

NASA R&D Climbs on Human Space Flight Spending, Research Falls

AAAS R&D Funding Update on NASA R&D in FY 2008 Final Appropriations

Highlights

- The National Aeronautics and Space Administration (NASA) received a large budget increase in the final 2008 appropriation, but the entire increase would go to human spacecraft, including the International Space Station and the project to develop the Space Shuttle's replacement. The total NASA budget for 2008 is \$17.1 billion, an increase of \$850 million or 5.2 percent (see Table). **NASA R&D spending, which excludes the Space Shuttle, would total \$12.5 billion, an increase of 5.7 percent or \$670 million** (see Table) **but the entire increase and more would go to development and R&D facilities spending for the two human space flight projects, leaving NASA basic and applied research in decline** despite congressional attempts to shift funds from human space flight to space science, aeronautics, and earmarks.

- The Constellation Systems program to develop the new Crew Exploration Vehicle and Crew Launch Vehicle would receive \$3.0 billion, a 6.2 percent increase. Construction of the International Space Station would receive the \$2.2 billion in 2008, up \$450 million or a staggering 26 percent over 2007.

- Hundreds of millions of dollars that Congress had been counting on to shore up NASA's research funding evaporated in last-minute negotiations over the 2008 omnibus appropriations bill, leaving NASA support of basic and applied research at an estimated \$3.4 billion, slightly below (0.2 percent) last year. Although earlier appropriations would have boosted the Earth Science portfolio by 10 percent or more, the final \$1.5 billion would be a 4.4 percent increase. Total Science funding would reach \$5.5 billion, a 1.8 percent increase that falls short of the request.

- Congress shifted money from Science to shore up the shrinking Aeronautics portfolio (down 11 percent to \$616 million instead of an even steeper requested cut) and to add \$83 million in congressional earmarks.

NASA R&D in FY 2008 Final Appropriations

On December 26, President Bush signed into law the FY 2008 omnibus appropriations bill (HR 2764) that had cleared Congress a week earlier, bringing the 2008 appropriations process to a close. The omnibus bill included a final version of the FY 2008 Commerce-Justice-Science appropriations bill that was billions of dollars less than earlier House or Senate versions of the bill providing funding for the National Science Foundation (NSF), the National Aeronautics and Space Administration (NASA), and the Department of Commerce. As a result, the final 2008 NASA budget falls short of the budget request by \$193 million for a total of \$17.1 billion, an increase of \$850 million or 5.2 percent over 2007. Although this would be a large increase in a generally tough budget environment for domestic programs, the 2008 appropriation would still leave NASA well short of 2005 and 2006 levels after a sharp cut in 2007 (see Table).

NASA's R&D funding would increase \$670 million or 5.7 percent to \$12.5 billion in 2008 (see Table), continuing a rebound from a dismal 2005 when Shuttle cost overruns forced the agency to siphon money from R&D programs to the non-R&D Shuttle and narrowly reaching a high point for this decade (see Figure 1). **Efforts to develop next-generation human space vehicles to replace the Shuttle and ramped-up construction of the International Space Station (ISS) would take up the entire 2008 increase, leaving all other NASA R&D programs in decline. NASA support of basic and applied research would fall to \$3.4 billion (down 0.2 percent).**

NASA's Constellation Systems program aims to develop a new Orion Crew Exploration Vehicle (CEV) and Ares 1 Crew Launch Vehicle (CLV) to replace the Space Shuttle as the primary means of getting humans into space. This large program to fund development of the CEV, CLV, and related technologies is part of the President's Vision for Space Exploration, announced in 2004, to get humans back to the moon and onward to Mars. Funding quadrupled from just \$422 million in 2005 to \$1.7 billion in 2006, and increased again to \$2.8 billion in 2007 (see Figure 1). The 2008 omnibus bill would fall short of the request, but would still boost funding 6.2 percent to \$3.0 billion (see Table). Although the goal is to have the new vehicles ready by 2014, a nearly half-billion dollar shortfall in the final 2007 appropriation compared to the request and project delays have caused NASA to push back the projected launch date to 2015 or later.

The International Space Station (ISS) budget climbs 26 percent or \$450 million to \$2.2 billion, slightly less than the request, partly because of a transfer of support costs from Constellation Systems to the ISS account and partly for a ramped-up construction schedule in 2008 aiming for final assembly of the Station in 2010, followed by full operations through 2016.

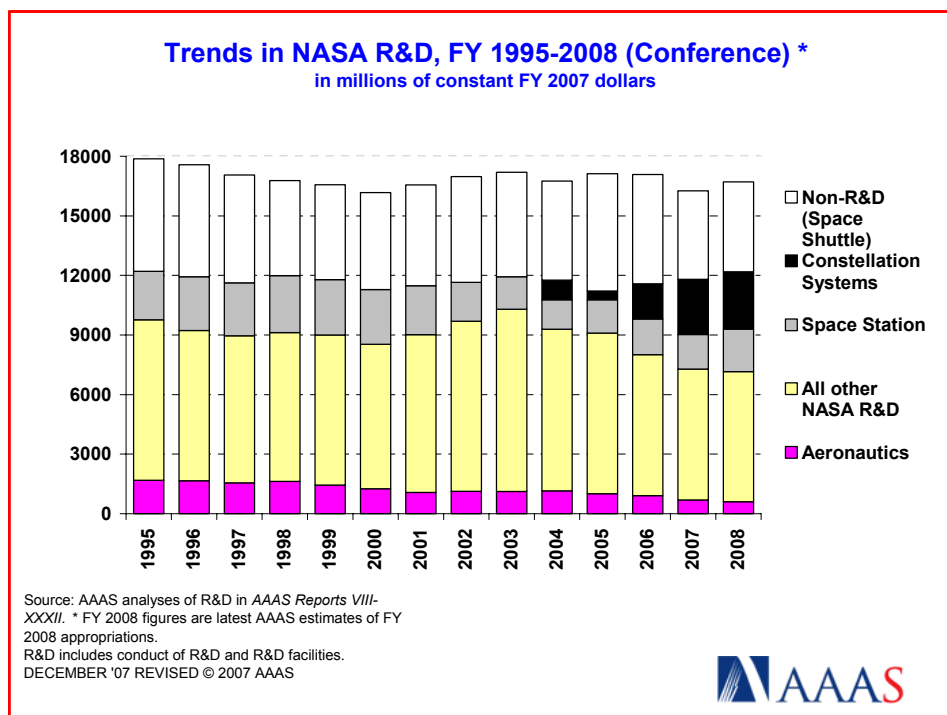


Figure 1. (click on the image for PDF)

The 2008 appropriation contains \$837 million in increases to the ISS project (along with ISS support costs) and the Constellation Systems project, more than the net \$670 million in increases for NASA R&D. **Funding for the rest of the NASA R&D portfolio would decline in 2008** (see Figure 1), especially NASA's support of basic and applied research. Hundreds of millions of dollars that Congress had been counting on to shore up NASA's research funding evaporated in last-minute negotiations over the 2008 omnibus appropriations bill. Ironically, NASA is a large supporter of physical sciences research but was left out of the President's American Competitiveness Initiative (ACI) to boost basic physical sciences research, and its support for physical sciences research and other research would fall in 2008 to an estimated \$3.4 billion for all NASA research (down 0.2 percent).

Although earlier appropriations would have boosted the Earth Science portfolio by 10 percent or more, the final \$1.5 billion would be a 4.4 percent increase. Congress tried to use Earth Science funding to implement recommendations of the National Research Council's (NRC) recent *Earth Science and Applications From Space: National Imperatives for the Next Decade and Beyond* report. This decadal

survey of earth science expresses concern that the number of earth-observing sensors on NASA spacecraft could decrease by 40 percent during this decade if current trends continue, such as a 30 percent real decline in earth science funding so far this decade. The report notes that NASA's satellite capabilities for observing the Earth from space are vital for environmental research, especially for understanding climate change, and would be nearly impossible to replace. The House and the Senate in earlier appropriations tried to add funding to various earth science programs, including several earth observing satellite missions, and provided funding specifically to top up funding for Earth Science Applications, a program that provides competitive grants for scientists to use satellite data for environmental and other research. But most of these additional funds evaporated in the last-minute negotiations over the omnibus bill and the final appropriation sets aside just \$40 million specifically to implement the NRC report's recommendations, \$15 million more than the request for Earth Science Applications, and \$24 million more than the request for Science-wide Research and Analysis efforts. Congress agreed to fund the full request of \$90 million for the Global Precipitation Measurement Mission, which will collect better data on hurricanes, among other weather phenomena. But all of these have to fit into a total Earth Science appropriation just \$10 million more than the 2008 request, so the future of NASA earth-observing satellites and research remains uncertain.

In the rest of the Science portfolio, Congress adds \$38 million to the request in Astrophysics specifically for the Space Interferometry Mission for a total of \$60 million, and \$5 million to the Planetary Science portfolio for an outer-planets mission. **All told, the Science portfolio gains a slight 1.8 percent or \$97 million to \$5.5 billion (see Table).** The appropriation would allow work on the Stratospheric Observatory for Infrared Astronomy (SOFIA) project to restart in 2008 after an abrupt halt in 2007, would allow the James Webb Space Telescope to ramp up development efforts to \$545 million toward a 2013 launch, and would fund a 2008 servicing mission for the current Hubble Space Telescope (\$280 million). Congress also boosts funding for the Space Interferometry Mission (SIM) to \$60 million, \$38 million more than the request. The omnibus bill sets Mars Exploration funding at the requested \$626 million, a decision made before NASA's recent announcement that the Mars Scout mission would miss the 2011 Mars launch window (every 26 months) because of project delays. NASA will have trouble fitting all of these congressional allocations into the Science portfolio, which would fall \$31 million short of the request.

Outside the Science portfolio in other NASA research programs, Congress adds \$62 million to the aeronautics research portfolio, enough to turn a steep requested cut into a smaller but still substantial 11 percent cut to \$616 million. Aeronautics research funding would have tumbled 21 percent in the request following similar cuts in previous years; in real terms, the aeronautics research portfolio would be half its size of just four years ago (see Figure 1), and in the report accompanying the omnibus bill Congress criticizes NASA for threatening U.S. preeminence in aviation and aerospace with its budget cuts. Elsewhere in the omnibus bill, there would be \$83 million allocated to congressionally designated, performer-specific projects (earmarks), a return to earmarking in 2008 after a one-year moratorium in 2007. Congress would fund NASA's Education program at \$173 million, down from last year but \$20 million more than requested, including \$8.5 million in new funding for a competitive program to educate students on global climate change and additional funding for several NASA competitive education grants programs.

Impacts of the NASA Budget

The increase to NASA's R&D portfolio in FY 2008 would continue a modest upward trend for the last few years after hitting bottom in 2005, as shown in Figure 1. **The 2008 increase brings NASA R&D back above \$12 billion in today's dollars for the first time since 1995.** Although the Bush Administration's moon and Mars plan ignited hopes of increasing resources in a time of fiscal austerity, NASA committed to carrying out its ambitious plans with a budget plan that would just keep pace with expected inflation over the next decade. Although inflationary increases are more than most R&D funding agencies are likely to get in the next few years, NASA's big plans for the next few years will require NASA to reshuffle its resources and to meet ambitious targets for deployment, construction, and then phase-out of the Space Shuttle and Space Station programs to make room for moon and Mars programs.

Because recent increases in NASA R&D have gone to development programs such as the Constellation Systems project and facilities such as the International Space Station (see Figure 1), NASA support of research has plummeted in real terms. The 2008 omnibus appropriation slows but does not reverse the slide.

Outlook and Next Steps

The 2008 NASA budget is now law, and NASA will shortly announce how it plans to apportion its funding among its many missions and programs. The President's FY 2009 budget request due in early February is expected to be another rough one for NASA's research-oriented programs because of the looming deadline for finishing the Space Station and milestones associated with Constellation Systems, within an overall budget request that is likely to call for another cut in total domestic spending.

(This analysis is one of a series of AAAS R&D Funding Updates on FY 2008 congressional appropriations. The complete series of AAAS R&D Funding Updates, including continually updated analyses of R&D in FY 2008 appropriations, is available on the AAAS R&D Web Site (<http://www.aaas.org/spp/rd>) in the "FY 2008 R&D" or the "What's New" sections.)

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Table. NASA R&D in FY 2008 House-Senate Conference

**Table. National Aeronautics and Space Administration
House-Senate Conference on R&D in the FY 2008 Budget
(budget authority in millions of dollars)**

	FY 2007 Estimate	FY 2008 Request	House-Senate Conference				
			FY 2008 CONF.	Chg. from Request Amount	Chg. from Request Percent	Chg. from FY 2007 Amount	Chg. from FY 2007 Percent
Summary of R&D by Appropriation:							
1. Exploration Capabilities (EC)							
International Space Station	1,735	2,239	2,185	-54	-2.4%	450	25.9%
Space Shuttle	3,976	4,008	3,937	-71	-1.8%	-39	-1.0%
Space and Flight Support	323	546	537	-9	-1.6%	215	66.5%
Total Exploration Capabilities	6,034	6,792	6,659	-133	-2.0%	625	10.4%
2. Science, Aeronautics and Exploration (SAE)							
Science:							
Earth Science	1,443	1,497	1,508	10	0.7%	64	4.4%
Heliophysics	1,013	1,057	1,045	-12	-1.2%	31	3.1%
Planetary Science	1,391	1,396	1,372	-24	-1.7%	-19	-1.4%
Astrophysics	1,540	1,566	1,561	-4	-0.3%	21	1.4%
Total Science	5,388	5,516	5,485	-31	-0.6%	97	1.8%
Exploration Systems	3,576	3,924	3,776	-147	-3.8%	201	5.6%
- Constellation Systems	2,784	3,068	2,956	-112	-3.7%	172	6.2%
- Advanced Capabilities	792	856	821	-35	-4.1%	28	3.6%
Aeronautics Research	695	554	616	62	11.2%	-79	-11.4%
Cross-Agency Support Programs	542	489	548	59	12.1%	6	1.1%
- Congressional Projects 1/	0	0	83	83	--	83	--
- Education	181	154	173	20	12.8%	-7	-4.1%
- Advanced Business Systems	105	103	82	-21	-20.7%	-23	-22.3%
- Innovative Partnerships	232	198	177	-21	-10.8%	-56	-23.9%
- Shared Capabilities	24	34	33	-1	-3.4%	9	38.8%
Total SAE	10,201	10,483	10,426	-58	-0.5%	225	2.2%
3. Inspector General	32	35	32	-2	-6.8%	0	0.7%
Total NASA Budget	16,267	17,310	17,117	-193	-1.1%	850	5.2%
<i>minus non-R&D Activities:</i>							
Space Shuttle	-3,976	-4,008	-3,937	71	-1.8%	39	-1.0%
Other non-R&D	-428	-649	-619	30	-4.6%	-191	44.7%
Inspector General	-32	-35	-32	2	-6.8%	0	0.7%
Education and Training	-25	-25	-53	-28	112.0%	-28	112.0%
Total NASA Non-R&D Activities	-4,461	-4,716	-4,641	75	-1.6%	-180	4.0%
TOTAL NASA R&D	11,806	12,594	12,476	-118	-0.9%	670	5.7%

AAAS estimates based on FY 2008 appropriations bills. Includes conduct of R&D and R&D facilities.

FY 2007 and FY 2008 request figures based on OMB R&D data and supplemental agency budget data.

FY 2008 Conference adjusted to reflect general rescissions in the 2008 omnibus appropriations bill.

Figures are rounded to the nearest million. Changes calculated from unrounded figures.

1/ FY 2008 omnibus bill includes separate account for congressionally designated projects.

NASA has proposed to restructure its programs in FY 2008.

Figures for all years have been adjusted to reflect the proposed structure.

FY 2007 and 2008 figures are in a new full-cost simplification method.

December 17, 2007 - AAAS estimates of House-Senate Conference appropriations.

These appropriations may be rejected by the House or Senate, and may be vetoed by the President.