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# Space Exploration: Issues Concerning the "Vision for Space Exploration"

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## Summary

On January 14, 2004, President George W. Bush announced new goals for the National Aeronautics and Space Administration (NASA), directing the agency to focus on returning humans to the Moon by 2020, and eventually sending them to Mars and "worlds beyond." The President invited other countries to join. Most of the funding for this "Vision for Space Exploration" is to be redirected from other NASA activities, including terminating the space shuttle program in 2010, and ending U.S. participation in the International Space Station by 2016. NASA released an implementation plan for the Vision on September 19, 2005, and estimated the cost of returning humans to the Moon by 2018 (NASA's current goal) at $104 billion. An estimate for sending people to Mars was not provided. This report identifies issues Congress has been considering as it debates the President's Vision. This is the final edition of this report; see CRS Issue Brief IB92011, *U.S. Space Programs: Civilian, Military, and Commercial*, by (name redacted), for further information.

## Overview of President George W. Bush's Vision for Space Exploration

On January 14, 2004, President George W. Bush announced a new "Vision for Space Exploration" [http://www.whitehouse.gov/news/releases/2004/01/20040114-3.html]. Amplified by documents from the White House Office of Science and Technology Policy [http://www.ostp.gov] and NASA, the main features include the following.

- Astronauts would return to the Moon in the 2015-2020 time period using a new "Crew Exploration Vehicle" (CEV) to be developed by NASA. (The last time Americans walked on the Moon was in 1972.)
- Eventually, astronauts would go to Mars. No date was announced.
- Robotic probes would serve as trailblazers for human explorers. The first probe to support the Vision would be launched to the Moon in 2008.
- Construction of the International Space Station (ISS) would be completed by 2010. The President promised that the United States would meet its

obligations to its partners in the ISS program — Europe, Canada, Japan, and Russia.[1] U.S. involvement in ISS would end by 2016.
- The space shuttle system would be retired in 2010. Between 2010 and 2014, when the CEV would be operational for Earth orbital missions, U.S. astronauts would rely on Russia to take them to and from ISS.
- NASA would redirect its research aboard the ISS to that which specifically supports the Vision, instead of the broadly based research program that was planned.
- Other countries were invited to participate in the Vision.
- A cost estimate was not provided, but FY2005 NASA budget documents showed that $12.6 billion would be "added"[2] to its budget for FY2005-2009 to begin implementing the Vision, and a NASA projected budget chart (the **"sand chart"**[3]) suggested that $150-170 billion would be spent on the Vision from FY2004-2020. Most of the money was to come from other NASA programs. The $12.6 billion, for example, comprised $1 billion in new money, and $11.6 billion redirected from other activities.
- A Commission on the Implementation of U.S. Space Exploration Policy was created by the President to advise NASA on implementation of the Vision; its report was issued in June 2004.

The speech came 11 months after the February 1, 2003, space shuttle *Columbia* accident (see CRS Report RS21408), and two weeks after the January 3, 2004, successful landing of a U.S. robotic probe (Spirit) on Mars. Invoking the explorations of Lewis and Clark, the President explained that America has ventured into space for the same reasons, "because the desire to explore and understand is part of our character. And that quest has brought tangible benefits that improve our lives in countless ways."

## Public Reaction

An Associated Press-Ipsos poll conducted before the President's speech, in response to press reports that it was imminent, found 48% of the respondents in favor of a Moon/Mars program, 48% opposed, and 4% not sure.[4] A June 22-July 7, 2004 Gallup poll sponsored by the Coalition for Space Exploration (a group of companies and organizations that support the Vision) found that, in response to a question about funding a Moon/Mars program as long as NASA's budget did not exceed 1% of the federal budget, 26% strongly supported, 42% supported, 15% opposed, and 9% strongly opposed the plan. A similar poll a year later found that 26% strongly supported, 50.5% supported, 14% opposed, and 6.5% strongly opposed it. The remainder were neutral, did not know, or did not answer. The polls are at [http://www.spacecoalition.com]. A CNN/USA

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[1] A 1998 Intergovernmental Agreement (IGA), and Memoranda of Understanding between NASA and its counterparts, detail those obligations. See [[http://www.hq.nasa.gov/office/oer/]].

[2] The characterization of the $12.6 billion as an "addition" was based on a NASA assumption that without the Vision, NASA would have been held to a flat budget. The "increase," therefore, was above a hypothetical budget that is lower than what NASA projected in its FY2004 budget.

[3] The 2004 "**sand chart**" is at [http://www.nasa.gov/pdf/54873main_budget_chart_14jan04.pdf].

[4] (1)"Results of AP Poll on Space Exploration," *Associated Press*, Jan. 2, 2004, 14:44. (2) Will Lester, "AP Poll: U.S. Tepid on Bush's Space Plans," *Associated Press*, Jan. 12, 2004, 14:50.

Today/Gallup poll conducted at the same time as the 2005 poll for the Coalition found, however, that 40% of those surveyed wanted to set money aside for a human trip to Mars, while 58% were opposed [http://poll.gallup.com/content/default.aspx?ci=17224&pg=1].

## Congressional Reaction

NASA's oversight and funding committees (House Science, Senate Commerce, and House and Senate Appropriations[5]) have held many hearings on the Vision and related issues. Members of both parties have expressed support for the goal, but also concern about the cost and the impact on other NASA activities and NASA's workforce.

**FY2005 Funding.** For FY2005, Congress appropriated almost all the funding NASA requested for all its activities (see CRS Report RL32676 for more information on NASA's FY2005 budget). Many Vision supporters considered that action as a sign of congressional support. Conferees on the act, however, explicitly stated that although they were appropriating substantial funds for the Vision, "to date there has been no substantive Congressional action endorsing this initiative." (H.Rept. 108-792, p. 1599).

**FY2006 Funding.** NASA's total FY2006 budget request was $16.5 billion, a 2.4% increase over what was appropriated in the FY2005 Consolidated Appropriations Act (P.L. 108-447). If a $126 million FY2005 supplemental is added, NASA's FY2005 total was $16.2 billion, and the FY2006 request was a 1.6% increase. By comparison, the White House projected a 4.7% increase for FY2006 when it announced the Vision in 2004. CRS Report RL32988 describes NASA's FY2006 budget in more detail.

Within NASA's total budget request, what constitutes funding for the "Vision" is open to interpretation. A NASA budget chart from February 2005 divided the FY2006 request into three categories: "exploration-specific," $6 billion; "shuttle & space station," $6.4 billion; and "earth science, aeronautics, and others," $4.1 billion. Some may consider the Vision funding as that in the "exploration-specific" category, which combines funding for the Exploration Systems Mission Directorate (ESMD) with many programs in the Science Mission Directorate, such as robotic solar system exploration and space telescopes. Others may add funding for the space shuttle and space station, since those are often described as the first steps in the Vision. Alternatively, funding only for ESMD ($3.2 billion) could be defined as funding for the Vision, which includes development of the new Crew Exploration Vehicle and a launch vehicle for it.

Congress appropriated $16,456.8 million for NASA in the FY2006 Science, State, Justice Commerce (SSJC) appropriations act (H.R. 2862, P.L. 109-108). It provides a net increase of $500,000 above the requested level, but is subject to a 0.28% across-the-board rescission in that act, and a 1% rescission in another appropriations act (P.L. 109-148). In the SSJC act, Congress added approximately $500 million for specific projects or activities and cut a similar amount. For ESMD, Congress cut $25 million from each of the two research and technology programs as recommended by the House; $34 million

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[5] For FY2005, NASA was overseen by the VA-HUD-IA subcommittees in the House and Senate appropriations committees. In the 109th Congress, NASA is part of the Science, State, Justice, Commerce (SSJC) appropriations subcommittee in the House; and the Commerce, Justice, Science (CJS) appropriations subcommittee in the Senate.

from Centennial Challenges (which awards monetary prizes for developing solutions to technological challenges set by NASA) as recommended by the Senate; and $200 million from Project Prometheus (see below). Congress also passed a NASA authorization act in 2005 (P.L.109-155). It endorsed the President's Vision, and authorized a total for NASA of $17.9 billion in FY2007 and $18.7 billion in FY2008. Both figures are higher than the out-year estimates in NASA's FY2006 budget request ($17 billion for FY2007 and $17.3 billion for FY2008). Congress continues to stress that NASA should continue a balanced set of programs, including science and aeronautics, not focus entirely on the Vision.

## Comparison with the 1989 Space Exploration Initiative

Although some media stories portray President Bush's speech as the first new vision for NASA since the Apollo era, [6] President George H.W. Bush made a similar proposal on July 20, 1989, the 20th anniversary of the first human landing the Moon. Known as the Space Exploration Initiative (SEI), the senior President Bush directed that the space station serve as a stepping stone to returning humans to the Moon and someday sending them to Mars. In a May 1990 speech, he added more details, saying that he believed humans would reach Mars by 2019. Richard Darman, then Director of the Office of Management and Budget (OMB), stated at a press conference the day of the President's original speech that fulfilling the Moon/Mars goals would cost $400 billion over 30 years. Other estimates (some higher, some lower) were offered later by NASA.

SEI was announced during a period when Congress was attempting to reduce the federal deficit, and the proposal was not received enthusiastically. Funding for SEI was requested in the FY1991, FY1992, and FY1993 budgets, though what constituted "SEI funding" changed during those years. For FY1991 NASA requested $953 million for SEI. The FY1991 NASA authorization bill (P.L. 101-611) approved almost full funding, but the appropriations bill essentially zeroed it (P.L. 101-507), although NASA was allowed to reprogram $37 million into SEI for FY1991. For FY1992, the NASA request was $94 million; Congress approved $32 million. For FY1993, $64 million was requested. The FY1993 NASA authorization bill (P.L. 102-588) approved approximately half of that; the appropriations bill (P.L. 102-389) essentially zeroed it.

## Implementing the Vision

Dr. Michael Griffin became NASA's Administrator in April 2005. In the early 1990s, while the senior President Bush was in office, Dr. Griffin headed NASA's SEI

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[6] The Apollo program was initiated by President John F. Kennedy in May 1961 to land a man on the Moon and return him safely to Earth before the end of that decade. NASA first developed experience with launching people into space, and extravehicular activities (EVAs, or spacewalks), through the Mercury (1961-1963) and Gemini (1965-1966) programs. The first Apollo mission was to be launched in 1967, but the crew died on January 27, 1967 when a fire erupted in the Apollo command module during a pre-launch test. The first successful Apollo mission was launched in 1968, and the first Americans landed on the Moon on July 20, 1969 (Neil Armstrong and Buzz Aldrin, while pilot Michael Collins orbited above in the Apollo 11 spacecraft). A total of six two-man crews walked on the Moon from 1969-1972. Another crew (Apollo 13) intended to land on the Moon in 1970, but made an emergency return to Earth when the Service Module of their spacecraft exploded enroute to the Moon.

program (see above). Dr. Griffin's plans for implementing the Vision are somewhat different from those of his predecessor, Mr. Sean O'Keefe.

**Crew Exploration Vehicle (CEV) and Crew Launch Vehicle (CLV).** President Bush directed NASA to develop a CEV to take astronauts to and from the Moon. He called for a demonstration flight by 2008, and an operational capability to Earth orbit no later than 2014. During Mr. O'Keefe's tenure, NASA would not commit to using the CEV to take crews to and from the ISS, wanting to keep the CEV design clearly focused on lunar transportation. Dr. Griffin, by contrast, has explicitly linked the CEV and the ISS. It will take crews back and forth to the ISS, and serve as a "crew return" vehicle (or lifeboat) for them. Mr. O'Keefe's plan was to open a competition for industry teams to design the CEV and conduct demonstration flights in 2008, after which a single contractor would be selected to build an operational CEV by 2014. Dr. Griffin decided that NASA itself should determine the basic design, and plans to award a single contract in 2006. He hopes for an Earth-orbital operational capability by 2012. That would leave a multi-year gap between the end of the shuttle and the availability of the CEV, during which time NASA would be dependent on Russia for transporting NASA astronauts to the ISS.

The CEV needs a launch vehicle, which is designated the Crew Launch Vehicle (CLV). The directive that NASA terminate the shuttle in 2010 refers to the shuttle in its current configuration — an airplane-like Orbiter carrying crew and cargo, with two Solid Rocket Boosters (SRBs) on each side, and a large, cylindrical External Tank (ET) containing fuel for the Orbiter's main engines. Dr. Griffin plans to develop two "shuttle-derived" launch vehicles (SDLVs) using the SRBs and ET, but not the Orbiter. One is the CLV, which will use one SRB and a new upper stage, with the CEV spacecraft on top. The other is a "heavy lift" SDLV using the ET and SRBs, with a cargo carrying spacecraft on top. For more information, see CRS Issue Brief IB93062.

**Project Prometheus.** NASA initiated this program to develop advanced nuclear power and propulsion systems before the Vision was announced. Its original goal was developing Nuclear Electric Propulsion (NEP) and advanced Radioisotope Thermoelectric Generators (RTGs) for a robotic probe, called the Jupiter Icy Moons Orbiter (JIMO), to study three of Jupiter's moons. RTGs have been used by NASA since the 1960s to supply power for spacecraft systems and experiments on probes that travel so far from the Sun that solar energy-based systems are impractical. RTGs also can be used for spacecraft that land on surfaces where they will experience "night" for long periods. NASA has not used nuclear propulsion, either NEP or a different type, Nuclear Thermal Propulsion (NTP), in the past, although NASA worked on developing NTP in the 1960s and early 1970s. After the Vision was announced, Prometheus took on greater importance because of its potential for providing power and propulsion for human exploration, as well as robotic spacecraft. However, the desire to accelerate development of the CEV means that funding must be shifted to it from other NASA activities. Project Prometheus is one of those. Initially, Dr. Griffin cut funds and refocused it on nuclear surface power systems (for use on the lunar surface, e.g.) and NTP, with NEP as a third priority. In a September 30, 2005 update to its operating plan, NASA announced it was further restructuring the program, yielding $76 million in FY2006 that would be redirected to the CEV/CLV program. JIMO was canceled, and only low-level funding will be provided for key nuclear systems research and technology issues. Funding for Prometheus was shifted back to the Science Mission Directorate (where it originated), although the program will be managed by ESMD. As noted, Congress cut $200 million from Prometheus in NASA's FY2006 appropriations act.

## Key Issues for Congress

Many media accounts of the Vision focus on the long term "Moon/Mars" goals, but nearer term questions of how long to fly the space shuttle and utilize the International Space Station, and the funding impact on other NASA activities, are an immediate focus.

**What Are the Implications of Terminating the Shuttle Program in 2010?** The shuttle program, and debate about its future, are discussed in CRS Report RS21408. The shuttle is the only U.S. vehicle capable of taking astronauts to and from space. President Bush directed NASA to retire the shuttle in 2010, when construction of the International Space Station (ISS) is expected to be finished. Dr. Griffin has repeatedly expressed his intention to terminate the shuttle program in 2010, whether or not ISS is completed. Issues include whether announcing a strict date for terminating the shuttle could create schedule pressure similar to that cited by investigators as a factor in the 2003 space shuttle *Columbia* tragedy; and whether the United States wants to be dependent on Russia for human access to space during the gap between the end of the shuttle program and the availability of the new CEV (see above).

**Should U.S. Involvement in ISS End by 2016?** The ISS is discussed in more detail in CRS Issue Brief IB93017. It is being assembled in Earth orbit, and assembly is expected to be completed in 2010. Plans had called for ISS to be operated for at least 10 years after "assembly complete" as a laboratory for microgravity experiments, with research benefitting both future NASA exploration missions and people on Earth. Now, the plan is for NASA to complete its utilization of the ISS by 2016, and narrow its research program to only that needed to support human space exploration. Some question whether the U.S. investment in the space station (about $35 billion through FY2005) is worth the benefits under those circumstances. The NASA authorization act (P.L. 109-155) seeks to enhance the use of the ISS for scientific research by designating it as a national laboratory and requiring that 15% of ISS research funds be spent on non-Vision related research. Other questions include what will happen to the ISS when NASA ends its participation — will it be turned over to the other ISS partners, privatized, or deorbited?

**What Are the Costs and Other Details?** The Bush Administration has not provided a cost estimate for the Vision as a whole, but in 2005, NASA estimated the cost for returning humans to the Moon by 2018 (its current goal) at $104 billion (excluding $20 billion that would be spent on ISS servicing using the CEV). A September 2004 Congressional Budget Office [http://www.cbo.gov] report cautioned that, based on historical trends at NASA, the actual cost could be much higher than NASA estimates.

Taking most of the requisite funds from other NASA programs instead of adding new money for the agency may mitigate concerns that the Vision could increase the deficit or detract from other national priorities. It raises issues, however, about the impact to those other NASA programs, and whether the level of funding is adequate to achieve the goals. Dr. Griffin asserts that he will not take money from space science, earth science, or aeronautics programs to pay for the Vision, so the source of the needed funds is unclear, especially since NASA's budget is projected to rise only at the rate of inflation for the foreseeable future. Additional questions include the extent to which other countries will want to participate in the Vision, and whether the Vision is an appropriate goal for NASA. Some argue that space exploration can be done more safely and less expensively by robotic probes.