NSF Investments and Strategic Goals

The National Science Foundation's FY 2003 funding request supports the agency's investment in *People*, *Ideas*, and *Tools* – the Foundation's three strategic outcome goals. These goals flow from NSF's statutory mission – "to promote the progress of science..." and form the basis for the many activities of the Foundation. NSF's investments in *People, Ideas*, and *Tools* work in concert to promote progress in all aspects of science and engineering research and education, and are underpinned by investments in administration and management.

- *People* - Developing "a diverse, internationally competitive and globally engaged workforce of scientists, engineers and well-prepared citizens."
- *Ideas* - Enabling "discovery across the frontier of science and engineering, connected to learning, innovation, and service to society."
- *Tools* - Providing "broadly accessible, state-of-the-art and shared research and education tools."

NSF Budget by Strategic Goal
(Millions of Dollars)

	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate
People	894	994	1,087
Ideas	2,297	2,431	2,559
Tools	1,055	1,145	1,122
Administration and Management[1]	214	227	268
Total, NSF[2]	$4,460	$4,796	$5,036

Totals may not add due to rounding.

[1]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 $261 million for A&M, and $5,028 million for the NSF total. The FY 2002 figures also include the accrual amounts.

[2]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.

The strategic plan identifies NSF's management of the investment process as a critical factor in achieving the agency's goals. NSF strategies for meeting new challenges and carrying out agency goals and mission, include:

- Continued funding to sustain an efficient and enabled research and education community;
- Investments in Priority Areas;
- Adequate funding of the Major Research Equipment and Facilities Construction account; and
- Maintaining a capable and well-trained science and engineering workforce.

Detailed discussions of NSF's investment in *People*, *Ideas*, *Tools*, and Administration and Management follows this section.

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Core Research and Education Activities

NSF investments in core research and education activities are targeted to disciplinary and multidisciplinary programs to support the best new ideas generated from the academic community. These funds support single investigator and small group grants and also provide primary support for junior faculty and students. They are extremely important in invigorating the research and education community since they promote emergence of new ideas and fields, especially where the defining borders of disciplines are blurring and new technologies are emerging. Investments in the core activities ensure the vitality of scientific and engineering fields in interdisciplinary research and discovery. If the nation is to continue to have access to the best science and engineering talent, it needs to maintain the health, security, and vitality of its citizens. Only the National Science Foundation has the vital role of providing this balance for U.S. science and engineering.

Investments in Selected Priority Areas

In addition to investments in core research and education, NSF funding for selected priority areas provides key, agency-wide opportunities for pursuing the strategic outcome goals. Through these priority areas, NSF identifies and accelerates progress in areas of emerging opportunity that hold exceptional promise for advancing knowledge and addressing national interests. Each requires appropriate attention to developing people with new skills and new perspectives; new approaches to knowledge generation across the frontiers of science and engineering; and creating the tools that enable rapid advances.

The FY 2003 Budget Request emphasizes investments in six interdependent priority areas – Biocomplexity in the Environment; Information Technology Research; Nanoscale Science and Engineering; Learning for the 21st Century Workforce; Mathematical Sciences; and Social, Behavioral and Economic Sciences. In addition, NSF continues to give high priority to the Math and Science Partnership begun in FY 2002 as part of the President's education plan, *No Child Left Behind*. Within the priority areas, there is a rich mix of activity that integrates areas of fundamental research with elements of practice in related fields. This synergy characterizes the interdependence of the priority areas as, for example, concepts and techniques from the mathematical sciences influence the development of our understanding of biocomplexity or nanoscale science and engineering and vice versa.

NSF Priority Area Investments
(Millions of Dollars)

Priority Area	FY 2001 Actual	FY 2002 Current Plan	FY 2003 Request	Change Amount	Change Percent
Biocomplexity in the Environment	54.88	58.10	79.20	21.10	36.3%
Information Technology Research	216.27	277.52	285.83	8.31	3.0%
Nanoscale Science and Engineering	149.68	198.71	221.25	22.54	11.3%
Learning for the 21st Century Workforce	143.33	144.82	184.69	39.87	27.5%
Mathematical Sciences	0.00	30.00	60.09	30.09	100.3%
Social, Behavioral and Economic Sciences	0.00	0.00	10.00	10.00	N/A
Total, Priority Areas	$564.16	$709.15	$841.06	$131.91	18.6%

Totals may not add due to rounding.

❑ Biocomplexity in the Environment

The world is facing significant scientific and societal challenges, including the prospect of rapid environmental and climate change, the threat of biological and chemical warfare, and the complicated question of long-term environmental security. The integrity of local, regional and global ecosystems is inextricably linked to human well-being as well as environmental and human health. Fundamental study of complex environmental systems is therefore a key element of local, national, and global security and critical to the development of new scientific and technological capabilities that will significantly advance our ability to anticipate environmental conditions and thus improve environmental decision-making.

The *Biocomplexity in the Environment* (BE) priority area is designed to respond to the demand for new approaches to investigating the interactivity of biota and the environment. It will result in more complete understanding of natural processes, of human behaviors and decisions in the natural world, and ways to use new technology effectively to sustain life on earth. Investigations must be highly interdisciplinary, consider non-human biota and/or humans explicitly, and examine challenging systems that have high potential for exhibiting nonlinear or highly coupled behavior. Advanced computational strategies and technologies must be developed and utilized. The term “biocomplexity” is used to stress the requirement that research questions must explicitly address the dynamic web of interrelationships that arise when living things at all levels – from molecular structures to genes to organisms to ecosystems to urban centers – interact with their environment.

Proposed funding for the Biocomplexity in the Environment priority area is as follows:

(Millions of Dollars)

	FY 2002 Current Plan	FY 2003 Request	Change Amount	Change Percent
Biological Sciences	16.90	35.86	18.96	112.2%
Computer and Information Science and Engineering	6.10	7.36	1.26	20.7%
Engineering	3.69	6.00	2.31	62.6%
Geosciences	23.00	22.22	-0.78	-3.4%
Mathematical and Physical Sciences	5.35	4.70	-0.65	-12.1%
Social, Behavioral and Economic Sciences	1.65	1.65	0.00	0.0%
Office of Polar Programs	1.41	1.41	0.00	0.0%
Total, Biocomplexity in the Environment	$58.10	$79.20	$21.10	36.3%

Totals may not add due to rounding.

Long-term Goals: For the next three years, NSF will emphasize research and education on the role of *Biocomplexity in the Environment*. This priority area is part of investments and accomplishments within NSF's FY 2003 environmental investment portfolio of approximately $930 million. The intellectual goals of the effort are to:

- Synthesize environmental knowledge across disciplines, subsystems, time and space;
- Discover new methods, theories, and conceptual and computational strategies for understanding complex environmental systems;
- Develop new tools and innovative applications of new and existing technologies for cross-disciplinary environmental research;
- Integrate human, societal and ecological factors into investigations of the physical environment and environmental engineering;
- Improve science-based forecasting capabilities and enhance research on decision-making and human environmental behaviors; and
- Advance a broad range of infrastructure to support interdisciplinary environmental activities: collaboratory networks, information systems, research platforms, international partnerships, and education activities that enhance and diversify the future environmental workforce.

Long-term funding for the Biocomplexity in the Environment priority area is as follows:

(Millions of Dollars)

FY 2000 Actual	FY 2001 Actual	FY 2002 Current Plan	FY 2003 Request	FY 2004	FY 2005
50.00	54.88	58.10	79.20	87.76	92.24

FY 2003 Areas of Emphasis: In FY 2003, NSF plans to invest $79.20 million in the interdisciplinary Biocomplexity in the Environment activities described below. The first two areas listed have been added this year to specifically address the long-term need for increased biosecurity.

- **Microbial Genome Sequencing** – a systematic effort to determine the genetic composition and gene function of microbes in order to build a knowledge base to identify and characterize species and to understand the dynamics of microbial communities, particularly in response to environmental changes. Sequencing of microbes with specific relevance to bioterrorism will be included.

- **Ecology of Infectious Disease** – development of predictive models and discovery of principles for relationships between environmental factors and transmission of infectious agents. Research focuses on ecological determinants of transmission by vectors or abiotic agents, the population dynamics of species, and transmission to humans or other hosts. Anthropogenic environmental factors include habitat destruction or fragmentation, biological invasion, agricultural practices, environmental pollution, climate change, and bioterrorism.

- **Dynamics of Coupled Natural and Human Systems** – quantitative, interdisciplinary analyses of relevant human and natural system processes and the complex interactions among human and natural systems at diverse scales, with special emphasis given to studies of natural capital; landscapes and land use; and uncertainty, resilience, and vulnerability.

- **Coupled Biogeochemical Cycles** – the interrelation of biological, geochemical, geological, and physical processes at all temporal and spatial scales, with particular emphasis on understanding linkages between chemical and physical cycles (for example, the carbon, oxygen, nitrogen, phosphorus and sulfur cycles), and the influence of human and other biotic factors on those cycles.

- **Genome-Enabled Environmental Sciences and Engineering** – the integrated use of genomic and information technology approaches to gain novel insights into environmental questions and problems.

- **Instrumentation Development for Environmental Activities** – the development of instrumentation and software that takes advantage of microelectronics, photonics, telemetry, robotics, sensing systems, modeling, data mining, and analysis techniques to bring recent laboratory instrumentation advances to bear on the full spectrum of environmental biocomplexity questions.

- **Materials Use: Science, Engineering and Society** – studies directed toward reducing adverse human impact on the total, interactive system of resource use, the design and synthesis of new materials with environmentally benign impacts on biocomplex systems, as well as maximizing the efficient use of individual materials throughout their life cycles.

In addition to these primary areas, other multidisciplinary research and education activities will be supported:

- Molecular scale studies of environmental processes and technologies – interdisciplinary teams to investigate biogeochemical processes and alternative manufacturing processes at the level of molecular reactions and interfaces.
- Water cycle – research on complex, planetary-scale hydrologic processes, including investigation of how those processes interact with weather and climate to alter landscapes, coastal ecosystems, terrestrial vegetation, and aquifers.
- Social and behavioral processes – emphasis on predictive capabilities and response to extreme and unpredictable events, including the study of adaptation to environmental change in the Arctic.
- "Tree of Life" – exploration of genealogical relationships of the 1.7 million extant species at a genetic level with emphasis on providing information on the identity and characteristics of the majority of species on Earth to a wide range of users in medicine, biotechnology, agriculture, and industry.
- Educational activities – a range of projects associated with biocomplexity studies that include informal science activities, development of instructional material, and efforts in scientific literacy and communication.

- International partnerships – collaborations that include research partners in other countries in order to broaden the experience of U.S. students and expand the scope of biocomplexity research activities.

Information Technology Research

Enabled by basic scientific and engineering advances, Information Technology (IT) has become pervasive in our public and private lives and is transforming science, commerce, learning, and government. NSF's portfolio will continue to emphasize fundamental research in IT and in all the areas that IT impacts. In FY 2000, the NSF Information Technology Research (ITR) program stressed fundamental research; in the second year, additional applications in science and engineering were added; and in the third year, the program expanded to research in multidisciplinary areas, focusing on fundamental research at the interfaces between fields and disciplines. In FY 2003, ITR will exploit and deepen the research initiated to this point; it will support research to create and utilize cutting-edge cyberinfrastructure; and it will create new opportunities for novel research and technology development.

Proposed funding for the Information Technology Research priority area is as follows:

(Millions of Dollars)

	FY 2002 Current Plan	FY 2003 Request	Change Amount	Change Percent
Biological Sciences	6.08	6.80	0.72	11.8%
Computer and Information Science and Engineering	173.51	190.67	17.16	9.9%
Engineering	10.23	11.17	0.94	9.2%
Geosciences	12.16	13.21	1.05	8.6%
Mathematical and Physical Sciences	33.06	35.52	2.46	7.4%
Social, Behavioral and Economic Sciences	4.26	4.65	0.39	9.2%
Office of Polar Programs	1.22	1.33	0.11	9.0%
Subtotal, Research and Related Activities	240.52	263.35	22.83	9.5%
Education and Human Resources	2.00	2.48	0.48	24.0%
Subtotal, R&RA and Education and Human Resources	242.52	265.83	23.31	9.6%
Major Research Equipment and Facilities Construction	35.00	20.00	-15.00	-42.9%
Total, Information Technology Research	$277.52	$285.83	$8.31	3.0%

Totals may not add due to rounding.

Long-term Goals: By expanding basic research in interdisciplinary areas and addressing large problems, NSF will amplify the benefits of IT in all areas of science and engineering, and spur progress across the national economy and society. The Information Technology Research program over the next two years will continue to target the following areas: large-scale networking; high-end computing; high-end computation and infrastructure; high-confidence software and systems; human computer interaction and information management; software design and productivity; and social, economic, and workforce implications of IT plus IT workforce development.

Long-term funding for the Information Technology Research priority area is as follows:

(Millions of Dollars)

FY 2000 Actual	FY 2001 Actual	FY 2002 Current Plan	FY 2003 Request	FY 2004
126.00	216.27	277.52	285.83	291.21

FY 2003 Areas of Emphasis: Investments will emphasize the following research:

- **Large-Scale Networking –** Research in large-scale networking will explore strategic Internet technologies such as network-centric middleware, network monitoring, and problem detection and resolution. It will establish principles and tools (design, security, scaling, simulation, and recovery) for active and intelligent networks that can adjust when wireless devices move from place to place. Optical networking issues form another area for investigation. It is anticipated that the research will enable new classes of applications in areas such as distributed, data-intensive computing; collaboration protocols; computational steering of scientific simulations; distance visualization; operation of remote instruments; and large-scale, distributed systems.

- **High-End Computing –** Research investments in high-end computing will focus on such advanced computing concepts as new architectures, software component technologies, and algorithms that are specifically targeted at scientific and engineering applications. New materials and methods will be examined that may lead to creation of new designs for processors in computing devices (e.g., quantum phase data storage and retrieval; nanoscale device and system architectures; and biological substrate computing, using organic molecules). Research will also center on the creation of efficient systems software technologies, including operating systems, programming languages, compilers, memory hierarchies, input/output, and performance tools for high-performance systems.

- **High-End Computation and Infrastructure –** Research investments in high-end computation and infrastructure will support collaborative research and information sharing on high-end applications across the sciences; and support electronic collaboratories in which scientists in any field and any location can work together in real time through distributed networked applications. Additionally, investment in this priority area will advance research in computation-intensive systems and data-driven applications, including robotics, human augmentation, image processing, simulation, animation, and telepresence; and create computation and visualization technologies and tools to enable researchers to see, feel, interact with, and analyze computed and measured data from a variety of scientific and engineering disciplines. The program will also provide continued support for Terascale Computing Systems in order to strengthen the high performance computational capability needed for computational science research and applications.

- **High-Confidence Software and Systems** – Research investments in high-confidence software and systems will provide a sound theoretical, scientific, and technological basis for assured construction and certification of safe, trusted computing systems in interconnected environments. It will provide the necessary understanding to build system engineering tools that incorporate risk-based assurance appropriate to specific application domains; lead to discovery of scientific principles for the construction of high-confidence systems that are predictable and robust, including adaptive systems that are "self-healing;" and enable exploration of the theoretical and engineering foundations for real-time distributed and embedded systems, including hybrid discrete and continuous systems.

- **Human Computer Interaction and Information Management** – Research investments in the field of human computer interaction and information management will be pursued through innovative information technology applications in educational and work environments. These applications will lead to enhanced human abilities, such as augmenting human memory, attention span, sensory perception, and comprehension. Research will focus on development of multimodal technologies, tools, and devices that may enable all individuals to live full and independent lives, whatever their ages or physical capacities. Language technologies, such as machine translation, speech-driven computer interactions, pattern recognition, and automated transcription will be investigated. Investments will focus on the development of digital library collections, including study of how to determine, collect, and preserve what is of value in the world's enormous new digital output, as well as how and what to digitize from humanity's pre-digital knowledge stores. Research will be performed in architectures, tools, and technologies for organizing, annotating, searching, mining, preserving, and utilizing distributed, heterogeneous multimedia archives. In addition, advanced technologies for managing and working with digital information, from visualization, data fusion, and analysis capabilities to remote collaboration and metadata notation schemes will be developed.

- **Software Design and Productivity –** Research investments in software design and productivity will focus on development of mathematical, computer science, and engineering models to test fundamental new directions for cost-efficient development of very high-quality software in the emerging world of interconnectivity among heterogeneous devices, from embedded processors to mobile devices to massive systems of systems. It will address the theoretical foundations of software design while including substantial experimental evaluations, and attack the challenges of scalability pressures and the inherent heterogeneity of components. Improvements will be made through evaluation and testing of the practical applicability of new methods and techniques on realistic large-scale application platforms.

- **Social, Economic and Workforce Implications of IT and IT Workforce Development –** Research investments in this category will support issues in IT literacy and workforce development, including a focus on barriers and impediments to information technology careers among women, minorities, and other underrepresented groups. Innovative information technology applications will be developed for work-related learning and broader access to IT by expanding the high-performance infrastructure to encompass all educational communities and students. The fundamental questions about the efficacy of IT in education, including the examination of theories and models of learning, and development of high-quality IT applications for learning environments will be addressed.

❑ Nanoscale Science and Engineering

Nanoscale science and engineering (NSE) encompasses the systematic organization, manipulation and control of matter at atomic, molecular and supramolecular levels. Novel materials, devices, and systems – with their building blocks on the scale of nanometers – shift and expand possibilities in science, engineering, and technology. A nanometer (one-billionth of a meter) is to an inch what an inch is to 400 miles. With the capacity to manipulate matter at this scale, a revolution has begun in science, engineering, and technology including individualized pharmaceuticals, new drug delivery systems, more resilient materials and fabrics, and order of magnitude faster computer chips.

Nanoscale science and engineering has the promise of enabling a better understanding of nature, a new world of products beyond what is now possible, high efficiency in manufacturing, sustainable development, better healthcare, and improved human performance.

Proposed funding for the Nanoscale Science and Engineering priority area is as follows:

(Millions of Dollars)

	FY 2002 Current Plan	FY 2003 Request	Change Amount	Change Percent
Biological Sciences	2.33	2.98	0.65	27.9%
Computer and Information Science and Engineering	10.20	11.14	0.94	9.2%
Engineering	86.30	94.35	8.05	9.3%
Geosciences	6.80	7.53	0.73	10.7%
Mathematical and Physical Sciences	93.08	103.92	10.84	11.6%
Social, Behavorial and Economic Sciences	0.00	1.11	1.11	N/A
Subtotal, Research and Related Activities	198.71	221.03	22.32	11.2%
Education and Human Resources	0.00	0.22	0.22	N/A
Total, Nanoscale Science and Engineering	$198.71	$221.25	$22.54	11.3%

Totals may not add due to rounding.

The National Nanotechnology Initiative (NNI) is a government-wide effort that began in FY 2001 (http://www.nano.gov). NSF is emphasizing long-term, fundamental research aimed at discovering novel phenomena, processes, and tools; addressing NNI Grand Challenges; supporting new interdisciplinary centers and networks of excellence including shared user facilities; supporting research infrastructure; and addressing research and educational activities on the societal implications of advances in nanoscience and nanotechnology.

NSF has been a pioneer among federal agencies in fostering the development of nanoscale science, engineering and technology. In FY 2002, NSF is investing $198.71 million in a wide range of research and education activities, including approximately 15 nanotechnology research and education centers, which focus on areas such as electronics, biology, optoelectronics, advanced materials and engineering.

This investment will be expanded in FY 2003 by 11.3 percent to develop and strengthen critical fields and to establish the science and engineering infrastructure and workforce needed to exploit the opportunities presented by these new capabilities. Besides single investigator research, support will be focused on interdisciplinary research and education teams, national science and engineering centers, exploratory research and education projects, and education and training.

Long-term Goals include building a foundation of fundamental research for understanding and applying novel principles and phenomena for nanoscale manufacturing and other NNI Grand Challenges; ensuring that U.S. institutions will have access to a full range of nano-facilities; enabling access to nanotechnology education for students in U.S. colleges and universities; and catalyzing the creation of new commercial markets that depend on three-dimensional nanostructures. These goals will make possible development of revolutionary technologies that contribute to improvements in health, advance agriculture, conserve materials and energy, and sustain the environment.

Long-term funding for the Nanoscale Science and Engineering priority area is as follows:

(Millions of Dollars)

FY 2001 Actual	FY 2002 Current Plan	FY 2003 Request	FY 2004	FY 2005
149.68	198.71	221.25	251.25	266.25

FY 2003 Areas of Emphasis: NSF's planned investment for Nanoscale Science and Engineering in FY 2003 is $221.25 million. The Foundation's five programmatic focus areas are:

- **Fundamental Research and Education –** The FY 2003 request includes an estimated $141.0 million for fundamental research and education, with special emphasis on:
  - *Biosystems at the Nanoscale* – Approximately $21 million to support study of biologically-based or inspired systems that exhibit novel properties and potential applications. Potential applications include improved drug delivery, biocompatible nanostructured materials for implantation, exploiting of functions of cellular organelles, devices for research in genomics, proteomics and cell biology, and nanoscale sensory systems, such as miniature sensors for early detection of cancer.
  - *Nanoscale Structures, Novel Phenomena and Quantum Control* – Approximately $53 million to discover and understand phenomena specific at the nanoscale, create new materials and functional nanoscale structures and exploit their novel properties. Potential applications include quantum computing and new devices and processes for advanced communications and information technologies.
  - *Device and System Architecture* – Approximately $28 million to develop new concepts to understand interactions among nanoscale devices in complex systems, including the physical, chemical, and biological interactions between nanostructures and device components. Interdisciplinary teams will investigate methods for design of systems composed of nanodevices.
  - *Nanoscale Processes in the Environment* – Approximately $10 million to support studies on nanoscale physical and chemical processes related to the trapping and release of nutrients and contaminants in the natural environment. Potential benefits include artificial photosynthesis for clean energy and pollution control, and nanoscale environmental sensors and other instrumentation.
  - *Multi-scale, Multi-phenomena Theory, Modeling and Simulation at the Nanoscale* – Approximately $21 million to support theory, modeling, large-scale computer simulation and new design tools and infrastructure in order to understand, control, and accelerate development in new nanoscale regimes and systems.
  - *Manufacturing processes at the nanoscale* - Approximately $8 million to support new concepts for high rate synthesis and processing of nanostructures, fabrication methods for devices, and assembling them into nanosystems and then into larger scale structures of relevance to industry and medical fields.

- **Grand Challenges –** Approximately $10.7 million will fund interdisciplinary activities to focus on major long-term challenges: nanostructured materials 'by design,' nanoscale electronics, optoelectronics and magnetics, nanoscale-based manufacturing, catalysts, chemical manufacturing, environment and healthcare.

- **Centers and Networks of Excellence –** Approximately $37.9 million will support six research and education centers established in FY 2001, and a multidisciplinary, multi-sectoral network for modeling and simulation at the nanoscale. Support includes the nanofabrication user facilities that come online in FY 2002.

- **Research Infrastructure –** Approximately $21.7 million will support instrumentation and facilities for improved measurements, processing and manipulation at nanoscale, and equipment and software for modeling and simulation. University-industry-national laboratory and international collaborations will be encouraged, particularly for expensive instrumentation and facilities.

- **Societal and Educational Implications of Science and Technology Advances –** Approximately $9.9 million will support student assistantships, fellowships and traineeships, curriculum development on nanoscience and engineering and development of new teaching tools. The implications of nanotechnology on society will be analyzed from social, behavioral, legal, ethical, and economic perspectives. Factors that stimulate scientific discovery at the nanoscale, ensure the responsible development of nanotechnology, and utilize converging technologies to improve human performance will be investigated. The development and use of nanoscale technologies is likely to change the design, production and use of many goods and services, ranging from vaccines to computers to automobile tires.

❑ Learning for the 21st Century Workforce

Continued U.S. leadership in the global economy is dependent on the availability of a diverse science, technology, engineering, and mathematics (STEM) workforce. U.S. citizens as a whole will also need greater STEM literacy in order to participate in an informed manner in important public policy discussions and to utilize scientific and quantitative skills in their daily lives. The teachers who will develop our scientific and engineering workforce and prepare our young people for responsible citizenship form an important part of the larger workforce. Moreover, as technological advances radically change workplace environments, the workforce at large will require new skills (i.e., higher degrees of problem solving ability, quantitative computer and communications literacy, and increased competencies in STEM). The Learning for the 21st Century Workforce priority area focuses on generating the base of knowledge that will support effective research-based pedagogies that will address these higher order skills and prepare and support the STEM workforce of the future.

In order to use new learning concepts to meet emerging workforce needs, NSF has adopted a strategy that includes two overarching goals: (1) improve our understanding of learning processes through an aggressive research program; and (2) transfer that understanding into learning environments and apply it to workforce development. Successful pursuit of these goals will generate the knowledge, people and tools needed to develop a modern workforce that is second to none in its ability to use, adapt and create STEM concepts in the workplace. It will also develop a science, technology, engineering, and mathematics workforce that leads the world and fully reflects the strength of the nation's diversity.

Proposed funding for Learning for the 21st Century Workforce priority area is as follows:

(Millions of Dollars)

	FY 2002 Current Plan	FY 2003 Request	Change Amount	Change Percent
Biological Sciences	1.70	1.93	0.23	13.5%
Computer and Information Science and Engineering	1.15	1.20	0.05	4.3%
Engineering	3.40	4.87	1.47	43.2%
Geosciences	3.90	4.23	0.33	8.5%
Mathematical and Physical Sciences	5.00	5.97	0.97	19.4%
Social, Behavioral and Economic Sciences	5.40	5.46	0.06	1.1%
Office of Polar Programs	1.10	1.12	0.02	1.8%
Integrative Activities	0.00	20.00	20.00	N/A
Subtotal, Research and Related Activities	21.65	44.78	23.13	106.8%
Education and Human Resources	123.17	139.91	16.74	13.6%
Total, Learning for the 21st Century Workforce	$144.82	$184.69	$39.87	27.5%

Totals may not add due to rounding.

Long-term Goals: Over a five-year period, NSF will explore several connected aspects of learning in order to:

- Expand our understanding of learning in young people and adults, and take advantage of opportunities provided by state-of-the-art information and learning technologies to explore new models of workforce preparation and development.
- Support the transformation of today's workforce into one that is prepared to learn throughout life.
- Develop exemplary practices for broadening participation in STEM career fields to better reflect the diversity of the nation.
- Include opportunities in formal and informal STEM education to experience the realities of the national and global workplace and to better prepare those entering the workforce.
- Prepare the next generation of leaders and develop a citizenry that understands the processes of creating new knowledge and the value of incorporating new knowledge into their working practice.

Long-term funding for the Learning for the 21st Century Workforce priority area is as follows:

(Millions of Dollars)

FY 2001 Actual	FY 2002 Current Plan	FY 2003 Request	FY 2004	FY 2005
143.33	144.82	184.69	191.97	197.00

FY 2003 Areas of Emphasis: The Learning for the 21st Century Workforce priority area combines a concentration in certain core programs in the Education and Human Resources (EHR) Account with research and education efforts sponsored by the Research and Related Activities Account. NSF core programs include the Interagency Education Research Initiative (IERI), the Research on Learning and Education (ROLE) program, Centers for Learning and Teaching (CLT), and others. These programs will be expanded by an NSF-wide integrative activity, the new Science of Learning Centers that forms the centerpiece of the Learning for the 21st Century Workforce priority area in FY 2003.

- **Science of Learning Centers** – multidisciplinary, multi-institutional centers to expand our understanding of learning through research on the learning process, the context of learning and learning technologies leading to enhanced understanding of how people think and learn. SLCs will serve as national "learning" resources, and will play a critical role in the demonstration of effective workforce preparation strategies. NSF expects to fund this program at $20.0 million in FY 2003, providing funds for three or four centers and a number of catalyst projects. Catalyst projects include planning grants to support seed projects which could become SLCs at a later date. At this level, the SLC investment will support a diverse portfolio of projects, providing leadership across a broad range of science and engineering approaches, including research that will speak to and learn from educational reform, workforce development, and the linkage of educational strategies to economic development, and add generally to the knowledge base in cognition.

  SLCs will be organized around a unifying research focus and an effective implementation strategy that will achieve all three of the SLC principal goals: (1) advancing the understanding of learning, through research on the learning process, the context of learning, and/or learning technologies; (2) strengthening the connections between science of learning research and educational and workforce development, in a manner that mutually advances both; and (3) building effective collaborative research communities with sufficient resources and organizational capacity to respond to new educational and workforce challenges, and capitalize on new research opportunities and discoveries.

- **Learning research** – investments in multidisciplinary research incorporating fields such as design of learning environments, human-computer interactions, cognitive psychology, cognitive neuroscience, computational linguistics, child development, sociology and complex educational systems. Investments include IERI, ROLE, and other research activity related to child learning and cognitive development. The FY 2003 request for research is $67.75 million.

- **Learning tools** – research, development, and testing of information technology-based tools that facilitate learning across many levels of formal and informal education and for both individuals and groups. New communication and information technologies show promise to enhance the delivery of education and offer the possibility of providing truly learner-centered, independent learning environments over an entire lifetime and at any convenient place and time. Continuing investments include the National Science, Technology, Engineering and Mathematics Education Digital Library (NSDL), a prototype information technology-based tool designed to increase the quality, quantity, and comprehensiveness of Internet education resources. The FY 2003 request is $27.50 million.

- **Creating connections** – activities that link formal and informal STEM education and create connections across levels of formal education and workforce development. Investments in this core element recognize that learning happens continuously and in many ways. They provide mechanisms to bridge gaps caused by the organization of learning environments into discrete systems of formal and informal education, and into discrete educational layers. Investments include the Graduate Teaching Fellowships in K-12 Education (GK-12) program, which is budgeted at $41.44 million in FY 2003.

- **Centers for Learning and Teaching (CLT)** – activities that link K-12 and higher education to provide lifelong learning opportunities for the instructional workforce in contexts supported by information technology tools and by research on learning, science and mathematics. CLTs will address the need to increase the quality of research on learning and teaching, to develop the next generation of science and mathematics education specialists, and to strengthen the competencies of the preK-16 instructional workforce. The request for Centers for Learning and Teaching program is $28.0 million in FY 2003.

The Math and Science Partnership discussed below also reflects many of the goals of Learning for the 21st Century Workforce. The partnerships developed with various localities will ensure that all students have the opportunity to perform to high standards by using effective, research-based approaches, improving teacher quality, and insisting on accountability for student performance.

❑ Mathematical Sciences

Today's discoveries in science, engineering and technology are intertwined with advances across the mathematical sciences. New mathematical tools disentangle the complex processes that drive the climate system; mathematics illuminates the interaction of magnetic fields and fluid flows in the hot plasmas within stars; and mathematical modeling plays a key role in research on micro-, nano-, and optical devices. Innovative optimization methods form the core of computational algorithms that provide decision-making tools for Internet-based business information systems.

The fundamental mathematical sciences – embracing mathematics and statistics – are essential not only for the progress of research across disciplines, they are also critical to training a mathematically literate workforce for the future. Technology-based industries, which help fuel the growth of the U.S. economy, and increasing dependence on computer control systems, electronic data management, and business forecasting models, demand a workforce with effective mathematical and statistical skills that is well-versed in science and engineering.

It is vital for mathematicians and statisticians to collaborate with engineers and scientists to extend the frontiers of discovery where science and mathematics meet, both in research and in educating a new generation for careers in academe, industry, and government. For the United States to remain competitive among other nations with strong traditions in mathematical sciences education, more young Americans must be attracted to careers in the mathematical sciences. These efforts are essential for the continued health of the nation's science and engineering enterprise.

The role of mathematics has expanded in science and society, but the resources devoted to three key areas – fundamental mathematical and statistical research, interdisciplinary collaboration between the mathematical sciences and other disciplines, and mathematics education – have not kept pace with the needs, thus limiting the nation's scientific, technical, and commercial enterprises. To strengthen the mathematical foundations of science and society, NSF will focus on the mathematical sciences, encompassing interdisciplinary efforts in all areas of science, engineering and education supported by the Foundation.

In FY 2002, NSF provided $30.0 million in funding support as a focused investment in interdisciplinary research in mathematics within the Mathematics and Physical Sciences Activity; Mathematical Sciences becomes a Foundation-wide priority area in FY 2003, building on this initial investment.

Proposed funding for the Mathematical Sciences priority area is as follows:

(Millions of Dollars)

	FY 2002 Current Plan	FY 2003 Request	Change Amount	Change Percent
Biological Sciences	0.00	0.91	0.91	N/A
Computer and Information Science and Engineering	0.00	2.29	2.29	N/A
Engineering	0.00	0.91	0.91	N/A
Geosciences	0.00	4.57	4.57	N/A
Mathematical and Physical Sciences	30.00	47.39	17.39	58.0%
Social, Behavioral and Economic Sciences	0.00	1.10	1.10	N/A
Office of Polar Programs	0.00	0.18	0.18	N/A
Subtotal, Research and Related Activities	$30.00	$57.35	$27.35	91.2%
Education and Human Resources	$0.00	$2.74	2.74	N/A
Total, Mathematical Sciences	$30.00	$60.09	$30.09	100.3%

Totals may not add due to rounding.

Long-term Goals: From FY 2003 through FY 2007, the mathematical sciences priority area will advance frontiers in three interlinked areas: (1) fundamental mathematical and statistical sciences; (2) interdisciplinary research involving the mathematical sciences with science and engineering through focused, selected themes; and (3) critical investments in mathematical sciences education. A five-year investment plan will allow efforts in research and education to take root and begin a transformation in the way mathematics, science, and education interact. The long-term goals of the investments in the priority area are to:

- Foster significant advances in fundamental mathematics and statistics with important benefits for the mathematical and other sciences and engineering;
- Promote the synergy of fundamental mathematical sciences research with its use in other fields of fundamental research and applications;
- Enhance the use of state-of-the-art mathematical and statistical tools across NSF research fields while exploring those fields for seeds of new mathematical and statistical directions;
- Ensure award size and duration for researchers in the mathematical sciences that enable them to bring new ideas to fruition and to promote interdisciplinary collaborations;
- Train a new generation of researchers in interdisciplinary approaches to future science and engineering challenges with mathematical and statistical elements;
- Increase the numbers and diversity of U.S. students trained in the mathematical and statistical sciences to meet the increasing demands of scientific research, engineering, and technology in academic institutions, industry and government laboratories; and
- Develop a framework to significantly advance the image and understanding of mathematics in the general population.

Long-term funding for the Mathematical Sciences priority area is as follows:

(Millions of Dollars)

FY 2002 Current Plan	FY 2003 Request	FY 2004	FY 2005	FY 2006	FY 2007
30.00	60.09	72.10	86.50	99.50	109.50

FY 2003 Areas of Emphasis: In FY 2003, NSF plans to invest $60.09 million in the Mathematical Sciences activities described below.

- **Fundamental Mathematical and Statistical Sciences**. Fundamental research areas include themes such as dynamical systems and partial differential equations, geometry and topology, stochasticity, number theory, algebraic and quantum structures, the mathematics of computation, Bayesian estimation, and multi-scale and multi-resolution analysis. To enhance research in these areas, the NSF will provide increased support for mathematical sciences through focused research groups and individual investigator grants, as well as through institutional and postdoctoral training activities.

- **Advancing Interdisciplinary Science and Engineering**. The concepts and structures developed by fundamental mathematics often provide just the right framework for the formulation and study of phenomena in other disciplines. Mathematics and statistics have yielded new analytical, statistical, computational and experimental tools to tackle a broad range of scientific and technological challenges long considered intractable. This success has fueled both interest in the further development of new mathematical and statistical ideas and techniques and demand for research teams capable of recognizing the potential and for using these sophisticated techniques in addressing science and engineering problems. A new breed of researchers, broadly trained in both mathematics and science or engineering disciplines and capable of translating mathematical concepts and techniques across disciplines, is needed to tackle the increasingly complex multidisciplinary research topics that confront society. Three broad research themes have been identified for initial emphasis in the mathematical sciences priority area:

  - *Mathematical and statistical challenges posed by large data sets* – Much of modern science and engineering involves working with enormous data sets. Major challenges include: the identification and recovery of meaningful relationships between data; the identification and validation of the structure of large data sets, which require novel mathematical and statistical methods; and improvement of theories of control and decision-making based on large data streams, with new statistical techniques to assess complicated data sets. These challenges arise in such diverse arenas as: large genetic databases; the explosion of data gathered from satellite observation systems, seismic networks, and global oceanic and atmospheric observational networks; situations in which privacy and missing data are major concerns; the massive data streams generated by automated physical science instruments which must be compressed, stored and accessed for analysis; and data produced by modern engineering systems that place networked sensors and actuators on scalable networks to support dynamic interactions.

- *Managing and modeling uncertainty* – Predictions and forecasts of phenomena – bracketed by measures of uncertainty – are critical for making better decisions, whether in public policy or in research. Improved methods for assessing uncertainty will increase the utility of models across the sciences and engineering and result in better predictions of phenomena. Improving the ability to forecast extreme or singular events will improve safety and reliability in systems such as power grids, the Internet, and air traffic control. Advancing techniques to assess uncertainty has applications ranging from helping to forecast the spread of an invasive species, to predicting genetic change and evaluating the likelihood of complex climate change scenarios. For example, in the social sciences, methods for assessing uncertainty will improve the utility of forecasts of market behavior.

- *Modeling complex nonlinear systems* – Advances in mathematics are necessary for a fundamental understanding of the mechanisms underlying interacting complex systems and will be essential to the further development of modern physical theories of the structure of the universe at the smallest and largest scales. Across the sciences, there is a great need to analyze and predict emergent complex properties, from social behaviors to brain function, and from communication networks to multi-scale business information systems.

To enhance research in these areas of science and engineering which depend on cross-cutting themes in the mathematical sciences, NSF support will encompass interdisciplinary focused research groups, interdisciplinary centers, interdisciplinary cross-training programs, and partnership activities with other federal agencies. Training activities will cover interdisciplinary professional development at many levels and those that link highly innovative training activities with research.

- **Advancing Mathematical Sciences Education**. This effort will support innovative educational activities, centered on the research priorities highlighted above. Activities will include: teacher preparation and professional development; curriculum development both in the mathematical sciences and in incorporating sophisticated mathematics into other disciplines, introducing new technologies and materials across the K-16 spectrum; and research on how mathematics is learned, particularly in light of new learning technologies and emerging mathematical fields. Investments include support for undergraduate and graduate education and postdoctoral training coupled with curriculum reform.

❑ Social, Behavioral and Economic Sciences

The theme of the Social, Behavioral and Economic Sciences (SBE) priority area is to research how technology and society advance through continual interactions. The social system – society and its political, economic, legal, education, health care, and other institutions – influences how scientific discovery happens and what technologies are developed. Concurrently, technological development causes change in the social system. Every aspect of our lives – the way our economy operates, the ways we govern ourselves, the ways we learn, and the ways we communicate and relate to one another – has been changed by transportation, communications, and information technologies. With biotechnology, we are changing our sources and amounts of food, our abilities to diagnose disease, and the nature and range of medical therapies. And we are on the verge of even greater changes with nanoscale science and engineering. These changes have given the U.S. advantages over many other nations, and they have contributed to U.S. economic well-being and quality of life. But the changes made with technology also bring greater risks and call into question the extent to which contributions from technological innovation can be sustained.

The changes being created as a result of technological developments are happening so rapidly that laws and regulations, political and social institutions, schools and businesses, and society are being challenged to keep up. For example, U.S. economic data are inadequate for a global, information-driven economy and a world of e-commerce. Property rights, and laws governing markets, are not relevant to many new products and services. Technologies to limit, if not avoid, social and environmental harms or to gain a competitive advantage are not fully employed by organizations and businesses. Schools too often use technology to automate the way teachers teach, rather than to transform education.

Moreover, technological change may involve risks. Advances in information technology will increase risks to individual privacy. Greater reliance on technology for economic/financial transactions, health care, transportation, electric power generation and distribution, and communications leads to greater risks of widespread failures in these complex, critical systems. And a growing disparity of access to technology among diverse segments of society and among countries increases the risks of social tensions.

Globalization has also contributed to the rapid changes industrialized countries have fueled with technology. The world continues to become increasingly interdependent. Imports, exports, and foreign investment between nations continue to increase. More jobs require higher levels of education and the U.S. is becoming increasingly dependent on immigration to meet the needs for many specialized skills. Multinational corporations are a major part of the global economy and have reduced the control of national governments over the flow of financial as well as human capital.

Scientific and technological advances have placed the U.S. ahead of the competition in the global economy. But these same advances also provide other countries with broad and immediate access to scientific and technological information and other means to more readily be the first to develop a new technology and bring it to the global market. As a result, the country's current advantage may not be sustained.

If the U.S. is to maintain this standing and further the contributions of science and technology to economic well-being and quality of life, knowledge must be developed that will ensure continued, sustained leadership in technological innovation. This will involve the development of knowledge with which new technologies can be created to meet changing human needs; knowledge that will stimulate technological innovation through new markets, property rights, and other social frameworks; and knowledge that will enable individuals, organizations, and society to take greater advantage of technology and anticipate and prepare for the social, economic, and environmental effects.

The rapidly changing capabilities for society, associated with technological development, also provide the public with new opportunities to interact with the natural environment. Major improvements in observation, analytical, and modeling capabilities have greatly enhanced the potential to understand and more accurately predict the weather and short-term changes in ecosystems resulting from both natural processes and human activities. However, our understanding of these interactions over longer time periods is still fragmentary, and decisions about many longer-term environmental issues are made with incomplete information and uncertainty. As part of the President's Climate Change Research Initiative, the NSF will undertake a program in coordination with other federal agencies that focuses on decision-making under uncertainty related to climate change.

Funding for the Social, Behavioral and Economic Sciences priority area is seeded at $10.0 million in FY 2003, all within the SBE Activity. Included in the total is $5.0 million for research on risk management as part of the Climate Change Research Initiative.

Long-term Goals: Developing the necessary knowledge requires investing in new research in the social, behavioral, and economic sciences. From FY 2003 through FY 2007 this investment will generate the knowledge from the following:

- **Research on human factors in the design and development of technology**, leading to technologies to enhance human capabilities.

- **Research on social frameworks for scientific and technological innovation**, suggesting changes in our social frameworks to further stimulate scientific discovery and the responsible development of technology.

- **Research on adaptation to technological change**, enabling our society to take greater advantage of technology and to anticipate and prepare for its consequences.

Long-term funding for the SBE priority area is as follows:

(Millions of Dollars)

FY 2003 Request	FY 2004	FY 2005	FY 2006	FY 2007
10.00	20.00	30.00	40.00	50.00

FY 2003 Areas of Emphasis: In the first year, funding will focus on basic research that is primed for major advances because of new research tools or new data or because of prior research with successful applications that can be extended through new methods or different perspectives. Specifically, this priority area will concentrate on:

- Research on risk management with special reference to issues related to climate change. With the added funding, NSF will support a research program designed to produce new understandings of how to manage risks associated with climate change as well as new tools, perspectives, and information that will assist individuals, groups, and organizations with the development of public policies and private-sector decisions. NSF will coordinate the development of this program with other federal agencies participating in the U.S. Global Change Research Program.
- Research on game theory and empirical methods in economics and political science.
- Research on computational linguistics, speech recognition, and cognitive neuroscience, all areas where technological advances have created new tools for social scientists.

It is an opportune time to lay the foundation for an increased investment in the social, behavioral, and economic sciences to achieve these purposes. As these sciences have become more quantitative, they are creatively adapting and using technologies to advance the frontiers of knowledge with new data, models, methodologies, and modes of conducting research, including new methods of observation and experimentation.

Math and Science Partnership

The underlying philosophy of the Math and Science Partnership (MSP) is that collaborations of school systems, higher education, and other partners will increase the capacity of preK-12 educational systems, to provide requisites for learning to high standards in science and mathematics as a national priority, to ensure the future strength of the nation that derives from scientific advances and a science-literate citizenry. MSP is a cornerstone of the President's education policy, *No Child Left Behind*, which states that *"...we have fallen short in meeting our goals for educational excellence. The academic achievement gap between rich and poor, Anglo and minority is not only wide, but in some cases is growing wider still.... Among the underlying causes for the poor performance of U.S. students in the areas of math and science, three problems must be addressed — too many teachers teaching out-of-field; too few students taking advanced coursework; and too few schools offering a challenging curriculum and textbooks."*

The strategic focus of the Math and Science Partnership is to engage the nation's higher education institutions, local, regional and state school districts and other partners in preK-12 reform by calling for a significant commitment by colleges and universities to improving the quality of science and mathematics instruction in the schools and to investing in the recruitment, preparation and professional development of highly competent science and mathematics teachers. MSP, as a major national effort, is an investment intended to serve *all* students so that learning outcomes can no longer be predicted based on race/ethnicity, socio-economic status, gender or disability.

A defining feature of MSP is the development and implementation of productive partnerships among the major stakeholders, with each partnership requiring commitments from one or more local school systems and one or more higher education entities, and including other partners that bring additional assets to preK-12 teaching and learning. These other partners can include industrial organizations, which bring unique insights on workforce needs to the partnerships, state education agencies, and not-for-profit entities with a commitment to science and mathematics education. Institutions of higher education who partner in MSP are expected to tap their disciplinary departments in science, technology, engineering, and mathematics (STEM) as well as their education departments. The insistence that higher education must play a critical role in preK-12 educational reform, especially in support of professional education throughout the career of preK-12 teachers, distinguishes MSP from prior NSF-supported systemic efforts.

A second distinguishing feature of MSP is that it will not be an isolated set of local partnerships, but will become part of the NSF and national STEM education portfolio of interconnected sites whose experiences will help generate the capacity of the nation to serve all students well. Further, by involving the MSP awardees in a nationwide network of educational researchers and practitioners, the program will contribute to the development of a greater U.S. capacity to analyze and learn from the experience of large-scale change and to apply this knowledge to preK-12 STEM teaching and learning.

MSP seeks to improve student outcomes in high-quality mathematics and science by all students, at all preK-12 levels. The partnerships expect to contribute to increases in student achievement across-the-board, as well as reductions in achievement gaps in mathematics and science education among diverse student populations differentiated by race/ethnicity, socio-economic status, gender or disability. To achieve these long-term outcomes, MSP will support the development, implementation, and sustainability of exemplary partnerships addressing the following goals:

Goal 1: To significantly enhance the capacity of schools to provide a challenging curriculum for every student, and to encourage more students to participate in and succeed in advanced mathematics and science courses.

Goal 2: To increase and sustain the number, quality, and diversity of preK-12 teachers of mathematics and science, especially in underserved areas, through further development of a professional education continuum that considers traditional preservice education as well as alternative routes into the profession (e.g., scientists and engineers wishing to shift careers to preK-12 teaching, professional development during early phases of a career (i.e., induction), and continued professional growth (inservice) in mathematics and science for preK-12 teachers.

Goal 3: To contribute to the national capacity to engage in large-scale reform through participation in a network of researchers and practitioners that will share, study and evaluate educational reform and experimental approaches to the improvement of teacher preparation and professional development.

Goal 4: To engage the learning community in the knowledge base being developed in current and future NSF Centers for Learning and Teaching, and Science of Learning Centers.

The FY 2002 Current Plan for MSP is $160.0 million. In FY 2002, MSP will provide support for two types of partnership efforts, those that are comprehensive in nature and those that are more targeted in their expected outcomes, focusing on solutions to specific problems in the improvement of preK-12 science and math education. Some of the targeted awards may also be used to provide technical assistance to build capacity in those districts lacking the infrastructure or ability to be competitive initially for a comprehensive award. It is anticipated that the partnerships will share a number of key characteristics that will facilitate MSP reaching the above goals. For example, partnerships will design high learning expectations into all math and science classes, and will ensure that educators effectively match local and state standards to curricula, learning technology, instruction and assessment.

MSP funding in FY 2002 will also be used to support a combination of technical assistance, evaluation, and research grants and contracts. It is expected that research on learning and the application of math and science education models to a wide range of learning environments will be a key component of MSP and will contribute to the national understanding of how to introduce and sustain successful education reform in math and science.

NSF's intent is to develop creative and innovative approaches on a continuing basis to achieve the purposes of MSP. An assessment of lessons learned from the FY 2002 efforts will likely lead to changes in the program in FY 2003.

The U.S. Department of Education will be sponsoring numerous programs that support the President's initiative, and NSF and the Department of Education are planning program linkages to manage the federal investment in math and science education for the greatest effectiveness.

Proposed funding for the Math and Science Partnership is as follows:

(Millions of Dollars)

FY 2002 Current Plan	FY 2003 Request	FY 2004	FY 2005	FY 2006
160.0	200.0	200.0	200.0	200.0

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Federal Crosscuts

NSF will continue its active participation in federal crosscut areas in FY 2003, supporting research and education in the U.S. Global Change Research Program at $188.30 million, the Networking and Information Technology Research and Development (formerly HPCCIT) program at $678.74 million, and the National Nanotechnology Initiative at $221.25 million. In addition, in FY 2003, the Administration proposes to institute a new Climate Change Research Initiative, which is a multiagency effort with a strong focus toward short-term outcomes and deliverables. NSF will participate in four specific areas: understanding the North American Carbon Cycle, research on climate change risk management, developing sensors to measure carbon dioxide and methane; and measuring and understanding the impact of black carbon. The request includes $15.0 million to address these focused research challenges.

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Strategic Goals and NSF Budget Structure

The following table provides FY 2003 funding for strategic goals and budget accounts.

NATIONAL SCIENCE FOUNDATION
BY STRATEGIC GOAL AND ACCOUNT

(Millions of Dollars)

NSF Accounts	FY 2001 Actuals	FY 2002 Current Plan	FY 2003 Request: People	Ideas	Tools	A&M	FY 2003 Request	$ Change Request over Plan	% Change Request over Plan
FY 2001 Actuals	**$4,459.87**		**$894.39**	**$2,296.77**	**$1,054.99**	**$213.72**			
FY 2002 Current Plan		**$4,795.88**	**$993.50**	**$2,431.07**	**$1,144.62**	**$226.68**			
BIO	485.95	508.41	50.24	419.39	52.04	3.95	525.62	17.21	3.4%
CISE	478.15	514.88	53.33	328.57	139.29	5.74	526.94	12.06	2.3%
ENG	433.37	472.32	78.09	399.11	4.30	6.47	487.98	15.66	3.3%
GEO	563.60	609.47	35.02	413.31	234.74	8.00	691.07	81.60	13.4%
MPS	854.08	920.45	116.53	597.11	222.49	5.44	941.57	21.12	2.3%
SBE	177.22	168.79	11.02	143.35	37.99	3.25	195.61	26.82	15.9%
OPP[1]	282.28	297.81	4.77	73.77	222.77	2.50	303.81	6.00	2.0%
IA	97.64	106.51	5.00	47.61	58.00	0.00	110.61	4.10	3.8%
Research & Related Activities	**$3,372.30**	**$3,598.64**	**$354.01**	**$2,422.22**	**$971.62**	**$35.35**	**$3,783.21**	**$184.57**	**5.1%**
Education & Human Resources	**$795.42**	**$875.00**	**$732.69**	**$137.22**	**$23.60**	**$14.57**	**$908.08**	**$33.08**	**3.8%**
Major Research Equipment & Facilities Construction	**$119.24**	**$138.80**	**$0.00**	**$0.00**	**$126.28**	**$0.00**	**$126.28**	**-$12.52**	**-9.0%**
Salaries & Expenses	**$166.33**	**$176.40**	**$0.00**	**$0.00**	**$0.00**	**$210.16**	**$210.16**	**$33.76**	**19.1%**
Office of Inspector General	**$6.58**	**$7.04**	**$0.00**	**$0.00**	**$0.00**	**$8.06**	**$8.06**	**$1.02**	**14.5%**
Total, National Science Foundation[2]	**$4,459.87**	**$4,795.88**	**$1,086.70**	**$2,559.44**	**$1,121.50**	**$268.14**	**$5,035.79**	**$239.91**	**5.0%**
Proposed Federal Employee Retirement Costs[3]									
Salaries & Expenses	*$5.80*	*$6.36*				*$7.21*			
Office of Inspector General	*$0.26*	*$0.28*				*$0.36*			
Total NSF, Excluding Retirement Costs	$4,453.81	$4,789.24	$1,086.70	$2,559.44	$1,121.50	$260.57	$5,028.21	$232.34	4.9%
H-1B Visa	*$78.51*	*$90.00*					*$92.50*	*$2.50*	*2.8%*
Total NSF, Excluding Retirement Costs & Including H-1B	*$4,538.38*	*$4,885.88*	*$1,086.70*	*$2,559.44*	*$1,121.50*	*$260.57*	*$5,120.71*	*$234.84*	*4.8%*
Percent Increase over Prior Year, Including Retirement Costs & H-1B Visa		**7.5%**	**9.4%**	**5.3%**	**-2.0%**	**18.3%**	**5.0%**		

[1] Included in OPP for FY 2002 is $300K in emergency appropriation funds for Christchurch security.

[2] Includes proposed Pension and Health Costs as in footnote 3.

[3] Pension and Health Costs as proposed by the Administration's Costs Integration Legislation requiring agencies to pay their full share of the accrued cost of retirement beginning in FY 2003.