

National Science Foundation in the FY 2002 Budget

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HIGHLIGHTS

- The President's FY 2002 request for the National Science Foundation (NSF) is \$4.5 billion. This represents an increase of \$56 million, or 1.3 percent, over the estimated FY 2001 level of \$4.4 billion. This increase is below the rate of inflation (see Table II-7).
- Research and Related Activities (R&RA) would decrease by 0.5 percent under the President's request to \$3.3 billion in FY 2002. If Congress goes along with this proposal, it would be the first time that NSF's research program would decline since FY 1996.
- The largest new initiative in the President's request is \$200 million for a Math and Science Partnership initiative focused on K-12 math and science education.
- Another important increase within the NSF budget request is \$8 million to increase stipends for the Graduate Research Fellowships (GRF), Graduate Teaching Fellowships in K-12 Education (GK-12) and Integrative Graduate Education and Research Traineeship (IGERT) programs from their current level of \$18,000 to \$20,500 for academic year 2002-2003.
- The budget request continues four major interdisciplinary initiatives begun under the Clinton Administration: Biocomplexity in the Environment (BE), Information Technology Research

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(ITR), Nanoscale Science and Engineering, and Learning for the 21st Century.

- The budget request also begins an interdisciplinary mathematics program with an investment of \$20 million, focusing on managing large data sets, modeling uncertainty, and modeling and predicting complex non-linear systems such as brain function, economic behavior and weather prediction.

AGENCY OVERVIEW

NSF's Mission: In May 2000, NSF celebrated its 50th anniversary. During that period of time, the Foundation has had an extraordinary impact on American scientific discovery. Despite its small size, it is the only federal agency with responsibility for research and education in all major scientific and engineering fields.

NSF accomplishes its mission with remarkable efficiency. Approximately 95 percent of the agency's total budget goes directly to support the actual conduct of research and education, while less than five percent is spent on administration and management.

NSF Support: NSF plays a crucial role in the support of university research. Although NSF represents less than four percent of the total federal budget for research and development, it supports roughly 50 percent of all non-medical basic research at colleges and universities. In several fields, it is the lead federal source.

The agency funds approximately 10,000 research, education and training projects through grants, contracts, and cooperative agreements to more than 2,000 colleges, universities, and other research and/or education organizations in all parts of the United States. Nearly 200,000 people are involved directly in NSF research and education programs and activities. In FY 2002, these are projected to include nearly 40,000 senior researchers and other professionals, more than 60,000 postdoctoral, graduate and undergraduate students, 11,390 K-12 students and 80,830 K-12 teachers.

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The agency does not operate its own laboratories, but does support national research centers, user facilities, oceanographic vessels and Antarctic research stations. NSF also supports university-industry research partnerships, U.S. participation in international scientific efforts, and efforts to improve K-12 education.

Agency Structure: NSF is an independent federal agency run by a presidentially appointed, Senate-confirmed director and deputy director. The agency's policy direction is established by the National Science Board, which consists of 24 scientists, mathematicians, engineers, top university officials, and industry leaders.

NSF has a staff of roughly 1,200 people and is divided into seven directorates. Six of the directorates are directly responsible for funding discipline-oriented basic and applied research: Biological Sciences (BIO); Computer and Information Science and Engineering (CISE); Engineering (ENG); Geosciences (GEO); Mathematical and Physical Sciences (MPS); and Social, Behavioral and Economic Sciences (SBE). The remaining directorate is responsible for overseeing the Education and Human Resources (EHR) activity.

Congressional Support: NSF has traditionally enjoyed broad Congressional support. While the agency's appropriation dipped slightly between FY 1995 and FY 1996, the total appropriation has increased each year since then, even when other agencies under the VA, HUD and Independent Agencies appropriations bill were being cut. In FY 1998, the appropriation for NSF actually exceeded the Administration's budget request by \$159 million. For FY 1999 and FY 2000, Congress provided the agency with increases of 7.1 percent and 6.9 percent, respectively, over the previous year. Both of these appropriations were considered significant demonstrations of support, and were greater than the increases received by any other scientific research agency with the exception of the National Institutes of Health (NIH). Finally, for FY 2001, Congress provided the largest single increase in both percentage and dollar terms in the history of the agency, an increase of 13.3 percent over FY 2000.

Given the record of recent years, it will bear watching whether Congress will decide to exceed the essentially flat spending recommendation of the President in FY 2002. Advocates for the agency, including the Chairman

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and ranking Democrat on the Senate VA, HUD and Independent Agencies Subcommittee, Christopher Bond (R-MO) and Barbara Mikulski (D-MD), have proposed that the agency budget should double from its FY 2000 level of approximately \$4 billion to approximately \$8 billion in FY 2005. The FY 2001 appropriation of \$4.4 billion has been interpreted as the first step in this doubling initiative.

RESEARCH AND RELATED ACTIVITIES

Research and Related Activities (R&RA) would receive \$3.3 billion, a cut of 0.5 percent below the FY 2001 plan of \$3.3 billion (see Table II-7 for details of the NSF budget and the requests for specific directorates and programs).

Biological Sciences (BIO): \$483.1 million (down 0.5 percent). More than 80 percent of BIO funding goes toward investigator-initiated, fundamental research, primarily at colleges and universities. In FY 2002, BIO expects to make 3,150 awards with an average annualized award size of \$152,900 per year and an average duration of three years.

Three Science and Technology Centers that were supported by BIO receive final funding in FY 2001 and are not proposed for funding in the FY 2002 budget. The BIO Activity also supports the Center for Ecological Analysis and Synthesis, projected to receive \$2 million in FY 2002 (the same amount as in the FY 2001 plan), and 24 Long Term Ecological Research (LTER) sites in a variety of different climatic locations around the world. Support under BIO for these 24 LTER sites is projected at a combined total of \$13.8 million in FY 2002, the same amount as in FY 2001. Finally, NSF plans to devote \$31 million to Plant Genome Virtual Centers in FY 2002, the same amount as in FY 2001. (For more information on the biological sciences, please see Chapters 18 and 19.)

Computer and Information Science and Engineering (CISE): \$470.4 million (down 1.6 percent). CISE provides more than 43 percent of total support for basic computer science research at U.S. colleges and universities. In FY 2002, CISE expects to make 2,200 awards with an average annualized award size of \$160,000 per year and an average duration of 3.1 years. The largest activity within the CISE

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directorate is the Information Technology Research initiative, which is proposed to receive \$155.5 million in FY 2002, the same as in FY 2001.

Engineering (ENG): \$431.1 million (approximately the same level as FY 2001). NSF provides about 36 percent of the total federal support for academic engineering research and education. In FY 2002, ENG expects to make 2,950 awards with an average annualized award size of \$93,000 per year and an average duration of 2.8 years. (For more information on engineering, please see Chapters 24 and 25.)

Geosciences (GEO): \$558.5 million (down 0.6 percent). GEO is the principal source of federal support for academic research in atmospheric, geological and oceanographic science. In FY 2002, GEO expects to make 3,000 awards with an average annualized award size of \$80,000 per year and an average duration of three years. Funding for the National Center for Atmospheric Research (NCAR) would be cut by 1.1 percent to \$70.6 million. The Academic Research Fleet would receive \$59.9 million in FY 2002, an increase of 4.7 percent. Approximately 2,500 scientists and students use the fleet's 28 ships annually, accounting for about 75 percent of its total use. (Please see Chapter 15 for more information on atmospheric sciences; Chapters 15 and 16 for more information on ocean sciences; and Chapter 17 for more information on geological sciences.)

Mathematical and Physical Sciences (MPS): \$863.6 million (up 1.5 percent). NSF provides about two-thirds of government support for ground-based astronomy, including almost all federal support for radio astronomy, and over 66 percent for mathematics. In other MPS subfields, NSF support accounts for between 25 and 100 percent of federal funding of basic research. In FY 2002, MPS expects to make 4,900 awards with an average annualized award size of \$116,000 per year and an average duration of three years.

Support for facilities would increase by 5.1 percent in FY 2002, to \$221.6 million. Facilities supported by MPS include the Gemini Observatories, three major astronomical facilities, the Laser Interferometer Gravitational-Wave Observatory (LIGO), Cornell Electron Storage Ring, Michigan State University's National Superconducting Cyclotron Laboratory, the National High Magnetic Field Laboratory, National

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Astronomy Centers, the Atacama Large Millimeter Array (ALMA) and several other facilities.

Total center funding would increase 13.3 percent, to \$96.4 million. In FY 2002, MPS will support two Science and Technology Centers, 29 Materials Research Science and Engineering Centers, one International Materials Institute, 12 Chemistry Centers, four Physics Frontier Centers and three Mathematical Sciences Research Institutes. Several Nanoscience and Engineering Centers will also be supported in whole or in part by MPS. (Please see Chapter 13 for more information on physics, Chapter 14 for more information on astronomy, Chapter 20 for more information on chemistry, and Chapter 23 for more information on the Nanoscience and Engineering Centers.)

Social, Behavioral and Economic Sciences (SBE): \$163.2 million (down 0.8 percent). SBE is the principal source of federal support for basic research in the social, behavioral and economic sciences. For fields such as anthropology, archaeology and political science, NSF is the sole source of federal research support. In other fields, such as sociology and social psychology, NSF provides more than half of all federal support. NSF supports more than one-third of federal support for basic research in economics. In FY 2002, SBE expects to make 1,840 awards with an average annualized award size of \$56,000 per year and an average duration of 2.4 years.

Funding for centers would be cut by 15.7 percent to \$4.5 million. SBE-supported centers include the Science and Technology Center for Cognitive Science at the University of Pennsylvania, the National Consortium for Violence Research and two research centers on the Human Dimensions of Global Change at Indiana University and at Carnegie Mellon University. SBE also provides support for Long Term Ecological Research sites, although these are primarily supported by the BIO directorate. (For more information on Science Resources Studies within SBE, please see Chapter 22; for more information on the social sciences, please see Chapter 21.)

U.S. Polar Programs: \$276.6 million, up 1.2 percent. The FY 2002 request for U.S. Polar Programs includes \$214.0 million for U.S. Polar Research Programs and \$62.6 million for U.S. Antarctic Logistical

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Support. The extreme environments and geographically unique characteristics enable research to be performed in both the Arctic and Antarctic that is not feasible elsewhere.

Arctic programs conducted by NSF include Arctic and sub-Arctic Long Term Ecological Research (LTER) sites in Alaska; field stations and large instrument facilities in Alaska, Greenland and Arctic Canada; and research ships, submarines, planes, helicopters and other field support.

Each year, about 650 science personnel from institutions in 30 states travel to Antarctica for research purposes. NSF facilities there include the Center for Astrophysical Research at the South Pole and two Antarctic LTER sites, one near Palmer Station that focuses on marine research, and another in the Dry Valleys near McMurdo Station that studies polar desert oases and permanently ice-covered lakes.

Integrative Activities: \$80.6 million, down 17.5 percent. Integrative Activities (IA) was created in FY 1999 within the Research and Related Activities appropriation to support cross-disciplinary research efforts and major research instrumentation. The Integrative Activities program also supports the Science and Technology Policy Institute, which provides analytical support to the Office of Science and Technology Policy (OSTP) to identify short- and long-term objectives for research and development and identify options for achieving those objectives.

In FY 2002, the Major Research Instrumentation program is projected to receive \$50 million, a cut of 33.2 percent below FY 2001. The Partnerships for Opportunity program, which supports innovative, cross-disciplinary research and education, would not receive funding in FY 2002. For the Science and Technology Centers program, \$26.6 million is requested to fund a new cohort of centers across the range of disciplines supported by NSF.

EDUCATION AND HUMAN RESOURCES (EHR)

Education and Human Resources would receive \$1.0 billion, an increase of 12.1 percent. Of these funds, \$872.4 million would be appropriated, and \$144 million would come from H-1B Nonimmigrant Petitioner Fees.

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The new Math and Science Partnerships Initiative proposed by President Bush is projected to receive \$200 million. This initiative is intended to use research-based approaches, improve teacher quality and increase accountability by providing funds for state and local school districts to join with colleges and universities.

The Educational System Reform subactivity is projected to receive \$45.3 million, a decrease of 59 percent. This program seeks to reform science, mathematics and technology education in school systems across America. The new Math and Science Partnerships Initiative will absorb some of the activities previously contained in this program. The Experimental Program to Stimulate Competitive Research (EPSCoR) would receive \$74.8 million, approximately the same amount as in FY 2001. Elementary, Secondary and Informal Education activities would receive \$165.6 million (down 18.3 percent), undergraduate education would receive \$132.6 million (down 5.9 percent), and graduate education would receive \$95.5 million (up 8.8 percent). (For more information on EHR and other agencies' education programs, please see Chapter 5.)

MAJOR RESEARCH EQUIPMENT

The agency's request includes \$96.3 million for Major Research Equipment, a cut of 20.6 percent below the FY 2001 plan. Funds will be used for projects including the Large Hadron Collider (a superconducting particle accelerator to be constructed at CERN Laboratory in Switzerland; see Chapter 13), the Network for Earthquake Engineering Simulation, Terascale Computing Systems, Atacama Large Millimeter Array (a radio telescope consisting of 64 large antennas; see Chapter 14), the High-performance Instrumented Airborne Platform for Environmental Research (HIAPER), a new atmospheric research aircraft, and ongoing modernization of South Pole Station.