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National Science Foundation in the FY 2008 Budget

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HIGHLIGHTS

- The National Science Foundation (NSF) is one of three agencies targeted for major funding increases as part of the President's American Competitiveness Initiative (ACI). Even greater funding increases for the NSF have been called for by the Democratic Innovation Agenda and the National Academies 2005 report, *Rising Above the Gathering Storm*. The FY 2008 request for NSF is $6.4 billion, an increase of $513 million or 8.7 percent (see Table II-7).

- Overall NSF R&D funding—excluding education, training, and overhead costs—would rise to $4.9 billion, an increase of 8.3 percent. This increase comes after several years of flat funding and elevates total NSF R&D funding to an all-time high in real terms.

- Research and Related Activities (R&RA) would increase to $5.1 billion, a $368 million or 7.7 percent increase. Most research directorates receive increases of between 4 and 9 percent in FY 2008.

- NSF estimates that it will provide a total of 10,423 competitive awards and 7,436 research grants in FY 2008. This would represent an increase of 790 competitive awards. Despite this increase, competition for grants will remain difficult, with NSF expected to be able to fund just 21 percent of all research grant proposals it receives.

- The President is proposing to fund NSF's Education and Human Resources (EHR) programs at $751 million, a $52 million or 7.5 percent increase over FY 2007. While the EHR budget increases, it is still 19 percent below 2004 levels in real terms after steep cuts in 2005 and 2006.

- The Major Research Equipment and Facilities Construction (MREFC) account would be funded at $245 million, an increase of $54 million or

28.2 percent. Although final plans have yet to be announced, NSF plans to initiate the following projects in 2007: the Ocean Observatories Initiative, the National Ecological Observatory Network, and the Alaska Region Research Vessel.

AGENCY OVERVIEW

NSF's Mission: Since its founding in 1950, the Foundation has had an extraordinary role in American scientific discovery. In contrast to other federal agencies that support research focused on specific missions and despite its small size, it is the only federal agency with responsibility for the health of science and engineering across all disciplines. NSF is also charged with ensuring the nation's supply of scientists, engineers, and science and engineering educators.

NSF accomplishes its mission with remarkable efficiency. Approximately 94 percent of the agency's budget goes to support the actual conduct of research and education, and only about six percent to internal operations, administration and management.

NSF Support: NSF plays a crucial role in the support of university-based research, sending more than 79 percent of its total R&D support to colleges and universities. Although NSF investments account for only four percent of the total federal budget for research and development, it provides 22 percent of federal support to academic institutions and is the second largest sponsor of research at colleges and universities, after the National Institutes of Health (NIH). In several areas, including engineering, physical sciences, social sciences and environmental sciences, it is the leading federal source of support of academic research. And while NSF does not directly support medical research, its investments are critical to medical science and related industries because they lead to advances in diagnostics, regenerative medicine, drug delivery, and the design and manufacturing of pharmaceuticals.

Ninety percent of NSF funding is allocated through merit-based competitive awards. On average, NSF receives 40,000 research proposals and makes over 10,400 awards to 1,700 colleges, universities, and other nonprofit institutions throughout the country annually. It is estimated that in FY 2008 over 240,000 people will be directly involved in NSF research and education programs. These include approximately 51,655 senior researchers and other professionals, 64,130 postdoctoral, graduate and undergraduate students, and 126,000 K-12 teachers and students.

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 science, math and engineering education at the K-12 level as well as at colleges and universities.

Agency Structure: NSF is an independent federal agency managed 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 approximately 1,300 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 NSF's Education and Human Resources (EHR) activity. The NSF also supports research activities through its Office of Polar Programs (OPP). Last year, NSF created a new office, the Office of Cyberinfrastructure, specifically to support cyberinfrastructure research activities previously supported by CISE. NSF's large scientific facilities and major research projects are funded in a separate account known as the Major Research Equipment and Facilities Construction (MREFC) account.

Recent NSF Funding History: For the most part, NSF has seen steady growth over the past several decades. After declines in the NSF budget in the mid-1990's which resulted from growing pressure to balance the federal budget, growth began again for NSF in 1998. While the NSF has always enjoyed strong congressional support, this support surged during the late 1990's as key leaders in both the House and Senate began to speak in favor of doubling the NSF's budget over five years. The growing level of support for NSF was demonstrated in 2002 when Congress passed the NSF Authorization Act of 2002, a bill aimed at putting the NSF on a track to double its budget over five years. This Act (P.L. 107-368), signed into law in December 2002, increased authorized funding for NSF from its FY 2002 level of $4.8 billion to $9.8 billion in FY 2007. When the bill was introduced, House Science Committee Chairman Sherwood Boehlert (R-NY) stated that "In moving toward

doubling, we are returning to the vision that Vannevar Bush laid out in the 1940s, when he proposed a science agency that would be the preeminent funder of science for the federal government, with responsibilities across many areas of inquiry and application. Fifty-two years later, NSF is honorably attempting to fulfill that vision. We need to ensure that it succeeds."

Despite high hopes that passage of the NSF Authorization bill would result in significant funding increases for NSF, a dramatically changed federal fiscal environment—characterized by increasing budget deficits and costs associated with the war on terrorism—resulted in NSF funding falling well below authorized levels. In FY 2004, the first year after the authorization bill's passage, the NSF received $5.6 billion, a 5 percent increase, and in FY 2005 the NSF actually received a cut. This cut marked the first time in ten years that NSF did not see an increase overall and was the first time since FY 1986 that R&RA was cut in real terms.

In May 2005 things began to look up for the NSF when House Science, State, Justice, and Commerce Appropriations Subcommittee Chairman Frank Wolf (R-VA) wrote a letter to President Bush urging a "tripling in the innovation budget—federal basic research and development—over the next decade." He also included language in a supplemental appropriations bill requiring the U.S. Department of Commerce to convene a major conference on U.S. competitiveness. This conference, in November 2005, brought U.S. industry, university and government officials together to speak about their concerns with regards to national competitiveness, innovation, federal research funding and science, technology, engineering and math (STEM) education and workforce.

In the final conference agreement on the appropriations bill, Chairman Wolf fought to increase funding for the NSF, but despite his efforts NSF increased by only 2 percent in 2006, bringing its final budget back up only to where it had been two years earlier in FY 2004.

Congressional concerns such as those of Chairman Wolf were fueled by a number of reports issued by business, higher education and scientific organizations in 2005 which sounded the alarm that the U.S. might be losing its global scientific and technological edge. The most notable of these was the National Academies' *Rising above the Gathering Storm* report. These reports led to the introduction of major bipartisan innovation and competitiveness legislation in the U.S. Senate including the National Innovation Act (S. 2109) and the Protecting America's

Competitive Edge (PACE) legislative acts (S. 2197, S. 2198 and S. 2199). At the same time, House Democrats announced a major innovation agenda of their own. Like the already approved NSF authorization, all of these proposals called for significant funding increases for the NSF and other federal agencies with a significant role in the support of basic physical sciences and engineering research.

These growing concerns culminated with President Bush announcing the American Competitiveness Initiative (ACI) in his State of the Union address in January 2006 which called for doubling the NSF budget over 10 years. The Administration's initiative included a commitment to double the federal investment in basic research programs in the physical sciences over the next 10 years. For FY 2007, the ACI proposed $6.0 billion for NSF, an increase of $439 million, or 7.8 percent. The President's ACI announcement came on the heels of the House Democrats' release in November 2005 of their own "Innovation Agenda" which called for doubling NSF funding over a five-year period.

Due to partisan wrangling, the 109th Congress found itself unable to pass most of the FY 2007 appropriations bills. Finally, after months of debate, the 110th Congress passed H.J. Res. 20, the joint funding resolution for 2007. This measure fully funded the requested increase for Research and Related Activities ($4.8 billion) for FY 2007. Unfortunately, both the Education and Human Resources and Major Research Equipment and Facilities Construction accounts were not increased in the joint funding resolution and are funded at FY 2006 levels in 2007.

In terms of authorization legislation, U.S. Senate Majority Leader Harry Reid (D-NV) and Minority Leader Mitch McConnell (R-KY) recently introduced the America COMPETES Act (S. 761). Like last year's competitiveness legislation, this bill calls for a doubling in funding for NSF over the course of five years. Meanwhile, in the House, the Committee on Science and Technology is expected to advance NSF reauthorization legislation that would authorize similar funding levels for the agency for the next three years.

RESEARCH AND RELATED ACTIVITIES (R&RA)

Research and Related Activities (R&RA) would receive $5.1 billion in the President's FY 2008 budget, an increase of $368 million or 7.7 percent above the FY 2007 level (see Table II-7 for R&RA details).

Requests for specific R&RA directorates and offices are as follows:

Biological Sciences (BIO): $633 million (up $25 million or 4.1 percent). BIO is the dominant federal supporter of basic research in the non-biomedical biological sciences at academic institutions, providing 66 percent of all support. BIO's contribution to a broad array of biological sciences is critically important, particularly in such areas as environmental biology and plant sciences. BIO-supported research is important to furthering the understanding of how living organisms function and interact with nonliving systems which, in turn, has significant relevance to issues of national importance relating to the environment, economy, agriculture, and human welfare. In FY 2008, BIO expects to make 1,408 competitive awards and 941 research grants. The average award size would be $207,000 per year for an average duration of 3.0 years. (For more on BIO, see Chapter 17.)

Computer and Information Science and Engineering (CISE): $574 million (up $47 million, or 9.0 percent). CISE is the principal source of federal funding for university-based basic research in computer science, providing the vast majority (87 percent) of total federal support in this area. CISE provides academic researchers with advanced computing and networking capabilities and fundamental knowledge in computing science and engineering which, in turn, are essential to innovation and effectiveness in many areas, including advanced scientific research, medical care, national and homeland defense, organizational competitiveness, and governmental efficiency. In FY 2008, CISE expects to make 1,270 competitive awards and 1,000 research grants. The average award size is estimated to be $158,000 per year and an average duration of 3.0 years. (For more information on CISE, please see Chapter 22.)

Engineering (ENG): $683 million (up $55 million, or 8.7 percent). ENG is a major source of federal funding for university-based, fundamental engineering research, providing 42 percent of total federal support in this area. ENG investments in engineering research and education build and strengthen our nation's capacity to lead the world in innovation. These investments include such emerging technologies as sensors and sensor systems, nanotechnology, cyber-enabled engineering, metabolic engineering, bioengineering and manufacturing. In FY 2008, ENG expects to make 1,855 competitive awards and 1,265 research grants. The average award size is estimated to be $118,000 per year for an average of 3.0 years. (For more, see Chapters 24 and 25.)

Geosciences (GEO): $792 million (up $47 million, or 6.3 percent). GEO is the principal source of federal funding for university-based basic research in the geosciences, providing about 68 percent of total federal support in these areas. GEO plays a critical role in addressing the nation's need to understand, predict, and respond to environmental events and changes. Research supported by GEO also helps to determine the best use of Earth's resources. In FY 2008, GEO expects to make 1,600 competitive awards and 1,200 research grants. The average award would be $155,000 per year for 3.0 years. (For more on Atmospheric Sciences, see Chapter 15; for Earth Sciences, see Chapter 16.)

Mathematical and Physical Sciences (MPS): $1.3 billion (up $103 million, or 8.9 percent). MPS provides about 46 percent of federal funding for basic research at academic institutions in the mathematical and physical sciences and serves as the federal steward for ground-based astronomy. MPS provides about 43 percent of the federal support for academic astronomy; in chemistry, about 40 percent; in physics, approximately 36 percent; in materials research approximately 55 percent; and in mathematics more than 66 percent. In FY 2008, MPS expects to make 2,300 competitive awards and 1,800 research grants. The average award size is estimated to be $145,000 per year and an average duration of 3.1 years. (For more information on NSF mathematics research, see Chapter 21; for more on physics research, see Chapter 13; and for more on astronomy research, see Chapter 14.)

Social, Behavioral and Economic Sciences (SBE): $222 million (up $8 million, or 3.9 percent). SBE is a principal source of federal support for fundamental research on human cognition, behavior, social structures, and social interaction, as well as for research on the intellectual and social contexts that govern the development and use of science and technology. Overall, SBE accounts for about 61 percent of federal support for basic research in the social sciences at U.S. academic institutions. In some fields, including anthropology, archaeology, political science, linguistics, non-medical sociology, and the social aspects of psychology, SBE is the predominant or exclusive source of federal basic research support. In FY 2008, SBE expects to make 1,265 competitive awards and 790 research grants. The average award size is estimated to be $103,000 per year and an average duration of 2.4 years. (For more on SBE, please see Chapter 19.)

Office of Polar Programs (OPP): $465 million (up $27 million, or 6.1 percent). The FY 2008 request for Polar Programs includes $96.2 million

for Arctic Sciences, $64.4 million for Antarctic Sciences, and $240.9 million for Antarctic Infrastructure and Logistics. OPP supports research in the extreme environments and unique geography found at the earth's poles. Much of the research performed by the NSF in the Arctic and Antarctic is not feasible elsewhere. Each year, about 600 science personnel from institutions in 30 states travel to Antarctica for research purposes. In FY 2008, OPP expects to make 325 competitive awards and 300 research grants. The research awards would have an average award size of $162,700 per year and an average duration of 3.0 years.

Office of Cyberinfrastucture (OCI): $200 million (up $18 million, or 9.6 percent). Last year, cyberinfrastucture activities previously conducted within CISE were transferred to the newly created Office of Cyberinfrastructure (OCI). In FY 2008, the Administration requests $200 million, an increase of $18 million, for OCI. In FY 2008, OCI expects to make 50 competitive awards and 50 research grants. The research awards would have an average award size of $210,000 per year and an average duration of 2.8 years.

Office of International Science and Engineering (OISE): $45 million (up $4 million, or 10.8 percent). OISE serves as the focal point, both inside and outside NSF, for international science and engineering activities. OISE supports U.S. scientists and engineers engaged in international research and education activities in all NSF-supported disciplines involving any region of the world. Bold exploration at the frontiers of science and engineering increasingly requires international partnerships. OISE is the lead office in helping to develop such partnerships on behalf of the NSF. In FY 2008 OISE expects to make 350 competitive awards and 90 research grants. The research awards would have an average award size of $50,000 per year and an average duration of 2.6 years.

Integrative Activities (IA): $263 million (up $33 million or 14.6 percent). Integrative Activities (IA) was created in FY 1999 within R&RA to support cross-disciplinary research efforts and major research instrumentation. This year's budget proposes to transfer the Experimental Program to Stimulate Competitive Research (EPSCoR) from EHR to IA. The FY 2008 budget request for EPSCoR is $107 million, an increase of $7 million or 7 percent over FY 2007.

EDUCATION AND HUMAN RESOURCES (EHR)

NSF, in accordance with the NSF Act of 1950, is the principal federal agency charged with promoting science and engineering (S&E) education. In support of this mission, EHR promotes the development of a diverse and well-prepared workforce of scientists, technicians, engineers, mathematicians and educators and a well-informed citizenry who have access to the ideas and tools of science and engineering. The budget would fund EHR programs at $751 million in FY 2008, an increase of $52 million or 7.5 percent over FY 2007. Given that the joint funding resolution for 2007 did not increase funding for the EHR Directorate, EHR and its programs will be funded at FY 2006 enacted levels in fiscal year 2007.

A major reorganization occurred within EHR in FY 2006 with the consolidation of two EHR divisions, Elementary, Secondary, and Informal Education (ESIE) and Research, Evaluation and Communication (REC), into the Division of Research on Learning in Formal and Informal Settings (DRL). This realignment consolidated the science, technology, engineering, and mathematics (STEM) education research, development, and evaluation programs previously housed within the two divisions into a single entity. The consolidation was aimed at enhancing the management of these activities while building on existing strengths. The focus of DRL is on basic and applied research on learning at all levels and in both formal and informal settings. DRL has assumed a strong but not exclusive emphasis on K-12.

Funding for DRL is $222.5 million in the FY 2008 budget, an increase of $7 million or 3.2 percent above 2007. The Division of Undergraduate Education (DUE) would receive $210 million, a decrease of $2 million, or 0.8 percent. This is the third year in which the budget has proposed reductions for DUE. The Division of Graduate Education (DGE) would receive $170 million, an increase of $16 million or 10.7 percent.

Graduate fellowships and stipends: Within EHR, the budget would fund an estimated 5,375 graduate fellowships and traineeships NSF-wide, 2,950 Graduate Research Fellowships, 915 Graduate Teaching Fellows in K-12 education, and 1,510 Integrative Graduate Education and Research Traineeships.

Math and Science Partnerships (MSP): The FY 2008 request for MSP is $46 million. Approximately $30 million will be available for new

awards in FY 2008. The FY 2005 budget proposed transferring the MSP program to the Department of Education, which has long maintained a MSP program of its own. Funds for the MSP program at the Department of Education have traditionally been provided to states through block grants while the NSF program has made awards based upon peer review. (For more on NSF's EHR programs, see Chapter 4.)

MAJOR RESEARCH EQUIPMENT AND FACILITIES CONSTRUCTION (MREFC)

Like EHR, the joint funding resolution for 2007 did not increase funding for the MREFC account. Therefore, the MREFC account will be funded at FY 2006 enacted levels during fiscal year 2007. The FY 2008 budget requests funding the MREFC account at $245 million, an increase of $54 million or 28 percent over FY 2006 and FY 2007. This funding would support six ongoing projects: Alaska Regional Research Vessel ($42 million) Atacama Large Millimeter Array construction ($64 million), the IceCube Neutrino Observatory ($22 million), the National Ecological Observatory Network ($8 million), the Oceans Observatories Initiative ($31 million), and the South Pole Station Modernization Project ($6.5 million).

NSF PRIORITIES

The FY 2008 NSF budget emphasizes five priorities aimed at strengthening the science and engineering enterprise. These are: (1) Discovery Research for Innovation; (2) Preparing the Workforce of the 21st Century; (3) Transformational Facilities and Infrastructure; (4) International Polar Year Leadership; and (5) Stewardship. The priorities outlined in this year's budget seem to be very much in line with the Administration's American Competitiveness Initiative as well as the Democratic Innovation Agenda aimed at increasing the nation's investment in the physical sciences and engineering.

As part of its overall mission, NSF continues its support for major National Science and Technology Council (NSTC) crosscutting initiatives in the FY 2008 budget. For example, the FY 2008 budget request for Climate Change Science Program is $208 million (up $3 million); the Networking and Information Technology R&D Initiative is $994 million (up $90 million); and the National Nanotechnology Initiative is $390 million (up $17 million; see Table I-9.)