



## CRS Report for Congress

# 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 requested \$17.614 billion for NASA, an increase of 1.8% from the FY2008 appropriation of \$17.309 billion. The House Appropriations Committee recommended \$17.769 billion. The Senate Appropriations Committee recommended \$17.814 billion. The NASA Authorization Act of 2008 (P.L. 110-422) authorizes \$20.210 billion. Pending enactment of an FY2009 appropriations act, NASA is operating at FY2008 funding levels under the Continuing Appropriations Resolution, 2009 (Division A of P.L. 110-329). The President's 2004 Moon/Mars Vision for Space Exploration is the major focus of NASA's activities. Issues for Congress regarding this goal 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 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. Its programs include human and robotic spaceflight, technology development, and scientific research. NASA opened its doors on October 1, 1958, almost exactly a year after the Soviet Union launched the world's first satellite, Sputnik.<sup>1</sup> The first day of FY2009 was NASA's 50<sup>th</sup> 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,

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

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'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](http://www.nasa.gov/about/org_index.html)].

**Table 1. NASA Budget, FY2008 and FY2009**  
(\$ in millions)

	<b>FY2008 as Enacted</b>	<b>FY2008 Comparable to FY2009</b>	<b>FY2009 Request</b>	<b>FY2009 House Cmte.</b>	<b>FY2009 Senate Cmte.</b>	<b>FY2009 Authori- zation</b>
<b>Science</b>	<b>5,546.9</b>	<b>4,706.2</b>	<b>4,441.5</b>	<b>4,518.0</b>	<b>4,522.9</b>	<b>4,932.2</b>
Earth Science	1,524.2	1,280.3	1,367.5	1,447.6	1,439.5	1,518.0
Planetary Science	1,387.4	1,247.5	1,334.2	1,410.9	1,410.9	1,483.0
Astrophysics	1,578.8	1,337.5	1,162.5	1,181.0	1,184.1	1,290.4
Heliophysics	1,056.6	840.9	577.3	618.3	633.4	640.8
Carryover Adjustment	—	—	—	(139.8)	(145.0)	—
<b>Aeronautics</b>	<b>621.9</b>	<b>511.7</b>	<b>446.5</b>	<b>515.0</b>	<b>500.0</b>	<b>853.4</b>
<b>Exploration</b>	<b>3,821.0</b>	<b>3,143.1</b>	<b>3,500.5</b>	<b>3,505.7</b>	<b>3,530.5</b>	<b>4,886.0</b>
Constellation Systems	2,991.0	2,471.9	3,048.2	3,028.2	3,078.2	4,148.2
Advanced Capabilities	830.0	671.1	452.3	477.5	452.3	737.8
<b>Space Operations</b>	<b>6,733.7</b>	<b>5,526.2</b>	<b>5,774.7</b>	<b>5,764.7</b>	<b>5,774.7</b>	<b>6,074.7</b>
Space Shuttle	3,981.1	3,266.7	2,981.7	2,981.7	2,981.7	—
Internatl. Space Station	2,209.5	1,813.2	2,060.2	2,060.2	2,060.2	—
Space & Flight Support	543.1	446.3	732.8	722.8	732.8	—
<b>Education</b>	<b>177.7</b>	<b>146.8</b>	<b>115.6</b>	<b>187.2</b>	<b>130.0</b>	<b>128.3</b>
<b>Cross-Agency Support</b>	<b>375.6</b>	<b>3,242.9</b>	<b>3,299.9</b>	<b>3,244.8</b>	<b>3,320.4</b>	<b>3,299.9</b>
<b>Inspector General</b>	<b>32.6</b>	<b>32.6</b>	<b>35.5</b>	<b>33.6</b>	<b>35.5</b>	<b>35.5</b>
<b>Total</b>	<b>17,309.4</b>	<b>17,309.4</b>	<b>17,614.2</b>	<b>17,769.0</b>	<b>17,814.0</b>	<b>20,210.0</b>

**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, available online at [<http://www.nasa.gov/news/budget/>]. See text for explanation of "comparable." FY2009 House from draft House-reported bill and draft House report. FY2009 Senate from S. 3182 as reported and S.Rept. 110-397. FY2009 authorization from Sec. 101 of P.L. 110-422. Rounding may cause totals not to add.

## 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.<sup>2</sup> The House committee recommended \$17.769 billion. The Senate committee recommended \$17.814 billion. The NASA

<sup>2</sup> 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.

Authorization Act of 2008 (P.L. 110-422) authorizes \$20.210 billion. For a breakdown of these figures by program, see **Table 1**. FY2009 began on October 1, 2009. Pending the enactment of an appropriations act for FY2009, NASA is operating at FY2008 funding levels under the authority of the Continuing Appropriations Resolution, 2009 (Division A of P.L. 110-329). That authority extends through March 6, 2009.

For FY2009, NASA again changed how it accounts for overhead expenses.<sup>3</sup> 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 program content or NASA's total budget. For any 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 FY2009.

## 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 NASA Authorization Act of 2005 (P.L. 109-155), Congress endorsed the goals of the Vision and directed NASA to establish a program to accomplish them. The NASA Authorization Act of 2008 (P.L. 110-422) reaffirms this endorsement and expresses the sense of Congress that other countries should be invited to participate in the Moon/Mars program as part of an international initiative under U.S. leadership.

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. Most funding for the Vision is being redirected from other NASA activities. 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.<sup>4</sup> A report by the Government Accountability Office gives a total cost for the Vision of \$230

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<sup>3</sup> Other recent changes include "full cost accounting," introduced in the FY2004 budget request, and "full cost simplification," introduced during FY2007.

<sup>4</sup> NASA, *Exploration Systems Architecture Study: Final Report*, NASA-TM-2005-214062, November 2005, [[http://www.nasa.gov/mission\\_pages/exploration/news/ESAS\\_report.html](http://www.nasa.gov/mission_pages/exploration/news/ESAS_report.html)].

billion over two decades.<sup>5</sup> P.L. 110-422 directs the Congressional Budget Office to update its 2004 budgetary analysis of the Vision.<sup>6</sup>

The Exploration Systems Mission Directorate (ESMD) is responsible for implementing the Moon/Mars program. The FY2009 request for ESMD is \$3.500 billion. The House and Senate committees recommended \$3.506 billion and \$3.530 billion respectively. P.L. 110-422 authorizes \$3.886 billion in baseline funding plus \$1 billion to accelerate the availability of Orion and Ares I. The bulk of all these amounts would be for the Constellation Systems program, which is developing Orion and Ares I and related activities. The requested 23% increase for Constellation Systems is consistent with NASA's previous projections for the program. 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. The House committee recommended \$20 million less than the request for COTS, "without prejudice ... based on estimated expenditures"; the Senate committee recommended the requested amount.

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."<sup>7</sup> The 2005 and 2008 authorization acts both emphasized that NASA should have a balanced set of programs, including science and aeronautics as well as activities related to the Vision. The Senate committee report for FY2009 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 House and Senate committees recommended \$4.518 billion and \$4.523 billion respectively; both totals included reallocated balances carried over from past fiscal years. P.L. 110-422 authorizes \$4.932 billion. 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 Planetary Science and Earth Science would be offset by requested decreases for Astrophysics and Heliophysics. 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 increase for Earth Science would fund two new

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<sup>5</sup> Government Accountability Office, *High Risk Series*, GAO-07-310, January 2007, p. 75.

<sup>6</sup> Congressional Budget Office, *A Budgetary Analysis of NASA's New Vision for Space Exploration*, September 2004.

<sup>7</sup> Quoted in "NASA Will Protect CEV, Station Against Flat-Budget Squeeze," *Aerospace Daily and Defense Report*, January 11, 2007.

missions recommended by the National Research Council's decadal survey<sup>8</sup> and accelerate the schedule for several others; the House and Senate committees recommended further increases for this purpose of \$50 million and \$47 million respectively. Also in Earth Science, both committees supported inclusion of a thermal infrared sensor (TIRS) on the Landsat Data Continuity Mission; the House committee recommended an additional \$20 million for this purpose, while the Senate committee urged "development ... within available funds." 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). Both committees recommended the requested amount for JDEM. In FY2008, NASA reallocated part of SIM's funding to a new exoplanet exploration initiative, which could include a smaller version of SIM as recommended by the FY2008 Senate committee report (S.Rept. 110-124); the House committee recommended \$30 million more than the request for exoplanet exploration. Also in Astrophysics, the House committee deleted "without prejudice" the \$41.5 million requested for the Nuclear Spectroscopic Telescope Array (NuStar); the Senate committee recommended \$30 million. Both committees recommended increases to cover cost growth in several Science programs.

## 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). The House and Senate committees recommended \$515 million and \$500 million respectively. P.L. 110-422 authorizes \$853 million. P.L. 110-422 directs NASA to align its Fundamental Aeronautics program with a set of 51 technology challenges identified by the National Research Council.<sup>9</sup> According to NASA, 47 of those challenges are "well represented" in NASA's current and proposed aeronautics research portfolio, and that portfolio is also "closely aligned" with the 2007 national aeronautics R&D plan.<sup>10</sup>

## 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 seven more shuttle flights in 2008-2010 to complete the ISS, plus one mission in 2009 to service the Hubble Space Telescope. Two additional flights in 2010 to supply the ISS with spare parts were formerly considered "contingency" flights. P.L. 110-422 requires that the contingency flights be flown before the shuttle is retired and directs NASA to add an additional flight to deliver the Alpha

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<sup>8</sup> 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>].

<sup>9</sup> National Research Council, *Decadal Survey of Civil Aeronautics: Foundation for the Future*, June 2006, [<http://www.nap.edu/catalog/11664.html>].

<sup>10</sup> 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](http://www.aeronautics.nasa.gov/releases/aero_rd_plan_final_21_dec_2007.pdf)].

Magnetic Spectrometer to the ISS, if that can be done before the end of 2010. P.L. 110-422 also directs NASA to suspend any activity that would preclude the continued operation of the space shuttle after FY2010, if the next President were to decide to delay its scheduled retirement.

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 period.<sup>11</sup> 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.<sup>12</sup> P.L. 110-422 authorizes \$1 billion for this purpose in FY2009, but the House and Senate committees recommended no additional funds.

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 House recommendation for ESMD included \$50 million, nearly double the request, for research on the ISS; the 2005 authorization act directs that 15% of ISS research spending be used for non-Vision-related research; and P.L. 110-422 authorizes an additional \$100 million for ISS research utilization and directs NASA to extend ISS availability through at least 2020. Some observers consider it essential to fulfil U.S. commitments to its international partners in the ISS (Russia, Japan, Canada, and 10 countries in Europe); others find this rationale insufficient to justify the expense.

The FY2009 request includes \$5.775 billion for the Space Operations Mission Directorate (SOMD), 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. The House and Senate committees recommended \$5.765 billion and \$5.775 billion respectively. P.L. 110-422 authorizes \$6.075 billion, including \$150 million for the additional shuttle flight to deliver the Alpha Magnetic Spectrometer.

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<sup>11</sup> The Russian Soyuz is the only currently available alternative to the space shuttle for carrying humans. In order to contract for Soyuz service to the ISS, NASA needed an exemption from the Iran, North Korea, and Syria Nonproliferation Act. This exemption was extended to 2016 by P.L. 110-329. For details, see CRS Report RL34477, *Extending NASA's Exemption from the Iran, North Korea, and Syria Nonproliferation Act*, by Carl E. Behrens and Mary Beth Nikitin.

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