



## CRS Report for Congress

# National Aeronautics and Space Administration: Overview, FY2008 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. For FY2008, the Administration requested \$17.309 billion for NASA, an increase of 6.4% from the FY2007 regular appropriation of \$16.264 billion. The 2005 authorization act authorized \$18.686 billion. The House provided \$17.623 billion. The Senate provided \$17.460 billion, including \$1 billion in emergency funding. The final appropriation was \$17.309 billion. The key issue for Congress is implementation of the Vision for Space Exploration, including 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. In the five decades since, NASA has conducted 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'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.hq.nasa.gov/hq/org.html>].

## NASA's FY2008 Budget in Brief

The requested FY2008 budget for NASA was \$17.309 billion. That was 6.4% more than the FY2007 regular appropriation of \$16.264 billion, but 7.4% less than the \$18.686 billion authorized by the NASA Authorization Act of 2005 (P.L. 109-155). The House provided \$17.623 billion (H.R. 3093, H.Rept. 110-240). The Senate provided \$18.460 billion (H.R. 3093; see also S. 1745, S.Rept. 110-124). The final appropriation was \$17.309 billion, the same as the requested amount but allocated differently (P.L. 110-161, explanatory statement in the *Congressional Record*, December 17, 2007). For a breakdown of these amounts by program, see **Table 1**.

**Table 1. NASA FY2008 Budget**  
(\$ millions)

	FY2007	FY2008 Request	FY2008 House	FY2008 Senate	FY2008 Final
<b>Science, Aeronautics, and Exploration</b>					
<i>Science</i>	\$5,371	\$5,516	\$5,696	\$5,618	\$5,547
Planetary Science	n/a	1,396	1,421	1,357	1,387
Astrophysics	n/a	1,566	1,631	1,555	1,579
Heliophysics	n/a	1,057	1,072	1,082	1,057
Earth Science	n/a	1,497	1,572	1,624	1,524
<i>Exploration Systems</i>	3,457	3,924	3,924	3,946	3,821
Constellation Systems	2,550	3,068	3,068	3,098	2,991
Advanced Capabilities	907	856	856	849	830
<i>Aeronautics Research</i>	717	554	700	550	622
<i>Cross-Agency Support Programs</i>	540	489	577	518	553
Education	113	154	220	149	178
Other	428	335	356	370	376
<b>Subtotal</b>	<b>10,086</b>	<b>10,483</b>	<b>10,896</b>	<b>10,633</b>	<b>10,543</b>
<b>Exploration Capabilities</b>					
<i>Space Operations</i>	6,146	6,792	6,692	6,792	6,734
Space Shuttle	3,977	4,008	3,988	4,008	3,981
International Space Station	1,773	2,239	2,239	2,239	2,209
Space and Flight Support	396	546	466	546	543
<b>Subtotal</b>	<b>6,146</b>	<b>6,792</b>	<b>6,692</b>	<b>6,792</b>	<b>6,734</b>
<b>Inspector General</b>	<b>32</b>	<b>35</b>	<b>35</b>	<b>35</b>	<b>33</b>
<b>Return to Flight (emergency funding)</b>	<b>—</b>	<b>—</b>	<b>—</b>	<b>1,000</b>	<b>—</b>
<b>Total</b>	<b>16,264</b>	<b>17,309</b>	<b>17,623</b>	<b>18,460</b>	<b>17,309</b>

**Sources:** NASA briefing charts based on the FY2007 initial operating plan; the FY2008 NASA congressional budget justification (<http://www.nasa.gov/news/budget/>); H.R. 3093 as passed by the House and H.Rept. 110-240; H.R. 3093 as passed by the Senate and S.Rept. 110-124 (accompanying S. 1745); and P.L. 110-161, Division B, and explanatory statement, *Congressional Record*, December 17, 2007, pp. H15819-H15825.

**Notes:** The FY2007 column consists of base amounts appropriated by Sec. 20915 of P.L. 110-5 plus \$17 million for civil service pay increases under Sec. 111 of P.L. 110-5, adjusted for accounting changes. A supplemental appropriation of \$20 million in FY2007 for Hurricane Katrina recovery (P.L. 110-28) is not included. All reductions not yet allocated have been applied proportionately to the affected programs.

## The Vision for Space Exploration

On January 14, 2004, President Bush announced new goals for NASA: the Vision for Space Exploration, often referred to as 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.) 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 Earth-orbit capability is planned by 2014 (although NASA considers early 2015 more likely) 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 \$1 billion to NASA’s budget for FY2005 through FY2009 to help pay for the Vision, but subsequent Administration budgets more than eliminated this 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 or \$20 billion to use Orion to service the ISS.<sup>1</sup> A report by the Government Accountability Office gives a total cost for the Vision of \$230 billion over two decades.<sup>2</sup>

The Exploration Systems Mission Directorate (ESMD) is responsible for implementing the Moon/Mars program. The FY2008 request for ESMD was \$3.924 billion. Although this was a substantial increase from FY2007, the FY2007 appropriation was \$750 million less than had been requested (after adjusting for accounting changes). NASA Administrator Michael Griffin has testified that the FY2007 funding reduction and other factors will delay the schedule for Orion and Ares I by four to six months, with an initial operating capability (i.e., a first crewed flight) now expected in early 2015.<sup>3</sup> The House provided the requested amount for ESMD, while the Senate provided a \$49 million increase for development of Ares I. The final appropriation was \$3.821 billion, or \$103 million less than the request.

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 that “I will do

---

<sup>1</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)].

<sup>2</sup> Government Accountability Office, *High Risk Series*, GAO-07-310, January 2007, p. 75.

<sup>3</sup> Michael D. Griffin, testimony before the Senate Committee on Commerce, Science, and Transportation, Subcommittee on Space, Aeronautics, and Related Sciences, February 28, 2007.

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>4</sup> 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 again expressed concern about NASA's programmatic balance.

## NASA Science Programs

The FY2008 request for the Science Mission Directorate (SMD) was \$5.516 billion, a 5% increase from FY2007. After adjusting for accounting changes, the request reflected no net change from NASA's previous plans, which projected 1% growth in Science funding each year through FY2011. In response to critics who note that 1% growth is less than inflation, NASA officials say that funding for science at NASA grew faster than the agency's total budget during the 1990s and early 2000s and that sustaining such increases is impossible. They also state that the 32% share of NASA's budget allocated to Science in the FY2008 request is significantly more than the 24% allocated to science programs in FY1992. (Accurate comparisons between current programs and FY1992 are difficult because of numerous intervening changes in how NASA presents its budget and categorizes expenditures.) The House and Senate provided increases for Science of \$180 million and \$139 million respectively. The final appropriation was \$5.547 billion, an increase of \$31 million relative to the request.

In late 2006, NASA announced a reorganization of the Science Mission Directorate, creating four divisions where previously there had been three. The main result of the reorganization was to create a separate Earth Science Division. In the FY2006 and FY2007 budget cycles there was no separate budget for Earth science at NASA, and supporters were concerned that this was adversely affecting the field. The National Research Council (NRC) recommended in January 2007 that the United States "should renew its investment in Earth observing systems and restore its leadership in Earth science and applications."<sup>5</sup> Although the FY2008 request included increased funding for Earth Science and projected further increases in FY2009 and FY2010 relative to previous plans, most of the proposed increases were to cover cost growth and schedule delays in existing missions. The House provided an increase of \$60 million relative to the request to begin development of new missions based on the NRC survey, as well as \$60 million more for Research and Analysis to be "allocated in an equitable fashion" among the four Science divisions. The Senate provided \$138 million more than the request, including \$25 million to begin implementation of the NRC survey and \$96 million more for Earth Science Research. The final appropriation for Earth Science was \$27 million more than the request. It included \$40 million for NRC survey missions.

In the Astrophysics Division, the FY2008 request reinstated funding for the SOFIA airborne infrared telescope but deferred the Space Interferometer mission (SIM) beyond

---

<sup>4</sup> Quoted in "NASA Will Protect CEV, Station Against Flat-Budget Squeeze," *Aerospace Daily and Defense Report*, January 11, 2007.

<sup>5</sup> 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>].

FY2012. An initial operational capability for SOFIA is now expected in about 2010, and a full operational capability in about 2013. The requested funding for SIM in FY2008 was \$22 million, down from a projected \$139 million, with further reductions projected in future years. According to the budget request, the lower funding level for SIM would support engineering risk reduction, mission design, and core scientific expertise, but no actual development work. The House provided \$72 million for SIM, which it said is ready for development. In contrast, the Senate provided reductions in the Navigator program (which includes SIM) and urged NASA to reformulate Navigator toward a smaller, medium-class satellite development program. The final appropriation for SIM was \$60 million.

## NASA Aeronautics Research

The FY2008 request for Aeronautics Research was \$554 million. Although that was \$163 million less than the FY2007 appropriation, it was \$49 million more than NASA had projected for FY2008 in its previous plans. The House provided an increase of \$146 million. The Senate provided the requested amount. The final appropriation was \$622 million, an increase of \$68 million relative to the request. These funding changes follow significant changes in the structure and content of the program, the release of a major policy report on the future of aeronautics at NASA, and the establishment of a new national policy on federal aeronautics research and development.

In late 2005, the NASA aeronautics program was refocused on core competencies in subsonic, supersonic, and hypersonic flight. 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 wind tunnels and other test facilities, whose continued viability has been under pressure for several years.

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.<sup>6</sup> Along with other recommendations, the report identified 51 technology challenges to serve as the foundation for aeronautics research at NASA for the next decade. The House committee report and the explanatory statement for the final bill both directed NASA to apply a portion of its funding increase to the top-ranked priorities of the decadal survey.

In December 2006, as required by the FY2006 appropriations act (P.L. 109-108, Sec. 628), President Bush issued a new National Aeronautics Research and Development Policy ([<http://www.ostp.gov/html/NationalAeroR&DPolicy12-19-06.pdf>]). The policy establishes general principles and goals for federal aeronautics activities, lays out the roles and responsibilities of NASA and other agencies, and directs the National Science and Technology Council to issue a national aeronautics R&D plan by December 2007 and at least every two years thereafter. The House committee report urged NASA to "continue to support the principles and objectives outlined in the Policy."

---

<sup>6</sup> National Research Council, *Decadal Survey of Civil Aeronautics: Foundation for the Future*, 2006, [<http://www.nap.edu/catalog/11664.html>].

## 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. NASA has also 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.

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. 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. The explanatory statement for the final bill directed the Government Accountability Office to review NASA's transition plans and provide quarterly updates. 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>7</sup>

Considering the modest ISS research agenda that remains, some question is whether completing the ISS is worth the cost — more than \$2 billion per year plus about \$4 billion per year for the shuttle. Alternatively, some 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 FY2008 request included \$6.792 billion for the Space Operations Mission Directorate, which consists of the space shuttle, the ISS, and the Space and Flight Support program. This was an increase of about 11% above the FY2007 appropriation, but almost the entire increase was previously planned to reflect the schedule of ISS construction. New funding for two additional Tracking and Data Relay System (TDRS) satellites, required for ground communications with near-Earth spacecraft, was approximately offset by reductions in reserves for the shuttle and the ISS. The Senate provided approximately the requested amount. The House provided \$20 million less for the ISS (mostly from reserves), provided \$80 million less for Space and Flight Support, and rejected the requested increase for TDRS procurement. The final appropriation was \$6.734 billion, including \$27 million less than the request for the shuttle and \$30 million less for the ISS.

A Senate floor amendment provided an additional \$1 billion in emergency funding for the post-*Columbia* shuttle return-to-flight effort. The final appropriation did not include this provision.

---

<sup>7</sup> Michael D. Griffin, testimony before the Senate Committee on Commerce, Science, and Transportation, Subcommittee on Space, Aeronautics, and Related Sciences, November 15, 2007.