

NSF Enjoys Strong ACI Boost in 2009 Budget

AAAS R&D Funding Update on R&D in the FY 2009 NSF Budget

(This analysis is a preview of the NSF chapter in the forthcoming *AAAS Report XXXIII: Research and Development FY 2009*, a comprehensive look at the President's budget for R&D in FY 2009. This analysis contains revised AAAS estimates of NSF R&D, different from figures originally presented in the President's budget. More tables and continually updated supplemental materials on R&D in the FY 2009 budget can be found on the AAAS R&D Web site at <http://www.aaas.org/spp/rd>.)

Highlights

- The National Science Foundation (NSF) benefits from the Administration's American Competitiveness Initiative (ACI) with a 13.6 percent boost for its total budget to \$6.9 billion in fiscal year (FY) 2009 (see Table II-7), an especially large increase designed to keep NSF on track to double its budget between 2006 and 2016 after appropriations setbacks in 2007 and 2008. **NSF's R&D investments would total \$5.2 billion, a 15.5 percent increase to an all-time high in real terms.**

- **All of NSF's research directorates would receive large increases in 2009** after flat funding in 2008, and all would recover from budget cuts after 2004 to reach all-time highs in inflation-adjusted dollars (see Figure 2). The 2009 NSF request clearly favors the physical sciences, with requested increases approaching 20 percent for the Mathematics and Physical Sciences (MPS; up 20 percent), Engineering (ENG; up 19 percent), and Computer and Information Science and Engineering (CISE; up 20 percent) directorates (see Table II-7). The Biological Sciences (BIO; up 10 percent), Geosciences (GEO; up 13 percent), and especially the Social, Behavioral and Economic Sciences (SBE; up 9 percent) would lag behind but would narrowly match past funding levels.

- NSF's education and human resources programs would gain 9 percent to \$790 million.

NSF R&D in the FY 2009 Budget

In his final budget proposal for FY 2009, President Bush would follow through on his 2006 call to substantially increase funding for key physical sciences research agencies over ten years as part of an "American Competitiveness Initiative" (ACI) by keeping the National Science Foundation (NSF) budget on track to double between 2006 and 2016, despite appropriations setbacks in 2007 and 2008. NSF is one of three agencies (the others are the Department of Energy (DOE) Office of Science, and the National Institute of Standards and Technology laboratories) favored with large requested increases as part of the ACI.

Although NSF and the other ACI agencies received less than requested in the last two appropriations seasons, the FY 2009 request presses ahead with the ACI vision. **NSF would receive a total budget of \$6.9 billion in FY 2009, \$822 million or 13.6 percent more than 2008** (see Table II-7). Although increases for NSF's physical sciences-related programs would lead the pack, there would be increases across the entire NSF research portfolio, which spans the range of science and engineering disciplines, and increases for NSF's education and human resources programs as well. NSF is the third-largest federal sponsor of physical sciences research, after DOE and the National Aeronautics and Space Administration (NASA), but is among the top 3 federal funding agencies for nearly every science and engineering discipline. NSF is the second largest funding source for R&D at colleges and universities, behind only the National Institutes of Health (NIH), and provides the majority of federal support for basic research at

colleges and universities in the social sciences, environmental sciences, non-medical biology, mathematics, and computer sciences. For the physical sciences and engineering, NSF funds more than 40 percent of all federally supported academic basic research. Thus, the broad-based increases in the 2009 budget could have a major impact on nearly all science and engineering disciplines, especially at universities.

After adjusting for inflation, the 2009 requested increase would bring the NSF budget to an all-time high in inflation-adjusted terms (see Figure 1). After peaking in 2004, NSF funding fell in 2005 and 2006 but rose in 2007 and 2008 after Congress approved some though not all of the Bush Administration's requested ACI increases.

NSF's R&D funding, which excludes NSF's education and training activities and overhead costs (such as polar logistics and administrative salaries), would total \$5.2 billion, a gain of 15.5 percent or \$696 million that would also be an all-time high (see Table II-7 and Figure 1).

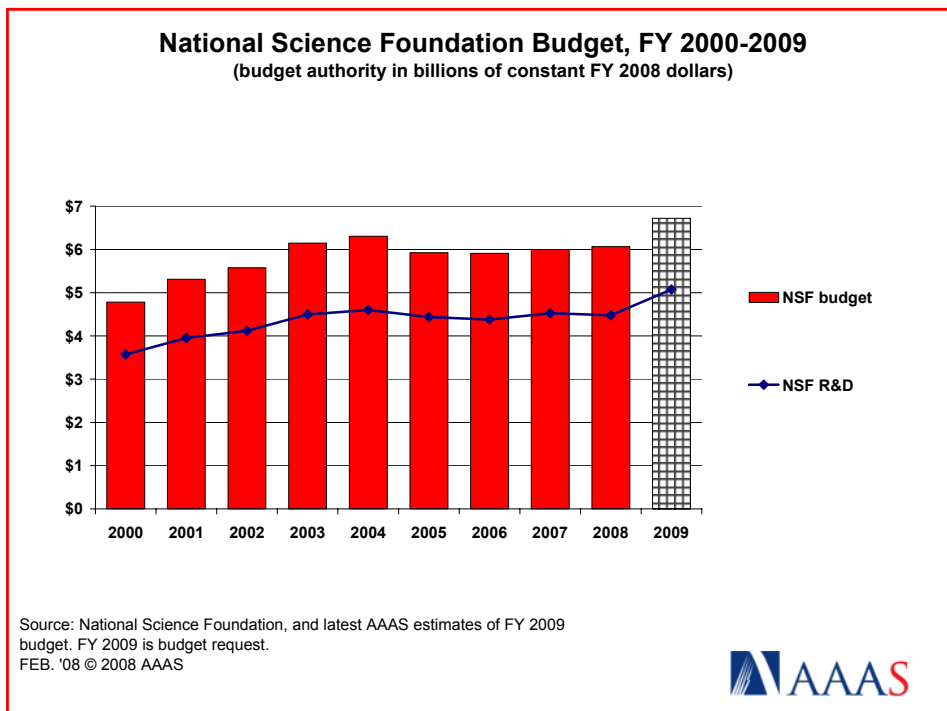


Figure 1. (click on the image for PDF)

NSF's main **Research and Related Activities (R&RA)** account, which funds nearly all of NSF's basic and applied research and contains NSF's discipline-based research directorates, would increase 16.4 percent to \$5.6 billion (see Table II-7). **All of NSF's research directorates would receive large increases in 2009 after flat funding in 2008, and all would recover from budget cuts after 2004 to reach all-time highs in inflation-adjusted dollars** (see Figure 2). The 2009 NSF request clearly favors the physical sciences, with requested increases approaching 20 percent for the largest Mathematics and Physical Sciences (MPS) directorate (up 20 percent to \$1.4 billion), the Engineering (ENG) directorate (up 19 percent to \$759 million), and the Computer and Information Science and Engineering (CISE) directorate (up 20 percent to \$639 million; see Table II-7). The Office of Cyberinfrastructure (OCI) would also see a strong gain with a 19 percent boost to \$220 million. OCI supports the procurement, development, and operation of state-of-the-art cyberinfrastructure resources for the entire research community. Funding for all of these physical sciences-oriented directorates would hit all-time highs in real dollars.

The increases would be smaller but still substantial for other NSF research directorates away from the physical sciences. The Biological Sciences (BIO; up 10 percent to \$675 million), Geosciences (GEO; up 13 percent to \$849 million), and especially the Social, Behavioral and Economic Sciences (SBE; up 9

percent to \$233 million) would lag behind in percentage terms, but all would narrowly manage to match past funding levels in real dollars (see Figure 2), although funding for the SBE directorate has just barely kept pace with inflation this decade.

Within R&RA, the Integrative Activities (IA) account would climb 19 percent to \$276 million to fund its cross-disciplinary suite of programs. There would be a large 23 percent increase to \$115 million for Major Research Instrumentation (MRI), a program to distribute competitively awarded instrumentation grants to institutions for state-of-the-art research instrumentation that would be too costly to be funded through regular NSF research awards. The other large increase in IA would go to the Science and Technology Centers program (from \$1 million this year to \$16 million in 2009) to support a competition in 2009 to name five to seven new centers for multidisciplinary centers integrating research, education, workforce development, and technology transfer. The Experimental Program to Stimulate Competitive Research (EPSCoR) would receive \$114 million, a small increase over the current year. EPSCoR assists research institutions and states that have traditionally been underrepresented in federal R&D funding to build research capacity. The program is currently open to 25 states, Puerto Rico, and the U.S. Virgin Islands; collectively, the EPSCoR states received just 10.4 percent of NSF R&D funds in FY 2004.

The Office of Polar Programs (OPP), which funds polar research but also provides logistical support for research activities at both poles and maintains the South Pole Station, would receive \$491 million, up 11 percent from 2008 to reach an all-time high in real terms (see Figure 2). The OPP funding would build on a large increase in 2007 to fund research during the International Polar Year (2007-2009) and to fund logistics costs to support that research. After the IPY ends in March 2009, NSF hopes to sustain a vibrant polar research effort with the 2009 increase.

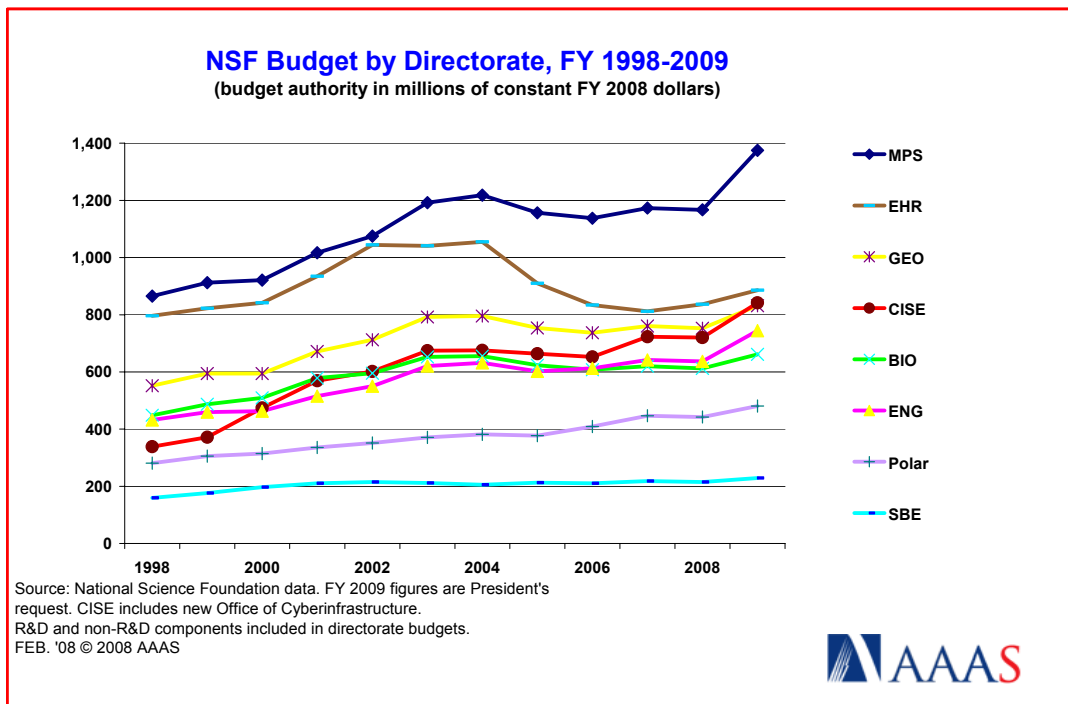


Figure 2. (click on the image for PDF)

NSF R&D facilities funding would be one of the few areas in the 2009 NSF budget to decline. The Major Research Equipment and Facilities Construction (MREFC) budget would fall \$58 million or 28 percent to \$148 million (see Table II-7). From funding 7 projects in 2008, the 2009 budget would fund only 3 construction projects and one new design project, although 4 more projects would inch along with previously appropriated funds. MREFC funds only the construction of large scientific facilities; smaller facilities projects, planning and design for future facilities, research instrumentation grants, and facilities

operations are funded in R&RA by the research directorates. In 2009, NSF would ramp up construction of the Advanced Laser Interferometer Gravitational Wave Observatory (AdvLIGO), an upgrade to the existing LIGO in Washington and West Virginia of the world's most sophisticated optical interferometers, with a \$51 million allocation. The Atacama Large Millimeter Array (ALMA) would receive \$82 million for its eighth year of funding out of a planned 11, and construction of the IceCube project in Antarctica would begin winding down with \$11 million in 2009 toward full operations in 2011. A small \$2.5 million request would initiate design work on the Advanced Technology Solar Telescope, which could become a full-fledged MREFC project in future years.

NSF education and human resources programs would increase \$65 million or 8.9 percent to \$790 million, but would remain 16 percent below 2004 levels in real terms after bottoming out in 2007 from steep cuts in 2005 and 2006 (see Figure 2). Graduate Research Fellowships (GRF) funding would climb 33 percent to \$117 million to make up the bulk of the Graduate Education budget. The 2009 budget envisions supporting up to 3,075 promising scientists and engineers in their graduate educations with three-year fellowships through the GRF; the research directorates would support additional fellowships. The Federal Cyber Service: Scholarships for Service program to support students in critical information infrastructure disciplines in exchange for federal service in cybersecurity fields after graduation would receive \$15 million, a 30 percent increase. The Robert Noyce Teacher Scholarship Program to encourage undergraduates to become mathematics and science teachers would receive \$12 million, up 7 percent from 2008.

Through its research directorates, NSF would expand its participation in several multi-agency initiatives in 2009. NSF's contribution as the lead agency in the National Nanotechnology Initiative would increase 2.1 percent to \$397 million in 2009, with major funding split between ENG and MPS. NSF is also the lead agency in the Networking and Information Technology R&D (NITRD) initiative; NSF's contribution would jump 17 percent to \$1.1 billion, with the majority of support coming from CISE and OCI. NSF also participates in the Climate Change Science Program (CCSP) with a \$221 million contribution (up 8 percent), mostly from GEO.

NSF Funding Mechanisms

The large proposed increases for the research directorates would mean a year of gains to reverse recent declines in competitively awarded research grants, if the 2009 request makes it intact through the 2009 appropriations season. Looking only at competitively awarded research grants, NSF's core funding mechanism, NSF expects to fund 8,880 research grants next year, an 18 percent increase after several years stuck near 7,500, while at the same time NSF hopes to increase the median award size to \$123,575 (up 4.6 percent). After several years of declining success rates, NSF projects that it will fund 23 percent of research grant proposals, up from 21 percent in 2008. The broad-based increases would allow every research directorate to increase the three key measures of the number of research grants, the median grant size, and the projected success rate.

NSF Research Portfolio and Performers

NSF is the only federal agency with responsibility for research in all major science and engineering fields. NSF has a balanced research portfolio covering the breadth of science and engineering, with roughly equal shares for the broad disciplinary groupings of physical sciences, environmental sciences, engineering, and mathematics/computer sciences, followed closely by biological sciences (see Figure 3). In most fields, NSF is the largest or second-largest source of federal funding.

NSF's longstanding leadership role in federal support of basic research continues to have a big impact on the nation's colleges and universities. NSF sends 79 percent of its R&D support to colleges and universities, by far the highest ratio of any R&D funding agency. NSF is the second-largest federal supporter of academic R&D, behind the National Institutes of Health (NIH), and dominates federal support in most non-biomedical fields.

Outlook for the NSF Budget

The 2009 NSF budget goes to the 110th Congress, where ACI-inspired requested increases in 2007 and 2008 were chiseled away to make room for other domestic priorities. The outlook for NSF winning its full request in 2009 is highly uncertain. Congress will have reservations about approving a 14 percent requested increase for any agency in a President's budget in which overall domestic spending would be flat and dozens of social programs are proposed for dramatic cuts or even elimination. If Congress succeeds in boosting domestic 2009 appropriations above the President's request, then NSF may get all or nearly all of its request; but if, as in 2007 and 2008, President Bush succeeds in forcing congressional appropriators to stick to his domestic totals, then Congress will no doubt follow the pattern of the past two years by diverting some of the requested NSF increases to shore up funding for programs in dire straits. Unfortunately, the final outcome may not be decided until well into FY 2009, and possibly not until a new President takes office in January 2009.

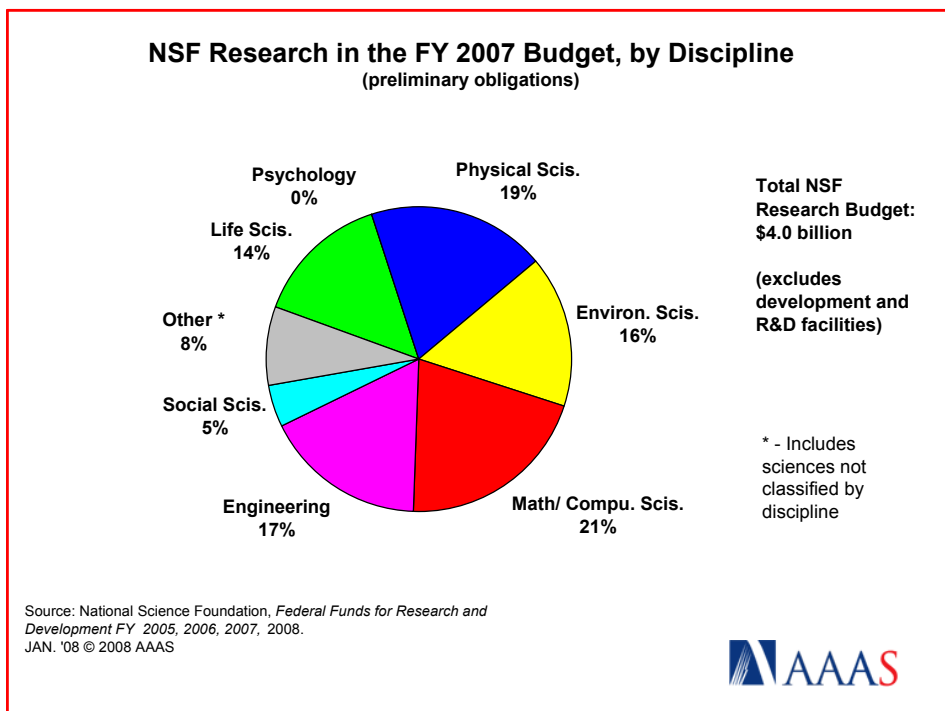


Figure 3. (click on the image for PDF)

(More materials on R&D in the FY 2009 budget, historical data and charts, and more information on *AAAS Report XXXIII: Research and Development FY 2009*, can be found on the AAAS R&D Web site at <http://www.aaas.org/spp/rd>.)

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AAAS R&D Budget and Policy Program
1200 New York Avenue, NW
Washington, DC 20005
(202) 326-6607
AAAS R&D Web site: <http://www.aaas.org/spp/rd>



Table II-7. NSF R&D

Table II-7. R&D in the National Science Foundation
(budget authority in millions of dollars) *

	FY 2007 Actual	FY 2008 Estimate	FY 2009 Budget	Change FY 08-09	
				Amount	Percent
1. Research and Related Activities (R&RA)					
Mathematical and Physical Sciences (MPS)					
Astronomical Sciences	215	218	250	32	14.8%
Chemistry	191	194	245	50	26.0%
Materials Research	257	260	325	64	24.7%
Mathematical Sciences	206	212	246	34	16.0%
Physics	248	251	298	47	18.8%
Multidisciplinary Activities	33	33	40	7	22.3%
Total MPS	1,151	1,167	1,403	235	20.2%
Engineering (ENG)					
Chem, Bioeng, Env & Transport	128	131	173	42	32.3%
Civil, Mechanical & Manuf. Innov	157	160	202	42	26.3%
Electrical Commun & Cyber Sys	83	84	94	11	13.0%
Industrial Innovation Partnersh.	121	122	141	19	15.8%
- SBIR/ STTR	109	109	127	18	16.1%
Engineering Edu. & Centers	115	116	120	4	3.4%
Emerging Frontiers in Res. Innov	25	25	29	4	16.0%
Total ENG	630	637	759	122	19.2%
Biological Sciences (BIO)					
Molecular and Cellular Bioscis	112	113	126	14	12.1%
Integrative Organismal Systems	202	200	216	16	8.2%
Environmental Biology	110	111	126	15	13.3%
Biological Infrastructure	80	87	87	0	0.1%
Emerging Frontiers	105	102	120	18	17.9%
Total BIO	609	612	675	63	10.3%
Geosciences (GEO)					
Atmospheric Sciences	227	229	261	31	13.6%
Earth Sciences	153	156	178	22	13.9%
Innov. & Collab. Edu. & Res.	57	57	57	0	0.0%
Ocean Sciences	309	310	354	43	13.9%
Total GEO	746	753	849	96	12.8%
Computer and Information Science and Engineering (CISE)					
Computing & Communic. Foun.	123	143	180	37	25.5%
Computer & Network Sys.	163	174	207	33	19.0%
Info. & Intelligent Sys.	119	139	174	35	25.0%
Information Tech. Research	122	78	78	0	0.0%
Total CISE	527	535	639	104	19.5%

Table II-7. NSF R&D

Table II-7 (continued). R&D in the National Science Foundation
(budget authority in millions of dollars) *

	FY 2007	FY 2008	FY 2009	Change FY 08-09	
	Actual	Estimate	Budget	Amount	Percent
Office of Cyberinfrastructure	182	185	220	35	18.8%
Social, Behavioral, and Economic Sciences (SBE)					
Social & Economic Scis.	100	100	107	7	7.0%
Behavioral & Cognitive Scis.	85	85	93	8	9.6%
Science Resources Statistics	30	30	33	3	10.4%
Total SBE	215	215	233	18	8.5%
Office of International Sci & Eng	40	41	47	6	14.8%
US Polar Programs					
Arctic Sciences	89	91	104	13	14.4%
Antarctic Sciences	57	60	71	11	18.0%
Antarctic Infra. & Logistics	234	228	255	27	11.7%
Polar Env., Safety & Health	6	6	7	1	12.7%
Polar Icebreaking 1/	53	57	54	-3	-5.3%
Total Polar Programs	438	443	491	48	10.9%
Integrative Activities	219	232	276	44	18.8%
- EPSCoR 2/	102	111	114	2	2.2%
- Major Res. Instrumentation	90	94	115	21	22.5%
Arctic Research Commission	1	1	2	0	4.1%
BA Adjustment *	10	-17	0	17	--
Total R&RA *	4,768	4,804	5,594	790	16.4%
2. Major Research Equip. & Facils.	191	205	148	-58	-28.2%
3. Education & Human Resources (EHR)					
Research on Learning in Formal and Informal Settings					
Undergraduate Education	209	214	227	13	5.8%
Graduate Education	205	211	220	9	4.2%
Human Resource Develop.	156	160	191	31	19.1%
BA Adjustment *	126	140	153	13	9.2%
BA Adjustment *	-1	0	0	0	--
Total EHR	695	726	790	65	8.9%

(continued)

Table II-7. NSF R&D

Table II-7 (continued). R&D in the National Science Foundation
(budget authority in millions of dollars) *

	FY 2007	FY 2008	FY 2009	Change FY 08-09	
	Actual	Estimate	Budget	Amount	Percent
4. Agency Ops. & Award Mgmt.	248	282	305	23	8.3%
5. National Science Board	4	4	4	0	1.5%
6. Inspector General	11	11	13	2	14.6%
Total NSF Budget *	5,917	6,032	6,854	822	13.6%
Deduct non-R&D Activities:					
<i>R&RA non-R&D</i>	-575	-590	-633	43	7.2%
<i>EHR non-R&D</i>	-639	-667	-724	58	8.7%
<i>Agency Ops. & Award Mngmt.</i>	-248	-282	-305	23	8.3%
<i>National Science Board</i>	-4	-4	-4	0	1.5%
<i>Inspector General</i>	-11	-11	-13	2	14.6%
Total NSF R&D	4,440	4,479	5,175	696	15.5%
Conduct of R&D	3,978	4,017	4,742	725	18.0%
R&D Facilities	462	461	433	-29	-6.2%

Source: NSF budget justification and Quantitative Data Tables.

* - Directorate detailed figures are in obligations. BA adjustment converts obligations to budget authority.

1/ Transfer to Coast Guard for polar icebreaking costs.

2/ Experimental Program to Stimulate Competitive Research. Included in Integrative Activities for all years.

February 7, 2008

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