U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON RESEARCH AND SCIENCE EDUCATION

HEARING CHARTER

An Overview of the National Science Foundation Budget for Fiscal Year 2013

Tuesday, February 28, 2012
10:00 a.m. - 12:00 p.m.
2318 Rayburn House Office Building

1. Purpose

On Tuesday, February 28, 2012, the Committee on Science, Space, and Technology Subcommittee on Research and Science Education will hold a hearing to examine the Administration's proposed fiscal year 2013 (FY13) budget request for the National Science Foundation.

2. Witnesses

The Honorable Subra Suresh, Director, National Science Foundation

The Honorable Ray Bowen, Chairman, National Science Board

3. Hearing Overview

The National Science Foundation (NSF) is an independent federal agency created by Congress in 1950 "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense…" With a current annual budget of $7 billion, it is the funding source for over 20 percent of all federally supported basic research conducted by America's colleges and universities. NSF has been consistently recognized for its ties to the economic competitiveness and national security of the United States.

NSF Overview

NSF is the primary source of federal funding for non-medical basic research, providing approximately 40 percent of all federal support, and serves as a catalyst for science, technology, engineering, and mathematics (STEM) education improvement at all levels of education. NSF is the major source of federal funding for many fields like mathematics, computer science, and the social sciences. It supports the fundamental investigations that ultimately serve as the foundation for progress in nationally significant areas such as national security, technology-driven economic growth, energy independence, health care, nanotechnology, and networking and information technology.

Through over 11,000 new awards per year, NSF supports an average of 285,000 scientists, engineers, educators and students at universities, laboratories and field sites all over the U.S. and throughout the world. These grants fund specific research proposals that have been judged the

most promising by a rigorous and objective merit-review system. In the past few decades, NSF-funded researchers have won more than 180 Nobel Prizes.

National Science Foundation (NSF) Spending

(dollars in millions)

Account	FY11 Actual	FY12 Estimate	FY13 Request	FY13 Request versus FY12 Estimate	
				$	%
Research and Related Activities (RRA)	**5608.4**	**5689.0**	**5983.3**	**294.3**	**5.2**
Biological Sciences (BIO)	*712.3*	*712.4*	*733.9*	*21.5*	*3.0*
Computer and Info. Science and Engineering (CISE)	*636.1*	*653.6*	*709.7*	*56.1*	*8.6*
Engineering (ENG)	*763.3*	*826.2*	*876.3*	*50.2*	*6.1*
Geosciences (GEO)	*885.3*	*885.3*	*906.4*	*21.2*	*2.4*
Mathematical and Physical Sciences (MSP)	*1312.4*	*1308.9*	*1345.2*	*36.2*	*2.8*
Social, Behavioral, and Economic Sciences (SBE)	*247.3*	*254.3*	*259.6*	*5.3*	*2.1*
Cyberinfrastructure (OCI)	*300.8*	*211.6*	*218.3*	*6.6*	*3.1*
International Science and Engineering (OISE)	*49.0*	*49.9*	*51.3*	*1.4*	*2.9*
Polar Programs (OPP)	*440.7*	*435.9*	*449.7*	*13.9*	*3.2*
Integrative Activities (IA)	*259.6*	*349.6*	*431.5*	*81.9*	*23.4*
U.S. Arctic Research Commission	*1.6*	*1.5*	*1.4*	*(0.1)*	*-4.1*
Education and Human Resources (EHR)	**861.0**	**829.0**	**875.6**	**46.6**	**5.6**
Major Research Equipment & Facilities Const (MREFC)	**125.4**	**197.1**	**196.2**	**(0.9)**	**-0.4**
Agency Operations & Award Management	**299.3**	**299.4**	**299.4**	**0**	**0**
National Science Board (NSB)	**4.5**	**4.4**	**4.4**	**0**	**0**
Office of Inspector General (OIG)	**14.0**	**14.2**	**14.2**	**0**	**0**
Totals:	**6912.6**	**7033.1**	**7373.1**	**340**	**4.8**

NSF Budget Summary

The FY13 budget request for NSF is $7.4 billion, an increase of nearly 5 percent, or $340 million over the FY12 estimated level. The request continues to keep NSF on a doubling path for funding as set out in the America COMPETES Act and America COMPETES Reauthorization Act. The budget for NSF is divided into three main accounts: Research and Related Activities, Education and Human Resources, and Major Research Equipment and Facilities Construction. The NSF FY13 budget request also includes funding requests for Agency Operations and Award Management, the National Science Board, and the Office of Inspector General.

NSF Budget Priorities

Beginning in FY13, NSF plans to enable seamless operations across organizational and disciplinary boundaries through a new OneNSF Framework. The OneNSF Framework encompasses a set of investments to "create new knowledge, stimulate discovery, address complex societal problems, and promote national prosperity."[1] OneNSF Framework priorities

[1] *FY13 NSF Budget Request to Congress*, p. 3.

for FY13 include: $257 million for Cyber-Enabled Materials, Manufacturing, and Smart Systems (CEMMSS) to transform static systems and processes into adaptive "smart" systems; $106 million for Cyberinfrastructure Framework for 21st Century Science and Engineering (CIF21) to address the science-driven integration of cyberinfrastructure; $49 million for a new Expeditions in Education (E^2) to establish a partnership with the research directorates and the Education and Human Resources directorate (EHR) to integrate and expand STEM education research; $19 million for NSF Innovation Corps (I-Corps) to assess opportunities to transition emerging technologies into new products; $63 million for Integrated NSF Support Promoting Interdisciplinary Research and Education (INSPIRE) to integrate existing interdisciplinary investments with new Foundation-wide activities; and $110 million for Secure and Trustworthy Cyberspace (SaTC) to align Foundation investments with the national cybersecurity strategy. (See Appendix A for more details on each program.)

OneNSF Framework priorities also incorporate the existing Science, Engineering and Education for Sustainability (SEES) program, which crosses all NSF directorates and has a goal of advancing "climate and energy science, engineering, and education to inform the societal actions needed for environment and economic sustainability and sustainable human well-being." The FY13 budget request for SEES is $202.5 million, an increase of $45.5 million or 29 percent. When compared to the FY12 budget request of $998.19 million, the SEES portfolio request appears to have shrunk dramatically. The FY12 request estimated spending on SEES for FY11 to be $660.74 million; the FY13 request reflects FY11 actual spending to be $87.96 million or $572.78 million less than reported in the previous year. According to NSF, the SEES program was rebaselined in FY12 to reflect more stringent criteria for investments, including strong requirements for interdisciplinarity and systems based research, including social and economic aspects. All SEES programs established after FY10 are included in the rebaselined SEES, while legacy programs are excluded.

The overall budget request for OneNSF Framework activities is $807 million, an increase of $291 million or 56 percent over the FY12 level.

Research and Related Activities (RRA)

The FY13 budget request includes over $5.9 billion for Research and Related Activities (RRA), an increase of $294 million or 5.2 percent over FY12. RRA is made up primarily of six disciplinary directorates: non-biomedical life sciences (BIO); computer sciences (CISE); engineering (ENG); geosciences (GEO); math and physical sciences (MPS); and social, behavioral, and economic sciences (SBE). The FY13 budget request provides an increase for each of these disciplinary directorates ranging from 2 percent for SBE to nearly 9 percent for CISE. The request for the Office of Integrative Activities (IA) is $431 million, a 23 percent increase from FY12 primarily due to the fact that it will serve as the organizational lead for INSPIRE.

In addition to the significant increases in funding for the OneNSF Framework priorities, the FY13 NSF RRA budget request also illustrates the manner in which NSF plans to use funds to highlight several Administration priorities, including: "a focus on interdisciplinary science and engineering; innovative research on clean energy and sustainability; key investments in advanced manufacturing, break-through materials, wireless communications, and smart systems; and emphasis on bolstering our Nation's cybersecurity; strong support for new faculty and young

investigators; and vital evidence-based educational activities.[2]" NSF will continue investments in a number of multifaceted programs, including a $335 million investment in Clean Energy; a $149 investment in Advanced Manufacturing; a $216 million investment in the Faculty Early Career Development program (CAREER); a $243 million total investment in the Graduate Research Fellowship program (GRF) ($121 million from RRA); and a $158 million investment in the Experimental Program to Stimulate Competitive Research (EPSCoR).

Education and Human Resources (EHR)

The FY13 budget request for Education and Human Resources (EHR) is $845.6 million, a $46.6 million or 5.6 percent increase over the FY12 level and the largest percentage increase for the agency.

Significant increases in the FY13 budget request include $20 million, a $12 million or 150 percent increase over FY12, for the Widening Implementation and Demonstration of Evidence-based Reforms (WIDER)/E^2 program and $20.5 million for a new Expeditions in Education (E^2) initiative to engage, empower, and energize learners in STEM.

The FY13 budget request continues to flat fund the Robert Noyce Scholarship Program (NOYCE) at $54.9 million and decreases funding for the federal Cyber Service: Scholarship for Service/Cybercorps (SFS) program by 44 percent to $25 million. Likewise, the Administration's budget request continues to place a high priority on Graduate Research Fellowships (GRF) by increasing the funding to $121.5 million, a 10.8 percent increase over the FY12 level, while significantly reducing funding for the Integrative Graduate Education and Research Traineeship Program (IGERT) to $22.9 million, a 26.7 percent cut.

Several new or reorganized initiatives are to be carried out in conjunction with the Department of Education (ED), OSTP, and other federal science mission agencies to address national priorities in STEM education through a coordinated STEM education investment strategy. The budget request includes three specific NSF EHR collaborations with ED in FY13, including flatlining the NSF Math and Science Partnership (MSP) program at $57 million and aligning it with ED's Effective Teaching and Learning: STEM initiative (formerly ED's MSP program). In addition, the request includes $15 million from the Discovery Research K-12 (DR K-12) and $15 million from the TUES program to be directed towards a new evidence-based grant competition focused on developing, evaluating, and scaling proven practices that can help increase student learning in mathematics K-16. And lastly, efforts to establish joint standards of evidence for STEM education innovations and research are underway between EHR and ED's Institute of Education Sciences (IES), to improve the evidence base for STEM education programs across government.

Additionally, the FY13 request includes the renaming of the Informal Science Education program, now referred to as the Advancing Informal STEM Learning program (AISL). The new name emphasizes planned changes to the program to fund projects that advance the field, highlight learning outside of school, are related to all fields of STEM education, and focus on learning by individuals of all ages. The FY13 request for AISL is $47.8 million, a decrease of $13.9 million or 22.1 percent from FY12. According to the FY13 request, "AISL will support fewer awards, focusing on the research and model building of the program to better understand

[2] *FY13 NSF Budget Request to Congress*, R&RA p. 1.

effective means and innovative models for engaging today's young people and adults in science outside of school settings.[3]"

The FY13 request also reflects a fundamental reframing of the EHR investment portfolio. EHR retains its existing four divisions: 1) Research on Learning in Formal and Informal Settings (DRL); 2) Undergraduate Education (DUE); 3) Human Resource Development (HRD); and 4) Graduate Education (DGE). Funding for each division will now fall under one of three categories: Core R&D, Leadership, and Expeditions. The Core R&D areas of research include STEM learning, STEM learning environments, broadening participation and institutional capacity in STEM, and STEM professional workforce preparation. A new $5 million "Core Launch Fund" to allow a first round of grant awards will shape each area and will be administered by one of the divisions. The Leadership investments will focus on the next generation of STEM researchers and educators. And finally, the Expedition investments will be a key component for EHR to partner with other NSF directorates and offices and with ED to take on specific challenges over defined, shorter periods of time.

Major Research Equipment and Facilities Construction (MREFC)

The MREFC account funds the construction of large research facilities, such as telescopes and research ships. Funding for the design, operation and management of these major user facilities is included in the RRA budget.

The FY13 budget request includes $196.2 for the Major Research Equipment and Facilities Construction (MREFC) account. This is a slight 0.4 percent decrease from FY12. The request includes funding for four existing projects: 1) $91 million for the National Ecological Observatory Network (NEON); 2) $25 million for the Advanced Technology Solar Telescope (ATST); 3) $15 million for the Advanced Laser Interferometer Gravitational-Wave Observatory (AdvLIGO); and $65 million for the Ocean Observatories Initiatives (OOI). The IceCube Neutrino Observatory (IceCube) and the Atacama Large Millimeter Array (ALMA) no longer require MREFC funding.

Agency Operations and Award Management (AOAM)

The AOAM account funds the internal operations of NSF. The FY13 budget request includes $299.4 million for AOAM, this is a flat funding request from FY11 and FY12. The NSF building lease is scheduled to expire in April, 2013; the FY 13 budget request for AOAM includes potential increased GSA rental costs should an interim occupancy agreement be necessary.

National Science Board (NSB)

The NSB is responsible for establishing policies for NSF and for providing national science policy advice to the President and Congress. The FY13 budget request would provide level funding for NSB at $4.4 million. "The FY13 Budget Request will enable the Board to fulfill its policy-making responsibilities for NSF.[4]"

[3] *FY13 NSF Budget Request to Congress*, EHR p. 8
[4] *FY13 NSF Budget Request to Congress*, NSB p. 1.

Office of the Inspector General (OIG)

The OIG conducts and supervises audits and investigations of NSF programs, evaluates allegations of research misconduct, and issues semiannual reports to NSB and Congress regarding problems, corrective actions, and progress towards improving the management and conduct of NSF programs. The FY13 budget is $14.2 million for OIG, this mirrors the estimated funding level for FY12. "The FY13 Request level identifies the resources needed to support OIG, including amounts for personnel compensation and benefits, contract services, training, travel, supplies, materials, and equipment.[5]"

Interagency Research Activities

NSF Spending on Interagency Research Activities

(dollars in millions)

Interagency Program	FY11 Actual	FY12 Estimate	FY13 Request	FY13 Request versus FY12 Estimate	
				$	%
National Nanotechnology Initiative (NNI)	485	426	435	9	2.1
Networking and Information Technology R&D (NITRD)	1189	1138	1207	69	6.1
US Global Change Research Program (USGCRP)	321	333	333	0	0

National Nanotechnology Initiative (NNI)

The National Nanotechnology Initiative (NNI) focuses on R&D that creates materials, devices, and systems that exploit the fundamentally distinct properties of matter as it is manipulated at the nanoscale. There are currently 25 federal agencies that participate in NNI, with 15 of those agencies reporting a nanotechnology R&D budget. The FY13 budget request for NNI is $1.8 billion; NSF's contribution in this request would be $435 million, an increase of 2.1 percent from FY12. The Administration's budget request continues funding for three signature initiatives: Nanoelectronics for 2020 and Beyond; Sustainable Manufacturing: Creating the Industries of the Future; and Nanotechnology for Solar Energy Collection and Conversion.

Networking and Information Technology R&D (NITRD)

The mission of the NITRD program is to accelerate progress in the advancement of computing and networking technologies and to support leading edge computational research in a range of science and engineering fields, including high-end computing systems and software, networking, software design, human-computer interaction, health IT, and cybersecurity and information assurance research activities. Information technology research continues to play a critical role in U.S. economic strength. Currently, 14 federal agencies contribute funding to the NITRD program and additional agencies participate in planning activities.

The FY13 NITRD budget request is $3.8 billion; NSF's contribution in this request would be $1.2 billion, an increase of 6.1 percent from FY12. The Administration request includes a focus

[5] *FY13 NSF Budget Request to Congress*, OIG p. 1.

on research to improve our ability to derive value and scientific inferences from enormous quantities of data, and continues to emphasize foundations for assured computing and secure hardware, software, and network design and engineering to address the goal of making Internet communications more secure and reliable.

On February 7, 2011, the Committee on Science, Space, and Technology ordered to be reported H.R. 3834, *Advancing America's Networking and Information Technology Research and Development Act of 2012*. This measure updates and further codifies the NITRD program and is similar to H.R. 2020 from the 111th Congress that passed the House twice, but was not enacted.

U.S. Global Change Research Program (USGCRP)

The FY13 budget request is $2.6 billion for the interagency USGCRP; NSF's contribution in this request would be $333 million, a level funding request from FY12. Started in 1989, the USGCRP is an interagency effort comprised of 13 departments and agencies. Activities of the USGCRP are grouped under the following areas: improving knowledge of Earth's past and present climate variability and change; improving understanding of natural and human forces of climate change; improving capability to model and predict future conditions and impacts; assessing the Nation's vulnerability to current and anticipated impacts of climate change; and improving the Nation's ability to respond to climate change by providing climate information and decision support tools that are useful to policymakers and the general public.

APPENDIX A: OneNSF Framework Priorities[6]

- **Cyber-enabled Materials, Manufacturing, and Smart Systems (CEMMSS**) ($257.42 million) will transform static systems, processes, and edifices into adaptive, pervasive "smart" systems with embedded computational intelligence that can sense, adapt, and react. The smart systems of tomorrow, created through CEMMSS, will vastly exceed those of today in terms of adaptability, autonomy, functionality, efficiency, reliability, safety, and usability. CEMMSS plays a key role in NSF's growing portfolio of advanced manufacturing investments.

- **Cyberinfrastructure Framework for 21st Century Science and Engineering (CIF21)** ($106.08 million) aims in FY 2013 to more deeply address a highly science-driven integration of cyberinfrastructure (CI), supporting development of new statistical, mathematical, and computational methods, algorithms, and tools, as well as the cultivation of the next generation of computational and data-enabled researchers who prototype, develop, and use CI in all disciplines.

- **Expeditions in Education (E2)** ($49.0 million) establishes a partnership between the Directorate for Education and Human Resources (EHR) and other research directorates and offices. E2 will integrate, leverage, and expand STEM education research and development to improve learning in science and engineering disciplines and capitalize on the scientific assets across NSF to enhance EHR investments in learning and education.

- **NSF Innovation Corps (I-Corps)** ($18.85 million), launched in FY 2011, will continue to establish opportunities to assess the readiness of emerging technology concepts for transitioning into valuable new products through public-private partnerships. I-Corps will bring together technological, entrepreneurial, and business know-how to move discoveries toward commercialization.

- **Integrated NSF Support Promoting Interdisciplinary Research and Education (INSPIRE)** ($63.0 million) integrates NSF's existing interdisciplinary efforts with a suite of new Foundationwide activities. INSPIRE encourages research that involves multiple disciplines, connects disciplines, or creates new disciplines. It aims to widen the pool of prospective discoveries that may be overlooked by traditional mechanisms.

- **The Secure and Trustworthy Cyberspace (SaTC)** ($110.25 million) investment aligns NSF's cybersecurity investments with the four thrusts outlined in the December 2011 national cybersecurity strategy, *Trustworthy Cyberspace: Strategic Plan for the Federal Cybersecurity Research and Development Program*. SaTC directly addresses the critical Administration priority of cybersecurity issues by supporting research that seeks to protect the Nation's critical information technology infrastructure, including the Internet, from a wide range of threats that challenge its security, reliability, availability, and overall trustworthiness.

- **Science, Engineering, and Education for Sustainability (SEES)** ($202.50 million) focuses on targeted programs that promote innovative interdisciplinary research to address pressing societal issues of clean energy and sustainability. In FY 2013, SEES includes five programs that are consistent with the SEES long-term vision: Coastal SEES; Arctic SEES; Sustainable Chemistry, Engineering, and Materials (SusChEM); Creating a More Disaster-Resilient America (CaMRA); and a program on the Role of Information Sciences and Engineering in SEES (RISES).

[6] *FY13 NSF Budget Request to Congress*, Overview p. 3-4.