National Science Foundation
Budget Overview
FY 2003

The National Science Foundation requests $5.036 billion for FY 2003, $239.9 million or 5.0 percent over FY 2002. The priorities established in this Budget Request take into account both growing needs and expanding opportunities for high-impact investments to strengthen U.S. world leadership in science, engineering and technology. They aim to keep the nation's science and engineering enterprise healthy, dynamic, and relevant.

NSF Funding by Appropriation
(Millions of Dollars)

	FY 2002 Current Plan	FY 2003 Request	Percent Change
Research and Related Activities	3,598.64	3,783.21	5.1%
Education and Human Resources [1]	875.00	908.08	3.8%
Major Research Equipment & Facilties Construction	138.80	126.28	-9.0%
Salaries and Expenses	176.40	210.16	19.1%
Office of Inspector General	7.04	8.06	14.5%
Total, NSF [2]	$4,795.88	$5,035.79	5.0%

Totals may not add due to rounding.

[1] Does not include estimates of $90 million in FY 2002 and $92.5 million in FY 2003 from H-1B Nonimmigrant Petitioner Fees.
[2] The figures shown for Salaries and Expenses (S&E) and the Office of Inspector General (OIG) include pension and health costs as proposed by the Administration's Cost Integration Legislation, requiring agencies to pay their full share of accrued costs of retirement beginning in FY 2003. Net of these additional amounts, the adjusted totals for FY 2003 are $202.95 million for S&E, $7.70 million for OIG, and $5,028.21 million for the NSF total. The FY 2002 figures also include the accrual amounts.

Productivity growth in the 1990s – powered by new knowledge and driven by technological innovation – makes the economic benefits of a comprehensive fundamental research and education enterprise abundantly clear. New products, processes and entire new industries depend upon rapid advances in research. In the highly competitive global economy, continued progress in science and engineering is the principal path to continuing U.S. leadership.

The events of September 11th and subsequent anthrax attacks demonstrate that a nation strong in science and technology can respond rapidly and effectively to crises and changing national circumstances. Fundamental research across the full spectrum of science and engineering disciplines, together with the highly skilled workforce that makes research and innovation possible, provides the knowledge capital for the nation to draw upon in times of exceptional need. A growing stock of knowledge focused on the frontiers of research increases the options available for response. A talented and highly skilled science and engineering workforce accelerates the development of new technologies to meet unexpected needs.

Shoebox-sized robots – developed with NSF funding – were key additions to the search and rescue efforts at the World Trade Center following September 11. They were able to reach areas of the collapsed structures that were inaccessible to rescue workers and dogs.

Photo Credit: University of South Florida

The capacity to advance economic prosperity, ensure homeland security, and raise the quality of life for all citizens depends critically on the nation's science and engineering talent. Technology is now prevalent throughout society, in our daily lives and in the workplace. As the pace of technological change has accelerated, more sophisticated skills are needed in nearly every profession and across all levels of education. NSF investments reflect a commitment to the integration of education and research that addresses these challenges. Although NSF accounts for under 4 percent of federal research and development spending, it supports roughly 50 percent of the non-medical fundamental research at our colleges and universities. These funds support the work of over 200,000 scientists, engineers, teachers and students every year.

People, Ideas, and Tools: NSF Strategic Goals

NSF aims to increase the productivity of the nation's research and education enterprise through priority investments linked directly to three strategic goals, expressed simply as People, Ideas, and Tools. These goals reflect outcomes at the heart of the research enterprise: a world-class science and engineering workforce; the generation of new knowledge across the frontiers of science and engineering; and the tools to get the job done efficiently and effectively.

NSF Budget by Strategic Goal
(Millions of Dollars)

	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate
People [1]	894.29	993.50	1,086.70
Ideas	2,296.87	2,431.07	2,559.44
Tools	1,054.99	1,144.62	1,121.50
Administration and Management [2]	213.72	226.68	268.14
Total, NSF	$4,459.87	$4,795.88	$5,035.79

Totals may not add due to rounding.

[1] Does not include $78.5 million in FY 2001, and estimates of $90 million in FY 2002 and $92.5 million in FY 2003 from H-1B Nonimmigrant Petitioner Fees.

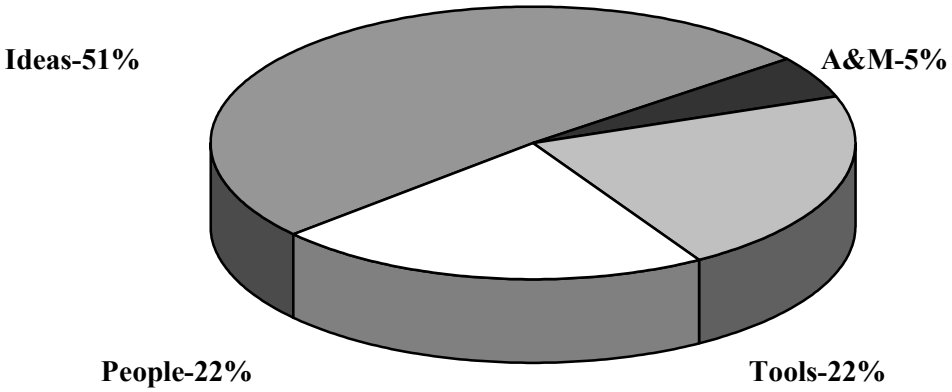
[2] The figures shown for Administration and Management (A&M) include pension and health costs as proposed by the Administration's Cost Integration Legislation, requiring agencies to pay their full share of accrued cost of retirement beginning in FY 2003. Net of these additional amounts, the adjusted totals for FY 2003 are $260.57 million for A&M, and $5,028.21 million for the NSF total. The FY 2002 figures also include the accrual amounts.

NSF facilitates significant discoveries at the frontiers of knowledge by quickly recognizing and flexibly responding to changing and emerging research areas and educational needs. Continuous dialogue with the community of researchers assures a wide variety of high quality investigations that lead to new knowledge. This uniquely effective, collaborative mode of operation is even more critical today to ensure the optimal use of limited funds as the pace of scientific discovery increases.

People produce the Ideas that are the currency of the new knowledge-based economy. The need for more sophisticated Tools has paralleled recent advances in science and engineering, creating a growing demand for access to them. NSF's overall strategy is to invest in state-of-the-art tools that add unique value to research and are accessible and widely shared among researchers across the nation.

The FY 2003 Budget Request provides $1.1 billion for programs specifically addressing the NSF strategic goal of People; $2.6 billion for Ideas; and $1.1 billion for Tools. The request also includes a $268.1 million investment in Administration and Management, which responds to priorities outlined in the *President's Management Agenda*.

FY 2003 Budget Request of $5.04 Billion



Highlights and Priorities

Investing in Top Talent

A highly skilled, diverse science and engineering workforce is a principal driver of growth in our knowledge-based economy. Since NSF's inception in 1950, 23 former NSF graduate fellows have gone on to receive the Nobel Prize.

The FY 2003 Budget Request provides approximately $37 million to increase annual stipends and the number of students in the Graduate Research Fellowships, Graduate Teaching Fellowships in K-12 Education, and Integrative Graduate Education and Research Traineeships (IGERT) programs. Stipends will rise from $21,500 to $25,000 for academic year 2003-2004, continuing the program of gradual increases initiated in FY 2001.

Attracting more of the nation's most promising students into graduate level science and engineering is NSF's highest priority. However, several factors are discouraging students from pursuing advanced degrees, including:

- Average starting salaries for students holding a Bachelor's degree in science or engineering are nearly twice the level of current stipends for graduate students.
- Debt incurred by U.S. undergraduates has more than doubled in the 1990s.

The low level of stipends, combined with the increasing burden of debt, acts as a deterrent, limiting the number of students choosing to pursue advanced studies. These problems are particularly prevalent among minority students, who are far more likely to borrow for undergraduate study.

Previous increases in stipends have already produced results. Applications to the NSF Graduate Research Fellowship program, which had decreased by nearly 40 percent during the 1990s, are increasing once again as stipend levels have risen from $15,000 in 1999 to $21,500 for academic year 2002-2003.

Furthermore, the need to encourage the best students – at all educational levels – to pursue studies in science, technology, engineering and mathematics extends well beyond graduate education. Two NSF programs target undergraduate students. The Noyce Scholarships ($4.0 million) will address the shortage of highly trained K-12 teachers by funding talented mathematics, science and engineering students who wish to pursue teaching careers in elementary or secondary schools. The Science, Technology, Engineering and Mathematics Talent Expansion Program ($2.0 million), established in FY 2002, provides grants to colleges and universities to implement programs designed to increase the number of undergraduate math and science majors.

Math and Science Partnership (MSP)

The FY 2003 Budget Request proposes $200.0 million for the second year of the Math and Science Partnership program, part of a five-year investment of about $1.0 billion.

America's future prosperity and security can be assured only if all of the nation's children have the opportunity to develop their talents and realize their full potential. High levels of achievement in math and science at the preK-12 levels are increasingly necessary for success in the complex, high technology workplace of the 21st Century.

The MSP brings states and local school districts together with the science, engineering, mathematics and education departments of institutions of higher education to strengthen preK-12 math and science education. Recent successes with systemic reform efforts in urban and rural schools demonstrate that significant improvements in student achievement can be sustained through the application of evidence-based approaches to math and science education.

The Math and Science Partnership program will build on these efforts through experimental approaches to the improvement of teacher preparation and professional development, and through building the capacity of schools to provide a challenging curriculum for every student. The partnership also aims to increase the number, quality and diversity of preK-12 math and science teachers. By integrating participants into a national network of educational researchers and teachers, the program will improve the national capacity to analyze, evaluate and apply promising approaches to math and science education.

Climate Change Research Initiative

As part of the Administration's new multi-agency Climate Change Research Initiative, NSF will implement a $15.0 million program of research to advance understanding in highly focused areas of climate science in FY 2003. The initiative aims to reduce uncertainty in critical areas of climate change and provide timely information to facilitate policy decisions.

NSF's investments will support investigations in four areas:

- Advancing our understanding of the carbon cycle;
- Improving our ability to manage the risks associated with climate change and to make sound decisions, despite uncertainty;
- Developing sensors to measure carbon dioxide and methane; and
- Measuring and understanding the impact of black carbon.

The initiative will include the development of improved sensors and diagnostic systems for observing, modeling, and analyzing carbon dioxide, methane, and other greenhouse gases in the atmosphere, the oceans, and terrestrial environments, including soils. As part of this effort, better data on black carbon particles, a significant source of aerosols in the atmosphere, will be collected and integrated into climate models to gain a better understanding of the magnitude of their effect on climate.

These studies will also incorporate a vigorous modeling and data synthesis effort to improve and refine climate change models. Research on risk communication and management, together with the development of information bases and improved tools to support decisions, will enhance national capacity to make informed policy decisions on climate change. Through workshops and consultation with the community, NSF will develop consensus on promising research directions in these areas, and establish 3 to 4 interdisciplinary risk management research centers. These focused investigations will complement NSF's ongoing programs in climate change science.

Recent studies in Antarctica's Dry Valleys found a unique, distinct cooling trend over the last 35 years. Conversely, warming has been documented on other parts of the continent, notably the Antarctic Peninsula. All of this information has proven vital to studies of the global climate.

Photo credit: Peter Doran/National Science Foundation

Priority Areas

NSF Funding by Priority Area
(Dollars in Millions)

Priority Area	FY 2002 Current Plan	FY 2003 Request	Percent Change
Biocomplexity in the Environment	58.10	79.20	36.3%
Information Technology Research	277.52	285.83	3.0%
Nanoscale Science and Engineering	198.71	221.25	11.3%
Learning for the 21st Century Workforce	144.82	184.69	27.5%
Mathematical Sciences	30.00	60.09	100.3%
Social, Behavioral and Economic Sciences	0.00	10.00	NA
Total, Priority Areas	$709.15	$841.06	18.6%

Totals may not add due to rounding.

NSF investments are focused on the frontiers of knowledge, where discovery and innovation are likely to produce significant progress. In addition to a balanced portfolio of investments that maintain the vitality

of core disciplines, NSF identifies and supports emerging opportunities that hold exceptional promise to advance knowledge. Investments in each of these priority areas support a broad range of promising research directions and platforms in developing areas of science and engineering. NSF's objective is to provide the sustained level of investment necessary to move research forward rapidly, while training the cadre of scientists and engineers who maintain research momentum and transfer research results to industry.

NSF's FY 2003 Budget Request includes a new Mathematical Sciences priority area, provides seed funding for a new priority area in the Social, Behavioral and Economics Sciences, and sustains funding for four established priority areas: Biocomplexity in the Environment, Information Technology Research, Nanoscale Science and Engineering, and Learning for the 21st Century Workforce.

Mathematical Sciences ($60 million): Mathematics is both a powerful tool for insight and a common language for science and engineering. Underlying recent progress in genomics, information technologies, and climate science are powerful new mathematical and statistical tools and applications. These tools enable scientists and engineers to tackle a broad range of scientific and technological challenges long considered intractable.

In addition to fundamental research in the mathematical and statistical sciences, the Mathematical Sciences priority area will support the integration of mathematics and statistics research and education across the full range of science and engineering disciplines. Investigations will focus on the challenges posed by large data sets such as those generated by research on genomes, and by today's sophisticated sensors and satellite observation systems, including seismic and global oceanic and atmospheric observational networks. Other studies will produce improved methods for assessing uncertainty, and enhance our ability to forecast extreme or singular events, improving the safety and reliability of such systems as power grids, the Internet and air traffic control.

The development of new mathematical tools is also needed to analyze and predict emergent complex behavior in interacting systems, from social behaviors to brain function, and from communication networks to multi-scale business information systems.

Social, Behavioral and Economic Sciences ($10 million): The FY 2003 Budget Request provides seed funding for a new priority area in the Social, Behavioral and Economic Sciences that explores the complex interactions among society, its institutions, and technology. This priority area aims to enable our society to take greater advantage of technology and to anticipate and prepare for its consequences. Deeper understanding of these dynamics can inform a wide range of 21st Century phenomena, from innovation to globalization, from the risks and benefits of new technologies to adaptation to rapid change, with a special emphasis on global change research.

Recent advances in information technologies and quantitative and experimental methods have paved the way for major advances in these fields. One research area will explore human information and language processing, cognition, learning and decision-making to provide advances that could drive new technologies to enhance these basic human capabilities. Other studies will extend recent research in game theory and experimental methods that has produced a better understanding of market performance and has led to the improvement of electromagnetic spectra auctions. A special emphasis will be on decision-making under uncertainty as part of the President's Climate Change Research Initiative.

Biocomplexity in the Environment ($79 million): This priority area focuses on the complex interdependencies of natural and human systems in the environment at scales ranging from microscopic to global. The use of advanced scientific and technological capabilities – including genomics, computational and information technologies, and real time sensing techniques – is beginning to yield a

wealth of data about the environment and promises to significantly improve our ability to forecast outcomes of multiple interactions and thus expand the knowledge base relied on by decision makers. Because of the growing urgency of environmental questions for national security and quality of life, development of superior ways to study, explore, and model complex environmental processes is increasingly important.

Two new emphasis areas this year are microbial genome sequencing and ecology of infectious diseases. Research in both of these areas will contribute knowledge needed to develop strategies to assess and manage the risks of infectious diseases, invasive species, modified organisms, and biological weapons. Research on the dynamic links and feedbacks among biophysical and socioeconomic systems and on the links between geophysical cycles, humans and other biotic factors will continue. Other interdisciplinary investigations will hasten development and application of powerful new molecular, bioinformatic and computational methods and technologies. Attention in this priority area will also be given to understanding the processes, systems, and social structures that optimize the use of materials throughout their life cycles, from natural resource to consumer use and reuse. The FY 2003 Budget Request in this area builds on past investments in core disciplines and in biocomplexity, that is, the remarkable and dynamic web of interrelationships that arise when living things at all levels interact with their environment

Information Technology Research ($286 million): Information technology has become pervasive in our public and private lives through basic scientific and engineering advances. Yet only a small portion of its potential to transform commerce, learning and government has been tapped.

NSF's Information Technology Research (ITR) priority area, entering its fourth year in FY 2003, will exploit and deepen fundamental research at the interface between fields and disciplines. From the investigation, development, and strengthening of large-scale networks to the creation of new integrative software and advanced architectures for high-end computing, ITR will support a wide-range of research to expand the benefits of IT across the national economy and society.

Studies will continue to explore new applications to advance research across all fields. Other research will focus on providing a sound basis for assured construction and certification of safe, trusted computing systems in interconnected environments – needed both to support business applications and to provide security for cyberinfrastructure. An emphasis on the interactions between humans and computers will advance understanding of the educational impacts and uses of IT, and of issues in IT literacy and IT workforce development, including a focus on barriers and impediments to IT careers among women, minorities, and other underrepresented groups. Research will address fundamental questions about the efficacy of IT in education, examine theories and models of learning, and integrate cutting-edge IT research into curricula and classrooms. ITR will also support the creation of digital library collections and the development of advanced technologies for managing and working with digital information.

Nanoscale Science and Engineering ($221 million): Nanoscale science and engineering -- the systematic organization, manipulation and control of matter at atomic, molecular and supramolecular levels -- promises revolutionary advances in pharmaceuticals, more efficient manufacturing, higher performance materials, faster computers and networks, a cleaner environment with sustainable development, and improved defense. NSF plans to support a wide range of fundamental research and educational activities in this priority area, including approximately fifteen nanotechnology research and education centers, which focus on electronics, biology, optoelectronics, advanced materials and engineering.

In its third year, this priority area will emphasize long-term, fundamental research aimed at discovering novel phenomena, processes and tools. One research area will focus on the study of biologically based

systems, with potential applications in drug delivery, materials for implants, and nanoscale sensor systems, such as early cancer detection devices. Another will explore nanoscale physical and chemical processes related to trapping and release of nutrients and contaminants in the natural environment, with potential benefits for clean energy and pollution control.

Other investigations will contribute to the creation of new materials and functional nanoscale structures, with applications in quantum computing and advanced communications and information technologies. Support for innovative educational models will ensure a cadre of scientists and engineers well versed in this emerging field, and research on the implications of nanotechnology for society will contribute to its responsible development and application.

Learning for the 21st Century Workforce ($185 million): Continuing U.S. leadership in the global economy is increasingly dependent on a highly skilled and diverse science, technology, engineering and mathematics workforce. Citizens will need greater understanding in all these fields to meet the requirements of the high technology workplace, reap the benefits of a growing economy, and participate effectively in public policy decisions. This priority area aims to improve our understanding of learning processes through research and to enhance the synergy of understanding and practice through applications and explorations in learning environments and workforce development contexts.

The centerpiece of the FY 2003 investment in this priority area is the new Science of Learning Centers activity. This program creates multidisciplinary, multi-institutional centers to expand our understanding of learning through research on the learning process, the context of learning and learning technologies. The centers will serve as national resources, and will play a critical role in the demonstration of effective workforce preparation strategies. NSF expects to support three to four centers and provide seed funding for a number of projects that could eventually develop into centers.

Other activities in this priority area will explore the potential of information technology to enhance learning, and create activities to strengthen the links between formal and informal education and across educational levels. Investment in Centers for Learning and Teaching will provide lifelong learning opportunities for the instructional workforce in contexts supported by information technology tools and by research on learning, science and mathematics.

Core Investments

NSF ensures the vitality of "core" research and education activities across all disciplines and educational levels by supporting the best ideas in science, engineering, mathematics and technology. One of NSF's enduring strengths is its reliance on merit-based competitive processes to identify the most promising research directions. Each year NSF can fund only about one-third of the proposals submitted for consideration, but many more are highly rated in the peer review process. Investments in core research and education advance the frontiers of knowledge on a broad front, providing the knowledge needed to make progress in established fields, as well as fuel new research areas and contribute to emerging interdisciplinary fields.

A major focus for NSF core funding in FY 2003 will be an increase in average annual grant size to $125,000. In constant dollars, the average size of NSF grants has been falling for many years. An increase is needed to improve the efficiency and effectiveness of the science and engineering community. Implementing this increase in grant size may have an effect on the number of grants awarded, but will lead to greater research productivity. Over the longer term, NSF intends to address the need to increase the duration of grants as well. The average duration is currently 2.9 years, too short to achieve results in many promising areas of research. Improving both grant size and duration are important long-term priorities for NSF.

NSF is in the process of conducting two surveys to obtain the views of the U.S. research community on award size and duration issues. The surveys will be conducted with principal investigators receiving NSF grants in FY 2001 as well as representatives from the principal investigators' respective institutions. The results from the surveys will help NSF improve the efficiency of the proposal and award process and will be used in the formulation of the FY 2004 budget.

Major Research Equipment and Facilities Construction

The Major Research Equipment and Facilities Construction (MREFC) Account will fund two new projects in FY 2003:

- **EarthScope**: The Budget Request provides funding of $35.0 million for EarthScope, an earthquake detection and research network, to investigate the structure and evolution of the North American continent and the physical processes controlling earthquake and volcanic eruptions. EarthScope will use state-of-the-art technology to gather data that will be used to assess and mitigate national risks associated with earthquakes, volcanic eruptions, and landslides.

- **NEON**: Funding of $12.0 million for FY 2003 will be provided to establish two prototype sites of the National Ecological Observatory Network (NEON). NEON will develop and deploy cutting-edge data collection and monitoring tools, and will construct integrated models of ecosystem function and dynamics. Sites will share data and resources through high-speed Internet connections. When fully implemented, NEON will provide the capability to integrate ecological data and deepen understanding of complex ecosystem dynamics at the local, regional, and national levels. Data gathered, monitored, analyzed and modeled will establish a baseline against which to detect abrupt changes or long-term trends, such as climate change, and enhance our ability to predict their effects. In this way, NEON could act as an early detection system for a wide array of biological and chemical threats, from invasive species to chemical and biological warfare agents.

In addition to the two new projects already described, the MREFC Account for FY 2003 will fund five continuing projects:

- ALMA, Phase II: ($30.0 million);

- Large Hadron Collider ($9.7 million);

- Network for Earthquake Engineering Simulation ($13.6 million);

- South Pole Station Modernization ($6.0 million); and

- Terascale Computing Systems ($20.0 million).

In January 2002, the National Science Foundation (NSF) joined its international partners in dedicating Gemini South, the second of the two Gemini telescopes to become operational.

Photo Credit: Gemini Observatory

Additional FY 2003 Highlights

EPSCoR: Funding for the Experimental Program to Stimulate Competitive Research (EPSCoR) will total approximately $105.0 million in FY 2003. This includes $75.0 million provided through the Education and Human Resources Appropriation, and approximately $30.0 million provided through NSF's Research and Related Activities Account. EPSCoR builds the capacity of educational institutions to compete more effectively for research funds, and enables researchers from these institutions to participate more fully in NSF research activities.

Partnerships for Innovation: Funding for the Partnerships for Innovation (PFI) program is provided in FY 2003 at a level of $5.0 million for a total investment of $34.5 million since the inception of the program in FY 2000. The PFI program builds innovation capacity by linking new knowledge and knowledge-rich workforce to economic growth and other societal benefits through the partnership endeavors of a diverse range of colleges and universities, private sector firms, local, state, and federal government entities and other organizations.

Plant Genome Research Program: The FY 2003 budget provides $75.0 million to support ongoing research on the genomics of plants of major economic importance. Working in virtual centers (centers without walls), multi-investigator teams will focus on functional genomics, large-scale sequencing, and developing tools and resources for plant genomics studies. To increase the participation of new investigators in plant genome research, a program of Young Investigator Awards in Plant Genome Research will be established.

Increasing Management Efficiency/Administration and Management: The FY 2003 request includes a $268.1 million investment in NSF's Administration and Management (A&M) portfolio, a $41.5 million (18 percent) increase. This includes funding for 67 additional full-time equivalent positions (FTE) – the first increase in more than a decade, as well as significant new investments in leading-edge information technology systems, to advance NSF's leadership in e-government.

This request reflects findings from the first stages of a comprehensive, strategic assessment of NSF's A&M responsibilities. This framework for this assessment is based on the five government-wide, mutually-reinforcing goals stated in the *President's Management Agenda*:

- Strategic Management of Human Capital
- Budget and Performance Integration
- Competitive Sourcing
- Expanded e-Government
- Improved Financial Management.

Over its 50-plus year history, NSF's commitment to excellence in supporting research and education has consistently been matched by its high standards and commitment to innovation in administration and management. Continuing this tradition of excellent stewardship requires a level of investment that reflects NSF's increasing responsibilities, the growing complexity of its workload, and new requirements for both IT and physical security.

Transfers from Other Agencies

In FY 2003, three programs are proposed to be transferred to the NSF from other agencies:

- Environmental Education formerly at the Environmental Protection Agency ($9.0 million). This will establish a comprehensive program that will fund a broad suite of environmental science education activities at the preK-12 level, in informal education venues, and at the undergraduate level.

- National Sea Grant program formerly at the National Oceanic and Atmospheric Administration ($57 million). The National Sea Grant program was originally developed at NSF in the 1960s. NSF will re-establish and operate it as a competitive, merit-based research, education, and outreach program focused on development of marine resources.

- Hydrology of Toxic Substances formerly at the United States Geological Survey ($10 million). NSF will establish new activities focused on the science of water quality at the interface of natural and human systems. Based on the USGS Toxics program, this new effort in water quality will be reoriented to focus on the fundamental processes affecting water quality.

For each of these programs, NSF will work in partnership with the relevant agencies to sustain each program's major objectives while incorporating NSF's experience with merit-based, competitive processes.