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National Aeronautics and Space Administration: Overview, FY2009 Budget, and Issues for Congress

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Summary

The National Aeronautics and Space Administration (NASA) conducts U.S. civilian space and aeronautics activities. For FY2009, the Administration has requested $17.614 billion for NASA, an increase of 1.8% from the FY2008 appropriation of $17.309 billion. The most recent NASA authorization act (P.L. 109-155) does not specify a funding level for FY2009. The overarching issue for Congress is implementation of the Vision for Space Exploration. Aspects of this issue include the development of new vehicles for human spaceflight, plans for the transition to these vehicles after the space shuttle is retired in 2010, and the balance in NASA's priorities between human space exploration and the agency's other activities in science and aeronautics.

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.[1] In the five decades since, NASA has conducted programs in human and robotic spaceflight, technology development, and scientific research. The first day of FY2009 will be NASA's 50th anniversary.

NASA is headquartered 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**

[1] See CRS Report RL34263, *U.S. Civilian Space Policy Priorities: Reflections 50 Years After Sputnik*, by Deborah D. Stine.

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's programs are organized into four Mission Directorates: Aeronautics Research, Exploration Systems, Science, and Space Operations. More information on the agency's centers, directorates, and management team can be found on the NASA website at [http://www.nasa.gov/about/org_index.html].

NASA's FY2009 Budget

The requested FY2009 budget for NASA is $17.614 billion, which is 1.8% more than the FY2008 appropriation of $17.309 billion.[2] The NASA Authorization Act of 2005 (P.L. 109-155) is the most recent NASA authorization act; it does not specify a funding level for FY2009. For a breakdown of the request by program, see **Table 1.**

Table 1. NASA Budget, FY2008 and FY2009

($ in millions)

	FY2008 as Enacted	FY2008 Comparable to FY2009	FY2009 Request
Science	**$5,546.9**	**$4,706.2**	**$4,441.5**
Earth Science	1,524.2	1,280.3	1,367.5
Planetary Science	1,387.4	1,247.5	1,334.2
Astrophysics	1,578.8	1,337.5	1,162.5
Heliophysics	1,056.6	840.9	577.3
Aeronautics	**621.9**	**511.7**	**446.5**
Exploration	**3,821.0**	**3,143.1**	**3,500.5**
Constellation Systems	2,991.0	2,471.9	3,048.2
Advanced Capabilities	830.0	671.1	452.3
Space Operations	**6,733.7**	**5,526.2**	**5,774.7**
Space Shuttle	3,981.1	3,266.7	2,981.7
International Space Station	2,209.5	1,813.2	2,060.2
Space and Flight Support	543.1	446.3	732.8
Education	**177.7**	**146.8**	**115.6**
Cross-Agency Support	**375.6**	**3,242.9**	**3,299.9**
Inspector General	**32.6**	**32.6**	**35.5**
Total	**17,309.4**	**17,309.4**	**17,614.2**

Sources: FY2008 as enacted from P.L. 110-161, Division B, and explanatory statement, *Congressional Record*, December 17, 2007, with general reductions applied proportionally. FY2008 comparable and FY2009 request from NASA FY2009 congressional budget justification, [http://www.nasa.gov/news/budget/]. See text for explanation of "comparable." Totals may not add because of rounding.

[2] As well as appropriating new funds for NASA for FY2008, the Consolidated Appropriations Act, 2008 (P.L. 110-161) rescinded $192 million in unobligated NASA funds from prior years. The request for FY2009 is 2.9% more than the FY2008 appropriation less this rescission.

For FY2009, NASA has again changed how it accounts for overhead expenses.[3] In the previous system, indirect costs were included in each program's budget. In the new system, most indirect costs are budgeted separately in the Cross-Agency Support account. This change reduces the stated budget of each program (except Cross-Agency Support) without affecting actual program content or NASA's total budget. For any particular program, amounts expressed in the new accounting system are not directly comparable with amounts expressed in the previous system. **Table 1** displays FY2008 amounts both ways: in the old system, as enacted, and in the new system, for comparability with the FY2009 request.

The Vision for Space Exploration

On January 14, 2004, President Bush announced new goals for NASA: the Vision for Space Exploration. 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.) The President further directed NASA to fulfill commitments made to the 13 countries that are its partners in the International Space Station (ISS). In the 2005 authorization act, Congress endorsed the goals of the Vision and directed NASA to establish a program to accomplish them. NASA is developing a spacecraft called Orion (formerly the Crew Exploration Vehicle) and a launch vehicle for it called Ares I (formerly the Crew Launch Vehicle). An initial operating capability (i.e., a first flight into Earth orbit with a crew on board) is planned for March 2015, with the ability to take astronauts to and from the Moon following no later than 2020.

NASA stresses that its strategy is to "go as we can afford to pay," with the pace of the program set, in part, by the available funding. In 2004, the President proposed adding a total of $1 billion to NASA's budget for FY2005 through FY2009 to help pay for the Vision, but subsequent Administration budgets more than eliminated this proposed increase, and actual appropriations by Congress have been even less. Most funding for the Vision is thus being redirected from other NASA activities. To free up funding for Orion and Ares I, the space shuttle program will be terminated in 2010, and U.S. use of the ISS will end by 2017. NASA has not provided a cost estimate for the Vision as a whole. Its 2005 implementation plan estimates that returning astronauts to the Moon will cost $104 billion, not including the cost of robotic precursor missions, and that using Orion to service the ISS will cost an additional $20 billion.[4] A report by the Government Accountability Office gives a total cost for the Vision of $230 billion over two decades.[5]

The Exploration Systems Mission Directorate (ESMD) is responsible for implementing the Moon/Mars program. The FY2009 request for ESMD is $3.500 billion. The bulk of this amount would be for the Constellation Systems program, which is

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[3] Other recent changes include "full cost accounting," introduced in the FY2004 budget request, and "full cost simplification," introduced during FY2007.

[4] NASA, *Exploration Systems Architecture Study: Final Report*, NASA-TM-2005-214062, November 2005, [http://www.nasa.gov/mission_pages/exploration/news/ESAS_report.html].

[5] Government Accountability Office, *High Risk Series*, GAO-07-310, January 2007, p. 75.

developing Orion and Ares I and related activities. The request for Constellation Systems is $3.048 billion, a 23% increase from FY2008 but consistent with NASA's previous projections. The level of reserves within Constellation Systems through FY2010 is 7%. NASA describes this level as "minimal" and is seeking to compensate for it through "rigorous risk management." The FY2009 request for ESMD restores full funding for the Commercial Orbital Transportation Services (COTS) program to help private-sector companies develop space transportation systems that could service the ISS after the shuttle is retired.

Along with a host of implementation challenges, the Vision creates issues about the balance between human space exploration and NASA's other activities in science and aeronautics. NASA Administrator Michael Griffin has reportedly said, "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."[6] The 2005 authorization act emphasized that NASA should have a balanced set of programs, including science and aeronautics as well as activities related to the Vision. The House and Senate appropriations committee reports for FY2008 also expressed concern about NASA's programmatic balance.

NASA Science Programs

The FY2009 request for the Science Mission Directorate (SMD) is $4.442 billion. After adjusting for the accounting change, this is a 6% decrease from FY2008, but almost the entire decrease results from a transfer of the Deep Space and Near Earth Networks from SMD's Heliophysics division to the Space Operations Mission Directorate. The request would increase funding for Research and Analysis in all four SMD divisions as well as for suborbital research carried out on balloons and sounding rockets. Requested increases for Earth Science and Planetary Science would be offset by requested decreases for Astrophysics and Heliophysics. The increase for Earth Science would fund two new missions recommended by the National Research Council's decadal survey[7] and accelerate the schedule for several others. The request for Planetary Science includes $60 million to initiate a new program in lunar robotic science, including a Moon orbiter to be launched by 2011 and a pair of small landers to be launched by 2014. The request for Astrophysics includes funding for the NASA/DOE Joint Dark Energy Mission (JDEM), as directed by Congress in the FY2008 explanatory statement, but not for the Space Interferometer mission (SIM). NASA's FY2008 operating plan for SIM includes just $24 million of the $60 million that Congress appropriated. NASA has allocated the remainder of that $60 million (after adjusting for the accounting change) to a new exoplanet exploration initiative, which could include a smaller, medium-class version of SIM as recommended by the FY2008 Senate Appropriations Committee report (S.Rept. 110-124).

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

[7] See National Research Council, *Earth Science and Applications from Space: National Imperatives for the Next Decade and Beyond*, 2007, [http://www.nap.edu/catalog/11820.html].

NASA Aeronautics Research

The FY2009 request for the Aeronautics Research Mission Directorate is $446 million. That level is consistent with NASA's previous projections, but it would be a 13% decrease relative to the FY2008 appropriation (after adjusting for the accounting change). Most of the proposed reduction would be in two programs: Airspace Systems (down $26 million) and Fundamental Aeronautics (down $34 million).

In June 2006, the National Research Council released a decadal strategy for federal civil aeronautics activities, with a particular emphasis on NASA's research program.[8] Along with other recommendations, the report identified 51 technology challenges to serve as the foundation for aeronautics research at NASA for the next decade. According to the FY2009 NASA budget justification, 47 of those 51 challenges are "well represented" in NASA's current and proposed aeronautics research portfolio.

In December 2006, as required by the FY2006 appropriations act (P.L. 109-108, Sec. 628), President Bush issued a new national aeronautics R&D policy.[9] The policy established general principles and goals for federal aeronautics activities, laid out the roles and responsibilities of NASA and other agencies, and directed the National Science and Technology Council to issue a national aeronautics R&D plan at least every two years. The first national aeronautics R&D plan was released in December 2007.[10] According to NASA, its aeronautics research portfolio is "closely aligned" with the national aeronautics R&D plan.

The Space Shuttle and the International Space Station

Construction of the ISS, suspended after the *Columbia* disaster in February 2003, resumed in September 2006. NASA plans 10 shuttle flights in 2008-2010 to complete the ISS, plus one mission in 2008 to service the Hubble Space Telescope. Two additional "contingency" flights may be flown to supply the ISS with spare parts for use in the period after shuttle flights end.

The gap between the end of shuttle flights in 2010 and the expected availability of Orion in 2015 raises several issues. Some analysts are concerned that placing a fixed termination date on the shuttle may create schedule pressure similar to that identified as a contributing factor in the *Columbia* disaster. Some question whether the United States should be dependent on Russia to launch U.S. astronauts to the ISS during the gap

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[8] National Research Council, *Decadal Survey of Civil Aeronautics: Foundation for the Future*, 2006, [http://www.nap.edu/catalog/11664.html].

[9] Executive Office of the President, National Science and Technology Council, *National Aeronautics Research and Development Policy*, December 2006, [http://www.aeronautics.nasa.gov/releases/national_aeronautics_rd_policy_dec_2006.pdf].

[10] Executive Office of the President, National Science and Technology Council, *National Plan for Aeronautics Research and Development and Related Infrastructure*, December 2007, [http://www.aeronautics.nasa.gov/releases/aero_rd_plan_final_21_dec_2007.pdf].

period.[11] A major concern is how NASA will retain its skilled workforce during the transition from shuttle to Orion, especially if Orion's schedule slips and the gap lengthens. Administrator Griffin has testified that Orion's first flight could be moved forward to September 2013 at the cost of an additional $2 billion.[12]

Considering the modest ISS research agenda that remains, some observers question whether completing the ISS is worth the cost — about $2 billion per year plus about $3 billion per year for the shuttle and $1 billion per year of indirect costs in the Cross-Agency Support account. Alternatively, some policymakers want to restore the ISS research program: for example, the 2005 authorization act directs that 15% of ISS research spending be used for non-Vision-related research. Fulfilling U.S. commitments to its international partners in the ISS (Russia, Japan, Canada, and 10 countries in Europe) is seen as essential by some observers; others find this rationale insufficient to justify the expense.

The FY2009 request includes $5.775 billion for the Space Operations Mission Directorate, which consists of the space shuttle, the ISS, and the Space and Flight Support program. A requested decrease of $285 million for the space shuttle is largely offset by a requested increase of $247 million for the ISS. Both are consistent with NASA's previous projections: they reflect the trend toward the shuttle program's completion in 2010 and the planned construction schedule of the ISS. The requested increase for Space and Flight Support mostly reflects the transfer of the Deep Space and Near Earth Networks from SMD.

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[11] The Russian Soyuz is the only currently available alternative to the space shuttle for carrying humans. Some private companies involved in the COTS program are developing concepts for human-rated vehicles, but their main efforts are focused on transporting cargo.

[12] Michael D. Griffin, testimony before the Senate Committee on Commerce, Science, and Transportation, Subcommittee on Space, Aeronautics, and Related Sciences, November 15, 2007.