

R&D in the FY 1999 Federal Budget Request

The FY 1999 federal budget proposal, submitted to Congress on February 2, 1998, is the first in 30 years to project a bottom-line surplus, freeing up “more funds to invest in America’s future,” in the words of President Clinton. After several

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years of essentially stagnant science budgets—and dire threats of sharp decreases in the future—the administration has proposed strong growth in the federal investment in research, especially nondefense basic research. Total federal spending on R&D, including equipment and facilities, would grow by \$1.961 billion (an increase of 2.6%) in FY 1999, to a total of \$78.159 billion.

With 60% of the increment to be devoted to basic research programs, the proposed budget represents something of a departure for the Clinton administration, which has tended to favor applied research. The major categories would be treated as follows (all tables in this document use current dollar estimates for FY 1998 and current dollar proposals for FY 1999; figures in millions):

Major R&D Category	FY98	FY99	Change
Basic			
civilian research	\$14,673	\$15,811	7.8%
Applied			
civilian research	\$11,244	\$11,772	4.7%
Civilian development	\$8,010	\$8,229	2.7%
Basic			
defense research	\$1,100	\$1,155	5.0%
Applied			
defense research	\$4,309	\$4,504	4.5%
Defense development	\$34,464	\$34,057	-1.2%

“New starts” in the President’s S&T budget include a Climate Change Technology Initiative; a Food Genome Initiative; a NASA mission to Europa (one of Jupiter’s moons); construction of the National Spallation Neutron Source; and an Education Research Initiative. Continuing priorities include health and health care policy research; food safety research; the international partnership on the Large Hadron Collider; the Advanced Technology Program; Large Scale Networking and High-End Computing and Computation (formerly known as the High Performance Computing and Communications initiative), including the Next Generation Internet; intelligent transportation infrastructure; DOE’s Accelerated Strategic Computing Initiative to create simulation and modeling tools for stewardship of the U.S. nuclear stockpile without live tests; the Partnership for a New Generation of Vehicles; and DOD’s Dual Use Applications Program.

Many of the nondefense components of the S&T portfolio, totaling \$31 billion, have been “bundled” into the Research Fund for America, also called the 21st Century Research Fund, and targeted for an aggregate 8% increase in FY 1999 and a 32% increase over the next five years. But don’t be confused by the use of the word “Fund”—unlike the Social Security Trust Fund or the Transportation Trust Fund, the cash in this case will not sit in a separate bank account. Appropriations will proceed as usual, with each component requiring its own justification. The “Fund” designation, which was also given to two other spending categories (environmental resources and transportation), was used in an attempt by the administration to exceed the discretionary spending caps enacted last year, with some portion of the Funds’ budget growth to be offset with new revenue sources outside the cap.

Outlook for Congressional Action On R&D

The chief advantage of the Fund is its usefulness as a sound bite, something the President can take to the American people in defense of expenditures that exceed the caps. Trumpeting the 21st Century Research Fund will draw more applause during speeches than would claiming credit for, say, the National Spallation Neutron Source (despite that facility’s value in biomedical research). But it also creates a target for congressional Republicans, who immediately criticized the budget’s spending levels and reacted with skepticism to the projection of a surplus. “The President’s budget,” said House

Appropriations Committee chair Bob Livingston (R-LA), “violates the spirit of last year’s discretionary spending caps and has no basis in legislative reality.” He also criticized the research and the other two Funds as “backdoor attempts to violate last year’s Budget Agreement.” He called the proposed offsets “phony,” as none of the new revenue sources are likely to be enacted.

The criticism should probably be viewed as targeting the “Fund” tactic rather than research spending increases per se. Key Republicans in Congress have been increasingly supportive of expanding the federal investment in research, with Senator Phil Gramm (R-TX), a dyed-in-the-wool fiscal conservative, leading the charge. Last fall he and three of his Senate colleagues—Joseph Lieberman (D-CT), Pete Domenici (R-NM), and Jeff Bingaman (D-NM)—introduced bipartisan legislation to authorize doubled aggregate funding for civilian research agencies. This and other Republican expressions of support probably sparked President Clinton’s new-found appreciation for basic research, although the shrinking deficit made his conversion easier.

But Republican supporters of science will be pulled two ways, as many of their colleagues will oppose large federal spending increases even if there is a surplus, preferring to devote more money to tax cuts. Others have targeted transportation infrastructure as a top priority for any extra funds. And congressional Democrats may have ideas of their own; they do not always share the President’s enthusiasm for his spending proposals. So we’re in for the usual wrangling over the budget. Nevertheless, with good will toward science emanating from across the political spectrum, there is cause for optimism, at least with respect to noncontroversial agencies like NSF and NIH. The science, mathematics, and engineering communities will need to be on full alert and continue to intensify their advocacy activities.*

Outlook for Congressional Action On Education

The situation with the education budget is even more contentious: Deep philosophical differences have led to virtual showdowns between the administration and congressional Republicans over recent education appropriations. This year will be no different. Rep. Bill Goodling (R-PA), chair of the House Education and the Workforce Committee, assailed the Department of Education’s FY 1999 budget proposal because it “shifts support to the Washington education bureaucracy and away from programs that send funds directly to teachers and classrooms.” He and strong contingents of Republicans in both chambers oppose any expansion of the federal role in education and favor programs that send funds to states and school districts with few strings attached. They’re adamantly opposed to anything that smacks of a national curriculum. President Clinton, on the other hand, wants a dynamic Department of Education that identifies and tracks critical education needs and undertakes programs tailored to address them. There’s little room for compromise.

This situation was well demonstrated in last year’s battle over the President’s proposal to develop and administer voluntary national tests in 4th-grade reading and 8th-grade mathematics. The FY 1998 education appropriations bill provides funds for development but prohibits implementation of the tests. Republicans will seek to renew the ban on implementation during consideration of the FY 1999 appropriations bill, setting up a confrontation with the administration that will play out over the course of the appropriations process.

National Science Foundation Budget Request

The FY 1999 budget proposes the largest increase ever for the National Science Foundation—\$344 million, an increase of 10%. (The 10% increase is based on an FY 1998 estimate that does not include \$23 million NSF is supposed to receive from Internet domain name registration fees; this money is tied up in court, and NSF has been directed not to spend it. If NSF is allowed to spend this money in FY 1998, the proposed budget increase for FY 1999 would work out to 9.1%. The tables below do not include the \$23 million in the FY 1998 figures.) NSF’s total budget request is \$3.773 billion, up from \$3.429 billion in FY 1998, and would be distributed as follows (figures in millions):

Budget Category	FY98	FY99	Change
Research & related activities	\$2,545.7	\$2,846.8	11.8%
Education & human resources	\$632.5	\$683.0	8.0%
Major research equipment	\$109.0	\$94.0	-13.8%
Salaries, Expenses & Inspector General	\$141.8	\$149.2	5.2%

Function	FY98	FY99	Change	Proportion
Research project support	\$1,898	\$2,126	12.0%	56.3%
Education & training	\$666	\$737	10.7%	19.5%
Research facilities	\$699	\$735	5.4%	19.5%
Administration	\$167	\$175	5.3%	4.6%

The NSF budget documents cite the agency's priorities and directions: advance science and engineering at and across the frontiers; move forward in key multidisciplinary areas, including Knowledge and Distributed Intelligence (KDI) and Life and Earth's Environment (LEE); and Educating for the Future, including the integration of research and education. These themes are virtually the same as those being emphasized in FY 1998.

KDI is an NSF-wide effort that aims to improve the ability to discover, collect, represent, transmit, and apply information. It has three multidisciplinary components: Knowledge Networking, Learning and Intelligent Systems, and New Computational Challenges. The mathematical sciences have a fundamental role in all three.

The Educating for the Future initiative includes a \$28 million funding increment as part of a joint effort with the Department of Education to improve K-8 mathematics instruction and achievement; NSF's contribution will focus on professional development of teachers and implementation of standards-based instructional material. Another \$25 million is slated for a new program, Research on Education and Training Technology, NSF's contribution to another joint DoEd NSF effort to expand support for educational research. This program was created in direct response to a recommendation made by the President's Committee of Advisors on Science and Technology (PCAST) in a report calling for expanded efforts to develop and implement educational technology. (Additional details on both initiatives appear in a section on the Department of Education, which can be found in the complete version of this article at <http://forum.swarthmore.edu/social/jpbmcan/fy99budget.html>.)

NSF would also continue support for activities that contribute to the multi-agency research initiatives overseen by the National Science and Technology Council: Large Scale Networking and High-End Computing and Computation, including the Next Generation Internet (\$310 million); the U.S. Global Change Research Program (\$187 million); and the Partnership for a New Generation of Vehicles (\$52 million).

Research and Related Activities

Funding for NSF's research directorates is projected as follows (figures in millions):

Directorate	FY98	FY99	Change
Biological Sciences	\$370.8	\$417.8	12.7%
Computer & Information Sciences & Engineering	\$284.2	\$331.1	16.5%
Engineering	\$358.0	\$400.6	11.9%
Geosciences	\$455.1	\$507.3	11.5%
Mathematical & Physical Sciences	\$715.7	\$792.0	10.7%
Social, Behavioral, & Economic Sciences	\$130.7	\$150.3	15.0%

Mathematical and Physical Sciences

Within the MPS budget, funding for the divisions would grow as follows (figures in millions):

Division	FY98	FY99	Change
Mathematical Sciences	\$97.2	\$114.1	17.4%
Astronomy	\$117.8	\$128.0	8.6%
Physics	\$148.5	\$171.9	15.8%
Chemistry	\$135.6	\$148.0	9.1%
Materials Research	\$186.6	\$200.0	7.2%
Office of Multidisciplinary Activities	\$30.0	\$30.0	0.0%

The MPS budget can also be broken down by function (figures in millions):

Function	FY98	FY99	Change
Research project support	\$548.8	\$591.2	7.7%
Research facilities	\$142.4	\$162.2	13.9%
Education & training	\$21.0	\$34.9	66.3%
Administration & management	\$3.6	\$3.8	5.0%

Research emphases in MPS's FY 1999 plan include fundamental and applied mathematics, the origins of the universe, the quantum realm, and molecular connections. The directorate will also implement efforts to increase the average size and duration of its awards. The integration of research and education will continue as an overriding objective, and more than \$19 million of MPS's FY 1999 funding increment would be used to expand support for programs under the Educating for the Future initiative, including Grant Opportunities for Academic Liaison with Industry (GOALI), Faculty Early Career Development programs (CAREER), Research Experiences for Undergraduates (REU), and the Integrative Graduate Education and Research Training (IGERT) program.

Division of Mathematical Sciences. The DMS budget is slated for a generous \$16.9 million increase in FY 1999, which would bring it to a total of \$114.1 million. The increment is to be divided roughly evenly between the two program elements: Research Project Support, which would grow from its FY 1998 level of \$70.2 million to \$79.1 million (an increase of 12.7%), and Infrastructure Support, which would grow from \$27.0 million in FY 1998 to \$35.0 million (an increase of 29.6%).

With the increase for Research Project Support, DMS would emphasize adequate funding for outstanding researchers in areas of greatest scientific potential by increasing the average size and duration of its awards. The \$8 million increment for infrastructure support would be divided among the Grants for Vertical Integration of Research and Education in the Mathematical Sciences (VIGRE) program (\$4.5 million), the joint DoEd-NSF initiative in K-8 mathematics (\$3.0 million), and enhanced support for institutes (\$0.5 million). VIGRE, a departmental grants program beginning in FY 1998 with approximately eight awards, would expand in FY 1999 to 12 or 15 more sites. Funded departments will use their awards for undergraduate, graduate, and postdoctoral activities designed to improve and reform the research and educational opportunities in the mathematical sciences.

Education and Human Resources

The EHR budget would increase by more than \$50 million in FY 1999, with most of the increment to be directed to systemic reform, K-12, and undergraduate programs (figures in millions):

Division	FY98	FY99	Change
Educational System Reform	\$102.8	\$117.0	13.9%
Elementary, Secondary, & Informal Education	\$183.3	\$200.3	9.3%
Undergraduate Education	\$100.7	\$110.9	10.1%
Graduate Education	\$73.8	\$75.8	2.7%
Human Resource Development	\$77.6	\$79.6	2.6%

EHR support can also be broken down by educational level (figures in millions):

Educational Level	FY98	FY99	Change
PreK–12 education	\$374.3	\$414.9	10.8%
Undergraduate education	\$115.7	\$122.7	6.0%
Graduate education	\$78.8	\$81.0	2.8%

EHR's proposed budget increase would be used to expand investment in collaborative efforts with the Department of Education (DoEd), supporting the joint initiatives in K–8 mathematics and education research, NSF's contribution to the latter focusing on K–12 education and training technologies; implement strategies to accelerate production of K–12 science and mathematics teachers in response to demands of standards-based reform and aging of the instructional workforce; expand urban systemic programming to redress inequitable access to quality education; and support application of learning technologies across EHR activities.

Division of Undergraduate Education. EHR's undergraduate programs will be realigned to focus on institution-wide implementation of high-quality instructional materials and educational practices in classrooms and laboratories. Emphasis will be placed on innovations that apply state-of-the-art research on learning, instruction, and educational technologies; ensure access to cutting-edge science; and respond to the varying cultural, academic backgrounds, and learning styles of students. Funding for DUE's Advanced Technological Education (ATE) program would increase by \$2.3 million. The budget for the Course, Curriculum, and Laboratory Improvement (CCLI) program, which combines the old Course and Curriculum Development, Undergraduate Faculty Enhancement, and Instrumentation and Laboratory Improvement programs, would total \$52.8 million, an increase of \$2.7 million, to be used in support of educational technology efforts and a new effort to reform undergraduate earth science curriculum under the Life and Earth's Environment theme.

Division of Graduate Education. In the graduate arena, support for traineeships would remain constant in FY 1999, but more funds would be allocated to the NSF-wide Integrative Graduate Education and Research Training (IGERT) program—a research-based, interdisciplinary effort that provides PhD students with the content knowledge and professional skills for meeting career demands of the future. A \$5 million minority graduate education program, begun in FY 1998 at the direction of Congress, would continue to support implementation of innovative strategies to increase substantially the number of minorities obtaining doctorates in science, mathematics, and engineering. EHR will also continue the phase-in of a rise in the cost-of-education allowance, defraying more of the actual tuition costs of graduate fellows and trainees. This increase will result in reductions in the number of graduate students supported as it is implemented over the FY 1998–2000 period.

Department of Defense R&D Budget Request

DOD's FY 1999 budget request for military research, development, test, and evaluation (RDT&E) totals \$36.078 billion, a decrease of 1.6% from the FY 1998 level. Basic research would be funded at \$1111.2 million in FY 1999, an increase of 6.7%. DOD support for applied research would grow by only 0.8%. (Note: The defense R&D budgets reported in the first section of this document include nonmilitary defense activities supported by agencies other than DOD, primarily DOE.) Broken down by branch, the budget requests are as follows (figures in millions):

Branch & Research Type	FY98	FY99	Change
Army Basic Research	\$180.6	\$200.8	11.1%
Army Applied Research	\$654.1	\$511.3	-21.8%
Navy Basic Research	\$338.7	\$362.7	7.1%
Navy Applied Research	\$493.6	\$524.7	6.3%
Air Force Basic Research	\$196.3	\$209.4	6.7%
Air Force Applied Research	\$567.8	\$582.0	2.5%
DOD-wide Basic Research	\$326.2	\$338.4	3.7%
DOD-wide Applied Research	\$1,280.6	\$1,401.8	9.5%

(Additional details and an analysis of how this budget would affect DOD's mathematical sciences programs, will be provided in a document, "Mathematical Sciences in the FY 1999 Budget" at <http://forum.swarthmore.edu/social/jpbmcan/math99.html>.)

Budget Requests of Other Research Agencies

Spending plans for the R&D components of other federal departments and agencies are as shown in the table at the top of the next column (figures in millions).

Department of Energy

The Department of Energy's FY 1999 budget request, subtitled "Science, Technology, and Energy for Our Future," totals \$18.0 billion, an increase of \$1.5 billion, or almost 9%, above the FY 1998 level. Research and development account for about 40% of DOE's budget. The FY 1999 priorities of DOE's Office of Energy Research (OER) include the Spallation Neutron Source, participation in the Climate Change Technology Initiative, improving productivity at DOE's science facilities, the Next Generation Internet, science education, delivering the Large Hadron Collider, and nuclear fusion.

The budget proposal for Computational and Technology Research includes \$141.3 million for the Mathematical, Information, and Computational Sciences (MICS) subprogram, up from \$127.2 million in FY 1998. MICS would provide \$22 million for research in support of the Next Generation Internet and would also continue funding for several "Grand Challenge" projects started under the old HPCC program. MICS also maintains a mathematical sciences program to support researchers in DOE labs as well as academic institutions. Its base budget would remain at \$16 million and could be supplemented by an additional \$1.5 million in FY 1999 for a new initiative, Predictability of Complex Phenomena.

OER's science education priorities include building partnerships with NSF-sponsored school systems, expanding teacher enhancement activities at DOE labs, and providing student experiences through undergraduate laboratory research fellowships.

National Institute of Standards and Technology

NIST's FY 1999 budget request is \$715 million, a 6.3% increase above the FY 1998 appropriation of \$672.9 million. It would provide funding for three separate activities: \$291.6 million for Scientific and Technical Research and Services, including \$286.3 million for the NIST Measurement and Standards Laboratories and \$5.4 million for the National Quality Program; \$366.7 million for Industrial Technology Services, including \$259.9 million for the Advanced Technology Program and \$106.8 million for the Manufacturing Extension Partnership; and \$56.7 million for Construction of Research Facilities, including \$40 million for the planned Advanced Measurement Laboratory.

NIST's Measurement and Standards Laboratories program budget would increase by \$17.4 million over the FY 1998 amount, to be used mostly to help address the nation's multiplying needs for measurement-related services in four key areas: provide new measurement tools and services for the semiconductor device, equipment, and materials industries; improve measurements and data underpinning the next generation of climate change technologies; develop and disseminate the measurements and standards for next-generation disaster mitigation technologies; and create the comprehensive structure of technical measurements and standards needed for international trade and to promote the global use of U.S. measurement and standards.

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