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CRS Report for Congress

# National Aeronautics and Space Administration: Overview, FY2007 Budget in Brief, and Key Issues for Congress

Daniel Morgan and Carl E. Behrens
Resources, Science, and Industry Division

## Summary

The National Aeronautics and Space Administration (NASA) conducts U.S. civilian space and aeronautics activities. Its FY2006 appropriation was $16.623 billion. For FY2007, the Administration requested $16.792 billion, a 1% increase (or a 3.2% increase if one-time FY2006 funding for hurricane recovery is excluded). The NASA Authorization Act of 2005 (P.L. 109-155) authorized FY2007 funding of $17.932 billion. The House provided $16.709 billion. The Senate Appropriations Commitee recommended $17.797 billion. Final funding awaits action by the 110th Congress on a continuing resolution for the remainder of FY2007. The key issue for Congress is how NASA is implementing the Vision for Space Exploration, including whether it is maintaining a balanced portfolio of programs that include science and aeronautics. This report will be updated.

## Agency Overview

The National Aeronautics and Space Administration (NASA) was created by the 1958 National Aeronautics and Space Act (P.L. 85-568) to conduct civilian space and aeronautics activities. NASA opened its doors on October 1, 1958, almost exactly a year after the Soviet Union launched the world's first satellite, Sputnik. In the five decades since, NASA has conducted far-reaching programs in human and robotic spaceflight, technology development, and scientific research.

NASA is managed from headquarters in Washington, DC. It has nine major field centers: **Ames Research Center**, Moffett Field, CA; **Dryden Flight Research Center**, Edwards, CA; **Glenn Research Center**, Cleveland, OH; **Goddard Space Flight Center**, Greenbelt, MD; **Johnson Space Center**, near Houston, TX; **Kennedy Space Center**, near Cape Canaveral, FL; **Langley Research Center**, Hampton, VA; **Marshall Space Flight Center**, Huntsville, AL; and **Stennis Space Center**, in Mississippi, near Slidell, LA. In addition, it has a federally funded research and development center, the **Jet Propulsion Laboratory**, Pasadena, CA, operated by the California Institute of

Technology. NASA Administrator Dr. Michael Griffin leads a workforce of more than 19,000 civil servants and more than 40,000 contractors and grantees ([http://nasapeople.nasa.gov/Workforce/data/page7.htm]). More information on NASA's organization, including details of its four Mission Directorates (Aeronautics Research, Exploration Systems, Science, and Space Operations) can be found on the NASA website at [http://www.hq.nasa.gov/hq/org.html].

## NASA's FY2007 Budget Request

For FY2007, NASA requested $16.792 billion in new budget authority (see **Table 1**). For FY2006, the agency received $16.623 billion (when adjusted for two across-the-board rescissions totaling 1.28%, a transfer of $27 million from the National Oceanic and Atmospheric Administration, and a supplemental appropriation of $350 million for recovery from Hurricane Katrina). The net requested increase for FY2007 is 1%, or 3.2% if the one-time hurricane funding is excluded. The House provided $16.709 billion (H.R. 5672), while the Senate Appropriations Committee recommended $17.797 billion, of which $1.040 billion would be emergency funding (S.Rept. 109-280).

### Table 1: NASA FY2007 Budget Request

($ millions)

| | FY2006 (OMB) | FY2006 (NASA) | FY2007 Request | FY2007 House | FY2007 Sen. Cmte. |
|---|---|---|---|---|---|
| **Science, Aeronautics, and Exploration** | | | | | |
| *Science* | *$5,254* | *$5,254* | *$5,330* | *$5,405* | *5,362* |
| Solar System Exploration | — | 1,582 | 1,610 | — | 1,610 |
| The Universe | — | 1,508 | 1,509 | — | 1,509 |
| Earth-Sun System | — | 2,164 | 2,211 | — | 2,242 |
| *Exploration Systems* | *3,114* | *3,050* | *3,978* | *3,828* | *3,922* |
| Constellation Systems | — | 1,734 | 3,058 | 3,042 | 2,961 |
| Exploration Systems R&T | — | 692 | 646 | 511 | 686 |
| Human Systems R&T | — | 624 | 275 | 275 | 275 |
| *Aeronautics Research* | *929* | *884* | *724* | *824* | *759* |
| *Cross-Agency Suppt. Programs* | *367* | *534* | *492* | *425* | *492* |
| *Reductions Not Allocated* | — | — | — | — | *–45* |
| **Subtotal** | **9,664** | **9,721** | **10,524** | **10,482** | **10,489** |
| **Exploration Capabilities** | | | | | |
| *Space Operations* | *6,578* | *6,870* | *6,234* | *6,194* | *6,235* |
| Space Shuttle | — | 4,778 | 4,057 | 4,057 | 4,057 |
| International Space Station | — | 1,753 | 1,811 | 1,778 | 1,811 |
| Space and Flight Support | — | 339 | 367 | 359 | 367 |
| **Subtotal** | **6,578** | **6,870** | **6,234** | **6,194** | **6,235** |
| **Inspector General** | **32** | **32** | **34** | **34** | **34** |

| | | | | | |
|---|---|---|---|---|---|
| **Return to Flight (emergency)** | — | — | — | — | **1,000** |
| **Hurricane Katrina (emergency)** | — | — | — | — | **40** |
| **Total** | **16,274** | **16,623** | **16,792** | **16,709** | **17,797** |
| 2005 Hurricane Augmentation | 350 | — | — | — | — |
| **Grand Total** | **16,623** | **16,623** | **16,792** | **16,709** | **17,797** |

**Sources:** The first FY2006 column is from Office of Management and Budget, *Budget of the United States Government, FY2007*, p. 272, with the grand total added by CRS. The second FY2006 column is from the FY2007 NASA budget request ([http://www.nasa.gov/pdf/142458main_FY07_budget_full.pdf]) and reflects the program allocation of hurricane recovery funds as well as other changes made by the agency's FY2006 initial operating plan. The FY2007 columns are from the budget request, H.Rept. 109-520, and S.Rept. 109-280. The House did not specify funding for the three themes within Science. The Senate committee did not specify amounts within the Science, Aeronautics, and Exploration appropriations account; these amounts are estimated by CRS based on the requested amounts and the program increases and decreases specified in the Senate committee report. The amount shown as "Reductions Not Allocated" is calculated by CRS as the difference between the recommended overall decrease for the account and the sum of the specified program increases and decreases. Totals may not add because of rounding.
**Notes:** R&T = Research and Technology. Comparisons with years before FY2006 are difficult at anything less than the total agency level because of repeated changes in NASA's budget structure. The only major such change for FY2007 is the new Cross-Agency Support Programs category, which consists of the Education, Advanced Business Systems, and Shared Capabilities Themes and the Innovative Partnerships Program. Education was previously its own top-level budget category.

## The Vision for Space Exploration

On January 14, 2004, President Bush announced new goals for NASA: the Vision for Space Exploration, often referred to simply as the Vision or the Moon/Mars program. The President directed NASA to focus its efforts on returning humans to the Moon by 2020, and some day sending them to Mars and "worlds beyond." (Twelve U.S. astronauts walked on the Moon between 1969 and 1972. No humans have visited Mars.) Other countries were invited to participate in the Vision, and the President further directed NASA to fulfill its commitments to its partners in building the International Space Station (ISS): Russia, Japan, Canada, and 10 European countries.

The President added only $1 billion to NASA's budget plan to implement the Vision, out of the estimated $12.6 billion that would be needed for FY2005-2009; the rest is to be redirected from other NASA activities. From FY2010 to FY2020, NASA's budget would remain level with inflation. To free funds for the Vision, the President directed that the space shuttle program be terminated in 2010, and according to a NASA budget chart released in conjunction with the President's speech, U.S. use of the ISS will end by FY2017. The Vision creates issues that center on whether NASA should be devoted solely to human space exploration or retain its commitment to science and aeronautics.

Under the Vision, NASA is to develop a new spacecraft called Orion (formerly the Crew Exploration Vehicle) and a launch vehicle for it called Ares I (formerly the Crew Launch Vehicle), with an Earth-orbit capability by 2014 and the ability to take astronauts to and from the Moon no later than 2020. On September 19, 2005, NASA released its implementation plan for the Vision, setting a goal of having Orion and Ares I ready for Earth-orbit missions by 2012 and returning astronauts to the Moon by 2018. NASA stresses, however, that this is a "go-as-you-can-pay" program, with its pace set, in part, by available funding.

A cost estimate for the Vision as a whole has not been provided by NASA. The September 2005 implementation plan estimates that it will cost $104 billion to return astronauts to the Moon by 2018, not including robotic missions or $20 billion to use Orion to service the ISS. (NASA plans at least two robotic missions to the Moon, the first in 2008, to provide data on potential landing sites.)

NASA created the Exploration Systems Mission Directorate (ESMD) to implement the "Moon/Mars" program. The FY2007 budget and its out-year projections would shift about $1.5 billion out of ESMD to help pay for shortfalls in the space shuttle and ISS programs. In order to fund Orion and Ares I, NASA has significantly cut other ESMD activities, such as Project Prometheus (to develop space nuclear power and propulsion systems) and microgravity research on the ISS.

# Key Congressional Issues

The major issue facing Congress as it debates NASA's FY2007 budget request is how to implement the Vision. Debate over NASA's FY2005 and FY2006 budgets answered the question of *whether* the Vision should be adopted — the 2005 NASA authorization act (P.L. 109-155) directs NASA to establish a program to accomplish the goals set out by the President. However, that law and NASA's FY2006 appropriations act (P.L. 109-108) emphasize that NASA should have a balanced set of programs that include not only those related to the Vision, but science and aeronautics as well. Exacerbating the dilemma of how to maintain this balance without a significant long-term budget increase, NASA is contending with the costs of returning the space shuttle to flight status, completing the ISS, and overruns in a number of science programs. Dr. Griffin has stated that "I will do everything I can to keep Orion and Ares I on schedule. That will be right behind keeping shuttle and station on track, and then after that we'll fill up the bucket with our other priorities."[1]

## Impact on NASA's Science Programs

NASA's activities in space science and earth science were merged into the Science Mission Directorate (SMD) in 2004. On several occasions in 2005, Dr. Griffin said that he would not take money from NASA's space science, earth science, or aeronautics programs to pay for the exploration vision. (This pledge did not include microgravity science activities, such as research aboard the ISS.) Nevertheless, the FY2007 request would take $3.1 billion from SMD over the five-year period FY2007-2011 relative to projections in the FY2006 budget. Most of that (about $2 billion) would be used to cover a shortfall in the space shuttle and ISS budgets. Consequently, the requested budget for SMD would increase by 1.5% in FY2007 and 1% in the subsequent four years, less than the projections in the FY2006 budget and less than the rate of inflation. In addition, the FY2006 initial operating plan shows that NASA shifted $176 million from SMD to ESMD in FY2006 and took the entire congressionally directed general reduction ($90 million) for the Science, Aeronautics, and Exploration account from SMD. NASA officials stress that funding for space science during the 1990s and early 2000s grew at a rate faster than the total NASA budget and state that sustaining such increases was not

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[1] Quoted in "NASA Will Protect CEV, Station Against Flat-Budget Squeeze," *Aerospace Daily and Defense Report*, January 11, 2007.

possible. They also say that science programs account for 32% of NASA's budget in FY2007, significantly more than the 24% allocated to them in 1992.

The requested budget would delay or defer several space science programs because of budget constraints. Among these are two space telescopes (the Space Interferometry Mission and the Terrestrial Planet Finder), several robotic Mars probes, a dedicated mission to study Jupiter's moon Europa, research on new space propulsion and spacecraft power sources, and the Global Precipitation Mission. Funding for Research and Analysis, which provides grant funding to individual investigators, would be cut 15%. No funding was requested for the SOFIA airborne infrared telescope. On the other hand, the request does include FY2007 funding for missions such as the James Webb Space Telescope, robotic Mars probes to be launched at each of the next three launch opportunities (2007, 2009, and 2011), the Juno probe to study Jupiter, the Glory spacecraft to study atmospheric aerosols and solar irradiance, and a dedicated land remote sensing satellite to continue the Landsat series. Information on all these programs is available on NASA's website [http://science.hq.nasa.gov/missions/index.html].

The House provided an increase of $75 million above the request for Science: $50 million additional for Research and Analysis, $15 million to initiate planning for a Europa mission, and $10 million for continued development of the Terrestrial Planet Finder. The Senate Appropriations Committee recommended an increase of $31.5 million and directed NASA to fund SOFIA through a reprogramming request.

## Impact on Aeronautics

The FY2007 budget request for the Aeronautics Research Mission Directorate is consistent with the out-year projection for FY2007 in the FY2006 request, but the structure and content of the program have changed significantly.

In February 2005, NASA proposed transforming the largest element of the aeronautics program, Vehicle Systems, by placing more emphasis on barrier-breaking demonstrations and focusing resources on a smaller number of research areas. Among the topics to be eliminated from the restructured program were hypersonics, rotorcraft, and most of subsonic aeronautics. This proposal drew strong criticism from the House and Senate committees with oversight over NASA.

In late 2005, NASA reshaped its plans for aeronautics in a manner that it described as "consistent with direction received from our Committees." The new plan, which is reflected in the FY2007 request, refocused the program on core competencies in subsonic, supersonic, and hypersonic flight, including rotorcraft. The former Vehicle Systems program was renamed Fundamental Aeronautics to reflect its new character. The other two programs, Aviation Safety and Airspace Systems, had their content reorganized. A fourth program, the Aeronautics Test Program, was created to ensure the availability of aeronautics test facilities, such as wind tunnels, whose continued viability has been under pressure for several years. Aeronautics research supporters have expressed continuing concern over the program's downward funding trend. The impact of that reduced funding on the NASA workforce has also been an issue for Congress. The new National Aeronautics Research and Development Policy, required by the FY2006 appropriations act and issued by President Bush as an Executive Order on December 20, 2006, came too late to influence action in the 109$^{th}$ Congress.

An amendment to the Senate FY2007 budget resolution (S.Amdt. 3033 to S.Con.Res. 83) increased the recommended funding for NASA aeronautics by $179 million. The House provided an increase of $100 million. House report language directed NASA to report on its response to the National Research Council's decadal survey of aeronautics released in June 2006. The Senate Appropriations Committee recommended an increase of $35 million.

## The Space Shuttle and the International Space Station

Under the Vision, NASA was directed to terminate the space shuttle program in 2010, instead of continuing the program until 2015 or beyond as planned prior to the loss of the *Columbia*. The President also directed NASA to narrow the program of research aboard the ISS to include only research needed to accomplish the Vision.

Construction of the ISS, suspended since the loss of the *Columbia*, was resumed in September 2006. The ISS is now approximately 50% complete. U.S.-Russian crews continue to live and work aboard the ISS, using Russian spacecraft to take crews back and forth and resupply the outpost with cargo. NASA currently estimates that 13 more shuttle flights are needed to complete ISS construction, plus one mission in September 2008 to service the Hubble Space Telescope. NASA has allocated $500 million over five years to help private-sector companies develop low-cost space transportation systems that could service the ISS after the shuttle is retired.

NASA's FY2006 budget request included estimates ("placeholders") for shuttle funding in FY2008-2010 that were $3-5 billion less than what is actually needed. Additional funds are also required for the ISS program. The FY2007 request would shift funding into the space shuttle and ISS programs to cover the shortfall: approximately $2 billion from SMD and $1.5 billion from ESMD. Thus, although the space shuttle and ISS are scheduled for termination over the next decade, in the near term they require additional funding, which is being taken from science and exploration activities.

Among the issues surrounding the space shuttle and ISS programs is whether placing a fixed termination date on the space shuttle creates schedule pressure similar to that prior to the *Columbia* accident and whether the United States wants to be dependent on Russia to launch U.S. astronauts to the ISS during the "gap" between the end of the shuttle and the availability of Orion. Another question is whether ISS is worth the investment of approximately $2 billion per year, in addition to the $4 billion per year cost of the shuttle, considering the modest research agenda that remains. Alternatively, some want to restore the ISS research program: the 2005 NASA authorization act (P.L. 109-155), for example, directs that 15% of ISS research spending be used for non-Vision-related research. Fulfilling U.S. commitments to its international partners is seen by some observers as sufficient rationale for continued U.S. involvement in the ISS.

The House provided $6.194 billion in FY2007 for the Exploration Capabilities account, which includes the shuttle and the ISS. Relative to the request, this is a reduction of $41 million, of which $33 million would be from the ISS program, in light of "the uncertainties surrounding the nature and scope of the science to be conducted on the ISS." The Senate Appropriations Committee recommended the requested amount. crsphpgw