 additional latent cancer fatalities among potentially exposed members of the population; however, such accidents are considered extremely unlikely.

D. Choice of Alternatives

In view of the small risks associated with the New Horizons mission, it is my intention to select the Proposed Action, Alternative 1 (above, page 4), based on the following.

The Proposed Action enables the best return of scientific and technical information, makes most effective use of fiscal, human, and material resources, and avoids disruption of the Nation's program for the exploration of the solar system.

The Proposed Action will complete a key step in NASA's reconnaissance of the known planets in our solar system, begun with Mariner 2 to Venus in 1962. The suite of instruments on the New Horizons spacecraft has been carefully selected to maximize collection of scientific data to

meet the mission's objectives. Scientists would, for the first time, be able to closely examine the physical and chemical characteristics of Pluto, its moon Charon, and possibly other objects in the Kuiper Belt. These investigations of such primitive bodies could lead to fundamentally new insights into the formation and evolution of the solar system.

Because the science to be performed at Pluto and Charon is time-critical, it is desirable to launch the mission as early as practicable during the primary January – February 2006 launch opportunity. This would ensure the availability of Jupiter for a gravity assist flyby maneuver to minimize the total flight time to Pluto, with arrival in 2015. Launch dates later in the 2006 opportunity, or in the 2007 backup opportunity, would arrive at Pluto in sufficient time and with sufficient electrical power margin to achieve the primary science objectives of the mission, but the scientific return may be reduced and would be realized three to five years later.

The No Action Alternative (Alternative 2) is the environmentally preferable alternative because there would be no launch of the New Horizons spacecraft. However, under the No Action Alternative, there would be no close reconnaissance of Pluto, Charon, or any objects within the Kuiper Belt. The proposed high-priority science to be performed at Pluto and Charon is time-critical because of long-term seasonal changes in the surfaces and atmospheres of both bodies. Achieving objectives involving surface mapping and surface composition mapping would be significantly compromised if a spacecraft does not arrive at the Pluto-Charon system before this system recedes too far from the Sun. More of the surfaces of Pluto and Charon will be in permanent shadow each year until 2042. Furthermore, Pluto's withdrawal from perihelion is widely anticipated to result in substantial decline, if not complete collapse, of its atmosphere. Much of the atmospheric science would be lost if a spacecraft cannot arrive before the atmosphere significantly declines or completely collapses. Once that happens, fulfilling this science objective would have to wait until Pluto's next perihelion passage in 248 years. Canceling the New Horizons mission would create a significant gap in NASA's objectives for exploring the solar system. In summary, the No Action Alternative does not satisfy the purpose and need for the Proposed Action defined in the EIS.

The selection of the Proposed Action (Alternative 1) is fully consistent with the mandate of the National Aeronautics and Space Act to contribute to the expansion of human knowledge of phenomena in space.

E. Additional Information

In addition to the requirements under the National Environmental Policy Act (NEPA) and NASA policy and procedures, there is a separate and distinct Executive Branch interagency process for evaluating the nuclear launch safety of the New Horizons mission. Pursuant to paragraph 9 of Presidential Directive/National Security Council Memorandum #25 (PD/NSC-25) a nuclear Safety Analysis Report (SAR), including an uncertainty analysis, was prepared by DOE and reviewed by an *ad hoc* Interagency Nuclear Safety Review Panel (INSRP), who then prepared a Safety Evaluation Report (SER) for the mission. The PD/NSC-25 process is still ongoing, but I have received a preliminary briefing on the results of the analyses presented in the SAR and SER. While there are some differences in mission phase risk estimates, the differences are not significant with regard to potential public health consequences and do not change the overall nuclear launch safety mission risk, but reasonably bound that risk. The DOE and the INSRP will provide NASA a formal briefing on the SAR and SER analyses prior to NASA's decision on

whether or not to request launch approval from the White House Office of Science and Technology Policy in accordance with PD/NSC-25.

F. Mitigation

The only expected or immediate environmental impacts of launching the New Horizons mission are the same as those for the launch of every currently-available Delta and Atlas class vehicle, and mitigation will accordingly be the same. Range Safety at CCAFS monitors launch surveillance areas to ensure that risks to people, aircraft, and surface vessels are within acceptable limits. Models which take into account current meteorological conditions, the probability of a launch failure, and emergency preparedness procedures, are used to predict launch hazards. Launches are postponed if the predicted public risks of injury from toxic gases, debris, or blast overpressure exceed acceptable limits.

This EIS primarily addressed possible radiological consequences of mission accidents. Regarding such possible radiological impacts, NASA, with expert technical assistance from DOE, the EPA, the U.S. Department of Homeland Security, the U.S. Department of Defense, and other Federal agencies, and in cooperation with State and local authorities, is developing a federal radiological contingency response plan for the New Horizons mission. Key elements of monitoring and data analysis equipment will be pre-deployed to enable rapid response in the event of a launch accident. The plan, to be documented elsewhere, will define the roles of the agencies involved and will address short-term monitoring and mitigation activities associated with the launch. Post-accident mitigation activities, if required, would be based upon detailed monitoring information and assessment. The plan will define the roles of the agencies involved.

I am confident that all practicable means to avoid or minimize environmental harm from the New Horizons mission have been adopted.

Decision

Based upon all of the foregoing, it is my decision to complete preparations for launch of the New Horizons mission in January or February of 2006, and to operate the mission. In the event NASA is unable to launch the mission during the primary 2006 launch opportunity, launch could instead occur during a backup opportunity in February 2007.

M. L. Cleave

Mary L. Cleave
Associate Administrator for
Science Mission Directorate

7 Sept 2005
Date