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National Science Foundation in the FY 2005 Budget

Tobin L. Smith and Katherine Bailey Mathae,
Association of American Universities

HIGHLIGHTS

- The FY 2005 request for the National Science Foundation (NSF) is $5.7 billion (see Table II-7). This represents an increase of $167 million, or 3.0 percent, over FY 2004. This falls well short of the $7.4 billion authorized in the NSF Authorization Act enacted in December 2002.

- Of the proposed $167 million funding increase for the NSF, approximately $75 million is directed to the Salaries and Expenses account for internal operations and staffing, making the real increase for NSF programs $92 million, an increase of only 1.6 percent.

- Research and Related Activities (R&RA) would increase to $4.5 billion, a $201 million or 4.7 percent increase over the FY 2004 level of $4.3 billion. $80 million of this funding comes from a transfer of funds into R&RA to support previous obligations made under the Math Science Partnerships (MSP) program. In previous years the MSP has been funded in the Education and Human Resources (EHR) account. If one discounts this transfer of MSP funds, the R&RA increase is only 2.8 percent.

- In addition to NSF's "core" research and education activities, five priority areas are highlighted: Nanoscale Science and Engineering; Mathematical Sciences; Human and Social Dynamics; Biocomplexity in the Environment; and Workforce for the 21st Century. Beginning in FY 2005, the previous Information Technology Research (ITR) priority area will be merged into new and ongoing research programs across the NSF.

- The President is proposing to fund NSF's Education and Human Resources (EHR) programs at $771 million, a $168 million or 17.9 percent decrease. This significant reduction in the EHR account is due to the proposed transfer of the Math Science Partnership (MSP) program

from the NSF to the Department of Education, for which Congress provided the NSF with $139 million in FY 2004.

- Within the EHR account, the budget would expand the number of graduate fellowships from a projected 5,000 fellowships in FY 2004 to 5,500 in FY 2005. Stipends for FY 2005 NSF fellows will remain at the $30,000 level established in FY 2004. The Experimental Program to Stimulate Competitive Research (EPSCoR) would be funded at $84 million, a decrease of $10 million from FY 2004.

- The Major Research Equipment and Facilities Construction (MREFC) account would receive $213 million, an increase of $58 million or 37.6 percent. This supports continued funding for the Atacama Large Millimeter Array (ALMA), the IceCube Neutrino Observatory, and EarthScope. There would be funds for three new MRE projects: the National Ecological Observatory Network (NEON), the Scientific Ocean Drilling Vessel, and the Rare Symmetry Violating Processes (RSVP).

AGENCY OVERVIEW

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

NSF accomplishes its mission with remarkable efficiency. Approximately 95 percent of the agency's budget goes to support the actual conduct of research and education, while only about five percent is spent on administration and management. For a third straight year, NSF received very high marks from the Office of Management and Budget for the quality of its overall management. Again this year it was awarded two "green lights" on the Executive Branch management scorecard, the highest rating given to any federal agency.

NSF Support: NSF plays a crucial role in the support of university-based research. Although NSF represents less than four percent of the total federal budget for research and development, it 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, and environmental sciences, it is the leading federal source of support of academic research.

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. More than 205,000 people are involved directly in NSF research and education programs and activities. These include 44,000 senior researchers and other professionals, 68,000 postdoctoral, graduate and undergraduate students, 11,000 K-12 students and 83,000 K-12 teachers.

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 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 1,300 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 has an account for Major Research Equipment and Facilities Construction (MREFC).

Congressional Support: While the NSF has traditionally enjoyed broad congressional support, this support has been growing in recent years. In the Senate, the Chairman and ranking Democrat on the Senate VA, HUD and Independent Agencies Appropriations Subcommittee, Christopher "Kit" Bond (R-MO) and Barbara Mikulski (D-MD), have spoken in

favor of doubling the NSF's budget over five years. Likewise, House VA, HUD and Independent Agencies Appropriations Subcommittee Chairman James T. Walsh (R-NY) has said that NSF is his top priority within the VA-HUD bill.

While the Foundation's appropriation dipped slightly between FY 1995 and FY 1996, the total appropriation for the NSF has increased each year since then, even when other agencies funded under the VA-HUD bill were cut. Indeed, since FY 1999, the Congress has continually provided the NSF with increases to its budget that have been greater than the increases received by any other scientific research agency except NIH. In FY 2001, Congress provided the largest single increase in both percentage and dollar terms in the history of the NSF, an increase of 13.3 percent over FY 2000. Likewise, in FY 2002 and FY 2003 Congress again substantially exceeded the President's requests for the NSF providing increases of 8.5 percent and 10.9 percent respectively.

The growing level of Congressional support for increasing the NSF budget was demonstrated in 2002 when Congress passed H.R. 4664, 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 by President Bush on December 19, 2002, authorized a maximum funding level for the NSF in FY 2004 of $6.4 billion and proposed up to $7.4 billion in funding in FY 2005. 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 the passage of the NSF Authorization bill would result in yet another significant funding increase for NSF in FY 2004, increasing budget deficits and wartime expenses resulted in a final funding level for NSF of only $5.6 billion, or a 5 percent increase. While a significant increase, this level fell well short of the $6.4 billion authorized and hoped for by many in the scientific community.

Given the record of growing NSF support in recent years and with significant funding increases called for as a part of the NSF

Authorization Act of 2002, it is likely that Congress will again exceed President Bush's request in FY 2005. However, it is unlikely that they will be able to provide anywhere near the $7.4 billion authorized for the NSF in FY 2005. In fact, they will likely still fall short of the $6.4 million level called for in the authorization bill for FY 2004.

Even the House Science Committee has recognized that the authorized levels for NSF are not likely to be reached given the current fiscal restraints. In its Views and Estimates Document to the House Budget Committee concerning the FY 2005 budget for the NSF, the committee states, "While recognizing that budget realities may not allow Congress to fund NSF at the guidance level provided in the current authorization, the Committee still believes that significant increases for NSF's overall budget are warranted. Congress should provide as much funding as possible to strengthen support for core science and education programs, and priority areas such as information technology and nanoscale science and engineering research."

Of course, one of the difficulties always faced by Congressional appropriators in trying to increase funding for the NSF is that it receives its funding from the same appropriations bill that funds other major research and non-research agencies, *e.g.* NASA, the Environmental Protection Agency (EPA), the Department of Veterans Affairs (VA), and the Department of Housing and Urban Development (HUD). The significant funding pressures resulting from the VA and HUD alone invariably make it difficult to significantly increase funding for other agencies contained in this bill, including the NSF.

The pressures within the VA-HUD bill are likely to be even greater in a year in which the President has proposed a significant funding increase for NASA (See Chapter 10). Moreover, the growing pressure from within Congress to freeze domestic discretionary spending, to increase funding for homeland security, and to support our troops in Iraq and Afghanistan will make it particularly difficult this year to provide any significant funding increase above what the President has requested.

RESEARCH AND RELATED ACTIVITIES (R&RA)

Research and Related Activities (R&RA) would receive $4.5 billion in the President's FY 2004 budget, an increase of $201 million, or 4.7 percent above the FY 2004 level (see Table II-7 for R&RA details). $80

million of this funding increase, however, is money to support continuing obligations made under the Math Science Partnerships (MSP) program, funds previously contained in the Education and Human Resources (EHR) account. This transfer of MSP funds into Integrative Activities within R&RA has the impact of making the overall R&RA appear higher than it actually is. If one excludes this $80 million, the overall increase for R&RA over this year's level is 2.8 percent.

Requests for specific R&RA directorates are as follows:

Biological Sciences (BIO): $600 million (up 2.2 percent). Among the activities supported within BIO are Molecular and Cellular Biosciences; Integrative Biology and Neuroscience; Environmental Biology; Biological Infrastructure; Emerging Frontiers; and Plant Genome Research. In FY 2005, BIO expects to make 1,404 competitive awards and 845 research awards. The research awards would have an average annualized award size of $190,750 per year and an average duration of 3.3 years. (For more on BIO programs, see Chapter 19.)

Computer and Information Science and Engineering (CISE): $618 million (up 2.2 percent). This directorate provides the advanced computing and networking capabilities needed by academic researchers for cutting edge-research in all science and engineering fields. In FY 2005, CISE expects to make 900 competitive awards and 1,040 research awards. The research awards would have an average annualized award size of $165,000 per year and an average duration of 3.1 years. (For more information on CISE, please see Chapter 24.)

Engineering (ENG): $576 million (up 1.9 percent). Activities supported within ENG include Bioengineering and Environmental Systems; Chemical and Transport Systems; Civil and Mechanical Systems; Design, Manufacture and Industrial Innovation; Electrical and Communications Systems; and Engineering Education and Centers. In FY 2005, ENG expects to make 1,915 competitive awards and 920 research awards. The research awards would have an average annualized award size of $119,500 per year and an average duration of 2.9 years. (For more information, see Chapters 26 and 27.)

Geosciences (GEO): $729 million (up 2.2 percent). Activities supported within GEO include Atmospheric Sciences; Earth Sciences; and Ocean Sciences. In FY 2005, GEO expects to make 1,500 competitive awards and 800 research awards. The research awards would have an average

annualized award size of $147,900 per year and an average duration of 3.0 years. (For detailed information on Atmospheric Sciences, see Chapter 16; for Ocean Sciences, see Chapter 17; and for Earth Sciences, see Chapter 18.)

Mathematical and Physical Sciences (MPS): $1.1 billion (up 2.2 percent). Activities supported within MPS include Astronomical Sciences; Chemistry; Materials Research; Mathematical Sciences; Physics; and Multidisciplinary Activities. In FY 2005, MPS expects to make 2,110 competitive awards and 1,610 research awards. The research awards would have an average annualized award size of $140,000 per year and an average duration of 3.1 years. (For more information on NSF mathematics research, see Chapter 23; for more on physics research, see Chapter 14; and for more on astronomy research, see Chapter 15.)

Social, Behavioral and Economic Sciences (SBE): $225 million (up 10.3 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 provides more than one-third of federal support for basic research in economics. In FY 2005, SBE expects to make 951 competitive awards and 549 research awards. The research awards would have an average annualized award size of $95,829 per year and an average duration of 2.4 years. (For more on SBE, please see Chapter 21; for more on Science Resources Statistics within SBE, see Chapter 22.)

U.S. Polar Programs: $350 million (up 2.2 percent). The FY 2005 request for U.S. Polar Programs includes $282 million for U.S. Polar Research Programs and $68 million for U.S. Antarctic Logistical Support. The extreme environments and geographically unique characteristics enable research to be performed in both the Arctic and Antarctic that is not feasible elsewhere.

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 Long Term Ecological Research (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: $240 million, up 66.5 percent. Integrative Activities (IA) was created in FY 1999 within R&RA to support cross-disciplinary research efforts and major research instrumentation. IA also supports the Science and Technology Policy Institute, which provides analytical support to the Office of Science and Technology Policy (OSTP) to identify short-term and long-term objectives for research and development and identify options for achieving those objectives.

NSF PRIORITY AREAS

In addition to NSF's "core" research and education activities, the NSF intends to continue it support for five major research initiatives, or "priority areas." Beginning in FY 2005, activities previously funded as part of the Information Technology Research (ITR) priority area will be merged into new and ongoing research programs across NSF. The specific priority areas highlighted in the NSF's funding request include:

Nanoscale Science and Engineering: NSF plans to spend approximately $305 million, an increase of $52 million over FY 2004 funding. This funding is to be used to develop and strengthen critical fields including nanobiotechnology, manufacturing, instrumentation and catalysis at the nanoscale. The request includes funding for at least two new nanotechnology research and education centers to focus on electronics, biology, optoelectronics, modeling and simulation, and advanced materials and engineering (see Chapter 25.)

Mathematical Sciences: In FY 2005, NSF plans to spend $89 million on this priority area, approximately the same funding level as in FY 2004. Funding for this priority areas will be used to explore fundamental mathematical and statistical sciences and to support interdisciplinary research connecting the mathematical sciences with science and engineering and mathematical sciences education (see Chapter 23.)

Human and Social Dynamics (HSD): NSF's FY 2005 request for this priority area would be $23 million, a reduction of approximately $1 million from the FY 2004 funding level. HSD research will develop and apply multidisciplinary approaches to answer questions about how people and institutions respond to, and are influenced by, new knowledge and technologies. The goal is to improve our understanding of the dynamics underlying these complex interdependencies. Special attention within this priority area will be given to: the agents of change;

dynamics of human behavior; decision-making under uncertainty; spatial social science; modeling human and social dynamics; and instrumentation and data resource development.

Biocomplexity in the Environment (BE): The FY 2005 budget requests $100 million for this initiative, approximately the same funding level as was provided in FY 2004. This priority research area seeks to bring together environmental knowledge across scientific fields to investigate the interactions among ecological, social, and physical earth systems. A new emphasis in BE for FY 2005 will be research on the complex interactions between freshwater and the rest of the environment.

Workforce for the 21st Century: NSF proposes to spend approximately $20 million on this priority area in FY 2005, which is aimed at coordinating NSF's effort to ensure a scientifically literate and technically skilled future workforce. In FY 2005, new investments will be made in Integrative Institutional Collaborations and Workforce Research grants.

EDUCATION AND HUMAN RESOURCES (EHR)

The budget would fund NSF's EHR programs at $771 million, a reduction of $168 million, or 17.9 percent, from the FY 2004 funding level. Graduate education programs would receive $174 million, an increase of $18 million, or 11.5 percent, over FY 2004. Undergraduate education programs would receive $159 million, an increase of $3 million, or 2.2 percent over FY 2004. Elementary, secondary, and informal education programs are slated to receive $173 million, a reduction of $40 million, or 18.6 percent. The Experimental Program to Stimulate Competitive Research (EPSCoR) would receive $84 million, a reduction of $10 million, or 11.1 percent, from FY 2004.

Math and Science Partnerships (MSP): The budget proposes no new funds within the EHR directorate for the Math and Science Partnerships (MSP) program at NSF. This NSF program was created to link local elementary and secondary schools with colleges and universities in an attempt to raise the performance of all U.S. students in mathematics and science, train teachers, and create innovative ways to reach underserved students and schools.

In FY 2004, the President proposed $200 million for NSF's MSP program and the Congress provided $139 million. The FY 2005 budget proposes transferring the MSP program to the Department of Education, which has long maintained a Math and Science Partnerships 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 to proposals based upon peer review. NSF's FY 2005 proposed budget supports the continuation of MSP projects previously awarded, but no new awards. The budget includes $80 within R&RA Integrative Activities for this purpose.

Graduate fellowships and stipends: Within the EHR account, the budget request would expand the number of graduate fellowships from a projected 5,000 fellowships in FY 2004 to 5,500 in FY 2005. The number of awards will increase in the following programs: Graduate Research Fellowships (GRF), Graduate Teaching Fellows in K-12 education (GK-12), and Integrative Graduate Education and Research Traineeships (IGERT). Stipends for FY 2005 NSF fellows will remain at the $30,000 level established in FY 2004. (For more on NSF's EHR programs, please see Chapter 5.)

MAJOR RESEARCH EQUIPMENT AND FACILITIES CONSTRUCTION

The Major Research Equipment (MREFC) account is proposed to receive a total of $213 million, an increase of $58 million, or 37.6 percent over FY 2004 funding. This supports three continuing MRE projects at the following levels: $50 million for construction of the Atacama Large Millimeter Array (ALMA); $34 million for the IceCube Neutrino Observatory; and $47 million for EarthScope. Under the budget, three new projects will be initiated and funded as follows: $12 million for the National Ecological Observatory Network (NEON); $41 million for the Scientific Ocean Drilling Vessel; and $30 million for Rare Symmetry Violating Processes (RSVP).

SALARIES AND EXPENSES

NSF is requesting $294 million for Salaries and Expenses. This would be a $75.3 million, or 34.4 percent, increase. The request includes an increase of over $20 million to strengthen the NSF's workforce and additional investments of over $50 million to enhance the Foundation's information technology infrastructure and security.