

## Senate Adds to NASA Earth Science

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

#### Highlights

- The National Aeronautics and Space Administration (NASA) suffered a budget setback in 2007, but looks to rebound in 2008 with a large requested budget increase, endorsed and added to by the **Senate for a total budget of \$17.5 billion in the Senate plan, \$1.2 billion or 7.3 percent more than 2007** (see Table). **The Senate would add \$150 million to the request, primarily for earth science programs.**

- The Constellation Systems program to develop the new Crew Exploration Vehicle and Crew Launch Vehicle would increase 11.3 percent from 2007 to \$3.1 billion in 2008. Funding shortfalls in 2007 and project delays recently led NASA to push back the launch date from 2014 to 2015 at the earliest. Construction of the International Space Station, now in full gear with the return of the Space Shuttle to flight, would receive the requested \$2.2 billion next year in the Senate, up \$503 million from this year.

- **The Senate would give NASA's Science portfolio \$5.6 billion, a 4.3 percent increase and slightly more than requested to shore up earth sciences, especially satellite earth observing systems.** But the Senate would not add funds to NASA's aeronautics research portfolio despite criticizing NASA's planned budget cuts, and would leave it down 21 percent at \$550 million. The Senate would designate \$70 million for congressionally designated projects after a one-year moratorium on earmarking in 2007.

#### NASA R&D in FY 2008 Senate Appropriations

On June 28, the Senate Appropriations Committee approved its version of the FY 2008 Commerce-Justice-Science appropriations bill (S 1745) providing funding for the Department of Commerce, the National Science Foundation (NSF), and the National Aeronautics and Space Administration (NASA), for consideration by the full Senate in July. The House has drafted its own version of the bill for consideration by the House Appropriations Committee in July. Both the House and Senate bills contain close to \$54 billion in 2008 discretionary spending, \$3 to \$4 billion more than the current year and between \$2 and \$3 billion more than the President's request for these programs.

The National Aeronautics and Space Administration (NASA) continues to forge ahead with its full program of flying the Space Shuttle, building the Space Station, funding research across a broad range of disciplines, and developing the next generation of space vehicles as part of the Vision for Space Exploration, but tight budget constraints in the overall federal budget and NASA Administrator Michael Griffin's promise to do everything within a budget rising no faster than the rate of inflation are forcing tough choices in the agency's priorities. **The Senate would try to make things a little easier by adding \$150 million to NASA's 2008 request for a total budget of \$17.5 billion, \$1.2 billion or 7.3 percent more than the current year, but the Senate increase would still fall short of past budgets in real terms after a sharp cut in 2007** (see Figure 1). (For details of NASA's FY 2008 request, see the March 21 AAAS R&D Funding Update or Chapter 9 of *AAAS Report XXXII: R&D FY 2008*.)

**NASA's R&D funding would climb \$992 million or 8.4 percent to \$12.8 billion** in the Senate plan (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. **But 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 R&D increase, leaving all other NASA R&D programs combined with flat funding even after the extra Senate dollars.**

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 last year, and increased again to \$2.8 billion in 2007. The 2008 Senate plan would further boost funding 11.3 percent or \$314 million to \$3.1 billion, with \$1.2 billion for the CEV, \$951 million for the CLV, and the remainder for supporting development projects. Although the goal is to have the new vehicles ready by 2014, a nearly half-billion dollar shortfall in the final 2007 appropriation from the 2007 request and project delays have caused NASA to push back the projected launch date to 2015 or later.

The International Space Station (ISS) budget would climb 29 percent or \$503 million as requested to \$2.2 billion in the 2008 Senate appropriation, partly because of a transfer of support costs from Constellation Systems to the ISS account and partly for a ramped-up construction schedule aiming for final assembly of the Station in 2010, followed by full operations through 2016.

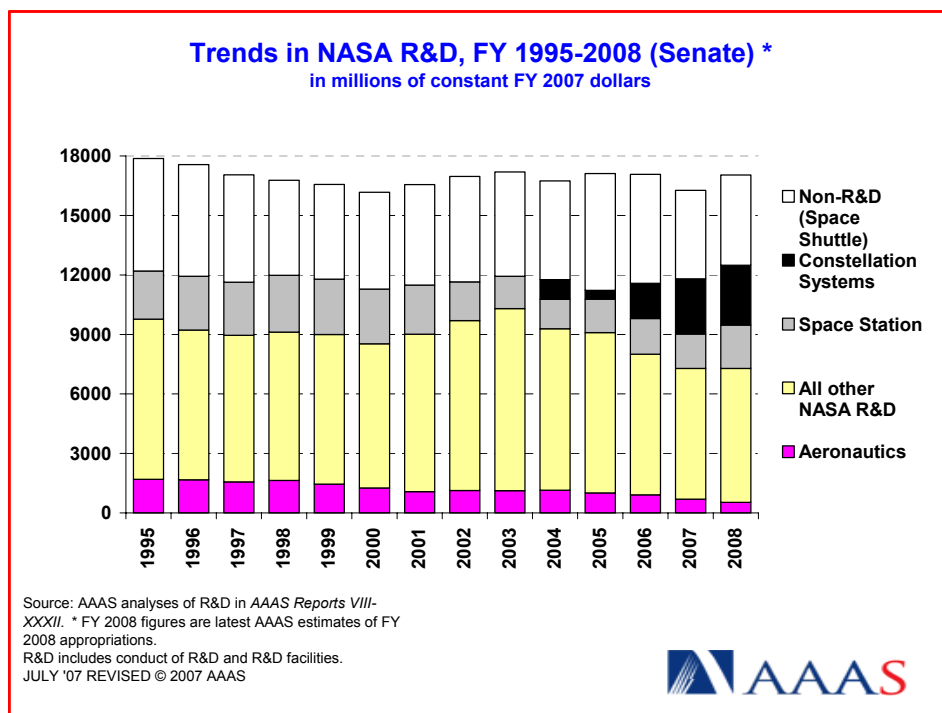


Figure 1. (click on the image for PDF)

**Together, the Constellation Systems and ISS increases would take up the entire increase for NASA R&D, leaving all other NASA R&D programs combined with flat funding, or a cut in real terms, following steep cuts in each of the last four years** (see Figure 1). 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 the 2008 request and just stay even with inflation in the 2008 Senate appropriation.

**The Senate would intervene to shore up NASA support of the earth sciences** with \$1.6 billion for the Earth Science portfolio, \$128 million more than the request and \$182 million or 13 percent more than the current year. \$25 million in new funding would go to implement recommendations of the National Research Council's 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

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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 Senate would add funding to various earth science programs, including several earth observing satellite missions, and would provide \$15 million 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.

The Senate would also add funding for the Heliophysics program for a total of \$1.1 billion, up 6.7 percent, for this portfolio focused on studying the Sun and its impact on Earth. The Planetary Science portfolio would fall 2.4 percent to \$1.4 billion, while the Astrophysics portfolio would gain slightly (0.9 percent) to \$1.6 billion. The increase 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 (\$308 million).

But the Senate would join NASA in cutting other parts of the research portfolio. Aeronautics research funding would tumble 21 percent down to \$550 million in 2008 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), despite language accompanying the Senate bill expressing concern over steady declines in aeronautics funding. The Human Research program would have an increase to \$183 million, but only after a 60 percent cut in 2007 and cuts in previous years to leave it a shadow of its former self, when it was the Biological and Physical Research portfolio and funded a broad range of life and physical sciences (see Figure 2). Elsewhere in the Senate bill, there would be \$70 million allocated to congressionally designated, performer-specific projects (earmarks), a return to earmarking in 2008 after a one-year moratorium in 2007.

### **Impacts of the NASA Budget**

The proposed increase to NASA's R&D portfolio in FY 2008, now endorsed and added to by the Senate, would continue a modest upward trend for the last few years after hitting bottom in 2005, as shown in Figure 1. NASA's R&D funding has just kept pace with inflation going back to FY 1991, and recent increases have been just barely ahead of inflation. 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.

Although much of NASA's R&D portfolio funds development and facilities projects such as the Space Station, **NASA is responsible for 8 percent of all federal support for basic and applied research, with far larger roles in key fields.** NASA funds nearly a quarter of total federal support for engineering research. NASA supplies nearly all the federal support for some engineering sub-fields such as astronautical engineering and aeronautical engineering. NASA is also the leading federal sponsor of the environmental sciences (oceanography, atmospheric sciences, geological sciences). The environmental sciences are a quarter of NASA's portfolio, but NASA accounts for almost a third of total federal support for environmental sciences research and is the largest agency participant in the multi-agency Climate Change Science Program (CCSP). NASA also invests heavily in the physical sciences (astronomy, chemistry, and physics). NASA is the second largest federal sponsor of physical sciences behind the Department of Energy, and is by far the leading sponsor of astronomy research with more than 70 percent of the federal total.

**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),**

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**NASA support of research has plummeted in real terms, and the 2008 Senate appropriation would arrest the slide but not reverse it.**

### **Outlook and Next Steps**

There is growing congressional dissatisfaction over NASA's course of doing everything it has promised within a flat real budget. Congressional appropriators and authorizers have criticized the agency for siphoning resources away from research to keep the Space Shuttle, ISS, and moon and Mars programs on track, but have mostly been unable to come up with the additional money needed to sustain research. The 2008 appropriations process has so far been the same: although Senate appropriators tried to boost NASA funding, their relatively modest additions shored up the earth science portfolio somewhat but still leave NASA research funding in decline.

The full Senate is expected to debate and approve the Commerce-Justice-Science bill in July, while the House Appropriations Committee is expected to consider its version in July, also. Congress will try to send a final version of the bill to President Bush before the October 1 start of FY 2008. The President has threatened to veto any 2008 appropriations bill that exceeds his request, as the Senate bill does by more than \$3 billion, so the bill may have a long way to go before its funding levels become final.

(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&amp;D in FY 2008 Senate Appropriations

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

	FY 2007 Estimate	FY 2008 Request	Action by Senate				
			FY 2008 Senate	Chg. from Request Amount	Chg. from Request Percent	Chg. from FY 2007 Amount	Chg. from FY 2007 Percent
Summary of R&D by Appropriation:							
<b>1. Exploration Capabilities (EC)</b>							
International Space Station	1,735	2,239	<b>2,239</b>	0	0.0%	503	29.0%
Space Shuttle	3,976	4,008	<b>4,008</b>	0	0.0%	32	0.8%
Space and Flight Support	323	546	<b>546</b>	0	0.0%	223	69.2%
Total Exploration Capabilities	6,034	6,792	<b>6,792</b>	0	0.0%	758	12.6%
<b>2. Science, Aeronautics and Exploration (SAE)</b>							
Science:							
Earth Science	1,443	1,497	<b>1,625</b>	128	8.5%	182	12.6%
Heliophysics	1,013	1,057	<b>1,081</b>	24	2.3%	68	6.7%
Planetary Science	1,391	1,396	<b>1,357</b>	-39	-2.8%	-34	-2.4%
Astrophysics	1,540	1,566	<b>1,554</b>	-11	-0.7%	14	0.9%
Total Science	5,388	5,516	<b>5,618</b>	102	1.8%	230	4.3%
Exploration Systems	3,576	3,924	<b>3,946</b>	22	0.6%	370	10.4%
- Constellation Systems	2,784	3,068	<b>3,097</b>	29	0.9%	314	11.3%
- Advanced Capabilities	792	856	<b>849</b>	-6	-0.8%	57	7.2%
Aeronautics Research	695	554	<b>550</b>	-4	-0.7%	-145	-20.8%
Cross-Agency Support Programs	542	489	<b>518</b>	29	5.9%	-24	-4.4%
- Congressional Projects 1/	0	0	<b>70</b>	70	--	70	--
- Education	181	154	<b>149</b>	-5	-3.4%	-32	-17.9%
- Advanced Business Systems	105	103	<b>74</b>	-29	-28.6%	-32	-30.0%
- Innovative Partnerships	232	198	<b>192</b>	-6	-3.2%	-40	-17.4%
- Shared Capabilities	24	34	<b>34</b>	0	-0.6%	10	42.9%
<b>Total SAE</b>	10,201	10,483	<b>10,633</b>	150	1.4%	432	4.2%
3. Inspector General	32	35	<b>35</b>	0	0.0%	3	8.1%
<b>Total NASA Budget</b>	16,267	17,310	<b>17,460</b>	150	0.9%	1,193	7.3%
<i>minus non-R&amp;D Activities:</i>							
Space Shuttle	-3,976	-4,008	<b>-4,008</b>	0	0.0%	-32	0.8%
Other non-R&D	-428	-649	<b>-619</b>	30	-4.5%	-192	44.8%
Inspector General	-32	-35	<b>-35</b>	0	0.0%	-3	8.1%
Education and Training	-25	-25	<b>0</b>	25	-100.0%	25	-100.0%
Total NASA Non-R&D Activities	-4,461	-4,716	<b>-4,662</b>	54	-1.2%	-201	4.5%
<b>TOTAL NASA R&amp;D</b>	11,806	12,594	<b>12,798</b>	204	1.6%	992	8.4%

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 2007 figures include 2007 supplemental appropriations enacted in Public Law 110-28.

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

1/ FY 2008 Senate 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.**

**July 2, 2007 - AAAS estimates of Senate Appropriations Committee-approved appropriations.**

**These figures may be amended or rejected by the full Senate.**