1. PURPOSE AND NEED FOR ACTION

This *Final Constellation Programmatic Environmental Impact Statement* has been prepared by the National Aeronautics and Space Administration (NASA) to assist in the decision-making process as required by the National Environmental Policy Act of 1969, as amended (NEPA) (42 United States Code [U.S.C.] 4321 *et seq*.); Council on Environmental Quality regulations for implementing the procedural provisions of NEPA (40 Code of Federal Regulations [CFR] parts 1500-1508); NASA policies and procedures at 14 CFR subpart 1216.3; and Executive Order 12114, *Environmental Effects Abroad of Major Federal Actions*.

1.1 BACKGROUND

The Constellation Program would provide the flight systems and Earth-based ground infrastructure for an expanded human presence in the Solar System. Building on the achievements of previous lunar exploration efforts and crewed missions to low Earth orbit and the many technological advancements made over the past five decades, the Constellation Program would enable the United States (U.S.) to continue to access the International Space Station, return humans to the Moon, and enable human exploration of Mars and beyond.

1.1.1 U.S. Human Space Exploration Programs

Beginning in the late 1950s, the U.S. embarked upon the ongoing effort of human space exploration. The first human spaceflight initiative was Project Mercury, established in October 1958 with crewed spacecraft first launched from Cape Canaveral Air Force Station (CCAFS) in the early 1960s. NASA's Launch Operations Center and the portions of CCAFS that were used by NASA were renamed the John F. Kennedy Space Center (KSC) in 1963. Project Mercury was followed by Project Gemini and the Apollo Program. Project Gemini was announced in January 1962 and served to perfect maneuvers in Earth orbit. The Apollo Program was initiated in 1961, successfully landing U.S. astronauts on the Moon beginning in 1969 and returning them safely to Earth.

In the mid-1970s, NASA initiated development of the Space Transportation System (commonly called the Space Shuttle) as the next crewed vehicle. Designed solely for missions to low Earth orbit, the Space Shuttle was the first and is still the only winged U.S. spacecraft capable of launching crew vertically into orbit and landing horizontally upon returning to Earth. Over the past 25 years, the Space Shuttle fleet has supported more than 100 missions.

1.1.2 New Exploration Initiative

After the Space Shuttle *Columbia* accident on February 1, 2003, NASA established the Columbia Accident Investigation Board (CAIB) to perform an in-depth review of the Space Shuttle Program. As a result of this review, the CAIB concluded that it was in the best interest of the U.S. to develop a replacement for the Space Shuttle. The CAIB concluded that it should be possible by 2010 using past and future investments in technology to develop the basis for a system, "significantly improved over one designed 40 years earlier, for carrying humans to orbit and enabling their work in space" (NASA 2003).

In January 2004, President George W. Bush announced a new exploration initiative (the *Vision for Space Exploration*) to return humans to the Moon by 2020 in preparation for human exploration of Mars and beyond. As part of this initiative, NASA will continue to use the Space Shuttle fleet to fulfill its obligation to complete assembly of the International Space Station and then retire the fleet by 2010. As the first step toward developing the vehicles to explore the Moon, Mars, and beyond, the President directed NASA to build and fly a new Crew Exploration Vehicle (CEV [since named Orion]) by 2014. The Orion spacecraft would be a new multi-functional human-rated space vehicle capable of supporting four to six crew members. The Orion spacecraft would be used to transport humans to low Earth orbit for missions to support the International Space Station and would be a key component for future missions to Mars and beyond. It would also be the vehicle used to transport a crew to lunar orbit.

Congress expressly endorsed the President's exploration initiative and provided additional direction for the initiative in the NASA Authorization Act of 2005, authorizing NASA to "…establish a program to develop a sustained human presence on the Moon, including a robust precursor program to promote exploration, science, commerce and U.S. preeminence in space, and as a stepping stone to future exploration of Mars and other destinations" (Pub. L. 109-155).

1.1.3 The Exploration Systems Architecture Study

In May 2005, in response to the President's exploration initiative, NASA Administrator Michael Griffin commissioned the Exploration Systems Architecture Study (ESAS) (NASA 2005e) to perform four specific tasks:

1. Complete assessment of the top-level CEV requirements and plans to enable the CEV to provide crew transport to the International Space Station and to accelerate the development of the CEV and crew launch system to reduce the gap between Space Shuttle retirement and CEV initial operational capability
2. Provide definition of top-level requirements and configurations for crew and cargo launch systems to support the lunar and Mars exploration programs
3. Develop a reference lunar exploration architecture concept to support sustained human and robotic lunar exploration operations
4. Identify key technologies required to enable and significantly enhance these reference exploration systems and reprioritize near- and far-term technology investments.

The ESAS Team took on the task of developing CEV requirements and a baseline configuration to meet those requirements. Many design studies were performed to address potential CEV shapes, including blunt-body, slender-body, and lifting shapes. Aspects of a CEV mission to the International Space Station were examined in detail, including docking approaches and the use of the CEV as a cargo transport and return vehicle. Requirements for activities performed outside the confines of the CEV and any lunar habitat (*i.e.*, extravehicular activities [EVAs]) were examined, and different airlock designs were investigated. Additional CEV studies included, but were not necessarily limited to, landing mode, propellant type, number of engines, level of capability with a failed engine, and abort approaches.

The ESAS Team examined multiple combinations of launch elements to perform missions to the International Space Station, the Moon, and Mars. Different types and sizes of launch vehicles and numbers of launches required to meet specific mission configurations called Design Reference Missions were evaluated. The ESAS Team performed a detailed examination of the costs, schedule, reliability, safety, and risk of using launch vehicles derived from the Space Shuttle and from current and proposed U.S. heavy-lift launch vehicles (*e.g.*, Delta IV and Atlas V launch vehicles) for crew and cargo missions. Other studies included propellant types for launch vehicle stages, numbers of engines per stage, use of common components and systems on vehicle stages, and number of stages. Based upon the results of the studies, the ESAS Team developed new architecture-level requirements and an overall architecture approach to meet those requirements.

In order to determine the crew and cargo transportation requirements, the ESAS Team examined a variety of lunar surface mission types, surface systems, and approaches to constructing a lunar outpost. The use of in situ resources for propellant and power production was examined, as were nuclear and solar power sources. The central study conducted by the ESAS Team was an examination of various mission modes for transporting crew and cargo to the Moon, including lunar and Earth orbit operations, and direct return from the lunar surface. In addition, a number of different configurations were examined for the Lunar Surface Access Module (Lunar Lander). Studies performed for the Lunar Lander included the number of stages, propellants and engine types, level of capability with a failed engine, airlock approaches, cargo capacity, and abort options.

The ESAS Team's assessment of the exploration goals and mission requirements was formulated into the ESAS as a set of recommendations for a future exploration architecture. The study concluded that the launch vehicles should be derived from existing technologies, leveraging the lessons learned from past programs, such as the Apollo Program and the Space Shuttle Program. Specifically, the ESAS recommended an architecture which included a Crew Launch Vehicle (CLV [since named Ares I]) to ferry crew and cargo to the International Space Station and to carry crew to Earth orbit and a heavy-lift Cargo Launch Vehicle (CaLV [since named Ares V]) to support missions to the Moon and Mars.

1.1.4 The Constellation Program

To comply with Presidential and Congressional directives and to implement the ESAS recommendations, NASA initiated and is in the early planning stages of the proposed Constellation Program. The Constellation Program used the ESAS Team's recommendations and the underlying Presidential and Congressional directives as a starting point and has continued to refine the mission requirements, evaluate capabilities for the technologies studied by the ESAS, and perform more detailed examination of the developmental requirements (*e.g.*, test and verification requirements). This has resulted in a modified concept for the Constellation Program from that articulated in the ESAS. NASA expects that the Constellation Program would further evolve as human exploration needs and the capabilities of the selected technologies are assessed.

As envisioned by NASA, an incremental buildup would begin with up to four person crews making several short-duration trips of up to 14 days to the Moon until power supplies, rovers,

and living quarters become operational. These initial missions would be focused, to a greater degree than originally envisioned in the ESAS, on the establishment of a lunar outpost. These initial missions would be followed by long-duration lunar missions, increasing up to 180 days.

As the long-term objectives of U.S. space exploration evolve, the near-term goals remains the same: to develop the flight systems and ground infrastructure required to enable continued access to space and to enable future crewed missions to the International Space Station, the Moon, Mars, and beyond. The exploration vehicles proposed to be developed to meet this goal include the Orion spacecraft and two new launch vehicles, the Ares I and the Ares V. The Ares I launch vehicle would carry the Orion spacecraft to low Earth orbit where it would dock with either the International Space Station or with a payload launched earlier on an Ares V launch vehicle for transit to the Moon. For lunar missions, the Ares V launch vehicle would carry an Earth Departure Stage and Lunar Payload in a single launch. After the Orion spacecraft docks with the Earth Departure Stage/Lunar Payload in Earth orbit, the Earth Departure Stage engine would be ignited and would propel the Lunar Payload and the Orion spacecraft to the Moon. For future missions to Mars, Ares V launch vehicles would be used to launch the components needed to send and return a crew to Mars. This could include a Mars transfer vehicle, a lander, a surface habitat, and surface equipment.

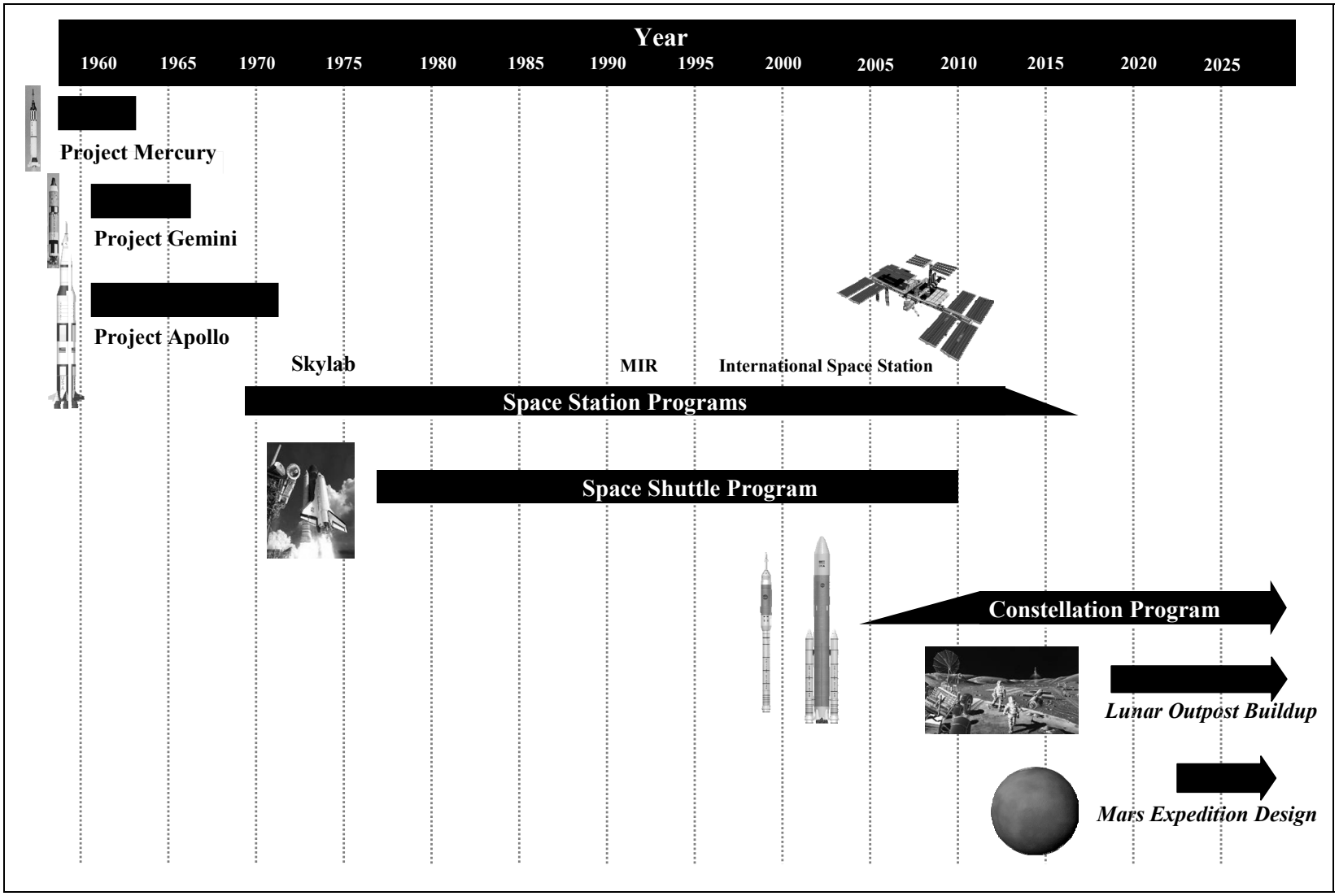
A timeline depicting U.S. human exploration efforts from Project Mercury through the proposed Constellation Program is shown in Figure 1-1.

1.2 PURPOSE AND NEED FOR ACTION

The announcement by President Bush in January 2004 of a new exploration initiative (the *Vision for Space Exploration*) set the long-term goals and objectives for U.S. space exploration efforts. The underlying goal of the initiative, hence the need for NASA action, is to advance the Nation's scientific, security, and economic interests through a robust space exploration program (TWH 2004). In achieving this goal, the U.S. will pursue the following initiatives:

- Implement a sustained and affordable human and robotic program to explore the Solar System and beyond
- Extend human presence across the Solar System, starting with a return of humans to the Moon by 2020 in preparation for human exploration of Mars and other Solar System destinations
- Develop innovative technologies, knowledge, and infrastructure both to explore and to support decisions about the destinations for human exploration
- Promote international and commercial participation in this new space exploration program.

As the lead agency, NASA was tasked with development of the plans, programs, and activities required to implement the Nation's space exploration efforts. The following directives were among those given to NASA in the NASA Authorization Act of 2005 (Pub. L. 109-155) and/or the President's announcement of the *Vision for Space Exploration* (TWH 2004):



Source: Adapted from NASA 2006c

Figure 1-1. Timeline of the U.S. Human Exploration of Space

- Develop a CEV to replace the Space Shuttle fleet by 2014, and as close to 2010 as possible
- To the fullest extent possible consistent with a successful development program, use the personnel, capabilities, assets, and infrastructure of the Space Shuttle Program in developing the CEV, CLV, and a heavy-lift launch vehicle
- Undertake lunar exploration activities directed at enabling robotic and human exploration of Mars and beyond
- Conduct the first extended human exploration mission to the lunar surface by the end of the next decade
- Use the knowledge gained from successful sustained human exploration of the Moon and robotic exploration of Mars, conduct human exploration expeditions to Mars and ultimately, other destinations in our Solar System.

The purpose of NASA's Proposed Action (Preferred Alternative) is to undertake the activities necessary to pursue the human exploration elements of these directives, including developing the flight systems and ground infrastructure required to enable the United States to have continued access to space and to enable future crewed missions to the International Space Station, the Moon, Mars, and beyond. Robotic exploration activities are the responsibility of other NASA programs and are subject to separate NEPA review and documentation, as appropriate.

NASA's current human space flight system, the Space Shuttle, was designed to support missions and activities in low Earth orbit and is not suited to travel to the Moon or beyond. To fulfill the purpose outlined in the President's exploration initiative and to accomplish the specific directives given to NASA by the President and Congress, NASA has initiated the proposed Constellation Program to develop a new class of exploration vehicles and the infrastructure necessary to support their development and use in exploring the Moon, Mars, and beyond. Those exploration vehicles are the proposed Orion spacecraft and the Ares launch vehicles.

Developing the Orion spacecraft and the Ares launch vehicles is only a part of the effort needed for human exploration of space. Missions need to be planned, crews and ground personnel need to be trained, and ground systems need to be readied for launch. These efforts would require an extensive Earth-based infrastructure. This infrastructure (test stands, launch pads, and other support facilities) would provide the means to develop the exploration vehicles; to develop test systems and procedures; configure the flight and ground systems; train the crew and flight controllers; perform integrated launch services; plan and fly the missions; and provide post-landing and recovery services. The Constellation Program would meet this need through the use of existing (modified, if necessary) and new systems and facilities, as appropriate.

Human exploration of the Moon and Mars would also require the development of systems to protect the crew outside the confines of the Orion spacecraft or a habitation module and additional transportation systems to get to, land on, and return from the Moon and Mars. The Constellation Program would meet these needs by developing EVA systems (*e.g.*, spacesuits, tools, and servicing and support equipment), the Lunar Lander, Lunar Surface Systems, and Mars transportation and surface systems.

Beyond meeting the needs of the exploration initiative, the Constellation Program would greatly enhance NASA's ability to meet other broad goals of the U.S. Space Program. Historically, the U.S. Space Program has produced technological advances that have tangible, global benefits. For example, advances in weather forecasting, communications, computing, search and rescue technologies, and robotics and electronics are direct results of the U.S. Space Program. Medical technologies that help save lives, such as computer-aided tomography (CAT) scanners and magnetic resonance imaging (MRI) machines, are derived from technologies developed for use in the U.S. Space Program. Such benefits have come directly from activities by NASA and activities inspired by the discoveries and advancements made through NASA programs. The Constellation Program would continue to provide the opportunity for other advancements by contributing to:

- The extension of the human presence beyond Earth orbit
- The pursuit of scientific activities that address fundamental questions about the history of Earth, the Solar System, and the Universe
- A challenging, shared peaceful experience that unites nations in pursuit of common objectives
- The expansion of Earth's economic sphere and conducting activities with benefits to life on Earth
- A vibrant space exploration program to engage the public, encourage students, and help develop the high technology workforce that will be required to address the challenges of tomorrow.

As directed by the President, retirement of the Space Shuttle fleet is expected to occur by 2010 and is a separate action from the Constellation Program. The environmental impacts associated with retiring the Space Shuttle fleet will be addressed in the *Draft Programmatic Environmental Assessment for Space Shuttle Program Transition and Retirement*, which is scheduled to be released by NASA for public review and comment in early 2008.

1.3 NEPA ACTIVITIES FOR THE CONSTELLATION PROGRAM

1.3.1 NEPA Planning and Scoping Activities

On September 26, 2006, NASA published a Notice of Intent (NOI) in the *Federal Register* (*FR*) (71 *FR* 56183) to prepare a Draft Programmatic Environmental Impact Statement (PEIS) and conduct scoping for the Constellation Program. Scoping meetings to solicit public input on the environmental issues to be addressed and the alternatives to be considered in the PEIS were held on October 18, 2006 in Cocoa, Florida; on October 20, 2006 in Washington, DC; and on October 24, 2006 in Salt Lake City, Utah. Comments were solicited from Federal, state, and local agencies, and other interested parties on the scope of the Constellation Program. Scoping comments were received from private organizations and individuals in the form of letters, electronic mail, telephone messages, and oral and written comments provided at the public scoping meetings. The scoping period ended on November 13, 2006. Scoping comments expressed concerns or questions about technological and environmental issues.

The issues and concerns contained within the scoping comments fall into several broad categories, including environmental impacts associated with the Constellation Program, technological alternatives to the Proposed Action, and a variety of issues that are outside the scope of this Final PEIS. Issues that are outside the scope of this Final PEIS were not considered in the development of this Final PEIS.

The following issues were identified through the public scoping process:

- The economic impact of the Constellation Program, locally and nationally, with an emphasis on the impact of the Program on jobs near NASA Centers
- Risks to the public associated with launch and Earth atmospheric entry
- Environmental impacts of the use of solid rocket fuels on the ozone layer and impacts associated with the deposition of combustion products near the launch area
- Impacts on local animal species (*e.g.*, sea turtles and manatees) associated with construction and launch activities in the KSC area
- Noise impacts associated with launch events
- Relationship between the Constellation Program and the Space Shuttle Program, including how the socioeconomic impacts of the Space Shuttle retirement and the Constellation Program overlap.

These issues are addressed in various sections of Chapter 4 of this Final PEIS.

Additional technology-related issues that were identified through the public scoping process include:

- Alternative technologies to be used for the launch vehicles, including the possibility of using Evolved Expendable Launch Vehicles (*i.e.*, Atlas V and Delta IV launch vehicles) developed by the U.S. Air Force instead of developing new launch vehicles
- Involvement of entities other than NASA in the development of the launch systems, in particular, potential international partnerships and partnerships with private industry.

These issues are addressed in Section 2.3 of this Final PEIS.

Issues raised that are outside the scope of this Final PEIS include the following:

- Possible military applications associated with the Constellation Program.
- Legal issues associated with the use of the Moon and its raw materials.
- Environmental impacts in outer space, including impacts on the Moon.
- Use of nuclear systems in support of the Constellation Program. (Future program activities may benefit from use of nuclear systems in areas such as planetary electrical power generation or interplanetary propulsion. Technical studies will be conducted to determine whether nuclear-based systems can safely and affordably enhance future mission capabilities. Any future activities associated with development and use of nuclear systems for the Constellation Program would be subject to separate NEPA review and documentation, as appropriate.)

- Maintaining funding for the Constellation Program for the extended period required to meet the Program's goals.
- Possible gap in the ability of the U.S. to provide crew transport to the International Space Station.
- Supply of crew and/or cargo to the International Space Station by commercial entities (which would be subject to separate NEPA review and documentation, as appropriate, by NASA independently or in connection with the Federal Aviation Administration commercial licensing process).

An additional issue that was raised which is relevant to the Constellation Program, but not addressed fully in this Final PEIS, involves traffic impacts (*e.g.*, congestion and emissions) associated with landing events at a terrestrial landing site. Impacts associated with terrestrial landing sites would be addressed in separate NEPA documentation, as appropriate.

The Constellation Program actions have the potential to impact several resources that fall under the jurisdiction of other Federal agencies. Therefore, NASA would consult with these agencies as to the impact of the Constellation Program on these resources. The resource areas include, but are not limited to, marine habitats, threatened and endangered species, and historic properties. The Constellation Program has consulted with the U.S. Fish and Wildlife Service regarding sea turtles and the National Marine Fisheries Service regarding essential fish habitats at KSC for Ares launches. Consultations with the respective State Historic Preservation Officers also are underway at the NASA Centers where historic properties may have to be modified to accommodate Constellation Program activities. The Constellation Program would initiate other consultations as appropriate.

1.3.2 Results of Public Review of the Draft PEIS

NASA published a Notice of Availability (NOA) of the *Draft Constellation Programmatic Environmental Impact Statement* on August 17, 2007 (72 *FR* 46218). NASA mailed over 300 hard copies and/or compact disks (CDs) of the Draft PEIS to potentially interested Federal, state, and local agencies; organizations; and individuals. In addition, the Draft PEIS was made publicly available in electronic format on NASA's web site. NASA also sent electronic mail (e-mail) notifications to 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 for the Draft PEIS closed on September 30, 2007. NASA received a total of 21 submissions (letters and e-mails) from Federal, state, and local agencies; organizations; and individuals, of which, 14 submissions contained comments regarding the Constellation Program. Seven submissions only requested to be added to the mailing list to receive a copy of the Final PEIS. The comment submissions included concerns regarding:

- Establishing a light management plan at KSC
- Establishing a monitoring program for bird strikes at KSC
- Water quality, air quality, and hazardous wastes at the U.S. Army's White Sands Missile Range (WSMR) in New Mexico

- Performing a coastal zone consistency determination for Langley Research Center in Virginia
- Raising awareness of metals in the environment
- Environmental impacts in outer space, including impacts on the Moon.

All comment submissions received by NASA during the Draft PEIS public review period can be found in Appendix B of this Final PEIS, along with NASA's responses to specific comments. No alternatives to the Proposed Action were raised during the public review of the Draft PEIS.

1.4 RELATED NEPA ACTIVITIES

The Constellation Program would be completed or accomplished in phases over several decades. This Final PEIS provides analyses of the anticipated and potential environmental impacts associated with the overall Constellation Program based on, and limited by, information currently available. However, in order to meet the timeline established by the President and Congress for the exploration initiative, NASA needed to begin work on several activities (*e.g.*, facility modifications and vehicle design, construction, and testing) in advance of rendering the record of decision (ROD) for the Final PEIS for the Constellation Program, anticipated in early-2008. As discussed in the following paragraphs and identified in Figure 1-2, NASA prepared separate NEPA documentation to analyze the potential environmental impacts of such activities prior to final planning and implementation. These NEPA documents are incorporated by reference in this Final PEIS.

NASA prepared the *Final Environmental Assessment for the Development of the Crew Exploration Vehicle* to address the design, fabrication, and assembly of a limited number of Orion spacecraft prior to selecting a prime contractor for this effort. NASA signed and published a Finding of No Significant Impact (FONSI) in the *Federal Register* on September 1, 2006 (71 *FR* 52169) enabling this action to proceed. Manufacture of the Orion spacecraft and additional testing are addressed in this Final PEIS.

NASA prepared the *Final Environmental Assessment for the Construction, Modification, and Operation of Three Facilities in Support of the Constellation Program, John F. Kennedy Space Center, Florida* to address modifications to Launch Complex (LC)-39 Pad B and associated elements at KSC to support early flight development tests of the Orion/Ares I launch configuration and subsequent mission launches. In order to support these test launches, modifications to several KSC facilities would be required, including the installation of a new Lightning Protection System for LC-39 Pad B. In addition, a new Mobile Launcher would be developed and fabricated. The planning and initial construction associated with these activities needed to begin in 2007 to perform early ascent test flights in time to support the proposed first crewed Orion spacecraft flight by 2014. NASA signed a FONSI on May 2, 2007 enabling this action to proceed.

NASA prepared the *Final Environmental Assessment for the Construction and Operation of the Constellation Program A-3 Test Stand, Stennis Space Center, Hancock County, Mississippi* to address construction and operation of a new test stand (A-3) in support of Ares I Upper Stage liquid engine tests. Test stand construction needed to begin at SSC in 2007 in order to support

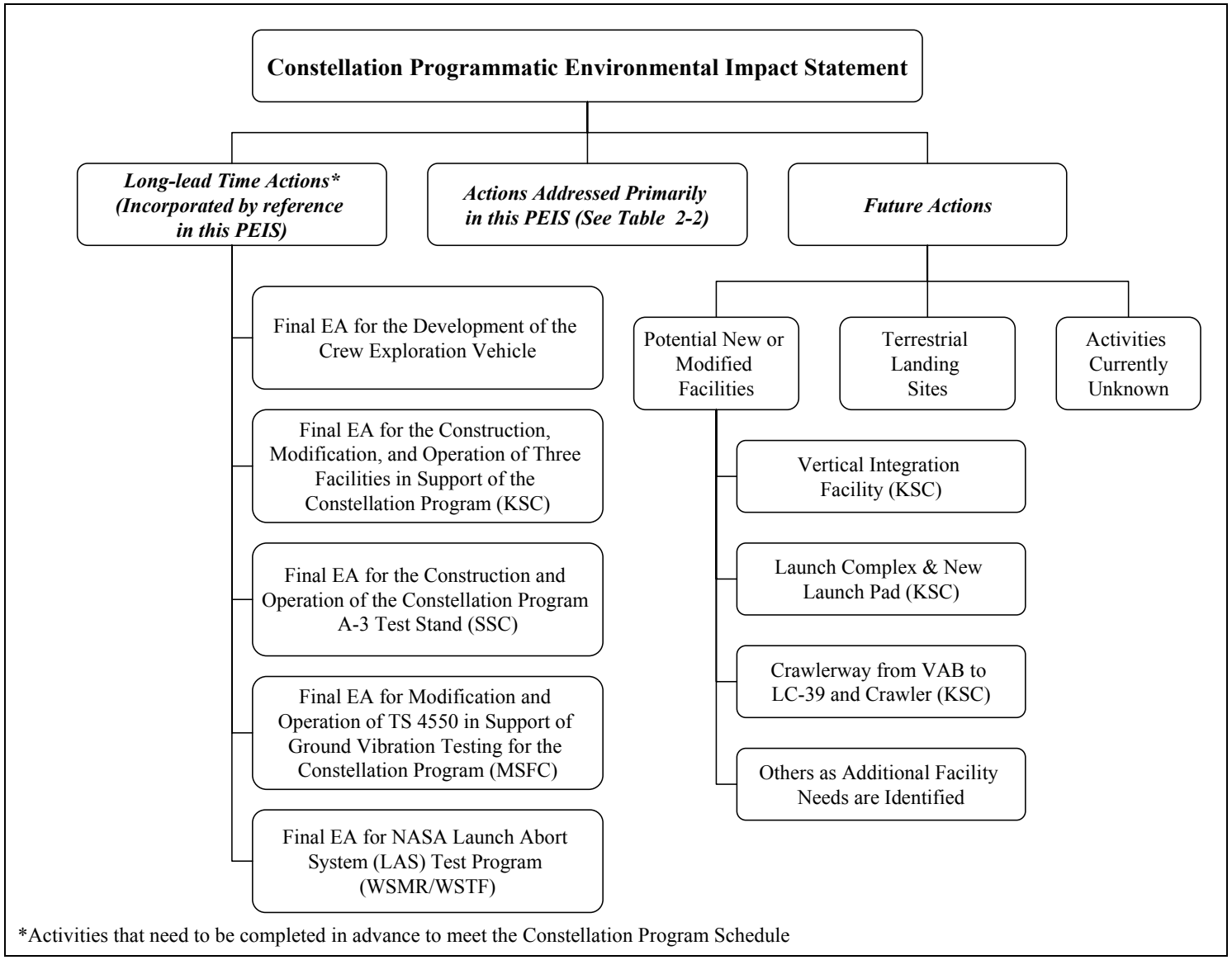


Figure 1-2. Constellation Program NEPA Elements

the proposed Ares I orbital flight tests from KSC in the 2012 timeframe. NASA signed a FONSI on June 4, 2007 enabling this action to proceed.

NASA prepared the *Final Environmental Assessment for NASA Launch Abort System (LAS) Test Program, NASA Johnson Space Center White Sands Test Facility, Las Cruces, New Mexico* to address test facility preparations and Launch Abort System testing activities. The Orion spacecraft design includes a Launch Abort System attached to the top of the Crew Module that would provide a means for the crew to escape in the event of an accident on the launch pad or during launch and ascent. An Orion/Launch Abort System Flight Development Test Program has been developed for this system and activities associated with the preparation of the test facilities needed to begin in 2007 in order to support the proposed first crewed Orion spacecraft flight by 2014. Launch Abort System tests would include on-pad and launch abort tests, which are expected to occur at WSMR. NASA signed a FONSI on August 5, 2007 enabling this action to proceed.

NASA prepared the *Final Environmental Assessment for Modification and Operation of TS 4550 in Support of Ground Vibration Testing for the Constellation Program* to address the modification of structures to support ground vibration testing of the Orion/Ares I integrated vehicle at George C. Marshall Space Flight Center (MSFC) in Huntsville, Alabama. The modification effort would consist of reconfiguring the existing East Test Area Test Stand (Building 4550) to conduct structural dynamic tests that would measure the dynamic characteristics of a full-scale Orion/Ares I vehicle. A FONSI is expected to be signed by NASA in early 2008.

In addition to the NEPA actions stated above, there are several other independent but overlapping actions discussed in the following paragraphs that would be expected to occur during the developmental phase of the Constellation Program.

The Constellation Program is considering the use of both water (ocean) and terrestrial landing sites for crew return. The selection of potential terrestrial landing sites is ongoing and some of the information necessary to identify and analyze the potential terrestrial landing sites will not be available before this Final PEIS is completed. Therefore, this Final PEIS includes only a general discussion of the environmental impacts associated with terrestrial landings. NASA intends to address the selection and operation of terrestrial landing sites in separate NEPA documentation, as appropriate. The environmental impacts associated with a water landing are addressed in this Final PEIS.

By Presidential order, the Space Shuttle fleet is to be retired by 2010 under a separate action from the Constellation Program. The environmental impacts associated with retiring the Space Shuttle fleet will be addressed in the *Draft Programmatic Environmental Assessment for Space Shuttle Transition and Retirement*, which is scheduled to be released by NASA for public review and comment in early 2008.

NASA has initiated agreements with several private sector companies via the U.S. Space Act to explore the possibility of supplying crew and cargo to the International Space Station on commercial terms, similar to terrestrial transportation (*e.g.*, commercial air transport) services. This effort could result in the replacement of some of NASA's transportation capabilities needed

to support the International Space Station with privately developed launch vehicles and ground systems. The effort also could reduce the need for the Constellation Program to provide supply services needed to support the International Space Station. This effort would be addressed by separate NEPA review and documentation, as appropriate.

This Final PEIS is intended to address the potential impacts associated with proposed Constellation Program activities through the early 2020s. Under the present schedule, this includes the proposed development of the Ares launch vehicles and Orion spacecraft, development of advanced systems needed to successfully complete lunar missions (*e.g.*, the Lunar Lander, Lunar Surface Systems, spacesuits [also used for missions to low Earth orbit], and tools), development and construction of the infrastructure needed to support ground and mission operations, early missions to support the International Space Station, and short-duration missions to the Moon. The U.S. commitment to the International Space Station extends well into the next decade, with up to five proposed Orion/Ares I launches per year. The current Constellation Program baseline plan includes up to four lunar missions through 2020.

There are potential future activities associated with the Constellation Program that are beyond the scope of this Final PEIS. Missions to establish a permanent lunar outpost and crewed missions to Mars are activities that are currently not expected to occur during the timeframe addressed in this Final PEIS. Development, operation, and mission activities associated with these actions would be subject to separate NEPA review and documentation, as appropriate. Future program activities may benefit from use of nuclear systems in areas such as planetary electrical power generation or interplanetary propulsion. Technical studies will be conducted to determine whether nuclear-based systems can safely and affordably enhance future mission capabilities. Any future activities associated with development and use of nuclear systems for the Constellation Program would be subject to separate NEPA review and documentation, as appropriate.