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

Marcia S. Smith
Resources, Science, and Industry Division

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." 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 FY2017. Space science, earth science, and aeronautics programs also would be impacted. In 2004, NASA estimated the cost for returning humans to the Moon at about $64 billion through FY2020 (excluding robotic probes). An estimate for the other Vision goals was not provided. The President invited other countries to join. Whether to proceed with the Vision as outlined by the President, and its impact on NASA's workforce and other activities, are being debated by Congress. This report is updated regularly.

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

On January 14, 2004, President George W. Bush announced new goals for the U.S. space program [http://www.whitehouse.gov/news/releases/2004/01/20040114-3.html]. Amplified by documents from the White House Office of Science and Technology Policy (OSTP) [http://www.ostp.gov] and NASA, the main features of this "Vision for Space Exploration" are 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, and "worlds beyond." No dates were 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 FY2017.

- The space shuttle system (see CRS Issue Brief IB93062) would be retired in 2010. Between 2010 and 2014, when the CEV would be operational, U.S. astronauts would rely on Russia to take them to and from ISS (though NASA currently does not have such an agreement with Russia).
- 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]) suggests that $150-170 billion would be spent on the Vision from FY2004-2020. Most of the money comes from other NASA programs. The $12.6 billion, for example, comprises $1 billion in new money, and $11.6 billion redirected from other NASA activities. In the FY2005 budget, the White House projected that NASA's total budget would increase about 5% per year for FY2005-2007, then at less than the rate of inflation (estimated at about 2%) for FY2008-2009.
- A Commission on the Implementation of U.S. Space Exploration Policy was created by the President to advise NASA on implementation of the Vision. Headed by former DOD official E.C. "Pete" Aldridge, its report was issued on June 16, 2004. CRS Report RS21866 provides a synopsis.

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 several days (January 9-11) before the President's speech, in response to press reports that the announcement 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 found 26% strongly support, 42% support, 15% oppose, and 9% strongly

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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/codei/].

[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, is above a hypothetical budget that is lower than what NASA projected in its FY2004 budget.

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

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

oppose the plan (the remainder were neutral, did not know, or did not answer). The poll is available at [http://www.spacecoalition.com].

Congressional Reaction

The committees that oversee NASA's budget (House Science, Senate Commerce, and House and Senate Appropriations[5]) have held many hearings on the Vision and related issues. Members of both parties on both sides of Capitol Hill have expressed support for the overall goals, but also concern about the cost, the impact on other NASA activities and NASA's workforce, and other issues.

FY2005 Funding. For FY2005, Congress appropriated almost all the funding NASA requested ($16.200 billion versus the $16.244 billion requested) in the FY2005 Consolidated Appropriations Act (P.L. 108-447). 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). It also should be noted that while Congress appropriated $16.2 billion, that was reduced to $16.07 billion by an across-the-board rescission, and over $1 billion must go to activities that were not included in the request — an extra $762 million needed for returning the shuttle to flight status, and over $400 million in congressionally directed spending. (NASA also received a $126 million FY2005 supplemental for hurricane relief, but plans to spend those funds on repairing hurricane damage, so the money is not available for other purposes.) The conferees gave NASA "unrestrained transfer authority" to shift funds between its two major budget accounts. NASA is notifying Congress about its plans for spending the money by submitting periodic "operating plans."

FY2006 Request. NASA's total budget request is $16.5 billion, a 2.4% increase over what was appropriated in the FY2005 Consolidated Appropriations Act. If the $126 million hurricane supplemental is added, the FY2005 total is $16.2 billion, and the FY2006 request is 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 RS22063 describes NASA's FY2006 budget request in more detail.

How much of the request is for "the Vision" is not specified, although a NASA briefing chart identifies $6 billion for "exploration specific" activities: $2.8 billion for robotic exploration, $1.1 billion for human exploration, and $2 billion for exploration technology. Another $6.4 billion is requested for the space shuttle and space station programs, which are often described as the first steps in the Vision. A June 7, 2005 House Appropriations Committee press release summarizing its markup of NASA's budget said $3.1 billion was approved for "the President's vision," but further details were not provided. The report has not yet been filed, and a bill number has not been assigned.

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[5] For FY2005, NASA was included under the VA-HUD-IA subcommittees in the House and Senate appropriations committees. Both committees reorganized for the 109th Congress. NASA now is part of the Science, State, Justice, Commerce (SSJC) appropriations subcommittee in the House; and the Commerce, Science, Justice (CSJ) appropriations subcommittee in the Senate.

Comparison with the 1989 Space Exploration Initiative

Although some media stories portray the current 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 cut government spending 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 significantly 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). Congress subsequently allowed NASA 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 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). 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. The plan was to open a competition for industry teams to design the CEV and conduct

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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.

demonstration flights in 2008, after which a single contractor would be selected to build an operational CEV by 2014. If the shuttle was terminated in 2010, and the CEV became available in 2014, a gap of up to four years might occur when NASA would be dependent on Russia for transporting NASA astronauts to and from the ISS. Dr. Griffin therefore has made accelerating development of the CEV a priority in order to reduce that gap. He also explicitly has added ISS transport to CEV's requirements. Dr. Griffin also thinks that the CEV design should be sufficiently straightforward that a single contractor can be selected in 2006 instead of 2008, saving an estimated $1 billion. One consequence of accelerating the CEV is that money must be shifted from other activities, such as Project Prometheus (see below) and the ISS research budget, to pay for it.

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. Dr. Griffin is changing the focus of Project Prometheus to nuclear "surface power" systems (for use on the lunar surface, e.g.) and NTP. Development of NEP is now third on the priority list. He also is reducing funding for the Project.

Launch Vehicles. NASA's space shuttle is designed to take both crews and cargo to and from space. For the future, however, NASA has decided to separate those functions, so crews and cargo will not be launched together. Two U.S. launch vehicles are available today that could be capable of launching a CEV — Lockheed Martin's Atlas V, and Boeing's Delta IV. Neither was designed to launch people, and what, if any, changes would be required to "human-rate" the vehicles is being assessed. What vehicle to use for cargo also is under study. Some support using "heavy lift" versions of the Atlas and Delta vehicles for that as well, but Dr. Griffin is a strong advocate of modifying the shuttle system to launch only cargo by replacing the airplane-like orbiter, where the crew and cargo are located, with a cargo pod. The President's directive that "the shuttle" be terminated in 2010 apparently is a reference only to the shuttle in its current form, not to a "shuttle derived" launch vehicle.

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 space shuttle has made 113 flights, two of which ended in tragedy — *Challenger* in 1986 and *Columbia* in 2003. The shuttle is the only U.S. vehicle capable of taking astronauts to and from space. The potential gap between the end of the shuttle program and the availability of the CEV is discussed above. If NASA becomes dependent on Russia for astronaut access to ISS, questions include how much Russia would charge, and

how NASA would pay, since the Iran Nonproliferation Act (P.L. 106-178) prohibits NASA from paying Russia for ISS-related activities unless Russia stops proliferating certain technologies to Iran. Other issues include the future of the shuttle workforce, how NASA would meet its commitments to its ISS partners without the shuttle to transport crews and cargo during ISS' operational period, and how to avoid placing schedule pressure on the shuttle program. The Columbia Accident Investigation Board (CAIB) cited schedule pressure as a factor in the *Columbia* tragedy, and some view the current decision to terminate the shuttle in 2010 as creating similar pressure.

Should U.S. Involvement in ISS End by FY2017? ISS is being assembled in Earth orbit. Assembly began in 1998 and is now expected to be completed in 2010. Plans had called for ISS to be operated for at least 10 years after assembly was completed as a laboratory for microgravity experiments, with research benefitting not only future NASA exploration missions, but people on Earth. Now, the plan is for NASA to complete its utilization of the ISS by FY2017, and the U.S. research program is being redirected to support only research needed to support human space exploration. Some question whether the taxpayer investment in the space station (about $35 billion through FY2005) is worth the benefits if the only U.S. research conducted there is related to the "Moon/Mars" goals. Senator Hutchison has raised questions about the lost opportunities in other scientific disciplines of focusing the research only on the Vision. Another question is what will happen to the space station when NASA ends its participation? Will it be turned over to the other partners? Will it be "privatized"? Will it be deorbited?

What Are the Costs and Other Details? The Bush Administration has not provided a cost estimate for the Vision, only a projected budget chart through 2020. In 2004, NASA estimated the cost for returning humans to the Moon by 2020 at $64 billion — $24 billion to build and operate the CEV from FY2004-2020, plus $40 billion for FY2011-2020 to build the lunar lander portion of that vehicle, a new launch vehicle, and operations. The cost of robotic missions are not included. 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.

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. But it raises issues about the impact to those other NASA programs, and whether the level of funding is adequate to achieve the goals. NASA's FY2006 budget request, for example, proposes significant cuts to aeronautics programs, with an associated reduction of 1,100 aeronautics jobs by the end of FY2006. 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.